2024 ICAO REGIONAL SEMINAR ON ENVIRONMENT

In collaboration with CAAT
สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

APAC Region
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Bangkok, Thailand

ICAO
ENVIRONMENT

ACT SAF

CORSIA

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Indonesia's Potential for SAF Development

• LARGE AVIATION MARKET

- 251 Airports + 50 New Airports
- 65 million domestic air passengers + 29 million international passengers
- 304 Domestic routes operated by 17 airlines
- 125 international routes operated by 10 domestic airline & 54 foreign airline
- Ref: DGCA Data Per 2023

RESOURCE ABUNDANCE

- Indonesia is the world's largest producer of palm oil. In 2023 the total production reached more than 50 million tons or around 59% of the global production.
- estimated 3.9 million tons of Used Cooking Oil production in 2023
- National energy company's (Pertamina) refineries are projected to reach a SAF production capacity of 238 million liters/year by 2026.

Significant Revenue

- Potential annual profit US $ 750 million for Pertamina from domestic SAF demand and export surplus
- Assumption: SAF price of US $2,845.75/ton and 30% net profit margin

Ref: Pertamina, Coordinating Ministry for Maritime Affairs and Fisheries & TBI analysis

Information and Views Regarding The Need and Opportunities for Aviation Decarbonization Projects to Have Better Access To Financing and Investment: Case In Indonesia

Sustainable Aviation Fuels (SAF) is an aircraft fuel that has the potential to reduce greenhouse gas (GHG) emissions, as well as being one of the clean energy. The use of SAF has not been able to be carried out commercially due to several obstacles such as the availability of raw materials, economy, and facilities and infrastructure.

Opportunities in the development of SAF, with one of them being to meet the high demand in the domestic market and the international market. Another is the development of the potential of domestically available raw materials.

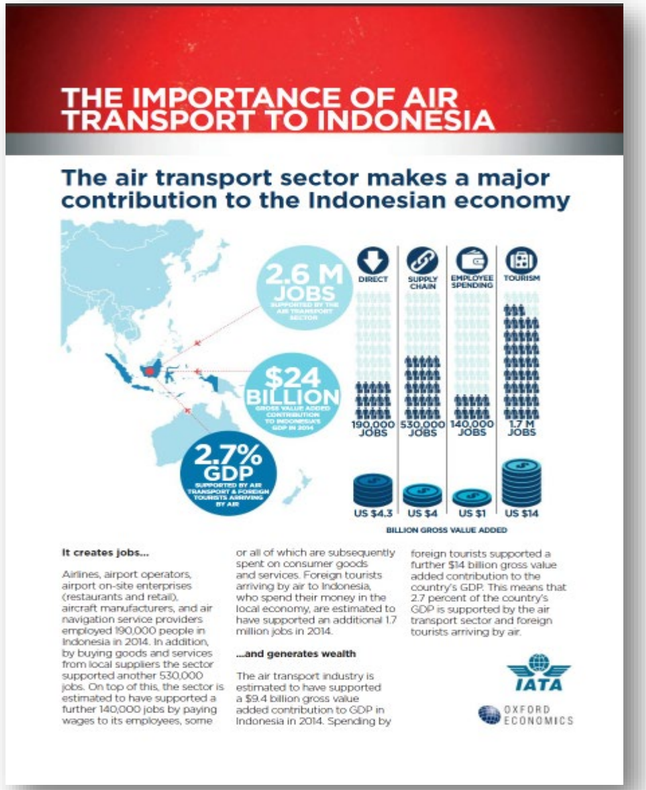
Since 2020, Indonesia has conducted J2.0 and J2.4 co-processing trials in Cilacap, and in Q3 2021 a J2.4 flight test using a C235 aircraft was carried out. In Q3 2023, a flight test using J2.4 has been successfully carried out on PT Garuda Boeing 737-800 commercial aircraft. The results of the flight test showed that there was no difference in response from engines that used fossil avtur.

Challenges in the Development and Implementation of Decarbonization

The roadmap for aviation decarbonation is currently still under discussion for gradual implementation of SAF from 2027 to 2060, both for domestic and international flights.

Increasing market potential and financing schemes as a critical solution for reducing carbon emissions to boost local feed stock, i.e. UCO, PFAD, POME, Coconut Non-Standard, in greener aviation.

Fulfillment of certification criteria to meet the LCA, ILUC, LCF values, as well as RSB and ISCC.

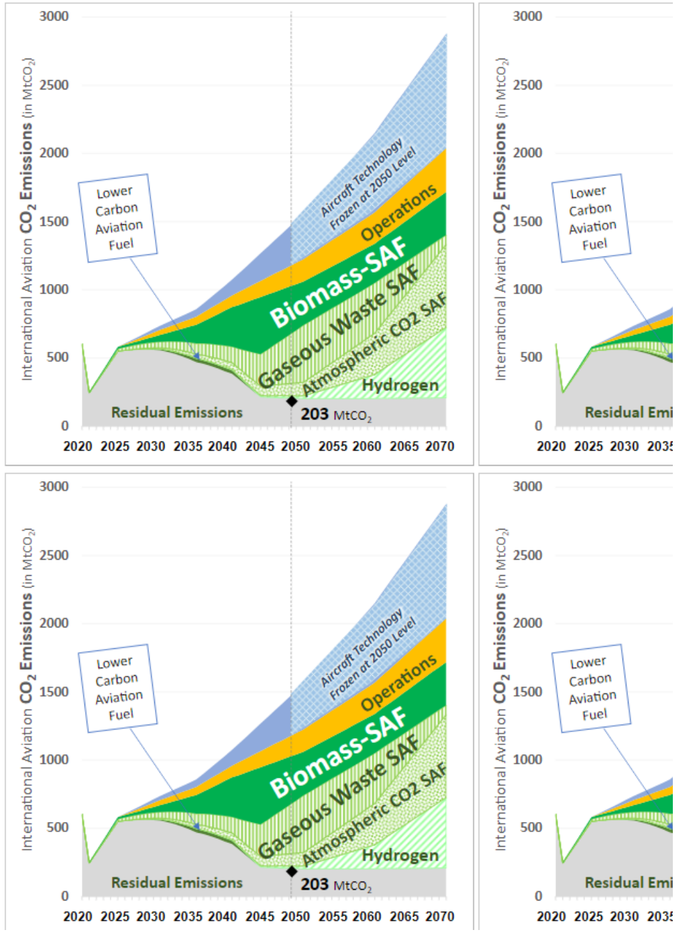


Unlocking the Potential of Aviation Decarbonization in Indonesia

The use of SAF has the opportunity to increase national energy security and reduce dependence on fossil-based energy. The challenges faced in the development of SAF must be solved by stakeholders, namely the Government, Airlines, Raw Material Producers and Processors, and International Institutions. This will be the key to accelerating the implementation of aviation decarbonization in Indonesia, which will harmonize the balance of economic growth and environmentally friendly development.

The preparation of a SAF or aviation decarbonization roadmap for commercial aviation needs to be completed immediately to encourage the production at an affordable economic price, so as to ensure that the development of aviation decarbonization is an important part of the transition to clean and environmentally friendly energy.

Innovative financing mechanisms and strategic partnerships can open up capital, both on the upstream side in the supply of raw materials and on the downstream side in processing. This is necessary for aviation decarbonization initiatives, so that it can accelerate the use of environmentally friendly energy.



The Role of Government Policies and Incentives

Regulatory Frameworks, with clear and consistent policies to development of SAF such as road map, pricing, incentives.

The provision of central and local governments incentives to companies such as tax holiday, tax credits, tax incentives for research and development, infrastructure assistance to attract bussiness, boost invesment, and create jobs.

Public-Private Partner to make such collaboration effors between the government and private sector to scale up SAF industries.

Government policies directly influence the economy by implementing various measures, such as tax policy, fiscal policy, interest rate policy, tarrifs and subsidies to support SAF.

National Strategic Projects and Special Economic Zones Policy to give priority to projects and regional development in a region through the provision of ease of licensing, land acquisition, spatial planning, and taxation (tax holiday, tax allowance).

Collaboration Between Aviation Industry and Financial Institutions

Green initiatives, including SAF, should be supported by the finance sector to increase investment as a transition collaboration between the aviation industry and the financial institutions.

Developing knowledge sharing to foster dialogue and exchange of expertise between the two institutions.

Developing joint frameworks to assess and mitigate the risks associated with aviation decarbonization projects and programs.

Indonesia’s Financing Strategy for SAF Development Project

Promote the SAF development project to become a National Strategic Project

- Provide business support to simplify the process, enabling rapid operation and production scale-up to meet growing demand.
- Giving Fiscal Incentives and Public Financing such as: Utilize capital grants, low-interest loans, and tax incentives to enhance SAF project feasibility

Incentive from Fund Management Agency

- The Indonesian Palm Oil Plantation Fund Management Agency (BPDPKS) manage the tax from Palm oil export and its derivatives. The fund is used to give incentive for the Biodiesel development in Indonesia

Incentive from Carbon Tax

- Develop a carbon tax mechanism that applicable to high-emission industries (e.g. oil & gas, cement, energy, transportation, and mining sectors)

Investment from Financing Body

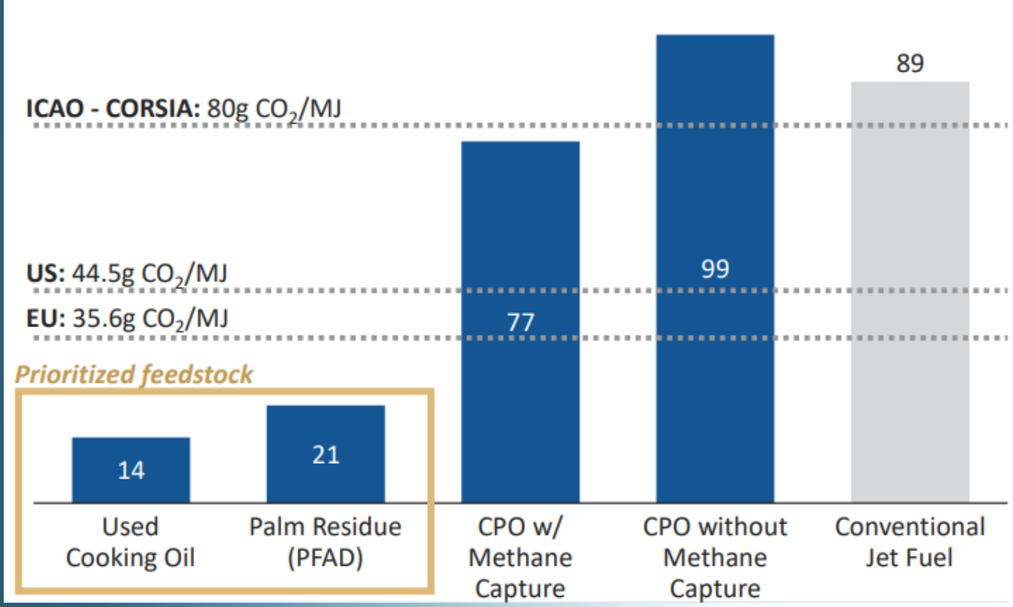
- Establish mechanisms, technical aspects, and policy incentives for SAF project investments.
- Financial Services Authority of Indonesia (OJK) is developing the Indonesia taxonomy for sustainable finance to classify “green” activity to get allocation of sustainable financing investment

Adopting Green Airfare Mechanism

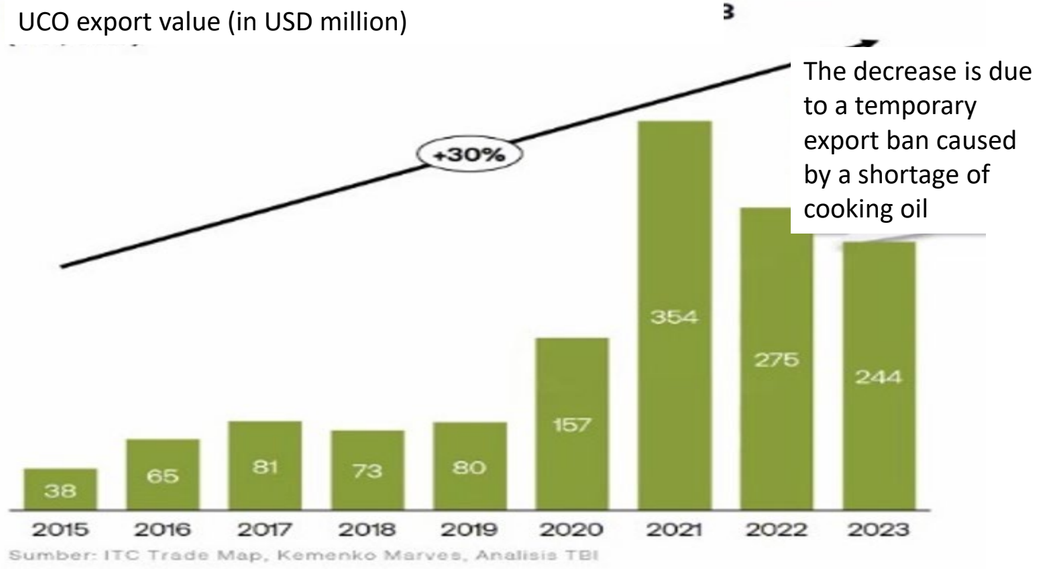
- Airlines offer passengers the option to purchase "green airfare" tickets, which are priced higher to support decarbonization effort through the usage of SAF

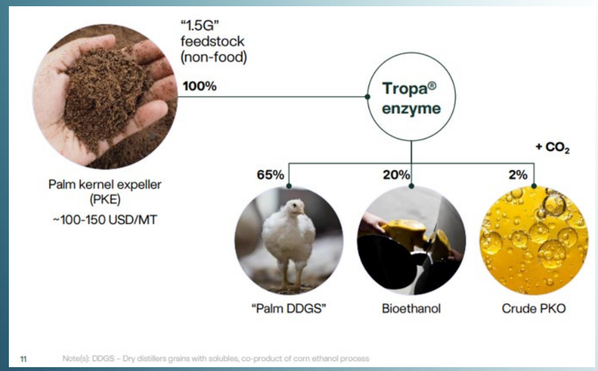
SAF Feedstock Potential In Indonesia

Considering the ICAO document CORSIA Default Life Cycle Emissions Value for CORSIA Eligible fuel, the potential SAF Feedstock in Indonesia focused on PKO, UCO and PFAD



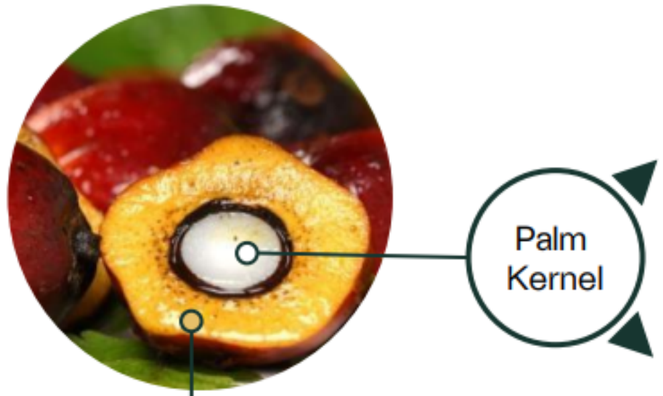
95% UCO in Indonesia is exported with the export value increase by 30% yearly average





- Indonesia considering to propose Palm Kernel Expeller (PKE) as a new feedstock to be listed for CORSIA eligible Fuel
- PKE is a by-product of the palm oil extraction process and can be used as a raw material for animal feed production.

Palm Kernel Expeller (PKE) as one of the potential ethanol raw materials



Crude palm kernel oil (CPKO) — *~5 million MT/y, ~1,200 USD/MT* → Oleochemicals (e.g. personal care)

Palm kernel expeller (PKE) — *~6 million MT/y, ~120 USD/MT* → Cattle feed

Crude palm oil (CPO) — *~45 million MT/y, ~600 USD/MT*

~90%

of PKE from Indonesia is exported to countries like Netherlands, New Zealand, and China

What is PKE

- PKE is a low value by-product, only ~1/10 the value of CPKO.
- The high fibre content makes it unsuitable for domestic poultry diets.
- The fibre is primarily galactomannan and cellulose.

Protein	16%
Fat	7%
Fibre	70%

10 Source(s): GAPKI, USDA 2022

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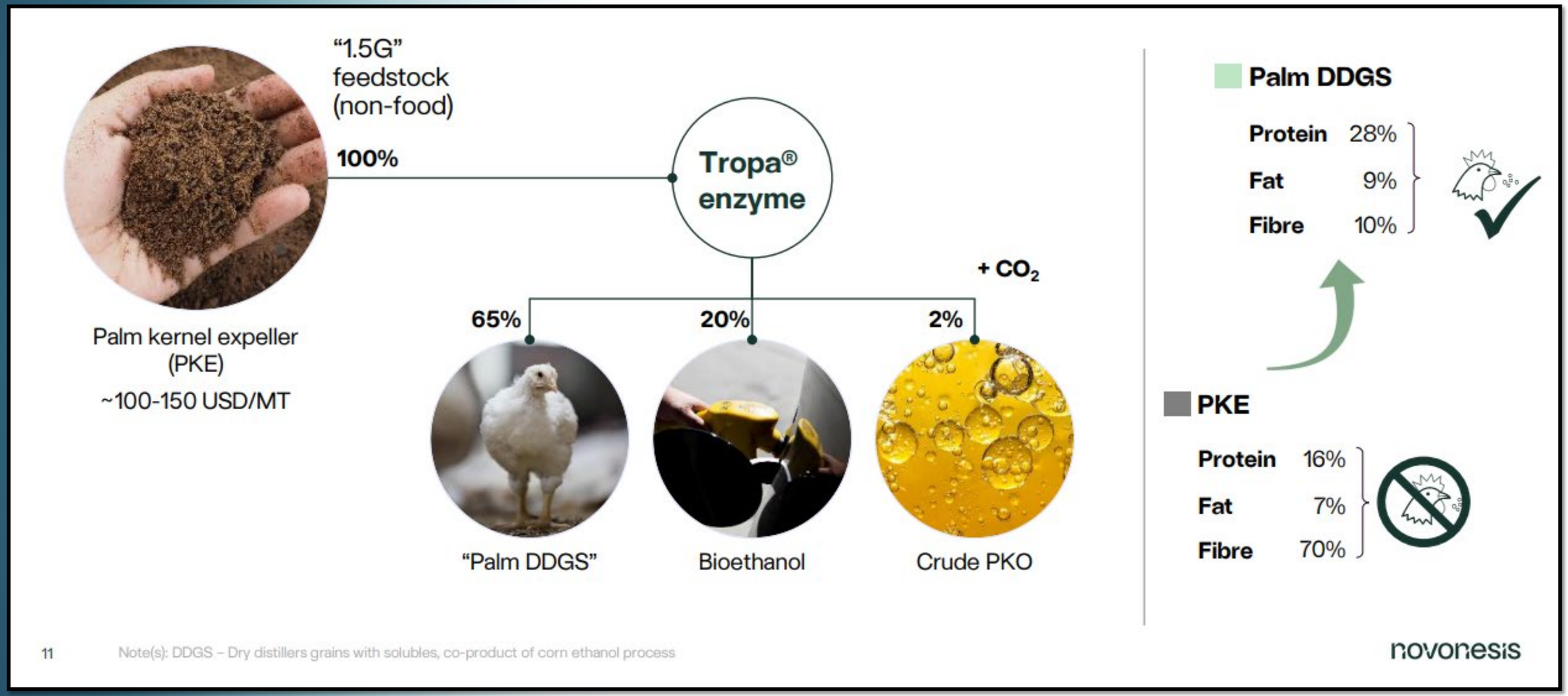
PKE can be converted to ethanol and high-value poultry feed



Opportunities for PKE Utilization

Energy security

PKE bioethanol is a low hanging fruit technology for abundant feedstock

Up to 250 Liter bioethanol can be produced per MT of PKE

IF we convert all PKE in Indonesia with enzymes:
(assume 6 million MT PKE)

1.4 million kL/year
bioethanol can be produced locally

For illustration...

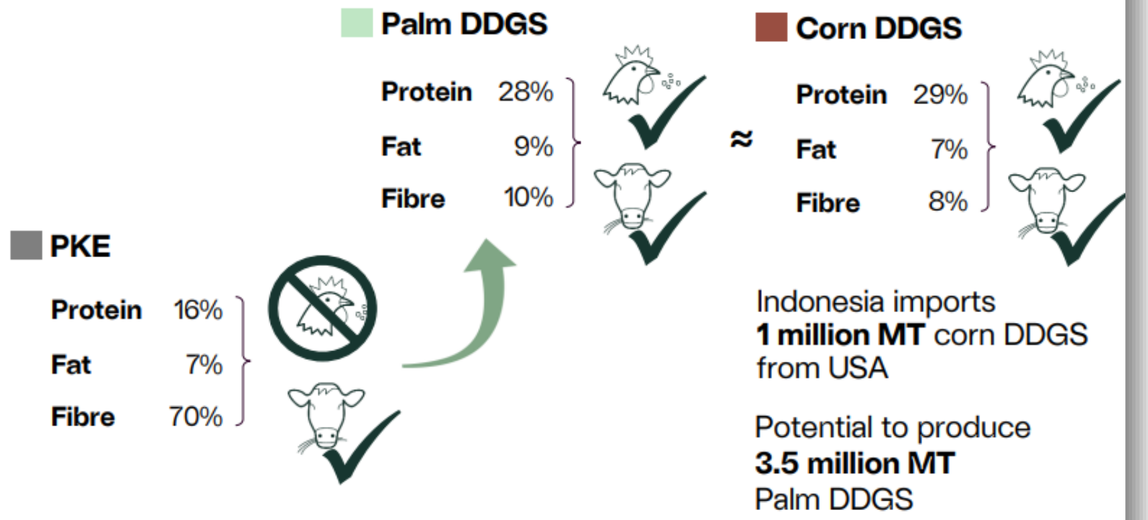
If we use E5 blending requirement as benchmark, which needs approx. 2.3 million kL/year bioethanol, this is equivalent to...

60%
of E5 blending requirement

PKE is readily available and aggregated	Reduce dependency on molasses and other food	"Bridge" while other tech matures

Food security

Enables production of higher value feed suitable for poultry sector



Indonesia imports **1 million MT** corn DDGS from USA

Potential to produce **3.5 million MT** Palm DDGS

Improve local feed supply robustness	Import substitution of corn and soybean	Forex savings for feed industry

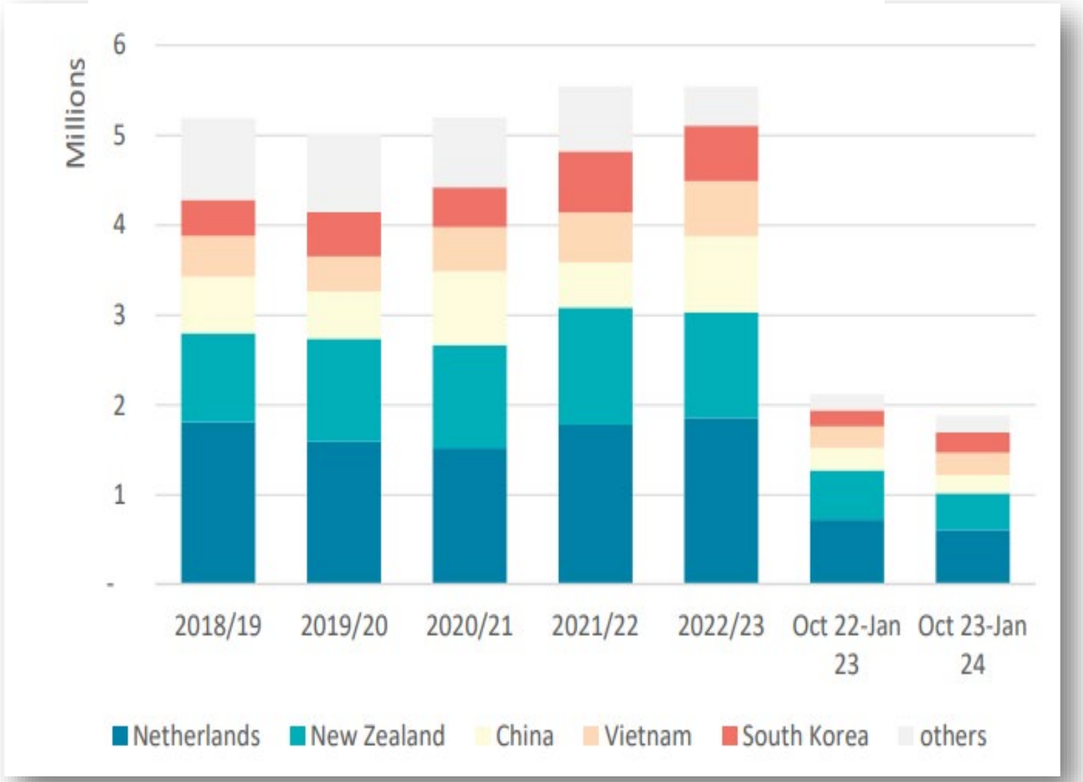
Indonesian Palm Kernel Meal

- Palm Kernel Meal (PKM) production in 2024 is estimated to reach 6.45 million tons.
- Exports from 2022 to 2024 are expected to exceed 5.5 million tons per year, with the largest export destinations being the Netherlands, New Zealand, China, Vietnam, and South Korea.

Production, Supply and Distribution for Palm Kernel Meal 2022/23 – 2024/25

Meal, Palm Kernel	2022/2023		2023/2024		2024/2025	
Market Begin Year	Oct-22		Oct-23		Oct-24	
Indonesia	USDA Official	New Post	USDA Official	New Post	USDA Official	New Post
Crush	11,880	11,880	12,060	12,030	-	12,225
Extr. Rate, 999.9999	0.53	0.53	0.53	0.53	-	0.53
Beginning Stocks	297	297	299	299	-	374
Production	6,248	6,248	6,344	6,325	-	6,450
MY Imports	-	-	-	-	-	-
Total Supply	6,545	6,545	6,643	6,624	-	6,824
MY Exports	5,541	5,541	5,650	5,500	-	5,700
Industrial Dom. Cons.	-	-	-	-	-	-
Food Use Dom. Cons.	-	-	-	-	-	-
Feed Waste Dom. Cons.	705	705	640	750	-	800
Total Dom. Cons.	705	705	640	750	-	800
Ending Stocks	299	299	353	374	-	324
Total Distribution	6,545	6,545	6,643	6,624	-	6,824
	-	-	-	-		-
(1000 MT) ,(PERCENT)						

Indonesia Palm Kernel Meal Export (in MT) 2018-2024



Source: Trade Data Monitor, USDA

Thank You

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