

Green Opportunities in Enhancing the Sustainability of Malaysian Palm Oil Milling Sector - an Industry Perspective

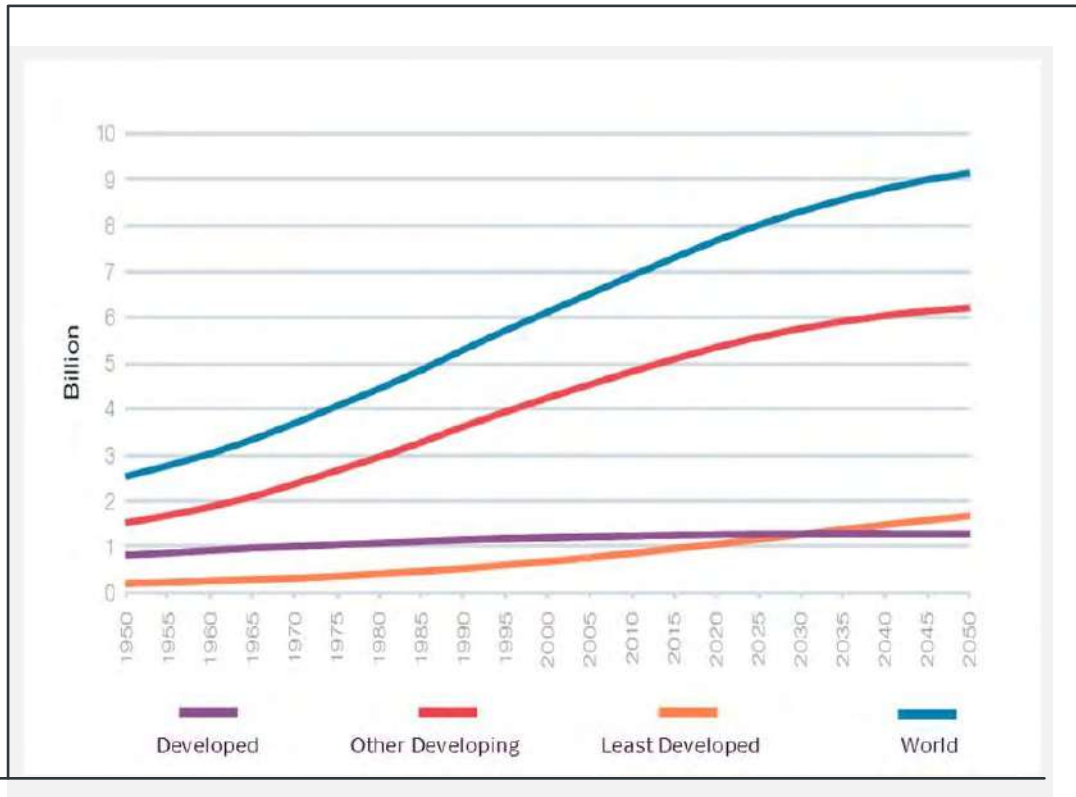
Malaysian Palm Oil Council's Science and Sustainability Engagement
27 May 2021

Hong Wai Onn, Novozymes Malaysia Sdn Bhd

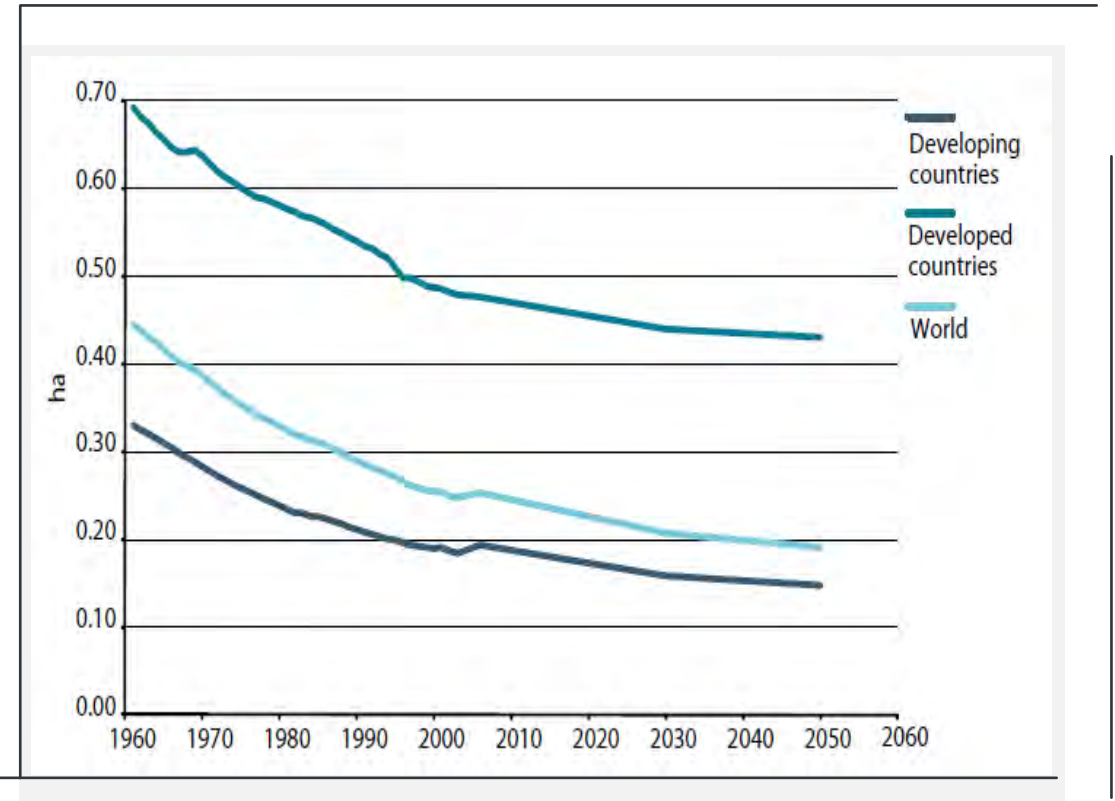
Can the palm oil milling
sector continue to remain
as it is for the next
decade?

How can we feed the world—today and tomorrow?

World population will reach 9.1 billion by 2050, with significant growth in developing countries

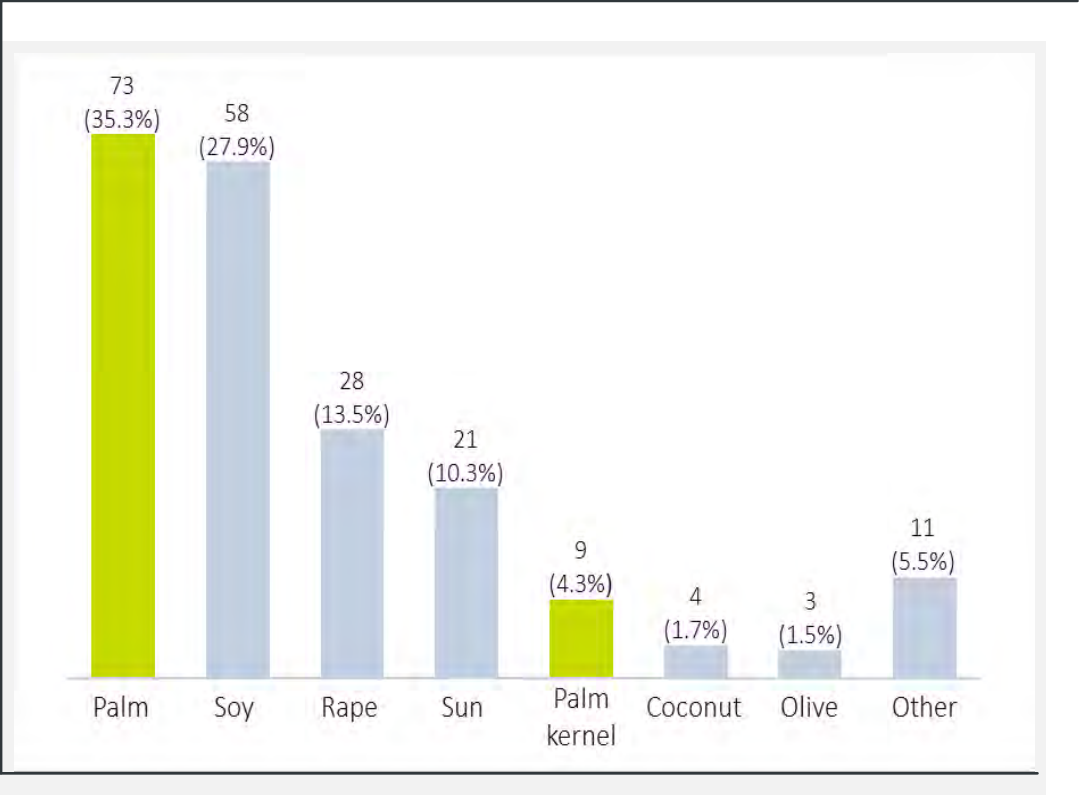


Arable land per capita with a projected decline from 0.38 ha in 1970 to 0.18 ha per person by 2050

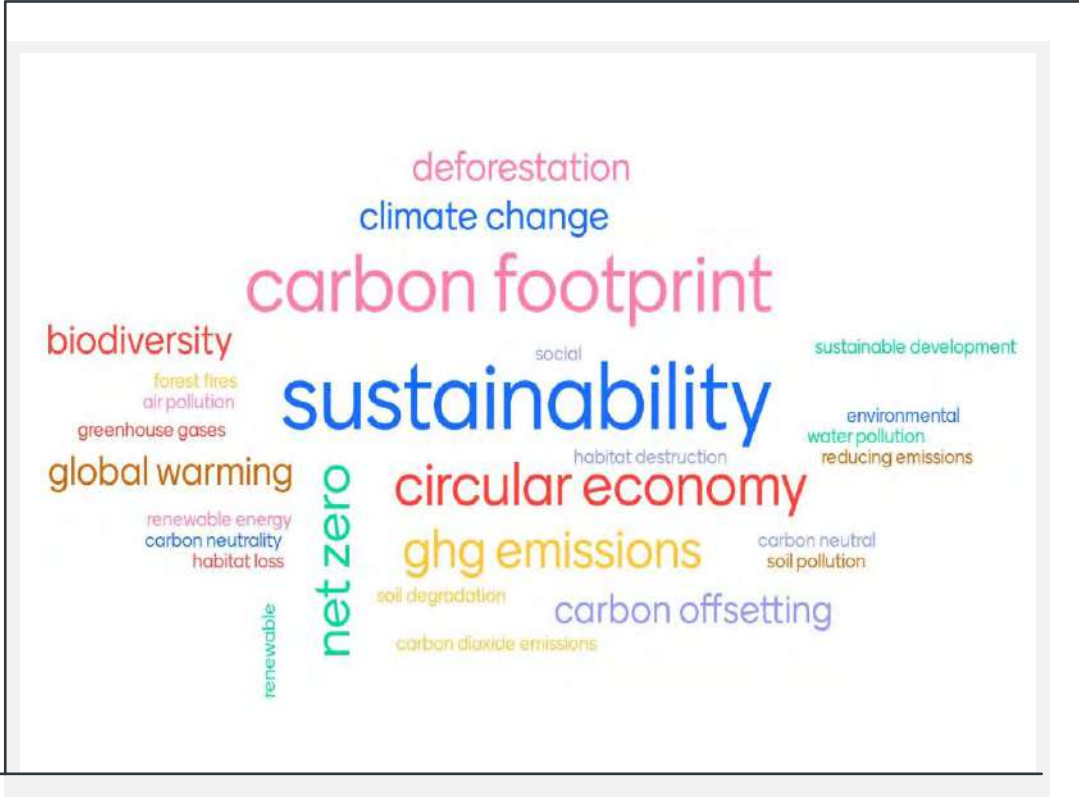


Palm could be the answer! But is the industry ready for the next revolution?

Palm oil and palm kernel oil comprises of one-third of the global vegetable oil production in '19/20 (million metric tonnes)

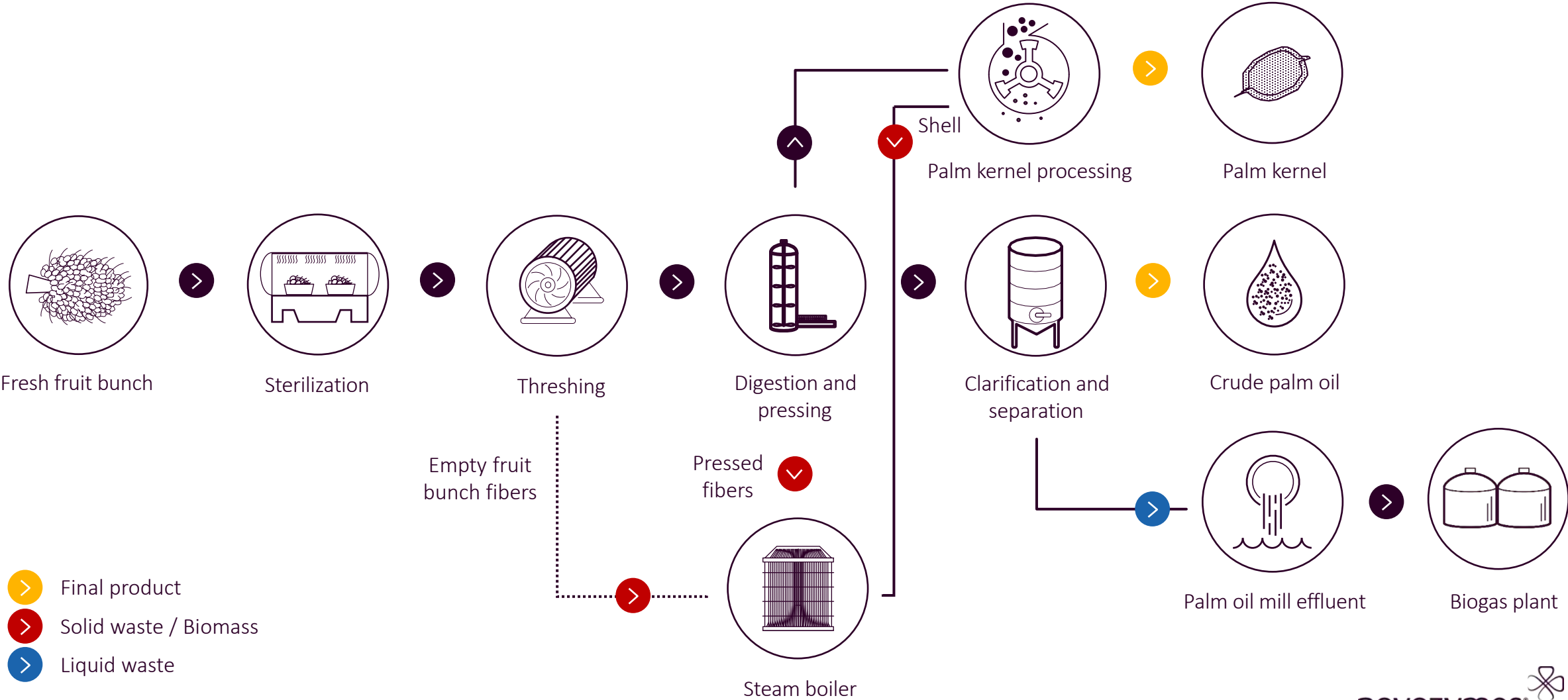


Palm oil industry is facing an uphill battle with challenges that have been enacted in the name of sustainability



Source(s): United States Department of Agriculture 2020

Palm oil milling operation has little changed since the publication of the Mongana report in the 1950s



Industrial biotechnology is the modern use and application of biotechnology for the sustainable processing and production of chemicals, materials and fuels from renewable sources, using living cells or enzyme.



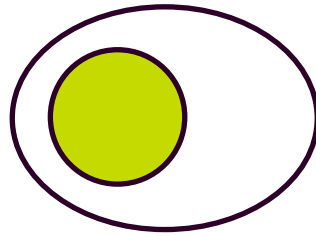
Enzymes are nature's problem solvers

Natural



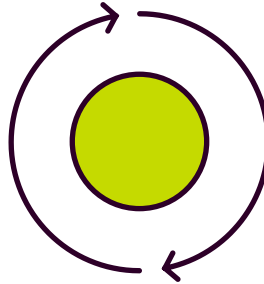
Enzymes are nature's tools – they speed up vital biological processes

Proteins



Enzymes are proteins present in all living cells. For example, they help digest foods

Catalytic



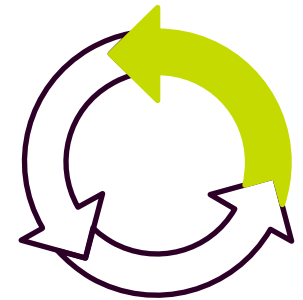
Enzymes are catalysts – enabling milder processes and saving energy and water

Specific



Enzymes are highly specific in their reactions and the substrates they target

Biodegradable



Enzymes are fully biodegradable and break down to harmless amino acids

You meet enzymes everywhere in your daily life



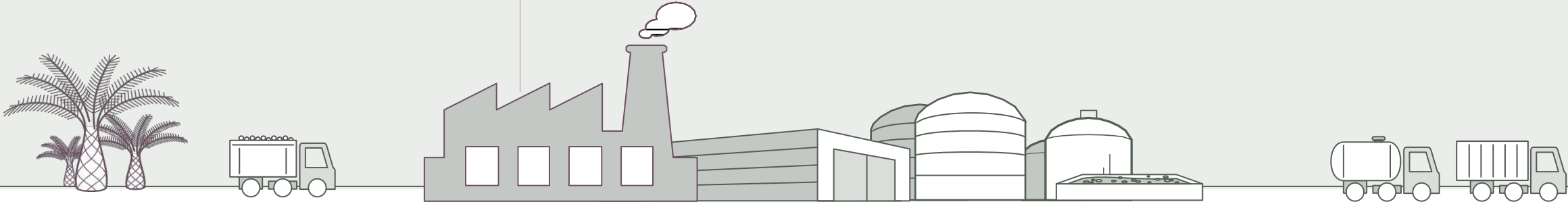
What could be the green
opportunities by
embracing
biotechnology?

Biotechnology could help make palm oil milling sector greener and more efficient



Unlocking yield potential

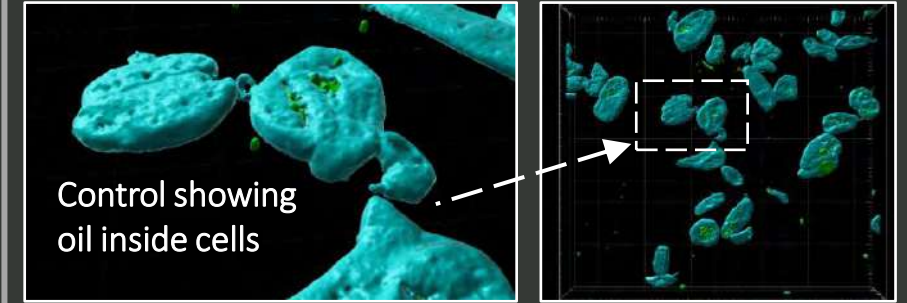
Improve oil yield and reduce greenhouse gas emissions



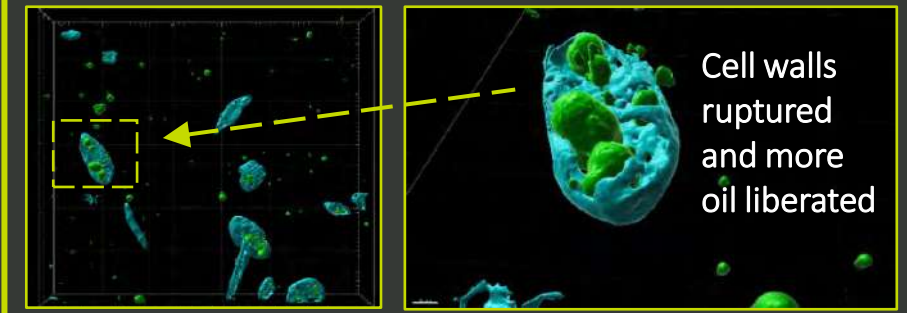
Biotechnology could make milling operation more efficient, thereby unlocking yield potential



Control (no enzyme)

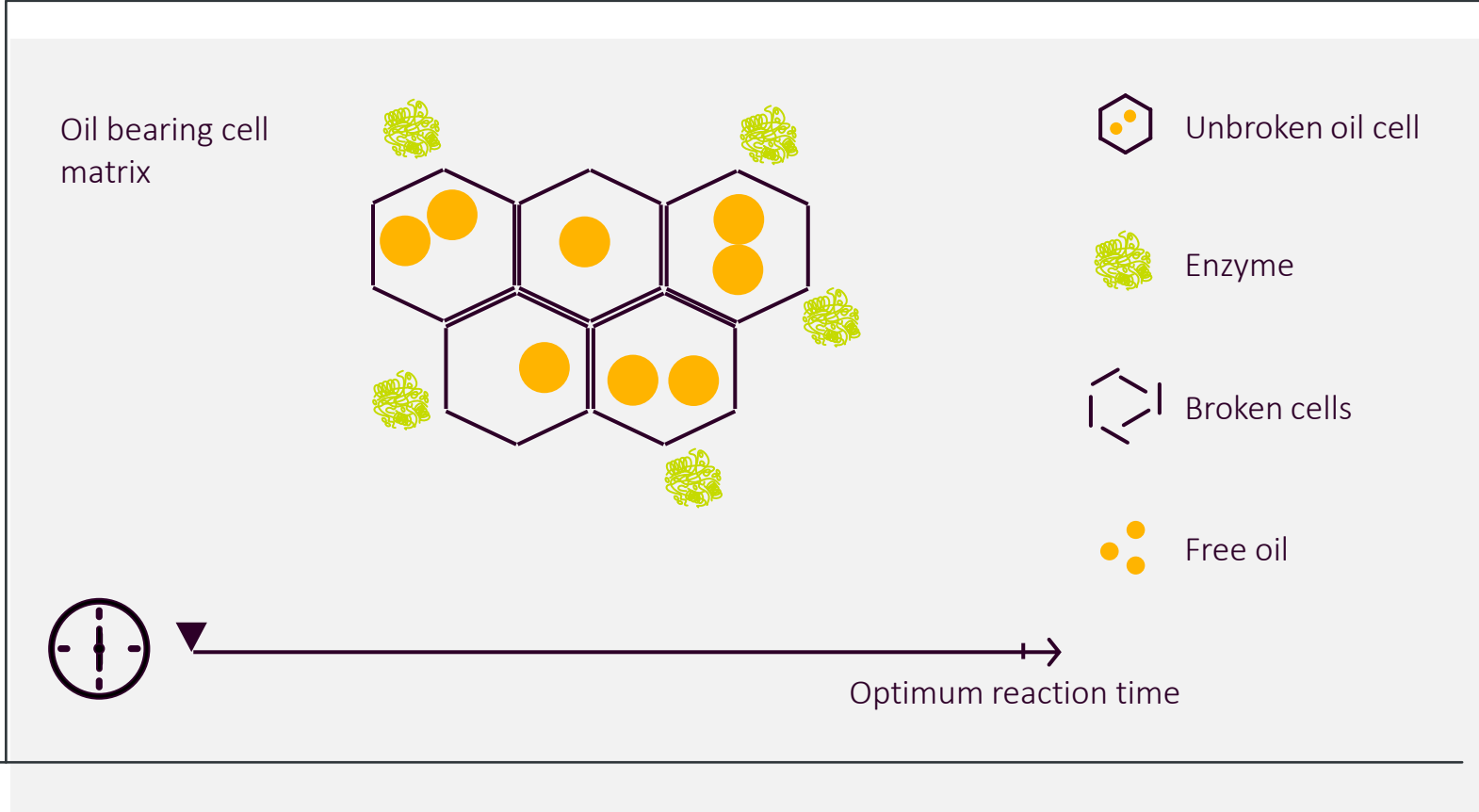


With enzyme



Confocal microscopy: 20X magnification of diluted crude palm oil

Enzyme increases cell wall rupture thereby enabling more oil to be released

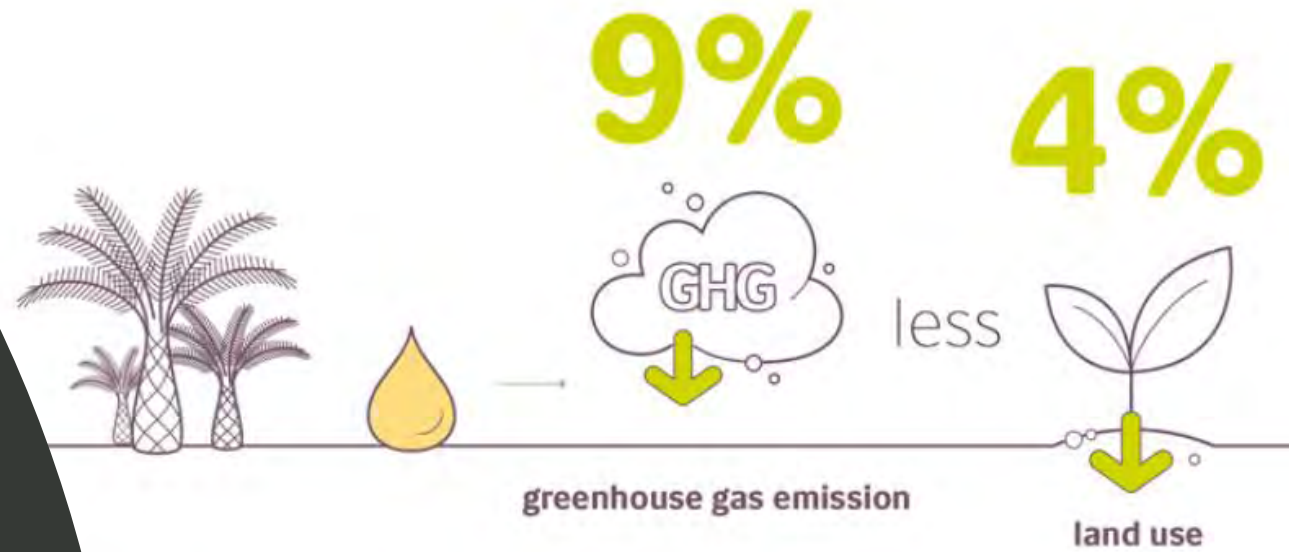


While digestion and pressing release most oil, some oil bearing cell walls remain unbroken in the traditional process.

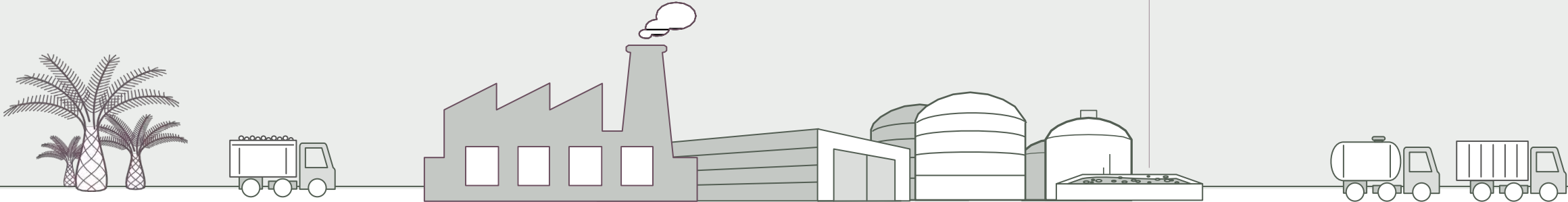
Enzyme increases cell wall rupture thereby enabling more oil to be released and captured.

Animation: based on microscopical enzymatic mode of action. Note that the honeycomb structure is merely illustrative

Alongside **yield improvement**, biotechnology could also enable **reduction in greenhouse gas emissions** and **lower land use**



Biotechnology could help make palm oil milling sector greener and more efficient



Unlocking waste to energy opportunity
Promote circular economy and reduce carbon footprint

Sludge oil could be harnessed for renewable energy. But are we tapping on this valuable resource enough?

Sludge oil / POME oil

- Around 0.5 t of sludge oil is generated with 100 t of FFB processed
- For a 45 tph oil mill, approximately 3 t sludge oil is generated per day



Present

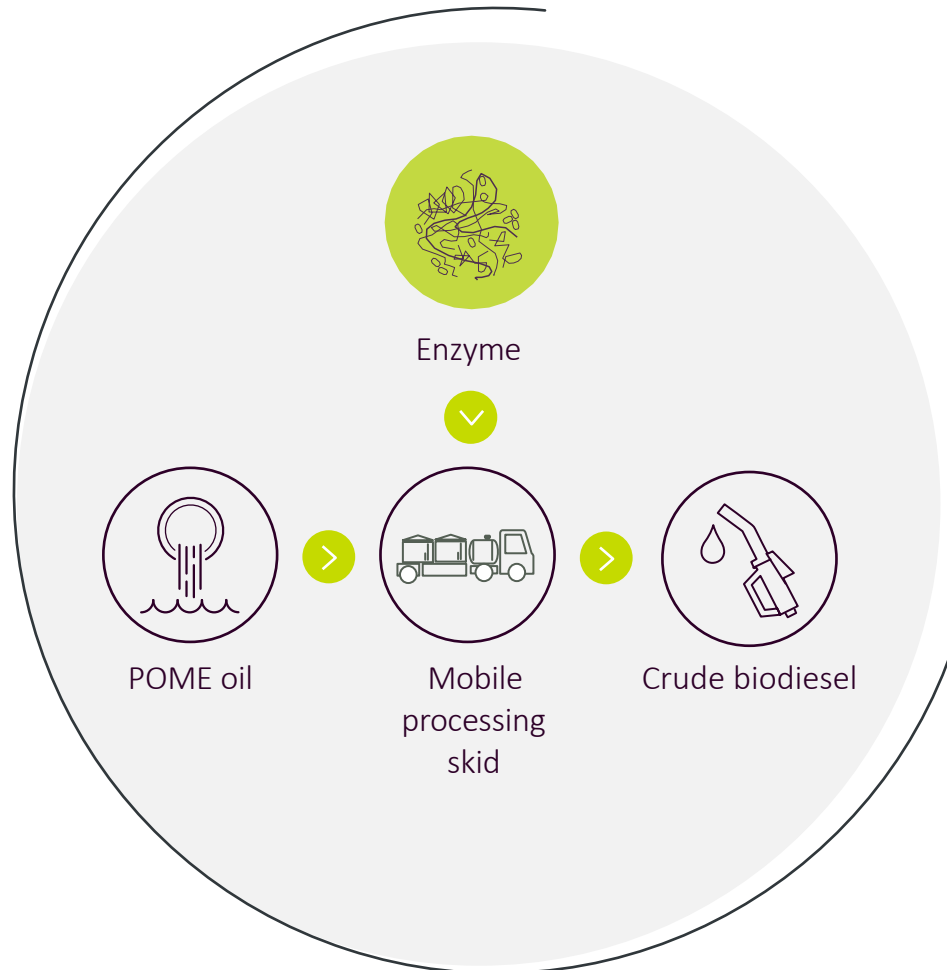
- Sold to sludge oil collectors
- Recycled back into production line?



Future

- Convert it into crude biodiesel for internal consumption (i.e., mill and plantation operations)

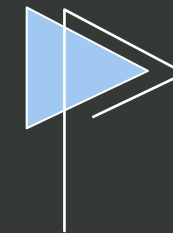
Biotechnology could convert POME oil into crude biodiesel, thereby unlocking waste to energy opportunity



It is a combined hydrolysis and esterification reaction as both glycerides and free fatty acid are converted into methyl esters

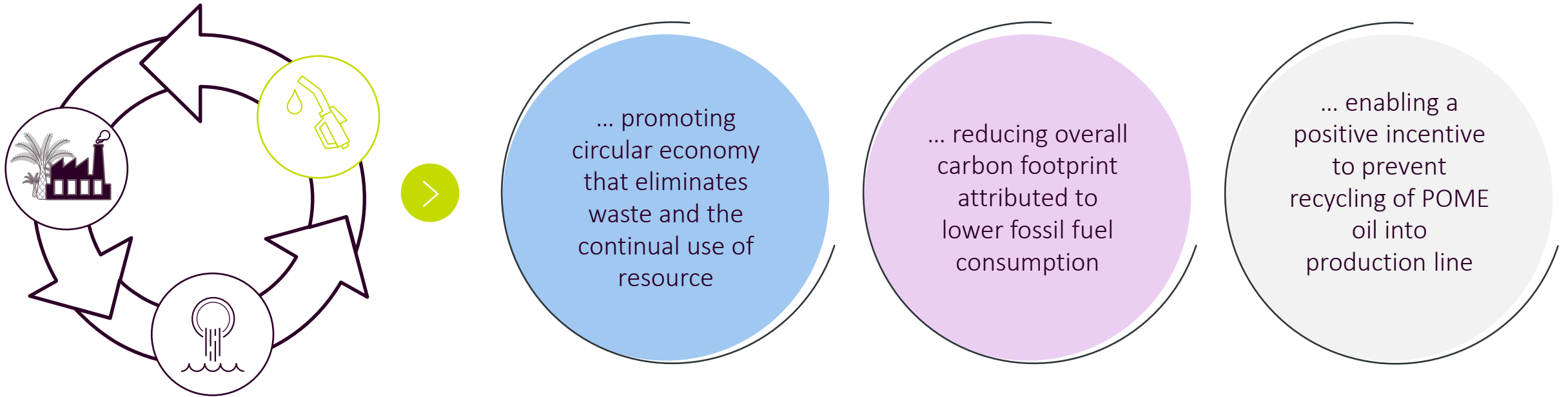


Instead of EN-spec biodiesel, crude biodiesel is produced. Hence lower capital and operational costs are expected

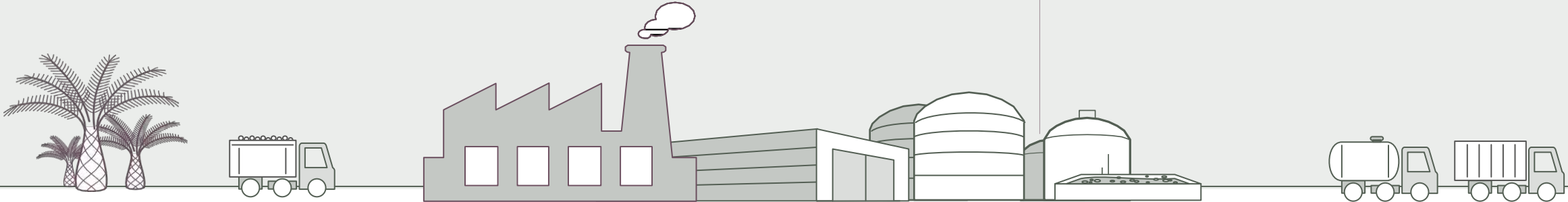


The mobile processing skid is designed to mobilize from one oil mill to another. Hence it could serve remote oil mills on campaign basis

Crude biodiesel produced could be used for mill and plantation operations, thereby...

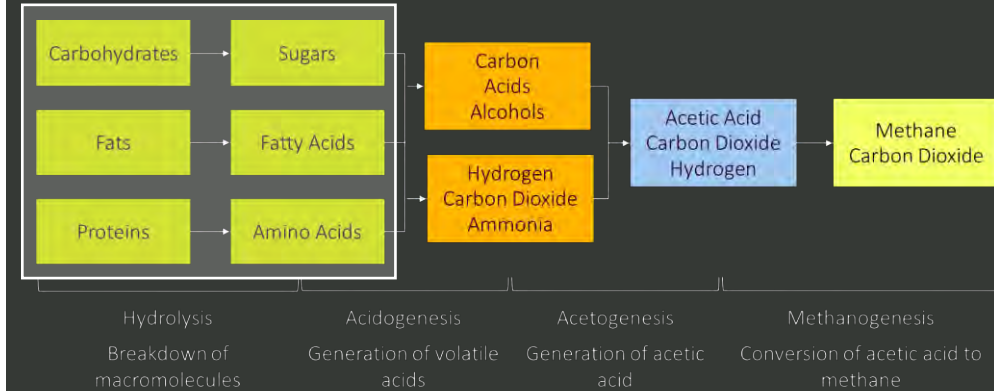
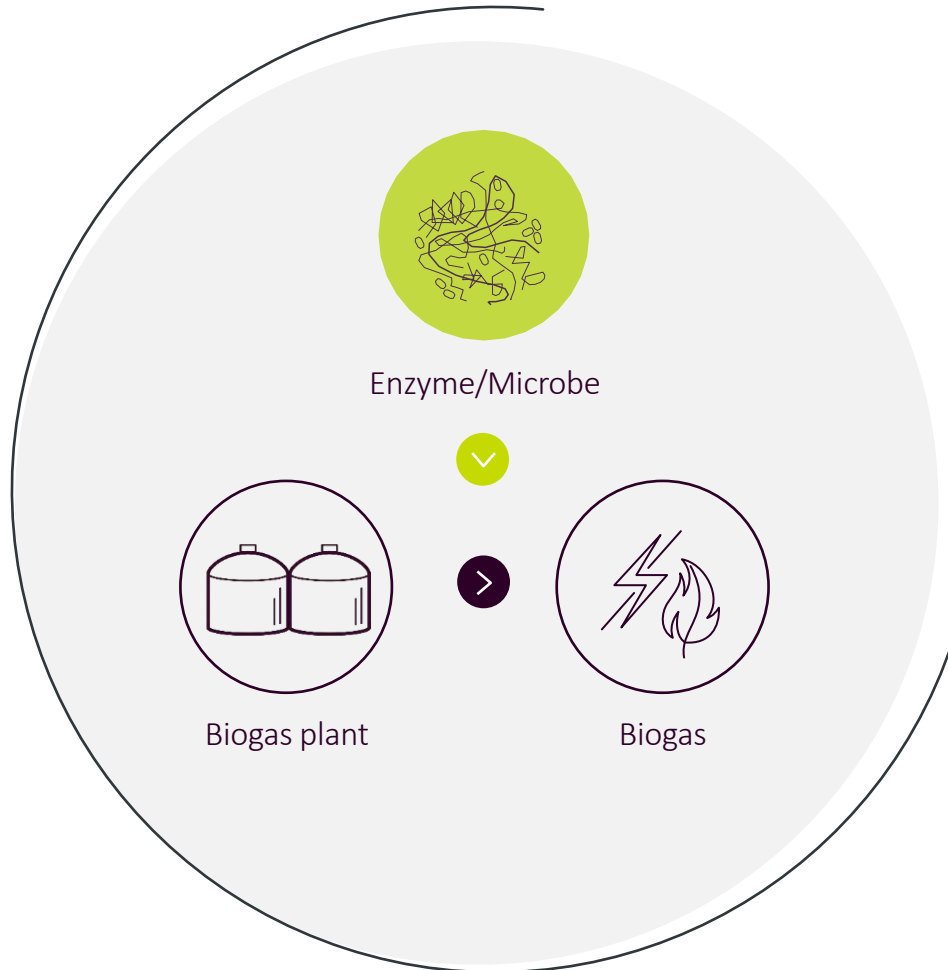


Biotechnology could help make palm oil milling sector greener and more efficient



Unlocking carbon offset opportunity
Improve biogas yield that lead to multiple potential benefits

Biotechnology could improve COD degradation, thereby unlocking biogas potential

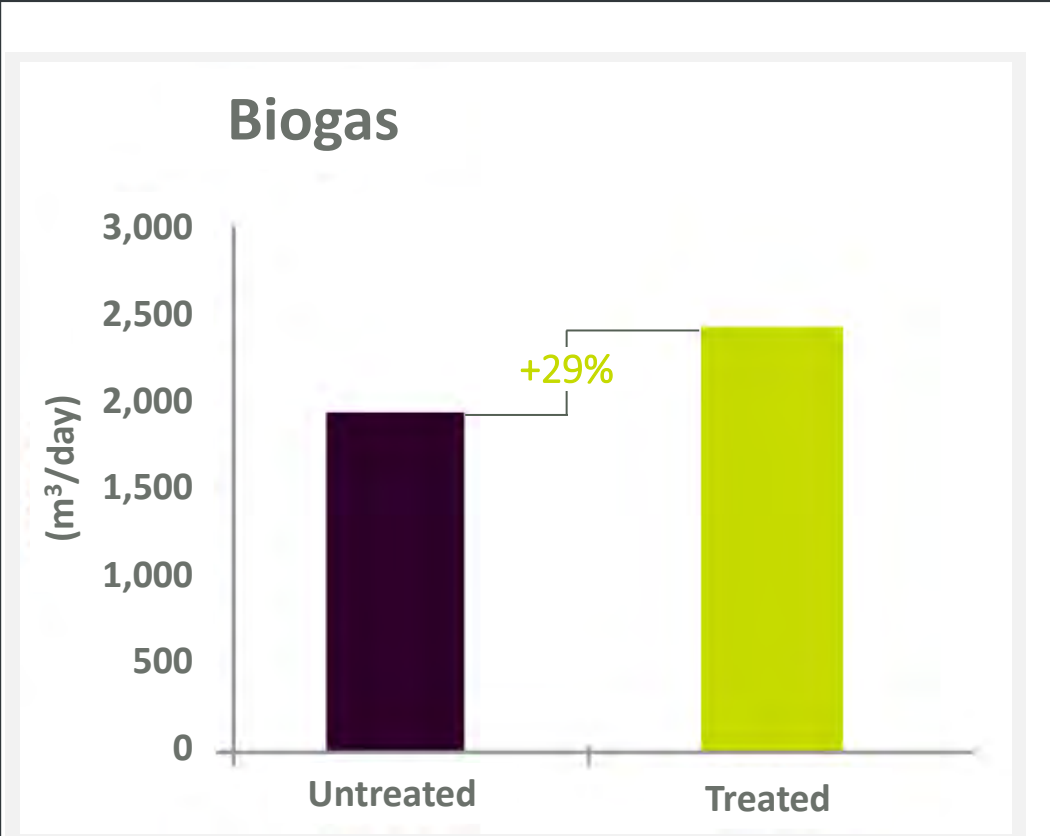


Rapid and complete breakdown of macromolecules, thereby stabilising the process



Increase anaerobic system efficiency, thereby unlocking biogas potential

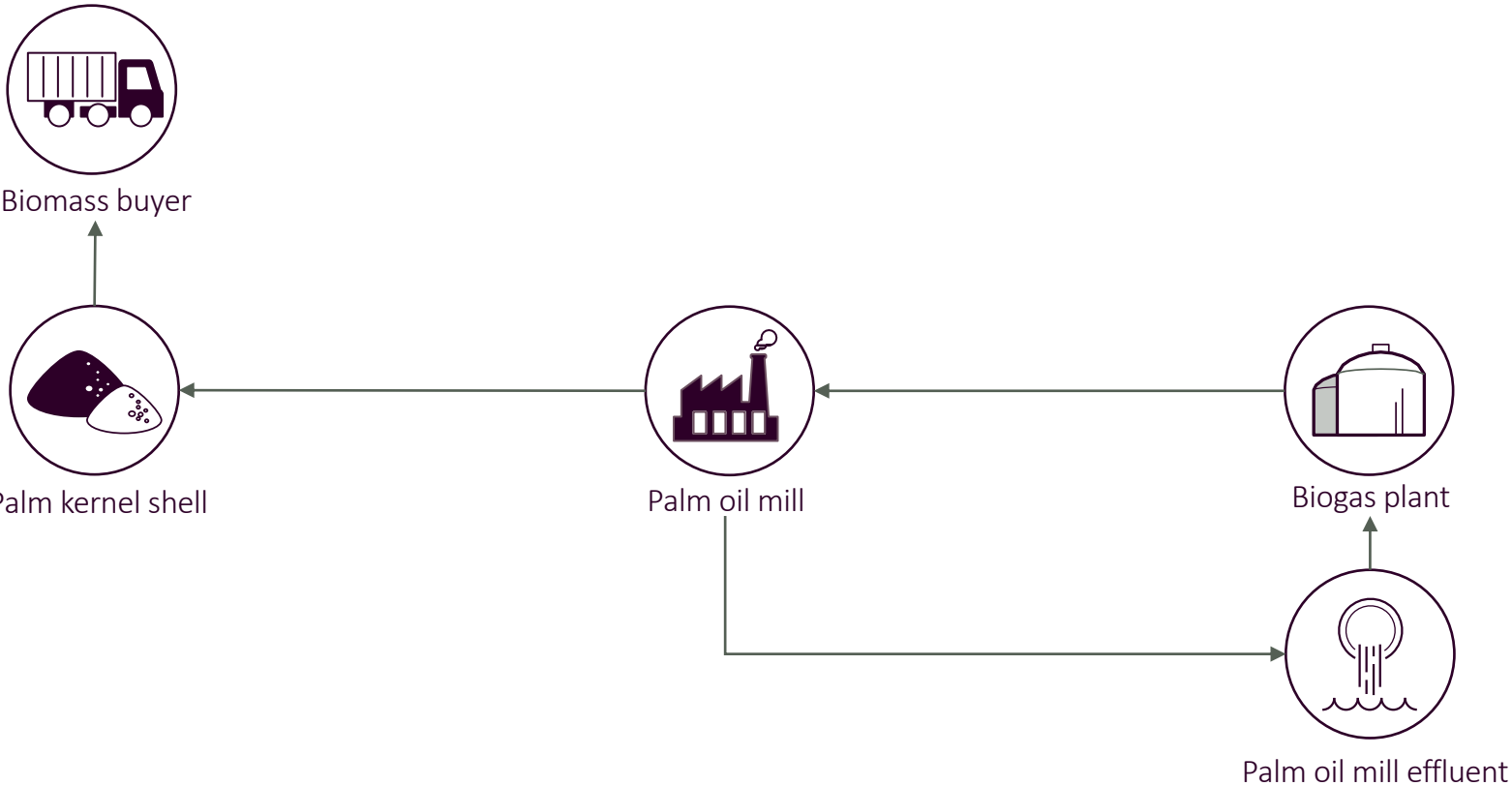
Increase in biogas and power generation at a slaughterhouse's anaerobic digester (organic-rich wastes)



Extra biogas production could unlock potential of green opportunities in palm oil mill

Carbon offset potential

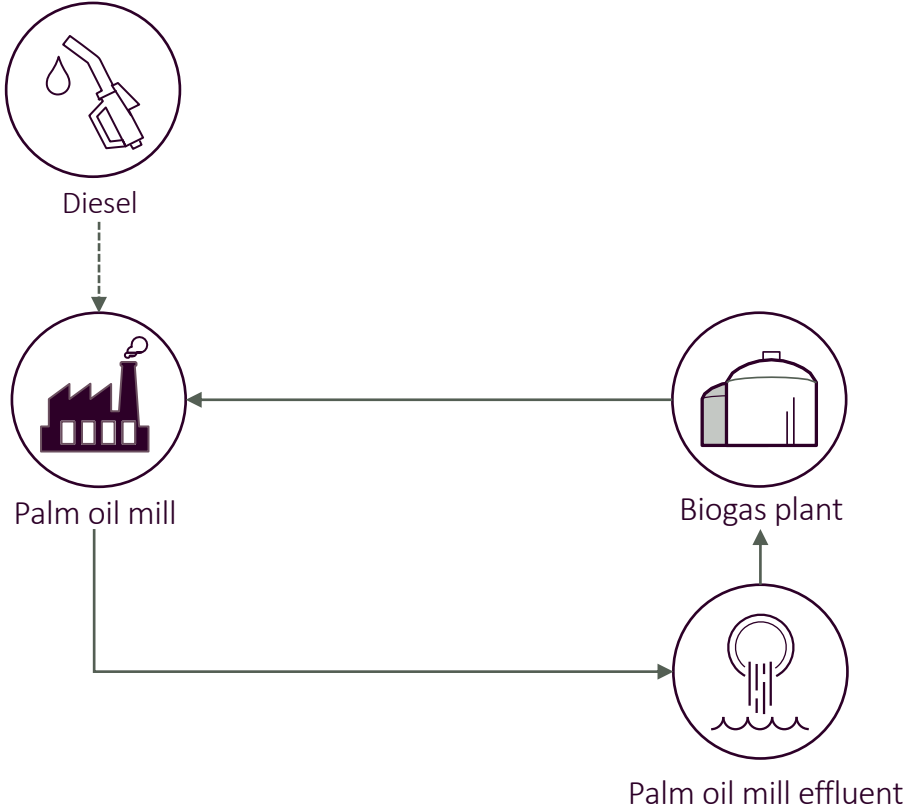
When biogas is used as fuel for the steam boiler to offset the use of biomass, it enables palm kernel shells to be sold and used as an alternative to fossil fuels



Extra biogas production could unlock potential of green opportunities in palm oil mill

Reducing emissions potential

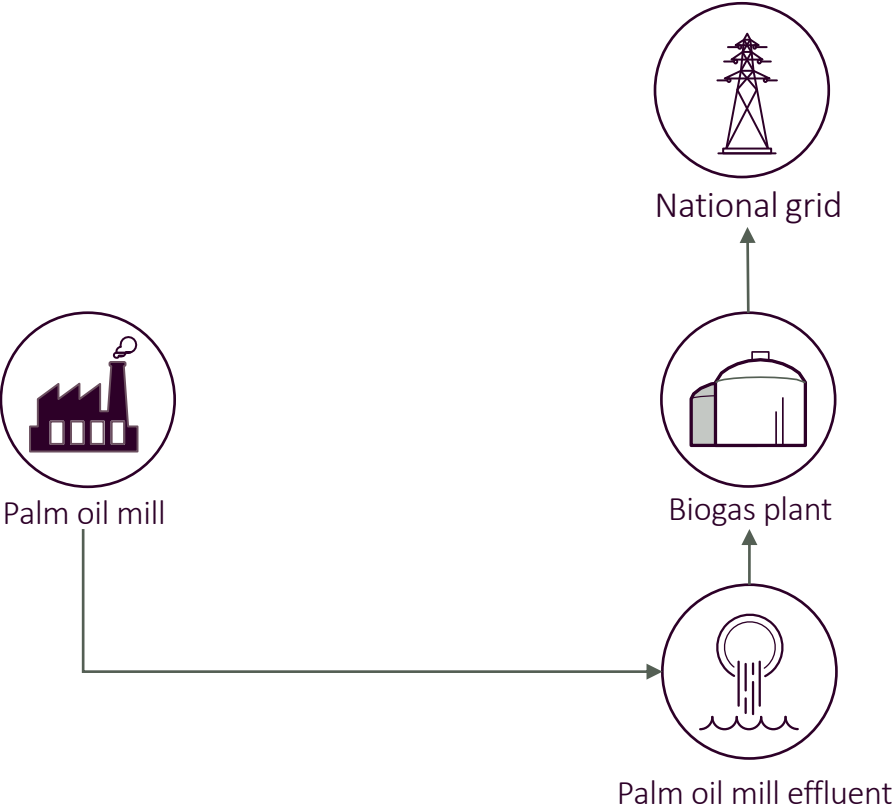
When biogas is used as fuel for the steam boiler during non-processing hours, it reduces diesel consumption, thereby reducing emissions



Extra biogas production could unlock potential of green opportunities in palm oil mill

Carbon offset potential

Biogas can be turned into electricity and exported to national grid. This translates into carbon offset due to less fossil fuels burning



Extra biogas production could unlock potential of green opportunities in palm oil mill

Carbon offset potential

When biogas is used as fuel for the steam boiler to offset the use of biomass, it enables palm kernel shells to be sold and used as an alternative to fossil fuels



Biomass buyer



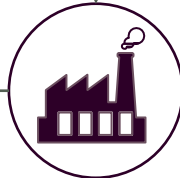
Palm kernel shell

Reducing emissions potential

When biogas is used as fuel for the steam boiler during non-processing hours, it reduces diesel consumption, thereby reducing emissions



Diesel



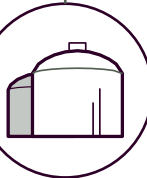
Palm oil mill

Carbon offset potential

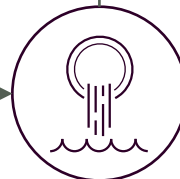
Biogas can be turned into electricity and exported to national grid. This translates into carbon offset due to less fossil fuels burning



National grid



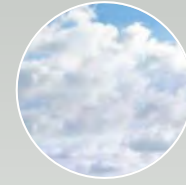
Biogas plant



Palm oil mill effluent

Biotechnology could create a sustainable future for Malaysian palm oil milling sector

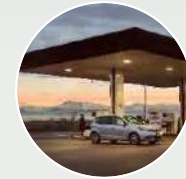
Reduce greenhouse gases while limiting energy use in daily operation



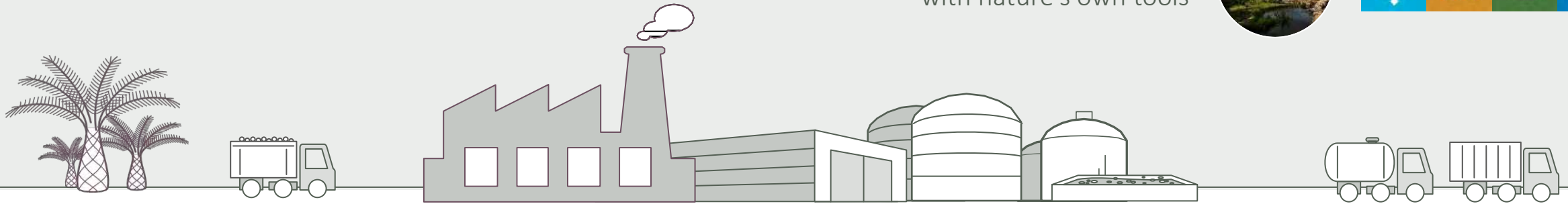
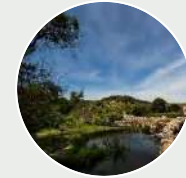
Feed the world by getting more out of nature's resource



Fuel the world by enabling people to drive more sustainably



Improve quality of water with nature's own tools



novozymes® 

Rethink Tomorrow