Renewable Energy perspectives in the Oil Palm Agribusiness

2021

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CON EL APOYO DEL FONDO DE FOMENTO PALMERO

ACEITE DE PALMA 100% COLOMBIANO

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Business Strategy and Marketing Unit

Promote and foster a fluid and efficient commercialization of oil palm products, through in-depth market analyses, differentiated marketing strategies, high-value business development initiatives and collaboration in public policy making.

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fedepalma is the Colombian National Trade Association of Oil Palm Growers and Palm Oil Producers

It was founded in **1962** and currently strives for the **competitiveness of the oil palm sector** and the **general well-being** of affiliated **oil palm growers, their families and communities** through a value proposition that contributes to improve the phytosanitary status, increase productivity and optimize profitability of the oil palm, **consolidating palm-growing as a sustainable business** and strengthening the **institutional framework** of the oil palm sector.

cenipalma is the Colombian Oil Palm Research Center

It was created in **1991** and is the **technical and scientific support for Fedepalma**, through three major fields of work: **Research**, **Extension** and **Technical Services**.

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Colombia is the fourth biggest producer of palm oil in the world and the biggest in America, concentrating its efforts on economic, environmental and social sustainability.

2021

>6,000
Oil palm growers
86% of them smallholders

590,188 ha
Planted area

More than 195,000
workers

Production volume 2020
1.5 million
Tonnes

51%
local sales

- Edible Oils **29,4%**
- Biodiesel **24,8%**
- Other uses **4,1%**

49%
exportación

EUROPE
65% of total exports

7.1%
Of agricultural GDP 2020
(palm oil and palm kernel oil)

Production value 2020
USD 1,1 billion

Most oil palm crops have been **established in areas previously used** for agriculture or in pastures.

1.5 SMLV
Average monthly salary:
USD 350

82,4%
Formal employment

63%
Workers with a contract over a year

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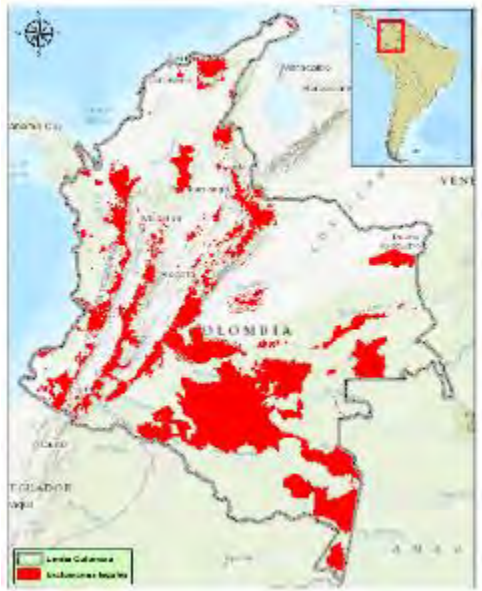
Of Colombia´s 114 million hectares, two thirds are protected areas, while one third, or approximately 39 million hectares, is suitable and available for agricultural activities (agricultural border), of which only 7,6 million (19%) are currently in use.

2021

Land area:

114 million hectares



Environmental exclusion areas and for archaeological heritage:

26,4 million hectares

Other natural forests (2010) and non-agricultural areas:

48,4 million hectares

National Agricultural Border:

39,2 million hectares

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Source: IAVH (2012), *Límites de los complejos de páramos.* ICANH (2017*), Límites de parques y áreas arqueológicas protegidas.* IGAC (2012), cartografía básica, escala 1:100.000. MADS (2014-2017), *Complejos de páramos delimitados.* — (2018), *Mapa de reservas forestales nacionales de ley 2ª, y mapa de sustracciones a las reservas forestales de la ley 2ª de 1959, escala 1:100.000.* UAESPNN (2018), *Límite de los Parques Nacionales Naturales de Colombia, V1.* — (2018*), Límite de las otras categorías reconocidas por el SINAP, V2* — (2017), Resolución 2247 de 2017. Cormacarena (Agosto de 2015, fecha de entrega), AMEM *Parque y DMI.* © UPRA, 2018

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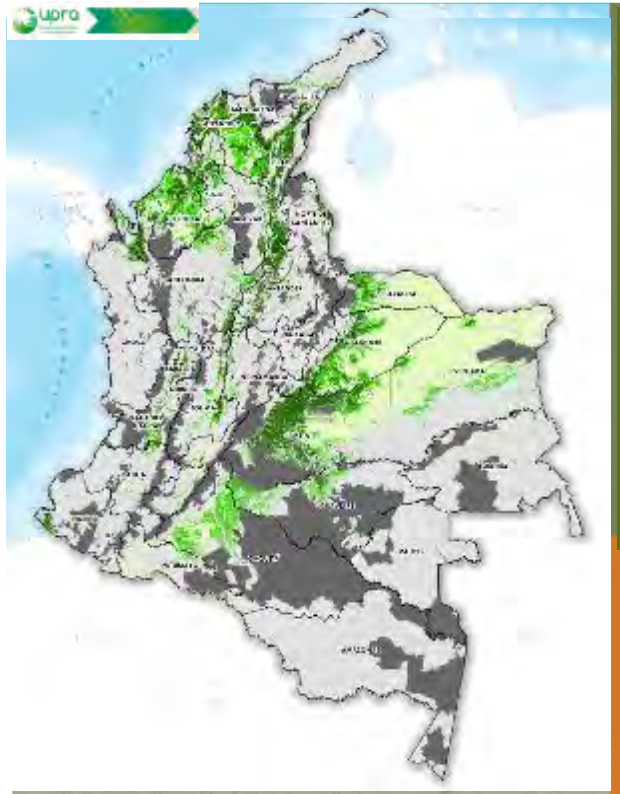
Colombia will be able to produce more than 2 million tons of palm oil with the current planted area, yet the oil palm agribusiness has huge potential to develop new area without causing deforestation or affecting protected areas.



Map of suitable land for commercial cultivation of oil palm

Potential area by suitability for Oil Palm

Suitability	Area (ha)	(%)
High	5.851.765	5,1
Medium	5.665.310	4,9
Low	10.065.340	8,8
Total (national)	**21.582.414**	**18,9**
N1: Not Fit	65.494.801	57,0
Legal exclusions	26.997.755	23,7
Total	**114.074.971**	**100,0**

21.582.414 ha

Total suitable land for oil palm

590.188 ha

2,7%

Planted with oil palm

Date: 2020

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Source: SISPA, Fedepalma and UPRA

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27,6% of Colombia´s crude palm oil was certified sustainable in 2020, with 23 companies having ISCC certification.

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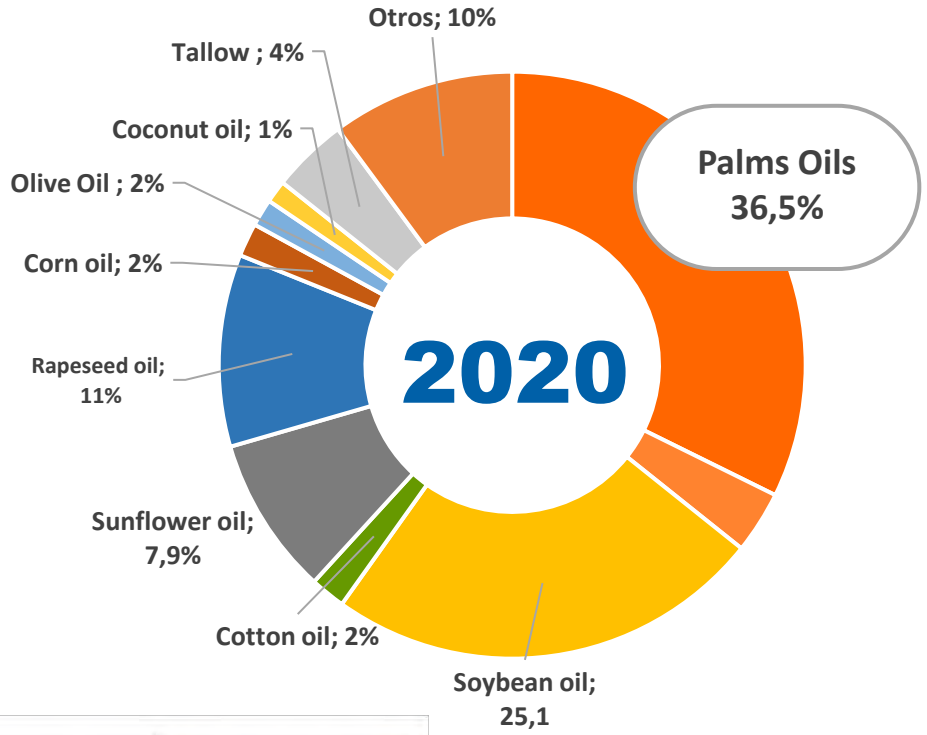
Biofuels from Palm Oil as Renewable Energy sources

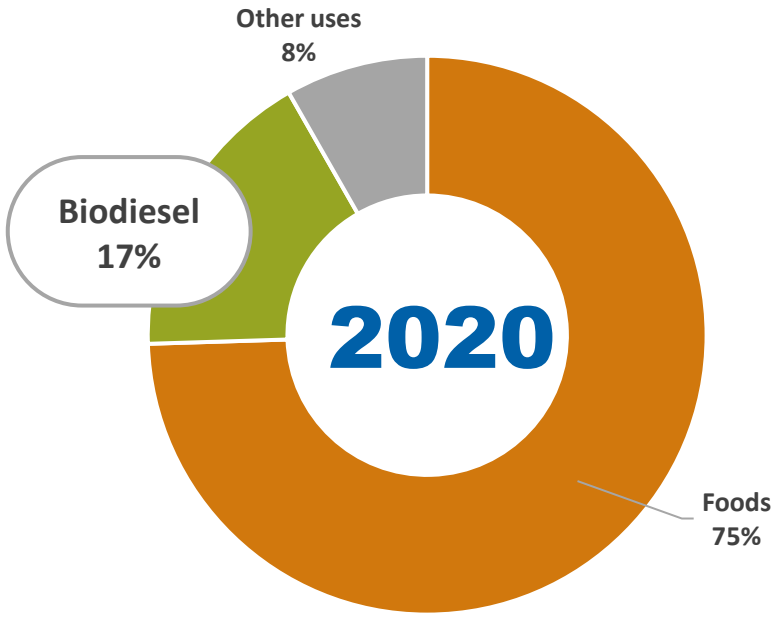
Palm oil is highly valued in the edible oil sector due to its versatility and its functional and nutritional advantages.
The higher stability of palm biodiesel at high temperatures has contributed to positioning it in the biodiesel segment.

2021

World production of oils and fats
240,1 million Ton



Oils and Fats
Markets Segments



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Source: Oil World Annual. 2021

Global production of biodiesel began in the 1990's and has evolved through public policies worldwide.

In the last 10 years, production has grown at a rate of 10% per year.

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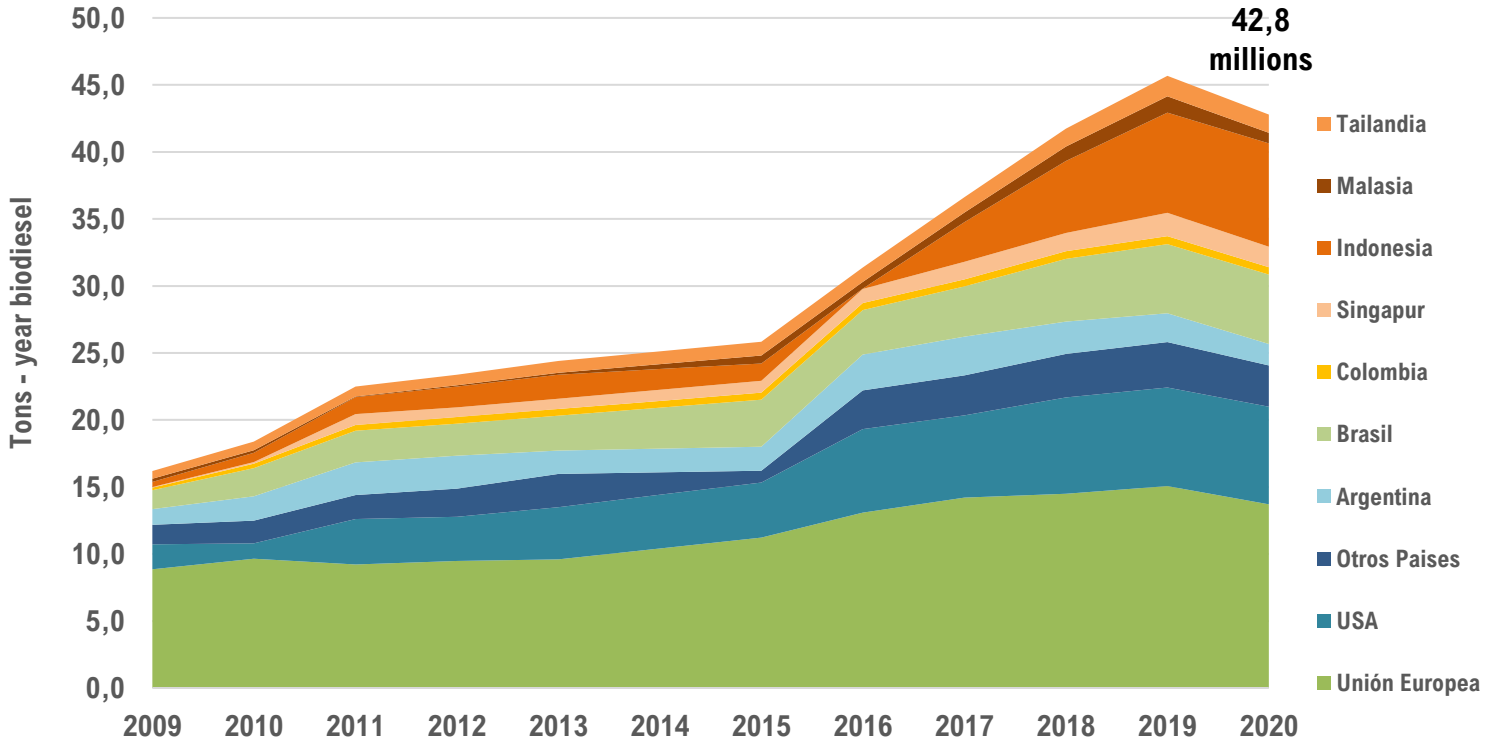
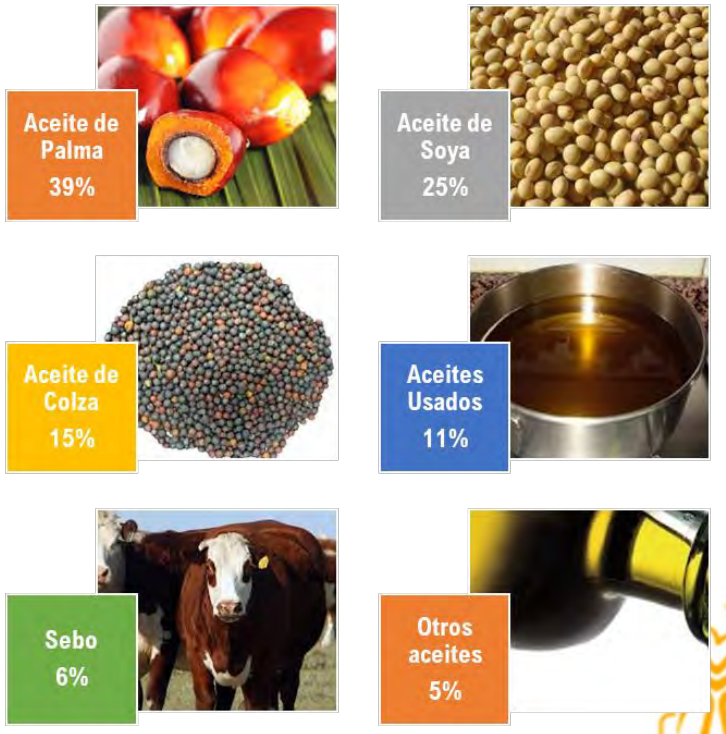
Biodiesel World Production 2009 - 2020



Raw materials share of biodiesel production – 2020



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Source: Oil World Annual. 2021

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The Colombian National Biofuels Program - ethanol and biodiesel
Local palm oil production supports the biodiesel initiative

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Fundamentals

Agricultural Sector Development and Employment Generation

Diversification of the Energy Mix

Environment Improvement

Palm Biodiesel

2003 – 2007
Feasibility analysis, structuring and promotion of the palm biodiesel program

2008 – 2013
Start of production and consolidation of regulatory framework and blends

2014 – 2018
Consolidation of installed capacity and stabilization of the Program

2019 – 2025
Search for increased market for palm biodiesel

Start date using the blend:
January 1st, 2008

Progressive increase of biodiesel in the blend
B5 - B10

Blend in all the national territory
B10

2019	2020	2021
B10 B12 (March - Sept.)	B10 Voluntary pilot mixes (B20)	B12 (April)

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The National Biofuels Program has contributed to diversify the energy mix of liquid fuels in Colombia. While palm oil is a growing and a renewable source, petroleum is depleting.

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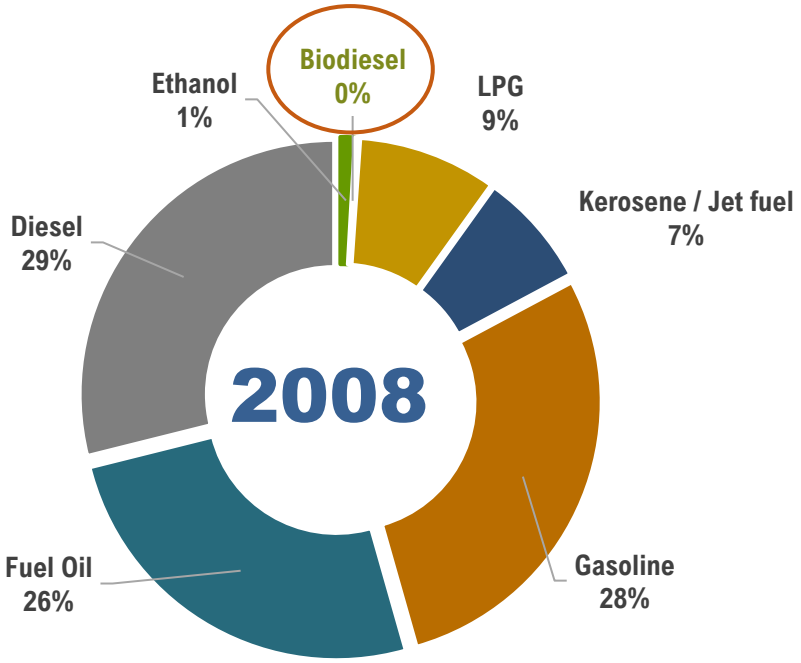
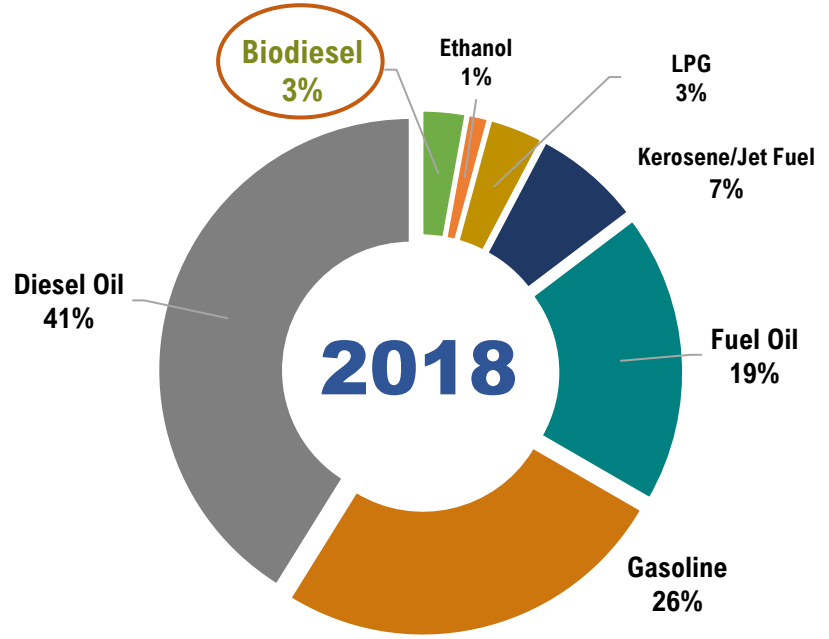
Energy matrix of liquid fuels in Colombia (TeraJoules)





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Source: https://www1.upme.gov.co/InformacionCifras/Paginas/PETROLEO.aspx

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Palm biodiesel has delivered in all aspects of the Program´s fundamentals, generating great value for the country.

2021

Agricultural Sector Development

✓

Added revenue for the sector (U$ 4.700 million 2014)

Rural employment generation

✓

Growth of formal rural employment in areas used for the production of palm oil for biodiesel

Environmental sustainability

✓

Significant savings in CO_2e emissions are evident

Diversification of the energy matrix

✓

Savings in diesel import logistics costs. Increased energy security

Benefit-Cost Ratio

3,31
for a B10 blend

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Source: DNP. Final report: Evaluation of the results of the document CONPES 3510 of 2008 policy guidelines to promote sustainable biofuel production in Colombia, 2015

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HVO (renewable diesel) and biodiesel are key in the transport sector´s energy transition and path towards reducing GHG emissions and meeting the world´s carbon reduction goals.

2021

HVO has a high degree of acceptance by the automotive sector thanks to its chemical similarity to diesel fuel and Jet fuel.

Experts estimate that demand of HVO will increase by 506% in the next four years.

The HVO production technology that has the highest degree of maturity is the process of hydrogenation / isomerization of oils and fats.

HVO production capacity is expected to triple in the next 4 years.

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There is an important opportunity for the palm oil industry increasing palm biodiesel blends.

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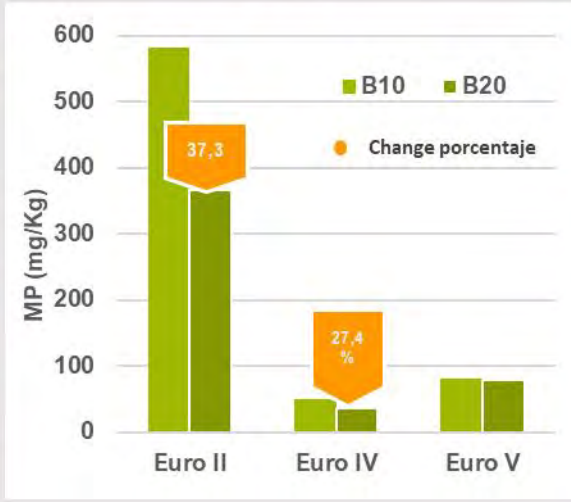
Bios 30

- ✓ Colombia produces enough palm oil for B30 blends between biodiesel and HVO.
- ✓ Pilot tests with blends +10% have demonstrated the advantages in terms of vehicle performance and favourable environmental impact.

Malaysia and Indonesia have successfully tested the use of B30 mixtures on a massive scale

PM2.5 emissions when using blends with palm biodiesel in Euro II, Euro IV and Euro V vehicles



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Sourcing Renewable Energy from Biomass and Biogas

The cultivation of oil palm is rich in the production of biomass, which is characterized by its high energy content.

Palm oils - 24%
39.600 kJ-kg

Empty Fruit Bunches – 21,5%
8.165 kJ-kg

Fiber – 12,5%
19.201 kJ-kg

POME - 80%
22.900 kJ-m^3
(High COD)

Shell - 6%
21.445 kJ-kg

For every 100 tons of FFB, 40 tons of solid biomass are produced

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The electrical energy required for the palm oil extraction process can be generated from solid and liquid biomass, and the surplus generated can be delivered to the electrical power grid.

2021

Fresh Fruit Bunches

Palm Oil Mill

POME

Biogas Capture

Electric engine

Energy from biogas

EFB

Shell

Fiber

Boiler

Turbine

Steam

Electric power and steam

Surplus to the network

Energy from solid biomass

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The current power generation potential of Colombia´s Oil Palm Agribusiness is 340 MW

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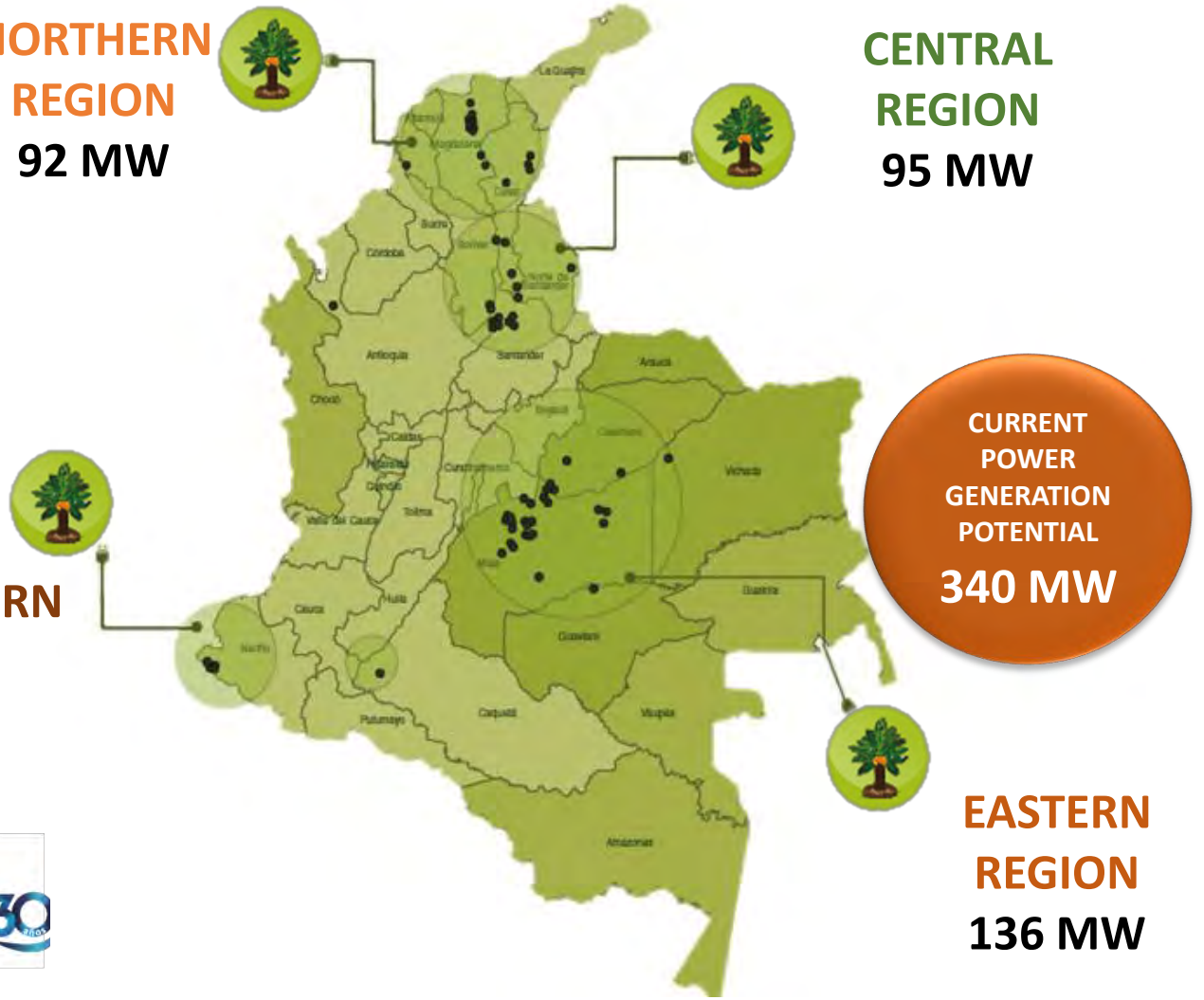
NORTHERN REGION
92 MW

CENTRAL REGION
95 MW



CURRENT POWER GENERATION POTENTIAL
340 MW

SOUTH WESTERN REGION
17 MW

EASTERN REGION
136 MW

The use of residual biomass for energy purposes will contribute to improving energy self-sufficiency, process efficiency and optimization of production costs.

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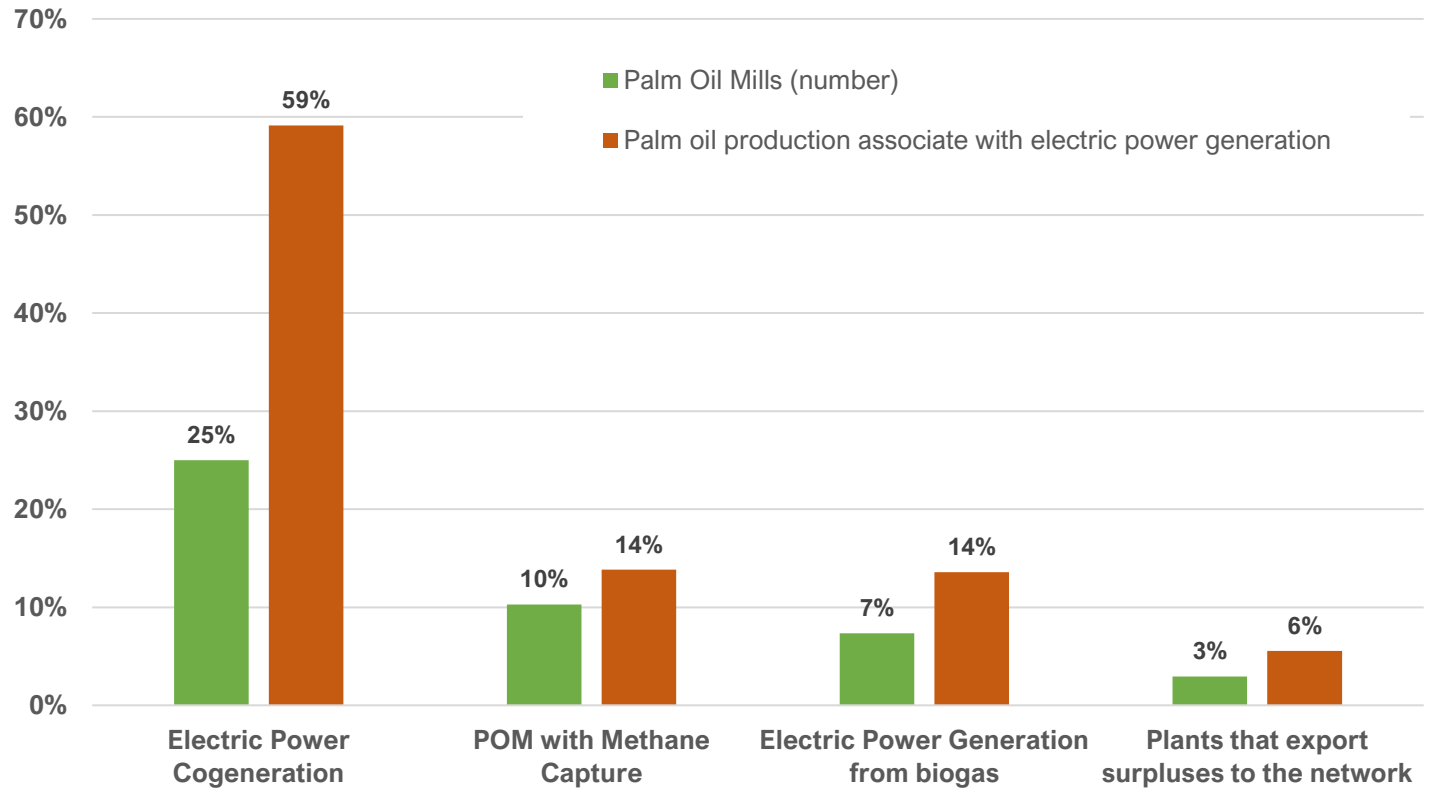
78% of fiber and 96% of shell is currently used to produce steam and generate energy (approximately 30 MW) for the palm oil extraction process, which does not use fossil fuels.



Current power generation:

Cogeneration → 26,6 MW

Biogas → 2,4 MW

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Source: Cenipalma – Fedepalma, 2020.

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The Oil Palm Agribusiness can play an important role in the global energy transition through the integral use of its oil, for biofuels, as well as residual biomass and biogas, for renewable energy generation.

2021

	B10	B15	Bios30
Fresh Fruit Bunches production (in Tons)	7´173.000	14´213. 000	28´125.000
Electric power generation **(MW)**	30 MW		
Electric power generation potential	340 MW	640 MW	1.300 MW
Current reduction in CO_2 capture (Ton CO_2- eq)	-1´100.000		
The GHG reduction potential (Ton CO2-eq)		-4´149.000	-7´133.000

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Thank you

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