# GP Group Zero Carbon Biofuel for Indonesia

## A Road Map to Produce Renewable Jet Fuel, Ethanol & Biodiesel and bottle palm oil


HVO Refining System to Convert Palm Oil/UCO to Renewable Jet fuel, Diesel, Naptha & biogas

Large quantity of palm oil from yield improvements will be refined and bottled to meet food needs

PT. GARUDA PRIMA ENERGY

Improving Yields of Palm Oil Plantations & food crops to provide extra food & oil for biofuel production

Co2 Credits for methane avoidance of POME & forest preservation to improve Co2e & get to net zero

# Zero Carbon Renewable Fuel?: Why Needed & Why it Matters

## Indonesia 2025 Jet Fuel/Biodiesel Mandates Offer Opportunities to Improve Palm Oil Sustainability

Indonesia has a law that requires 5% Renewable Jet Fuel in 2025 GP Group will reach 15%

Indonesia has set a goal of getting to 20% alcohol in gasoline. This can be done with agave & s. potato ethanol

Indonesia already reaching 30% biodiesel in diesel fuel & wants to go to 40%

**Indonesia can set a global example of how to reach 30-40% blends of biofuel in gasoline, diesel & jet fuel.**

**No need to import oil**

2030 Climate Goals hard to reach without sustainable biofuels blended globally

Ukraine War shows EU dependence on Russian oil & gas has a high cost

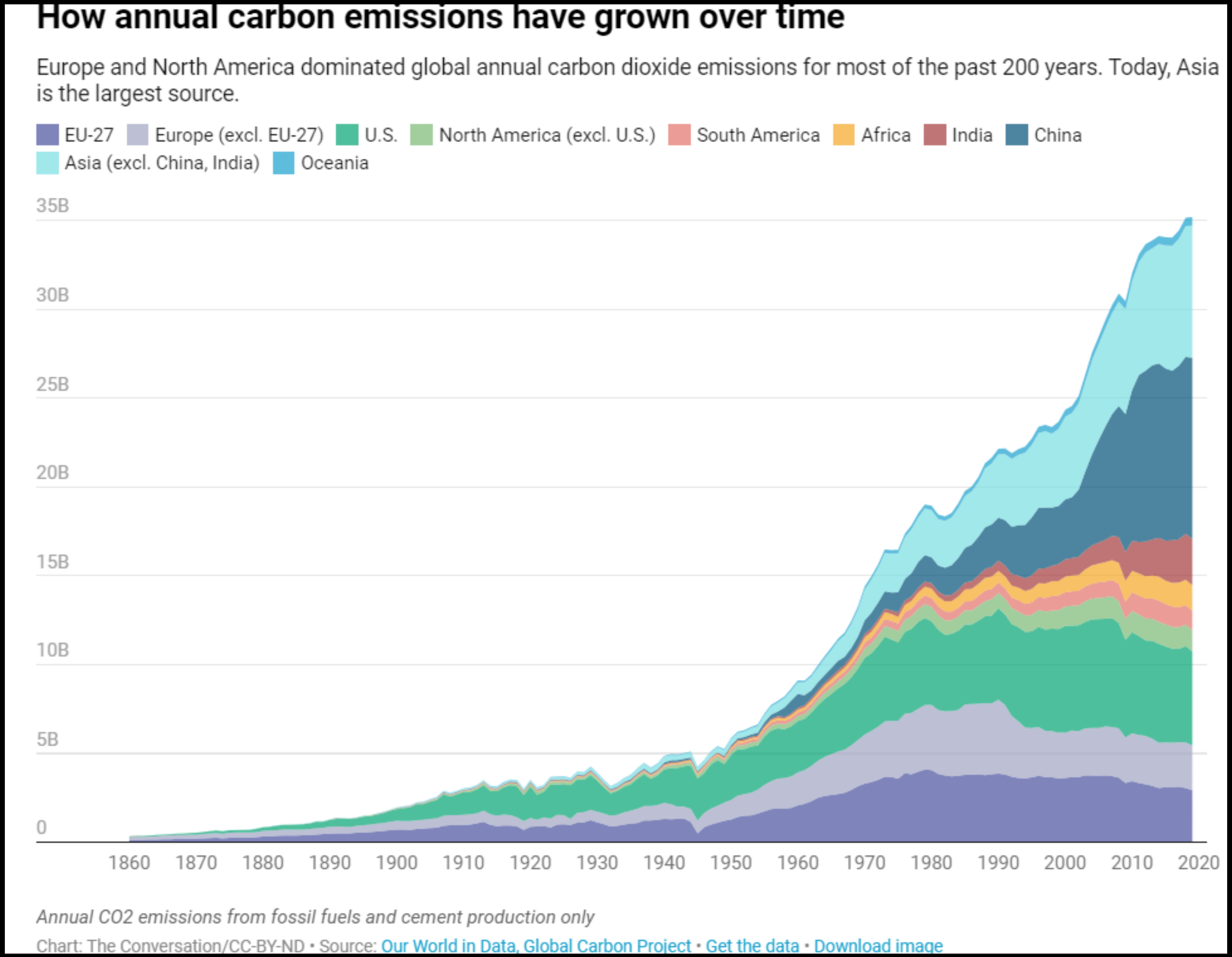
**To get to zero carbon fuels Indonesia needs to improve sustainability**

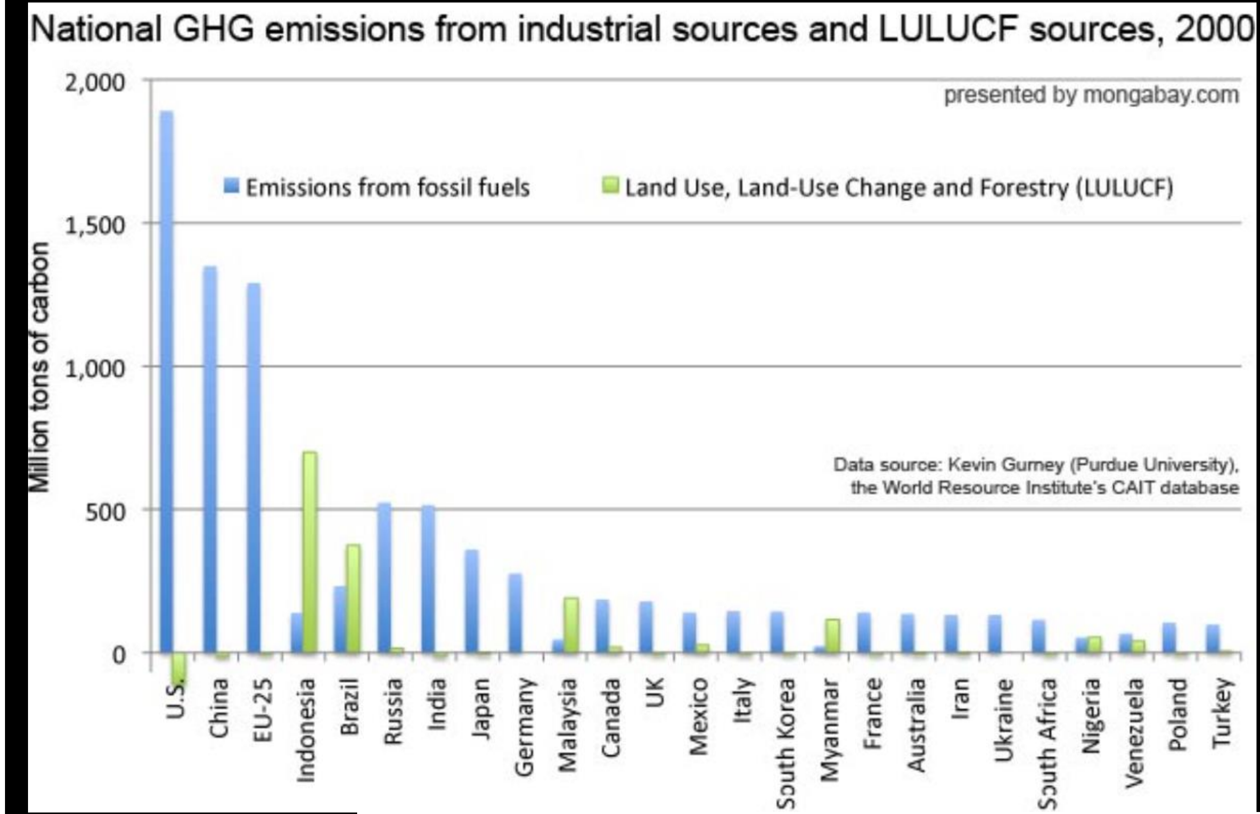
Diesel & jet fuel can be made from palm oil but work is needed to improve sustainability

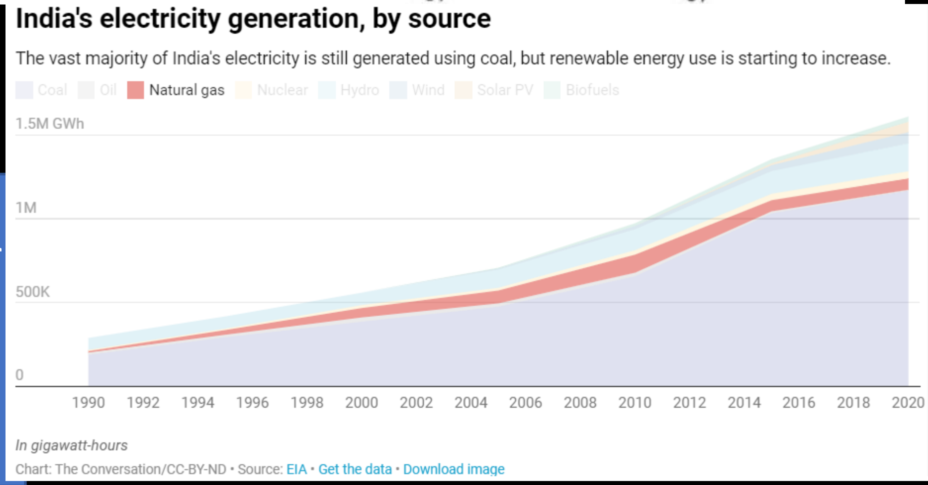
Yield of crops can be increased so produce biofuels without more land use

Indonesia can shift to high yield sustainable agriculture & strong forest preservation plan

# Why Asia Matters When Considering Climate Change

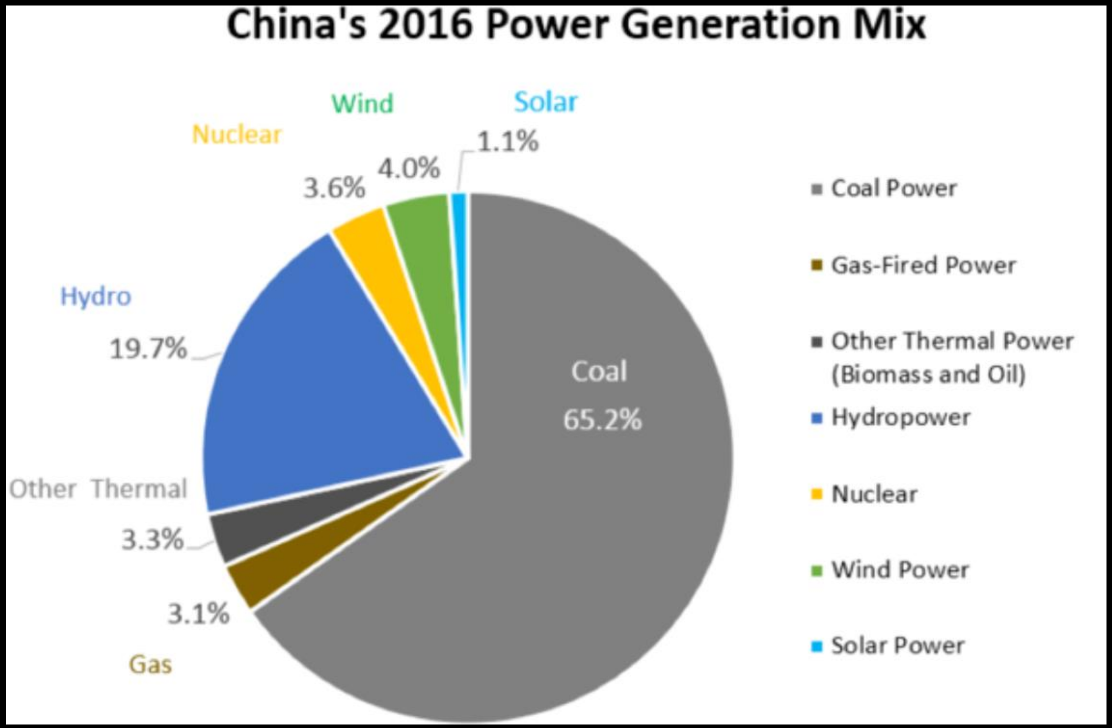


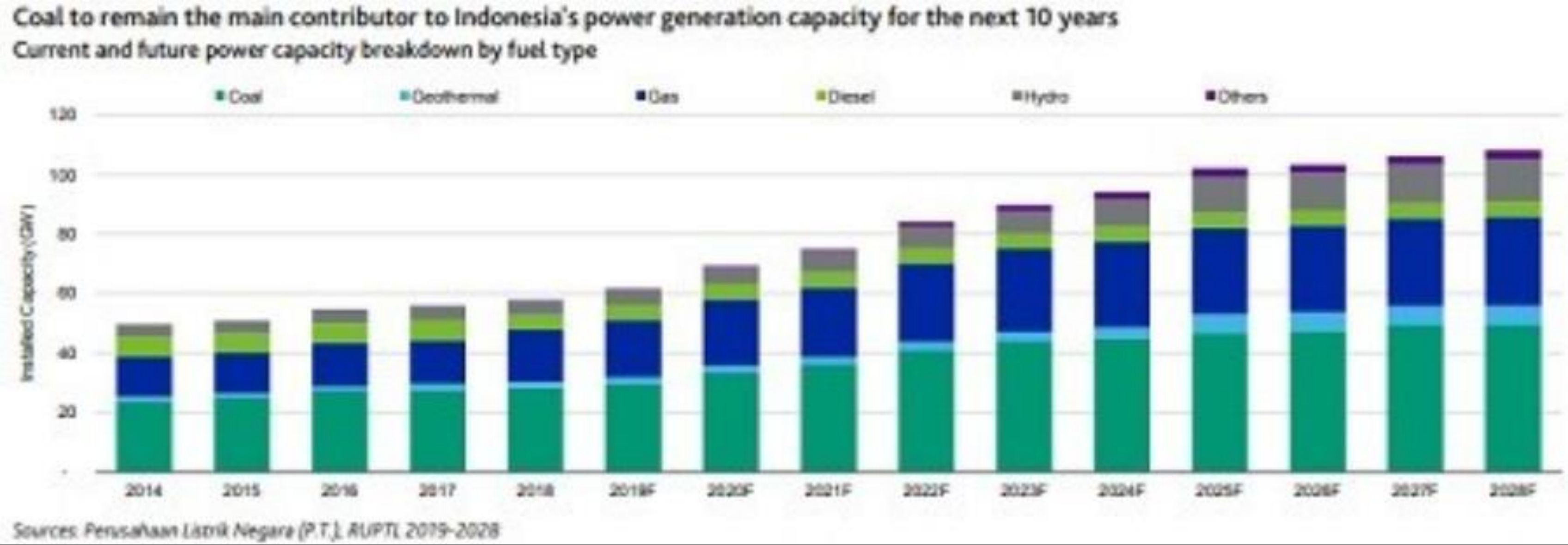




- Asia is half of the world's GHG emissions in 2020 and emissions are rising
- Indonesia's largest contribution is deforestation and in 2000 it was 4th largest GHG emitter although this has dropped considerably from 2016 to 2019
- India's main GhG contribution is coal power plants (70% of energy), coal plants still being financed and subsidies are bigger than renewable energy. Indonesia coal % is similar.
- EV's not logical if using coal fired power plants to produce electricity.

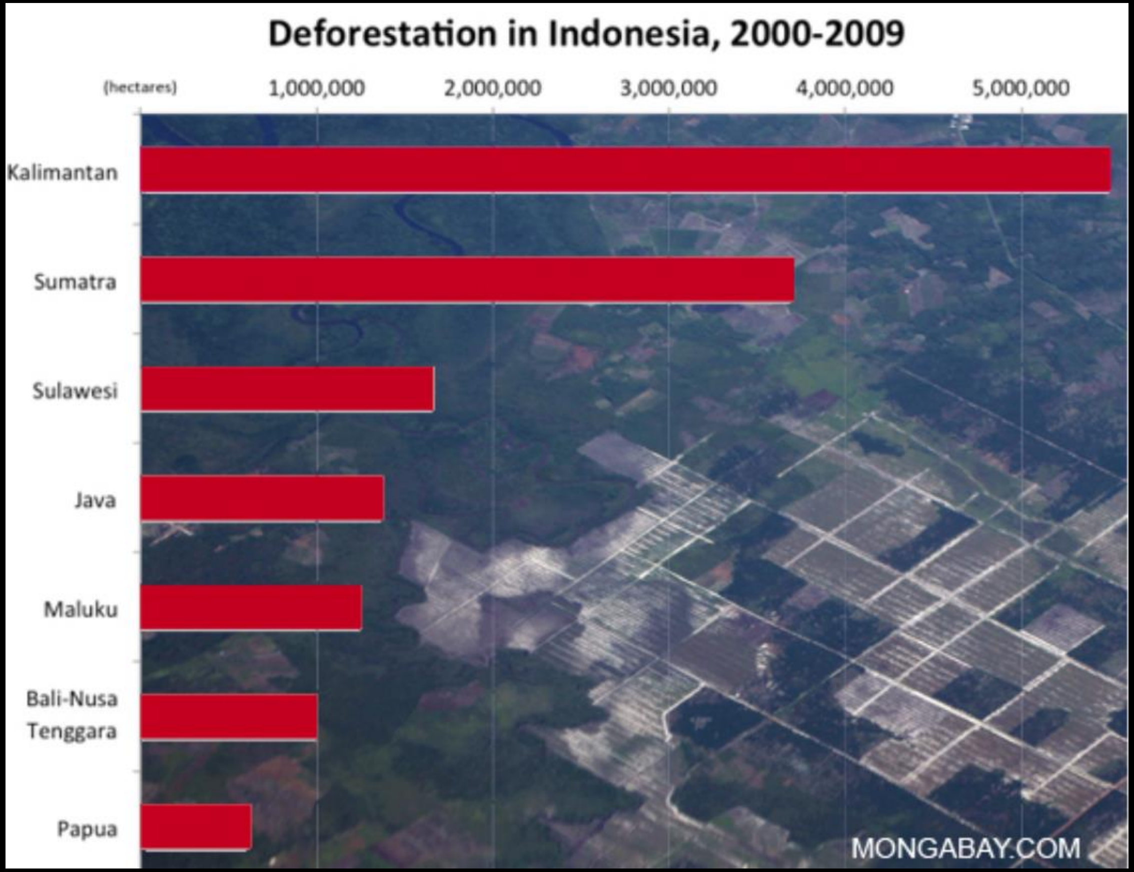
# Coal is Still King in China & Indonesia So EV's are not a Good Choice

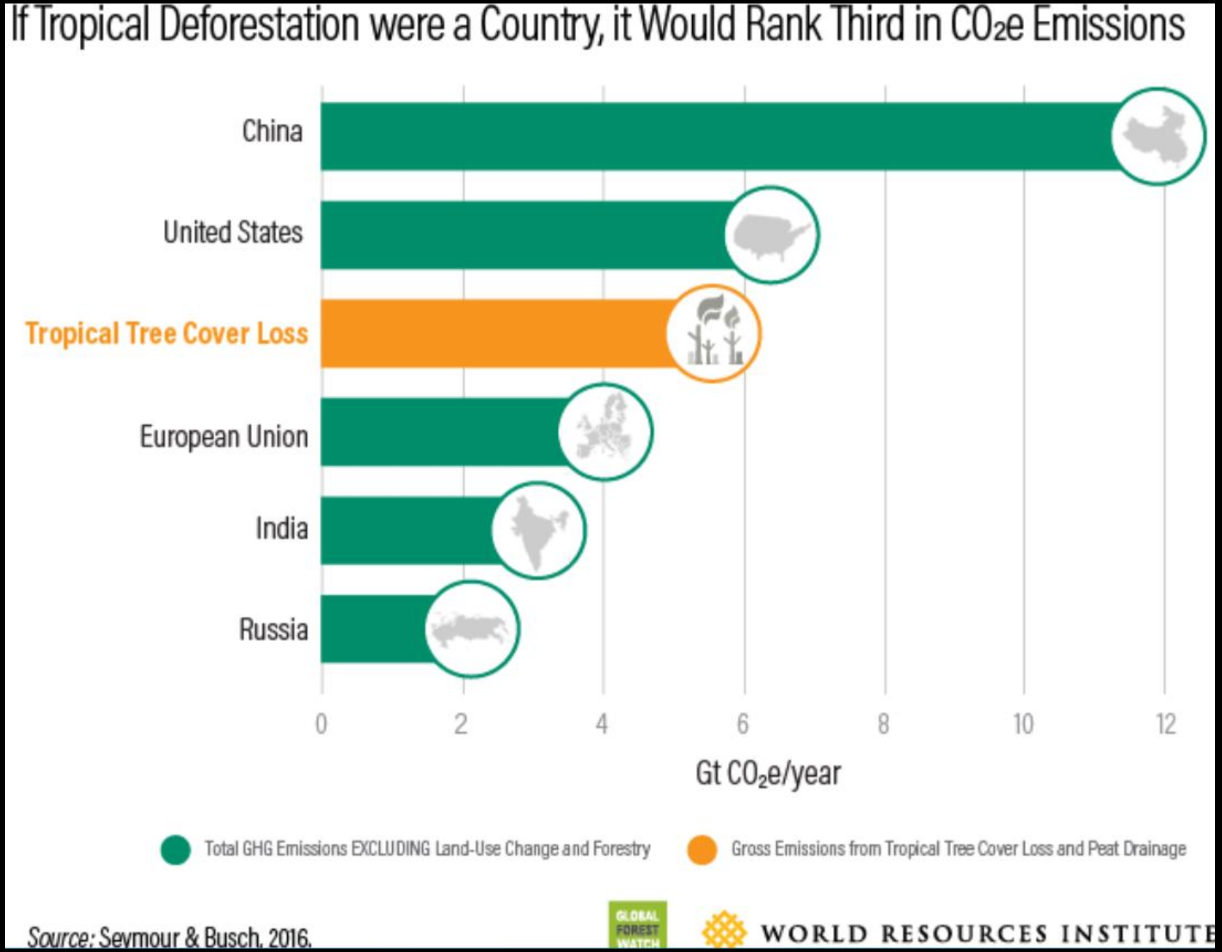


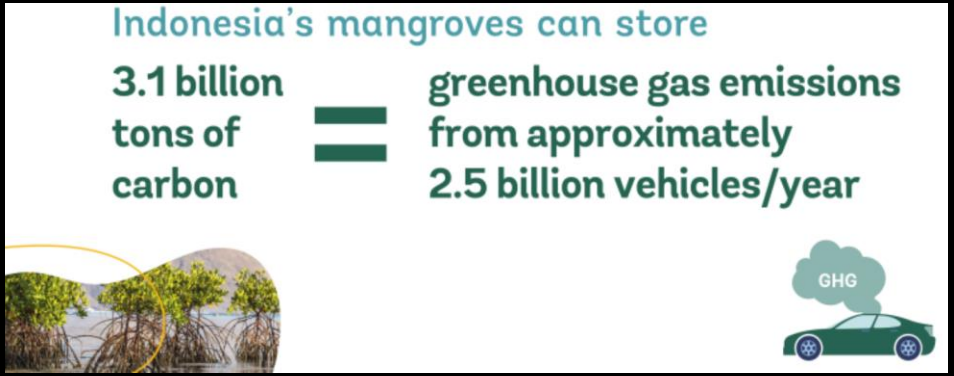

- 65% of China power generation was from coal in 2016. It has not changed much since then
- Indonesia's coal percentage for electricity is also high at 60%+
- Solutions that might work for transportation involving electricity in EU or USA have limited value in Indonesia, India and China with such a large percentage of electricity from coal.
- This presents an opportunity to increase biofuel market share for transport in both markets if problems with land use, land use change and deforestation can be addressed



# Why Deforestation Matters When Considering Climate Change

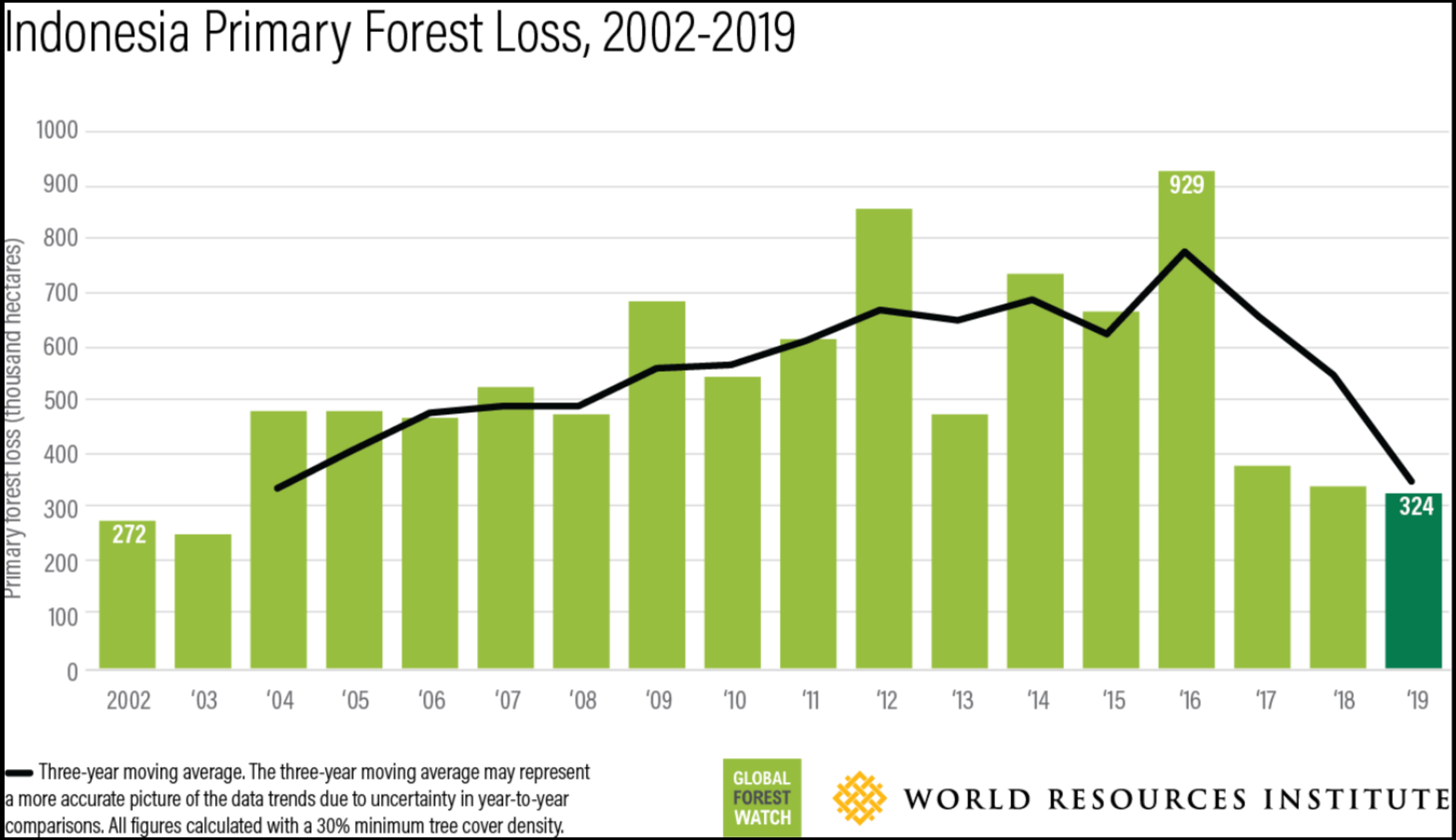


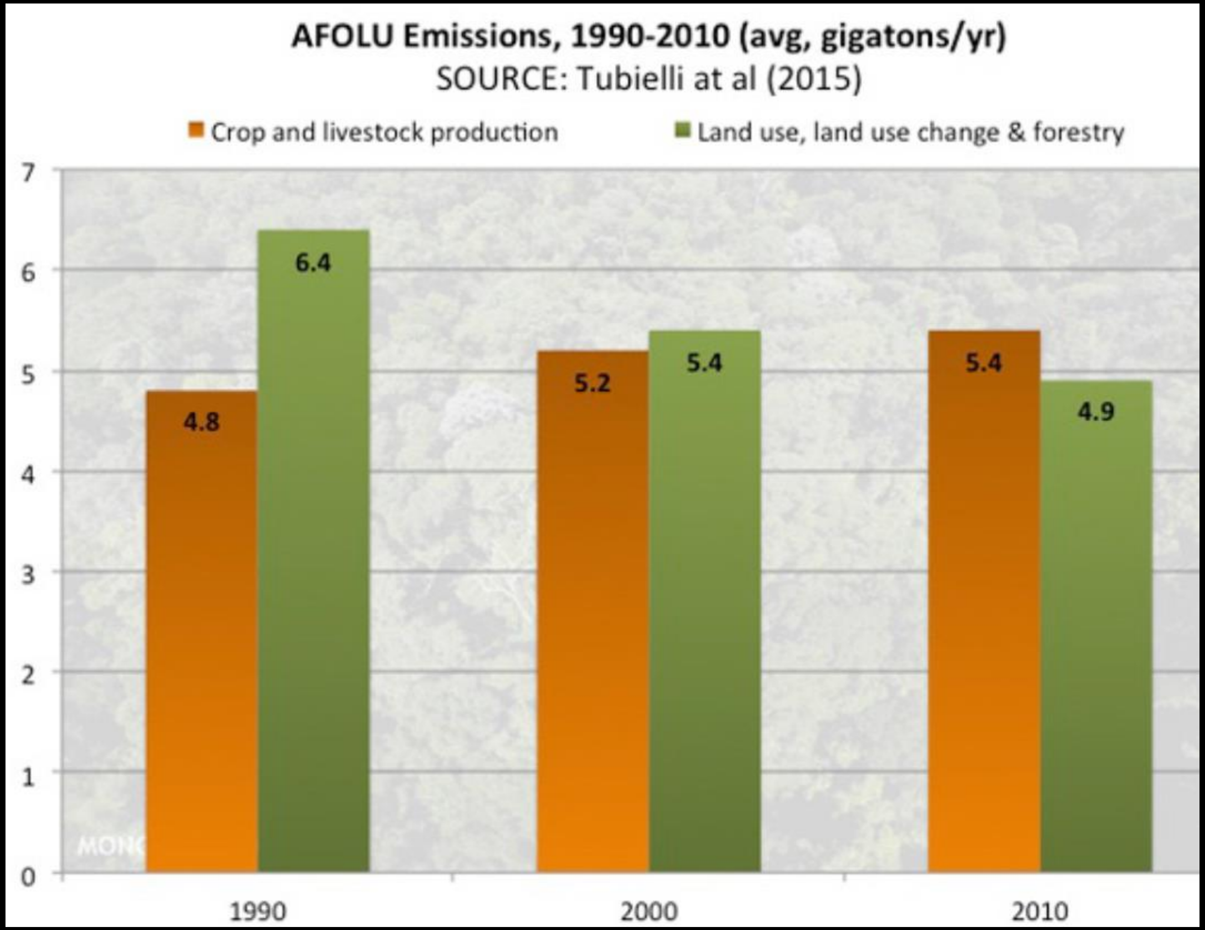

- Any solution to climate change to bring down China, USA, EU, Indonesia or India emissions needs to address deforestation or no benefits from development and use or export of energy
- Solution lies in high yield production of biofuels and food in parallel with stopping deforestation & illegal logging & mining

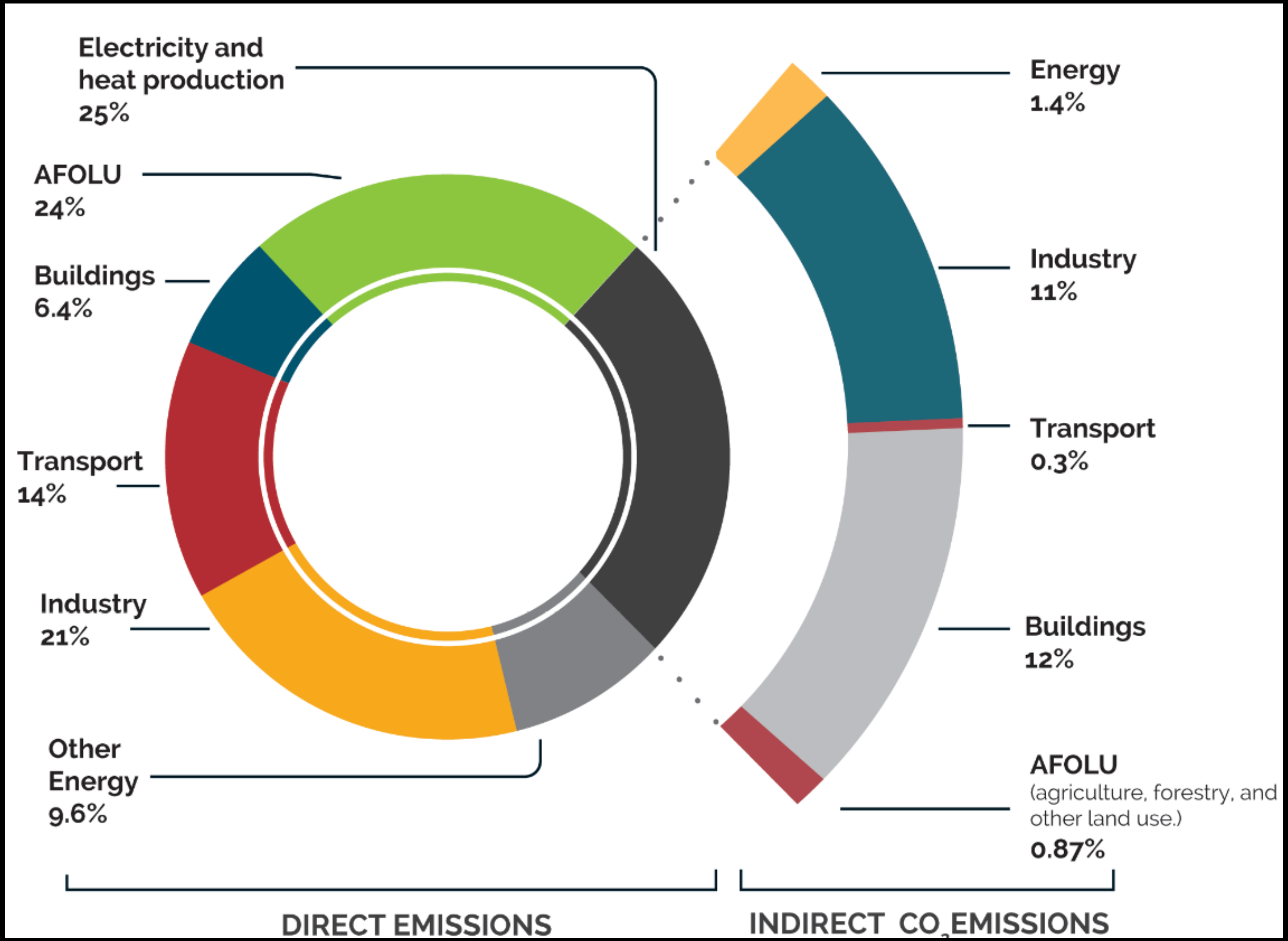
# Indonesia Deforestation Rates Have Dropped by 2/3rd from 2016 Peak




Indonesia deforestation rates have dropped by 2/3rds from 2016 peak but it is still a major sticking point in any development of agricultural related projects because of past history and changes in policy

# Agriculture & Land/Use Forestry 24% of GHG's, Ag is rising




Agriculture, land use change, forestry and deforestation are 24% of world GHG emissions. They were more important sources than agriculture but agriculture has now surpassed land use change and deforestation as a source of emissions. This is because of more attention on deforestation but also because the population is growing and needs more food. Any climate solution like biofuels needs to address rising food demand and reduce both deforestation and land use for food and fuel.

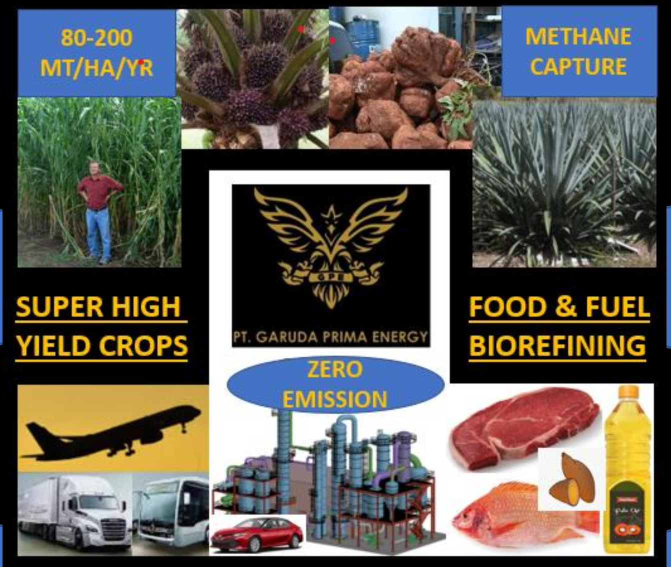
# Garuda Prima Group: Organizational Chart, Food Fuel Focus

## GP Group is organized into Divisions to initiate the various business activities with biofuel & food

**GP Group**
Parent Holding Company

**GP Group Jet Fuel Division**
Production of renewable jet fuel

**GP Group Petroleum & Trading Division**
Trading Oil/Minerals, Drilling Petroleum




**GP Group Biodiesel & Glyerin Division**
Production of Biodiesel & Glycerin

**GP Group Agricultural Division**
Planting of palm, yield improvements, FOME methane capture

**GP Group Ethanol & Meat Division**
Co-Production of ethanol & meat

**GP Group Palm Oil Division**
Refining & Bottling of Palm Oil

# Process Flow Renewable Jet Fuel Plant – 15% of Indo Market

## Incoming natural gas to hydrogen used on oil to produce jet fuel, diesel, naptha and bio-propane

NG of 827,205 cubic feet per hour

High Heating Value 1400 BTU/s.c.f.

1,158,000 MMBTU of natural gas

Hydrogen of 1,881,000 Cubic Meters/Hour

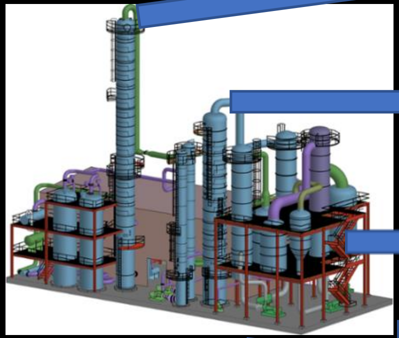
**Natural Gas Requirement to Produce Hydrogen**

**Hydrogen Produced**

For 875 million liters a year of capacity, you will need 1,881,000 cubic meters per hour of hydrogen. This will require 827,205 cubic feet per hour of natural gas assuming a High Heating Value of 1400 BTU/scf. This is 1,158,000 MMBTU per hour.

**100% Jet Fuel**

Hydrogen of 1,881,000 Cubic Meters/Hour



99,886 liter/hr. Jet Fuel

14,297 liter/hr. Naptha Feedstock

14,297 liter/hr Water & Waste

14,297 liter/hr Biopropane

**Hydrogen used for hydrotreating palm oil to produce refined fuels**

**Refine 3 Products**
(hourly output)

# Flow in of Oil & Out of Ren. Fuel (15% Indo jet market)

## Incoming natural gas to hydrogen used on oil to produce jet fuel, diesel, naptha and bio-propane

### Annual, Monthly & Weekly Production

Annual Production of 875 million liter jet fuel (700,000 MT)

72,917 MT or 91.15 mil. Lit./jet month

16,827 MT or 21.03 million lit. /jet week

### Palm Oil Shipped In

19,231 MT oil/week or 10 shipments of 1,923 MT

TOTAL JET PER WEEK 21.03 Million liters

### Markets & Market Share for Refined Product (50/50 Jet & Diesel)

### Product Output/Week (100% jet)

21.03 Mil. liter/week Renewable Jet Fuel

1.25 mil. liter/week Biopropane

1.25 mil. liter/week Naptha

1.25 mil. lliters/week Water & Waste

### Markets & Market Share for Refined Product (100% Jet)

| Products | Liters per year | Total Market Indo | % Market Share |
|---|---|---|---|
| Renewable Jet Fuel | 875,000,000 | 5,870,000,000 | 15% |
| Renewable Diesel | 0 | 34,120,000,000 | 0% |
| Renewable Naptha | 125,000,000 | (Used for chemicals) | n/a |
| Bio-Methane | 125,000,000 | 14,570,600,000 | 0.07% |

# Total Historical Jet Fuel Market & GPI Market Share in 2025-30


Garuda will have several pathways to reach 25% of Indonesian jet fuel market share in 2025 -30 and expects to have up to 1.47 billion liters of renewable jet fuel capacity on line at the end of 2025

2 pathways include lipids to HVO and alcohol to jet. This allow GP Group to use yield improvements on palm oil & methane capture & UCO as well as planting agave & sweet potato for alcohol to jet to meet SAF requirements

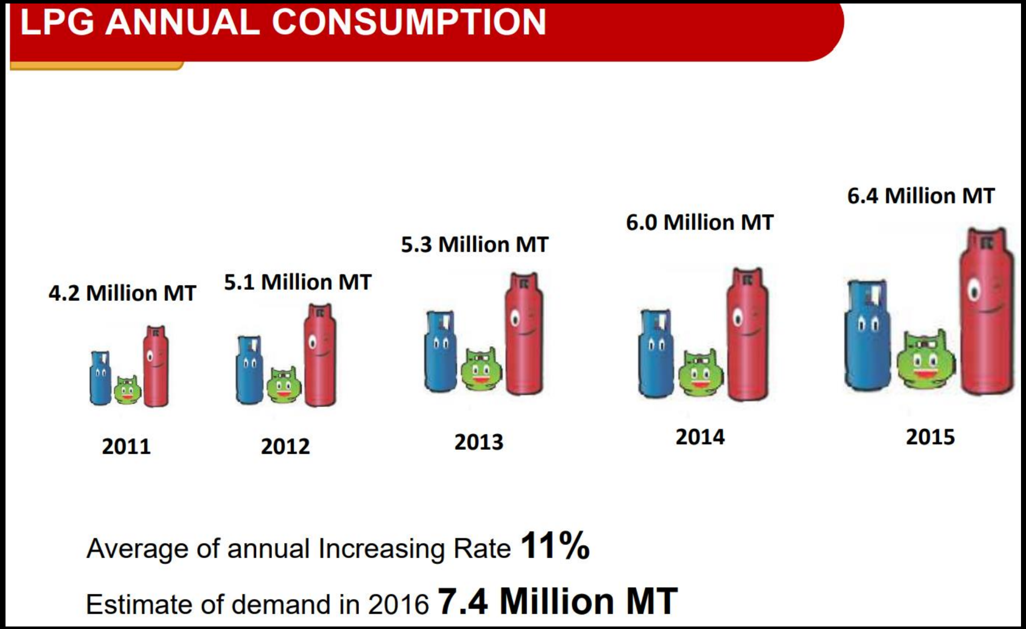
# Total Diesel & LPG Markets in Indonesia:

## Diesel Consumption 2019

In 2019, around **34.12 billion liters** of diesel were estimated to be used in Indonesia. Diesel fuel consumption in Indonesia has decreased in recent years as biodiesel percentage increases.

**GP Group biodiesel production of 1.8 billion liters will represent 5.2% of remaining diesel market in Indonesia**

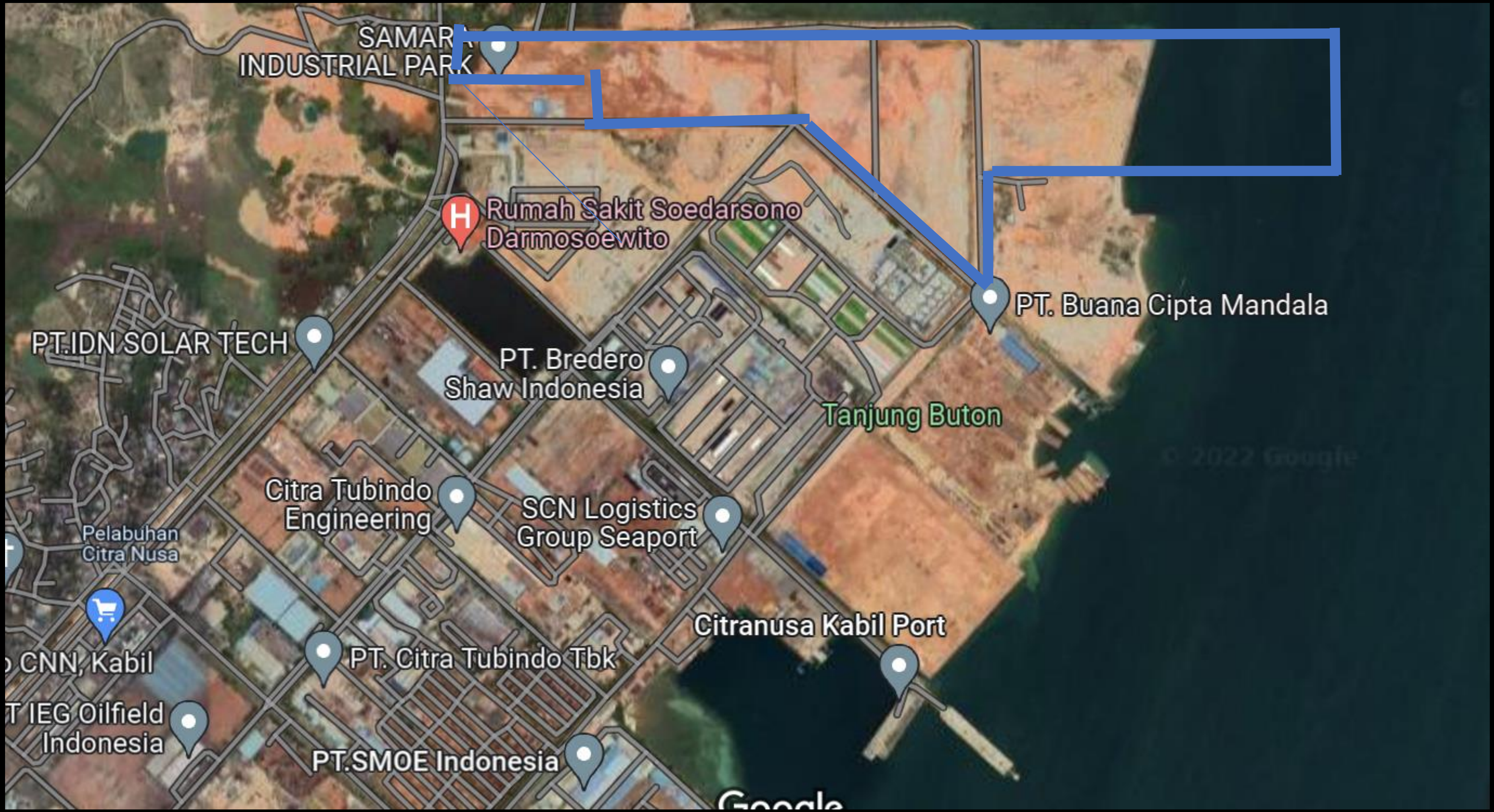
## LPG Consumption 2016




1969 liters of LPG per metric ton = 14,570,600,000 liters

**GP Group bioLPG production of 159 million liters will represent 1% of the LPG market in Indonesia**

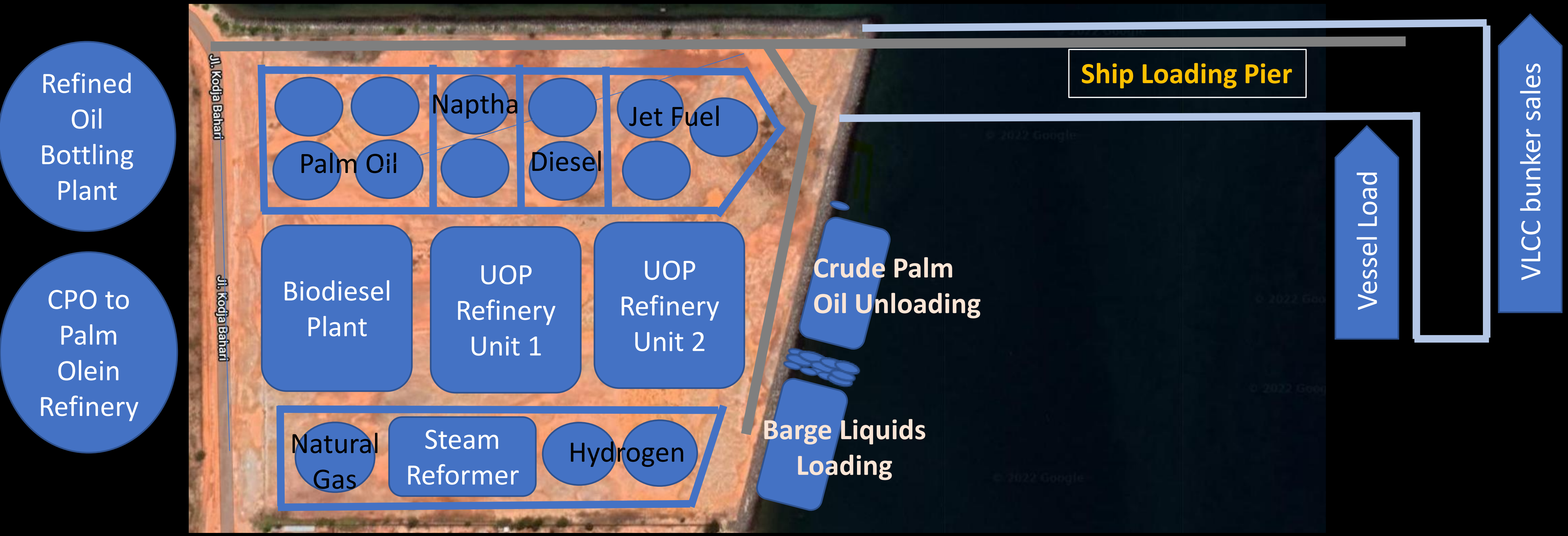
# Project Location: Kabil Int. Industrial Estate, Batam Island




## Ideal Location: Kabil Integrated Industrial Estate in Free Trade Zone Batam

We will set up the jet fuel & biodiesel plant and oil bottling complex in the Kabil Integrated Industrial Estate on the island of Batam in Indonesia across from Singapore. The industrial park is in a free trade zone. This allows us to import goods for manufacturing tax free and to export finished products tax free to Singapore or elsewhere. The rectangular area outlined in blue is the 27.5 hectares of land on-shore as well as 10.5 hectares of land in Samara Industrial Park. we plan to build the plants on this land and also build a pier and loading-unloading area for barges on 13 hectares of land offshore (total 51 hectares)

# HVO Jet Fuel, Biodiesel & Bottled Oil Project, Batam Island




## Biofuel, Oil & Port Complex: HVO Jet Fuel Plant, Biodiesel Plant, Gas/Liquids Storage, Ship & Barge Facilities

We will set up the jet fuel, biodiesel and oil bottling plant on a 37 hectare section of the industrial park plus an additional 13 hectares of ocean area for setting up barge and ship loading and unloading. The biofuel complex will include both jet fuel and biodiesel capacity and large gas & liquids storage capacity. The oil processing & bottling complex will be right next to the biofuel complex so oil can easily be transferred for value added processing. A VLCC will be docked at the outer edge of the pier to allow for sale of bunker fuel to ships in the region waiting to berth in Singapore or Batam Island.

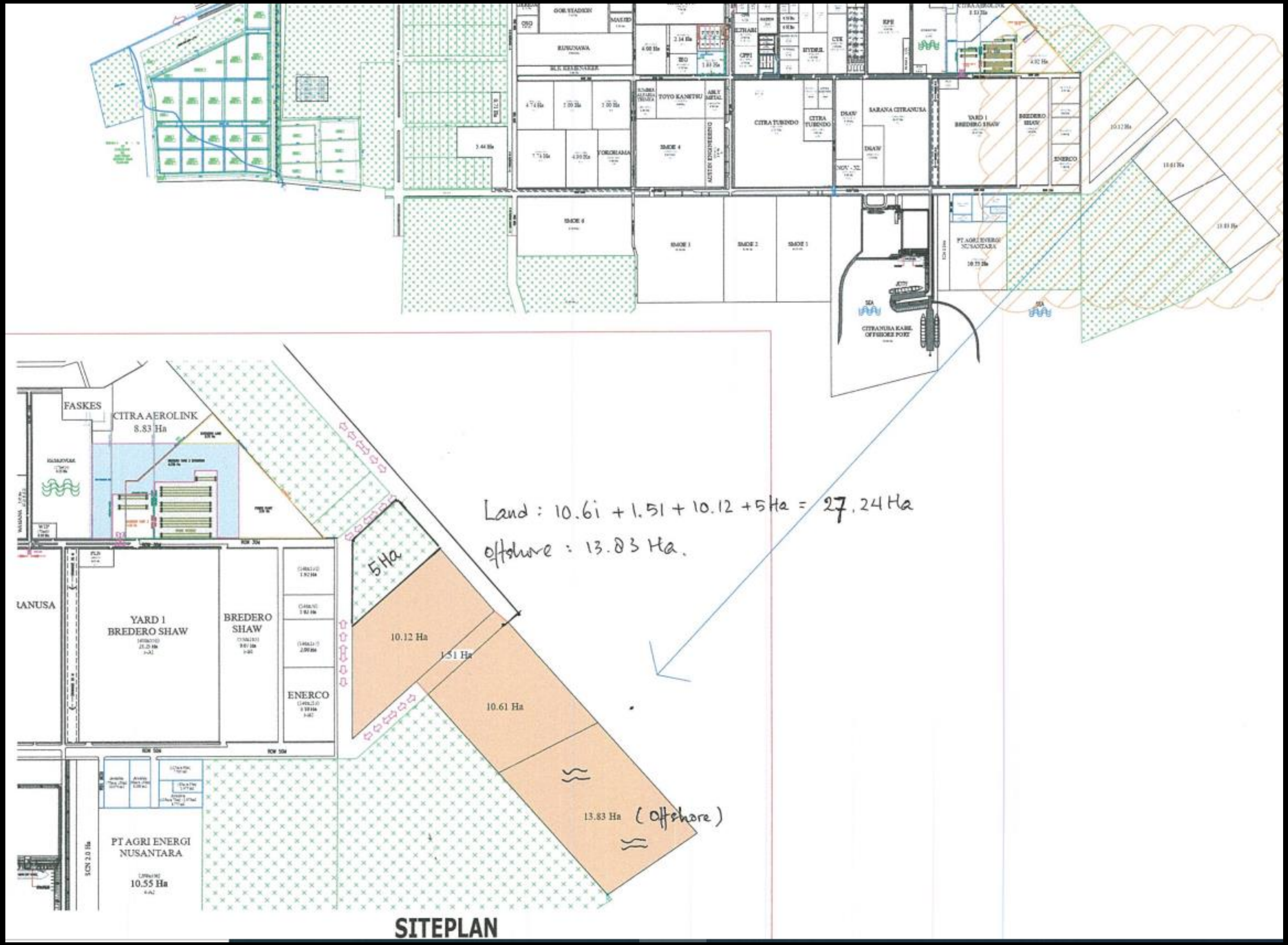
# Plant Site Land Parcels Being Purchased

## GP Group Will Purchase 37 hectares on land and 13 hectares offshore to build bottled oil-biofuel complex

The site plan below shows the layout of the Kahil Integrated Industrial Estate and the specific 51.5 hectares of land being offered to GP Group.
GP Group will buy 37.7 hectares of land on-shore and 13.8 hectares of land offshore so it can develp both the biofuel and food production complex and the logistics hub for moving palm oil and ethanol in and biofuel and bottled oil out.   An additional 15 hectares of land will also be purchased in adjoining Samara Industrial Park.

The lots will be contiguous and all merged into one development parcel so that we can install a security fence around the perimeter and freely move products from one industrial hub to another.  We plan on producing refined vegetable oil, bottled vegetable oil, biodiesel, renewable jet fuel, glycerin, bio LPG and bio-plastic feedstocks all in the same complex.

We will use existing port infrastructure at the Kahil IIE site combined with developing our own port facility in the offshore portion of the parcel being purchased.



# Plant Site Rendering Drawing

## BioIndustrial Complex Will Involve a Series of Refinery Units for Converting CPO to Refined Oil & Biofuels

The rendering drawing shows the possible layout that includes room for a biodiesel plant and renewable jet fuel, naptha and propane production units as well as the various tanking requirements for the different feedstock and finished products.  There will be an oil processing complex that will convert crude palm oil to refined palm oil as well as a bottling plant for packing finished products.  A pharmaceutical glycerine refinery will utilize biodiesel glycerlol by-products.  The net result will be a set of industrial facilities to convert vegetable oil into various value added products.

# EPC Contracting to Build Jet Fuel Plant

## We will negotiate a contract to build jet fuel plant under EPC terms and commissioning

**UOP Renewable Diesel/Jet Fuel Biorefinery Unit for Total Refinery in France**

**UOP Diesel/Jet Fuel Biorefinery in Paraguay**

The HVO refining process converts edible and non-edible natural oils, animals fats and other waste feedstocks to renewable diesel and jet fuel , which is chemically identical to petroleum-based diesel and jet fuel. We are selecting to focus on production of renewable jet fuel. The performance over commercial petroleum-based jet fuel is superior and the jet fuel can be used as a drop-in replacement in aircraft with no equipment modifications. Two competitor offers are being evaluated from Axens and UOP currently has licensed 20 Ecofining units in nine countries around the world, processing 12 different types of renewable feedstocks. Axens is a major engineering company owned by the national petroleum company of France. It is involved in five major petroleum refinery projects in Indonesia and all over the world and is also building HVO and alcohol to jet fuel plants.

**Axens receives order for its Vegan technology**

Axens has signed a license agreement for its Vegan® renewable hydroprocessing technology with Aemetis Inc. for its 'Carbon Zero 1' project in Riverbank, California, US.

**Gevo and Axens partner on ethanol-to-jet technology**

# Production of Renewable Jet Fuel: Specifications

## Renewable Jet Fuel Complies with ASTM D1655

Renewable jet fuel will comply with ASTM D1655 that is the standard specification for jet fuel globally. There are two types of specifications for Jet A and Jet A1 that involve the addition of static dissipator additive but this will be done by Pertamina when they blend with petroleum jet fuel. The renewable jet fuel is identical molecule for molecule with petroleum jet fuel and the ASTM committee permits a blend of up to 50% renewable jet fuel from fatty acid production processes.

Garudi Prima Energi will be obtaining its renewable jet fuel refinery from UOP, a Honeywell subsidiary company. UOP is the largest producer of equipment for petroleum refineries world-wide and has about a 50% market share of equipment in refineries. UOP will provide equipment to produce jet fuel to meet the ASTM D1655 specification. The EPC hired to build the plant will be required to commission the plant to confirm it is able to produce jet fuel meeting this specification.

Another important aspect of production is the testing of fuel during production to insure it complies with ASTM specifications. We will work closely with Pertamina to develop lab protocols and inspection processes that conform with their quality control requirements. Testing equipment will be electronically linked with Pertamina so there is on-going monitoring of fuel quality by both GP Group and Pertamina and renewable jet fuel fully complies with all quality requirements and specifications.

Jet Fuel – Jet A and Jet A-1
Compliant with Industry standard ASTM D 1655

**Product Properties**

| | Jet A | Jet A-1 |
|---|---|---|
| Acidity, mg KOH/g | 0.10 Max. | 0.10 Max. |
| Aromatics, Vol. % | 25 Max. | 25.0 Max.ax. |
| Sulphur, mercaptan, Wt. % | 0.003 Max. | 0.003 Max. |
| Sulphur, total, Wt. % | 0.30 | 0.30 |
| 10% Distillation, °C | 205 Max. | 205.0 Max. |
| Final Boiling Point, °C | 300 Max | 300.0 Max |
| Distillation Residue, % | 1.5 Max. | 1.5 Max. |
| Distillation Loss, % | 1.5 Max. | 1.5 Max. |
| Flash Point, °C | 38 Min. | 38.0 Min. |
| Density @ 15°C, kg/m3 | 775/840 | 775/840.0 |
| Freeze Point, °C | -40 Max | -47.0 Max |
| Viscosity @ -20°C, mm/s | 8.0 Max. | 8.0000 Max. |
| Net Heat of Combustion, MJ/kg | 42.8 Min. | 42.80 Min. |
| One of the following shall be met | | |
| 1) Smoke Point, mm, or | 25 Min. | 25.0 Min. |
| 2) Smoke Point, mm, and | 18 Min. | 19.0 Min. |
| Naphthalenes, Vol. % | 3.0 Max | 3.00 Max |
| Copper Strip Corrosion, 2 h % 100°C | No. 1 | No. 1 |
| Thermal Stability | | |
| Filter pressure drop, mm Hg | 25 Max. | 25 Max. |
| Tube Deposits | < 3 Max. | < 3 Max. |
| Existent Gum, mg/100 mL. | 7 Max. | 7 Max. |
| Water Reaction, Interface Rating | 1b Max. | 1b Max. |
| MSEP Rating | | |
| Without electrical conductivity additive | 85 | 85 |
| With electrical conductivity additive | 70 | 70 |
| Electrical conductivity, pS/m | | 50 Min. 600 Max. |

Note: Jet A-1 used in jurisdictions outside the United States usually contains static dissipator additive.

# Alternative Bids Will be Obtained to Build HVO Plant

## As this involves a multi-billion dólar contract to build jet fuel plant we will also approach others

There are other suppliers of hydro-treated vegetable oil (HVO) technology that have been building plants recently. While they do not have as much experience, their capital costs are potentially lower or timeline different. Denmark-based Haldor Topsoe A/S is a supplier of catalysts, technology, and services for the chemical and refining industries. Haldor Topsoe claims that the HydroFlex process layout offers lower capital expenditure (CAPEX), but also a lower energy consumption during operation, resulting in a lower Carbon Index (CI). Haldor Topsoe's H2bridge hydrogen technology is based on a modular and highly efficient convection reformer technology. The following are some projects they are developing:

- Revamping the Wynnewood refinery of CVR Energy in Oklahoma (OK) using Topsoe's HydroFlextechnology to produce approximately 100 million (US) gallons or 378.5 million liters of renewable diesel per year.

- Grön Fuels LLC, a portfolio company of the American asset management firm Fidelis Infrastructure LP, will also use "HydroFlex“ technology of Haldor Topsoe and will also include bio-carbon capture and by pumping Co2 into drilling wells in the region to enhance oil recovery or permanently store Co2 in a salt cavern near the site. Expected investment for all phases including carbon capture is $9.2 billion USD

- US-based renewable fuel start-up Indaba Renewable Fuels LLC (Indaba) will use the HydroFlex and H2bridge technologies of Haldor Topsoe for two greenfield refineries being developed in California (CA) and Missouri (MO).

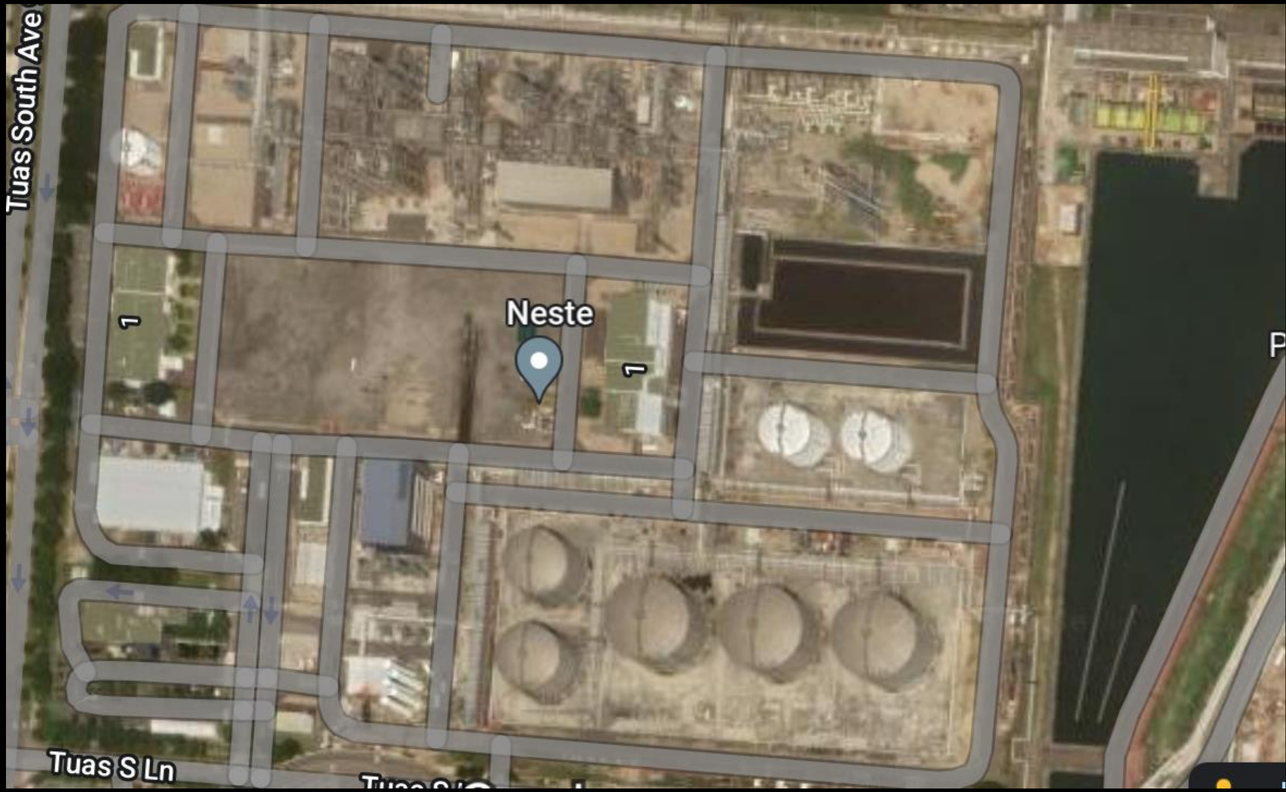
# NESTE: Renewable Jet Fuel & HVO Plants in SE Asia, USA & EU

## Neste is building 1.5 million MT of HVO Jet Fuel Capacity

Neste is in the middle of construction of a very large renewable jet fuel plant on Tuas Island in Singapore. This will involve 1 million MT of jet fuel and some additional secondary products. The plant is expected to come on line sometime in late 2023. The feedstock for the plant will be a combination of palm fatty acid oils, palm oil, used cooking oil and tallow. The mix will depend on market restrictions in export markets in Europe and USA. Neste is also building a large renewable diesel/jet fuel plant in Rotterdam in the Netherlands to provide HVO for EU markets. This will provide 1.95 billion liters of renewable jet fuel. When all production capacity is included in USA, Rotterdam, Finland and Singapore, production by the end of 2023 will be 5.5 million MT.

Neste is making a wide variety of products from its HVO capacity. This includes renewable diesel, renewable jet fuel, renewable feedstocks for plastics production (Naptha and BioLPG) and various specialty products. The company has an aggressive program to identify renewable feedstocks that can meet the sustainability criteria of global biofuel regulators. It is moving away from palm oil as a feedstock although it is still relying on palm acid oil distillate for a significant share of future feedstock. Neste relies heavily on used cooking oil for most of its production.

**Neste is adding 1 million MT of HVO jet fuel in Singapore**



# Neste Refinery Capacity in Rotterdam & Singapore

## Neste is building HVO plants in Rotterdam, Singapore and the USA in a large expansion of capacity 2022-30

## JV Marathon CA

Neste and Marathon Oil have formed a JV to convert Marathon's oil refinery in Martinez, California to a bio-refinery. The capacity will be 2.1 million MT and will be split between Neste and Marathon with each getting their own feedstock & selling their own fuel.

## Singapore Tuas Is. 1.5 M

Neste is expanding its Singapore HVO plant to add a large jet fuel unit (1 Million MT) and additional renewable diesel capacity for a total capacity of 1.5 million MT of fuel and some Naptha & BioLPG. Most of the fuel will be exported to Europe, Japan and USA. Chemicals are will most likely be sold locally.

## Rotterdam 1.5 M

Neste will be adding 1 million MT of new capacity as a result of purchasing a refinery in Rotterdam that will be retrofitted to make HVO diesel & jet fuel. The plant will produce renewable hydrogen to lower Co2 emissions & other innovations

# Comparisons of GP Group and Neste & Lessons Learned

## Neste is the largest HVO Biofuel producer in the world so much can be learned from their business model

| Consideration | Neste | GP Group |
|---|---|---|
| **Production Capacity Biofuels** | 4 million MT capacity by 2023, 3 main facilities in EU, USA & Asia | 1.0 million MT HVO by 2025, another 830,000 MT of biodiesel & ethanol |
| **Sales Revenues** | 15.8 billion Euros 2019, 15.2B 2021 | $14.3 billion in 2026 |
| **Profitability** | $2.2 billion in 2019, $2 bil. In 2021 | $2 billion in 2024, $5 billion in 2026 |
| **Feedstock Supply** | Phase out of palm oil, relying on PFAD, UCO, novel oils, waste | High saturated fat oil for HVO, biodiesel Ethanol from sweet potato & agave |
| **Sustainability** | Heavy emphasis, reducing CO2e 9 million MT & will reach 20 MT 2030 | Need to use similar sustainability strategy & communication to Neste |
| **Traceability** | Full traceability of all oil palm supply Working on traceability of PFAD | Will be closely tied to palm oil mills, need to work closely with plantations |
| **Deforestation** | Working with NGO's to preserve jungles. Monitor palm plantations | Must avoid deforestation or trouble GCarbon Coin could give big edge |
| **Life Cycle Co2 Reduction** | 80% on Sustainable Aviation Fuel 90% on Renewable Diesel | We may be able to get to 100% if LCFS can include methane & yield gains |

# Global HVO Capacity will Quadruple from 2020 to 2025

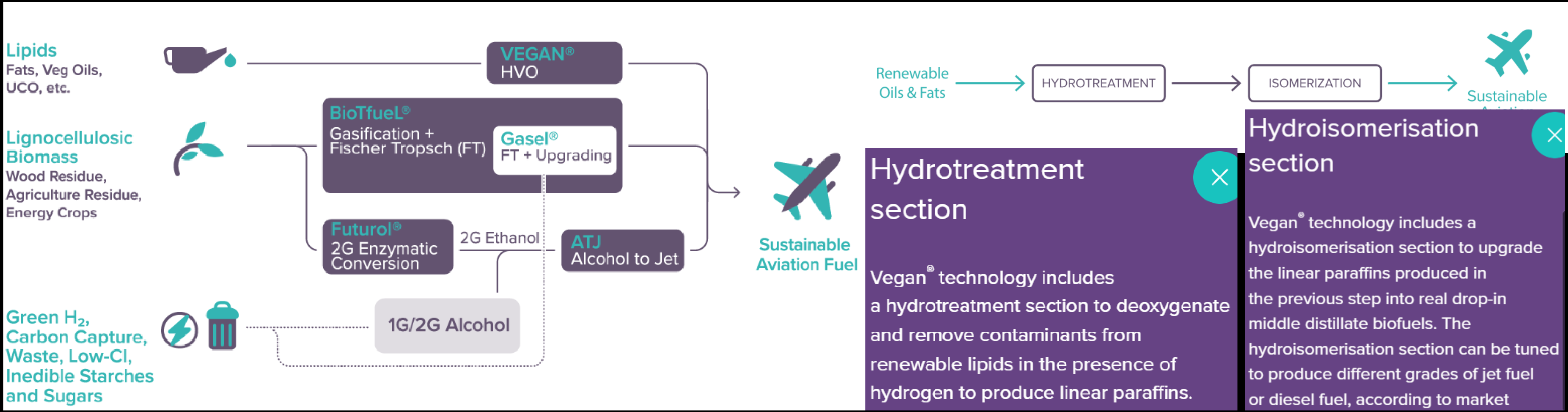
## GP Group is not the only HVO Biofuel producer coming on line and will share the Market with many others


According to a 2021 report from Greenea, the number of pure and co-processing HVO jet fuel projects will triple in the European Union, rise six-fold in the US, and three-fold in east Asia by 2025 compared to 2020, said the report. Globally, HVO production will rise from just over 7 million mt last year to more than 29.5 million mt by 2025. The US will become the single largest HVO producer, with annual production increasing from 1.9 million mt in 2020 to 12.6 million mt in 2025. Capacity in the EU will also increase from 3.5 million mt last year to 11.3 million mt by 2025. The European production will primarily be used in the EU where palm based renewable jet fuel will be impossible to sell. The EU Commission has proposed setting sustainable aviation targets for European Union-based airlines in 2025, starting with a 2% fuel burn using either synthetic fuels or biofuels that year. The sustainable aviation target then rises to 5% in 2030, when the minimum share of synthetic fuels is set at 0.7%.

Competition is expected in south-east Asia, where production is expected to grow to 3.9 million mt by 2025 from 1.3 million mt in 2020, largely due to Neste's expansion in Singapore. In east Asia, including China, Japan and South Korea, there will be smaller growth to 1.1 million mt in four years' time, up from 0.34 million mt last year. Production in Latin America will rise from nothing last year to 770,000 mt by 2025.

# Axens Major Supplier of Refinery Tech to Pertamina; Does HVO & ATJ

## We are also in discussions with Axens about HVO Plant Construction and Alcohol to Jet Fuel Plant in Kabil IIE



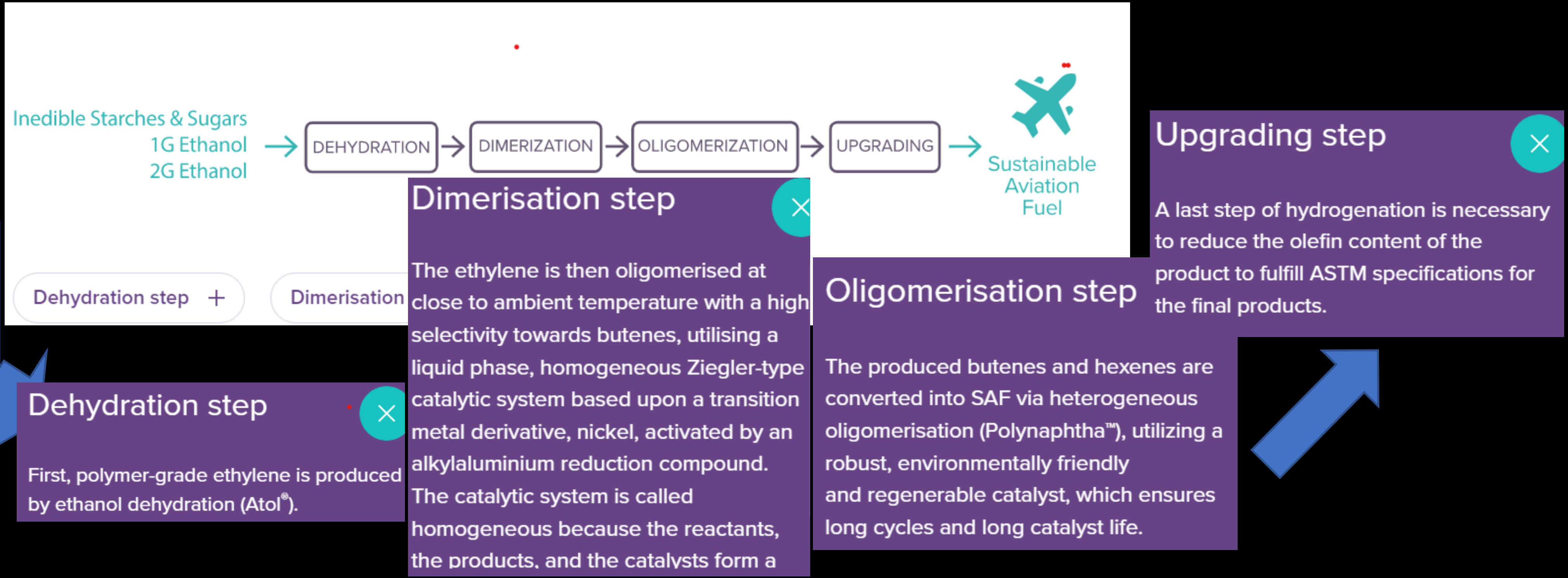

We have also met with Axens Group, which is a major supplier of refinery technology to Pertamina and competes with UOP on additions to petroleum refinery capacity. In the last 6 tenders for design of new or refinery upgrades, Axens was chosen 5 out of 6 times and will now be providing a large portion of the new technology going into petroleum refineries of Pertamina.

Axens has HVO technology that competes with UOP and various partners involved in building HVO plants world-wide. They use a similar hydrotreatment and hydroisomerisation process to UOP with the main difference being catalysts and reaction chamber design. Both companies are design and engineering companies that work with a specific Engineering, Design and Procurement (EPC) contractors to make sure the plant is built according to requirements/specs. The main difference in the two technologies will be net yield, waste characteristics, flexibility of modifying processing mix of jet and diesel and other variables. We are currently discussing obtaining bids for engineering and design services from both companies so we can make a rational decision about who to choose for construction of the HVO Plant. One significant difference between UOP and Axens is that Axens has both an HVO process (lipds) and an Alcohol to Jet process that will allow for production of renewable jet fuel from sugar and UOP only has HVO jet fuel production capabilities (lipids only)

# Axens Alcohol to Jet ATJ

## In discussions with Axens about Alcohol to Jet Fuel Plant in Kabil Next to HVO plant for Agave & Pot. Ethanol


GCarbon USA Ethanol Refinery Tech & Ethanol Plants Near Feestock


Axens Group also has a process to refine ethanol into jet fuel using a process track approved by ICAO for Alcohol to Jet Fuel. This will allow GP Group to produce ethanol using GCarbon and other technology and then refine the alcohol at a refinery in Batam that would be built in parallel with the HVO plant. The main advantage of sugar as a pathway and ethanol as the initial fuel is that the cost of the sugar is much lower than the cost of oil so there is much better economics in production of jet fuel. Sugar break even in Brazil is about $200 per MT. In addition, sugar from sweet potatoes and agave is much more environmentally friendly vs. palm oil and provides a dual track as a renewable jet fuel company that deflects from negative reactions to providing jet fuel from palm oil.

The other advantage is the link between carbon credits earned from planting agave from soil and root sequestration that links back to providing fuel for renewable jet fuel once the agave matures. This provides a means to offer lower cost sugar for ethanol conversion while also provide a very large amount of carbon credits for a carbon neutral flight program. We will be unrolling this program once we have validated agave carbon sequestration rates and developed a viable package for presenting to airline sustainable aviation fuel regulators (ICAO, CARB, USEPA, etc.) Program name will be ZE Fuel for Future

# Location of GP Group Projects in Indonesia

**Biofuel & bottled oil in Batam Island, CPO & CNG from Sumatra, S. Potato & Ethanol Sumatra, Agave S.E. Indo.**

**SUMATRA ISLAND**
143 CPO Mills &
Small Holder Farms

**BATAM ISLAND**
Bottled Oil, Biodiesel &
HVO & ATJ Jet Fuel Complex


**ETHANOL & FOOD PLANT**
Sweet Potatoes, Ethanol,
Animal Production

**NUSA TENGGARA, SUMBA, TIMOR**
Agave; Ethanol, Fibers, Sugar

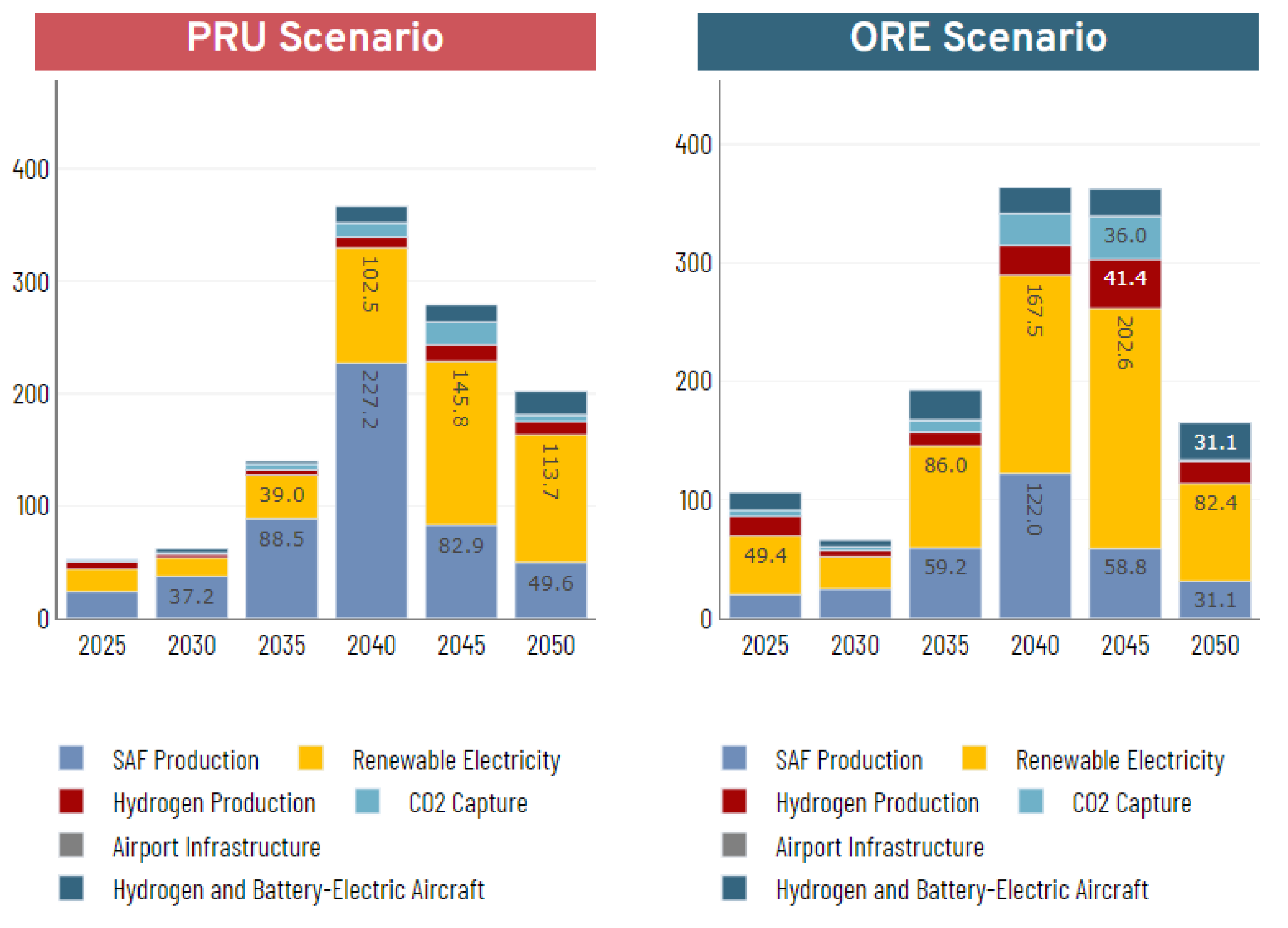
# Getting Airlines to Carbon Neutral by 2050 will Require Massive Investment

0.05-0.10 Mt SAF are produced per year in 2022, a tiny fraction of global fuel demand of 320 million MT of jet fuel. Current project pipelines of about 8 Mt are insufficient and need to be scaled up by a factor of 5-6 to supply 40-50 Million Tons SAF by 2030. That SAF volume could require about 300 SAF plants.”

Mission Possible Partnership (MPP), a collective of climate action leaders committed to decarbonising the world’s highest-emitting industries, stated “An unmitigated aviation sector would be responsible for 22% of world Co2 emissions by 2050. This is not sustainable.

Annual capital investments on top of Business as Usual, 2022-2050

, Trillion USD

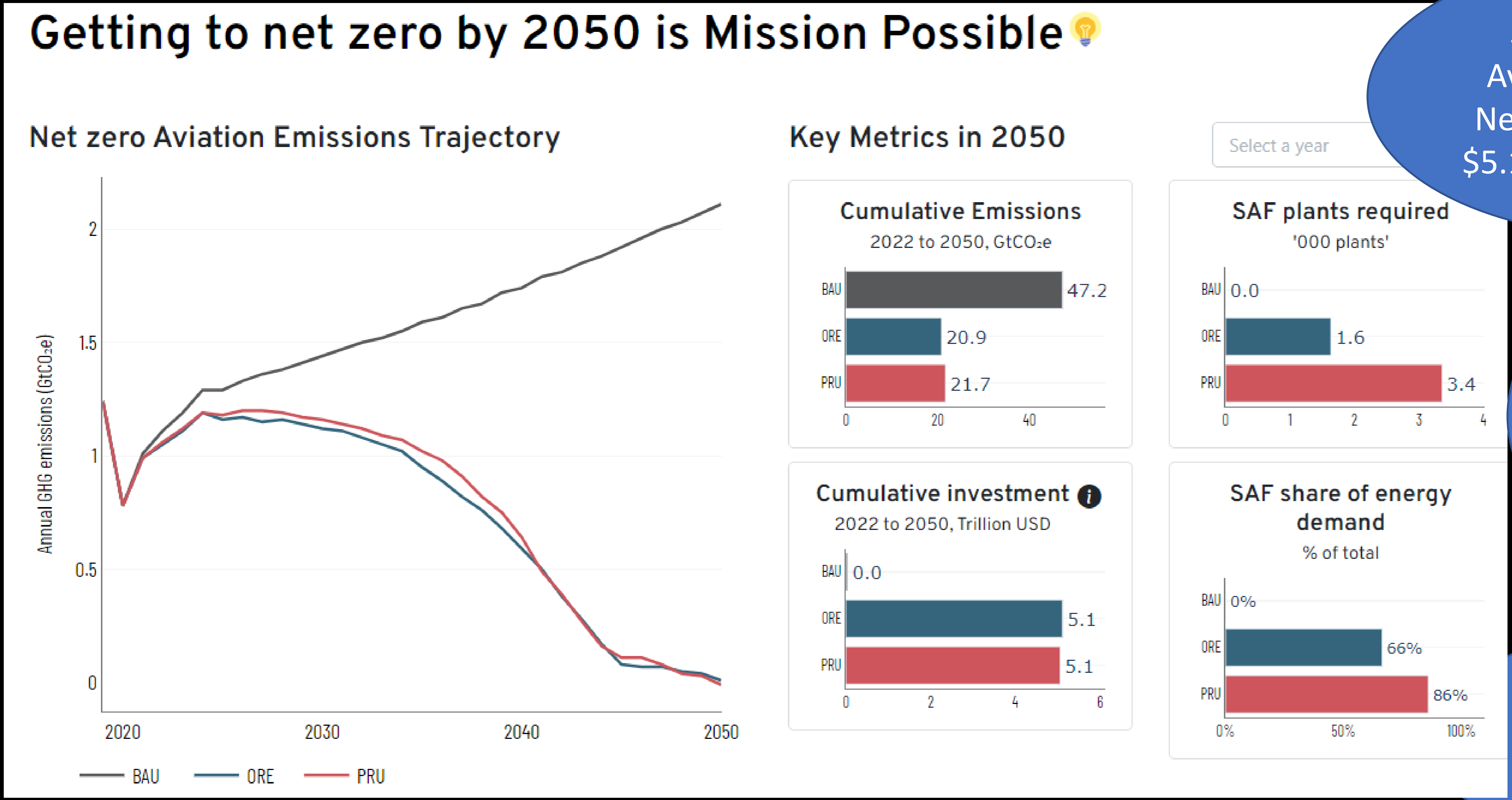



$37.2 Billion USD needs to be invested in Sustainable Aviation Fuel (SAF) to meet airline goals by 2030

This increases to $88.5 billion USD by 2035 and peaks at $227 billion in 2040. SAF production levels need to increase by a factor of 3000-7000 in less than 3 decades

**Garuda will lead in this investment effort in Indonesia with a $1.5 to $2 billion investment in SAF in 2022-2025 & $2 billion in feedstock dev.**

# Total Requirement for Renewable Jet Fuel Production by 2050

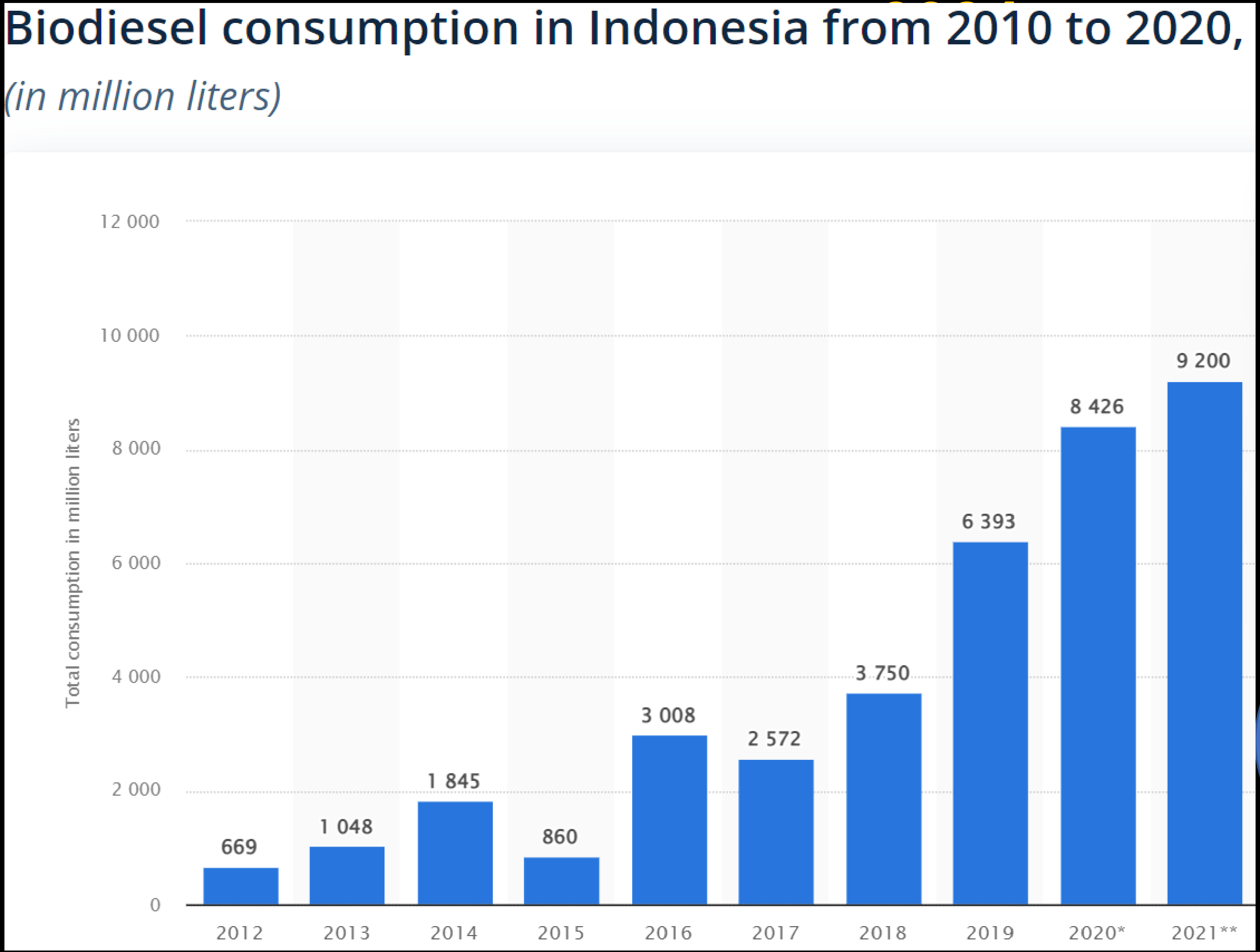



3400 Sustainable Aviation Fuel Plants Needed by 2050 from $5.1 Trillion Investment

Cumulative Emissions reduced from 47.2 Gigatons of Co2e to 21 gigatons

86% of energy demand met by Sustainable Aviation Fuel

# Total Historical Biodiesel Production & GP Group Refining Share




Indonesia Biodiesel production cut the import bill for diesel by $3.9 billion in 2021

Biodiesel demand is supposed to increase 2.9% per year to 2025

Garuda will produce 1.8 billion liters of biodiesel in 2024 or20% of 2020 production.  If biodiesel sold in USA it will capture 29% of US  2021 biodiesel market but only 1% of diesel market

# 1.6 Million MT of oil will be Used for Biodiesel Production

## A large portion of the crude palm oil will be turned into biodiesel to gain biofuel market share

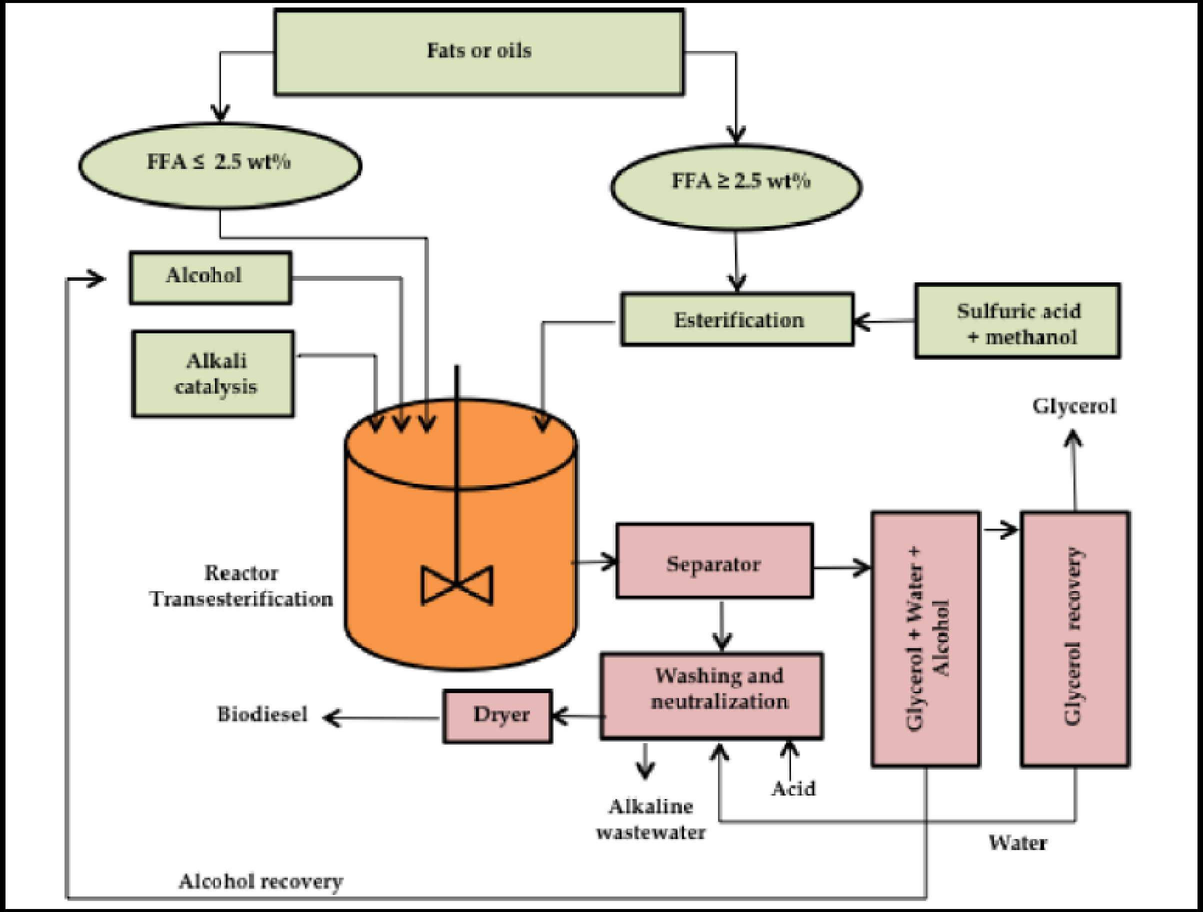
While there are large advantages of HVO technology in producing a diesel fuel that is identical to diesel and its ability to handle difficult oils and fats, the reality is that the capital cost is much higher than biodiesel plants. We therefore plan on making a large investment in biodiesel production capacity. This will ideally nvolve an ethyl ester fatty acid product, which is produced from combining ethanol and various vegetable oils, used cooking oils or fat but may involve a methyl ester fatty acid if we cannot contract with a suitable EPC to build the plant.

All biodiesel contains either 10% methanol or 10% ethanol as the alcohol required for the process. The advantage of using ethanol is that the carbon life cycle emissions are much lower if the ethanol has an excellent life cycle carbon number. The disadvantage is that more attention needs to be paid to complete the reaction without soap formation. But this can be controlled with the right processes and catalysts. Using ethanol greatly improves carbon emission reductions of biodiesel by 9-10%, which is essential in the USA, where producers must meet minimum carbon reduction targets to get subsidies. We plan to source engineering expertise from Brazil and may build equipment in Brazil or India. Brazil is a major producer of ethanol and biodiesel equipment and has perfected the process of making biodiesel using ethanol as the alcohol chemical constituent. We are in communication with several engineering firms very familiar with this process that will assist in providing a competitive bid for a very large biodiesel plant.

**High Sustainability Standards for Palm oil & UCO will lead to excellent LCFS results for biodiesel**


**We hope to use ethanol instead of methanol will improve Co2e by 9-10% vs. US producers that use methanol**

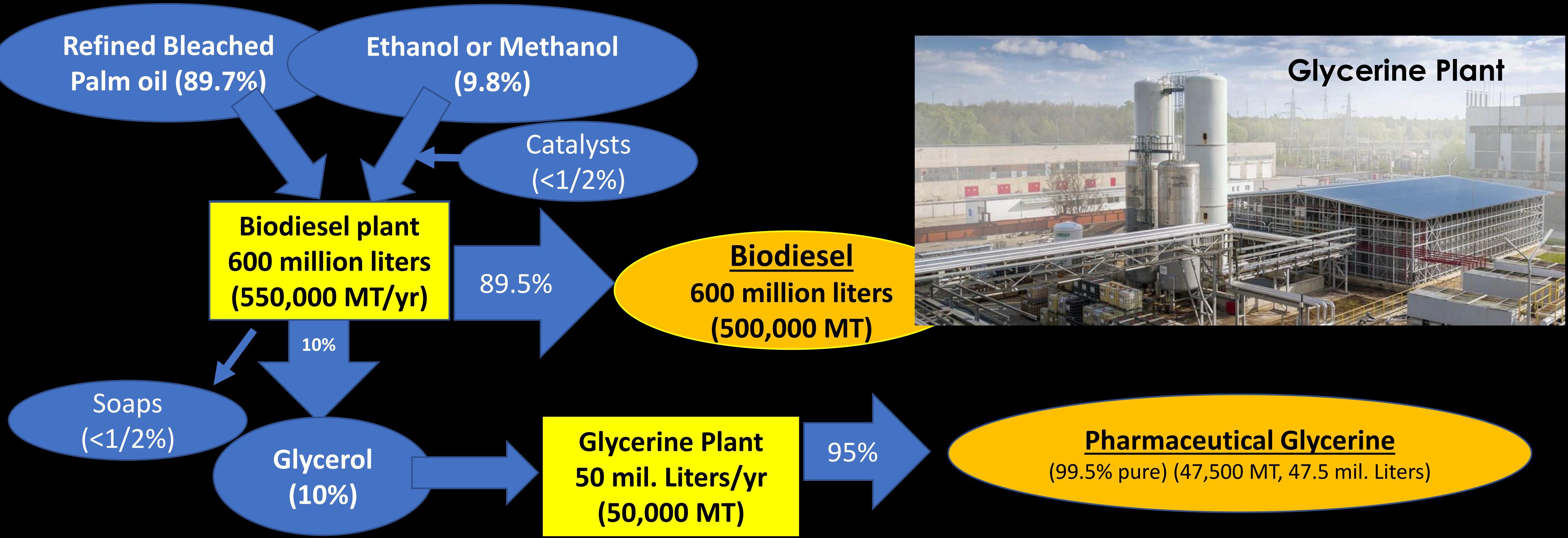
# Process Flow for Biodiesel Plant




## Biodiesel Production Process is Much Simpler than HVO which is Why CAPEX is Much Lower

The process flow drawing above shows requirements for production of biodiesel. The production process involves a chemical blending process vs. a hydrotreated refinery process. The main ingredients are vegetable oil, ethanol or methanol, potassium hydroxilate or sodium hydroxilate and other smaller volume catalysts ($NaOH$, $KOH$, $CH_3ONa$ and $CH_3OK$). Ethanol biodiesel processes are usually continuous flow to increase blending rates of the main chemicals and catalysts with in pipe mixing and then separation into tanks. Catalyst choice is critical to getting high blending rates and avoid soap formation.

# Production Output of Biodiesel Plant & Refining Requirements




**Biodiesel production will require large quantity of ethanol and produce large quantity of glycerine**

The flow chart above shows the requirements of inputs for production of biodiesel at the scale of 550,000 MT of capacity that can handle 500,000 MT of oil, and 50,000 MT of ethanol or methanol. This will lead to 600 million liters of biodiesel. We will also produce million liters of glycerol which must be further refined into pharamaceutical glycerine to have any market value. Pharmaceutical glycerine is easily marketed or can be used to make cosmetics. We have a special formula for a cosmetic product that involves glycerine, palm oil and several proprietary ingredients that is very effective in treating acme and various skin diseases.

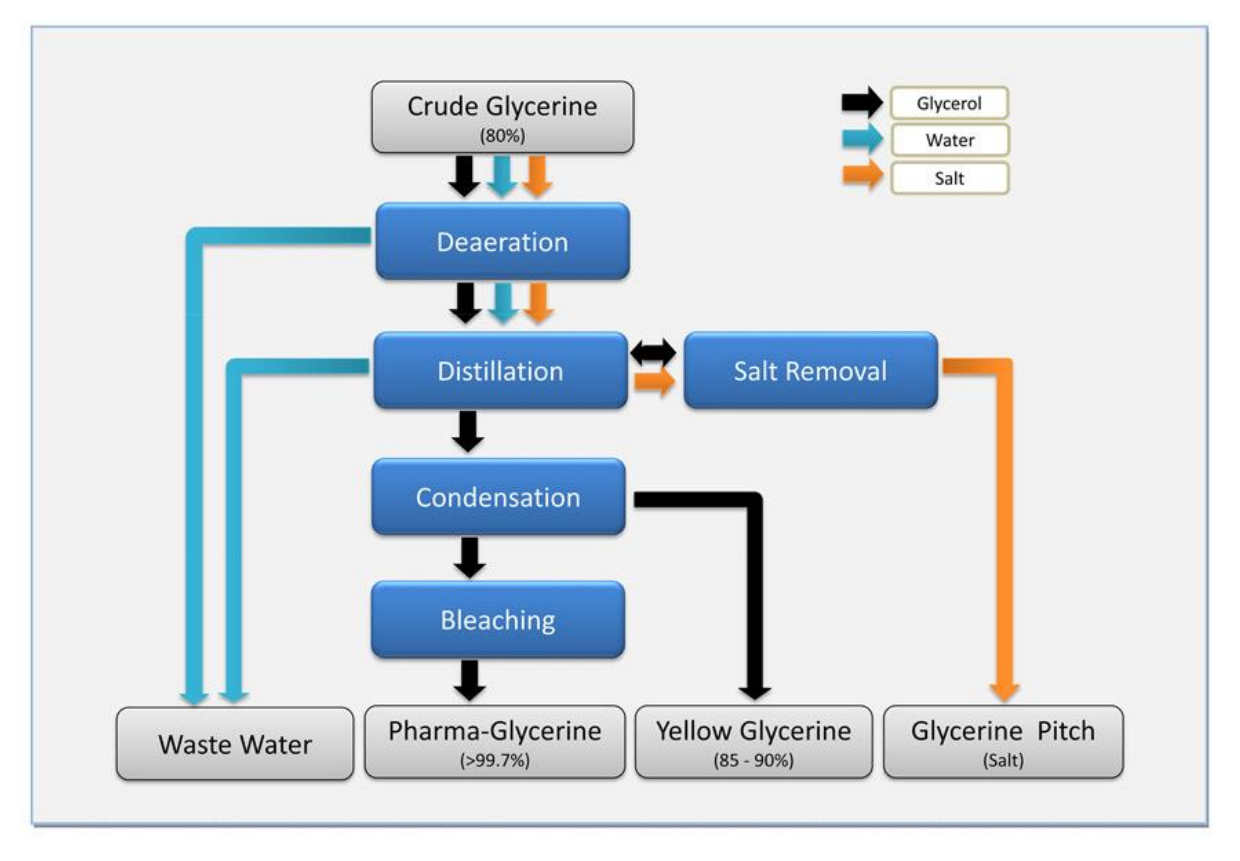
# Refining Glycerol into Pharmaceutical Glycerine

## Investment in pharmaceutical glycerine greatly improves biodiesel processing profitability

- Crude glycerine is a large percentage of the biodiesel production (10%) and has a low value. Typical crude glycerine contains glycerol, water, organic impurities (MONG), salt and residual ethanol. Pharmacautical glycerine has a high value but requires additional capital investment in machinery to purify glycerine into 2 grades; pharmaceutical (99.7% pure) and technical (90% pure)

## PROCESS DESCRIPTION

**a) Deaeration** Crude glycerine is treated with sodium hydroxide and heated and deaerated under vacuum to remove residual moisture, ethanol (if any) and un-dissolved gasses.
**b) Distillation**: Partially dried crude glycerine is fed to the distillation still for further heating under high vacuum. Distillation is carried out by means of circulation within force-circulation heater (using medium pressure steam) at temperatures of 160 °C. Top column pressure is maintained at high vacuum to facilitate good separation efficiency
**c) Condensation**: Condensation of glycerine vapors is achieved in high efficiency structured packing and special distributors. The high purity distillate (>99.7%) is obtained from a hot condensation system. The glycerine from 2nd condensation system is recovered as technical grade glycerine (90%) (also known as yellow glycerine) or recycled back to glycerine pretreatment section.
**d) Bleaching** Glycerine distillate 1 is filtered through activated carbon bed at 80 °C to remove color
**e) Salt Removal** When glycerine is distilled, the non-boiling compounds (MONG, Salt, Soap, etc) are being concentrated. Concentrated glycerine is periodically bled off to decanter system to remove salt as solid discharge. Liquid residue from decanter will be sent to post distillation still where glycerine is distilled off further.



# Market for Pharmaceutical Glycerine

- Glycerin is used safely in numerous personal care and cosmetics, such as toothpaste, soaps, shaving creams, and skin and hair products, to provide smoothness and lubrication. It helps prevent the loss of moisture from products. Glycerin is used for denaturants, fragrance ingredients, oral care agents, hair conditioning agents, skin protectants, and viscosity-decreasing agents.
- Glycerin is very good for the human skin. It helps repair the skin barrier, reduce transepidermal water loss, and restore the lipid's water barrier function. Glycerin is the most popular among the humectants used in personal care products.
- According to the 2020 data by FDA's Voluntary Cosmetic Registration Program (VCRP), glycerin is the third most frequently used ingredient in cosmetics after water and fragrance. It has been reported that the item is used in more than 23,366 products, which include lipsticks, bath soaps, detergents, hair dyes and colors, skincare products, baby products, suntan preparations, and eye care products.
- Glycerin is listed in the EU's Inventory of Cosmetic Ingredients and is not restricted. However, glycerin derived from raw materials of animal origin must comply with the European Union animal by-products regulations.
- Some global cosmetics manufacturers such as Unilever, Johnson & Johnson, and P&G are using pharamaceutical glycerin made from natural glycerol to meet the growing demand for bio-based cosmetic products.
- Glycerin is used in spray products, such as hair sprays (in pump spray products up to 30% and propellent spray products up to 10%), suntan products (in pump spray products up to 10% and propellant spray products up to 6%), face and neck products (up to 10%), body and hand products (up to 5%), and moisturizing products (up to 3.3%).
- The personal care and cosmetic industry has been growing at a robust rate worldwide, which is fueled by the increasing hygiene awareness, increased demand for products with growing women employment, significant addition in demand from the young generation in Asia-Pacific and Middle East, growing aging population in the United States, Canada, and China, and growing income levels.
- Demand for glycerin in soaps, handwash, and detergents increased during COVID-19 pandemic, particularly in the personal care industry.
- Major manufacturers of glycerine  are Emery Oleochemichals, IOI Corporation Berhard, Wilmar, Kao Corporation and Cargill
- Major buyers are P&G, Unilever, Johnson and Johnson and a large group of cosmetic producers in China
- IOI Corporation Berhad is building a110,000 metric ton (MT) per year oleochemical plant in Prai, Penang, at a cost of MYR 220 million ($50 million USD). The plant will process palm & palm kernel-based fatty acids & glycerine.  The plant is expected to come on line in mid 2022.
- GP Group is planning to build a 190,000 MT glycerine plant that is expected to cost $75 million USD & will make pharma grade glycerine

# Refining Crude Palm Oil into Refined Oil

## Primary investment will involve processing 20,000 MT per day of Crude Palm Oil (CPO) into Palm Olein & Stearin

GP Group has been tasked by the Government of Indonesia to come up with a plan to process 20,000 MT of crude palm oil (CPO) into edible oils and biofuels. We will set up a major oil processing plant on a portion of the 40 hectares of land in Kabil IIE that will process the CPO and then move oil to biofuel or edible oil final production. A portion of this edible oil will be targered for the domestic market to alleviate a shortage of edible oil in the market. The balance will be exported as bottled oil or palm stearin that will promote the sustainable strategies for food and fuel production and forest preservation through alliances with major supermarket chains (Walmart, Cosco, Whole Foods) and sale of private labelled bottle product that includes the sustainability messaging. GP Group is currently negotiating to purchase equipment for processing 7 million metric tons of crude palm oil (1087 liters/MT) into 4 billion liters of bottle vegetable oil. An additional 1.8 million MT will be refined and shipped bulk to other major oil bottling companies in Indonesia or export markets. For bottled oil, we will produce a poly-unsaturated palm oil consisting of only C-18-1 oils that are equivalent to olive oil in health properties (lowers cholesterol and heart attacks) and use saturated fats for biofuels.

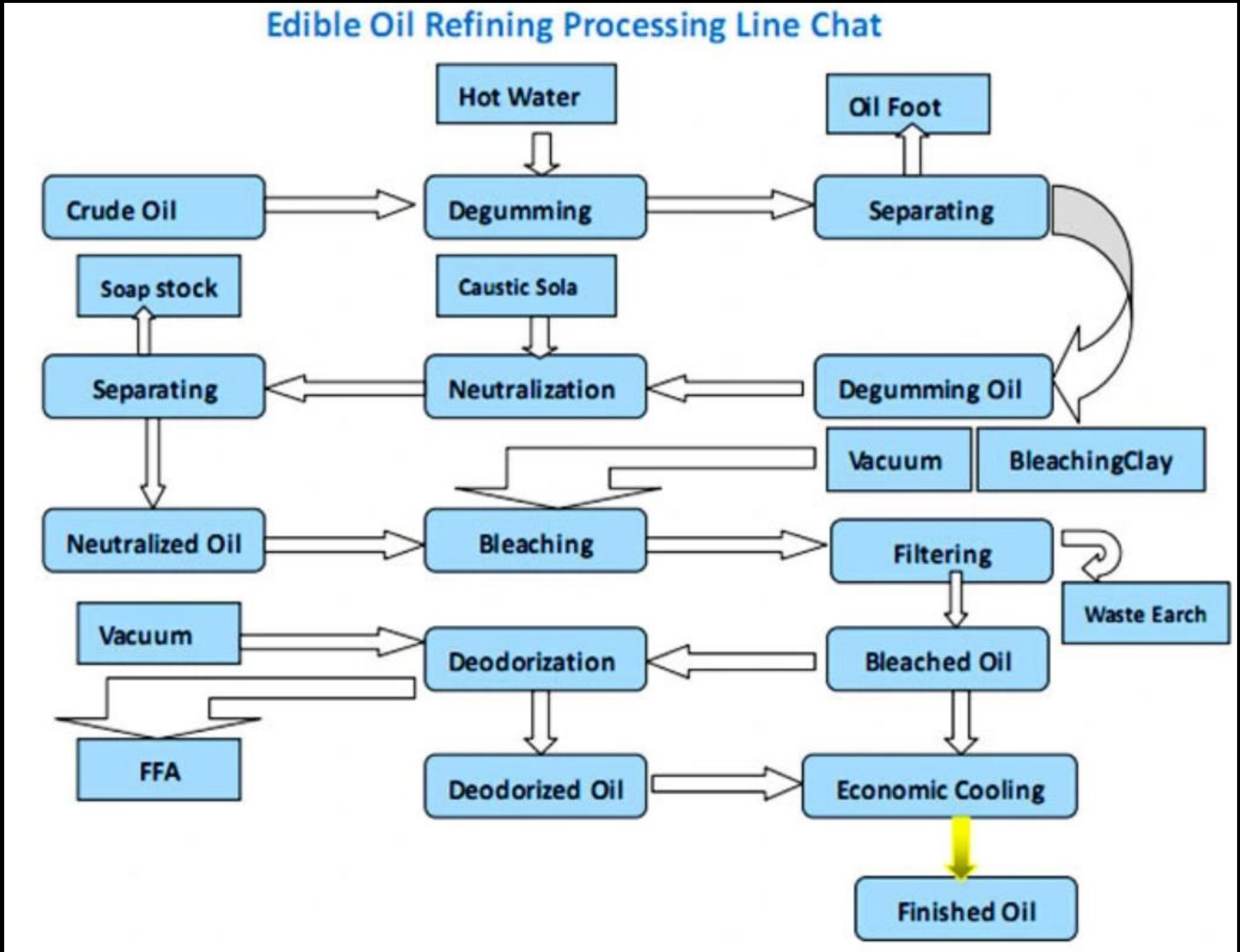
# Edible Oil Process Flow and Product Mix

## Processing Crude Palm Oil (CPO) into RBD

The first processing step in producing either edible oils for human consumption or biofuels from oil is to process crude palm oil into Refined, Bleached and Deoderized (RBD) oil. While deoderization is not needed for biodiesel or renewable diesel/jet it does need to be degummed and bleached.

Crude palm oil will be refined turned into 3 products:
Palm Olein either bottled or bulk RBD Palm Olein
Palm Stearin transfat free margarines & fats
Specialty high cartotenoid red salad oil & marg.

All processing of CPO will occur at a consolidated oil processing complex that will be set up at the Kabil Integrated Industrial Estate and refined oil will then be sent by pipeline to either an edible oil bottling plant or to biofuel production facilities. Major innovation will involve separation of saturated fatty acids (c12-c16) for biodiesel & jet fuel and use of poly-unsaturated oils (c-18-1) for edible oil products. The other innovation involves extraction of carotenoids from CPO in a manner that preserves the nutritional value and creating a super healthy oil



# Edible Oil Process Flow and Product Mix

## Bottling RBD into Private Label 1 or 5 L Bottles

GP Group is also planning to set up a set of 2 very large bottling plants that will process 4.3 billion liters of refined oil and pack it into 1 and 5 liter bottles for sale to major retailers.  This will involve private label packing for major supermarkets with a small percentage for a specialty GPGCarbon brand.  One plant will be in Batam Is. Indonesia and the other in Veracruz, Mexico

Bottling of vegetable oil will require a combination of equipment that involves initial formation of bottles from base plastic material (PET), washing, filling bottles to precise volumes and labeling on the front and back.

In addition to bottling itself, the product also needs to be packed in cartons. This is a semi-automatic process to form boxes, line them up for packing and tape final boxes.

Innovations we will bring to the process to insure high quality control involves ozonated water for bottle washing, ozone gas in chambers where capping is occurring and several steps to insure workers are fully sterilized to avoid disease transfer or contamination of bottled oil

# Components in Bottling Process

## Bottling Equipment Requirements

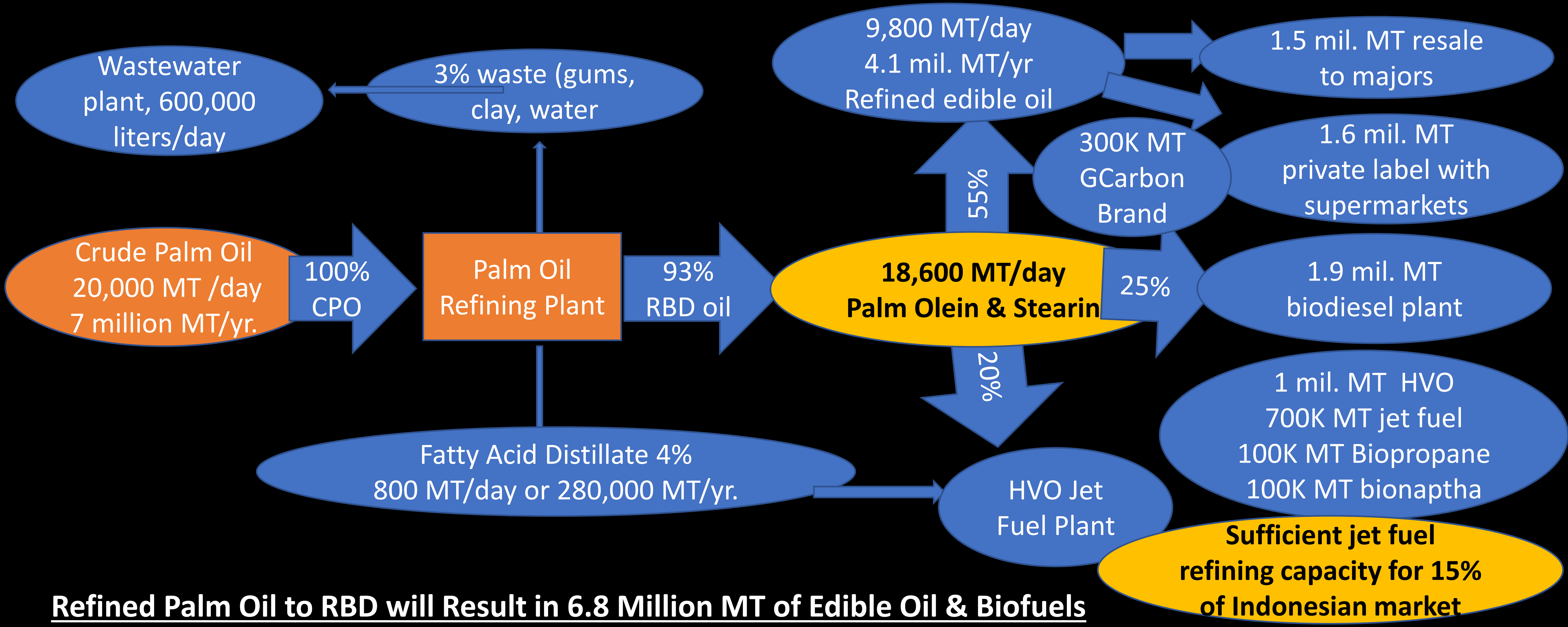
There are various equipment requirements in the bottling of vegetable oil that are detailed below and to the right in photos.  The most important is the filling machine which precisely fills and then weighs each bottle so it meets labeling requirements for accuracy.  There are numerous companies that provide this machine with varying accuracy & reliability of equipment.



Prior to filling, the bottle must be formed and then washed and sterilized prior to filling.  Forming involves a blow molding machine that injects air in a liquid PET plastic and then various cutting steps.


We will be producing 2 billion bottles a year so it will be important to set up an efficient process line for bottle formation and finishing. We will have redundant lines for bottle oil production to avoid having machinery problems lead to a total shutdown.  We will also have a strict maintenance schedule and systems for monitoring equipment performance prior to problems arising.

# Crude Palm Oil to Final Products-Product Options & Market share




**Refined Palm Oil to RBD will Result in 6.8 Million MT of Edible Oil & Biofuels**

The oil processing plant for refining crude palm oil into RBD will be set up to handle the 20,000 MT or 7 million MT of CPO. The bulk of oil will be processed into edible oil (4.1 million MT) with bottled oil distribution occurring to the indonesean market in bulkd and through sale of bottles to major supermarket chain globally (mostly white label but some own brand). The production of 700,000 MT of jet fuel will result in a 15% share of the Indonesian jet fuel market while biodiesel production will also be very significant with GP Group capturing about 18% of the USA market from sale of sustainable biodiesel.

# Feedstock to Final Products: Investment Required

| UPSTREAM INVESTMENTShd | Investment | Net Product Capacity | Market |
|---|---|---|---|
| Refining CPO to RBD | $250 Million | 7 mil. Tons./year (1.8 m bulk) | Major oil co's & export market |
| RBD Bottling Plant | $120 million | 3.7 mil. Tons./year (2 sites) | Supermarket white labeled product |
| Biodiesel Plant (550,000 MT total) | $200 million | 500,000 Ton/year (592 mil.Lit) | Export to California, US West Coast |
| Pharmaceutical Glycerin Plant | $25 million | 50 million kg/year (50K MT) | Pharma glycerin or cosmetics |
| Ethanol Plant (sweet potato/sorg.) | $100 million | 380 mil. Liters/year (333K MT) | export |
| Meat processing (int. ethanol plant) | $50 million | 450 mil. Kg/year (450K MT) | Indonesia sale & Export |
| HVO Ren. Jet, Naptha, & bioLPG | $700 milion | 1 mil. Tons/yr (total prod.) | 15% of Indo jet fuel market |

| DOWNSTREAM INVESTMENTS | Investment | | Market |
|---|---|---|---|
| Plant 20,000 ha. potatoes, preservation of 100,000 ha. jungle for Co2 credits | $80 Million | 2 mil. Tons./yr 2 potatoes | Ethanol and food production<br>Co2 credits for crypto coin |
| Fertilizer Tech to Improve Yields | $150 million | 2 mil. Tons./year | Shared yield contracts, farmers |
| **TOTAL UPSTREAM/DOWNSTREAM** | **$1.7 billion** | **1.8 mil. MT biofuel,<br>5.5 mil. MT refined oil** | **Indo & export markets biofuel<br>Private label veg. oil bottling** |

GP Group will be investing in various sectors of the palm oil industry in order to produce edible oil products and biofuels. The plan is to invest in a combination of agricultural and manufacturing steps to process 20,000 MT of CPO already secured & increase volume from yield improvements. Investment will occur in both upstream (RBD & biofuel processing) and downstream sectors (oil palm plantation, fresh fruit bunch to CPO). This will result in vertical integration for a part of the supply stream with high yields from trees, good margins on processing and a strong market position due to pricing & sustainability.

# Revenues & Margins:  EBITDA Potential by Yr. 4

| UPSTREAM Product Activity | Capacity | Price | Sales | Gross Margin, -10%=EBITDA |
|---|---|---|---|---|
| RBD for bulk resale | 1.8 mil. Tons./yr | $1450/MT | $2.6 billion | $250/ MT,  $405 million |
| RBD Bottling Plant & private label | 3.7 mil. Tons/yr. | $1550/MT | $5.7 billion | $350/MT, $1.17 billion |
| Biodiesel Plant (export with RIN/LCFS) | 592 mil. liters/yr | $1.75/liter | $1.04 billion | $0.75/liter, $400 million |
| Pharmaceutical Glycerin Plant | 45,000 T/yr (net) | $2,227/T | $100 million | $1114/MT, $50.1 million |
| Ethanol Plant (sweet potato/sorg.) | 380 mil. Liters/yr | $1.42/liter | $270 mil. | $0.71/lit.  $121.5 million (1/2 bio |
| Meat production (integrated w/ethanol) | 450,000,000 Kg. | $4.25/kg | $1.91 billion | $2.50/kg, $1.01 billion |
| HVO Jet, Naptha, LPG Plant (half in Indo. Half in USA market) | 875 mil. liters/yr. | $1.20/liter (av. US/In.) | $1.05 bilion | $0.35/liter, $306 million (margin if Indo price = petro jet/50% of sales) |
| **DOWNSTREAM Product Activity** | **Capacity** | **Price/MT** | **Sales Revenue** | **Gross Margin -10%=EBITDA** |
| Plant 20,000 ha. potatoes, Jungle pres. | 30 mil. T Co2 credit | $8/MT | $240 million | $5/MT, $135 million (start yr. 2) |
| Fertilizer & Yield+ Share | 1.5 mil. tons | $900/MT | $1.35 billion | $700/MT, $900.2 million |
| **YR 5 PRODUCTION, SALES, EBITDA** | **9.1 million MT** | | **$14.3 billion** | **$5.0 billion (EBITDA yr. 4)** |

Substantial margins exist in processing and biofuels, particularly if sustainability criteria are met.  The processing of CPO ro RBD oil for bulk sale is expected to contribute about $405 million to EBITDA and RBD bottled for export will add another $1.2 billion.  Biofuel margins will come from biodiesel that is exported and has good LCFS & carbon benefits which will add $400 million. Biodiesel co-product of glycerol will be refined into pharmaceutical glycerin which adds $50 million to EBITDA.  Half of renewable jet fuel will be sold in the Indonesian market at a slight increase to final jet fuel price and half will be sold to USA at a substantial margin and the combined sales will contribute $306 million to EBITDA (when including by products of LPG and naptha).  Ethanol will provide margins from fuel sales and by-product of wet residual will support meat production that provides food for Indonesia Additional margins will be realized from shared savings programs to improve palm yield in coops providing CPO which will have better sustainability and increase the value of biofuels in export markets.  Total sales revenue will reach $14.3 billion by year 4 with $5.0 billion EBITDA

# Construction Timeline: When Capacity will Come on Line

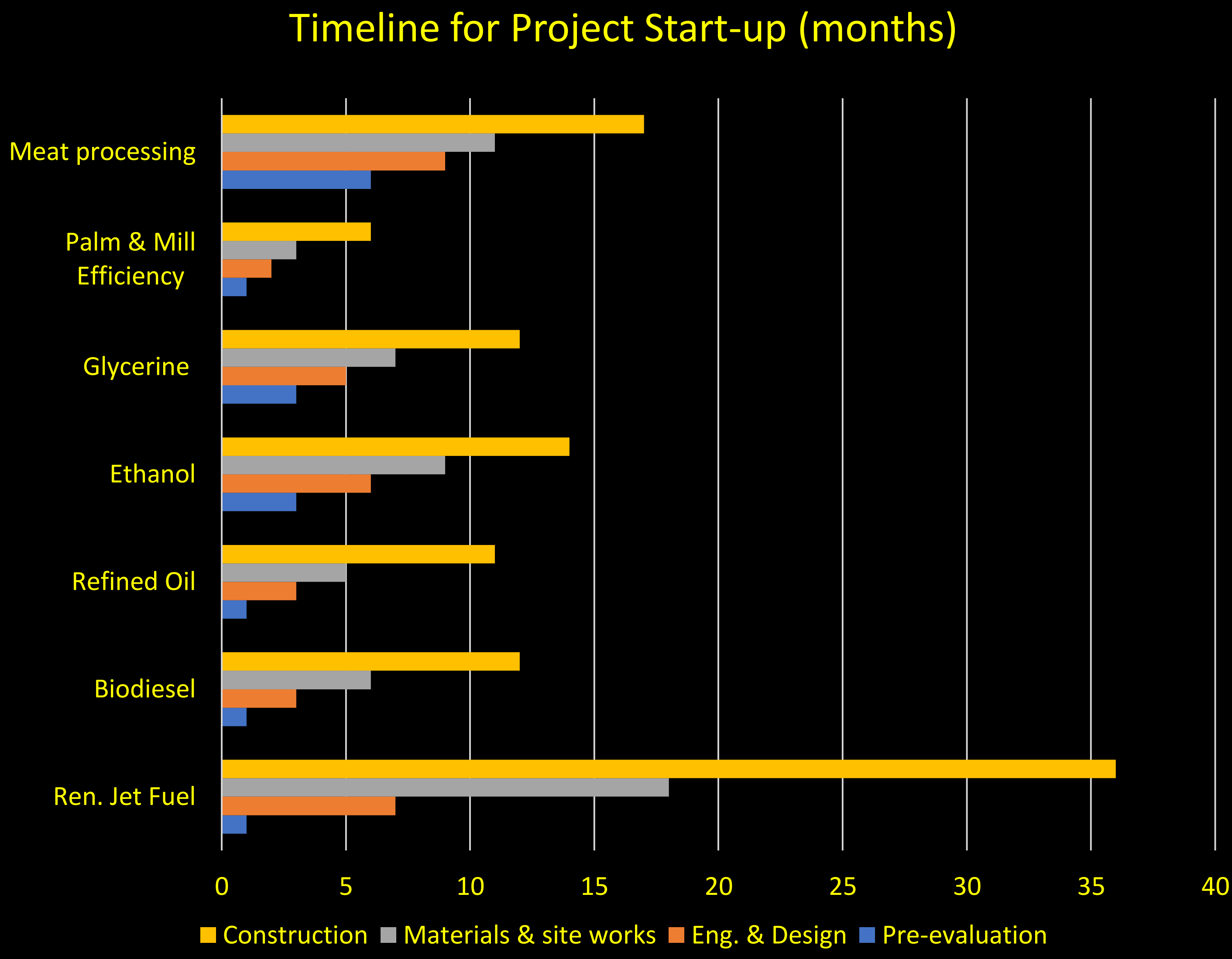
Construction timelines for different projects will depend on the complexity of the project, and wait times for critical equipment.

Timeline for the jet fuel project is the longest (3 yrs+) as the engineering and design phase is 6 months and equipment has long lead times & is estimated at 3-3.5 years

Refining of crude palm oil to refined oil is is only about 9-12 months from investment to the plant coming on line.

Other projects such as biodiesel construction should be completed in about 1 year but this will depend on equipment availability and will require some time to select contractor and finalize design.

Ethanol plant construction will be a little longer as there is the need for an evaluation phase as capacity is built in Brazil so there is more data on sweet potato and agave yields, animal production and ethanol profitability.



# Indonesian Export Market Levy; CPO, RBD & Biodiesel:

Export Levy Rate varies from $25 to $55 /MT depending on palm product type

70% of the Export Levy revenues are targeted for biodiesel subsidies which is about $39/MT which will help improve jet fuel margins

**Export Levy Provides Source of Revenue for Jet Fuel Subsidy**

The export levy on various palm oil products is used to support a biodiesel mandate of 30% in diesel in Indonesia. 70% of the revenue from the levy is used for this subsidy. We are confident that renewable jet fuel will be eligible for the same subsidy so that renewable jet fuel price will be jet fuel price plus the subsidy value.

Indonesia biodiesel levy schedule

| Products | Levy rate in US Dollar per-metric tonne |
|---|---|
| Crude Palm Oil | 55.00 |
| Crude Palm Kernel Oil | 55.00 |
| Crude Palm Olein | 55.00 |
| Crude Palm Stearin | 55.00 |
| Crude Palm Kernel Olein | 55.00 |
| Crude Palm Kernel Stearin | 55.00 |
| Palm Fatty Acid Distillate | 45.00 |
| Palm Kernel Fatty Acid Distillate | 45.00 |
| RBD Palm Olein | 35.00 |
| RBD Palm Olein non-bulk < 25kg | 25.00 |
| RBD Palm Oil | 25.00 |
| RBD Palm Stearin | 25.00 |
| RBD Palm Kernel Oil | 25.00 |
| RBD Palm Kernel Olein | 25.00 |
| RBD Palm Kernel Stearin | 25.00 |
| Palm Methyl Ester | 25.00 |

# Pricing Justification: Jet Fuel, 100% Sold in Indonesia

TANKERING FUEL DECISION

**Revision = 16 (15-JUL-22)**

| NO | ROUTE | | REMARK | FUEL PRICE Rp/LTR | | BENEFIT (RP) |
|---|---|---|---|---|---|---|
| | DEP | DEST | | DEP | DEST | |
| 60 | CGK | TNJ | OK | 16806 | 18557 | 1133 |
| 61 | CGK | GTO | OK | 16806 | 18454 | 354 |

Price mid July
$1.13/liter

HIGH VOLATILITY
OF PRICING

Export Levy on CPO $55/MT
*70% = $39 per MT or
$0.03/liter

| 5 August 2022 | Share in World Index | cts/gal | $/bbl | $/mt |
|---|---|---|---|---|
| Jet Fuel Price | 100% | 305.26 | 128.21 | 1012.42 |
| Asia & Oceania | 22% | 292.56 | 122.87 | 970.71 |

Price Aug. 5
$0.78/liter

Indonesian Price of Jet Fuel
$1.13 per liter July, $0.78/liter Aug.
(30% volatility index!)

+

Export Levy Subsidy
$0.03/liter (same as biodiesel)
($39/MT)

=

Expected Price
$0.81-1.16/liter

**Current Indonesian Price for Jet Fuel**

**Expected Export Levy Premium**

We are assuming that the price we will obtain for jet fuel is equal to the Indonesian market price for jet fuel plus an equivalent subsidy equal to the premium provided to biodiesel producers for meeting the 30% biodiesel mandate in diesel. The current market price for jet fuel August 5 is $0.78 per liter (USD) but was $1.13/liter in July. There is currently a levy on CPO exports of $55 per MT and 70% of income is for biofuel. At his ratio this is $39/MT subsidy or $0.03 per liter. This will result in a market price of $0.78 to 1.16 per liter or up to $1000-$1300 per MT for jet fuel with subsidies. There is a small margin if jet fuel prices are low ($112 per MT and production cost will be at least $50-100 per MT based on current CPO price is $872 per MT. If petroleum jet prices are high then there are large margins. This indicates renewable jet fuel prices will be needed to be sold at a higher price to insure margins.

# Pricing of Jet Fuel in USA: Jet Fuel price plus incentives

JET FUEL PRICE END OF JULY USA *(IATA) $3.04/gallon ($0.80 per liter)

Large USA subsidies now with combination of RIN Credits, Federal Tax Credits and LCFS Carbon Credits

Susidy Value is by itself $0.81/liter

US Federal Tax Credit $1.25-$1.75 per gal. ($0.31/liter)

+

D4 Biomass Diesel RIN Credit $0.40/liter

+

LCFS Credit (US West Coast) $0.10/liter

=

Expected USA Price $1.61/liter

## Strong Incentive to Export Jet fuel to USA will Require Incentive to Sell Jet Fuel in Indonesia

While the current price of jet fuel is high and there is a large margin relative to the price of palm oil, this may not be the case in the future. In the event there are no subsidies for renewable jet fuel use, GP Group might be required to sell jet fuel to the USA or other markets to stay profitable. The recent passage of a climate bill in the USA now provides a $1.25 per gallon ($0.31 per liter) credit for jet fuel in addition to a RIN credit now worth about $0.40 per liter plus an LCFS credit of $0.10 if sold in the US West. This provides $0.81 per liter incentive plus the price of fuel. While Garuda is planning to sell all of its jet fuel in Indonesia, it will have the option to sell to export markets if margins are break even or negative. This shows the need for a jet fuel subsidy so that Indonesia can be competitive and secure Sustainable Aviation Fuel to meet in renewable fuel goals in the aviation sector.

# Impact of Higher Renewable Jet Fuel Price at 5% Blend:

**Even if renewable jet fuel is sold at double the price of regular jet fuel, it will only raise ticket prices 1%**

Indonesian Price Aug. 5 $0.81/liter

Value of renewable jet fuel in US market is 50-100% higher than the value of jet fuel in Indonesia

USA Price with subsidies $1.61/liter

Indonesia has a 5% blend mandate in place in 2025. This means regardless of renewable jet fuel price it must be blended if available

If the price of jet fuel offered to Pertamina is double the regular jet price and it is blended at 5% the cost impact on ticket prices is only 1%

Renewable Jet Price $1.61/liter

Price impact on fuel is only 2.5%

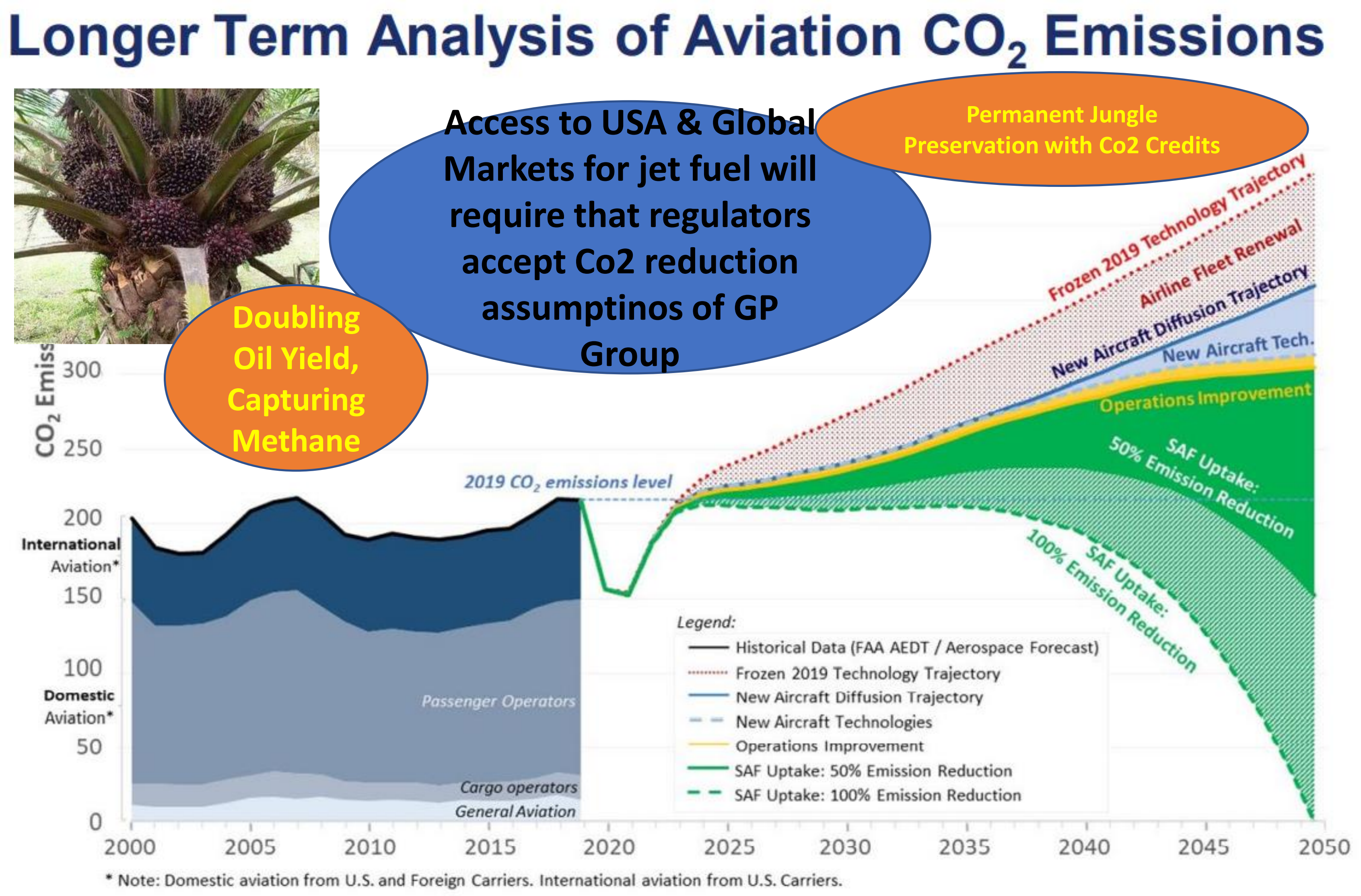
Fuel is about 40% of airline operating costs

Ticket price impact is only 1%

# Jet Fuel Sales in USA using Palm Oil will Require EPA/CARB OK

## GP Group will have to prove that jet fuel from palm oil is not contributing to deforestation to earn RIN & LCFS Cred

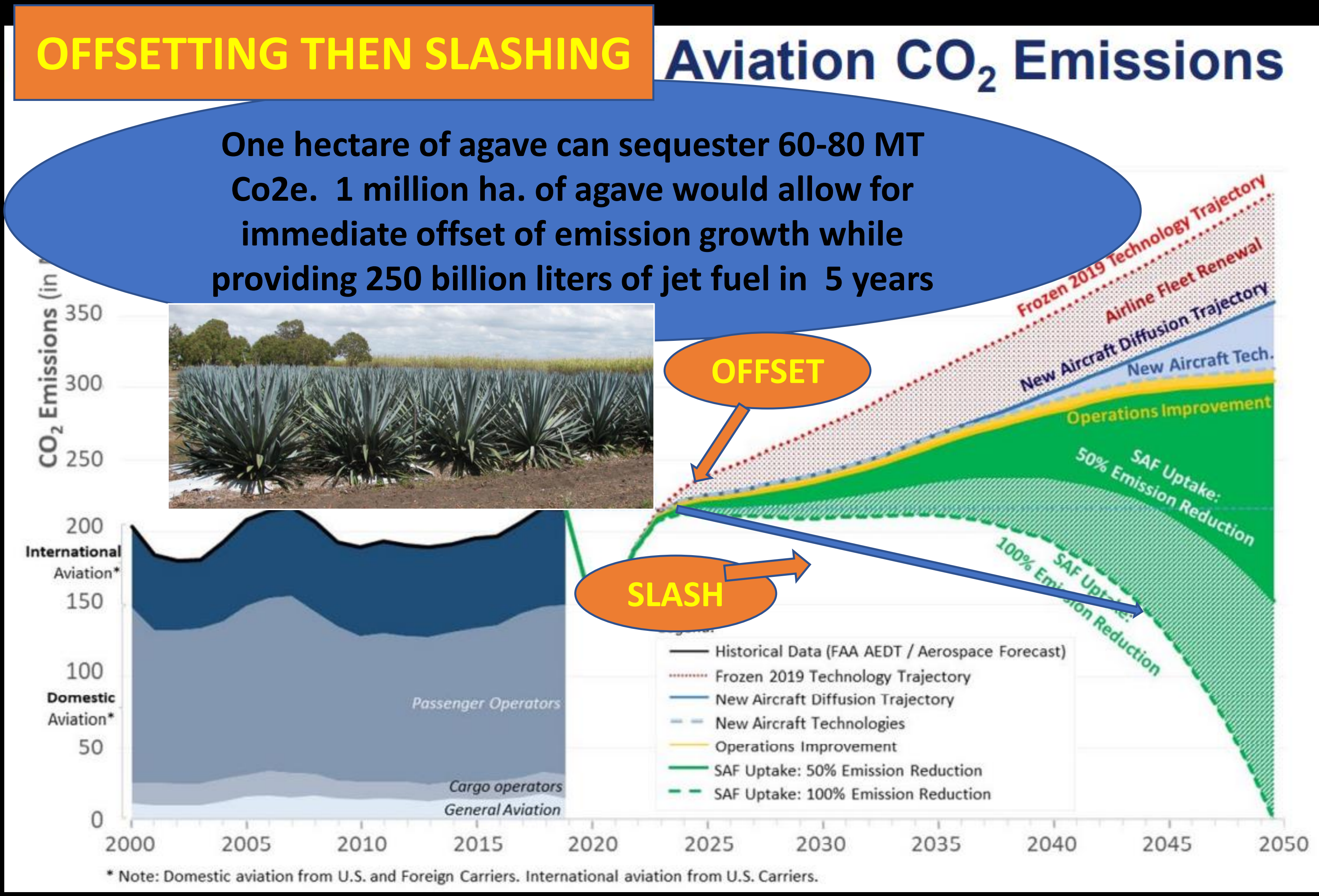
Jet fuel is a major source of greenhouse gas emissions and the airline industry has agreed to get to net zero emissions by 2050. To reach this goal will require tremendous quantities of sustainable aviation fuel. This will require huge quantities of biomass to produce this quantity of biofuels. This must be done in a way that it counts in reduction of Co2 emissions. Otherwise jet fuel can only be sold in Indonesia. To do this will require going through an LCFS analysis with CA Air Resources Board and US Environmental Protection Agency and prove that the pathway for palm oil production invoving yield improvements and methane capture will not affect deforestation and will lead to very large Co2e emission benefits. This is a very important task that must be undertaken as soon as the jet fuel project is initiated.



# Jet Fuel Can Be Made from Ethanol;"Fuel for Future"can Finance

**GP Group can also produce jet fuel from ethanol: Fuel for Future program with airlines could finance planting effo**

Airlines can immediately offset their greenhouse gas emissions and get to net zero emissions by 2050 if they plant fuel for the future and sequester Co2e as part of the immediate solution. This could linvolve a global program to plant agave in semi-arid areas and macauba in cattle pastures. The benefits of agave are detailed further in the presentation and provide 70 to 200 tons of jet fuel per hectare. More importantly, it can sequester 60-80 tons of Co2e per hectare per year. Planting 1 million hectares of agave would provide 60-80 million tons of Co2 sequestration and offset all of the emissions growth until 2030. Once the agave are ready to harvest in year 5, 350 million hectares of biomass and 200 million tons of ethanol (250 billion liters of fuel) will allow the airlines to level off and reduce emissions to below 2019 levels. This could all be done through a matching program with customers to fly "carbon neutral" and fund "Fuel for the Future"



# Jet Fuel Prices Highly Volatile & Hard to Predict in 2025

Prices dropped 10% between mid July (slide before) and this pricing

High volatility in petroleum and jet markets is not abnormal making pricing uncertain

## Fuel Price Analysis

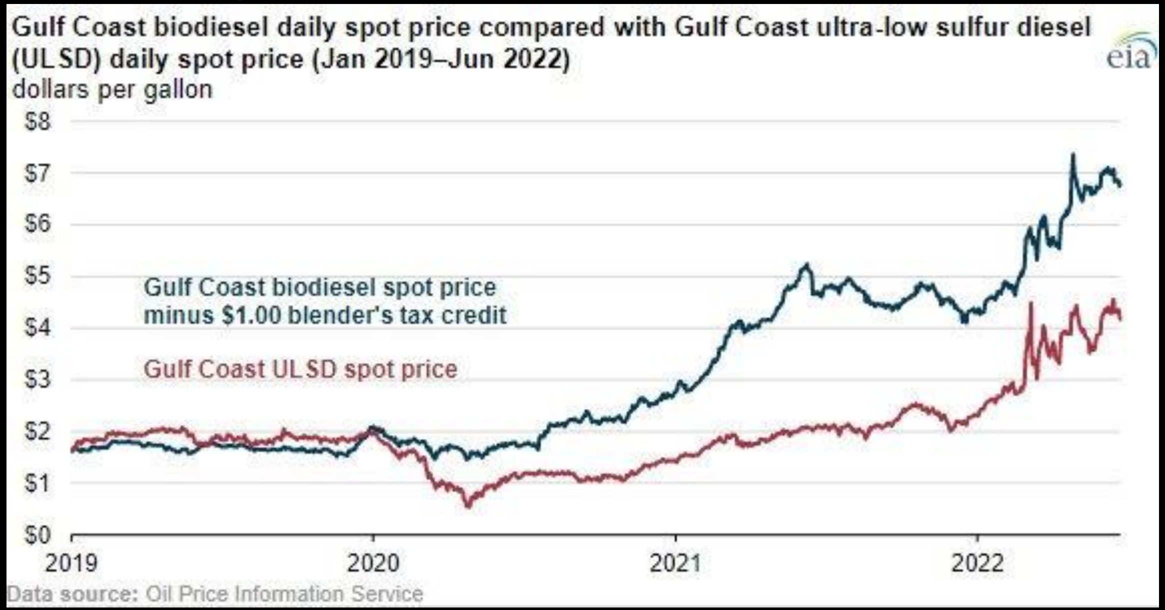
The jet fuel price ended last week down 10.4% at $128.2/bbl:

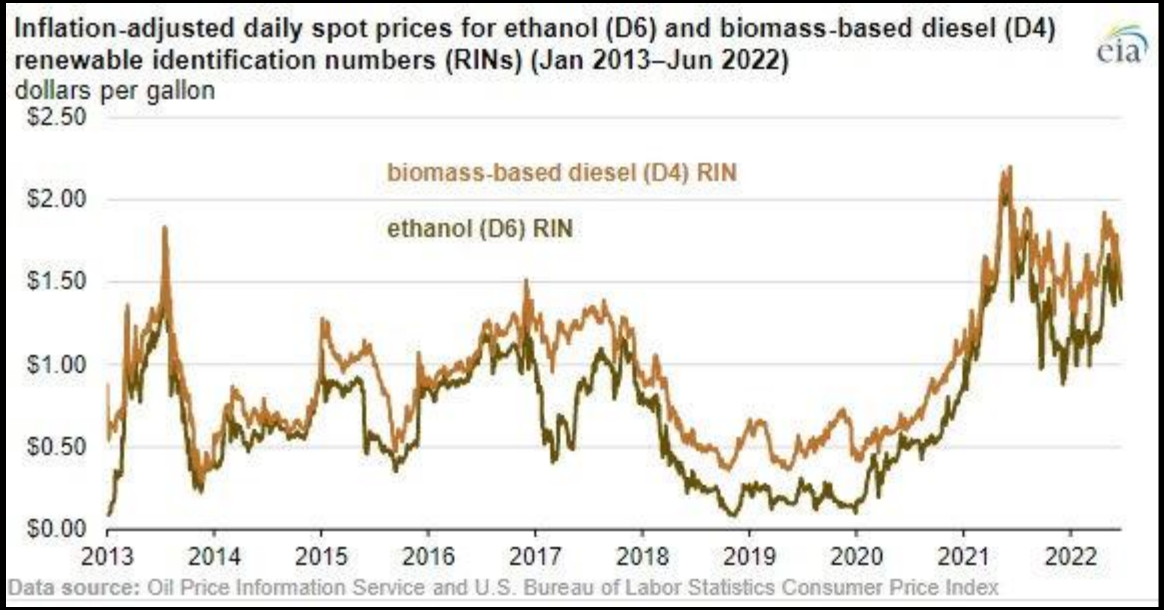
| 5 August 2022 | Share in World Index | cts/gal | $/bbl | $/mt | Index Value 2000 = 100 | vs. 1 week ago | vs. 1 month ago | vs.1 yr ago |
|---|---|---|---|---|---|---|---|---|
| **Jet Fuel Price** | 100% | 305.26 | 128.21 | 1012.42 | 350.47 | -10.4% | -12.3% | 65.1% |
| Asia & Oceania | 22% | 292.56 | 122.87 | 970.71 | 351.09 | -9.4% | -11.2% | 61.7% |
| Europe & CIS | 28% | 314.78 | 132.21 | 1043.13 | 356.21 | -10.2% | -9.8% | 71.7% |
| Middle East & Africa | 7% | 295.07 | 123.93 | 978.50 | 370.09 | -10.1% | -10.6% | 64.6% |
| North America | 39% | 304.97 | 128.09 | 1011.87 | 340.52 | -11.2% | -15.0% | 61.4% |
| Latin & Central America | 4% | 326.91 | 137.30 | 1084.69 | 380.35 | -10.0% | -11.4% | 75.4% |

## High volatility of Prices Makes it Hard to Predict Price of Jet Fuel when Renewabale Capacity in on line

Prices for jet fuel are highly volatile depending on jet demand, crude oil prices and refiner's capacity. Jet fuel prices dropped last week to $128.20 per barrel because oil prices dropped on recession fears. So it is hard to lock in jet fuel prices. This makes it important to identify specific subsidies that can be provided for renewable fuel use that can greatly reduce risk. Usually palm oil prices drop consistent with petroleum but not always. We have large volumes so lower than published prices so our margins will always be there but may vary depending on jet fuel prices and subsidies available.

# Pricing Justification: Biodiesel, 100% Sold in USA, Canada



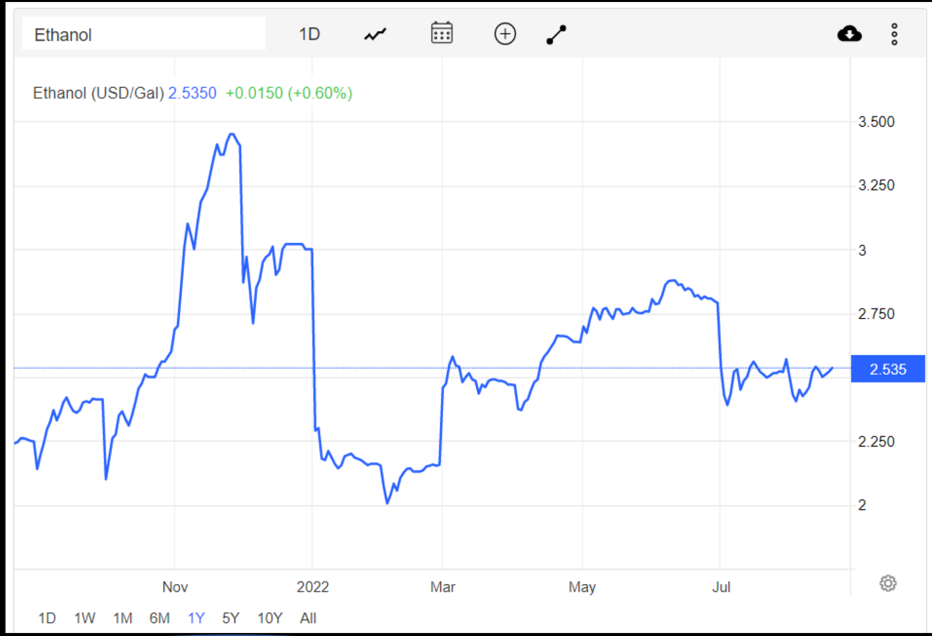




US Gulf Coast ULSD $1.15 per liter (4.32/gal.) + RIN Credit (biomass based diesel D4) $0.40/liter, + LCFS Credit (CA, WA, OR) $0.10/liter = $1.65/liter biodiesel price (fuel + credits)

## USA Price for Diesel Fuel Plus Federal & State Subsidies Make Biodiesel Profitable if Sustainability Goals Met

We are assuming that the price we will obtain for biodiesel in the US West Coast and British Columbia is equal to the US price for diesel fuel wholesale (Gulf Coast ULSD spot price), plus RIN credit (Renewable Identification Number for renewable fuels) plus LCFS credit (carbon reduction % as calculated in Low Carbon Fuel Standard). This market is only available if sustainability factors are considered in production and sourcing of feedstock for biofuel and if low carbon refining systems are used. We are assuming we will capture methane from mill effluent and credit it in the palm oil product. This can be done through filter pressing of FOME and use as fertilizer. We will also increase yields per ha. and lower petro-fertilizer use. We will also use ethanol for 10% of the raw materials instead of methanol. These measures should open up the market for biodiesel in the USA and greatly improve profitability of biodiesel production. RIN values are high in 2022 for biodiesel & ethanol. Prices for biodiesel peaked at $8.36 per gallon so the assumed price of $1.65/liter is conservative ($7.30/gallon equivalent). Most Indonesian biodiesel producers are not exporting because they have made no effort to improve LCFS and RIN carbon numbers and are kept out of the market for this reason (ILUC penalty is high).

# Pricing: Ethanol, 50% for biodiesel, 50% for USA, Canada





US Price ethanol
$0.72/liter (2.74/gal)

RIN Credit (Federal)
$0.39/liter ($1.49/gal.)

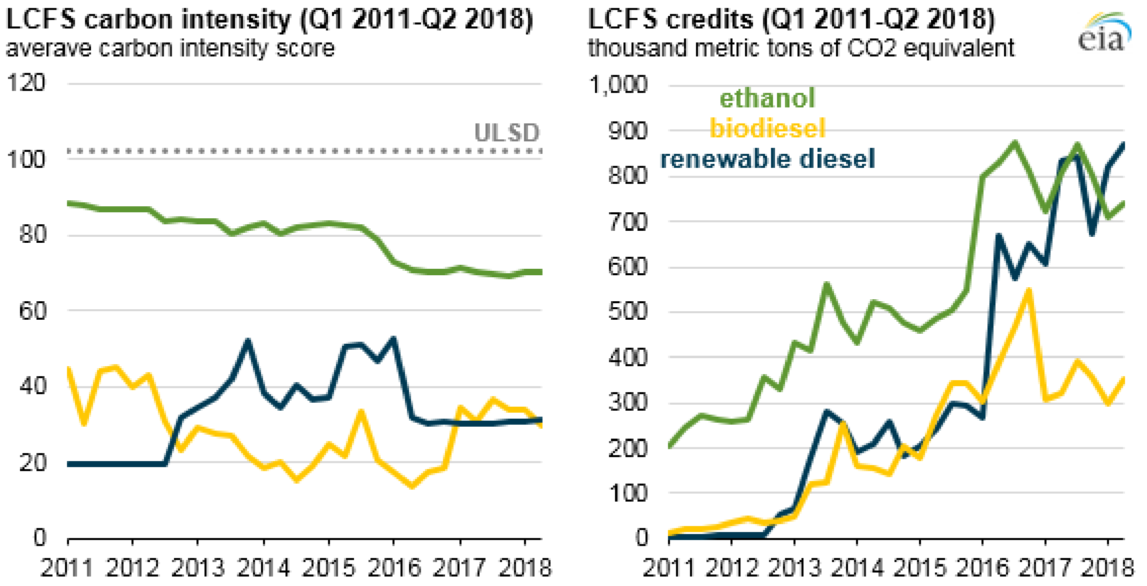
LCFS Credit (CA, WA, OR, BC)
$0.10/liter

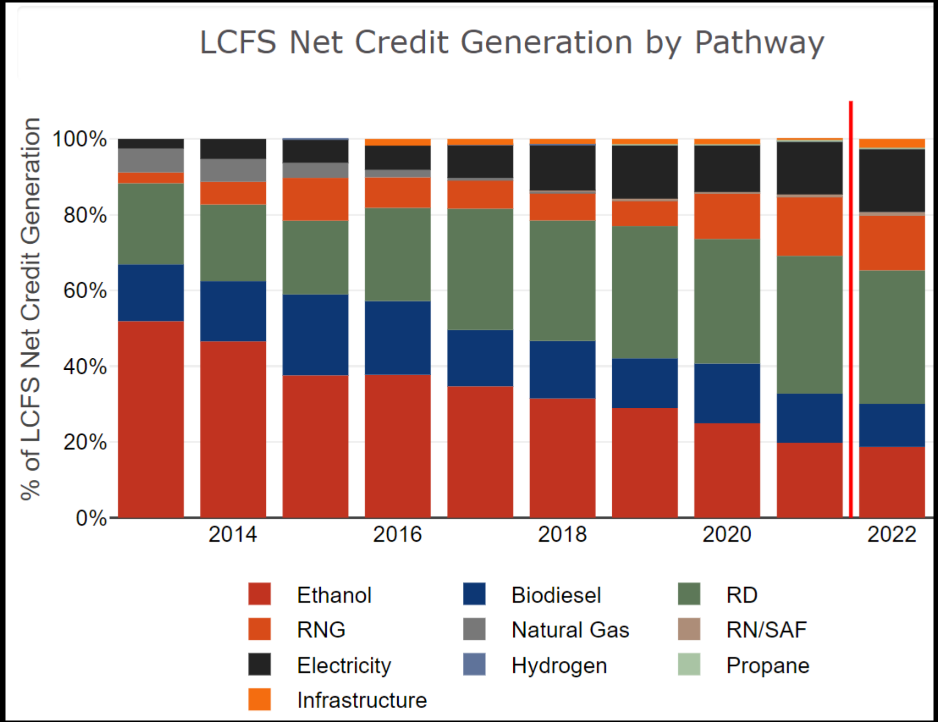
$1.21/liter
ethanol price
(fuel + credits)

## USA West Coast Price for Fuel Plus Federal & State Subsidies Make Ethanol Profitable if Sustainability Goals Met

We are assuming that the price we will obtain for ethanol in the US West Coast and British Columbia is equal to the US wholesale price FOB Chicago plus the transportation cost to the West Coast (about 20 cents per gallon) ($2.54 plus 20cents), plus RIN credit (Renewable Identification Number for renewable fuels) plus LCFS credit (carbon reduction % as calculated in Low Carbon Fuel Standard). This market is only available if sustainability factors are considered in production and sourcing of feedstock for biofuel and if low carbon refining systems are used. We assume use of sweet potatoes at 100 MT/ha./yr as feedstock. The value can also be increased if we capture methane from animal production and incorporate it in the product. This can be done through anaerobic digestion of animal waste and piping of gas to the ethanol plant. These measures should open up the market for ethanol in the USA and greatly improve profitability of ethanol production. Half of the ethanol will be used in biodiesel production to lower carbon emissions of biodiesel. Half will be exported to the USA & British Colombia. RIN prices have been high in 2021 and 2022 and are likely to continue at high levels (RIN $1.49 in 2022 but was $0.59 in 2019). This supports a price of $1.21/liter in total.

# LCFS Prices Depend on Co2e Emission Reductions Achieved:

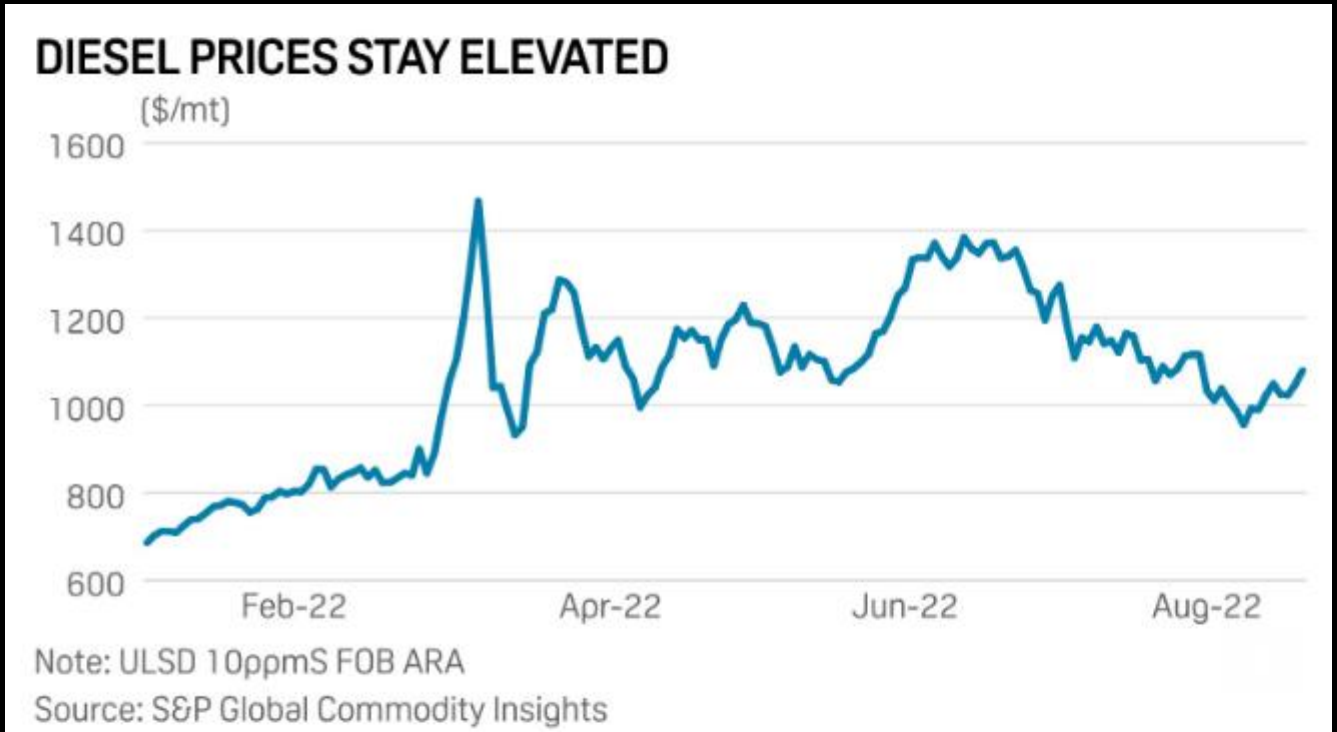



## LCFS Values Received Depend on Completing Life Cycle Carbon Analysis of Biodiesel & Ethanol With New Pathway

One very important activity that will have to be undertaken is to work with GCarbon USA and LCFS consultant in CA to prepare a new pathway for production of biodiesel, renewable diesel/jet and ethanol using the different feedstocks, methane capture programs and feedstock yield assumptions. The results are very different from other ethanol and biodiesel pathways, which are almost entirely corn based ethanol and soybean based biodiesel. We will be closer to the Co2e benefits of renewable diesel, which has captured about 35% of LCFS credits and renewable natural gas (biomethane) which is now at 14.8%. We expect to get an LCFS CI score that is equivalent to 85% or better Co2e reductions because of efficiency improvements in palm production, capturing FOME methane emissions and methane capture in ethanol production & very high palm oil & potato yields. This is important because the benchmark for being eligible for LCFS credits gets raised each year so that ethanol at only 45% Co2e reductions gets a much smaller share of the LCFS market. In addition, ethanol blending in CA is limited to 10% and E85 has not been encouraged. There is strong demand for high carbon reduction fuels as blenders need to meet higher Co2 reductions each year to reach the 20% reduction in carbon intensity of fuels by 2030. The reduction is now at 10% so the remaining 10% reduction will need to occur in only 8 years.

# Current Diesel Prices in EU and Indonesia:




### Indonesia Diesel prices, 22-Aug-2022

| Indonesia Diesel prices | Litre | Gallon |
|---|---|---|
| IDR | 19,280.000 | 72,982.705 |
| USD | 1.293 | 4.895 |
| EUR | 1.301 | 4.925 |

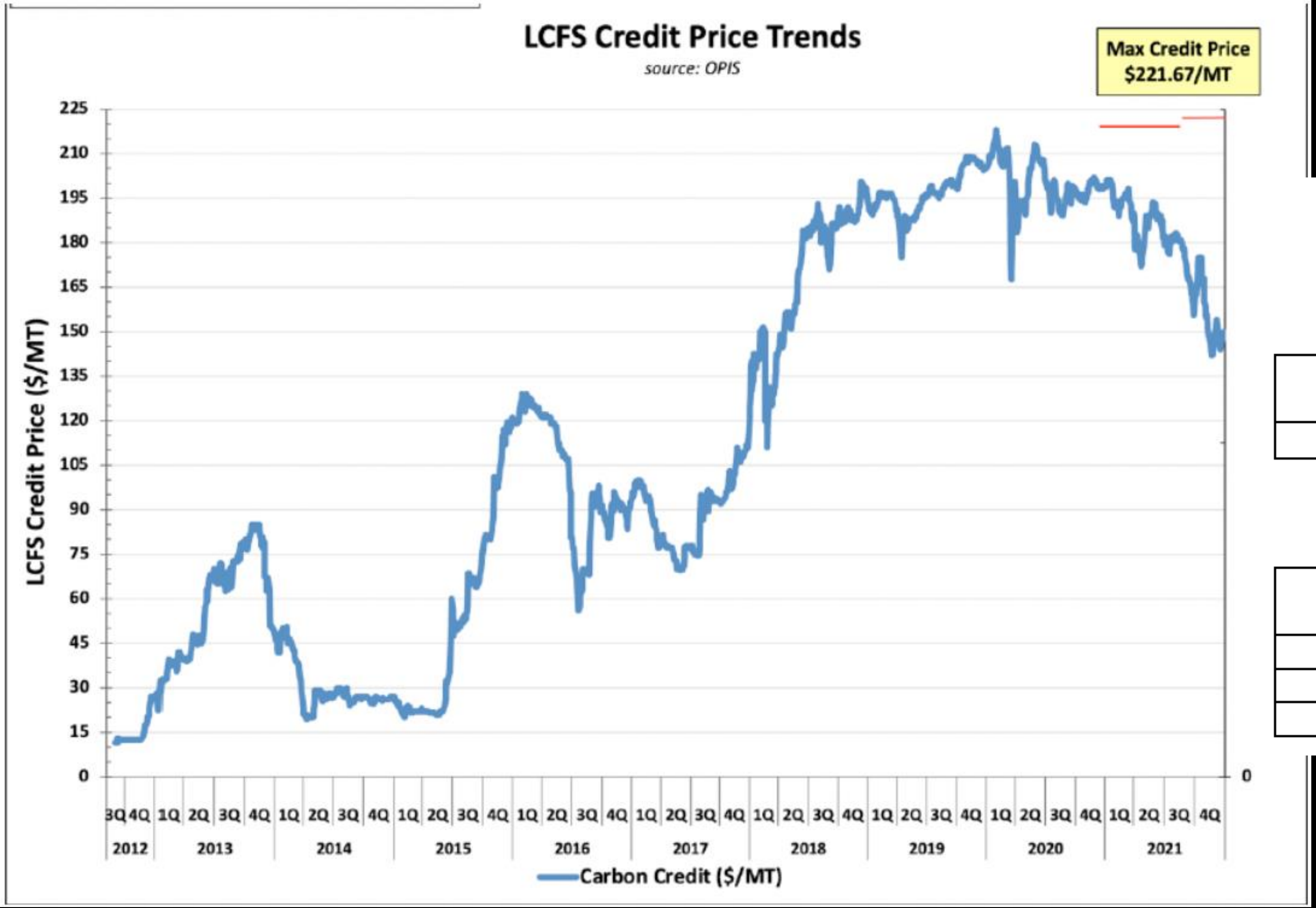
U.S. Gallon

**Diesel prices**: We show prices for Indonesia from 16-May-2022 to 22-Aug-2022. The average value for Indonesia during that period was 19,790.00 Indonesian Rupiah with a minimum of 18,680.00 Indonesian Rupiah on 16-May-2022 and a maximum of 19,280.00 Indonesian Rupiah on 22-Aug-2022. For comparison, the average price of diesel in the world for this period is 29,018.03 Indonesian Rupiah.

## EU Diesel Prices Have Peaked at $1400/MT in June & 1100-1200 MT, Indonesia at $1535 per MT

Prices for Diesel prices have been strong this year, flipping to a premium to gasoline of some $20 per barrel over the summer months, and market data indicates this trend is far from over. ULSD prices in Europe's key ARA trading region have been trending around $1,080 per metric ton lately, down some $400/mt from their erstwhile peak in March. It seems highly likely that September-October will see a diesel price surge, considering record low diesel stocks in Europe (as continuous backwardation discourages storage) and the nearing of harvest and heating seasons. - Considering that EU sanctions are coming into effect against Russia in February 2023, diesel prices in the EU are expected to stay strong . Pricing in Indonesia is about $1.29 per liter or $1535 per metric ton or a $400 price premium to Rotterdam prices.

# Current LCFS Prices in California:




Monthly LCFS Credit Transfer Activity Report for June 2022

Posted on 7/12/2022

Current Time Period

| Time Period | Transfers [1] (numbers) | Total Volume[1 2] (credits-MTs) | Avg. Price[1 3] ($ per Credit) |
|---|---|---|---|
| Jun-22 | 133 | 1,268,000 | $113 |

Previous Three Months

| Time Period | Transfers [1] (numbers) | Total Volume[1 2] (credits-MTs) | Avg. Price[1 3] ($ per Credit) |
|---|---|---|---|
| May-22 | 119 | 861,000 | $125 |
| Apr-22 | 468 | 4,584,000 | $153 |
| Mar-22 | 280 | 3,301,000 | $158 |

## LCFS Prices Have Peaked at $222/MT and in June were $113/MT in June or about $0.10/liter

Prices for LCFS credits have dropped sharply from their peak in 2020 as more renewable diesel and dairy biogas projects come on line. The price has dropped even lower in August but is expected to rebound in the upcoming year as inventory in the LCFS bank is depleted and higher carbon reduction requirements take effect in 2025-2030. The value of LCFS credits is based on the Co2e emission reductions achieved, since less fuel is needed for meeting requirements if there is a high Co2e reduction.

# Future RIN & LCFS Prices in US West Coast, BC & USA/Canada:

## Future Prices for RINs and LCFS likely to increase to reach higher Co2 reduction goals at Federal & State level

### LCFS Prices in CA, US West Coast & BC

The current reduction targets in California set a goal of 10% in 2022, decreasing steadily to 20% in 2030. CARB has indicated that they are considering proposing to strengthen pre-2030 targets in addition to an extension of the targets post-2030 at an accelerated reduction rate. Additional details have not yet been offered. What is likely is that Co2 reduction targets will go out to 2035 or 2040 with higher annual rates of CI-reduction starting in a few years. This will mean much higher LCFS credit prices unless a lot of new renewable diesel, biogas and electric vehicle capacity comes on line. As 2030 approaches, prices will drop as more electric vehicles come on line. What happens in California is usually duplicated by Oregon, Washington and British Colombia. The US East Coast is considering adopting LCFS but has not so far taken any action. A larger pool of states impelementing LCFS would increase prices on LCFS credits.

### Extension of Renewable Fuel Mandate Done Annually by USEPA that Affects RIN requirements & prices

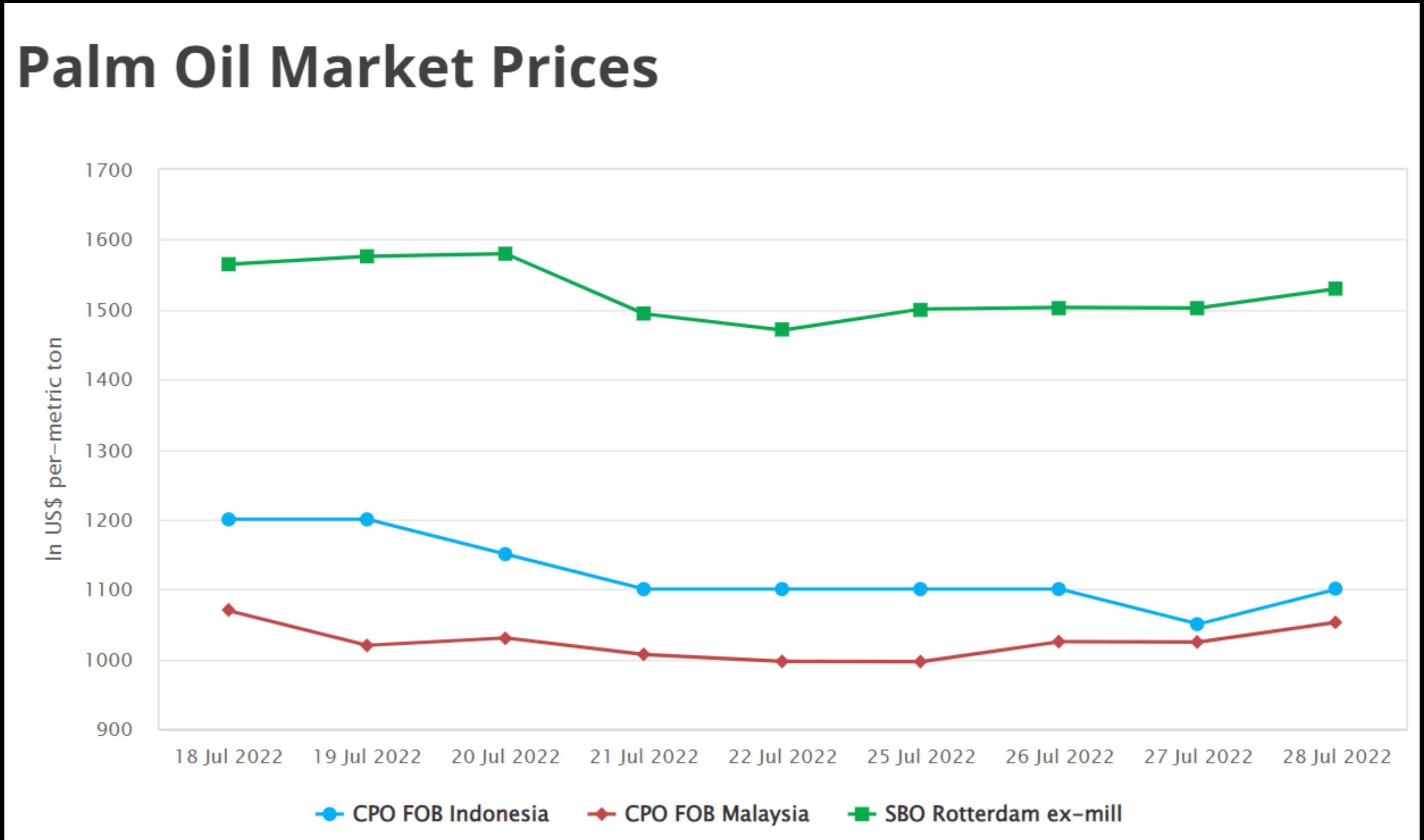
Sale of biodiesel will be affected by the price of RIN6 credits which will depend on availability of biodiesel and renewable diesel in the future. If there is a large increase of renewable diesel from Neste projects coming on line with US sale, RIN prices might drop. At the same time, EPA may increase the target of biomass based diesel if there is more supply. Ethanol is capped at 15 billion gallons but there is a category for cellulosic biofuels that has not been utilized to date and might shift to a category pertaining to biofuels with a high carbon reduction. There is not a lot of new corn ethanol capacity coming on line so RIN credit prices have remained high but this could change if a lot of ethanol enters the market.

| Fuel Type Sold | AAA price petro – 20% | RIN Credit 2022 (-50% co2e) | LCFS Credit 2022 | Total |
|---|---|---|---|---|
| Biodiesel | Diesel $4.62 ($1.22/liter) | $1.49 ($0.39/liter) | $113/MT ($0.10/liter) | $6.49/gal. $1.71/liter |
| Ethanol | E85 $3.50 ($0.93/liter) | $1.49 (0.39/liter) | $113/MT ($0.10/liter) | $5.37/gal $1.42/liter |

# Palm Oil Market Prices, CPO & Refined:

$400 USD Spread between CPO & RBD bottled oil

Palm oil prices have dropped since July 2022 but spread similar

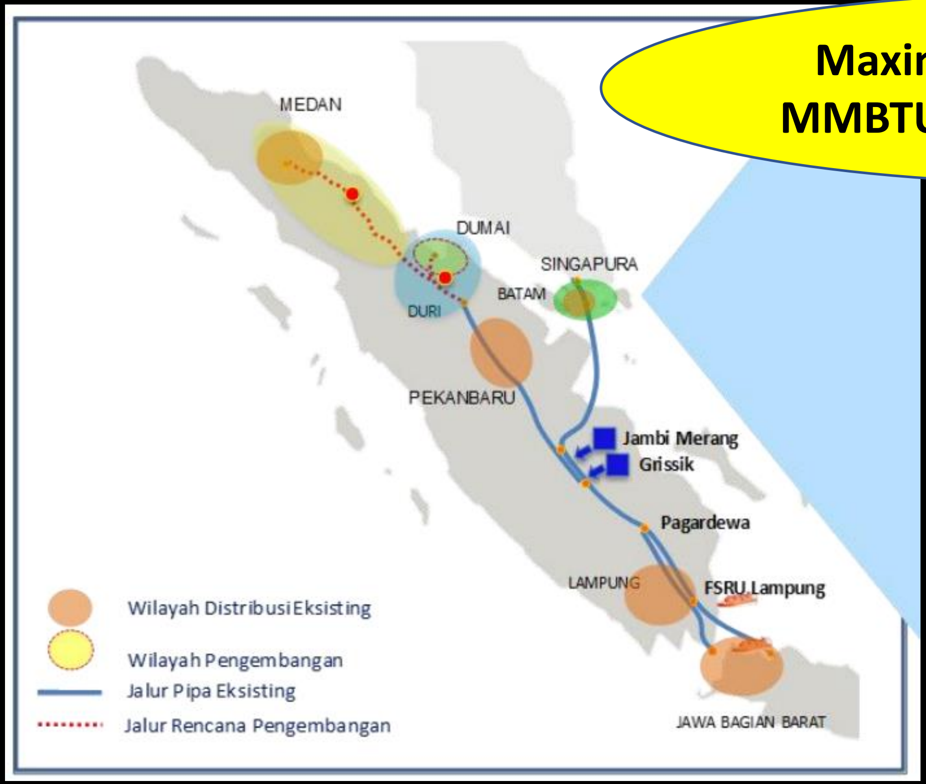



## Palm Oil Prices Have Large Spread between CPO and Refined

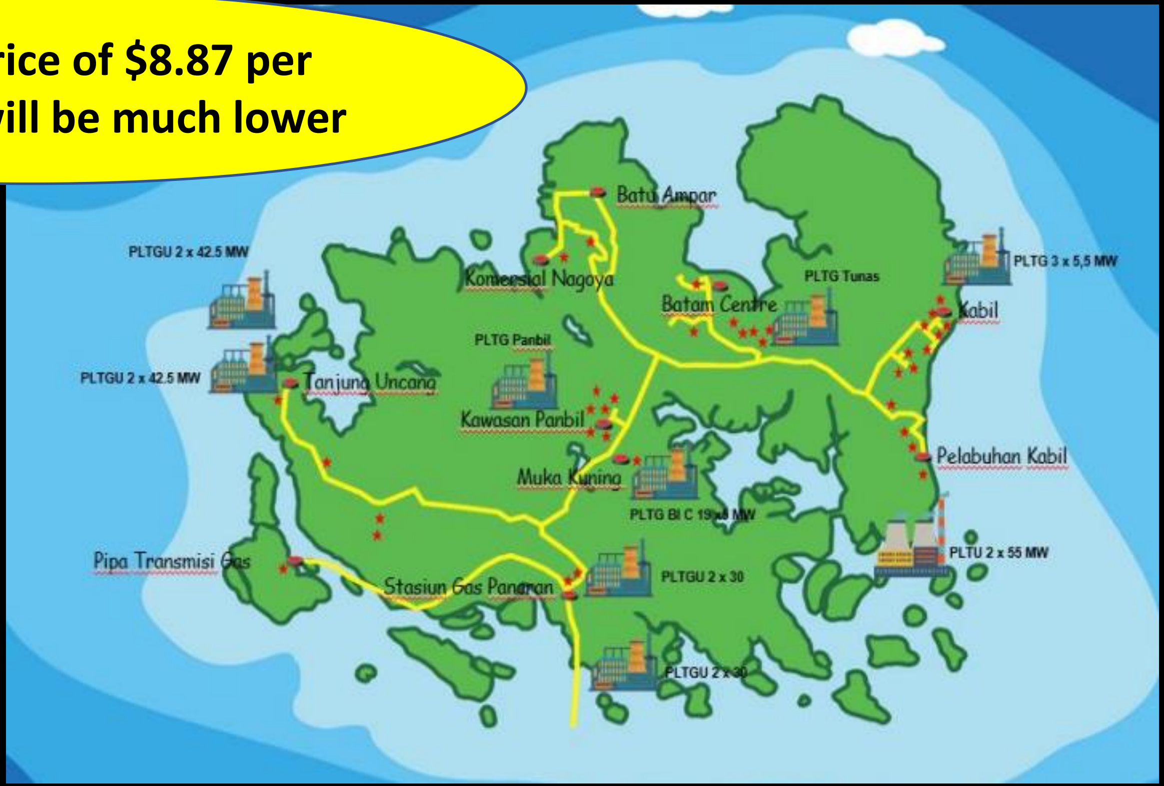
Crude palm oil usually trades below Rotterdam bottled oil pricing for palm oil and this is true in 2022. The spread is partly because of losses in the refining process (3% to 6%), cost to refine and bottle and demand overall for vegetable oil. There is currently strong demand for bottled vegetable oil in the EU and global market. Our CPO purchase price is well below the published price at $872 per MT ($950 per MT current price)

# Gas Supply and Pricing in Batam Island, Indonesia:

**Maximum Price of $8.87 per MMBTU but will be much lower**




**Gas Supply from Sumatra Island**




**Gas Distribution System on Batam Island**

We had a meeting with Pertamina Gas Negara to discuss supply of gas for the HVO, biodiesel & bottling plant in Kabil IIE. They confirmed there is plenty of excess gas available and that they can easily supply our requirement for 1.3 million MMBTU of gas (about 30% of their supply is needed). As long as they know what our future supply requirements are they can hold back gas for Indonesian use and increase production throughput as the pressure in the pipes is much lower than pipe design capacity. They also suggested the highest price for industrial use would be $8.87 per MMBTU and will be much lower due to volume required, (to be negotiated). This means gas is not a limit to growth of the industrial plants and pricing is competitive

# Local Pipeline Location, Contracting & Price Negotiations:

**Price of $8.87 per MMBTU is for Bronze 3 but we are 8 times greater volume so price will be lower**

**Line extension to the plant is short and no permits required**

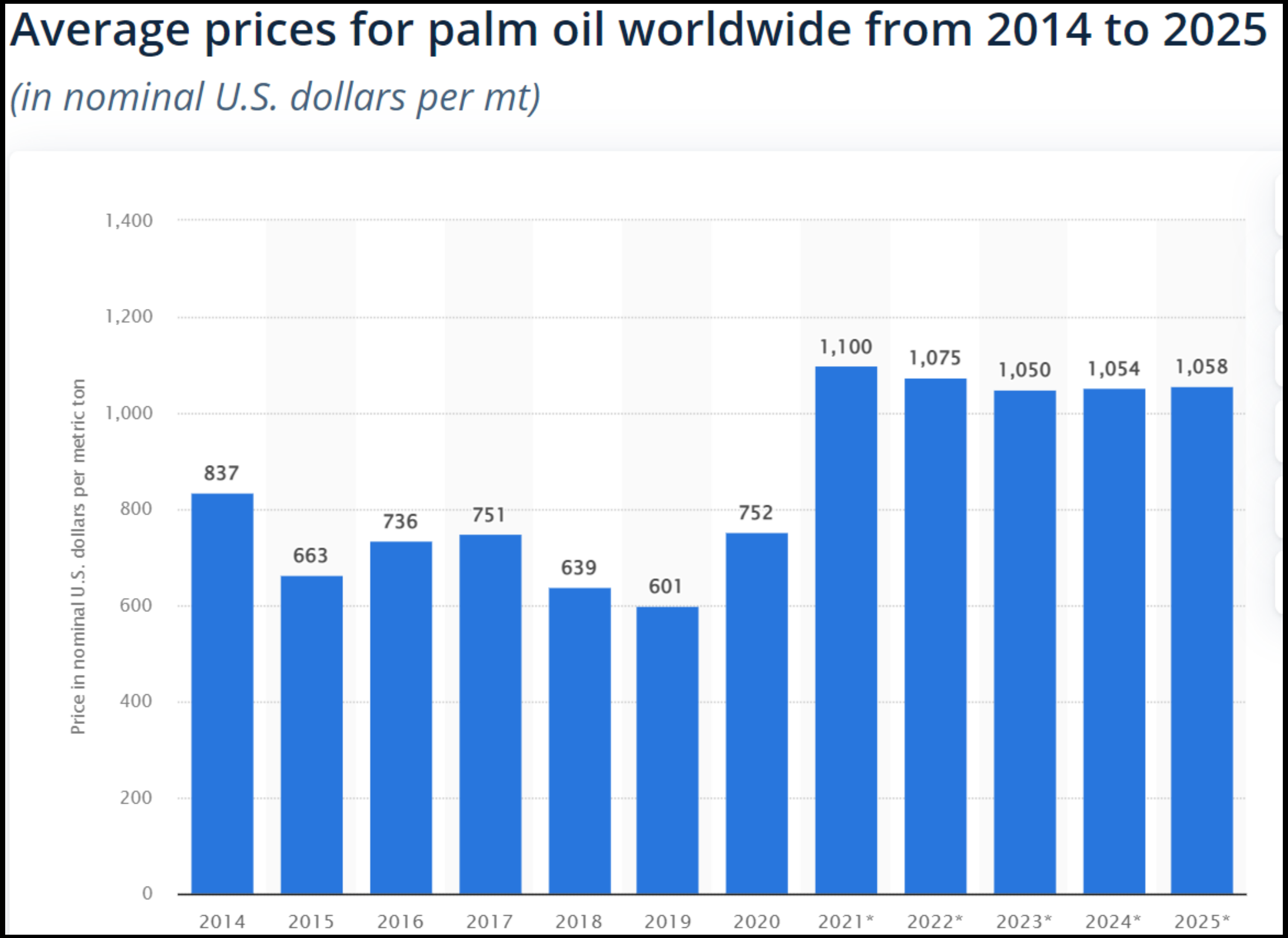
| DESCRIPTION | Bronze 3 |
|---|---|
| Volume MMBTU | 1.750 – 17.500 MMBTU |
| Volume CONTRACT | RANGE :130 %<br>EX : 1750 – 2275 MMBTU |
| PRICE | USD 8,87 / MMBTU |
| GUARANTEE | 2 x Usage Projection Gas x Gas Price |
| Compensation | Min Contract x Gas Price |
| Commitment Period | 36 month |


**Gas Offer Details of Bronze 3 Customers of Pertamina Gas Negara**

**Local Gas Distribution at Kabil Int. Ind. Estate**

Pertamina Gas Negara is the gas supplier for the industrial park in Kabil Integrated Industrial Estate.  They confirmed that they have run a main line to Enerco RPO International for their tire to oil process and that an extension of service from this line will not be a problem.   We plan on getting this line extended along the roal right of way alon JL Kodja Bahari and hooking in at the far corner of the biofuel complex..  We will then extend gas lines to the various steam and gas requirements of the HVO, biodiesel, oil processing, bottling & glycerine plants.  Upgrades of pipeline distribution are likely.

# Palm Oil Market Prices, CPO & Refined:

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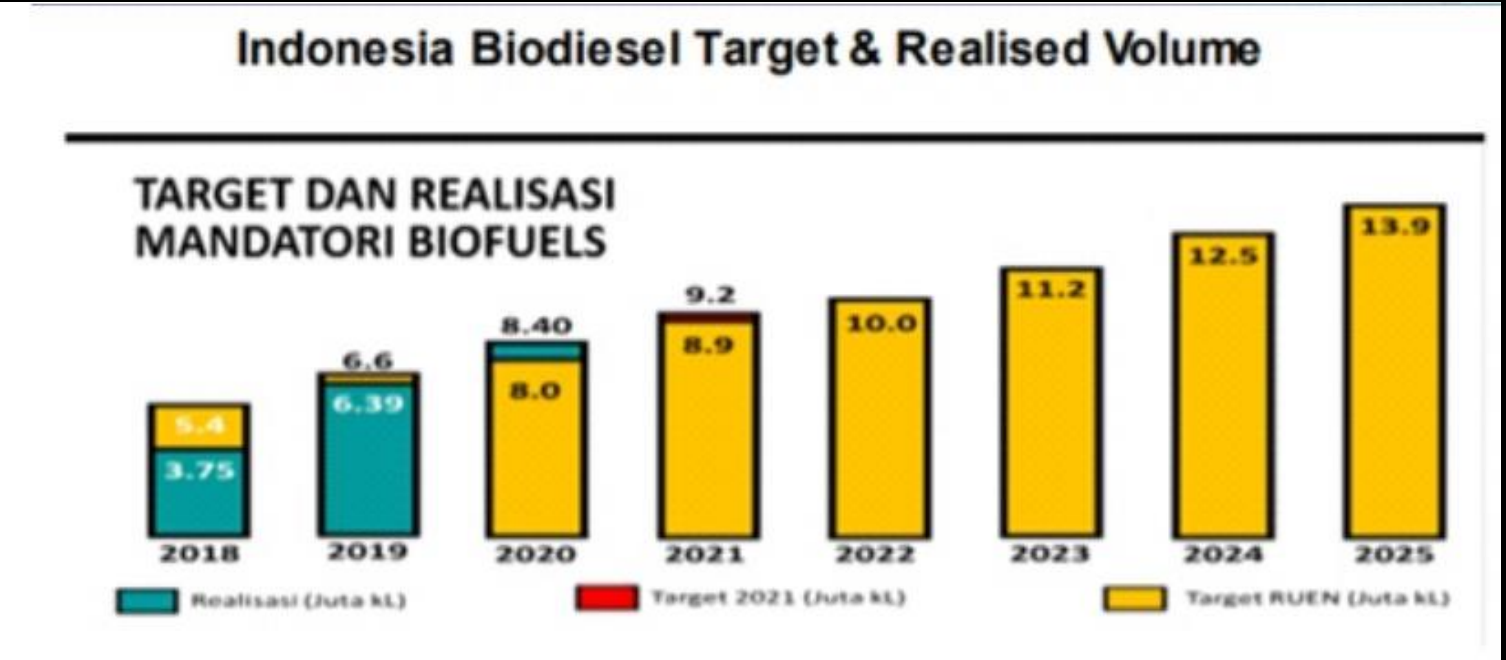
## Crude Palm Oil Prices Have Historically been Much Lower Dropping to $601/MT in 2019

Crude palm oil has historically sold at much lower prices in the 2014 to 2020 period indicating that there is now a substantial margin for producers.   The 2019 price was down at $601 per MT.  The break even is even lower as palm oil prices have traded as low as $400 per MT In the 2010-2012 period.  Our price is currently $872 per MT.  Higher palm oil prices ($1000 or above) are expected in 2022-2025.

# Palm Oil Demand & Impact of Biofuel Mandate in Indonesia:




## Indonesia has Required On-Road Blending of 30% Biodiesel Since 2020 & Will Increase Percentage in 2025

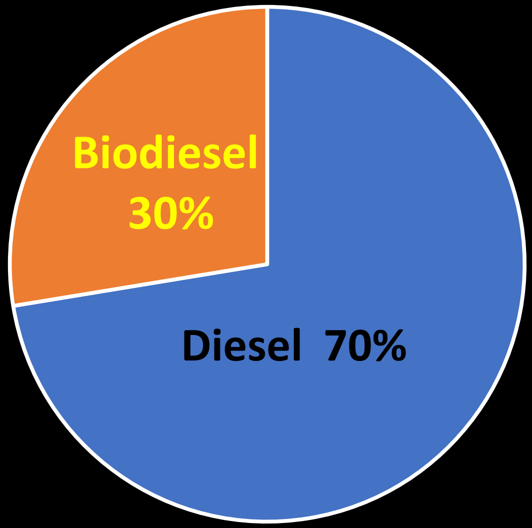
Indonesia has maintained its nationwide biodiesel program with a high on-road blending rate average of 30 percent nationwide since 2020, despite the financial challenge of supporting a widening price spread between palm oil and diesel prices during the COVID-19 pandemic. After facing significant shortfalls in 2020, the CPO Fund subsidy program has generated record revenue as a result of high global palm prices during 2021 and 2022. Biodiesel exports are forecast to remain low due to export taxes, COVID-impacted demand for diesel in Europe, and a CPO-diesel price spread that has sharply curtailed China's discretionary demand.

The Indonesian government has raised the B30 biodiesel quota for 2022 to 10 million kiloliters from 9.4 million kiloliters in 2021.  The 2021 export levy collection is estimated at between US$4.87 to 4.94 billion, of which US$3.4 billion is used to support the B30 program. Funding from the palm oil exports levy is sufficient to support the mandate in 2022 and beyond given current high palm oil prices.

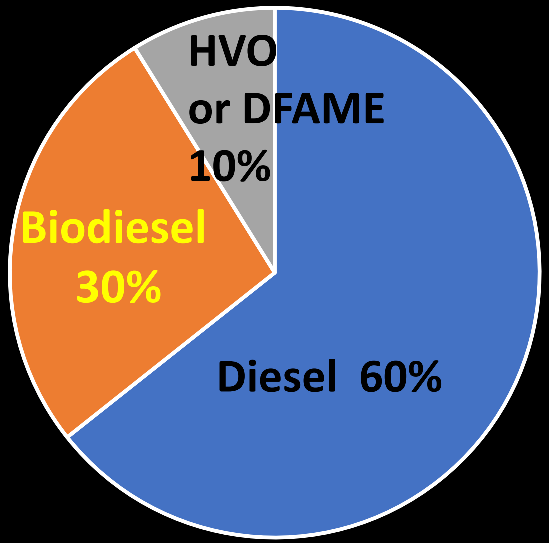
# Palm Oil Demand and Mandates for Diesel Fuel in 2025:

**Indonesia is requiring a 30% blend of biodiesel in road diesel in 2022 and will rise to 40% biofuel in 2025**

**2022 Jet Fuel Mix**




**2025 Biodiesel/HVO or DFAME Mandate**

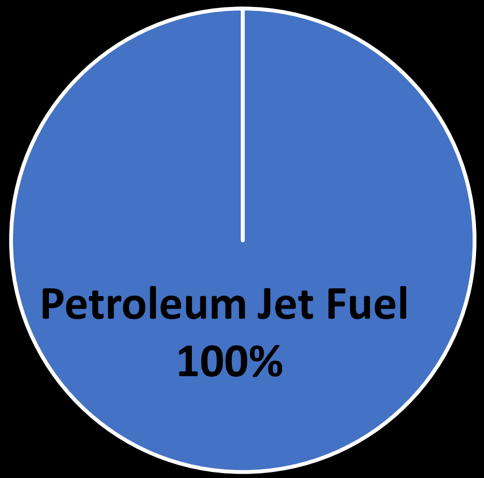



Indonesia Ministry of Energy and Mineral Resources is conducting a road test of B40 blend in 2022 with 2 options; 30% biodiesel & 10% Hydrotreated Vegetable Oil (HVO) and 30% biodiesel and 10% distillate fatty acid methyl ester (distillate FAME). The study will help them support a requirement for a 40% biofuel blend in diesel in 2025. The export levy tax collection is expected to support biodiesel & HVO production from 10 million kiloliters in 2022 to 13.9 million kiloliters in 2025 (40% jump).

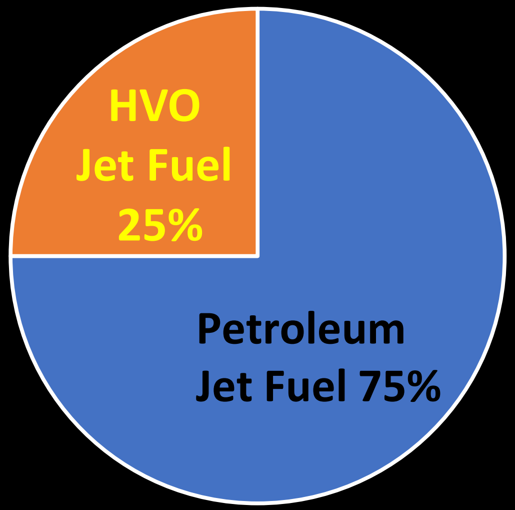
The demand for HVO for diesel blending above 30% offers another opportunity for HVO sales in Indonesia. It is not clear if competition from distillate FAME will affect pricing for diesel HVO versus a non-competitive market for HVO in the jet fuel sector. These factors will be considered in looking at any expansion of HVO capacity beyond the 25% blend in jet fuel.

# Palm Oil Demand and Mandates for Renewable Jet Fuel in 2025:

**2022 Indonesia Jet Fuel Mix**




**2025 Goal of Garudi Prima Energi**




**Indonesia is requiring 5% renewable jet fuel in 2025 and Mandiri Prima Energi Expects to reach a 25% blend rate**

Indonesia Ministry of Energy and Mineral Resources is requiring that 5% renewable jet fuel be included in all jet fuel sales in 2025 in Indonesia. GP Group is confident that it can greatly exceed that requirement and achieve a 25% blend rate of renewable jet fuel by 2025. This will be in conjunction with building a 1.9 billion liter refinery that will produce 1.47 billion liters of jet fuel from sustainable palm oil and palm oil waste feedstocks.

The ability to reach this aggressive goal will depend on having in place a subsidy equivalent to the subsidy offered to biodiesel producers for reaching the 30% biodiesel mandate. We will also implement a program for capturing methane emissions from CPO mills that are producing palm oil and improving the efficiency of palm oil plantations by double. These two measure will provide very low life cycle carbon emissions and further support regulatory requirements and subsidies to lower the investment risk & optimize profits.

# Other Veg. Oil Options, Used Cooking Oil:

| Country | Estimated potential collection | Estimated current collection | Current collection share of potential | Total of estimated current collection + 2019 imports | Total of 2019 exports + estimated current biofuel use | Net of totals |
|---|---|---|---|---|---|---|
| China | 5,131 | 3,086–4,097 | 60%–80% | 3,128–4,139 | 1,655 | 1,473–2,484 |
| India | 1,697 | 224–326 | 13%–19% | 273–375 | 74 | 199–301 |
| Indonesia | 715 | 182–266 | 25%–37% | 191–275 | 149 | 42–126 |
| Japan | 331 | 70–122 | 21%–37% | 79–131 | 106 | (27)–25 |
| Malaysia | 158 | 48–71 | 30%–45% | 256–279 | 321 | (65)–(42) |
| Republic of Korea | 116 | 88–107 | 76%–92% | 150–169 | 168 | (18)–1 |

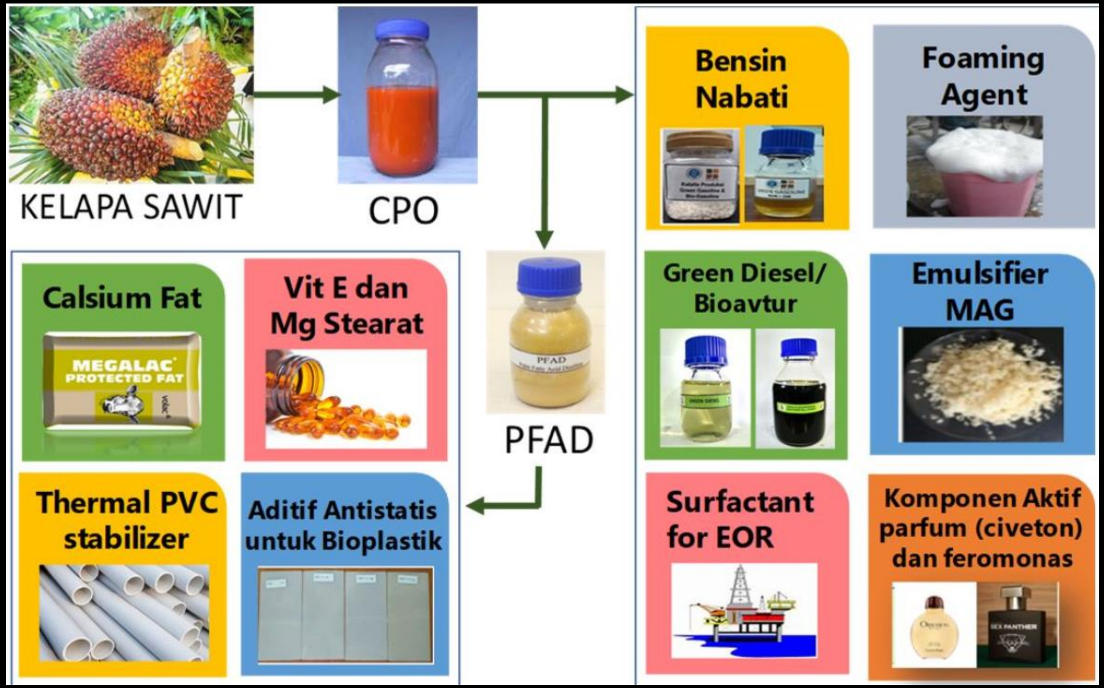
**Table 1.** Summary of estimates of UCO potential, UCO collection, import-export, and biofuel use, in kilotonnes per year.

## Export of Biodiesel Will Require Responsible CPO Sourcing, Used Cooking Oil, PFAD or other Waste Oil Sources

European restrictions of sale of biodiesel make it impossible to ship palm oil biodiesel to the EU. The US and Canadian restrictions are based on going through a life cycle analysis of the chosen feedstock and proving the carbon benefits from well to wheel for the fuel. It also requires certification of palm oil sourcing from one of the various certification bodies that confirms there is no link to palm plantations and deforestation. We are working closely with all 142 of our palm oil mills to insure this is not occurring. One option to improve sustainability is to include used cooking oil or palm fatty acid distillate (PFAD) as feedstocks for biodiesel or renewable diesel/jet fuel production. The main problem with used cooking oil is the limited resource in Indonesia (149,000 MT) and difficulty in setting up collection systems. At the same time, it may be worthwhile undertaking this effort to improve the sustainability overall of biodiesel production. When this is coupled with other sustainability measures to improve yield and source CPO from sustainable producers, the overall effect will be a very climate friendly feedstock supply.

# Other Veg. Oil Options, Palm Fatty Acid Distillate

Palm Fatty Acid Distillate (PFAD)




## 3-5% of CPO to RBD Refining is Palm Fatty Acid Distillate, a Waste By-Product for Use in Making Jet Fuel

A by-product of CPO to RBD refining is palm fatty acid distillate, which is considered a “waste” in analysis by the European Union and some USA regulators. This makes it easier to import biofuels made from Palm Fatty Acid Distillate. We plan on using all of our palm fatty acid distilatte for biofuel production and have not determined which process will be easier to incorporate the feedstock, biodiesel or HVO and where the best market benefits will be. We expect we will use the feedstock for biodiesel production slated for export. We will also explore purchasing Distilate Free Fatty Acid from other oil refiners in Indonesia as a means to enhance the sustainability of any biofuels that are exported.

# Sourcing of 20,000 MT/day CPO from 143 Sumatra Coop Mills

142 Coop Mills will supply CPO


Location of oil processing plant & biofuel plants

## GP Group has Agreement with 143 Coop Mills in Sumatra to Supply 20,000 MT/day (7 mil. MT/yr.) of CPO starting in

GP Group will be starting production of refined palm oil in 2023 using Crude Palm Oil (CPO) supplied by 143 small coop mills in Indonesia. The oil will initially be used to produce refined palm oil for export or for domestic market use as biofuel capacity is put on line. The oil refinery is expected to come on line by the third quarter of 2023 and biodiesel capacity will come on line the 4th quarter of 2023. GP Group will work with the coops to improve the productivity of mills and oil palm plantations so that oil availability increases over time. GP Group will also work on a methane capture program for FFB empty bunches and palm mill effluent. GP Group will implement responsible sourcing policies and zero-deforestation commitments so that no palm oil is sourced from areas recently deforested. These combined measures will make it easy to comply with NPDE (No Peat, No Exploitation) of the Sustainable Palm Oil Coalition and requirements of any buyers of refined palm oil. We also plan to have NGO's monitor the yield improvement program so they can understand how we plan to increase yield per hectare among smallholders and create a large excess quantity of palm oil without requiring any additional land clearing.

# Major Source of Methane Emissions is Palm Oil Mill Effluent

## Capturing methane from mill ponds = Most Methane Capture at Lowest Cost

According to Energy Studies Institute study of emission reductions potential in S.E. Asia, biogas installations can deliver the greatest impact in terms of greenhouse gas emission reductions of any renewable energy technology. Methane or $CH_4$ has a global warming potential 28 times higher than $CO_2$. Therefore, its mitigation can reduce total emissions by 25–40 times the level of an equivalent capacity of solar or wind power. For every palm oil mill equipped with biogas capture, approximately 40,000–50,000 $tCO_2e$ can be abated annually, which is equal to the carbon benefits of a 50 MW solar PV plant. Capturing POME methane at 850 mills in Indonesia will cut 41 million $tCO_2e$, equivalent to about 80 per cent of land-based $CO_2e$ emitted in Singapore in 2014.

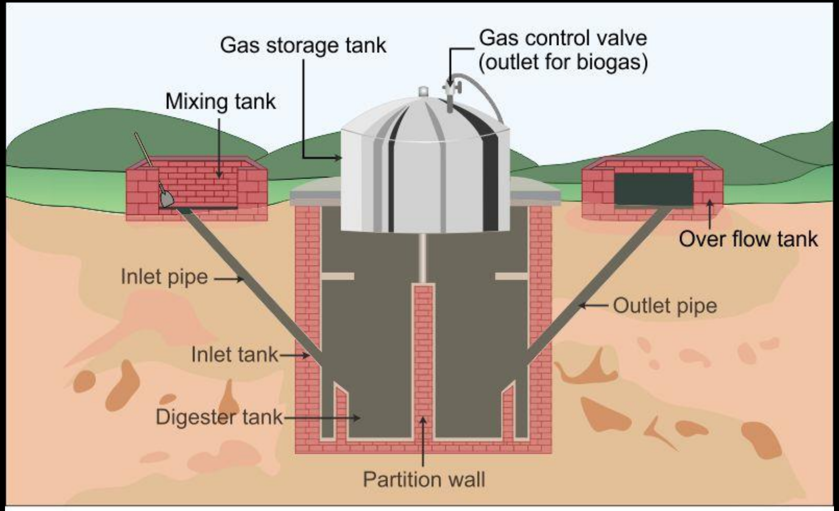
Garudi has 142 mills that it is working with to supply the 20,000 MT of CPO. The plan is to institute methane capture programs and organic fertilizer production at all of the mills in order to reduce emissions and improve yields. Methane emission rates based on the study above is an average of 48,235 MT Co2e per mill. Over all 142 mills, this is 6.85 million metric tons of Co2e. About 23% of the oil is being used for biodiesel so a credit of 1.56 million MT can be incorporated into the life cycle carbon emissions of biodiesel production. This will insure that life cycle Co2 emissions from biodiesel are below zero (net negative emissions) which will guarantee a high price in USA, Canada and other markets. Another 27.7% of the oil will be used in jet fuel production. This provides another 1.9 million MT of Co2e that can be applied against jet fuel emissions that will insure that we reach net zero emissions for jet fuel for sale in the Indonesian market.

Garudi Prima Energi will equip all palm oil mills with some type of methane capture or methane avoidance equipment. Details of different options are outlined in the next slides and include methane capture and use in steam production, methane avoidance via filtration and enhance methane emissions and capture as a part of POME wastewater treatment.

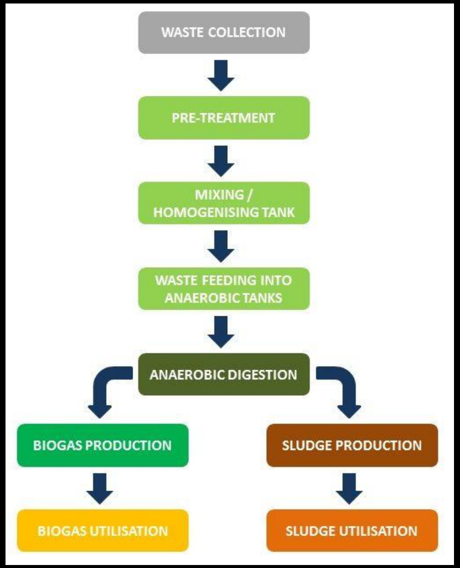
# Most Important Step to Zero Carbon Jet Fuel = Methane Capture

## Many CPO Processing Plants Leave Fruit bunches to rot = Methane emissions

### Option 1: Anaerobic Digestion



Biogas plant




- ✓ Methane capture with anaerobic digestion involves installing a tank that has a partition wall and is sealed to capture the gas. The empty fruit bunch is first treated in a mixing tank, moved to anaerobic tanks and then biogas captured and sludge used for fertilizer.

**Global Warming Potential (GWP) of CH4 is 28 times that of CO2**

### Option 2: Aerobic Digestion via Composting

Fig. 1. Scheme of windrow co-composting EFB and POME investigated in this research

- ✓ Methane reduction in aerobic digestion involves use of open biomass piles of Empty Fruit Bunches that are sprayed with Palm Oil Mill Effluent to aid in bio-digestion of the fruit bunches. Over a 90 day period the fruit bunches turn into fertilizer with limited methane emissions versus placing empty fruit bunches directly on the field. This could improve yields by providing a higher quality fertilizer with lower methane emissions. We have microbes that can also increase the breakdown rate so empty fruit bunches turn into fertilizer in a much shorter time period. We will combine a series of measures in managing pond and empty fruit bunch waste so that yields are improved and we reduce chemical fertilizer use. This will be combined with proper chemical fertilizer for optimum nutrients.

# Avoiding Methane Emissions with Belt Press Filtering of Pond Mill Effluent

## Belt press filtering of mill effluent can reduce methane emissions at a POME pond by 50%

Methane ($CH_4$) emissions at palm oil mills accounts for a significant share of life cycle emissions of palm oil products. A study was done at palm oil company KLK by a Dutch sustainable trade organization IDH using an international certification system ISCC (International Sustainability and Carbon Certification). The field work was conducted by Meo Carbon Solutions. A belt press filtering system was used to separate solid organic matter from wastewater. This is a common method to remove solids from wastewater but has not been used much in palm oil mills to remove solids from the palm oil mill effluent (POME) Adding a belt press provides a means to remove the root cause of methane emissions, i.e. the organic matter such as degrading parts of the oil palm fruit in the mill effluent.

What is also important is that there is now a method to calculate the actual emission reduction resulting from such filtering by hiring the same consulting firms to validate the emission savings from using g the belt presses in all of the 142 mills providing crude palm oil to GP Group. The on-going requirement once the press is installed is to weigh the belt press cake removed with the belt filter press and measure its carbon content. The amount of the belt press cake together with its carbon content provides the means to calculate removed organic carbon which, according to the study results, correlates with the reduction in measured methane emissions.

The belt press cake can also be combined with other measures such as mixture of POME with empty fruit bunches to produce organic fertilizer as it will accelerate breakdown of other ingredients. These steps will be combined with the very rapid system for biomass degradation using microbes and fungi as developed by Sustaiable Agricultural Systems. We will also use a GCarbon proprietary method to rapidly release methane for collection which also results in clean water for re-use. This will allow Garudi Prima Energi to then offer farmers high nitrogen organic fertilizer to improve yields. The bio-decomposition will greatly increase absorption of nutrients by the palm trees and assist in reaching high oil yields per ha.

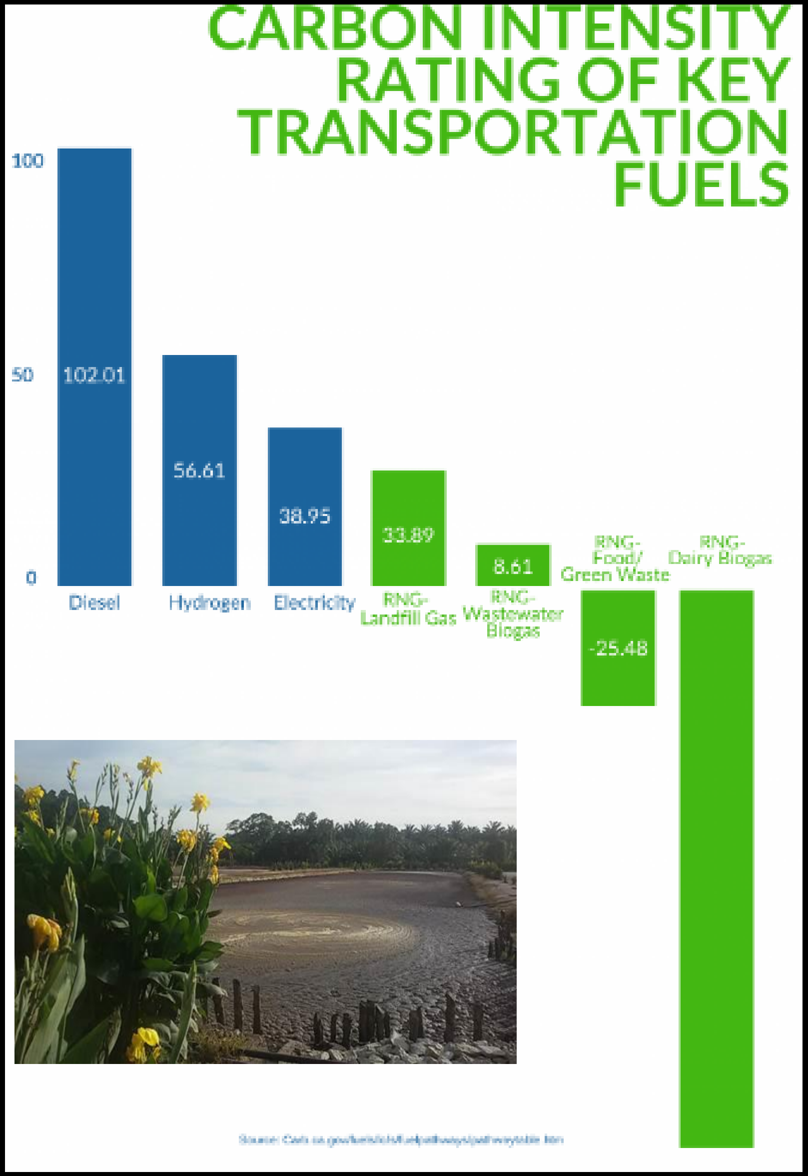
# Getting to Zero Carbon BioFuel involves Methane:

## Biggest CI Negative Fuel Dairy Biogas- POME & Empty Fruit Bunch Methane can lower CI a lot

- ✓ Methane is a highly reactive greenhouse gas (GHG) that is not in the atmosphere as long but has 21 times the GHG impact of Co2. This has a big impact if methane is avoided in the production of the fuel. We are planning to capture biogas from empty fruit bunches and use them for steam production at same facility as crude palm oil production. The gas will be used for the steam boiler and displace the need for biomass burning or natural gas use. We will also avoid methane emissions through improvement of palm oil mill effluent management.

- ✓ The main benefit for calculating CI is in the avoided methane emissions from crude palm oil production, since we will be reducing methane emissions from rotting empty fruit bunches and Palm Oil Mill Effluent (POME). If we install methane control systems for POME in all CPO plants, the total methane avoided will be very large. The use of this palm oil in biodiesel production can then allow us to credit the methane avoidance in fuel life cycle emissions.

- ✓ As noted on the chart to the left the value of this avoided methane is very large. Dairy methane capture and use as renewable natural gas in a vehicle has a value of USD$9.10/gallon or USD$2.4 per liter   Use of even a simple filter press as detailed previously can reduce methane emissions by 50% and provides a major boost to the life cycle carbon emissions from palm oil used in biodiesel production. Other technologies such as anaerobic digestion have higher costs but much greater methane reductions and provide biogas for use in the mill.



# RSPO Compliance with Social & Environmental Sustainability

## GP Group will register with Roundtable for Sustainable Palm Oil (RSPO) & Comply with Rules

- ✓ As a major oil processing facility and marketer of refined vegetable oils, it will be essential to comply with all of the requirements for avoided deforestation and social and environmental sustainability. This will require implementing a zero net deforestation policy by carefully monitoring the oil palm plantations and crude palm oil processors to insure they are complying with the net zero deforestation guidelines and to meet other social and environmental requirements.

- ✓ To achieve this goal GP Group will register as a member in the Roundtable for Sustainable Palm Oil (RSPO) and comply with all of the guidelines established by the Roundtable. There is also a Council of Palm Oil Producing Countries (CPOPC) that sets sustainability standards for producers on a multi-country basis and we will participate .

- ✓ We will also work with major buyers to meet their sustainability criteria and provide them with all data needed to certify that the palm oil we are processing is deforestation free and meets all of their sustainability criteria. To accomplish this we will take the following steps:
    - Full traceability of all CPO coming into RBD refining plant that tracks origin to specific mills
    - Record keeping requirements for mills that they trace their CPO production to specific farms
    - Records at each farm of land clearing activities, farming practices and labor so we can certify the farm is not deforesting and is not responsible for social abuses
    - Satellite based monitoring of farms providing oil palm fruits to the mills to confirm there is no deforestation without getting permission and without offsetting forest cutting with forest preservation elsewhere
    - No clearing of land in high conservation value (HCV) land or intact forests
    - Data collection will also be used to develop specific programs for each farm to improve yields through better soil & tree management, proper fertilizer application, proper water management, disease prevention and other measures

# Meeting Requirements for Social Sustainability for RSPO

## GP Group will participate in RSPO Certification of all Social Sustainability Guidelines

- ✓ GP Group will be working directly with farmers as a result of the yield improvement program we are implementing. This will put our team in close contact with all of the farmers and allow us to monitor their compliance with RSPO requirements for no forced labor, no child labor and other criteria.

- ✓ GP Group recognises and respects the rights of indigenous and local communities to give or withhold their Free, Prior and Informed Consent (FPIC) to the utilisation of land to which they hold legal, communal or customary rights to. Through FPIC, indigenous communities can negotiate conditions for new project design, implementation, monitoring and evaluation.

- ✓ Unlike most palm oil projects where land is being taken away for a project, we are part of a process to give back farms from big farm prior owners to small farmers. This will result in optimized social benefits, since high value palm plantations will be given to selected farmers for management, improvement and harvest at no cost.

- ✓ At the same time, we will take all steps necessary to prevent any land-related conflicts or environmental impacts. We will strictly adhere to national laws and regulations in the locations in which we operate and will work with accredited consultants and government departments to carry out environmental impact analysis AMDAL (Analisis Mengenai Dampak Lingkungan) for land-based development to assess adverse feedback from communities and negative impacts on the environment.

- ✓ We will also respect the legal and customary (or traditional) rights of local community in land tenure and ownership, where any access or use of land for development will be carried out in compliance with the Free Prior Informed Consent (FPIC) and the RSPO Principles & Criteria, UN Declaration on the Rights of Indigenous Peoples or ILO 169. We will insure no new plantings are established on local peoples' land where it can be demonstrated that there are legal, customary, land tenure or user rights. Refineries will be built in industrial zones authorized by the local government.

# Respecting Labor Rights and Insuring There is No Child Labor

## GP Group will take special measures to insure that labor rights are respected & no child labor

- ✓ GP Group recognises the Universal Declaration of Human Rights and promotes equal rights. Child labour will be strictly prohibited in all our and supplier operations. We will condemn any form of sexual harassment and abuse of women, and we will protect their reproductive rights. We will respect the right of all workers to form or become members of labor unions.

- ✓ GP Group and its suppliers will commit to abide by all labor conventions globally. This includes the ILO, Forced Labour Convention, 1930 (No. 29) where no one will be involved in any form of forced or compulsory labor including provisions in ILO Abolition of Forced Labour Convention, 1957 (No. 105) to further insure forced or compulsory labor is not used.

- ✓ All workers will enter into employment voluntarily and freely, without the threat of a penalty, and will have the freedom to terminate employment without penalty given reasonable notice or as per agreement in accordance with ILO conventions of Forced Labour Convention, 1930 (No. 29); Protocol of 2014 to the Forced Labour Convention, 1930 (P029); Abolition of Forced Labour Convention, 1957 (No. 105); and Forced Labour Recommendation, 2014 (No. 203)

- ✓ All workers will be allowed to organize into unions and we will abide by ILO Convention 87 (1948) Freedom of Association and Protection of Right to Organize. Workers will be able to freely join confederations of their own choosing and ILO Convention 98 (1949) Right to Organise and Collective Bargaining Protection and establishing a means for voluntary negotiation of terms and conditions of employment through collective agreements

- ✓ ILO Convention 100 (1951) Equal Remuneration for men and women for work of equal value and ILO Convention 111 (1958) Discrimination (Employment and Occupation) to provide equality of opportunity and treatment in respect to employment and occupation; no discrimination on the basis of race, colour, sex, religion, political opinion, or social origin

# Exceeding RSPO Requirements for No Deforestation

## GP Group will take extraordinary measures to avoid deforestation & preserve forests

- ✓ GP Group will be taking very strong steps to preserve forest areas around where we are working with palm oil plantations and CPO mills. This will include measures to be in compliance with RSPO requirements and much greater measures to preserve. We will discuss with all farmers the need to protect all species of conservation concern and biodiversity, in compliance with RSPO's P&C 7.12, IUCN red List & national red list. This includes controlling illegal hunting of all species in all our operation areas, including prohiting hunting of endangered, rare or threatened species except by local communities for subsistence purpose that does not cause a decline of local species populations and complying with SMART & sustainability guidelines

- ✓ We are in discussions with all 143 CPO mills to ensure they adopt commitments of no deforestation and contractors working to improve palm mill and farm efficiency and emissions will monitor both deforestation and animal protection to confirm suppliers are meeting RSPO and national requirements. This will include conducting assessments of High Conservation Value (HCV) and HCS areas before proceeding with any land clearance. We will conduct independent HCV assessment, in which an ALS licensed assessors who are technical members of the RSPO committees

- ✓ Another method we will use to manage and monitor significant biological and ecological areas is through the High Carbon Stock geospatial analysis. We will insure long-term protection of forests and native village areas by building an integrated forest management plan that integrates the recommendations of HCS, HCV, Social and Environmental Impact Assessment (SEIA) and peatland assessments within larger landscape planning and Environment Law in Indonesia and other countries.

- ✓ We also conduct spatial analysis on risk of deforestation and encroachment using Google Earth, ArcGIS software & Global Forest Watch. Satellite imagery will be used to get detailed deforestation information and match it with overlays of suppliers' location. If we find any indication of deforestation activity, it will be cross checked by overlay satellite imagery and suppliers will be notified. If there is deforestation occurring and steps take to protect the forests

# Respecting Indigenous Rights and Preserving Forests for RSPO

## GP Group will take special measures to preserve forests in Indigenous areas & allocate farms

- ✓ GP Group understands that indigenous peoples, local communities and users may have informal or customary rights in land that are not registered or recognized by the government or national laws. Demonstrable rights will be discussed in any development project and separated from spurious claims by direct engagement with local communities, so they have adequate opportunities to justify their claims, and with participatory mapping & involvement of neighboring communities.

- ✓ GP Group is committed to respect and recognize the rights of indigenous and local communities to the utilization of lands to which they hold legal, communal or customary, and to ensure a transparent and legal land allocation process. This is in accordance with our commitment to UN Declaration on the Rights of Indigenous Peoples (2007) (UNDRIP), ILO Convention 169 and RSPO P&C 4.4-4.8 and as part of GP Group's Sustainability Policy. This applies to all of our suppliers.

- ✓ Indigenous peoples will have the right to self-determination and to freely pursue their economic, social and cultural development including the right to consent to any project affecting their lands as expressed through their own representative institutions. ILO Convention 169 (1989) of Indigenous and Tribal Peoples – will be followed to Respect and safeguard rights to lands and natural resources traditionally occupied and used.

- ✓ GP Group will work with Mandiri Bank to insure that a portion of the farms being given to small farmers are indigenous farmers so that social benefits of palm oil farming extend to indigenous peoples. As these are farms that are long ago developed this will provide both an important source of income for indigenous people and not affect their spiritual and social connection to preservation of the forest.

# Meeting Requirements of RSPO Certification, Soil-Water Health

## GP Group will participate in RSPO Certification Schemes & Audit All Palm Oil Suppliers

- ✓ GP Group will be sourcing CPO from 143 mills, primarily on Sumatra Island. As a part of this sourcing we will be meeting all requirements for traceability to the mills and to the farmers as a result of the yield improvement program we are implementing. This will put our team in close contact with all of the farmers and allow us to monitor their compliance with RSPO requirements and to provide on-going data on traceability and compliance with RSPO guidelines.

- ✓ Key requirements for RSPO beyond traceability involve the minimum environmental requirements of no deforestation, no disturbance of peat lands and soil conservation in addition to social sustainability. Through supplier engagement and through the SMART agricultural tech transfer programs, we will be encouraging and supporting our farmers and mills to adopt best management practices on peat as defined by RSPO and peat experts, as well as effective water management to maximize oil palm yield and minimise GHG emissions through SMART technology.

- ✓ Peat soil and water preservation can be improved through proper water table management and implementation of water management monitoring plans. This ensures that water table depth is maintained at appropriate levels. We will also evaluate with our farmers options for long-term restoration or alternative use where existing peat is unsuitable for replanting.

- ✓ The SMART program will teach farmers best practices on enhancing soil fertility, minimizing soil erosion and degradation for enhanced productivity. We will also recommend avoidance of extensive planting on marginal and fragile soils.

- ✓ Pesticides that are categorised as World Health Organisation Class 1A or 1B, or that are listed by the Stockholm or Rotterdam Conventions, including paraquat will be prohibited to be used by all suppliers, unless authorized by government authorities for pest outbreaks. We have developed specific technology that minimizes use of pesticides and chemical fertilizers so we have minimal impacts on soil and water health.

# Strategies for Improving Yield of Palm Oil/Ha.

**Combination of High Yield Trees, Fertilizer, Moisture Retention, Disease Mgmt. & Harvest Systems**

## High Yield Varieties of Trees

**Best Available Tech – 10.5 MT oil/ha.**

## 1.5-2X Yields Possible

**Large corporate farms average 20-25 Tons of FFB per ha. while small farms average 14 MT of FFB. We believe with proper management we can double yield of small farms through tech transfer, fertilizers & best practice agronomic science**

## High Density Directional Planting

## Advanced Fertilizer & Water Mgmt.

NPK – Potassium Deficiency

Mg & Boron application

Avoiding waterlogging & dry season problems

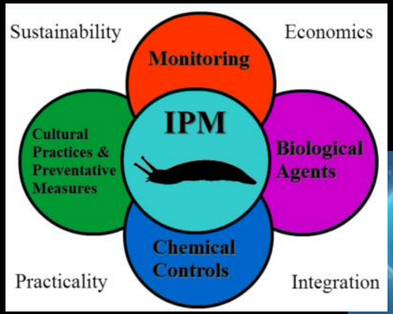
Nitrogen fixing cover crops

Organic fertilizer

Root fungus control

Rat control

## Disease Mgmt. & Better Harvesting




# Reasons for Low Yields of Small Holders:

## Yield of small holder plantations is 10 tons of FFB lower than large well managed plantations

### Large Yield Gap between Small Holders vs. Large Well Managed Farms

A study "Yield gaps in Indonesia Smallholder Plantation: Causes and Solutions" by Woittiez, Slingerland and Giller, indicated that small farms in Indonesia have a large gap between their average yield and those of well managed large plantations. Average Fresh Fruit Bunch yield in the best managed large plantations ranged from 20-25 tons/ha. while smallholder farms averaged 14 tons/ha. with some areas averaging only 11 Tons

### Main Cause of Low Yields is Insufficient Fertilizer

One of the major causes of yield reduction was the lack of specific nutrients essential to palm fruit growth, particularly potassium (K). The subsidized NPK fertilizer 15-15-15 (Ponska) does not provide sufficient K or N so it must be supplemented and small farmers do not add enough fertilizer because of cost. Additional nitrogen (N) was usually applied in the form of urea but insufficient urea was put on because of cost. KCL was also required but was not applied in sufficient quantities or not at all because of cost (only 30% of farmers applied straight K). K was the largest fertilizer deficiency affecting yield. Mg is also required for oil palm but ony about 50-70% applied Mg and also insufficient to provide a good results. This is mostly because they used Dolomite which has poor solubility and does not provide sufficient Mg at root level. Boron is also needed and all farmers interviewed did not apply sufficient Boron because of the cost with an application rate of only one tablespoon per tree vs. the recommended rate of 100-200 mg. Finally, none used micro-nutrients (copper & zinc) which can improve yield. The poor fertilization practices were demonstrated by soil deficiencies in phosphorus (P) in 40% of all the sampled plantations, and tissue deficiencies in 10%. Potassium (K) deficiency was observed most frequently, with 80-100% of the independent plantations in Sintang, and five out of six plantations in Ramin showing both soil and leaf K deficiencies. Visual deficiency symptoms could be observed in the field for all five major oil palm nutrients (data not shown), but potassium and boron deficiencies were especially common.

### Another Reason is Contamination of Plantations with Low Yielding Oil Trees & insufficient planting of high quality new trees

Another major reason for low yields were the types of trees on the plantations and the tree density. About half of the tested plantations were contaminated with Dura material which has a much larger interior shell and therefore less oil. On average there were 25% Dura fruits in the plantations, but a large variation from 5 to 75%. The presence of Dura indicates planting material of inferior quality. In one site only four plantations were tested concerning Dura presence, and all were contaminated with Dura, ranging from 30 to 50% of the bunches. There were also problems with sufficient funds to plant new trees when needed because of the lack of good seedlings or good seed material

# Reasons for Low Yields of Small Holders:

## Yield of small holder plantations is 10 tons of FFB lower than large well managed plantations

### Poor Drainage of Fields Because of Lack of or Non-Functioning Drainage Gates or Overdrainage

Another problem observed was from flooding of fields during periods of heavy rains and root damage from flooding. Palm plantations must have drainage systems with gates to control outflow of water so that some water is retained during rains to saturate the soil but not to inundate the roots and trunk. Many of the farms had non-functioning or no gates for drainage and had problems with flood damage to trunks and roots. Plantations on peat soils also had problems with insufficient water due to over-drainage and poor water retention. Water availability has also become a major problem due to longer El Nino's from climate change impacts that will increasingly impact yields in the future and will require better water management on palm plantations.

### Harvest Frequency was not Optimal

Most of the small farmers harvested once per two weeks, and none harvested at the recommended frequency of once per ten days, which shows that harvesting practices are sub-optimal (Lee et al., 2013). This was generally due to a lack of time or labor to do good management and to harvest at proper intervals.

### Rat Damage & Occasional Outbreaks of Leaf Eating Pests

Rat damage to the bunches is a common problem and is related to the use of empty fruit bunches as a means to provide organic fertilizer. While the bunches do eventually break down and provide soil nutrients, they also tend to harbor rats that eat the fruits and reduce yields. Another problem is occasional outbreaks of leaf eating pests that stress the trees and reduce yields.

Large Inner Shell of Dura Fruit on Right = Low Oil Yield

Leaves showing Boron Deficiency

Leaf symptoms showing K Deficiency (yellow spotting)

# High Yield Palm: Management of Small Farmers Essential

## Improving small farmer yields will require that GP Group has the ability to finance & manage small farms for best y

### Transferring of Land to Small Holders is a Unique Opportunity to Force Use of Best Management Practices to Optimize Yields

Mandiri bank is considering a major program for transfer of land to smallholders. We are 100% in favor of this transfer but believe it also offers an opportunity to control the management of the land transferred to it optimizes yield achieved. This can best be done by transferring the land with the condition that management of the farm initially is done by a well trained group of agronomists that apply best practices to the plantation and train farmers in proper application of fertilizers, weed management, cover crops, organic nutrient production, best planting practices for new trees, best seed and seedling varieties and new methods to improve yields such as microbial applications, mineral supplements, root fungus control, water management, etc. GP Group is proposing to implement this program through a “shared savings” approach where we provide the inputs and manage the farm for optimum yields in exchange for half of the difference between average yields and yields achieved. We are confident that with the application of best management practices, good fertilizer applications, new technologies and best tree seeds and seedlings, small farmer yields from plantations can equal or exceed the yields achieved on the best large plantations in Indonesia, thereby doubling oil yield.

### Best Management Practices to Optimize Yields

- Superior High Yielding Plant Genetics
- High density/directional planting format
- On-going Soil Evaluation and Intensive Soil Nutrition Program
- Application of proprietary oil palm specific microbial inoculations
- High Tech Nursery Establishment and Seedling Propagation
- GPS guided mechanical planting with superior soil cultivation methods
- Inter row legumes to aid carbon capture. soil fertility and weed control
- Fast Harvest to Processing System to obtain the highest oil recovery

### Best Tree Species Planted When Replacing Older or Wrong Trees

- Planting material shous produce a high yield of FFB (at least 25 T/ha)
- Fruits should have high oil ratio when processed (at least 8 T/ha)
- Oil palms should be culled for many years so it is near 100% female flowers
- Oil palm bunches should weigh much more than the industry average.
- Oil palms should produce an average 16 bunches per tree per year by yr. 2
- Should involve a mix of varieties that are cross bred for favorable traits
- Possible varieties to cross include Ekona (high oil to bunch), Bameda (high altitude palms),La Me (short and drought tolerant), Oleifera (high unsaturated oil and low height increment), Yangambi (early yield).




# Improving Yield of Palm Oil/Ha. with Better Trees

## Early Maturity

With the incorporation of the Yangambi gene through the paternal lineage the planting material can be vigorous and harvesting of fruits can commence 20 months after planting as opposed to the industry average 30-36 months.

## High Yield

Advance planting material can produce a high yield of 48 tonnes FFB (Fresh Fruit Bunches) & 15 Tonnes CPO/PKO (Crude Palm Oil / Palm Kernel Oil) per hectare, per year, at maturity.  This  allows for doubling of oil availability without requiring additional land or deforestation so up to 75 million MT of additional oil is then available industry-wide for biofuels and food production by 2030.

Very High Yield

## Slow height increment for prolonged economic life

With a certain percentage of genes from La Me and Oleifera species, planted palms can have a short trunk height which translates to a prolonged economic lifespan.  One of the suppliers has an 18 year old oil palm that has a trunk height of 4.0m as compared to 12.0m for a 25 year old palm from normal seed producers. Height increment can measure as low as 25cm per year which is less than half of that from normal plantings. Many of these trees have 40kg bunches yielding over 400kg per tree / year.

Short Trunk Height

# Strategies for Improving Yield of Palm Oil/Ha.

Selecting the Right Seed Supplier is Critical

**Higher ratio of female flowers**

Oil palms must be critically culled for at least 30 years to achieve as close as possible to 100% female flowers. This yields more bunches, per tree.

**Higher bunch weights**

Selection of seed suppliers should be based on oil palm bunch weight so the trees produce much heavier bunch weights than the industry average.

**Higher bunch numbers**

We will select seeds from oil palms that produce at least 16 bunches per tree per year from Year 2.

**Highest Yielding Seeds**

We are planning to plant carefully selected seeds so that a crop is produced as early as the 2nd year. One seed, Elaeis Guineensis, appears very promising. We will also use DxP crosses with diverse varieties such as Ekona (high oil to bunch), Bameda (high altitude palms), LaMe (short and drought tolerant), Oleifera (high unsaturated oil and low height increment) and Yangambi (early yield).

Fundamentals of Agronomy Important

**Higher Oil to Bunch Ratio**

A 32% oil to bunch ratio is important to achieve high yield versus the industry average of only 25%. This is much higher than current yield achieved by small farm holders

**Higher Oil Recovery**

Oil palms need to produce more oil within fruits when compared to industry standards so yields per ha. are higher.

**Higher Density Planting**

Oil Palms need to have shorter more erect fronds so that it is possible to plant 156 trees/hectare as compared to industry standard of 132 oil palms/hectare. More trees means more FFB's and oil per hectare

# UCO VS YIELD: Why Used Cooking Oil (UCO) is not the Answer

## Neste and other major HVO producers have shifted to UCO to avoid using palm oil but this just shifts demand

- Most HVO producers are shifting to use of Used Cooking oil (UCO) as a feedstock for HVO to avoid using palm oil and to earn more credits. Because UCO is classed as a waste product within the EU, fuel producers are given double carbon credits for using it in their fuels. This has sparked a boom in demand for used cooking oil that is so great that more than half of used cooking oil demand is being met with imports from Asia, primarily China.
- In the UK, the most common feedstock source of biodiesel between April and December 2018 was Chinese UCO, totalling 93 million litres. In the same period, used cooking oil from UK sources was used to produce 76 million litres of of fuel.
- A study from international bioeconomy consultants NNFCC suggests that demand for palm oil is increasing as a result of substitution of palm oil for UCO. Used cooking oil in some parts of Asia is considered safe for consumption by animals. As it is more profitable to sell Asian UCO to Europe for fuel rather than feed it to animals, it is likely being replaced by virgin palm oil which is cheaper to buy. Palm oil imports into China are increasing, in line with their increasing exports of used cooking oils. Between 2016 and 2018, palm oil imports into China rose by 1 million tonnes, an increase of more than 20%.
- As soon as that point is reached where you can sell used cooking oil for more than you can buy palm oil, there will be substitution in the market. Right now there is a spread of $300 per MT between palm oil and used cooking oil
- The global used cooking oil market size was valued at $6,041.2 million in 2018, and is projected to reach **$8,886.7 million by 2026**, registering a CAGR of 5.0% from 2019 to 2026. This growth, however, is primarily from increase in price of UCO. If we assume a UCO value of $1000-1200, this represents a resource of about 6 million MT.
- Global HVO capacity is expected to expand from 7 million MT globally to 30 million MT between 2020-2025 (4.5X growth). The estimated global UCO resource is limited by various constraints and overall supply is not likely to increase by more than 20%. This leaves a very large shortfall of fatty acids that will have to come from some feedstock. Where is not exactly clear.
- Some fatty acids can be pulled from wastewater. These are hard to process and require much higher equipment investments
- Improving yield of palm plantations or planting macauba on ranchland in Brazil offer much better alternatives as it increases the total available fatty acids globally. Huge increases in supply are possible if the overall yield increases 50% in Indonesia & Malaysia (75 m x 1.5 = 110 m. tons) or tens of millions of hectares of grassland add macauba (there is 165 million ha. in Brazil)
- Double counting UCO just means that Co2 reductions are not really occurring and the market distortions make no sense.

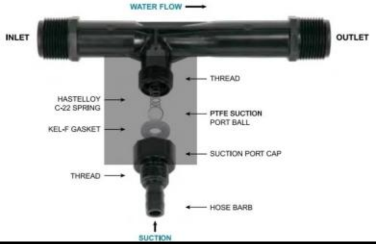
# Achieving Super High Yields Through SAS Integrated Strategy

## Organic approaches to improving water availability, soil quality, pest management & plant health

**Sustainable Agricultural Solutions (SAS) will license the following technologies to GP Group:**

**Cutting Water Use by factor of 3 or 4 & Better Soils**

Special blend of soils added at planting retain moisture at the roots and cut water use dramatically while improving soil quality

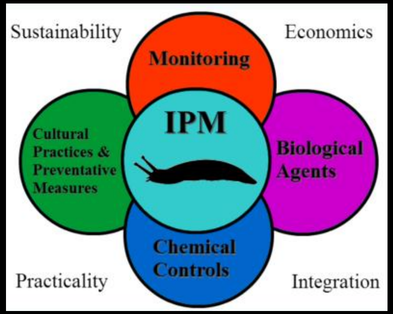




**Eliminating Root Fungus Disease without Chemicals**

Ozone is added through venturi system when irrigating that treats fungus & viruses at root level


**Organic Urea is Lower in Cost & More Effective**

Liquid Organic Urea (LOU) is applied instead of petroleum based nitrogen fertilizer and increases yields.




**Integrated Strategies for Pests**

Combining dusting systems for pests, soil mineralization, beneficial insects & ozone spray

# Agro-Tech: Ozone & Soil Mix

## Ozone & Special Soil Mix Can Double Yields, Eliminate Diseases

### Data Obtained from Testing at Las Palmas Farm:

**CORN**

- Applied soil mix when planting via irrigation
- Corn: one of the soils in mix can also be used to control worms
- Health Benefits: crops have high levels of silicates essential for building up ligaments, tendons & bone health from soil & urea
- Small Amount per treatment means it is very cost effective
- Yield has risen above 32 MT per ha. per harvest in not particularly rich soil and with tough growing conditions (hot sun, wind, etc.)
- Average Yield of corn is about 4-8 tons in Mexico (4-8 times better)

**SQUASH & FAVA BEAMS:**

- Squash/Beans: Applied soil mix when planting via irrigation
- Yield: Was able to double yield of fava bean and squash crops
- Diseases: Had no problems with diseases, vegetables very healthy

**CHICKENS:**

- Less diseases in chickens, more meat, more eggs laid, bigger yolks

**GOAL:**

We plan to work with the local agricultural Univerisity to document yields achieved in corn, beans, squash and other crops and then introduce the technology package in various agricultural projects.
We will also work with Universities in Indonesia to test technology

### Special Soils when Tilling/Ozone delivered by irrigation

Yield of corn reached 32 MT from ozone & soil mix

Doubled yields of squash and fava beans

Farmer in Las Palmas Valley has doubled crop yields
Farmer now has top corn yields in Mexico (32 MT/ha)
This is before special urea & while growing corn in a desert!

# Agro-Tech: Organic Urea

## Addition of Organic Urea Can Further Add to Yields, Lower Costs

### Data Obtained from Testing at Las Palmas Farm

CORN
- Corn; organic urea used as alternative to petro urea (same rate)
- Corn: added in irrigation water to apply at root level
- Health Benefits: crops have high levels of silicates essential for building up ligaments, tendons & bone health from soil mix
- Small Amount per treatment means it is very cost effective
- Yield has risen from 8 ears per harvest to 12 ears when going from soil mix/ozone to all three (soil mix, ozone, organic urea)
- Average Yield of corn will be higher than 32 tons (no data yet)

SQUASH & FAVA BEAMS:
- Beans/Squash: Applied soil mix when planting via irrigation
- Corn; Yield: Was able to double yield of fava bean and squash crops
- Diseases: Had no problems with diseases, vegetables very healthy

COST VS. NATURAL GAS UREA

Lower Cost: lower in cost vs. current prices for normal petro urea

GOAL:

We plan to work with the local agricultural Univerisity & U. of CA S.D. to document yields achieved in corn, beans, squash while comparing costs of applications of same amount of urea (SAS & petro)

Organic urea delivered by irrigation or injection

Yield of corn will go from 32 MT to 42 MT/ha from organic urea

50% increase in yields will be at a cost under petro urea

Farmer in Las Palmas Valley has increased crop yields Beyond top corn yields in Mexico already (32 MT/ha) We expect to increase yield another 50% & lower costs!

# Special Soil Blend to Retain Moisture

## Sust. Ag Sol. has developed a special soil blend that retains moisture at root level

### CUTTING IRRIGATION REQUIREMENTS BY UP TO 7 TIMES

- **Product**: proprietary blend of 3 low cost soils
- **Application:** Applied in parallel with producing soil mounds by cutting a trench when forming mounds and adding in special soil
- **Properties:** Allows soil to retain moisture around roots
- **Benefits:** Lowers cost of irrigation & water use by up to 7 times
- **Production Costs** are very low so it is feasible to offer to farmers
- **Cost Effective** reduces irrigation requirements and also greatly increases yields so it is very cost effective & good drought strategy

### MARKETS:

- **Agric.**: dry season farming feasible, allows farming during drought
- **Nutritive Value**: enhances nutritive value of crop or use as meal
- **Yield Boost**: retaining moisture at root level leads to higher yields
- **Health** plant health is improved which reduces crop failure risk

### GOAL:

Utilize special soil blend in test programs in Brazil, Mexico, Indonesia and USA to prove impact on yield and reductions in irrigation water and then market product to agricultural sector globally

### Soil Blend Production & Application


We are currently testing the soil blend with various farmers in Mexico to perfect the application process & measure yields and costs of implementing at a farm level

**3 SPECIAL SOILS IN LOW QUANTITY =**
**HIGH EFFICIENCY AGRICULTURE & LOW WATER USE**

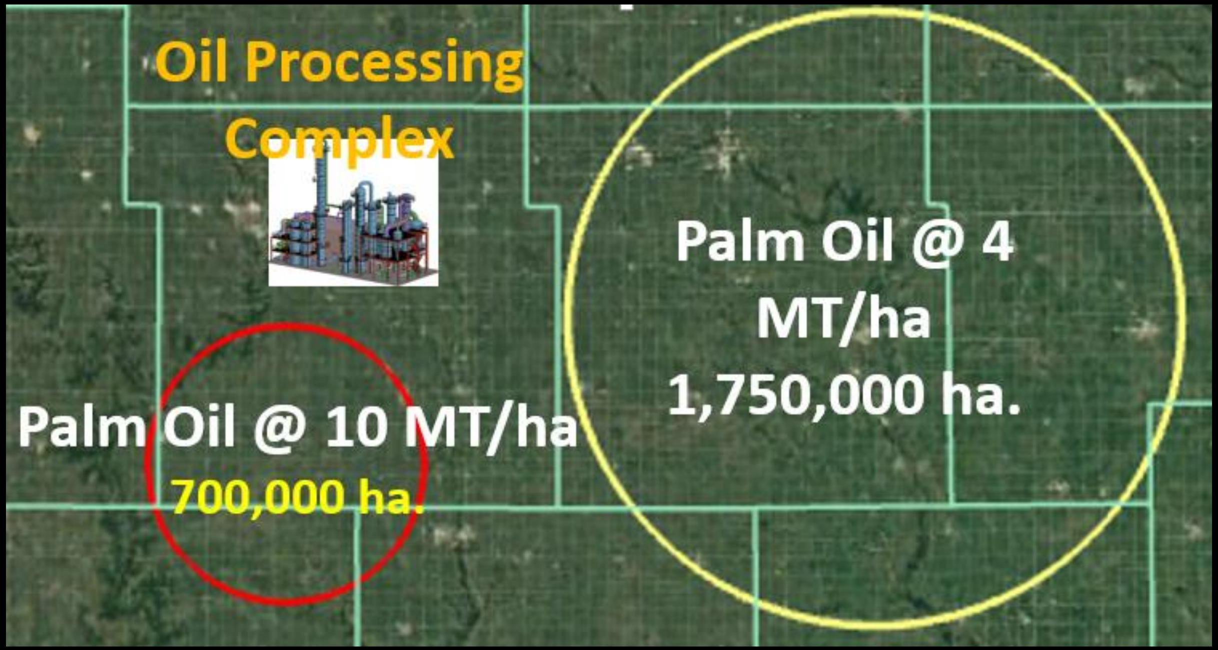
# Palm Oil Land Use:  Reducing Impact by Increasing Yield

**YIELD PER HA. INDONESIAN PALM**
Average:    under 4 tons/ha.
Target for GRE: 8-10 tons/ha.

**YIELD IMPROVEMENT TECH:**
Reduces need for land since yields are higher which lowers land use change and indirect land use change conflicts

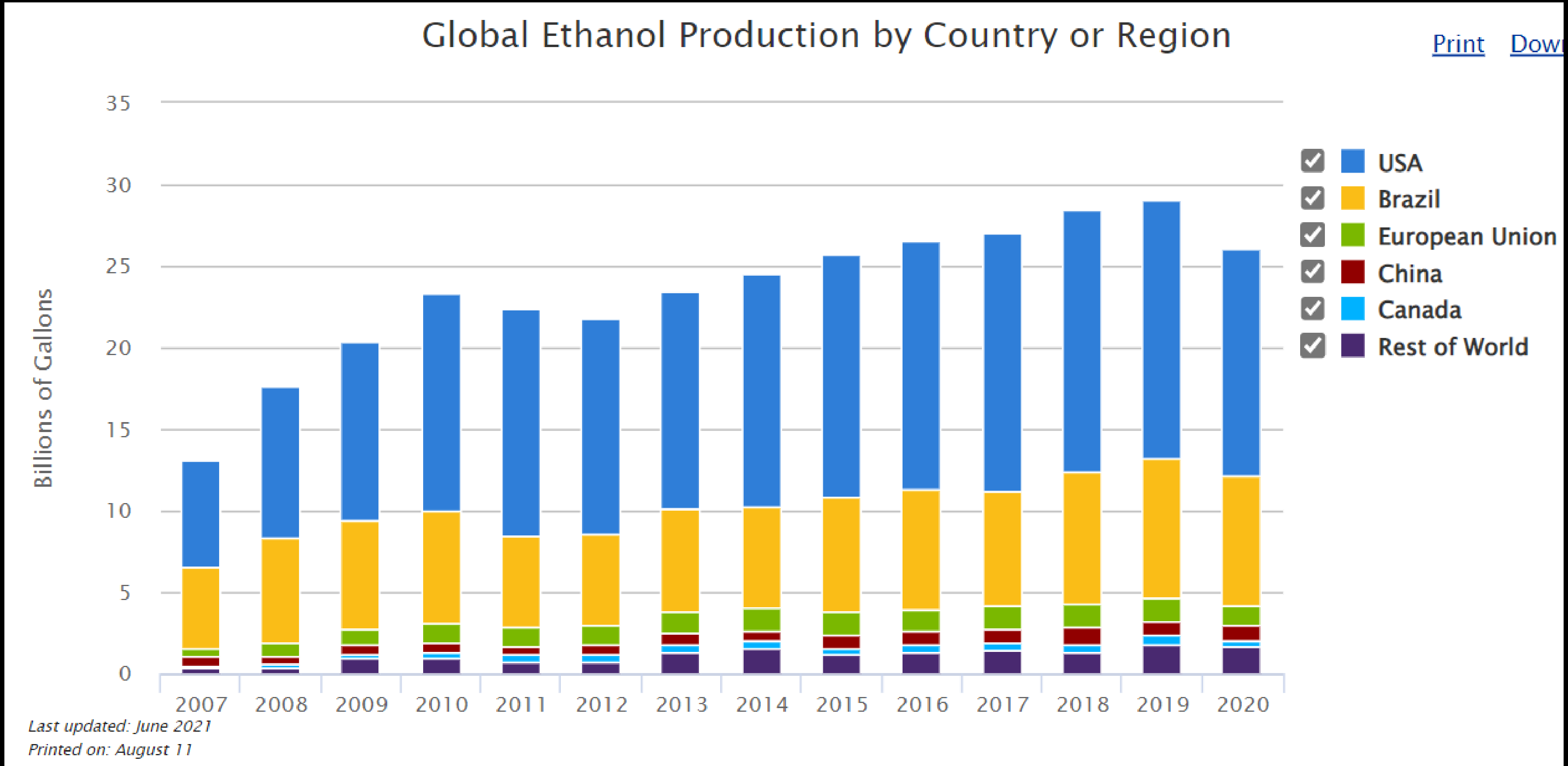
**LAND USE**
draw area for palm oil production is cut to 40-50% of area without yield improvement

**Draw Area Requirements for 20,000 MT per day of CPO with 4 MT/ha. vs. 10 MT/ha.**




✓ Indonesia can double its production of palm oil without requiring any additional land clearing just by investing in technology that will improve yield.  This eliminates arguments concerning deforestation.  However, this will only work if in parallel Indonesia make a serious effort to halt deforestation (through intensive agriculture on already cleared land)

# Ethanol: Indonesia at Near Zero, Could be World Leader

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Source: Renewable Fuels Association

**Indonesia produces no fuel ethanol at the moment but with 2 new crops it could be a world leader by 2030**

Indonesia's low yields of sugar have not justified much investment in ethanol production. There is only one producer with 10,000 MT of capacity and they are not very profitable. With the introduction of sweet potato and agave crops and the use of advanced yield improvement technologies, Indonesia could become a world leader in production of ethanol and blend 25% ethanol in gasoline with flex fuel vehicles by 2030. This would create tens of thousands of jobs and provide feed for greatly increasing animal production.

# High Yield Production of Feedstock for Ethanol & Food

## Global Cooperation Possible to solve Oil Dependency & Climate Challenges & Feed 9 billion

Sweet Potatoes Rotated annually with Sorghum = 80-100 MT per ha./year

Ethanol needed at 10% ratio to produce biodiesel

Agave on semi-arid land = 200-700 MT per ha. per year

**10X Yields Are Possible & Profitable Versus Brazil Sugar Cane and Offer Pathway for Indonesia Ethanol Production**

Water 40 tons

100 MT Potatoes

=

30 MT Animal Feed wet, 15 MT dry

+

30 MT Ethanol

**Major increase in animal production possible from additional quantities of ethanol residual feed that can double Indonesia meat production**

Production of ethanol reduces need to import oil to produce gasoline

Production of animals & fish allows Indonesia to feed its growing population

# Introducing Viable Ethanol Alternatives for Indonesia:

## How To Improve Yields, Economics and Carbon Intensity (CI) of Ethanol in Indonesia?

- ✓ Carbon Intensity (CI) is the score given a fuel that is based on carbon emissions from crop, fuel and transportation versus carbon benefits based on the efficiency of the fuel in an engine or drive system. It is used to compare alternative fuels vs. gasonline/diesel
- ✓ Indonesia has had limited success with ethanol production because of low yields of its sugar cane production and lack of excess sugar or starch ]
- ✓ Indonesia could produce an ethanol with a very low carbon intensity by using super high yield crops, reducing energy used for drying residuals, eliminating indirect land use change penalties (due to super high yields), co-product allocations (for example feed) and use of renewable steam
- ✓ GCarbon has developed various super-high yield crops (sweet potato, sweet sorghum & agave) in combination with an ethanol process that uses wet ethanol residuals for animal feed and biogas capture to eliminate methane emissions. When combined with solar for steam CI is very low
- ✓ GP Group will need large quantities of ethanol for blending with palm oil & UCO for biodiesel production. They will work with GCarbon to develop advanced ethanol plants using this integrated approach because the zero carbon emissions will carry over to biodiesel and improve the marketability of biodiesel in export markets
- ✓ Indonesia is already growing cassava (sweet potatoes) and has lots of semi arid land suitable for agave. A major national program for introducing high yield sweet potatoes and agave could allow the country to blend 25% ethanol in gasoline & switch to flex fuel ethanol-gas vehicles by 2030

## High Yield Crops Reduce Land Use

No Indirect Land Use Change Penalty

Sweet Potatoes & Sorghum (2 crops/yr) 80-100 MT Ha./yr

Agave 180-400 MT/ Ha./Year

## Renewable Energy

No natural gas use

Solar Thermal, Renewable Elec

Avoided Methane Credit

BioGas from Animal Wastes

## By-Product Allocation

No Drying, More Feed

Wet Residuals & Crop Residues for Feed

Easier to Get ByProduct Allocation

Animal Plant Integrated with Ethanol Plant

# Importance of By-Product Allocation, Market Value Modeling

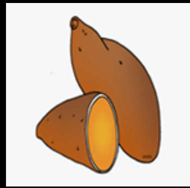
**Sweet potatoes have various by-products that enhance profits, value as by-products**

## Sugar extracted from Potatoes is an Ideal sugar for diabetics

- ✓ Our technology partner has an extraction process to obtain sugar from industrial sweet potatoes that is ideal for use by diabetic
- ✓ The high value of this by-product will allow us to allocate a large share of carbon emissions and reduce biofuel carbon intensity
- ✓ Sweet potato residue after sugar extraction can be termed a "waste product" when looking at relative value of the 2 products

## Large quantity of tallow will be produced from processing animals into meat = low CI Biodiesel

- ✓ GP Group will produce millions of animals per 80 million gallon ethanol plant, 11% of animals is fat so huge quantities of tallow
- ✓ The low carbon footprint from growing potatoes and feeding animals will mean tallow has excellent life cycle Co2 benefits
- ✓ Result will be excellent life cycle carbon benefits from biodiesel made from this tallow

| | High Value By-Products | | Economic Value | | By-Product Allocation | |
|---|---|---|---|---|---|---|
|  | Diabetic Sugar | Sugar is extracted from potatoes prior to use for ethanol | Medicinal Value | Sugar is very valuable as diabetic sugar | High value assigned | High sugar value = allocate carbon in economic model |
|  | Tallow | Tallow is a by-product of meat processing | Low CI Tallow | Tallow value higher due to low CI | Tallow valuable for biodiesel | Low CI biodiesel from low impact animal production |

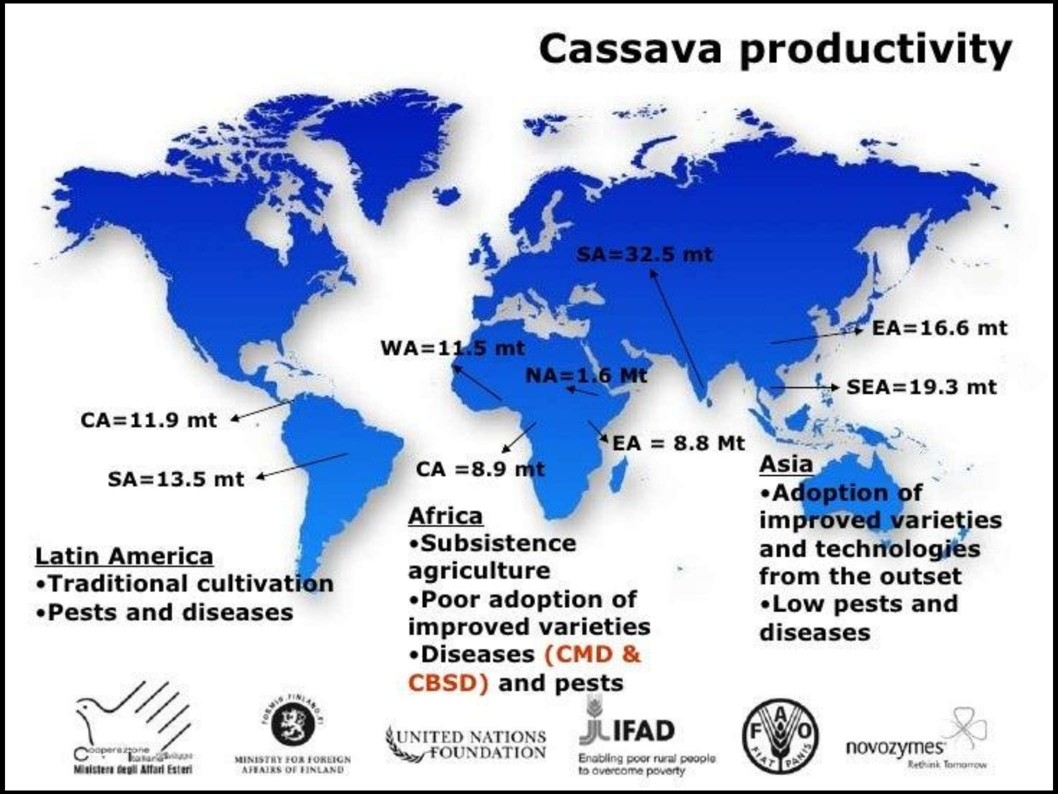
# Casava Production Well Established in Indonesia

## It should be easy to introduce Brazil Sweet Potato varieties as Indonesia is major Casava producer

**Casava production average in SE Asia is 19.3 MT/ha**


- **Cassava production in Indonesia**. 18,302,000 tonnes in 2020.
- Lampung Province is the major production center with 7 million MT
- Cassava growth period is much longer so yield per ha/yr. GP Group is looking at several locations for sweet potato production in either Lampung Province, Sumatra or in Central Kalimantan.
- It may be possible to get 3 harvests per year in Indonesia that world further raise yields

**3X Yields Are Possible & Profitable Using Brazil Sweet Potatoes Vs. Cassava & Cane and Offer Pathway for Indonesia Ethanol Production**




**Sweet Potatoes 2 crop cycle results in 100 MT/ha/year (60 MT & 40 MT/ha/harvest)**

Brazil achieves very high yield sweet potatoes because varieties have been developed specifically for high starch content and not for appearance and taste

High starch content results in more biomass for ethanol while very large size means more potato production per hectare. Results are 60 tons/ha/harvest in the first harvest & 40 tons in 2nd harvest and 2 harvests per year

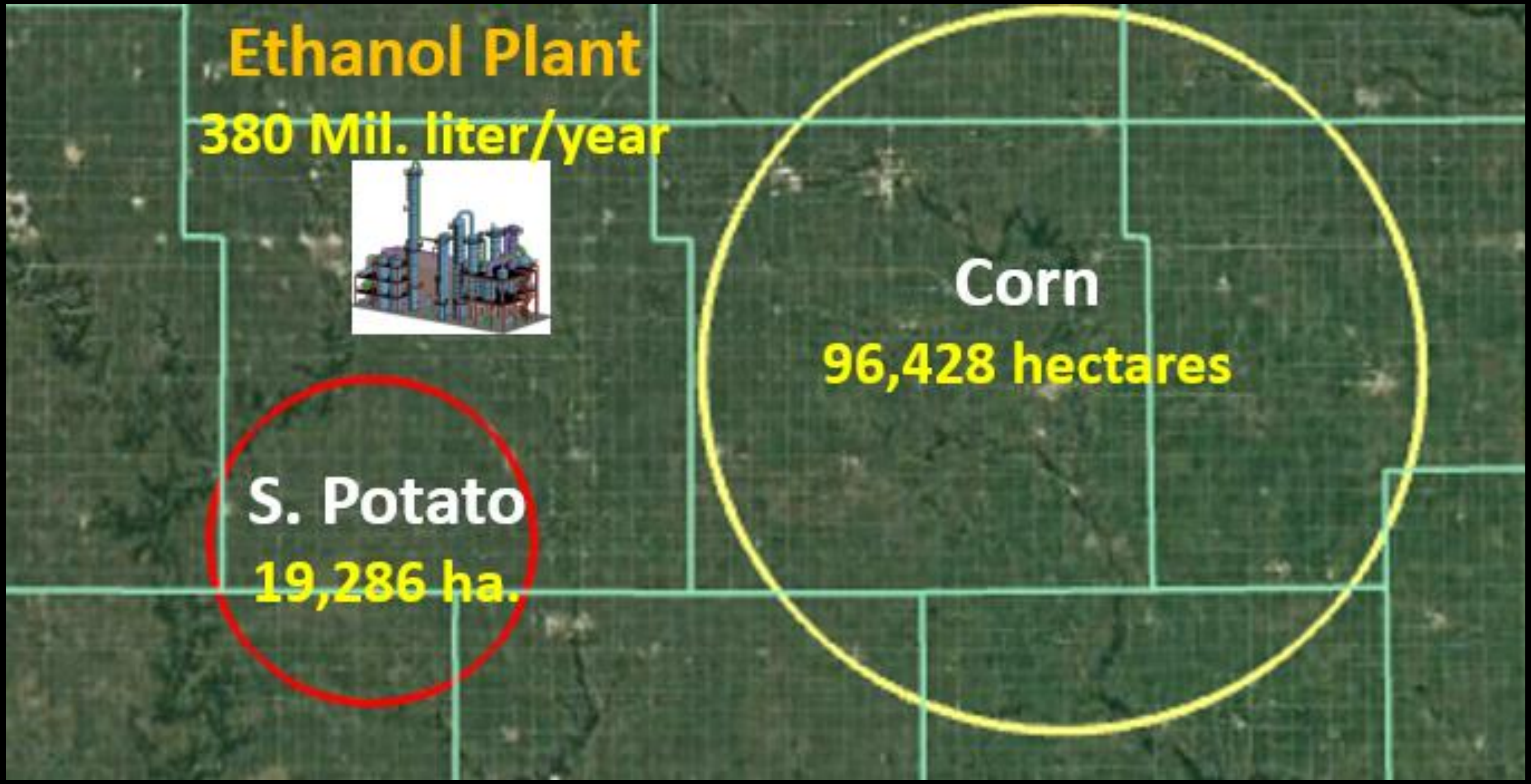
# Ethanol Land Use:  Corn  vs. Special Sweet Potato Variety

**Draw Area Requirements for 380 million liter/year ethanol plant; corn vs. sweet potato**

**Yield per Ha. Ethanol:**
**Corn: 3794 lit. /ha**
**Potato: 20,440 lit./ha.**

**POTATO LAND USE:**
**Draw area for 380 mil./liter/yr for potatoes:**
**19,286 ha.**

**CORN  LAND USE**
**draw area for 380 mil. Liter/ year corn ethanol plant up to 5 times greater;**
**96,428 ha**




✓ Up to 5 times more draw area and land use impact is required for corn vs. sweet potatoes.  The result is up to 5 times more carbon impacts from land use change and much greater carbon emissions life cycle from corn vs. potato ethanol.

# Sweet Sorghum Provides High Yield for 2nd Year Crop

## Colombia (similar climate to Indonesia) has been achieving high sweet sorghum yields/há/yr

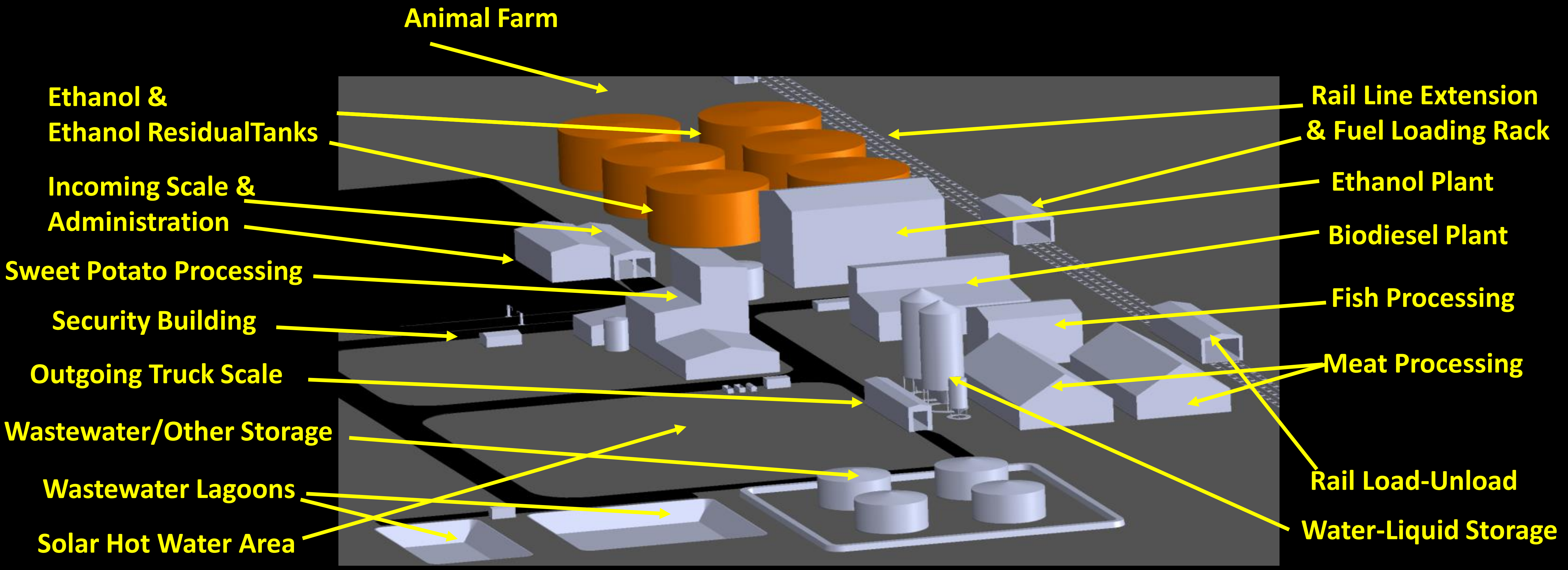
**Sweet Sorghum production in Colombia**
**- average is 39.3 MT/ha/yr**
**- peak producers have reached 80 MT/ha/yr**

- Sweet sorghum stalks contain up to 75% juice, varying between 12 and 23% in sugar.
- There's enough juice in a hectare of sweet sorghum to make 3800 liters to 7600 liters of ethanol per ha. per year and new varieties can get up to 9,470 liters per ha. per year
- Sorghum juice-derived ethanol is cheaper to produce than corn ethanol because it doesn't require the cooking and enzymes that corn requires for conversion of starch to sugar to ethanol
- About 6% of the crop is grain that is an excellent animal feed with high protein and various nutritional benefits
- The bagasse from extraction of juice is an ideal material for steam production for ethanol manufacturing or to co-produce electricity
- Sweet sorghum has lower fertilizer requirements than corn requiring only 270 kg of nitrogen per hectare
- The crop only needs 12-15 inches of rain during the growing season, making it suitable for dryland production or use of limited irrigation.

**Sweet Sorghum has lower fertilizer requirements & better drought tolerance vs. corn**

# Overall Design of Ethanol/Meat Processing Complex:
## 380 Mil. Liter/year Ethanol Plant, Food Processing, Infrastructure

- GRE has completed a preliminary concept diagram for the proposed ethanol-meat complex that will be put in a site near potato production. This layout drawing details the various building requirements, placement of buildings and associated investments for storage, infrastructure and logistics.



# Ethanol Specifications ASTM

**Since some ethanol may be exported to USA we will meet ASTM D4806, Spec for blending with USA gasoline**

**Ethanol Specifications**
USA spec is ASTM D 4806

**Water Removal:**
Specification is for less than 1% water
This usually means 99% ethanol minus a small percentage of other contaminants

**Requirements**
Storage of ethanol needs to be in stainless steel tanks to keep clean

**Brazilian Standard**
Since the ethanol technology supplier will be from Brazil we will also meet the Brazilian spec, which is a little tighter for anhydrous ethanol

**ASTM D 4806**

| Property | Specification | | ASTM Test Method |
|---|---|---|---|
| • Ethanol volume %, min | 92.1 | | D 5501 |
| • Methanol, volume %. max | 0.5 | | |
| • Solvent-washed gum, mg/100 ml max | 5.0 | | D 381 |
| • Water content, volume %, max | 1.0 | | E 203 |
| • Denaturant content, volume %, min | 1.96 | | |
| volume %, max | 4.76 | | |
| • Inorganic Chloride content, mass ppm (mg/L) max | 40 | (32) | D 512 |
| • Copper content, mg/kg, max | 0.1 | | D1688 |
| • Acidity (as acetic acid $CH_3COOH$), mass percent (mg/L), max | 0.007 | (56) | D1613 |
| • pHe | 6.5-9.0 | | D 6423 |
| • Appearance - visibly free of suspended or precipitated contaminants (clear & bright) | | | |

✓ **RIN Certification:** The most important spec will be life cycle Co2e emissions reduction exceeding 20% (minimum for renewable fuels). We are also hoping to get certified for greater than 50% Co2e as this will allow us to be eligible for advanced biofuel D5 RIN credits that are worth a lot more and do not have a volume limit (unlike D6 corn based ethanol)

# Ethanol Production Improves Co2, lowers cost for Biodiesel:

## Why Zero Carbon Fuel is possible as a Result of Innovations in Production

### Carbon Emissions Very Low Because:

### Carbon Benefits From:

# Options for Ethanol Residual – Wet or Dry Plus Vines/Leaves

## 1 ton Sweet Potatoes = 300 Kg wet residual OR 150 Kg dry residual


1 ton roots with 2% crude protein= approx. 150 kg dry matter residue with 16% crude protein


At 100 ton/ha:

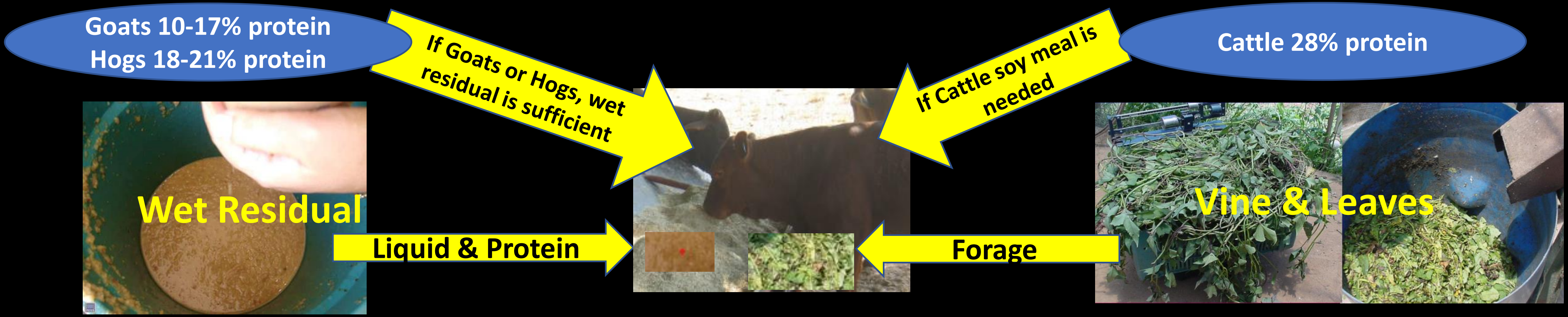
20 kg protein x 100 t/ha = = 2000 kg protein /ha (equiv. 5000 kg soybean grain)

Leaves-Vines=
Up to 18 MT fresh weight with high value to humans (delicious greens) & animals . Protein content is 18% wet

15% dry matter with 11.4% protein for dry season feed for hogs or others

- Ethanol residue can be used either wet or dry. As wet residue it can be fed directly to hogs, goats or cattle. As dry residue it can be mixed with other ingredients and fed to chickens, cattle or fish. Protein content wet is 18% and dry is 28%. It is preferable to keep the residual wet as this reduces capital cost and energy requirements of the ethanol plant
- Chemical characteristics of DDG include crude protein of 28.5%, EE1 39%, MM10 35%, FB 9.13% ENN 50.83%, FDN 31.53%, FDA 20.55%, NT 3.56^, NNP 1.21%, Naol 1.28%, NIDN 2.3%, NIDA 1.63%, P 0.7%, Ca 0.8%, Mg 0.3%, K 4.49%

# Growing Animals & Fish Because of Feed Availability




GP Group (GP Group) is incorporating animal production in ethanol plants because of the large amount of wet residual available that can be transferred to animals that are grown right next to the plant. This can eliminate 28% of the capital cost in a large ethanol plant and can eliminate 28% of energy needed for drying which improves carbon impact of ethanol production. Depending on the type of animal grown wet residual may be sufficient (18%) or will require addition of dry residual to meet protein requirements.


GP Group will also be assisting farmers to enter into on the farm aquaculture. This is aided by the ability to produce fish pellets locally using a combination of dried sweet potato residues, corn for flotation, soy meal and fish & animal viscera. This will lower the cost of fish production since this is 65% of the operating costs of an aquaculture operation.

# Producing Meat From Ethanol Residues & Vines

- GP Group’s other major source of revenue from ethanol plant is production of meat. Sales of meat have a greater value than ethanol by year 5

- We are able to grow a large amount of meat because ethanol residue and leaves/vines are available for free since sweet potatoes are grown for ethanol anyway. We will have differential pricing for potatoes depending if farmers provide vines and leaves with potatoes

- Feed represents about 60-75% of the total cost of raising animals so no or very low feed cost = high margins. With no feed costs we can choose when to process animals to optimize the value of meat

- GP Group build a processing plant to export meat & by products that will come on line in year 3 with 8000 head/day capacity. We will process 450 million Kg by year 5. We will used a confined system to raise animals next to the ethanol plant so that wet residual can be sent over to animals without requiring drying and methane can be sent back to the ethanol plant via pipeline to improve ethanol life cycle carbon benefits.

# 8000 head/day Meat Processing/project = Thousands of Jobs

## Production of animals from residual from ethanol leads to meat production & lots of jobs


**Indonesia could become self-sufficient in meat production if they have a lot of feed for animal production**

- ✓ Processing of 8000 head per day of animals and processing all parts of the animal and use all by-products including blood, intestines, organs as well as value added processing of meat cuts leads to a tremendous number of jobs. The by-products can be used to provide feed pellets for fish and further improve economics of the integrated production process.

- ✓ Indonesia is a major importer of meat products. Expanding ethanol production with sweet potatoes offers an opportunity to become self sufficient on meat production because of the high yield per ha. of ethanol residual for feed.

# Growing Agave Provides Ethanol in 5 years to reach 2030 25% Blend

**Planting agave on 560,000 ha per year for 5 years (2.8 mil. Ha total) = 38 billion liters/year of ethanol so a 25% blend in gasoline is possible**

- Our goal in growing agave in Indonesia is to to provide an alternative feedstock to sugar cane for the ethanol plants that can grow in a dry climate while providing income for farmers and workers from planting and processing.

- Agave produces up to 7 times more sugar than sugarcane (from 27 to 42 degrees Brix), 5 times more cellulose (26 Ton/ha/year) with faster growth than Eucalyptus and 2 times more dry biomass (40 tons/hectare/year). The sugar is ideal for ethanol production, reducing CO2 by more than 100%. No other plant in the world has such potential.

- Agave species can grow well on semi-arid marginal farmland around the world. Agave species have been cultivated for centuries for alcoholic beverages in Mexico but advanced research efforts makes it feasible to use the abundant central core liquids and leafs of mature plants for ethanol and composite production.

- We plan to produce ethanol and composites by planting agave in semi-arid regions of Indonesia where agave can thrive in conjunction with building ethanol plants as the agave mature and are ready for harvest.

- We will work with the Indonesia Ministry of Agriculture to set up two commercial plots of 10 hectares each in year 1 that will allow us to gather data on yields of some of the best varieties of agave being developed in Australia. This will provide a scientific basis to support a broad investment effort in this crop in year 2 & 3. If 560,000 ha. per year of agave is planted in starting in 2024 for 5 years (2.8 mil. Ha. total) there will be plenty of sugar available to produce 38 billion liters of ethanol per year indefinitely that will allow Indonesia to meet a 25% ethanol blend goal. This is about 3% of agricultural land and 1% of total land area.

# Agave Ethanol Can Also be Used to Produce Jet Fuel & Sequester Co2

## Agave to jet fuel ie possible using current tech of Axens & sequestration can pay for planting costs

- While there is a huge need for ethanol in Indonesia to blend in gasoline, ethanol can also be used to produce jet fuel. Axens has a process to convert ethanol to jet fuel that we can license and Lanzatech is also building large plants now but is not offering licenses and is a competitor. The ability to produce up to 7 times more sugar than sugarcane means sugar can be diverted to jet fuel and auto ethanol production without negatively impacting sugar for human consumption.

- Growing agave on semi-arid marginal farmland around the world means that high value land is not tied up in production of renewable ethanol or jet fuel and provides millions of jobs for people in semi-arid areas where there is no work. We plan to produce ethanol and composites by planting agave in semi-arid regions of Indonesia where agave can thrive in conjunction with building ethanol plants as the agave mature and are ready for harvest.

- Test planting planned in year 1 on agave to gather data on yields will also support an investment effort in this crop in year 2 for jet fuel. If 250,000 ha. of agave is planted per year starting in 2024 for 5 years (1.25 mil. Hectares) for ethanol for jet fuel there will be plenty of sugar available to produce 19 billion liters of ethanol that will allow Indonesia to meet at least a 25% renewable blend goal in jet fuel and gasoline in 2030. This is 2% of agricultural land & 1% of total land area and will result in various food and fiber by-products as a part of the planting effort. Event when combined with gasoline the total agricultural land area used is under 5% and provides sufficient fuel for both jet and car/scooter needs

- We plan on introducing a program to airlines and their customers called “ZE Food, Fuel Forest for Future” that promotes the concept of carbon neutral flights by planting agave on semi-arid marginal lands that sequesters 60-80 MT of Co2 in the soil and roots while providing a low cost, zero emission feedstock for production of renewable jet fuel in the future.

# Comparison of Yields of Agave Vs. Cane & Sorghum

- Our agave tech supplier is a company that is a specialist in the cultivation of agave in various climates. They have highly advanced varieties of agave and pay close attention to agronomic details and proper plant culture. Their primary business is to support the development of agave businesses and companies producing ethanol from agave.

- Agave cultivars developed by the company, under specific conditions, can produce between 880 to 2000 tons of biomass per hectare, reaching a sugar content of up to 20%. This provides a low cost source of raw materials for production of ethanol and fibers that greatly improves production margins. To be conservative, we have used only the lower end of this production assumption which is their current commercial product. The higher number is based on research completed in greenhouses but is projected from cultivars just now getting planted in the fields. However, we plan on planting as many of these cultivars as possible and may get two times more ethanol than projected.

- Agave has been genetically improved from conventional clones and has a high sugar content (20%) and high yield per hectare. The result is up to 7 times more ethanol per hectare versus sugar cane and 10 times more than corn

- Production costs for agave are similar to sweet potatoes in that planting requires some hand placement of shoots (with tractor support) and there is a long period of maintenance of shoots and replanting to get desired density of the crop. We are growing agave in areas where labor costs are very low and where land values are also low so that delivered feedstock costs remain low and ethanol margins are large when this feedstock is used starting in year 5 (first major harvest is in 5 years). This will make it possible for Indonesia to meet a 25% ethanol goal while providing employment for tens of thousands of people in areas where there are not many other job or agricultural opportunities.

# Comparison of Yields of Agave Vs. Cane & Sorghum

## Variety Y is only in 3rd year of evaluation so data on yields is extrapolated

AGAVE VS OTHER CROPS

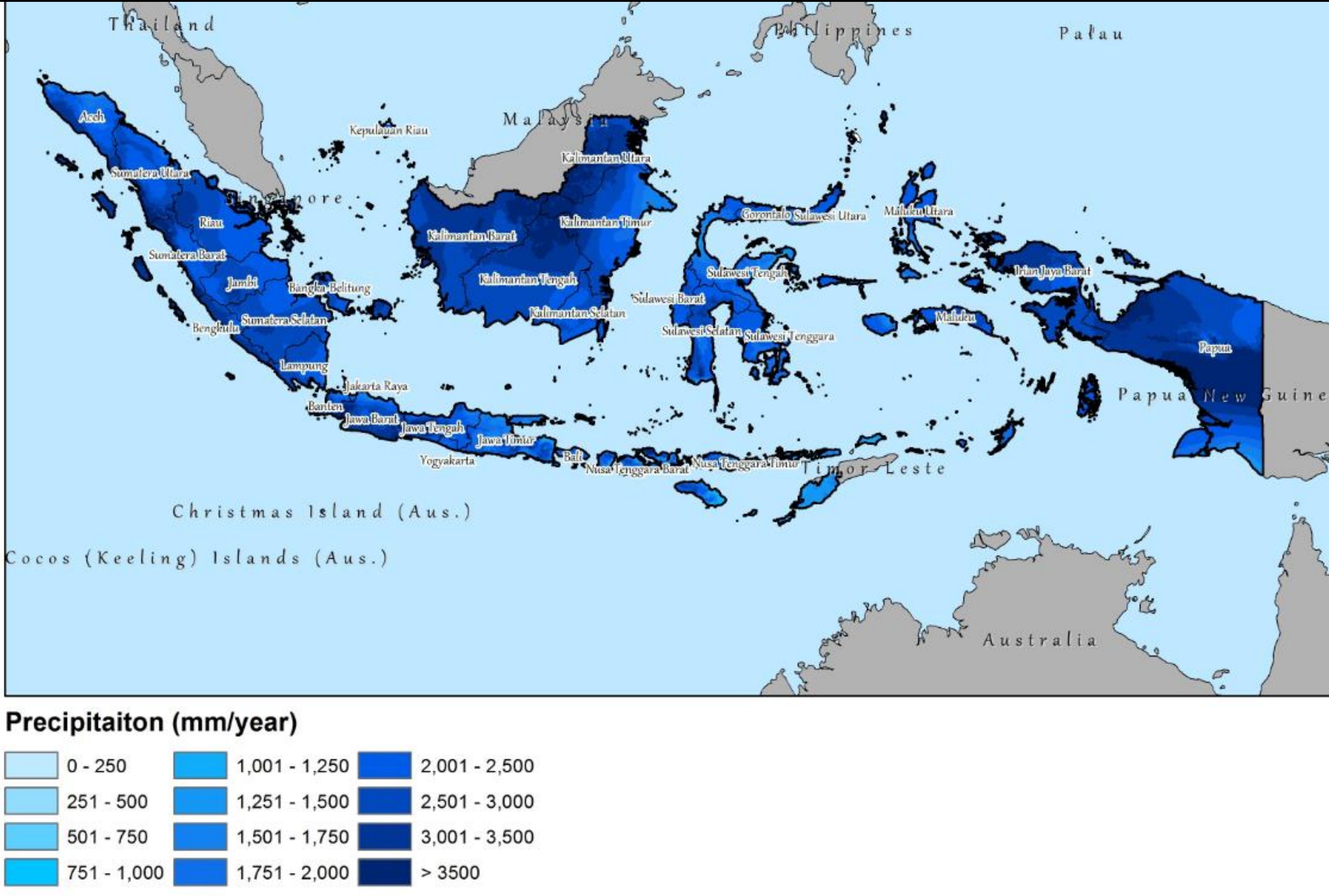
| | agave X | agave Y | sugar cane | energy cane | sorghum |
|---|---|---|---|---|---|
| yield/ha (tons) | 880 | 2000 | 100 | 200 | 70 |
| growth cycle (yrs) | 5 | 5 | 1 | 1 | 0.5 |
| yield/ha/yr (tons) | 176 | 400 | 100 | 200 | 140 |
| | | | | | |
| fermentable sugars % | 20% | 25% | 14% | 8% | 10% |
| sugar/ha/yr (tons) | 35.2 | 100 | 14 | 16 | 14 |
| | | | | | |
| fiber % | 30% | 30% | 25% | 30% | 15% |
| DryMatter/ha/yr (tons) | 52.8 | 120 | 25 | 60 | 21 |
| | | | | | |
| Type land use | semi-arid | semi-arid | optimal | optimal | optimal |
| | | | | | |
| Water requirement (mm/year) | 500 | 600 | 2,000 | 2,000 | 875 |
| | | | | | |
| Fertilizer requirement (N:P:K) | 0:00:00 | 100:50:50 | 300:150:150 | 300:150:150 | 100:50:50 |

# Suitable Growing Areas for Agave in Indonesia

## Best rainfall is 1 meter (1000 mm) to 1.4 meters which is Timor, Sumba, N. Teng.

**AGAVE BEST IN  TO GROW IN SE**

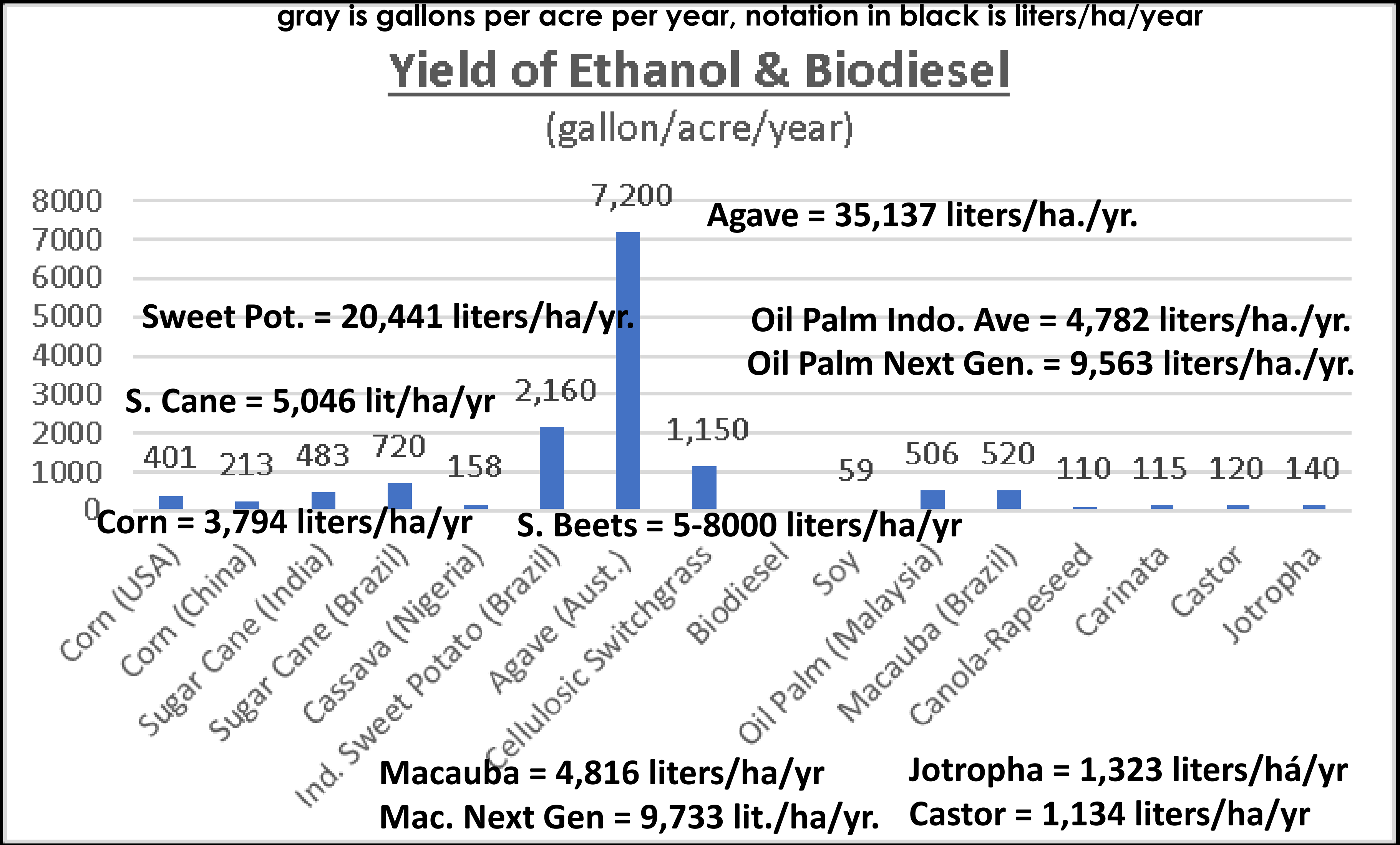
The best climate and rainfall to grow agave is between 1000 to 1400 mm of rain.  This limits the growing area to the Southern part of Indonesia in Nusa Tengara, Sumba and West & East Timor.  This area is very undeveloped and has lots of land available.  It also has sandy-loamy soil which is ideal for agave.  Agave can only tolerate clay up to 30% so this rules out large areas of Indonesia.



# Reason so Much Biofuel Production Possible; Super Yields

## (notation in gray is gallons per acre per year, notation in black is liters/ha/year)

Super large production of biofuel is possible because very high yields means less land is needed and the draw area of a biofuel plant is able to secure much greater raw materials with less land use. High yields also means lower cost for feedstock which provides bigger margins which justifies setting aggressive biofuel blend goals. Planting super high yield palm trees increases yield by 2X. Sweet potato is 2-3X more yield than cane which is 1.25X corn ethanol and agave is up to 7X cane and 10X corn. The other main driver for growth is higher value of super yield crops in reducing carbon emissions and earning LCFS & RIN Credits in export sales.



# SEEDS, SEEDLINGS, PLANTING, PLANTS, SUGAR


Seeds of Agave Tequilana

Greenhouse of Agave Tequilana

Planting systems for seedlings

Year 1 growth

Year 2 or 3 growth

Bulbs with sugar

# Investment Costs per Ha and Sugar Output & Value if Refined:

| | ITEMS | UNIT | QUANT. | UNIT COST | TOTAL (USD) |
|---|---|---|---|---|---|
| | **COSTS** | | | | |
| | Propogating and planting shoots, year 1 | $1 to $1.5 | 5000 | $5000-$7,500 | $5000-7,500 |
| | Fertilizer, Maintenance, Harvest year 2-5 | | | | $1,000 |
| | ***Total Cost for Planting, Maint. & Harvest*** | | | | **$6,000-7,500** |
| | **Investment Ave./yr.** (ave. over 5 years) | | | | $1,200, 1,500 |
| | BIOMASS: Agave biomass total | MT | 880-2000 | | **880-2000** |
| | **NET SUGAR VALUE** | | | Value 8-2022 | |
| | Sugar level at minimum of 20% | MT | 176-400 | $380/MT | **$70,400-160,000** |
| | **NET ETHANOL VALUE** | | | value/lit $1.20 | |
| | Assuming LCFS, RIN & USA sale of ethanol | MT | 88-200 | $1524/MT | **$134,112-$304,800** |
| | **NET MARGINS PER HA. PER YEAR if Sugar** | | | | |
| | Assumes investment in planting & refining | years | 5 | (minus $1350) | **$12,990-31,150** |
| | **NET PROFITS Per HA. PER YEAR if ethanol US** | | | **(agave cost/yr)** | |
| | Assumes investment in planting & refining | years | 5 | **(minus $1350)** | **$25, 472-59,610** |

**Planting of agave to vertically integrate ethanol production can add $25,472 -$59,610 in profits per year for each ha. of agave planted if invest in ethanol capacity to process agave to fuel**

# Land Use: Sugar Cane vs. Special Agave Variety

**Draw Area Requirements for 100 million gal./year ethanol plant; cane vs. agave**

**Yield per Ha. Ethanol:**
S. Cane: 6,813 lit. /ha
720 gal./acre
Agave: 35,137 lit./ha.
3,700 gal./acre

**SUGAR CANE LAND USE:**
Draw area for 100 mil./gal./yr
'sugar cane: ha. – 138,888
Acres - 347,200

**AGAVE LAND USE**
draw area for 100 mil.gal/year
Agave: ha . – 19,841 to 39,682
acres – 48,611 to 97, 241


3.5 to 7 times more draw area and land use impact is required for cane vs. agave. Agave needs much less water (1/3rd) and fertilizer (1/3). The result is 3.5 to 7 times higher carbon benefits from reduced land use change versus sugar cane and much better life cycle carbon emissions from agave versus sugar cane

# Dried Sweet Potato Residues, Glycerine & Agave Fibers Can Produce Biodegradable Plastic and Composite Parts

- Yield boosted Palm Oil, Used Cooking Oil & Animal Fat Can Provide Sutainable Fatty Acids for Biodiesel Plant
- Biodiesel by-product 10% of production is glycerin
- If you produce biodiesel with ethanol (ethyl ester) you do not have toxic impurities
- Dry Sweet Potato residues (15% of production volume) will be available from sweet potato ethanol refinery
- When you can combine sweet potato residues with glycerin you produce biodegradable bioplastic
- Sisal and agave fibers can be combined with biodegradable plastic to make auto parts
- Additional composites from MSW can be added to provide even greater strength
- This composite material is fully biodegradeable and can match the strength of steel


Bioplastic + Sisal Fibers + Agave Fibers = Biodegradable Composite Parts

# Main Issue in Biofuels/Food = Jungles = Why Saving Them Affects Agro/Fuel Profits

## If we are not proactive in preservation we will get blamed for the destruction, if we integrate forest preservation with high yield planting and use carbon credits there will be no ILUC

- One very important issue in producing biofuel in Indonesia is the potential to get blamed for destruction of forests due to increased demand for land for crops that get turned into biofuel. This is called indirect land use change (ILUC)

- When super high yield agriculture is introduced to Indonesia, the 2.5 to 7X yield improvement and huge biomass feedstock for animal feed reduces pressure to use other less efficient feedstocks to produce food and fuel. 70% of food crops are used to feed animals so if the residual of a biofuel plant is a very large biomass quantity (in our case 30% of output and 30 MT per ha. per year) then there is lots of feed & protein to grow huge numbers of animals & the opposite occurs of a glut of feed in the market and shrinking of hectares needed for animal feed crops (corn & soy).

- The importance of getting the positive message of producing FOOD & FUEL conveyed cannot be underestimated. If we are planning to sell biodiesel, renewable diesel or jet fuel in California, US West Coast or Canada then the link between biofuel production and loss of virgin forest needs to be cut completely or penalties for indirect land use change will make it impossible to sell biofuels in these markets. Sugar cane went through a regulatory balancing act, with initially no indirect land use change, then getting it included and Co2e reduced to 40% before finally convincing CARB their science was flawed so now there is no ILUC and Co2e reductions are 80%+.

- Our suggestion for Indionesia is simple and can be very effective. We suggest the country undertake a serious effort to preserve forests by offering to provide to the indigenous tribes the tools to protect their land from illegal logging and mining using drones, satellite surveillance, internet at villages and through getting support from monetizing the value of the preserved forests and using it to back a national digital crypto coin and global carbon credit trading program.

# GCarbon Coin: Using Tokens/Coins to Reforest/Preserve Amazon & Indonesia

## Direct marketing of Co2 Credits to Consumers/Corp's to be Co2 Neutral

Capture value of intact forest & reforesting in a coin

Distributed ledger to protect & retire credits

Government can monetize jungle carbon in national crypto coins


Crypto Coinholders trade carbon credits for discounts

Tokens distributed to govt., residents, indigenous, market

Monetize carbon & minerals in intact forest

Funds from token sales to plant trees, save jungles

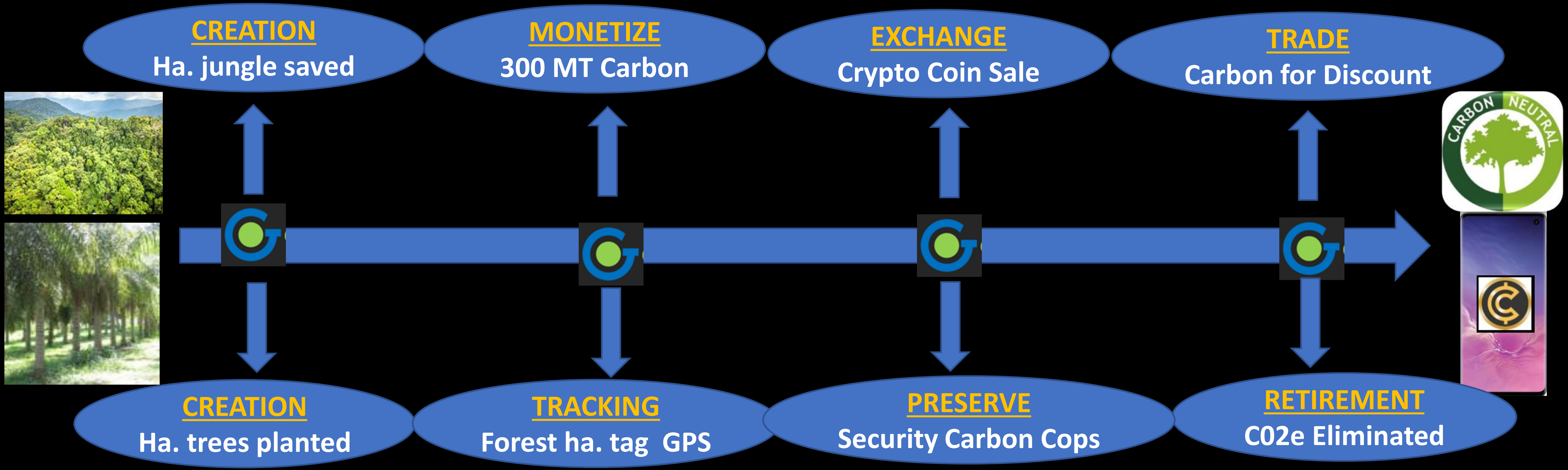
Forest Carbon & Gold backs value of token

# Why Blockchain for Carbon?

## Immutable Recording and Deleting of Carbon Credits, Permanent Securitized Token

Carbon credits created from 50 year commitment to preserve jungle or plant & care for tree used to reforest
Each ton of carbon tied to specific ha. of jungle saved or tree planted and cannot be altered without consensus
When carbon credit used for Co2 Neutral product blockchain finds ha. of jungle or tree, retires right carbon amount
GPS and drones & satellites used to confirm unaltered status of jungle or tree planted so carbon credit is real & permanent
Same system can be used for reforestation of areas illegally logged with native trees or agave planted in semi-arid areas

## HOW IT WORKS



# Blockchain Lowers Costs & Improves Credit Quality

## Normal Method to Market Carbon Credits is CDM - It Does Not Work for Anyone

**Carbon credits have traditionally been marketed at a wholesale level via Clean Development Mechanism (CDM)**
**Value of carbon credits is very low because they are sold in bulk, data access is difficult, bureaucracy level is high**
**When you only earn $1 per ton, the cost to meet the requirements for Carbon Credits makes it impossible to profit**
**Project developers must submit a 200 page document, hire consultants to confirm, file reports annually & other costly steps**
**Even with all these steps, because credits are bundled and developers hidden, end buyers have limited confidence in credits**

## WHY BLOCKCHAIN IS BETTER

**Carbon Credits Are Real, Permanent, Quantifiable, Verifiable & Additional and Buyers Believe Process is Valid**

### CREATION
**Immutable Record**

Carbon credits are real due to immutable record that's created in a block for each ha. of land preserved or planted with trees that can be verified through GPS satellite record and drone runs. This record is impossible to alter without consensus

### TRACKING
**Secure Movement**

Carbon credits are moved from creation to use via a secure transfer record that requires verification from multiple parties and cannot be duplicated. This insures that the credit moves from record to use with no changes so high confidence

### EXCHANGE
**Tie User to Credit**

There is a direct link between buyer of credit and original record of ha. saved or tree planted. This builds confidence in users while also demonstrating that the credit is additional and that resources are available to preserve the forest & trees

### USE & RETIRE
**No Double Count**

When carbon credits are sold and retired the blockchain ledger insures that the record is deleted for the credit so it is permanently retired and not double counted. This leads to strong confidence in carbon credit by end buyers such as corporations seeking to offset product emissions & consumers

# SIMPLE: Planting 4 crops on 170 million ha. = 75% less jet, diesel & gas use

## Macauba to reforest & agave semi-arid, high yield pot. & palm, eliminate 75% petro use in10 yrs

Global diesel consumption in 2019= 1.42 trillion MT

Planting 1/2 Brazil's grazing land or Amazon land deforested (84 million ha.) with macauba = 844 billion MT of veg. oil/year (10 MT oil/ha) @ 90% energy or 50% of diesel use in 8 years

Cost of planting = $206 trillion which could be paid over 10 years with $15 MT ($2 barrel) carbon fee on diesel globally

Global jet fuel consumption in 2019= 13 Quadrillion BTU

Indonesia can achieve 25% renewable jet fuel by 2025 just by doubling yield of palm plantations or with agave ATJ

Cost of planting is about $1000 per ha. per yr. but huge harvest

Global gasoline consumption in 2019= 1.37 trillion MT

Planting of agave on 70 million ha. semi arid land globally @ 700 MT/ethanol/ha./yr) = 2.45 trillion MT of ethanol yr. @ 75% energy of gasoline = 100% of gasoline use in 8 years

Cost of planting = $180 trillion which could be paid over 10 years with $13 MT ($2 barrel) carbon fee on gasoline globally

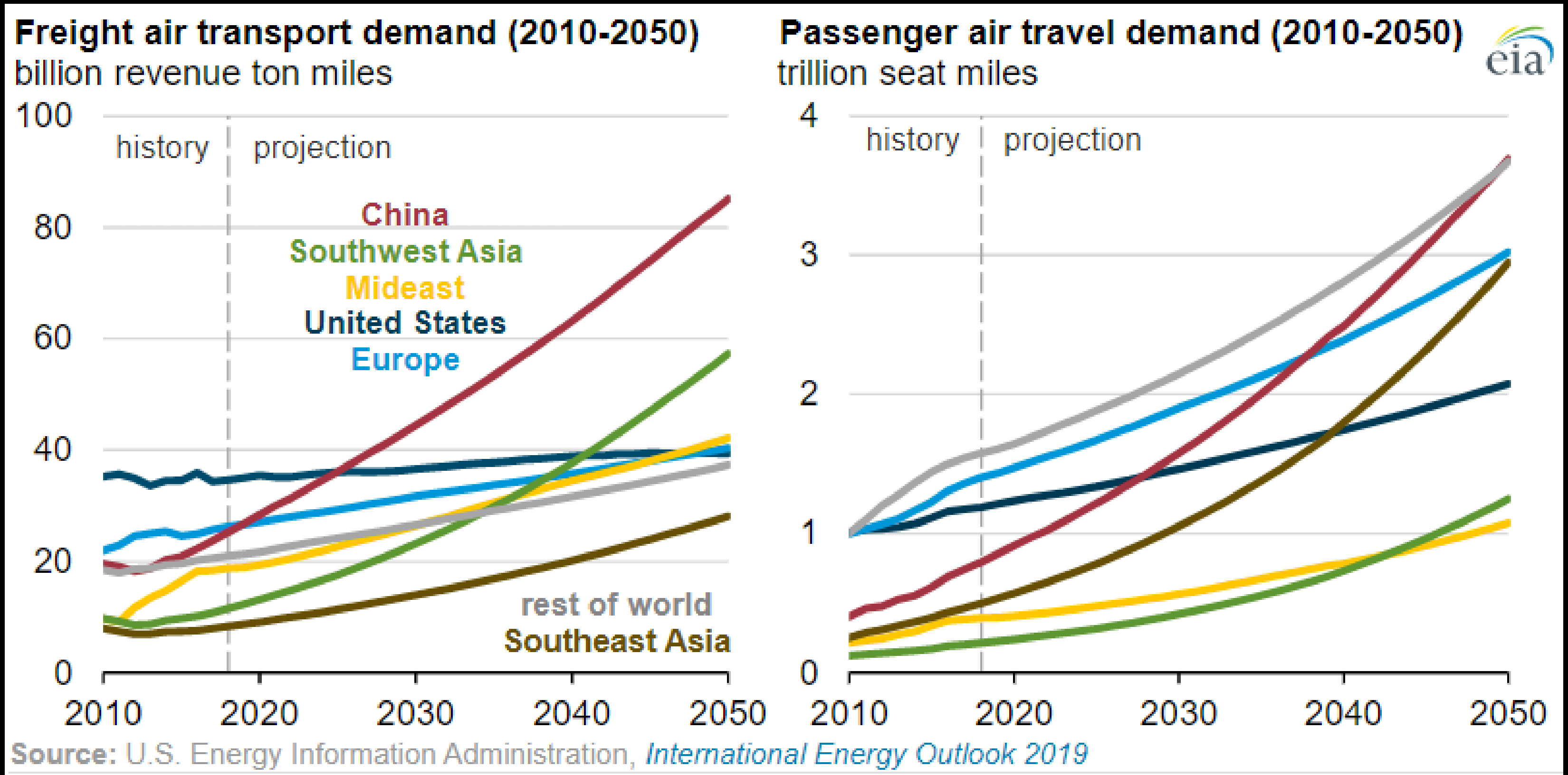
Other alternative is to plant sweet potatoes at 100 MT per ha. per yr. that provide huge quantities of food & fuel

**Sequestration of carbon of 25 MT/ha macabua = 2.1 trillion MT**

**SHIFT TO HIGH % OF RENEWABLE FUELS BY 2030 = MULTIPLE SOLUTIONS NOT JUST HYDROGEN & ELECTRIC, AND GLOBAL EFFORT TO INCLUDE BIOFUELS IN ALL PETRO FUELS & TAX PETRO**

**Sequestration of carbon of 60 MT/ha/yr. agave = 4.2 trillion MT/year**

# Jet Fuel Demand Rising Rapidly, Especially in China & SE Asia:




## China & SE Asia have the greatest growth in jet fuel demand and so need to implement sustainable jet fuel quickly

US Energy Information Administration (EIA) expects fuel consumption by air transport to increase at a faster rate than any other liquid transportation fuel. Between 2019-2050 global jet fuel use doubles from 13 Quadrilion BTU's to 29 Quadrilion BTU's (more than double). Countries in Asia are the largest source of future jet fuel demand and China and SE Asia represent more than half of global growth (59%) between 2019-2050. China's growth more than triples from 1.6 quads to 6 quads in 2050.

# 25% Ethanol Blend DOES NOT Mean Loss of Efficiency with Advanced High Pressure Engines & Has only a Minimal Cost Impact ($25/car):

## ETHANOL

25% less energy density in fuel

11 more octane points

## CHANGE ENGINE TIMING

If you optimize high pressure engine timing for ethanol octane

## NO LOSS OF EFFICIENCY

Higher Octane makes up for lower energy so efficiency at 25% is same

**Don't Re-invent the Wheel But Shift to Better Feedstocks**

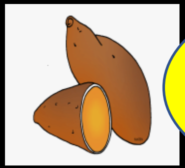
**Brazil has had Flex Fuel Vehicles & 25% ethanol in gasoline for 43 years**

Brazil has had Pro-Alcohol program since 1975 & well developed auto industry

Indonesia should require all new car and motorcycle engines be flex fuel in 2024

**700 MT/ha/yr**


Gradually increase ethanol content in gasoline from 5% to 25% by 2030 & offer ethanol at stations



**100 MT/ha/yr**

Engine & vehicle cost difference for ethanol flex vehicle is within $25 at manufacturing level

**A shift to 25% ethanol globally would reduce transportation GHG emissions by about 35% & global emissions 10%**

# Goal for World = 25% ethanol blend -85-100% Co2 by 2030

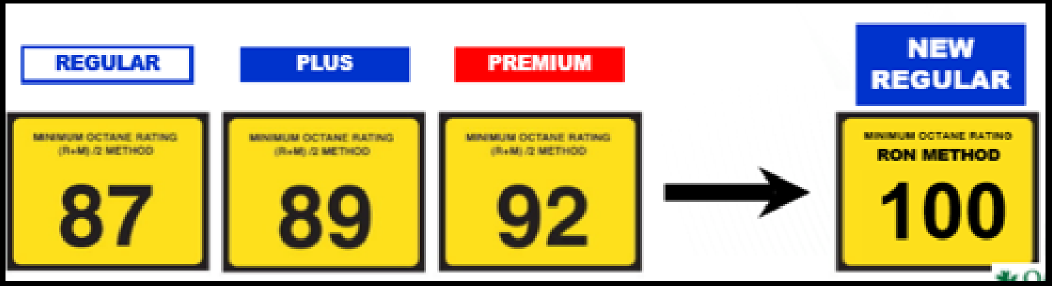
## High Co2 benefits (-75-100%)& high yield/low land use means 25% ethanol feasible in Indonesia

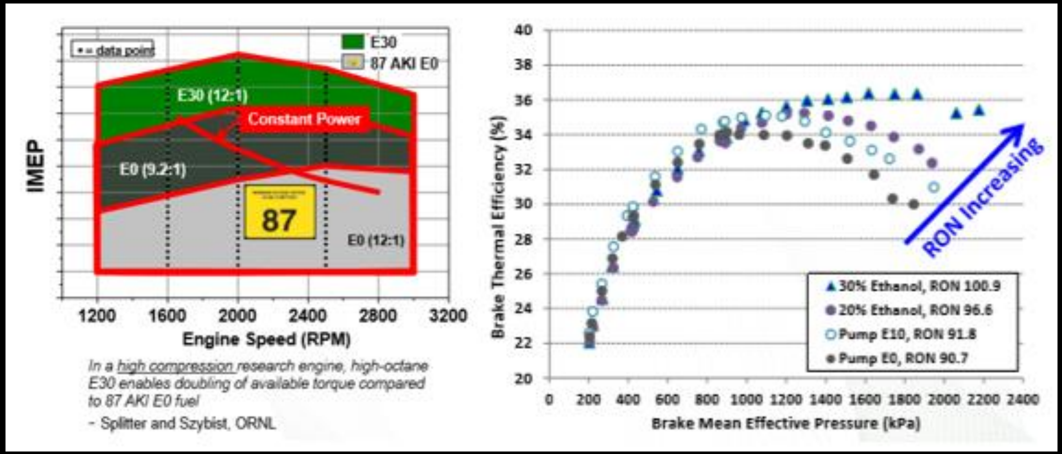
High octane of ethanol allows engines to be optimized for this fuel by adjusting RPM so that available torque can be doubled in high compression engines without engine knock

Higher torque means higher fuel economy so that there is no efficiency penalty from higher blends of ethanol even though the energy content of the fuel is lower. Existing engines can easily be modified to accept 25% blends of ethanol & benefit from improved performance/efficiency

High yields/acre of  sweet potatoes & agave makes its feasible to grow sufficient feedstock to meet a 25% ethanol goal by 2030  using only      million hectares if potatoes or only   million hectares if met by agave.  This is only a small % of available Indonesia crop land and would result in millions of tons of feedstock for cattle, chickens, etc. (i.e. bigger food benefits than current system).  Even less agricultural land is needed if agave grown in semi-arid land in Southeastern Indonesia.

It is only possible to consider 25% ethanol in gasoline if carbon reductions are at 70-85% or it does not solve climate problem



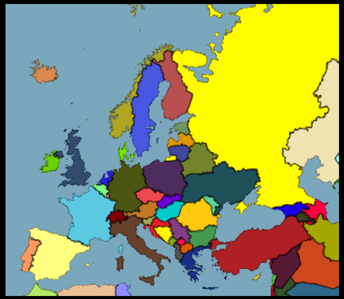




**25% ethanol in all Indonesia gasoline will require**
**38 Billions of liters of  new ethanol capacity**
**-75% Co2 reduced = millions of tons Co2/yr. savings**
**Market value of hundreds of billions of USD**

# 3 Country Consortium Could Challenge World to Reach 25-50% Ren. Fuel by 2030

| | | | |
|---|---|---|---|
| **2021** | 12% biodiesel 7.5 bil. Liter<br>25% ethanol , 35 billion liters | 30% biodiesel 9.2 billion liters<br>0 liters ethanol | 5% biodiesel 6.8 billion liters<br>11% ethanol, 60 billion liters |
| **2025** | 16% biodiesel 10 bil. liters<br>5% HVO/ATJ jet fuel 150 mil. liters<br>50% ethanol (FFV & blend) 70 bil. lit | 40% HVO/biodiesel 12 bil. liters<br>15% HVO/ATJ jet fuel 875 mil. liters<br>2% ethanol 3 bil. liters | 15% HVO/biodiesel 20 bil. liters<br>4% ren. Jet fuel, 5.7 billion liters<br>18% ethanol 105 bil. liters |
| **2030** | 28% HVO/biodiesel 17.5 bil. liters<br>10% HVO/ATJ jet fuel 300 mil. liters<br>75% ethanol (FFV & blend) 105 bil. liters | 50% HVO/biodiesel 15 bil. liters<br>50% HVO/ATJ jet fuel 2.8 bil. liters<br>25% ethanol 38 bil. liters | 30% HVO/biodiesel 40 bil. liters<br>8% ren. jet fuel 11.4 bil. liters<br>25% ethanol 150 bil. liters |

**Can Other countries Blend 25% renewable fuel by 2030?**

# MAJOR POLICY OBJECTIVE: Deep Discount & Renewable Tax

## Get a Majority of G20 Countries to Agree on Discount Pricing on Russian Oil & Fertlizer with Import Duty to Finance Rapid Transition to Renewable Fuels & Extra Food Production

RUSSIAN WAR has raised petroleum & food prices globally
G7 is Requiring Deep Discount on Russian Fuel & Crude

**BOYCOTT SHIFTS TO DEEP DISCOUNT**





**AGREE TO DEEP DISCOUNT RUSSIAN FUEL & FERTILIZER**






**SPECIAL TAX TO CONTROL TRADE**

IMO tracks vessel movements

Special Import Duty on Russian Fuels, Fertilizer

Trust Fund to Invest in Food & Renewable Fuels

**FOOD & RENEWABLE FUEL FUND**

Invest in Food & Renewable Fuel Production


Meet 2030 Climate Goals & Lower Food/Fuel Prices

# Paradigm Shift Needed for 25% Global Ren. fuel, 25% More Food:

Shift to new crops essential as well as improved agricultural efficiency to feed 20% more people & cut Co2 emissions by 30%

## Existing Biofuel Crops That Could be Expanded if Improved

| Palm Oil | Current Paradigm | Shift Needed by 2030 |
|---|---|---|
|  | Average yield in Indo. only 4 MT/oil/ha. | Increase yield to 8 MT/oil/ha = 75 mil. MT new oil |
| Sugar Cane  | Average yield 77 MT/ha. Brazil 50 MT/ha Indo. | Global Average needs to match Brazil = 50% more ethanol . |
| Corn  | Average yield in Indo. only 6 MT/ha. | Best yield achieved in Mexico is 32 MT/ha. in a desert, 48 MT in USA |
| Sugar Beets  | Ave. yield/ha. is high but costs are high | If production costs can be reduced it might play larger role |
| Wheat  | Major source of biofuel in EU but not elsewhere | Large quantity of biomass for 2nd generation biofuels |

## New Biofuel Crops or Processes Needed on Massive Scale

| S. Potato | Current Status/Barriers | Opportunity by 2030 |
|---|---|---|
|  | 100 MT/ha/yr Need crop results in Indo. | Produce 10% ethanol & double meat production |
| Agave   | 180 MT/ha/yr & up to 1000 MT at year 5 | 400 MT/ha/yr. so 25% ethanol possible for Indo |
| Waste: MSW | High plant capital costs but getting better | Integrated waste sorting & biofuel production, no ag. |
| Sorghum  | High yields need to be duplicated globally | Rotate with sweet potatoes to get high yield multi-year |
| Ind. Gases: CO & CO2 | Lanzatech has great process for steel gas waste | Convert Co2 to fuel using Fischer Tropsch/Plasma Arc |

# If You Want More Food & Fuel You have to Protect Forests:

**No global concensus on accelerated investments in increased food & fuel production without forest protection**

Cannot expand food & fuel production at expense of forests or no carbon benefits

Cannot stop illegal logging and mining if you do not offer alternative employment

Instead you need to invest in high yield crops or double the yield of current crops

Sweet potatoes
100 MT/ha./yr.
30 MT/ha biofuel, 30 MT feed


Agave
400 MT/ha./yr.
40 MT/ha/yr biofuel, 70 MT feed

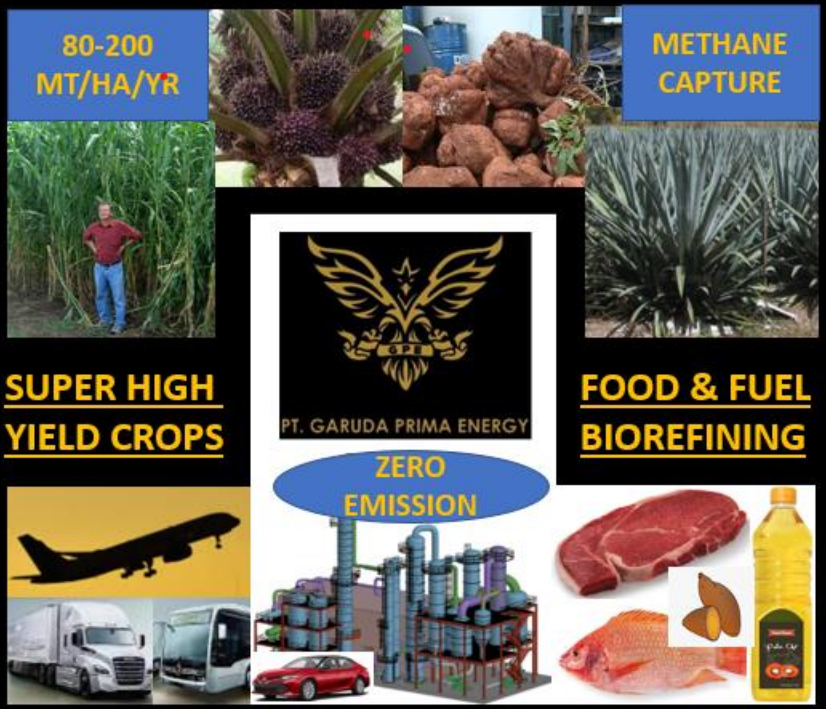
Palm Oil
30 MT/ha./fruits, 10 MT oil
75 mil. MT of new oil

Macauba Silvapasture
25 MT/ha./fruits, 10 MT oil
160 mil. Ha. available grazing land in Brazil co-used with cattle

# Thanks for your Attention:

# Contact Information

## *GP Group*




AUTHOR

Director, Sustainable Food & Fuel Div.
Bill Wason
Tel: +1 786 213 4675 (w app)
Tel: +62 821 2231 3367
billwason@GP Groupindonesia.com
billwason2@gmail.com

OFFICE

GP Group
WORLD CAPITAL TOWER 17th floor
Jl. Mega Kuningan Barat No.3, RT.5/RW.2, Kuningan, Kel. Kuningan Tim, Kecamatan Setiabudi. Kota Jakarta Selatan, Provinsi DKI Jakarta 12950 Indonesia +62 21 50918017