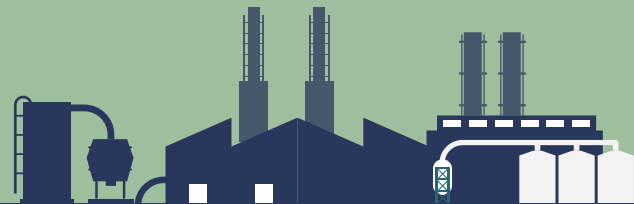




Kulim (Malaysia) Berhad (23370-V)

2016

# CARBON FOOTPRINT REPORT



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**INSIDE**

**CARBON  
FOOTPRINT  
REPORT**

**2016**

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## HIGHLIGHTS

2

## ABOUT KULIM

4

## OVERVIEW

- 11 Emissions from oil palm cultivation
- 15 Emissions from palm oil production

6

## MITIGATION STRATEGIES AND REDUCTION TARGETS

- 18 Methane capture and biogas generation
- 19 Fertiliser reduction
- 19 Outgrower engagement
- 19 Updated emissions reduction targets

18

## METHODOLOGY

- 20 PalmGHG
- 21 Assumptions for carbon reduction targets

20

## BASE DATA

- 22 Emissions data 2016 (PalmGHG Version 3)
- 23 Emissions data 2015 (PalmGHG Version 3)
- 24 Production data
- 24 Data collections and limitations

22

## GLOSSARY

26

## REFERENCES

28

## ABOUT THIS REPORT

29

# HIGHLIGHTS

Our achievement

2015–2016

**15%**

lower fertiliser emissions

**100%**

of our mills will include biogas capture

Our goals by 2025

At least  
**50%**  
reduction in emissions from POME

This target was revised to reflect changes to the operating environment and cost basis of biogas capture. See page 9 for further detail.

Our ambition

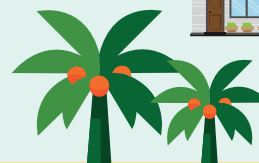
To achieve  
**58%**  
lower carbon footprint by 2020

Due to the significant changes in the PalmGHG methodology and changes to our biogas capture plans, we are currently reviewing this target and will update in future reports.

Land Clearing



Nursery





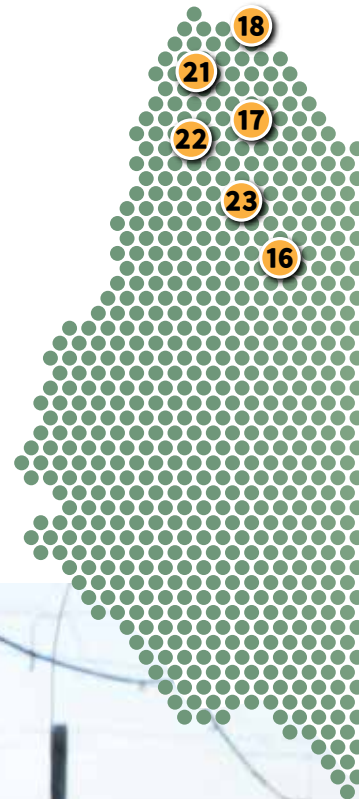
# ABOUT KULIM

**Kulim (Malaysia) Berhad (“Kulim”) is a wholly owned subsidiary of Johor Corporation with total landbank of 115,378 hectares. At the end of 2016, we have total oil palm planted area of 55,680 hectares spread across Malaysia and Indonesia.**

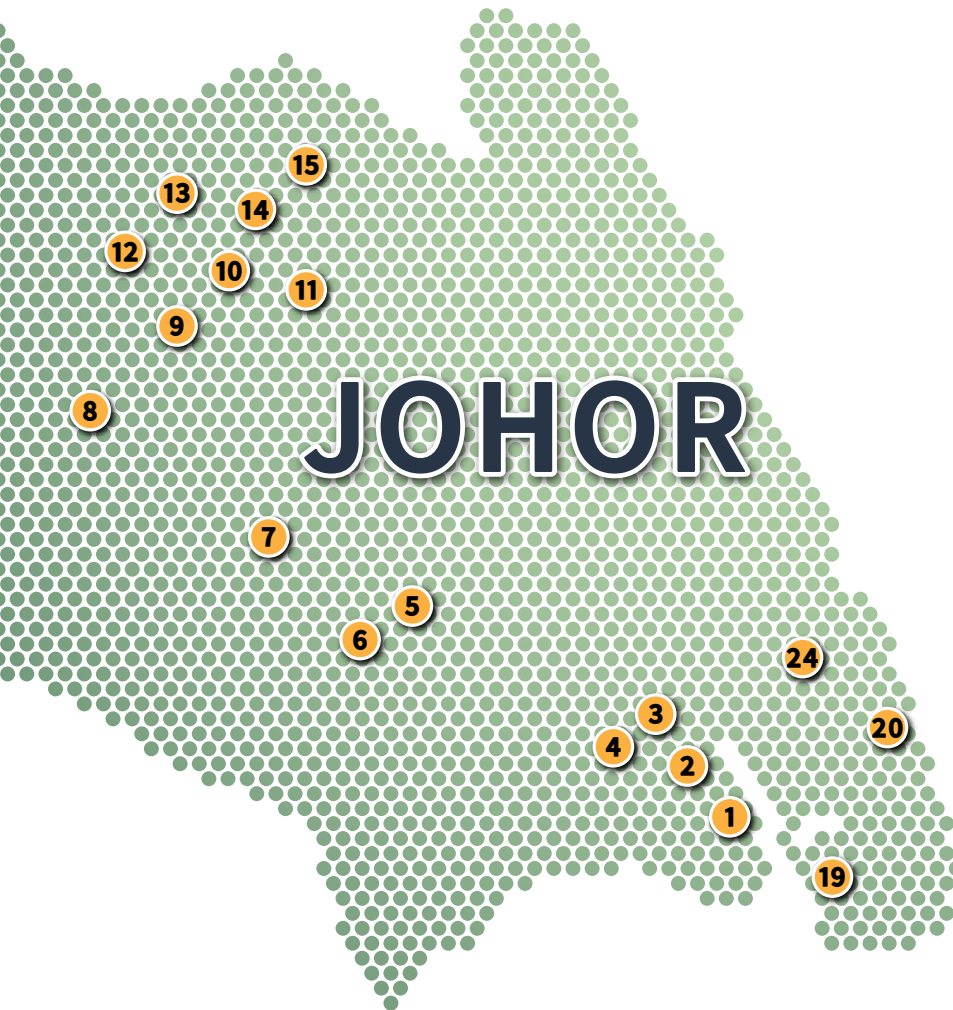
As we began plantings in our Indonesian operation in 2014, this report covers only our operations in Malaysia. These operations are located in the states of Johor and Pahang in the southern part of Peninsular Malaysia.

As at 31 December 2016, our landbank in Malaysia was 51,033 hectares, of which over 47,028 hectares are planted with oil palm. We produce Crude Palm Oil (“CPO”) and Palm Kernel (“PK”). In 2016, our total production was 273,354 tonnes of CPO and 70,030 tonnes of PK. We have four (4) RSPO-certified mills that processed a total of 1,339,659 tonnes of Fresh Fruit Bunches (“FFB”) in 2016. This included 364,778 tonnes (27.2%) of FFB purchased from external smallholders and outgrowers.

Most of our plantations were established between 1970 and 1990. The majority of these areas were converted from other agricultural crops, particularly rubber. Only 1,363 hectares of our planted area is on peat. Our new Pasir Panjang Palm Oil Mill was commissioned in March 2015 and is included in our carbon calculations for the first time in this report.



# LOCATION OF ESTATES AND MILLS



1. Bukit Layang Estate
2. Basir Ismail Estate
3. REM Estate
4. Ulu Tiram Estate
5. Sedenak Estate and Sedenak Palm Oil Mill
6. Kuala Kabung Estate
7. Rengam Estate
8. Sindora Estate and Sindora Palm Oil Mill
9. Tereh Selatan Estate
10. Enggang Estate
11. Mutiara Estate
12. Tereh Utara Estate and Tereh Palm Oil Mill
13. Sungai Tawing Estate
14. Selai Estate
15. Sungai Sembrong Estate
16. Labis Bahru Estate
17. Sepang Loi Estate
18. UMAC Estate
19. Sungai Papan Estate
20. Siang Estate
21. Palong Estate
22. Kemedak Estate and Palong Cocoa Palm Oil Mill
23. Mungka Estate
24. Pasir Panjang Estate and Pasir Panjang Palm Oil Mill

**4** RSPO Certified Mills

Planted **47,028** hectares

Landbanks **51,033** hectares

# OVERVIEW

**Kulim is a longstanding champion of sustainable development. We recognise the need to work towards the protection of our environment while meeting the basic needs and securing the development of current and future generations. We also acknowledge climate change as one of the greatest threats to our planet.**

Climatic changes wreak havoc on agricultural conditions and severely impact on the agricultural sector, on food security and most importantly on communities in rural areas that are vulnerable to natural disasters. Kulim therefore supports the Malaysian national target of achieving a 40% reduction in carbon emissions by 2020, as we believe that every individual and every business has a role to play in protecting our planet.

This is the third biennial Carbon Footprint Report for Kulim and part of our ongoing efforts to ensure that we track our progress towards this commitment. The report provides an overview of Kulim's climate change impacts, as well as a product carbon footprint of the Crude Palm Oil ("CPO") and Palm Kernel ("PK") produced at our Malaysian mills.



## CARBON EMISSIONS REDUCTION BY YEAR 2020

.....  
National Target **40%**  
.....

Kulim **58%**  
.....

**2016**  
**NET PLANTING**  
**EMISSIONS**  
**67,000** MT CO<sub>2</sub>e

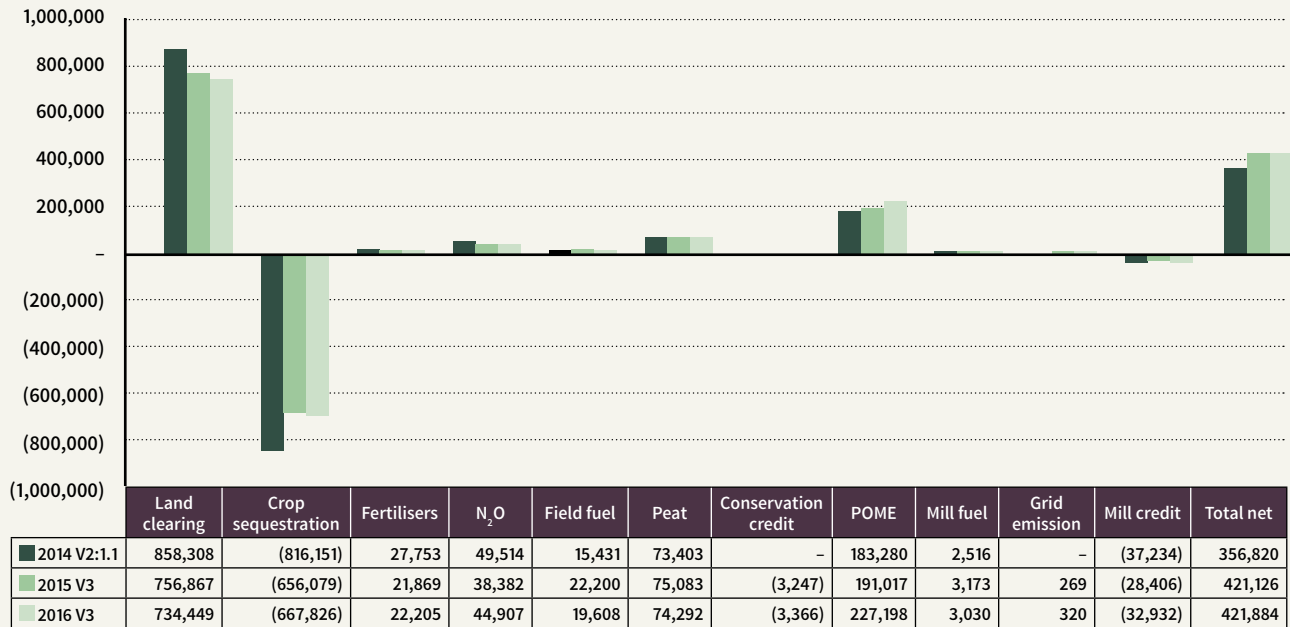
We believe in using the most advanced science and tools available to measure our performance. Kulim was one of the first companies to use the PalmGHG tool (V1) developed by the RSPO Greenhouse Gas (GHG) Working Group. An updated version of the tool (V2.1.1 referred to as “V2” in this report) was released in early 2014, with significant changes to the categorisation of previous land uses as well as default values and a further update in 2016 brought additional changes in default values. To benchmark against peers using the latest version, we have used PalmGHG V3 in this report. However, continual methodological changes (particularly between V1 and V3) make it impossible to compare year-on-year results. Because the changes are relatively minor between V2 and V3, particularly on POME emissions, we therefore make data comparisons on our performance between 2014 and 2016 in this report.

Our net emissions have increased by 18.2% since 2014, from just under 357,000 MT CO<sub>2</sub>e to around 422,000 MT CO<sub>2</sub>e. On a per-tonne basis, our carbon footprint is 1.23 MT CO<sub>2</sub>e, or 6.95% increase from 1.15 MT CO<sub>2</sub>e in 2014.

# OVERVIEW

By far the largest proportion of our emissions is associated with previous land use. As most of our landbank is oil palm replant, or converted from other agricultural crops with a similar emissions profile i.e. rubber, the sequestration associated with oil palm planting largely balances out these emissions. This resulted in net planting emissions of just over 67,000 MT CO<sub>2</sub>e in 2016.

## GHG emissions (MT CO<sub>2</sub>e) for Kulim's Malaysian operations including smallholders for the years 2014 - 2016



## BIOGAS FACILITY



Sedenak  
Palm Oil Mill



Pasir Panjang  
Palm Oil Mill



Sindora  
Palm Oil Mill

2018 Completion



Methane ( $\text{CH}_4$ ) released by Palm Oil Mill Effluent (POME) accounted for our main increase in emissions in 2016, totalling just over 227,000 MT  $\text{CO}_2\text{e}$ . The increase is due to mill cleaning processes. However reducing these emissions continues to be our main focus and we are confident that significant reductions can be achieved over the coming years. We have commissioned two (2) biogas facilities at our Sedenak Palm Oil Mill and Pasir Panjang Palm Oil Mill. These facilities will use  $\text{CH}_4$  capture technologies to convert POME emissions into electricity. A third facility at Sindora Palm Oil Mill is scheduled for completion in 2018. Through these investments we are targeting a 50% reduction in our overall emissions from POME by the end of 2025.

Our 2016 emissions from peat remained high at around 74,000 MT  $\text{CO}_2\text{e}$ , but with no significant change from 2014 and 2015. Combined emissions from fertiliser usage of nitrous oxide ( $\text{N}_2\text{O}$ ) and transport contributed 68,000 MT  $\text{CO}_2\text{e}$ , also in line with 2014 and while fuel consumption increased for mills and field use, emissions from these activities remained relatively low at just over 23,000 MT  $\text{CO}_2\text{e}$ .



**OVERALL EMISSIONS**

**50%**  
by Year 2025

# OVERVIEW

## EMISSIONS SOURCES AND EMISSIONS SINKS



Land clearing release stored carbon in the biomass. The level of emissions depends on the type of previous land use, with high levels of forest cover, such as primary forest releasing high levels of CO<sub>2</sub>, whereas grassland releasing only small amounts.

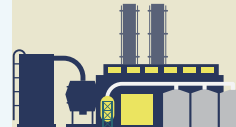
Fertiliser transport and use of fertilisers.



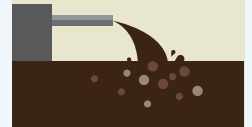
Field fuel use due to harvesting and collection of FFB. Diesel and gasoline combustion is a source of CO<sub>2</sub> emissions.



Mill diesel usage - fuel combustion is a source of CO<sub>2</sub>.



Palm Oil Mill Effluent release methane, which is a powerful greenhouse gas.



Peatland cultivation - these represent a significant source of GHG emissions. We have a small portion of peat within the cultivated area - 1,363 hectares (slightly over 1% of our cultivated land). This land was cultivated in 1999 - 2002 and the total area has changed due to land acquisition by Tenaga Nasional Berhad.



Biogas offset: Methane from Palm Oil Mill Effluent is captured and can be used for electricity or other energy usage, avoiding emissions.



Palm Kernel Shell ("PKS") sales: PKS sold externally and used as a replacement for fossil fuels can be offset as it reduces emissions.

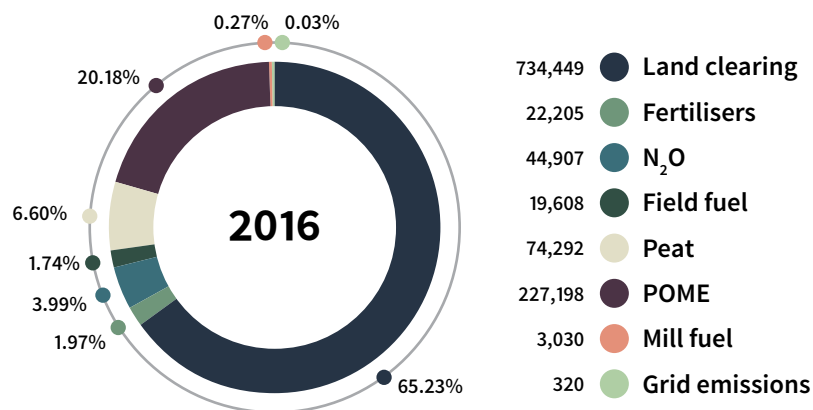


Carbon sequestration in the palm biomass. Oil palm can act as a 'sink' which fixes carbon and prevents emissions into the atmosphere.



Mill fuel offset - most power generation in the mill is based on biomass (shell and fibre) with only a small volume of diesel used for back-up generators. This leads to avoid emissions and can be offset.

## Gross Carbon Emissions by Source (MT CO<sub>2</sub>e)



## EMISSIONS FROM OIL PALM CULTIVATION

### Land clearing and crop sequestration

Land clearing contributed 65.23% of Kulim's carbon emissions in 2016, constituting a total of 734,449 MT CO<sub>2</sub>e, inclusive of outgrower emissions. By far the biggest share of these emissions derived from the replanting of oil palm, with minor areas converted from rubber estates, sentang and arable crops. There has been no conversion from non-agricultural land in our Malaysian operations in 2015 and 2016.

The amount of carbon we emitted through land clearing has been offset by the amount of carbon sequestered through the planting of oil palms. Carbon sequestration accounted for 667,826 MT CO<sub>2</sub>e in 2016, resulting in net carbon emissions of 66,623 MT CO<sub>2</sub>e from land use. This 37% increase from 2014 was partially due to replanting, which reduce crop sequestration values and partially due to increases in the default values between PalmGHG V2 and V3.

### Carbon footprint per tonne produced (MT CO<sub>2</sub>e per MT CPO/PK)

	2014	2015	2016	Variation 2014-2016
<b>KULIM</b>	<b>1.15</b>	<b>0.93</b>	<b>1.23</b>	<b>+ 6.95%</b>
Tereh Palm Oil Mill	0.71	0.90	1.37	+92.96%
Palong Palm Oil Mill	1.41	1.07	1.09	-22.70
Sedenak Palm Oil Mill	1.32	1.35	1.32	0
Sindora Palm Oil Mill	1.13	0.99	1.30	+ 15.04%
Pasir Panjang Palm Oil Mill	--	1.22	0.82	-

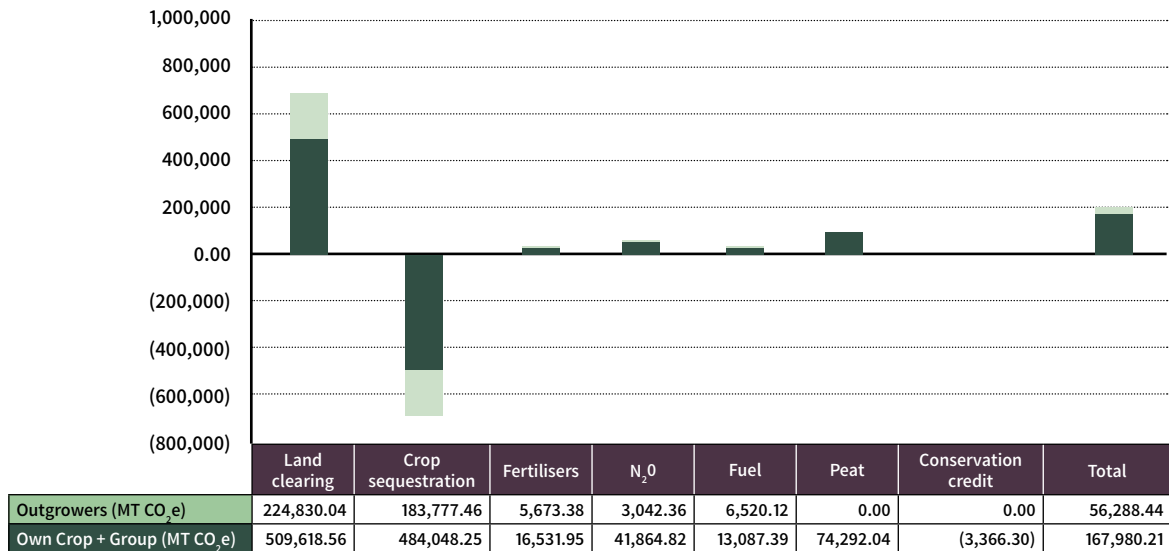
# OVERVIEW

## Land use change default values

Previous Land Use	PalmGHG Version 2	PalmGHG Version 3
Oil palm (mineral soil, estate)	199	234 No distinction between mineral/peat & estate/outgrower land
Oil palm (peat soil, estate)	194	
Oil palm (mineral soil, outgrower)	198	
Oil palm (peat, outgrower)	188	

Just over 27% of our crop was sourced from smallholders and outgrowers, accounting around 30% of our land clearing emissions and 27% of our carbon sequestration total.

## Field emissions (MT CO<sub>2</sub>e)



## Fertiliser use and Nitrous Oxide (“N<sub>2</sub>O”) emissions

GHG emissions resulting from fertiliser use in oil palm plantings contributed 67,112 MT CO<sub>2</sub>e or 5.96%, of our total emissions in 2016. This represents 13.14% reduction from 2014, where our fertiliser-related emissions totalled 77,267 MT CO<sub>2</sub>e. These emissions are generated through the production, transportation and application of fertilisers in the field in both our estates as well as those of outgrowers. While we do have a long-term target to reduce fertiliser use per hectare, the reduction seen since 2014 is primarily a result of less fertilisers being used at the current stage in the planting cycle.

### 2016 Emissions

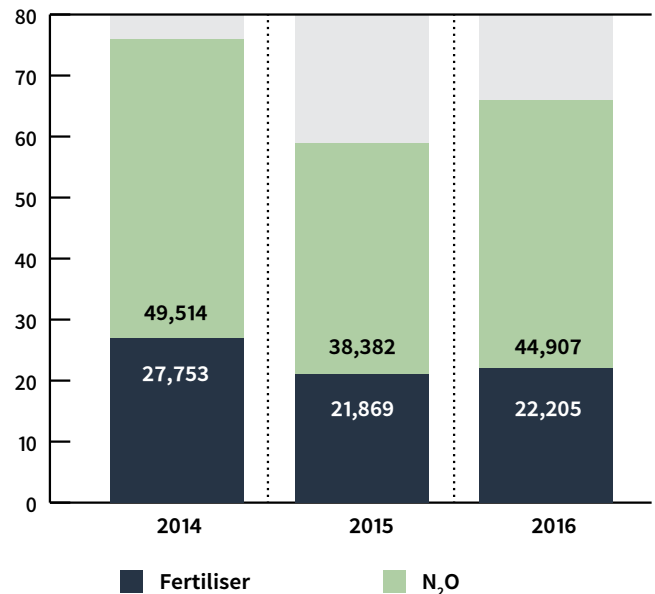


**5.96%**  
from fertiliser use in  
Oil Palm plantings



**1.74%**  
from fossil fuel use  
in field operations

## Fertiliser Emissions (MT CO<sub>2</sub>e) including Outgrowers



# OVERVIEW

The amount of CO<sub>2</sub>e emitted by each chemical component in a fertiliser varies widely, from 44 kg to 2,380 kg CO<sub>2</sub>e per MT of fertiliser used (see the table). N<sub>2</sub>O emissions derived from the nitrogen content are determined by multiplying by a factor of 44/28<sup>1</sup>.

## Default values

Fertiliser Production	Material kg CO <sub>2</sub> e/MT
Ammonium Nitrate (AN)	2,380
Diammonium Phosphate (DAP)	460
Ground Magnesium Limestone (GML)	547
Ground Rock Phosphate (GRP)	44
Kieserite	200
Muriate of Potash (MOP)	200
Sulphate of Ammonia (SOA)	340
Triple Superphosphate (TSP)	170
Ammonium Chloride (AC)	1,040
Urea	1,340

## Field fuel use

The use of fossil fuels i.e. diesel in our field operations contributed just 1.74% of our total emissions in 2016. This includes fuel consumed by equipment, vehicles and machinery in the transportation of materials and workers, field maintenance, fertiliser application and FFB harvesting. The emissions factor for diesel use is 3.12kg CO<sub>2</sub>e per litre (unchanged in V2 and V3).

## Plantings on peatland

The cultivation of oil palm on peatland results in the microbial decomposition of exposed organic carbon, thereby releasing GHGs including N<sub>2</sub>O into the atmosphere. There is still significant uncertainty as to the factors that affect the magnitude of these emissions, but they are likely to include drainage depth, peat subsidence and the age of a plantation.

<sup>1</sup> PalmGHG Version 1 guidelines: based on conversion of N<sub>2</sub>O (molecular wt. 44) to N<sub>2</sub> (molecular wt. 28)







Only 1.73% of the land cleared and cultivated in Kulim's estates and by our outgrowers is peatland. However, due to the high emissions factor of peat, the contribution made to our carbon footprint was significant, totalling 74,292 MT CO<sub>2</sub>e or 6.6% of our total emissions including outgrowers in 2016.

To reduce peat emissions, Kulim has implemented best management practices in compliance with the RSPO Principles and Criteria. We actively monitor and control water tables with a drainage depth of 60 cm to limit GHG emissions from peatlands. In determining GHG emissions from peatland, default emission values of 0.91 MT CO<sub>2</sub>e per cm per year (or 54.6 MT CO<sub>2</sub>e per ha per year for 60 cm drainage depth) and 16 kg N-N<sub>2</sub>O per ha per year are used, as proposed by the PalmGHG calculator.

#### **Carbon sequestration in conservation areas**

Land that is conserved instead of being used for oil palm cultivation can be included in carbon sequestration calculations. We have established 1,042 hectares of set-aside land, reducing our overall carbon footprint by 3,366 MT CO<sub>2</sub>e.

#### **Emissions from palm oil production**

Given that most of our field emissions are fixed, the vast majority of our avoidable CO<sub>2</sub>e emissions derive from the processing of FFB into CPO. There are two (2) emissions factors at mill level: methane from POME and fuel for mill use. The latter is insignificant for Kulim, as our operations are largely powered by biomass, with only a small amount of diesel which representing around 0.3% of our gross emissions being used for machinery.

# OVERVIEW



## Palm Oil Mill Effluent (“POME”) methane emissions

POME emissions, which account for 99% of our total mill emissions, increased 24% between 2014 and 2016. High levels of methane emissions at our second largest mill at Tereh Palm Oil Mill, which saw an overall emissions increase of 59,893 MT over this period, contributed the majority of this rise. The large increase was due to mill cleaning processes that resulted in a higher volume of organic matter being channeled into the effluent treatment area, as well as a high COD value for raw effluent in PalmGHG V3.

Now equipped with a fully operational biogas facility, our largest mill which is Sedenak Palm Oil Mill saw POME emission reductions of more than 30,000 MT CO<sub>2</sub>e. However, the reductions achieved were offset by cleaning processes as in Tereh Palm Oil Mill and for the emissions increase at Sindora Palm Oil Mill. Both Pasir Panjang Palm Oil Mill and Palong Palm Oil Mill recorded reduced POME emissions.

In addition to the biogas facility at Sedenak Palm Oil Mill, our new mill at Pasir Panjang has now commenced flaring and we expect to commission our third biogas facility at Sindora Palm Oil Mill in 2018. We anticipate reductions of around 60% of total POME emissions once all three (3) facilities are fully operated.

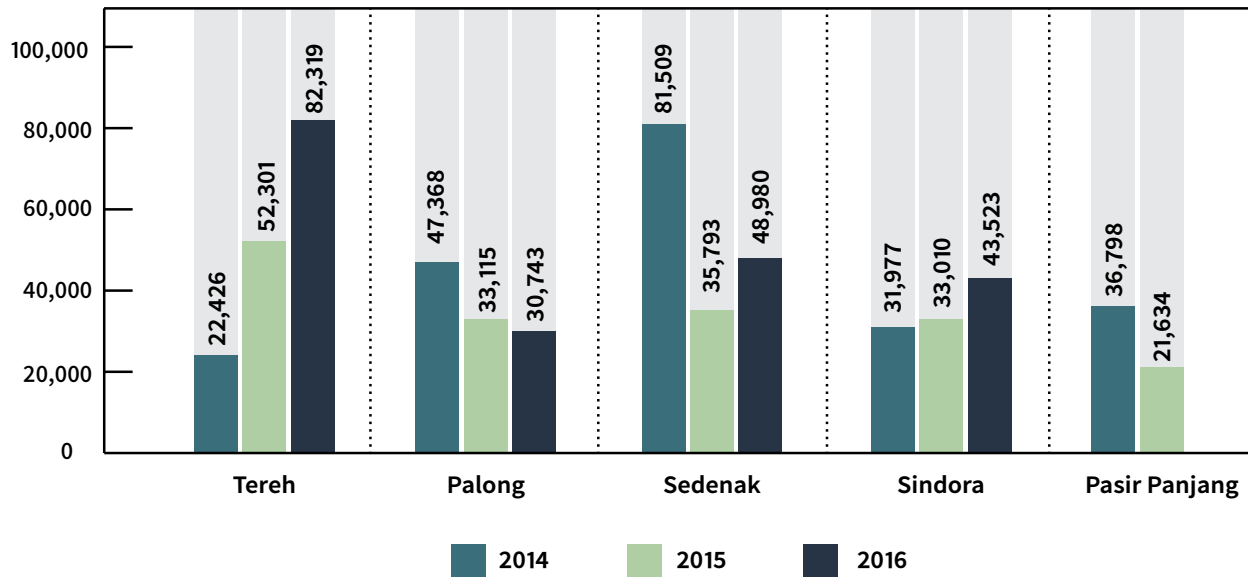
### SEDENAK PALM OIL MILL BIOGAS

 **POME emissions**  
**30,000** MT CO<sub>2</sub>e

### TOTAL POME EMISSIONS

 **60%** **All three facilities fully operational**

## POME Emissions by Mills (MT CO<sub>2</sub>e)



### Emissions credit from Palm Kernel Shell (“PKS”)

PKS is a side product derived from the production of CPO and PKO which currently used for power generation at our own mills or for third party use. In 2016, we sold 14,603 MT of PKS produced at our mills to external parties. PKS used as a replacement for coal and other fossil fuels in the generation of power creates a carbon offset. Having monitored PKS usage since 2014, we have concluded that most of the PKS we sell is used for this purpose and are thereby able to incorporate a carbon credit of 32,127 MT CO<sub>2</sub>e for 2016, which is greater than our total combined emissions from fossil fuel use at mills and in the field that year.

### PALM KERNEL SHELL USED FOR POWER GENERATOR

**32,127** MT CO<sub>2</sub>e

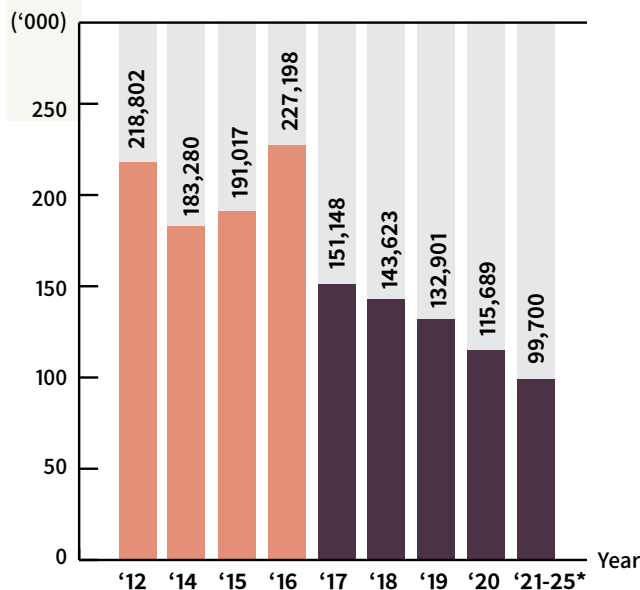
**Carbon Credit**

# MITIGATION STRATEGIES AND REDUCTION TARGETS

## METHANE CAPTURE AND BIOGAS GENERATION

At year end-2016, we had two (2) biogas plants installed and commenced operations at two of our palm oil mills. We commissioned our first methane capture and power generation project in Sedenak Palm Oil Mill in April 2014. This was a logical choice, as Sedenak Palm Oil Mill has the highest GHG emissions among all five (5) mills owned and operated by Kulim. The Sedenak Palm Oil Mill facility is now fully operational and is capturing around 30% of the methane generated. In 2016, it produced a total of 1,445,335 cubic metres of methane biogas for power generation and flaring with the engine clocking 2,624 hours of operation.

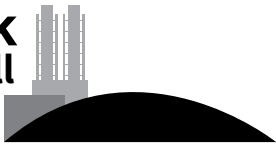
### Projected emissions reduction from POME (MT CO<sub>2</sub>e)



A second plant was commissioned in Pasir Panjang Palm Oil Mill in 2016, and flaring commenced in March 2017. This plant is able to utilise 100% of the POME generated and the biogas will be channeled to the mill boiler once the biogas production has stabilised.

Under these projects, almost 90% of the methane derived from POME degradation will eventually be captured and channeled for power generation in the mills and for flaring. Overall, we expect these two (2) projects to reduce our Malaysian emissions from POME by around 50% over the coming five years.

**Sedenak Palm Oil Mill**  
**30%**  
of methane generated is captured



Meanwhile, the proposed installation of biogas plant at Tereh Palm Oil Mill and Palong Palm Oil Mill – which was intended to facilitate exporting of electricity to Tenaga Nasional Berhad's grid – was postponed until the Feed-in-Tariffs (FITs) quota becomes available.

The installation of biogas plants at the remaining palm oil mills are now expected to complete by 2025 as per requirement by the Department of Environment. This new timeline will supersede our previous planning that the installation was expected to be completed in 2017.

## FERTILISER REDUCTION

We are also addressing GHG emissions from the production, transportation and use of chemical fertilisers as part of our effort to reduce our environmental impact.

Excessive use of chemical fertilisers can lead to the pollution of rivers and underground water sources. In order to minimise this risk without affecting FFB yields, we have embarked on a long-term organic fertiliser programme. The collection of field data is already underway in order to optimise our use of both organic and non-organic fertilisers. In addition, all Kulim mills have established composting projects to recycle nutrients from Empty Fruit Bunches (“EFB”) and POME back into the fields.

## OUTGROWER ENGAGEMENT

In 2012, we began a long-term engagement process with all of our independent outgrowers, who we found to account for more than 30% of our total carbon footprint. This work has been continued and is now evolving into a full-scale programme to assist outgrowers in achieving RSPO certification. So far, two (2) outgrower groups have achieved full certification and we continue to work with other groups toward the same end. In addition, the certification of our smallholders under the Malaysian Government’s Malaysian Sustainable Palm Oil (“MSPO”) Certification Scheme will be underway by 2018. We believe that by driving the adoption of good agricultural practices, including the efficient use of fertilisers, these certification schemes will enable a continual reduction in GHG emissions among our third-party FFB suppliers.



## UPDATED EMISSIONS REDUCTION TARGETS

Kulim’s original target, published in our 2012 Carbon Footprint Report, was to reduce our emissions overall carbon emissions by 58% by 2020. This was primarily based on the forecasted savings from our biogas initiatives. However, this target was based on the assumption that our biogas programme would be fully operational by 2020 and on stable default values for land use change in the RSPO PalmGHG methodology. Since we have to postpone some of our biogas capture projects and due to the significant changes in default values in the PalmGHG calculator, we will be reviewing our overall targets during the course of 2017-2018 and will recalculate a target which reflects these changes.

It is worth noting that we did in reduce emission significantly through the PKS tracking initiative, the optimisation of fertiliser use and the re-categorisation of peat areas from 2012-2014. These are one-off savings that we expect to sustain at the same level.

# METHODOLOGY

## PalmGHG

Unless otherwise noted, the calculations and definitions applied in this report are based on the PalmGHG Calculator Beta Version 1a developed by the RSPO Greenhouse Working Group 2. This version of the tool is in turn based on the Global Warming Potential Assessment of Palm Oil Production (“GWAPP”) model developed by Chase and Henson (2010).

The PalmGHG framework was developed to identify GHG emission ‘hotspots’ in the life cycle of palm oil, to enable internal monitoring of GHG emissions and to assist palm oil producers in highlighting GHG emission reduction opportunities and developing reduction plans.

Sources of emissions in the PalmGHG framework include:

- Land clearing.
- Production and transport of fertiliser.
- N<sub>2</sub>O and CO<sub>2</sub> emissions from the application of fertilisers in the field.
- Use of fossil fuels in plantations for planting work and FFB harvesting, collection and transport to mills.
- Use of fossil fuels in mill operations.
- Emissions of CH<sub>4</sub> from the anaerobic degradation of POME from mills.
- CO<sub>2</sub> and N<sub>2</sub>O emissions from cultivation on peat soil.



GHG fixation and credits included in the PalmGHG framework:

- CO<sub>2</sub> fixation by the growth of palm trees.
- CO<sub>2</sub> fixation by biomass in conservation areas.
- GHG emissions avoidance from the use of by-products, such as palm kernel shells, as well as the use of electricity generated by biomass from the mills.

Exclusion of GHG emissions sources/sinks in the PalmGHG tool:

- Nursery planting stage.
- Pesticides manufacturing, transport and use.
- Fossil fuel use during land clearing activities.
- Carbon footprint of infrastructure, plant and equipment.
- Carbon sequestration in palm end-products.
- Work-related employee travels and commuting.

### Assumptions of the PalmGHG framework

The PalmGHG tool provides a set of default values that are used in areas where company specific field data is unavailable. In this report, we use our own field data wherever they are available and can be verified from the records of our operations. Elsewhere, default values are used, such as in the case of determining GHG emissions from land use change, peat emissions, as well as the production and field application of fertiliser. Additionally, a number of emission factors were also based on the default values provided in the PalmGHG tool, including for POME conversion to methane, fossil fuel and grid electricity offset.

### ASSUMPTIONS FOR CARBON REDUCTION TARGETS

The projection assumes that only three (3) mills (Sedenak Palm Oil Mill, Sindora Palm Oil Mill and Pasir Panjang Palm Oil Mill) will have operational biogas plants within the next five (5) years. For Sedenak Palm Oil Mill, 50% of the total POME produced by the mill will be used in biogas production. As for Pasir Panjang Palm Oil Mill and Sindora Palm Oil Mill, it is assumed that POME will be gradually diverted from conventional ponding systems to biogas plants at the rate of 25% each year until all (100%) POME is diverted to biogas plants.

To ensure a conservative estimate it is assumed that all biogas generated will be flared and will not be used for electricity generation in mills (which would generate a higher carbon offset). All other data, including FFB throughput, land clearing and sources of emissions and sequestration, are assumed to remain at 2014 conditions.



# BASE DATA

## EMISSIONS DATA 2016 (PALMGHG VERSION 3)

DESCRIPTION	UNIT	PALONG COCOA PALM OIL MILL	SEDENAK PALM OIL MILL	SINDORA PALM OIL MILL	TEREH PALM OIL MILL	PASIR PANJANG PALM OIL MILL
Crude Palm Oil	MT CO <sub>2</sub> e/ MT CPO	1.09	1.32	1.30	1.37	0.82
Palm Kernel	MT CO <sub>2</sub> e/ MT PK	1.09	1.32	1.30	1.37	0.82
Net Emission	MT CO <sub>2</sub> e/yr	47,758	154,043	72,910	108,434	38,739
Land Clearing	MT CO <sub>2</sub> e/yr	118,436	249,789	120,509	133,127	112,588
Crop Sequestration	MT CO <sub>2</sub> e/yr	- 111,680	- 229,031	- 97,282	- 123,115	- 106,718
Fertiliser Production & Transport	MT CO <sub>2</sub> e/yr	3,181	5,998	3,792	4,741	4,493
Fertiliser Application (N <sub>2</sub> O)	MT CO <sub>2</sub> e/yr	7,101	18,953	5,527	8,375	4,952
Field Fuel Use	MT CO <sub>2</sub> e/yr	2,175	7,192	3,205	3,383	3,653
Peat Land Emissions	MT CO <sub>2</sub> e/yr	-	74,292	-	-	-
Conservation Area Offset	MT CO <sub>2</sub> e/yr	- 241	- 322	- 14	- 352	- 2,437
Methane from POME	MT CO <sub>2</sub> e/yr	30,743	48,980	43,523	82,319	21,634
Mill Fuel Use	MT CO <sub>2</sub> e/yr	249	989	368	713	711
Mill Electricity Supply Offset	MT CO <sub>2</sub> e/yr	- 2,414	- 22,798	- 6,829	- 756	- 135
<b>GHG Emission by FFB Source (exclude emission from mill activities)</b>						
Own Crops	MT CO <sub>2</sub> e/yr	15,338	99,896	12,153	21,955	16,530
Group	MT CO <sub>2</sub> e/yr	-	2,019	-	90	-
Outgrowers	MT CO <sub>2</sub> e/yr	3,634	24,957	23,584	4,114	-



## EMISSIONS DATA 2015 (PALMGHG VERSION 3)

DESCRIPTION	UNIT	PALONG COCOA PALM OIL MILL	SEDEKAK PALM OIL MILL	SINDORA PALM OIL MILL	TEREH PALM OIL MILL	PASIR PANJANG PALM OIL MILL
Crude Palm Oil	MT CO <sub>2</sub> e/ MT CPO	1.07	1.35	0.99	0.90	1.22
Palm Kernel	MT CO <sub>2</sub> e/ MT PK	1.07	1.35	0.99	0.90	1.22
Net Emission	MT CO <sub>2</sub> e/yr	50,479	170,068	63,194	75,035	62,351
Land Clearing	MT CO <sub>2</sub> e/yr	124,121	250,435	125,083	134,697	122,531
Crop Sequestration	MT CO <sub>2</sub> e/yr	- 117,074	- 201,181	- 102,193	- 124,989	- 110,641
Fertiliser Production & Transport	MT CO <sub>2</sub> e/yr	3,645	4,237	2,330	3,554	8,104
Fertiliser Application (N <sub>2</sub> O)	MT CO <sub>2</sub> e/yr	6,242	17,263	3,075	6,070	5,733
Field Fuel Use	MT CO <sub>2</sub> e/yr	1,800	8,056	4,046	3,922	4,376
Peat Land Emissions	MT CO <sub>2</sub> e/yr	-	74,364	718	-	-
Conservation Area Offset	MT CO <sub>2</sub> e/yr	- 241	- 170	- 14	- 326	- 2,495
Methane from POME	MT CO <sub>2</sub> e/yr	33,115	35,793	33,010	52,301	36,798
Mill Fuel Use	MT CO <sub>2</sub> e/yr	328	1,421	336	590	497
Mill Electricity Supply Offset	MT CO <sub>2</sub> e/yr	- 1,604	- 20,149	- 3,317	- 784	- 2,552
<b>GHG Emission by FFB Source (exclude emission from mill activities)</b>						
Own Crops	MT CO <sub>2</sub> e/yr	15,025	99,246	8,929	18,838	27,608
Group	MT CO <sub>2</sub> e/yr	-	432	840	13	-
Outgrowers	MT CO <sub>2</sub> e/yr	3,466	53,325	23,276	4,076	-

# BASE DATA

## PRODUCTION DATA

DESCRIPTION	UNIT	2016	2015	2014	2013	2012
<b>Palm Products</b>						
Crude Palm Oil	MT CPO/yr	273,354	294,255	257,881	254,735	217,146
Palm Kernel	MT PK/yr	70,030	78,290	69,681	70,891	61,464
<b>FFB Production</b>						
Own Crop	MT FFB/yr	974,881	990,629	845,257	774,615	647,628
Outgrowers	MT FFB/yr	364,778	419,994	407,568	494,115	433,454
<b>Planted Area</b>						
Own Crop	Ha	56,097	55,935	55,976	53,729	50,065
Outgrowers	Ha	22,816	23,095	20,328	20,328	20,328
<b>Fertiliser</b>						
Own Crop	MT/yr	62,642	60,376	23,450	25,202	21,303
Outgrowers	MT/yr	7,671	5,925	5,941	10,143	12,117
<b>Field Fuel Use</b>						
Own Crop	liters/yr	2,960,339	4,439,149	4,904,199	3,186,046	2,557,688
Outgrowers	liters/yr	2,090,917	2,691,904	1,909,507	1,648,730	1,481,951
Mill Fuel Use	liters/yr	971,047	1,016,824	676,298	721,522	878,882

## DATA COLLECTIONS AND LIMITATIONS

There are two distinct sets of data used in this report. Each set of data has associated challenges and scope for improvement.

### In-house data from estates and mills

Primary emissions data from Kulim's estate and mills were obtained from statistics and monitoring undertaken by Kulim's Estates and Engineering Departments. These data are assumed to have a high level of accuracy, although continuous efforts to increase robustness will be undertaken. Two areas in particular may contribute to significant improvements:

### Crop sequestration:

Calculation of carbon sequestration from the planting of new palm trees is estimated from the default values provided in the PalmGHG calculator. These default values are obtained from the OPRODSIM and OPCABSIM models<sup>2</sup> recommended in the calculator. Kulim does not presently have in place a practice of making on-site measurements of the biomass growth of its own palm trees.

### Peat emissions:

While the peat areas within Kulim-owned estates are being actively monitored and controlled for water table levels, similar monitoring and control cannot be ascertained for outgrowers' operations. Kulim is in the process of identifying these outgrowers within the supply chain and will work with them to preserve peatlands from degradation.



### Outgrower data

The second set of data relate to outgrowers' crops. Kulim's external crop is primarily purchased from third-party FFB traders who do not disclose the source of FFB. In order to allow some level of monitoring, data were collected using interviews and questionnaires sent to FFB traders and smallholders. Kulim has assigned dedicated personnel to engage these stakeholders in the process. A number of factors were found to contribute to a high margin of error:

**Diversity of suppliers:** All the respondents replied and provided the requested data. The data supplied suggested vast differences between suppliers due to variations in previous land use profiles.

**Insufficient record keeping:** Quality of record keeping varies significantly and may lead to a high level of uncertainty. This includes records of previous land use over the past three decades and the identification of mineral soils versus peatlands.

**Emissions from non-palm related activity.** It is assumed that all the fertilisers and fuels purchased by smallholders and outgrowers are used for oil palm cultivation and harvesting activities. However, it is likely that these resources may be used for other purposes, such as for the cultivation of additional crops or private transport. A more detailed methodology would therefore apportion resource use between palm and non-palm related activities.

Despite these shortcomings, we believe that this is still an improvement over the standard assumption that a company's FFB and externally sourced FFB have similar carbon profiles. Our calculations so far indicate that this is not the case. In addition, we believe that external FFB data can be improved over time as engagement with traders and external suppliers continues and levels of trust and transparency increase.

<sup>2</sup> OPRODSIM (Oil Palm Production Simulator) and OPCABSIM (Oil Palm Carbon Budget Simulator) are oil palm models specifically designed to estimate oil palm and associated biomass in the plantation (litter and ground cover) by generating growth curves based on climate and soil data, largely based on Malaysian conditions.

# GLOSSARY

**Biogas** is a mixture of methane and carbon dioxide produced by the bacterial decomposition of organic wastes and used as a fuel.

**Biomass** is biological material derived from living or recently living organisms. In the context of biomass for energy this is often used to mean plant based material, but biomass can equally apply to both animal and vegetable derived material.

**Carbon dioxide (CO<sub>2</sub>)** is the most widespread greenhouse gas. CO<sub>2</sub> is released to the atmosphere through natural and human activities, including fossil fuel and biomass burning, industrial processes, and changes to land use, among others. Carbon dioxide accounts for 76.7% of greenhouse gas emissions, with 13.5% arising from agriculture and 17.4% from forestry.

**Carbon dioxide equivalent (CO<sub>2</sub>e)** is a unit of measurement used to compare the climate effects of all greenhouse gases to each other. CO<sub>2</sub>e is calculated by multiplying the quantity of a greenhouse gas by its global warming potential. The standard form of labelling emissions is therefore to express them as carbon dioxide equivalents or CO<sub>2</sub>e.

**Carbon footprint** is the amount of carbon dioxide and other carbon compounds emitted through the activities of a particular person or group. Reports on these emissions for an operation or product are also referred to as carbon reports or carbon footprints.



**Carbon sequestration/carbon sink** describes the process by which vegetation captures carbon dioxide from the atmosphere through the process of photosynthesis, and releases oxygen and some carbon dioxide through respiration. Part of this carbon is retained in vegetation as biomass. Because around half of the biomass of a plant is carbon, as the plant grows and adds biomass it also adds or sequesters carbon. This is a natural process but it can be enhanced, for example by planting trees on land that has not previously had trees will sequester more carbon because of the increase in biomass. The term ‘sink’ is used to mean any process, activity or mechanism that removes a greenhouse gas from the atmosphere.

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**Greenhouse gases (GHGs)** are an important part of the earth’s natural cycle, keeping the planet warm enough to sustain life. Human activities are upsetting the balance, increasing the concentration of GHG to the point where rising temperatures threaten livelihoods, ecosystems and economies. The major GHGs and their contribution to the greenhouse effect (rounded up) are: water vapour (60%); carbon dioxide (26%); methane (5%); ozone (4%); fluorinated gases (4%); and nitrous oxide (2%).

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**Palm products** is a versatile oil and fat products intended for wide range application that being used in everyday items. Kulim (Malaysia) Berhad is in production of Fresh Fruit Bunches (“FFB”), Crude Palm Oil (“CPO”) and Palm Kernal (“PK”).

# REFERENCES



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## **PAS 2050:2011:**

Specification for the assessment of the life cycle greenhouse gas emissions of goods and services. Carbon Trust and DEFRA UK.





# ABOUT THIS REPORT

This report covers Kulim's oil palm operations in Malaysia for the calendar years 2015 and 2016. Data, commitments and targets do not cover Kulim's operations in Indonesia, which were initiated in 2014.

The data in this report are presented on a best-effort basis and may be subject to change. The data were collated in-house and screened and analysed by a third party consultant from Helikon Advisory Sdn Bhd. The data have not been subject to independent verification or assurance.

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We welcome feedback and questions.  
Please contact:

**SALASAH ELIAS**

**Kulim (Malaysia) Berhad**  
c/o Ulu Tiram Estate, Ulu Tiram, K.B 705  
80990 Johor Bahru, Johor  
Tel : +607 861 1611 / +607 862 2000  
Email : [salasaah@kulim.com.my](mailto:salasaah@kulim.com.my)

Designed by Affinity Worldwide Sdn. Bhd.

Kulim (Malaysia) Berhad (23370-V)  
Level 16, Menara KOMTAR  
Johor Bahru City Centre  
80000 Johor Bahru  
Johor Darul Takzim, Malaysia

T: +607 226 7692 / +607 219 5077  
F: +607 222 3044

[www.kulim.com.my](http://www.kulim.com.my)