Greenhouse Gas Assessment for Anglo-Eastern Plantations PLC

Assessment Period 2018

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Report Control

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Organisational boundary:	Anglo-Eastern Plantations owned premises and outgrower estates
Operational boundary:	Emissions associated with premises activities, company owned vehicles, third party vehicle use, employee housing, land use change, oil palm carbon sequestration and cultivation of peat soils on AEP's own estates and outgrower estates

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About Ecometrica

Ecometrica is an independent business bringing together experienced analysts and world-class scientists. Our team of professionals provides the following independent, scientific analytical services:

- Assessment of corporate and product greenhouse gas (GHG) emissions.
- Assessment and monitoring of ecosystem services for land use projects.
- Policy advice based on ecometric analysis and interpretation.

1. Introduction

A greenhouse gas (GHG) emissions assessment quantifies the total greenhouse gases produced directly and indirectly from a business or organisation's activities. Also known as a carbon footprint, it is an essential tool, providing your business with a basis for understanding and managing its climate change impacts.
A GHG assessment quantifies all seven Kyoto greenhouse gases where applicable and is measured in units of carbon dioxide equivalence, or CO_2e[1]. The seven Kyoto gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen triflouride (NF_3) and sulphur hexafluoride (SF_6). The global warming potential (GWP) of each gas, as per the IPCC fourth assessment report, is illustrated in Table 1.

Table 1. GWP of Kyoto gases (IPCC 2007 and IPCC 2012)

Greenhouse gas (GHG)	GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_2O)	298
Hydrofluorocarbons (HFCs)	124 – 14,800
Perfluorocarbons (PFCs)	7,390 – 12,200
Nitrogen trifluoride (NF_3)	17,200
Sulphur hexafluoride (SF_6)	22,800

GHG assessments are desk-based exercises that use client-supplied activity data on fuel and material consumption (for example kWh of electricity or litres of fuel), from which GHG emissions estimates are quantified by applying relevant emission factors. Ecometrica sources up to date and geographically relevant emission factors from reputable sources such as the IPCC, WBCSD, WRI, IEA, UNFCCC, Carbon Trust, US EPA, Defra and BEIS, so that the results are founded on best available evidence.

Reporting Mechanisms

The most comprehensive and internationally recognised reporting methodology available is the World Business Council for Sustainable Development and World Resources Institute's (WBCSD/WRI) *Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (Revised Edition).* This protocol is considered current best practice for corporate or organisational greenhouse gas emissions reporting. As a minimum Ecometrica carries out all its organisational GHG assessments in accordance with this protocol, reporting GHG emissions by Scopes 1, 2 and 3 (Figure 1). Scope 1 includes direct GHG emissions from sources that are owned or controlled by the company such as natural gas combustion and company owned vehicles. Scope 2 accounts for GHG emissions from the off-site generation of purchased electricity, heat and steam. Scope 3 includes all other indirect emissions such as those from waste disposal, business travel and staff commuting. Reporting of these activities is optional under the WBCSD/WRI GHG Protocol. Depending on the nature/remit of an

[1] CO_2e is the universal unit of measurement to indicate the global warming potential (GWP) of each of the seven greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide (WBCSD/WRI 2004)

organisation, scope 3 activities can contribute a significant portion of overall emissions and therefore Ecometrica recommends they are reported where applicable.

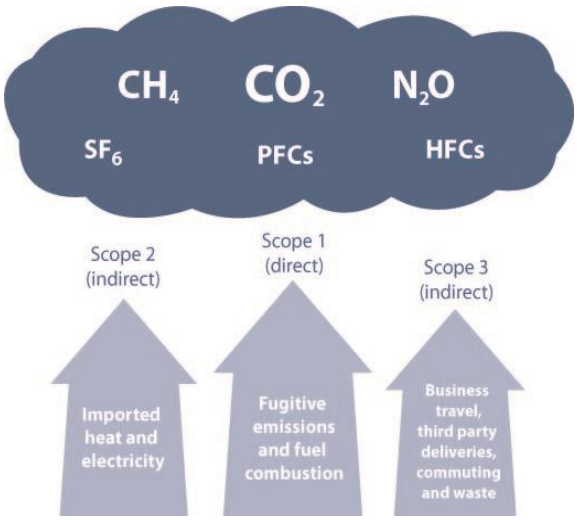

Figure 1. WBCSD/WRI reporting scopes

Benefits of Monitoring GHG Emissions

A GHG assessment is an essential tool in the process of monitoring and reducing an organisation's climate change impact as it allows reduction targets to be set and action plans formulated. GHG assessment results can also allow organisations to be transparent about their climate change impacts through reporting of GHG emissions to customers, shareholders, employees and other stakeholders. Regular assessments[2] allow clients to track their progress in achieving reductions over time and provide evidence to support green claims in external marketing initiatives such as product labelling or CSR reporting. Ecometrica GHG assessments are designed to be transparent, consistent and repeatable over time.

Anglo-Eastern Plantations PLC

Anglo-Eastern Plantations PLC (AEP) reported their greenhouse gas (GHG) emissions under GHG Regulations (Directors' Reports) for the first time in 2013. The emissions sources included in this report were fuel and electricity consumption at the mills, palm oil mill effluent (POME) treatment, nitrogen emissions from mineral fertiliser use, company owned vehicle fuel use, third party vehicle fuel use and electricity consumption in employee housing. The scope of the annual emissions assessment was expanded (in line with Ecometrica's recommendations) to include the emissions associated with land use change and carbon sequestration in July 2014.

[2] The WBSCD/WRI recommend annual GHG reporting

2. Data and Methodology

The assessment methodology is consistent with the WBCSD/WRI's GHG Protocol for Corporate Accounting. The assessment scope was determined in consultation with AEP and results are presented for the reporting period January to December 2018. Relevant and up-to-date emission factors have been applied to client-supplied data.

Land use emissions and carbon sequestration results were calculated in line with the methodology used by The Roundtable for Sustainable Palm Oil (RSPO) GHG Working Group 2 throughout the PalmGHG Calculator. Selected default emission factors, data and models taken from sections of this tool and used throughout this assessment are detailed in this report.

Land Clearance

Anglo-Eastern Plantations were able to provide data on the total hectares of oil palm planted on each of their estates for each year of an average oil palm crop cycle (28 years for AEP estates). Thus, data was provided from 1991 through to the end of 2018. Alongside this planting data the previous land use of the cleared land was provided, selected from 8 different categories as provided by the PalmGHG Tool. These categories, along with their respective carbon stocks, are shown in table 2.

Table 2. Previous land uses and their carbon stocks

Land use	tC/ha
Primary forest	268
Logged forest	128
Grassland	5
Rubber	75
Cocoa	75
Coconut	75
Food crops	8.5
Secondary regrowth	68.25

These carbon stock values were derived by the RSPO based on a review of relevant literature and satellite images for land use changes associated with oil palm plantations in Indonesia and Malaysia. These values are provided as defaults to be used in the absence of more accurate data (such as on-site field measurements) and are therefore to be treated as approximate figures.

Carbon Sequestered in Planted Oil Palm

Taking the data provided by AEP regarding the total hectares of new oil palm planted on the estates over the 28 year crop cycle the amount of carbon sequestered by the standing crop in each reporting period has been estimated. The values for the amount of carbon sequestered by the oil palm have been taken from the

OPRODSIM and OPCABSIM average growth models provided in the PalmGHG Tool. These models estimate the biomass in the oil palm plantation (including the palm, roots, ground cover, frond piles and palm litter) for each year of growth over the lifetime of an oil palm. The amount of carbon sequestered by palms of varying age across the estates is estimated by multiplying the total hectares of oil palm planted each year of the crop cycle by the amount of carbon that particular crop will sequester in 2018 based on its age. The total carbon sequestered by the entire standing crop in the reporting period is therefore the sum of the carbon sequestered in 2018 by each crop age group. As with land clearance the results for carbon sequestration could be more accurately estimated if on-site growth measurements from AEP estates were available, and the results from the OPRODSIM and OPCABSIM models should be treated as approximate.

Emissions from Peat Cultivation

Cultivation of peat soils results in CO_2 emissions due to oxidation of organic carbon; therefore an estimate of these emissions from AEP's peat soil estates has been included in this report. There is a lot of uncertainty regarding the determination of emission factors for peat cultivation and the methodology used in the PalmGHG Tool (and hence this report) is based on a report by Hooijer *et al* (2010) which determines emissions based on the drainage depth of the soil. AEP informed Ecometrica that the water table on their peat soil estates is actively managed at a depth of 55cm, and the resulting emission factor of 50.05 tCO_2 per hectare per year is used to estimate emissions. The equation used to derive this factor is shown in Figure 2 below.

Peat CO_2 emission (tCO_2/ha/year) = 0.91 x cm drainage depth

Figure 2. Peat emission factor derived by Hooijer et al (2010)

3. Results

The results presented in this report have not been amortized – the emissions from land clearance are those that arose from the clearance of land from the reporting year in question. As well as harvesting oil palm from their own estates AEP source a large quantity of oil palm crop for processing in their mills from outgrowers. It was not possible for AEP to gather appropriate land use data from outgrowers therefore an estimate of the land use emissions detailed in this report associated with the outgrower crop utilised by AEP has been derived by extrapolation. For each reporting period the total emissions associated with AEP's own crops were divided by the total tonnes of crop harvested in that reporting period, and this figure was multiplied by the total tonnes of outgrower crop utilised in the same period. The exception to this is the emissions from peat soil cultivation which were adjusted downwards to reflect the lower percentage of outgrower crop grown on peat soils (around 1.9%) versus own crops grown on peat soils (around 15%). Ecometrica recognises that this is an approximate method and the results should be treated with the appropriate caution.

As discussed in the introduction, AEP has reported several emissions sources under GHG Regulations (Directors' Reports) for the 2018 reporting year. Table 3 and figure 3 show the total emissions (operational, land use and carbon sequestration combined) broken down by activity for 2018. As was the case in 2017, emissions associated with land use change and carbon sequestration account for more than half of the organisational total with 408,762 tonnes of CO_2e. This value excludes any land use or carbon sequestration emissions associated with outgrowers' crop.

Table 3. Overall results (direct emissions) –2018 reporting year

Emissions source	Results	
POME treatment	189,794	tCO_2e
Fertiliser application	28,014	tCO_2e
Premises energy consumption	15,231	tCO_2e
Company owned vehicles	7,102	tCO_2e
Third party vehicle use	7,641	tCO_2e
Employee housing	1,772	tCO_2e
Operational emissions total	**249,553**	**tCO_2e**
Land clearance (own crop only)	429,970	tCO_2e
Carbon sequestered by standing crop (own crop only)	-510,051	tCO_2e
Emissions from peat soils cultivation (own crop only)	488,843	tCO_2e
Land use emissions total	**408,762**	**tCO_2e**
Overall emissions from 2018	**658,315**	**tCO_2e**

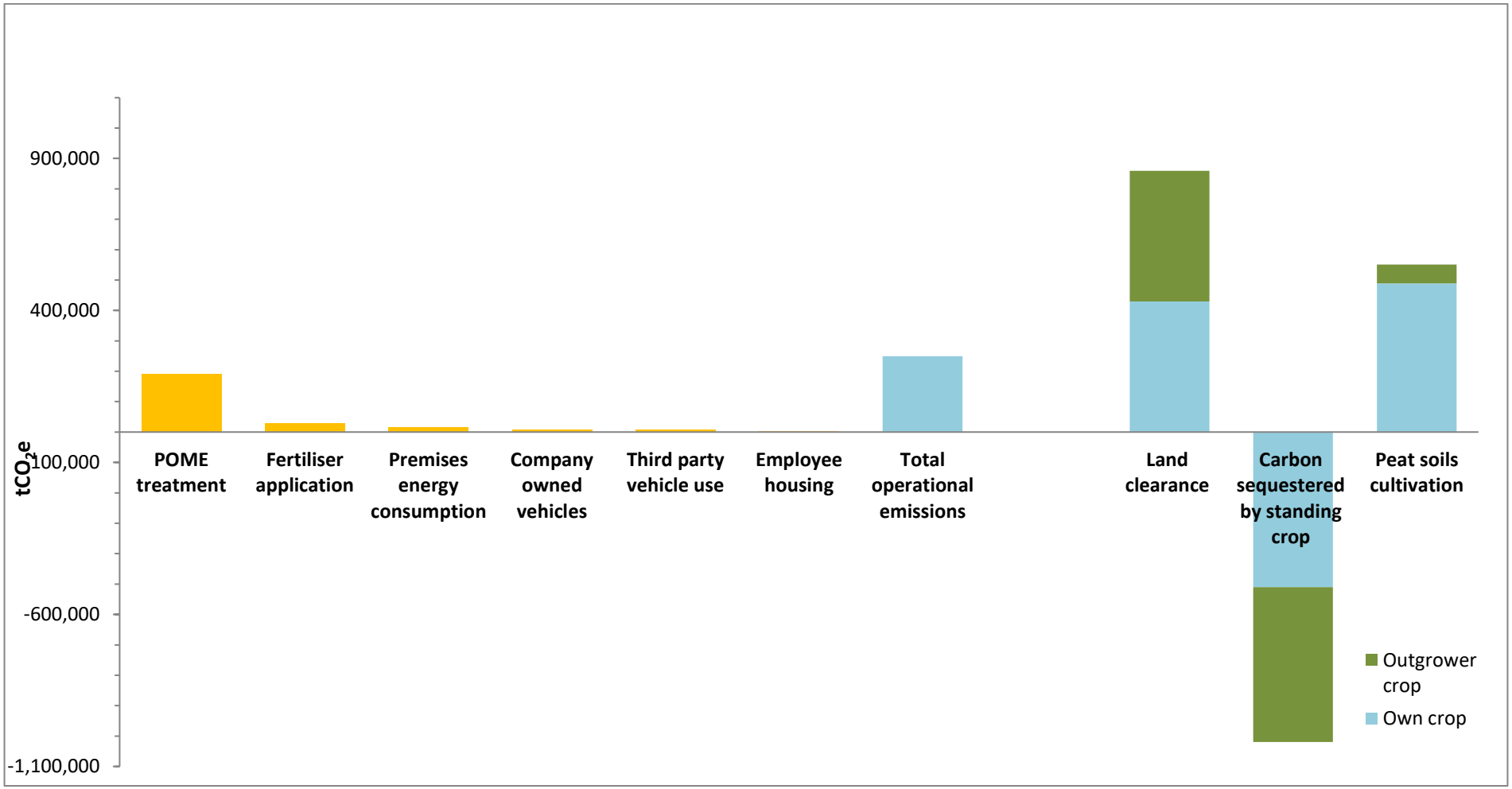

Figure 3. Total emissions from 2018 broken down by source

2018 Results Compared to 2017 Results

Table 4 and figures 4a to 4c show the difference in emissions per reported activity (including both own and outgrower crop for land use emissions). The overall emissions have decreased by 539,938 tCO_2e, or 46%, from 1,180,752 tCO_2e during the 2017 assessment period to 640,814 tCO_2e during the 2018 assessment period. This decrease is primarily due to a decrease in emissions associated with land use, specifically land clearance. During 2017, the emissions associated with land clearance were 1,488,204 tCO_2e, (own crop + outgrower crop) while this decreased to 859,450 tCO_2e during 2018 (own crop + outgrower crop).

Table 4. Results for 2018 reporting period compared to the 2017 reporting period

Emissions source	**2018 (tCO_2e)**		**2017 (tCO_2e)**	
POME treatment	189,794		204,771	
Fertiliser application	28,014		25,952	
Premises energy consumption	15,231		14,800	
Company owned vehicles	7,102		6,361	
Third party vehicle use	7,641		7,110	
Employee housing	1,772		1,736	
Total operational emissions	**249,553**		**260,730**	
	Own crop	*Outgrower crop*	*Own crop*	*Outgrower crop*
Land clearance	429,970	429,480	708,166	780,038
Carbon sequestered by standing crop	-510,051	-509,470	-534,435	-588,675
Peat soils cultivation	488,843	62,490	496,090	58,838
Total land use emissions	**391,261**		**920,022**	
Overall emissions	**640,814**		**1,180,752**	

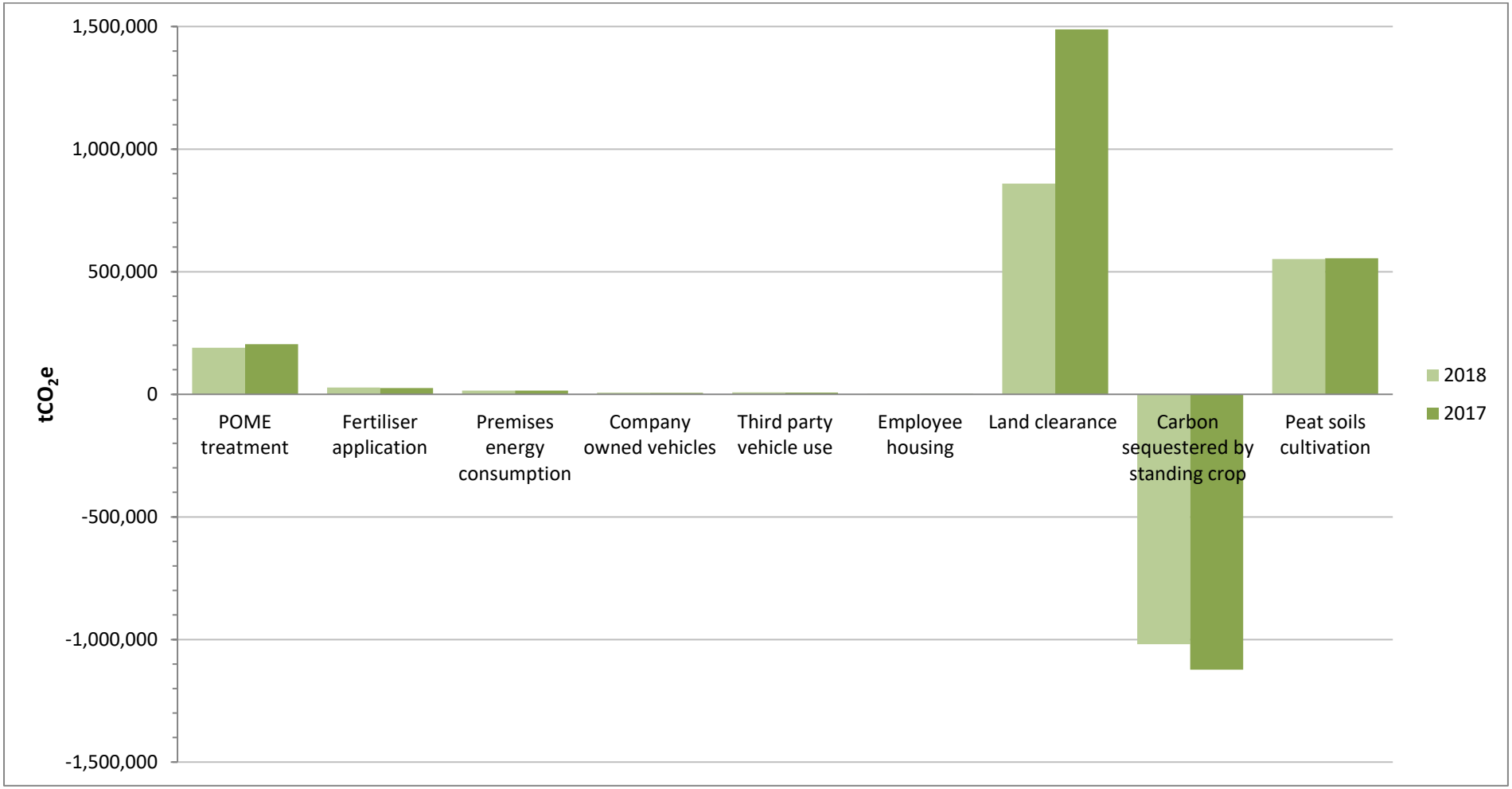

Figure 4a. 2018 emissions compared to 2017 emissions

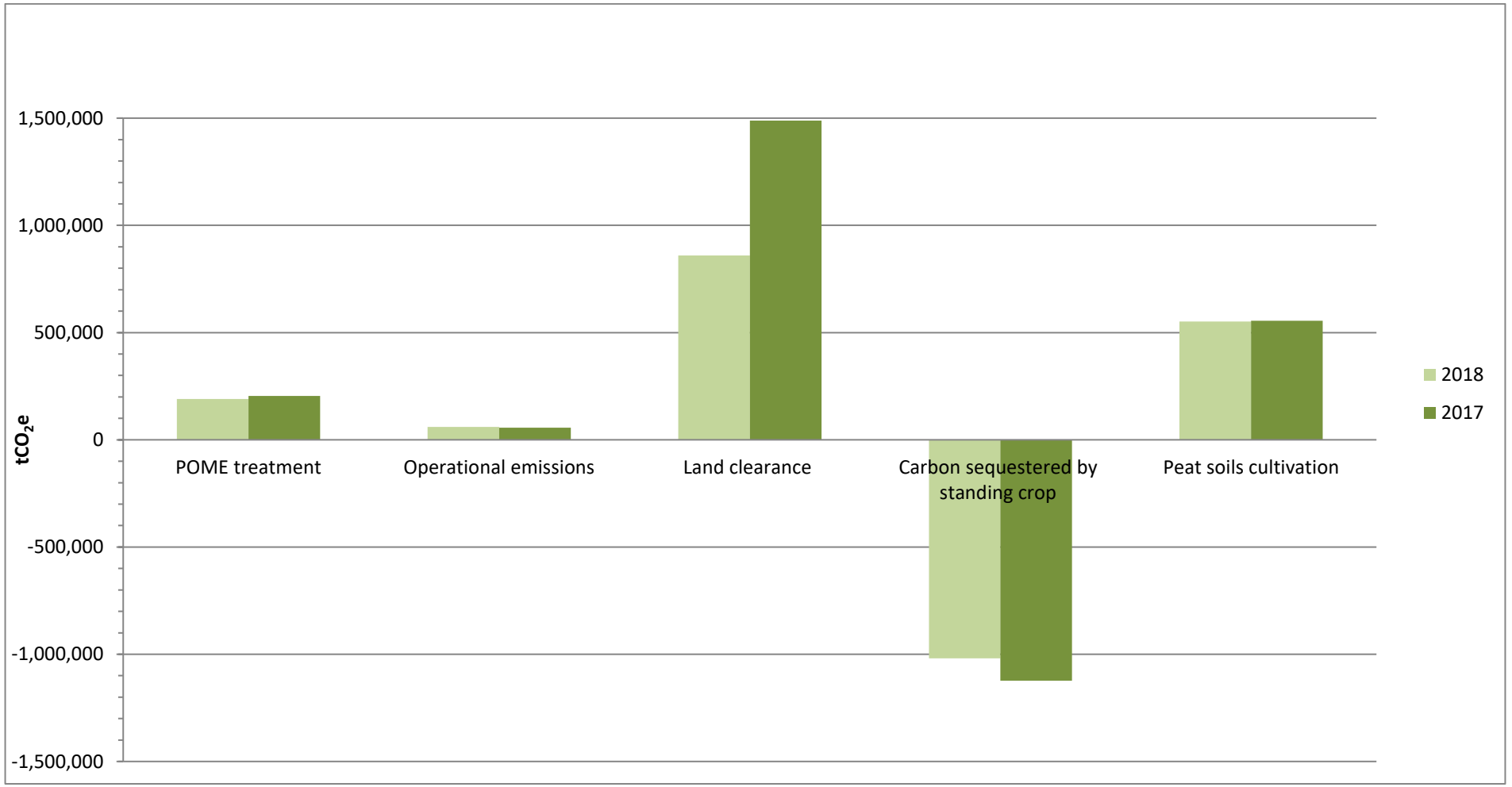

Figure 4b. Comparison of the 2018 and 2017 emissions associated with POME treatment, other (non POME) operational emissions, land clearance, carbon sequestration and the cultivation of peat soils.

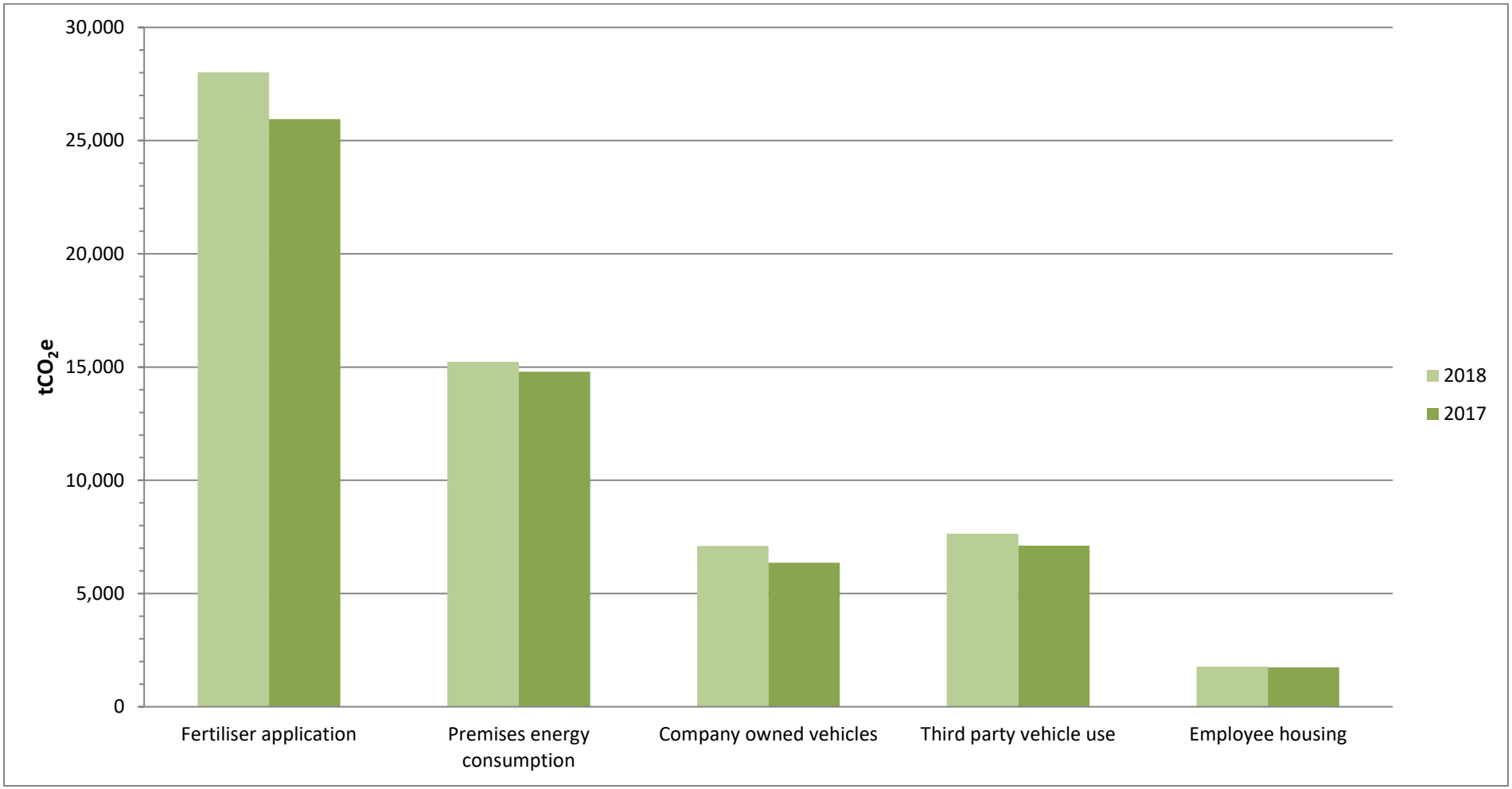

Figure 4c. Comparison of 2018 and 2017 non-POME operational emissions.

Table 5 and figure 5 display the comparative results between the 2018 and 2017 reporting years per chosen reporting metrics; tonnes of CPO production, tonnes of FFB production, tonnes of FFB processed, and hectares of planted area for company operational emissions (excluding land use change emissions). As previously noted, total emissions in 2018 have shown a decrease in comparison to 2017, when land use change emissions and sequestration are excluded, it becomes evident that operational emissions have also decreased between the two periods, this trend can be seen in the emissions per reporting metrics which have decreased for all operational metric based emissions.

Table 5. 2018 and 2017 operational emissions (excluding land use change emissions) per reporting metric

Reporting metric	2018 (tCO_2e)	2017 (tCO_2e)
per tonne of CPO production	0.60	0.67
per tonne of FFB production	0.24	0.28
per tonne of FFB processed	0.12	0.14
per hectare of planted area	3.78	3.92

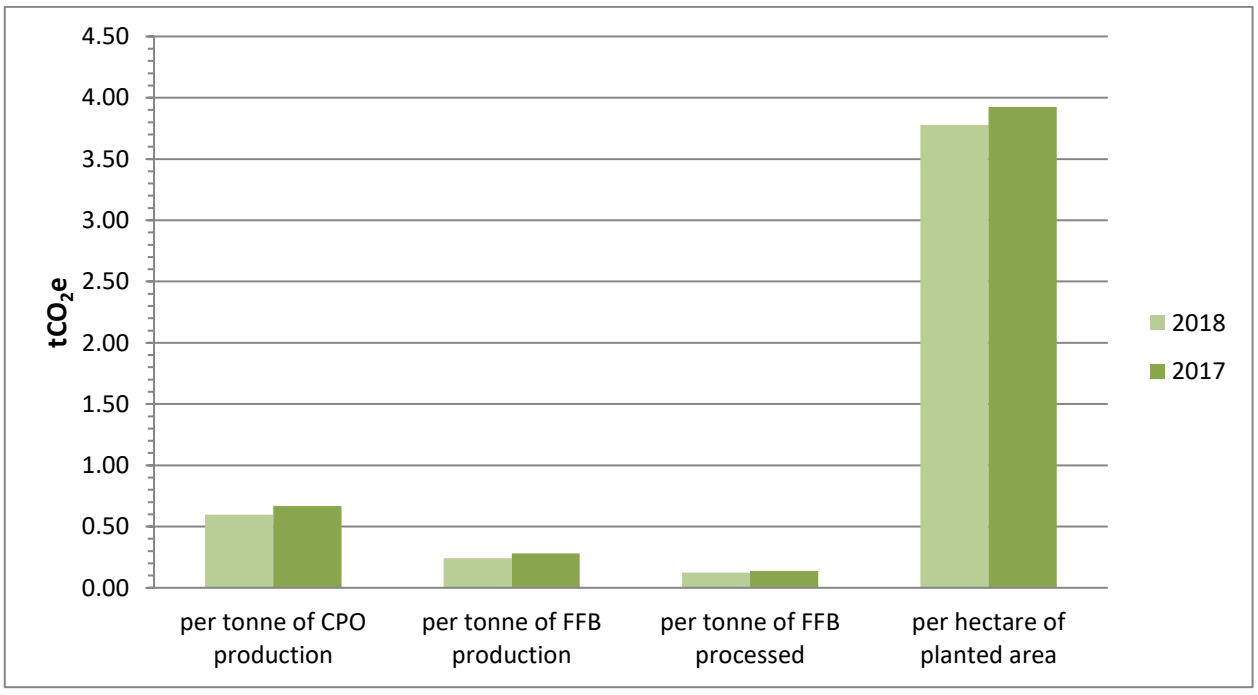

Figure 5. Comparison of 2018 and 2017 operational emissions (excluding land use change emissions) per reporting metric unit.

Table 6 and figure 6 display the comparative results between the 2018 and 2017 reporting years per chosen reporting metrics; tonnes of CPO production, tonnes of FFB production, tonnes of FFB processed, and hectares of planted area for total company emissions. Similarly to table 5 and figure 5, emissions per reporting metric have decreased for all metric based emissions when both operational emissions and land use change emissions are included.

Table 6. 2018 and 2017 total emissions per reporting metric

Reporting metric	2018 (tCO_2e)	2017 (tCO_2e)
per tonne of CPO production	1.53	3.02
per tonne of FFB production	0.62	1.27
per tonne of FFB processed	0.32	0.62
per hectare of planted area	9.70	17.77

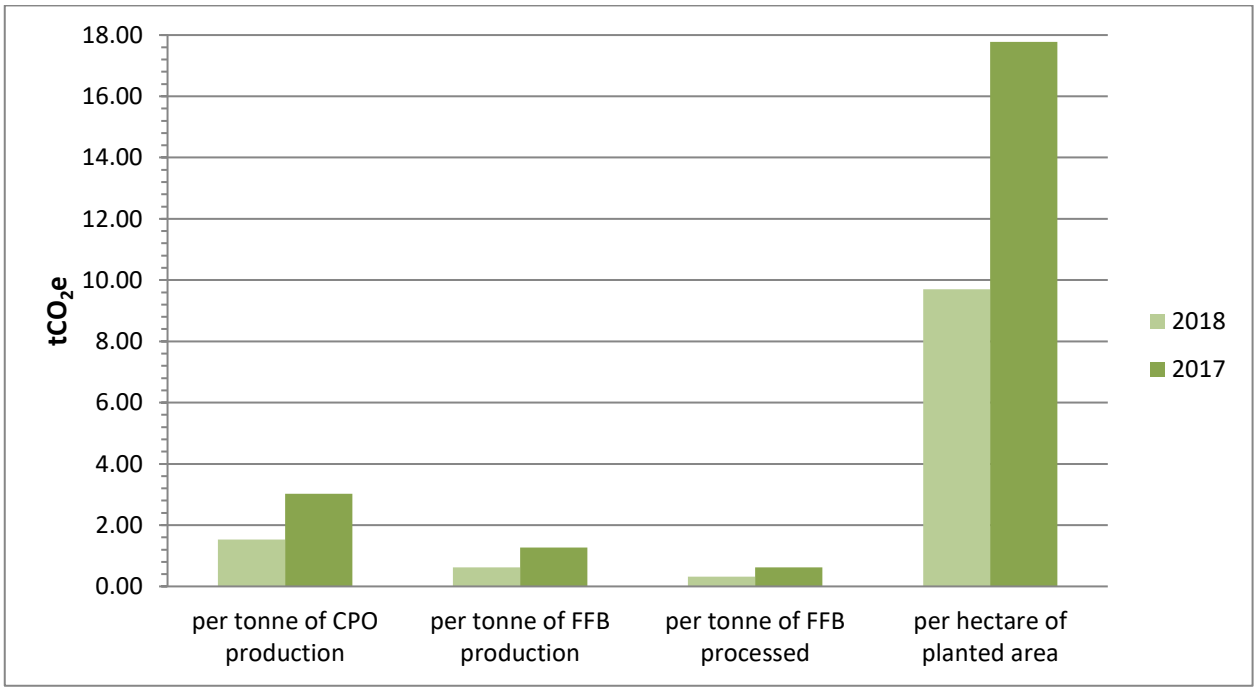

Figure 6. Comparison of 2018 and 2017 total emissions per reporting metric unit.

Table 7 and figure 7 display the difference in overall emissions by scope as published by the World Business Council for Sustainable Development and World Resources Institute's (WBCSD/WRI) Greenhouse Gas Protocol; a Corporate Accounting and Reporting Standard. Table 8 shows more specifically which of the emission sources are associated with which scope.

- Scope 1 emissions are responsible for the majority of emissions during 2018. As can be seen from figure 7, Scope 1 emissions have decreased between the 2017 and 2018 reporting periods; this is primarily due to the previously noted decreases in land clearance emissions, along with a reduction in emissions associated with POME treatment due to the increased amount of POME emissions being captured and flared.
- Scope 2 accounts for GHG emissions from the generation of purchased electricity, heat and steam generated off-site. Scope 3 includes all other indirect emissions such as waste disposal, business travel and staff commuting.
- Scope 3 emissions have decreased significantly. This decrease is mainly due to the decrease in emissions associated with outgrower crop land clearance.
- With an overall decrease in emissions in 2018, emissions associated with Scopes 1 and 3 have decreased compared to the 2017 scope emissions, however Scope 2 emissions show a very slight increase.

Table 7. 2018 and 2017 emissions by scope

Emissions source	2018 (tCO_2e)	2017 (tCO_2e)
Scope 1	648,809	921,619
Scope 2	1,688	1,651
Scope 3	-9,683	257,482

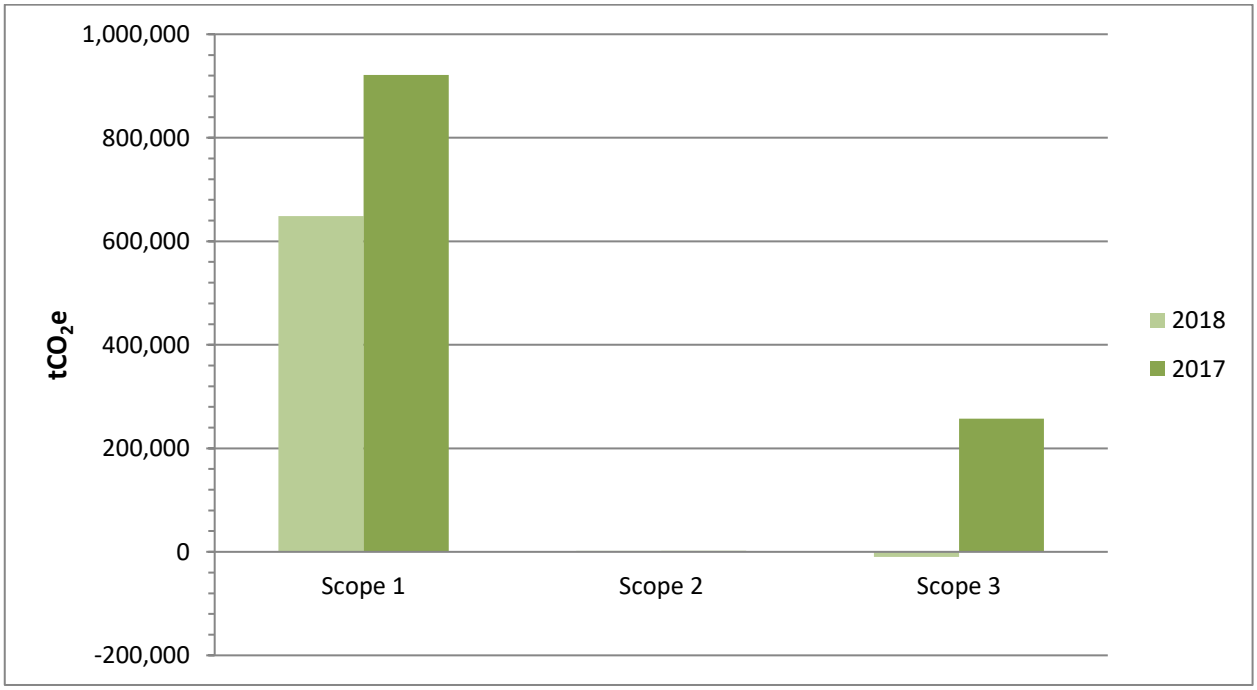

Figure 7. 2018 and 2017 emissions by Scope

Table 8. Emissions sources and their designated scope

Emissions source	Scope
POME treatment	1
Fertiliser application	1
Premises fuel consumption	1
Electricity consumption	2
Electricity - Transmission & Distribution losses	3
Company owned vehicles	1
Third party vehicle use	3
Employee housing	2
Land clearance (own crop)	1
Carbon sequestered by standing crop (own crop)	1
Peat soils cultivation (own crop)	1
Land clearance (outgrower crop)	3
Carbon sequestered by standing crop (outgrower crop)	3
Peat soils cultivation (outgrower crop)	3

4. Next Steps

The results detailed in this report provide AEP with an estimate of emissions from operations, land use and land use change across their estates and production mills, along with emissions from outgrower estates. As discussed, the methodology employed uses default data and models, therefore the results should be treated as an approximation. If AEP wants to improve the accuracy of the results the following steps could be taken:

- Expand the operational reporting system to include the data fields needed to update this study each year and have total GHG emissions impact reported within the Ecometrica system.

- To improve accuracy carry out on-site field measurement of carbon sequestration in oil palm crop (growth measurements of planting density, fronds and trunk for palms of different ages). The PalmGHG Tool suggests following the methods or Corley et al (1971) and Corley and Tinker (2003).

- To improve accuracy, explore the possibility of collection of land use data from outgrowers (hectares planted, previous land use and crop cycle length).

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