Introduction to PalmGHG
The RSPO greenhouse gas calculator for oil palm products

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Workstream 1
Measuring, monitoring & reporting operational GHG emissions

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PalmGHG
Palm products greenhouse gas accounting tool
PalmGHG

A calculator that quantifies the major forms of GHG emissions and C sequestration from a mill and its supply base (estate and out-growers)

It is based on a harmonized framework that is compatible with international GHG accounting methodologies (IPCC, ISCC, etc.)

The content of the calculator and the features of the tool have been discussed within the whole GHG Working Group 2
System boundary of the greenhouse gas balance calculation in PalmGHG, i.e. which sources of emissions are included.

Inputs:
- Emissions due to land clearing, i.e. due to losses of stored carbon in the biomass
- Emissions due to the transport and use of fertilizers (direct/short term + indirect/long term emissions)
- Emissions due to peatland cultivation, i.e. due to losses of stored carbon in the soil

Agricultural stage:
- Emissions avoided by carbon sequestration in the palm biomass
- Emissions due to fuel combustion
- Emissions due to Harvesting & Collection of the fruits, i.e. due to fuel combustion during collection and transport of the fruits to the mill

Mill stage:
- Emissions related to POME treatment, including possible avoidance through methane capture

Outputs:
- Emissions avoided by excess energy production
- Allocation of environmental burdens between CPO and PKO

tCO2e per ha and per tonne of palm products: CPO, PKO, Biodiesel (per MJ)

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Important features

a) Flexibility:

I. Adoption of different crop rotation lengths and possible choice of oil palm growth data
II. It allows use of alternatives to the standard defaults
III. It allows for the calculation of GHG for CPO, PKO and bio-diesel (to be compatible with the European Renewable Energy Directive requirements)

b) It caters for CO\textsubscript{2} emissions from land use change and peat soils management

c) It allocates total net emissions between co-products

d) It calculates annual net emissions per ha and per tonne of palm product; may be updated yearly

e) It allows for scenario testing
Objectives of the pilot

⇒ To allow growers to experiment with the tool: how can it be used and what can it be used for?

⇒ To test the consistency of the calculator: are all needed data available?

⇒ To gather feedback from users to outline improvement needs and development priorities
Overview of pilot results

<table>
<thead>
<tr>
<th>Mills</th>
<th>Mean tFFB/ha</th>
<th>Outgrowers included</th>
<th>Peat soils</th>
<th>Previous land use</th>
<th>tCO2e/tCPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>23</td>
<td>no</td>
<td>no</td>
<td>shrub</td>
<td>0.05</td>
</tr>
<tr>
<td>A2</td>
<td>24</td>
<td>no</td>
<td>no</td>
<td>shrub</td>
<td>-0.07</td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>no</td>
<td>no</td>
<td>cocoa, oil palm</td>
<td>0.79</td>
</tr>
<tr>
<td>C1</td>
<td>23</td>
<td>yes</td>
<td>25%</td>
<td>grassland, shrub</td>
<td>0.73</td>
</tr>
<tr>
<td>C2</td>
<td>19</td>
<td>yes</td>
<td>80%</td>
<td>grassland, shrub</td>
<td>2.46</td>
</tr>
<tr>
<td>F</td>
<td>19</td>
<td>no</td>
<td>no</td>
<td>logged forest, oil palm</td>
<td>1.85</td>
</tr>
<tr>
<td>G</td>
<td>26</td>
<td>yes</td>
<td>no</td>
<td>wide range from logged forest to arable crops</td>
<td>1.15</td>
</tr>
<tr>
<td>H</td>
<td>17</td>
<td>yes</td>
<td>no</td>
<td>logged forest</td>
<td>1.35</td>
</tr>
</tbody>
</table>

Previous land use: shrub, cocoa, oil palm, grassland, shrub, logged forest, oil palm, wide range from logged forest to arable crops.
Net emissions for pilot mills

- A1: 0.05
- A2: -0.07
- B: 0.79
- C1: 0.73
- C2: 2.46
- F: 1.85
- G: 1.15
- H: 1.35

Pilot companies

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Pilot results:
Example of mill C1 base case

<table>
<thead>
<tr>
<th>Category</th>
<th>Estate</th>
<th>Out-growers</th>
<th>Net Em.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Clearing</td>
<td>14%</td>
<td>26%</td>
<td>0.78</td>
</tr>
<tr>
<td>Peat</td>
<td>43%</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>CH4</td>
<td>28%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Mill Fuel</td>
<td>0%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>N2O</td>
<td>12%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Ferti.</td>
<td>9%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Field Fuel</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Elec.</td>
<td></td>
<td></td>
<td>-1.12</td>
</tr>
<tr>
<td>Seq.</td>
<td>-1</td>
<td>-1</td>
<td></td>
</tr>
</tbody>
</table>

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Pilot mill C1:
Combining estate & outgrowers

- Base case: 0.73 tCO2e/tCPO +/− 25%
- Grassland: 0.55 tCO2e/tCPO
- Shrub: 0.91 tCO2e/tCPO +32%
- Flaring of biogas: 0.30 tCO2e/tCPO -60%
- Electricity from biogas: 0.26 tCO2e/tCPO
- Low peat emissions (10 t/ha/yr): 0.30 tCO2e/tCPO
- High peat emissions (30 t/ha/yr): 0.96 tCO2e/tCPO
Pilot mill G:
Base case
Pilot mill G:
Capture and flare methane

Pilot mill G:
Capture methane and convert into electricity

<table>
<thead>
<tr>
<th>Process</th>
<th>t CO2e/t CPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Clearing</td>
<td>1.78</td>
</tr>
<tr>
<td>Peat</td>
<td>0.06</td>
</tr>
<tr>
<td>CH4</td>
<td>0.71</td>
</tr>
<tr>
<td>Mill Fuel</td>
<td>0.01</td>
</tr>
<tr>
<td>N2O</td>
<td>0.09</td>
</tr>
<tr>
<td>Ferti.</td>
<td>0.10</td>
</tr>
<tr>
<td>Field Fuel</td>
<td>0.03</td>
</tr>
<tr>
<td>Elec.</td>
<td>-0.08</td>
</tr>
<tr>
<td>Seq.</td>
<td>-1.64</td>
</tr>
<tr>
<td>Net Em.</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Pilot Mill G:
100% replant, capture CH4 and convert into electricity, reduced outgrower sequestration by 10%
Scenario testing

Base case 1: mixed previous land uses, peat 3%, no POME treatment, OER 20.8%, estate 20.2 tFFB/ha, outgrowers 14.2 tFFB/ha

Net emissions tCO2e/tCPO

0.71 1.58 5.09 0.27 0.24 -0.62 1.58 1 2 3 4 5 6

1. Scenario base case
2. 100% logged forest
3. 100% grassland
4. 100% peat
5. Capture and convert methane to electricity
6. 100% replant, no peat, capture and convert methane to electricity

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Scenario testing

Base case 1: mixed previous land uses, peat 3%, no POME treatment, OER 20.8%, estate 20.2tFFB/ha, outgrowers 14.2tFFB/ha
PalmGHG development

After Pilot Phase

⇒ Update C stock values and peat emission factors from WS3
⇒ Incorporate biofuel calculations for potential compliance with RED
⇒ Peer review of PalmGHG
⇒ Post-review development - user friendly, manual
Thank you