Global feedstock update

Implications for supply and demand

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AGENDA

- Role of SAF in decarbonization of aviation sector
- Routes for producing SAF: focus on HEFA
- Feedstock availability and Eni model

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- Fluctuations in the prices of crude oil, natural gas, oil products and chemicals;
- Strong competition worldwide to supply energy to the industrial, commercial and residential energy markets;
- Safety, security, environmental and other operational risks, and the costs and risks associated with the requirement to comply with related regulation, including regulation on GHG emissions;
- Risks associated with the exploration and production of oil and natural gas, including the risk that exploration efforts may be unsuccessful and the operational risks associated with development projects;
- Uncertainties in the estimates of natural gas reserves;
- The time and expense required to develop reserves;
- Material disruptions arising from political, social and economic instability, particularly in light of the areas in which Eni operates;
- Risks associated with the trading environment, competition, and demand and supply dynamics in the natural gas market, including the impact under Eni take-or-pay long-term gas supply contracts;
- Laws and regulations related to climate change;
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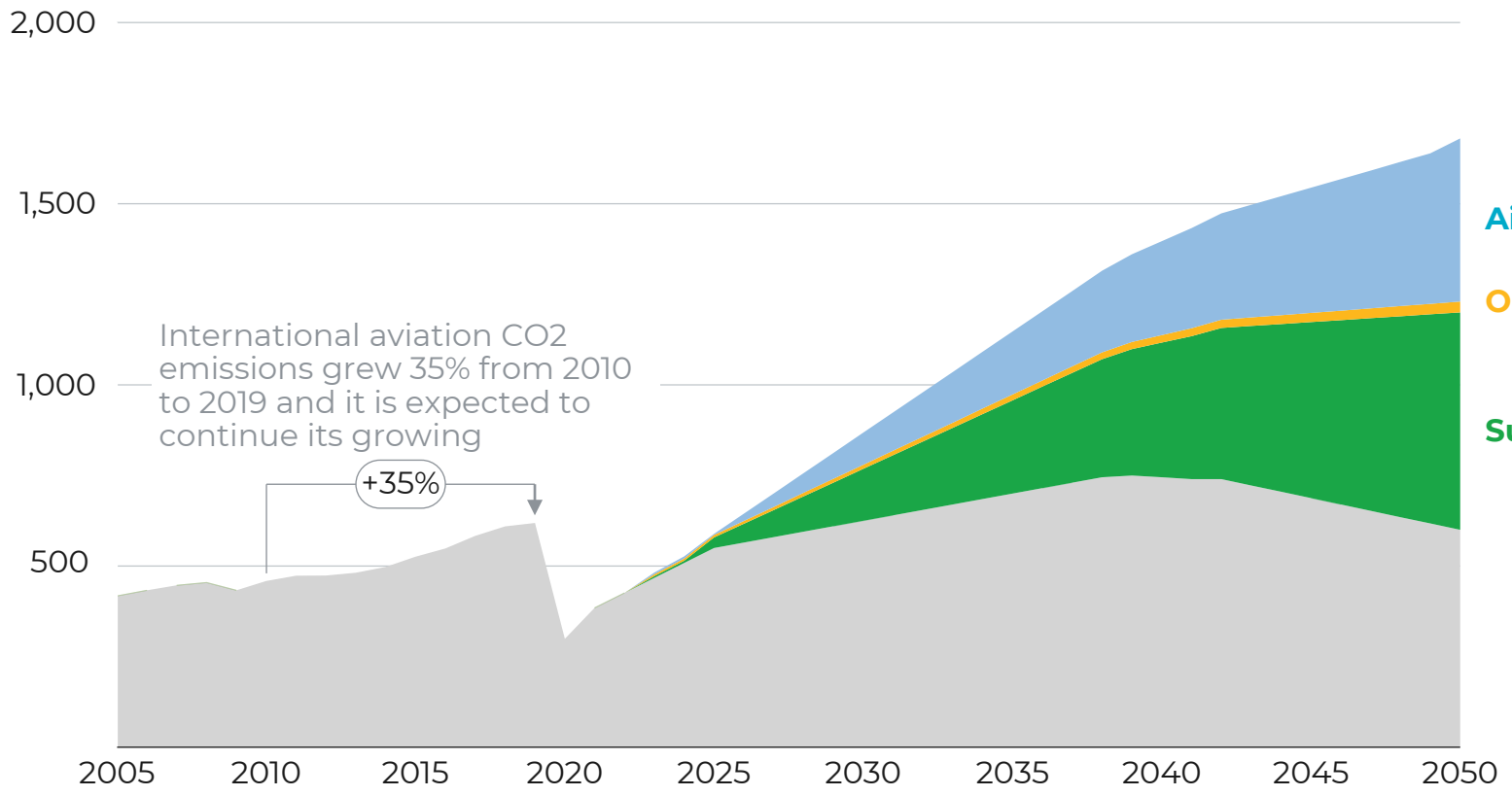
SAF adoption is expected to have a relevant role in decarbonizing aviation sector by 2050

International aviation CO_2 Emissions globally [$MtCO_2$; 2005-2050]



Aircraft Technology

Operations

Sustainable Aviation Fuels

Expected Impacts on CO_2 emissions reduction of **Aircraft technology improvements**, **Operations improvement** and **use of Sustainable Aviation Fuels**

Residual CO_2 Emissions from international aviation

Source: ICAO Long-Term Aspirational Goal (LTAG)

ReFuelEU define more stringent rules to cut aviation emissions by promoting an increasing quantity of Sustainable Aviation Fuels

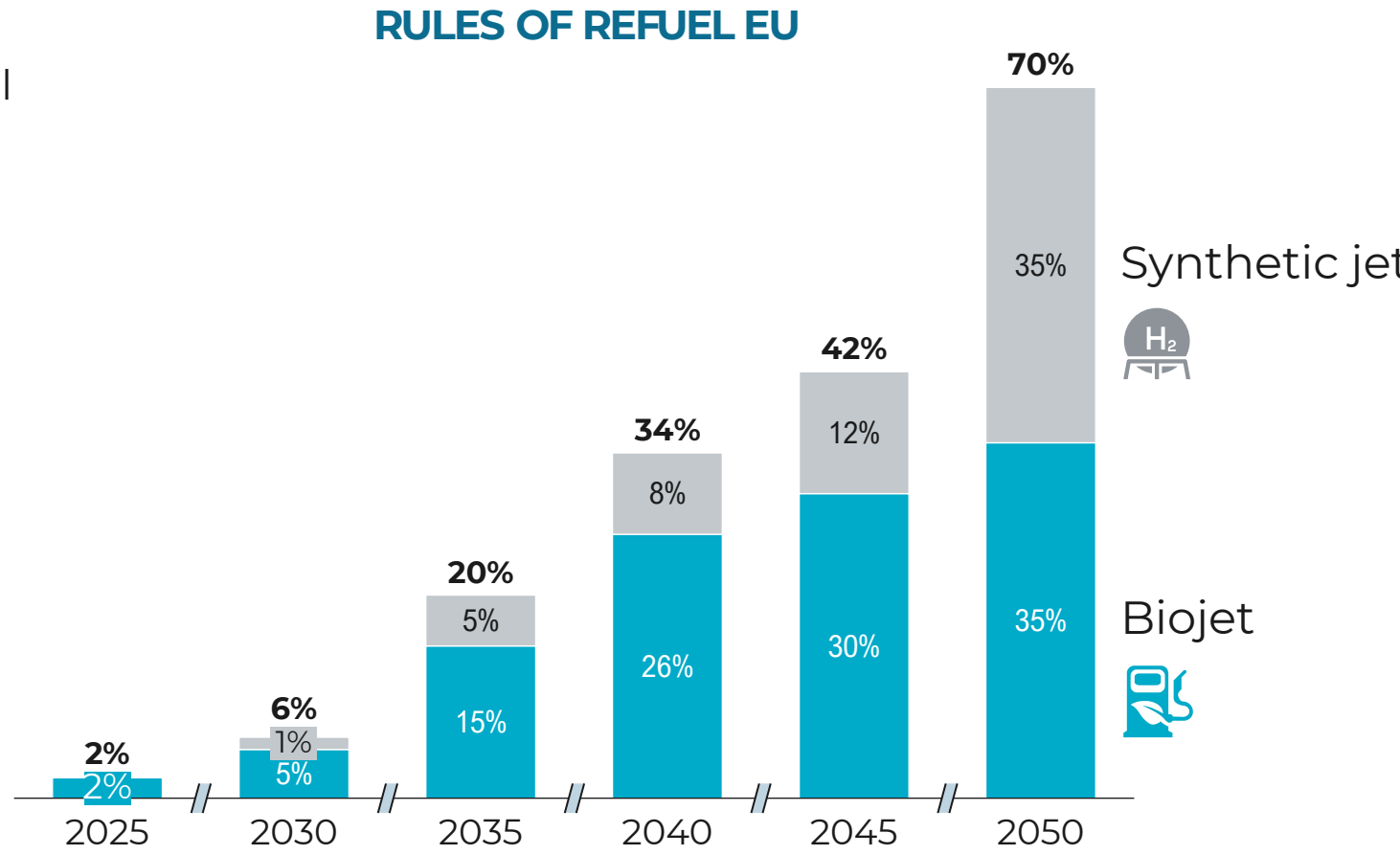
What are sustainable aviation fuels?

The term "sustainable aviation fuels" include **"drop-in" fuels,** fully fungible with conventional aviation fuels, belonging to:

Biofuels from:
- used cooking oil,
- animal fats (tallow)

and **advanced biofuels** produced from:
- agricultural or forestry residues
- bio-waste

Synthetic aviation jet fuel from
- hydrogen and
- CO_2



Source: European Commission;

There are several synthesis routes for producing SAF today
Biojet and synthetic jet

Biojet synthesis pathway and feedstock overview

SAF type	Biojet			Synthetic jet	
Technology	HEFA	Alcohol to Jet	Gasification – FT	Fischer-Tropsch (FT)	Methanol to Jet
Pathway description	**Hydroprocessed Esters and Fatty Acids**, it involves the refining of vegetable oils, tallow, or waste greases into SAF	**AtJ converts alcohol feedstocks** (sugars, starches, hydrolyzed cellulose) into SAF	**Gasification – Fischer Tropsch converts syngas from feedstock gasification**, into hydrocarbons in a FT reactor to produce SAF	**FT – Power-to-Liquid converts syngas** produced from H_2 and CO_2 into SAF via a **FT reaction**	**MtJ – Power-to-Liquid converts syngas** produced from H_2 and CO_2 into SAF **via methanol synthesis**
Feedstock	**Non-edible oils** **UCO** – Used Cooking Oil **Animal fats** **Vegetable oils** **Rapeseed** oil **Sunflower** oil Not allowed by ReFuelEU	**Lignocellulosic Biomass/ waste** **Forest/ agri** residues **Food and Bio-**waste **Crops** **Sugar crops** **Corn** Not allowed by ReFuelEU	**Lignocellulosic Biomass** **Forest** residues **Agri** residues **Waste** **Food** waste **Bio-**waste		

Hydrogen

Carbon dioxide

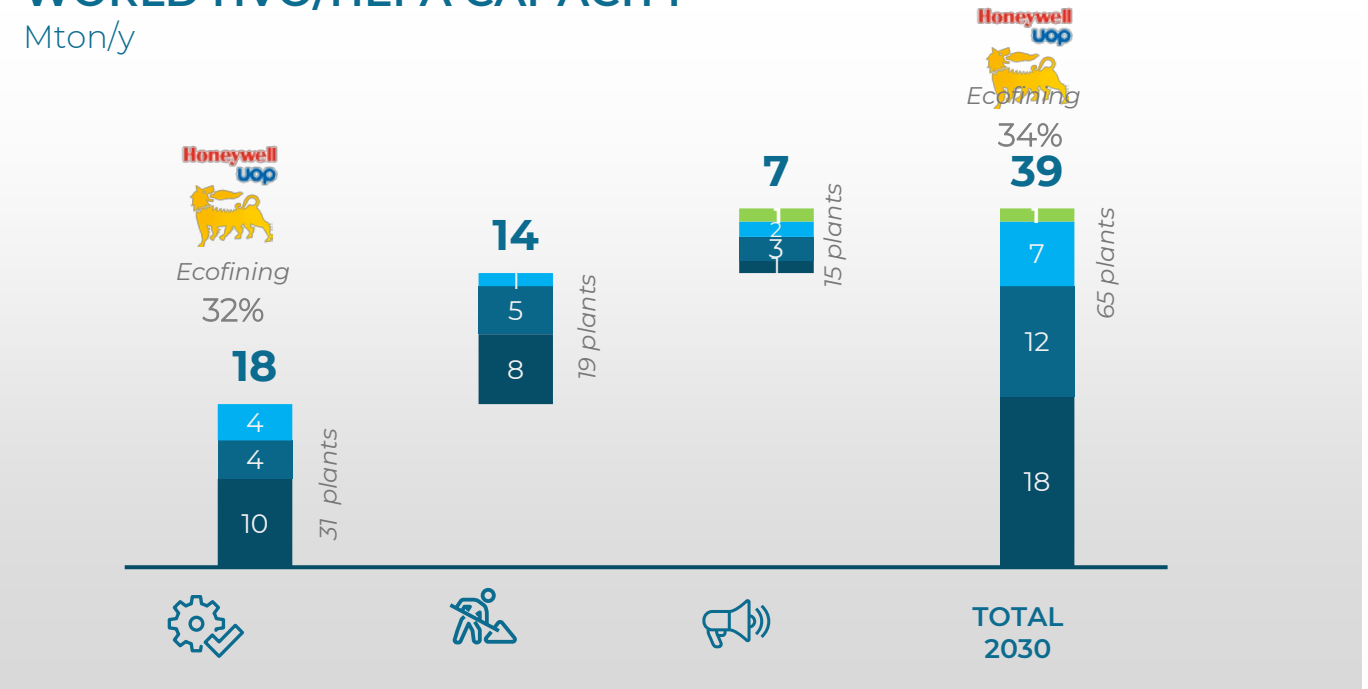
Today HEFA is the mature technology: many players have decided to invest in new capacity

HVO/HEFA1 capacity will more than double by 2026, mainly thanks to N. America projects

SAF type	Biojet			Synthetic fuels (PtL)	
Technology	HEFA	Alcohol to Jet	Gasification – FT	Fischer-Tropsch	Methanol to Jet
Technology Readiness Level (TRL)	Consolidated maturity and market presence (9) Large-scale production volumes	Emerging maturity with regional market presence (7) Small-scale production volumes	Emerging maturity with regional market presence (7) Small-scale production volumes	Low maturity with scare asset/ market presence (6) Technology demonstr. in rel. environments	Low maturity with scare asset/ market presence (6) Technology demonstr. in rel. environments

WORLD HVO/HEFA CAPACITY

Mton/y

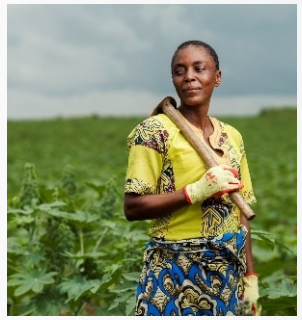


Source: Company information;

A distinguishing model

AGRICULTURAL PRODUCTION





SMALL FARMERS
CULTIVATION OF NON-FOOD CROPS

LARGE FARMERS
COVER CROPS AFTER CEREAL PRODUCTION

AGRO PROCESSING & AGRO-FORESTRY
RESIDUES AND FOOD REJECTS

AGRI HUB (OIL EXTRACTION PLANTS)

VEGETABLE OIL
FEEDSTOCK FOR BIO REFINERIES

BY PRODUCTS
ANIMAL FEED AND FERTILIZERS

AGRICULTURAL **SUPPLY CHAIN**

Cultivation entrusted to farmers (access to land)

Land and crops **crops not destined to food consumption**

Promotion of best agricultural practices and **carbon farming**

Access to market & socio-economic development in rural areas

INDUSTRIAL PLANTS

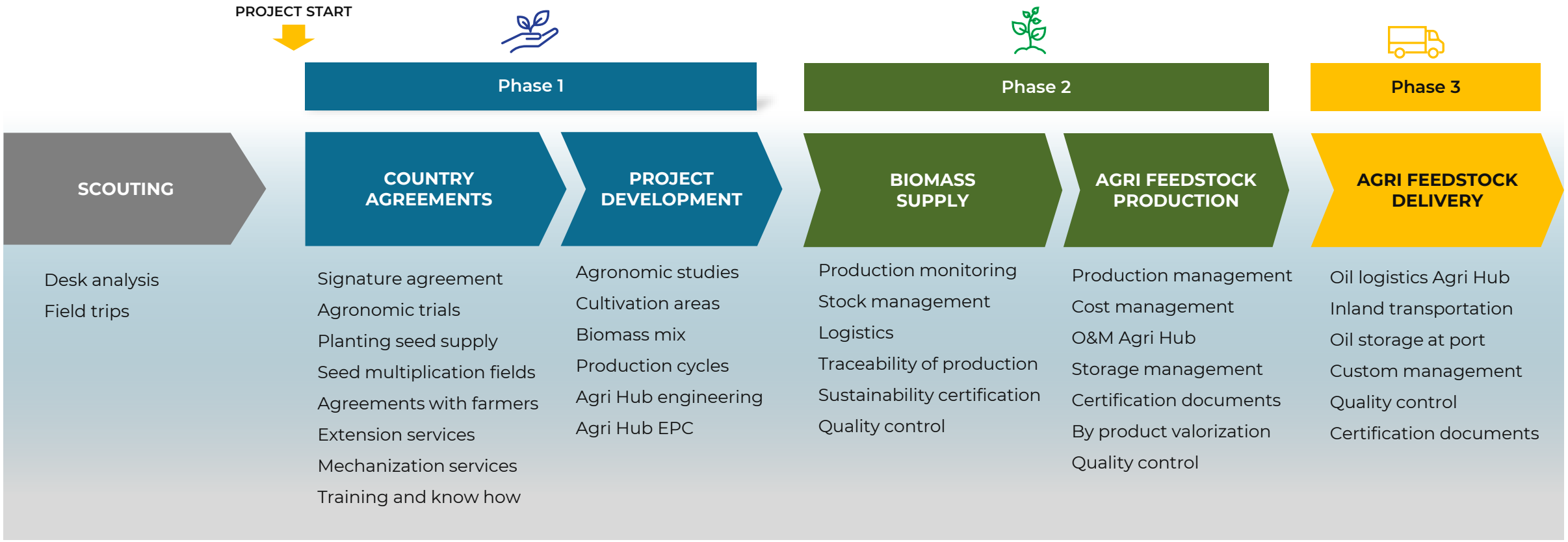
Food security with animal feed & fertilizer

Local content and transfer of **industrial know-how**

Capacity building targeting the best agricultural practice

Agri feedstock design and development

A global value chain across geographies



More sustainable biomass

NOVEL VEGETABLE OILS

CASTOR

non-food crop
drought resistant, suitable for inter-cropping, high oil content, sinergies with carbon farming

COVER CROPS

intermediate crops after primary production cycle: camelina, brassica c, sufflower, other.
Animal feed as by-product

AGRO-FORESTRY

Trees planted by farmers in agricultural areas, in synergy with carbon offset program. Stimulate land regeneration

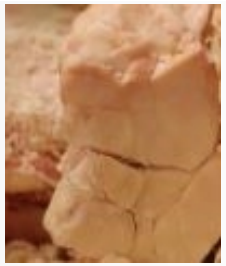
RESIDUES

FOOD AND AGRO INDUSTRIES

residual biomass from food processing industries, and ginneries; circular economy and industrial symbiosis

FORESTRY RESIDUES

residual oilseed from plantations or spontaneous trees; synergy with cooperatives and large agribusiness



OTHER BIO FEEDSTOCK

residues from animal husbandry, fishing and other agro-industrial processing; UCO and organic wastes

CERTIFIED RAW MATERIALS

Whole value chain certified according to European highest standards (ISCC EU)

Agricultural production not in competition with forest ecosystems

Traceability of agricultural production

Gurantee of labour human rights according to ILO standards

CONTINOUS IMPROVEMENT

Security of supply for **planting seeds** (mother fields)

Carbon farming, **biochar**, regenerative agriculture

Novel vegetable oils support the rising biofuels demand

Food vegetable oil
~250 Mton/y

POTENTIAL AVAILABILITY 2050

NOVEL VEGETABLE OILS

Wastes and residues
>**40** Mton/y

Cover Crops
70 Mton/y

Non-food crops
85 Mton/y

Agricoltural residues
Up to **40** Mton/y

COMPETITIVE LANDSCAPE


UCO


Animal fats

POME, SBEO, Tall oil, others

COMPETITIVE LANDSCAPE


Camelina


Sufflower

Brassica carinata, Sunflower, others


Castor

Others

FIRST MOVER


Rubber seed


Waste from dried fruit

Others

FIRST GENERATION

~25% biofuel use
in producing countries (e.g. Indonesia)
in conflict with food chain
High ILUC banned in EU from 2030
Impact on food prices
De-forestation risk/land use change

SECOND GENERATION
ADVANCED AND LOW ILUC (INDIRECT LAND USE CHANGE)

~67% biofuel use
W&R collection avoid improper waste disposal

Large potential for biofuel/industrial use

Intermediate crops after production of cereals or other food crop, additionality

Land with low organic content, abandoned or contaminated

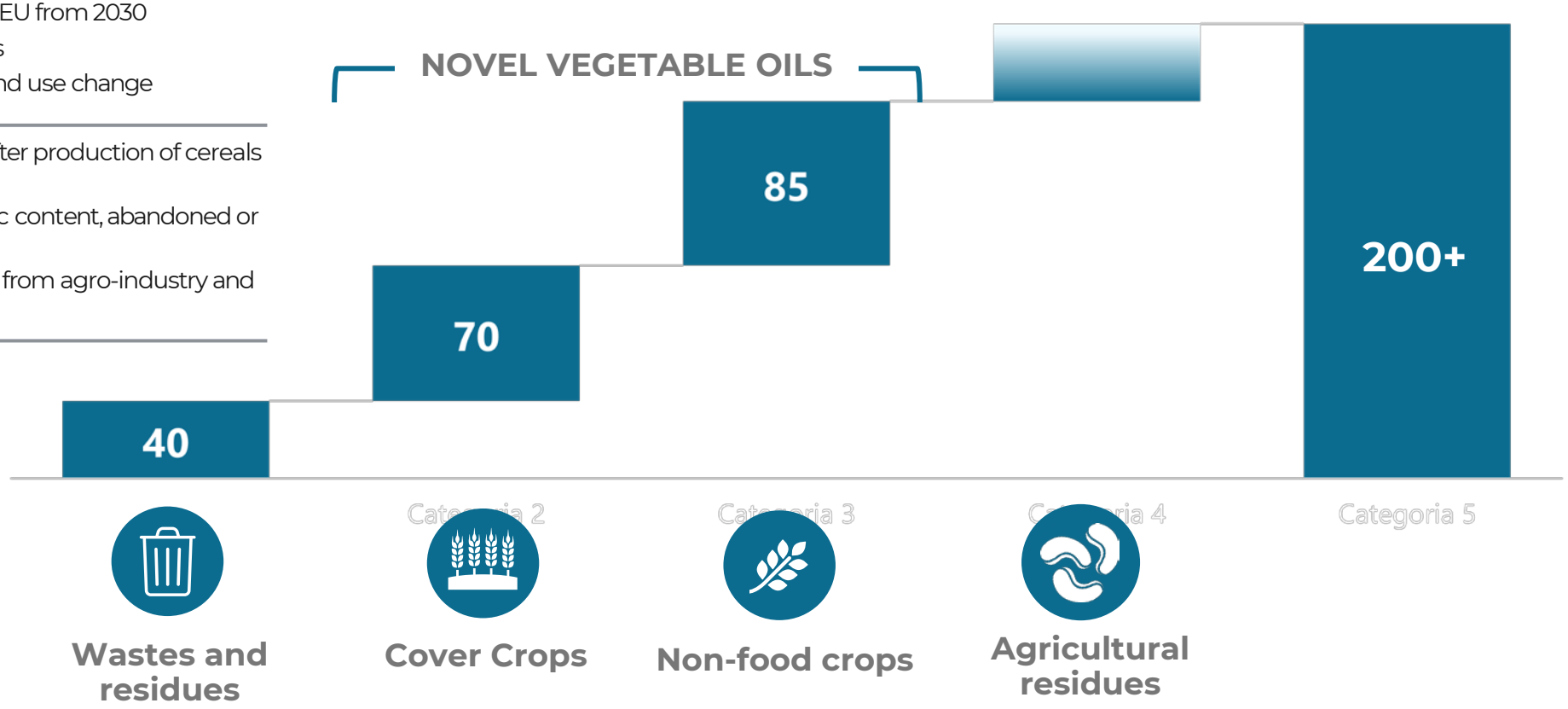
Residues and wastes from agro-industry and agro-forestry

Source: Eni elaborations and Mckinse Clean skies for tomorrow

HVO/HEFA more sustainable feedstock availability

First generation:	• Relevant contribution to food vs fuel conflict • High ILUC banned in EU from 2030 • Impact on food prices • De-forestation risk/land use change
Second generation advanced and low ILUC:	• Intermediate crops after production of cereals or other food crops • Land with low organic content, abandoned or contaminated • Residues and wastes from agro-industry and agro-forestry

POTENTIAL HVO/HEFA SUSTAINABLE FEEDSTOCK AVAILABILITY 2050 | MTON/Y



Source: Eni elaborations and Mckinsey Clean skies for tomorrow

Eni is working on ample and flexible feedstocks

Raw materials for Ecofining™ technology

Wide range of waste and by-products from oil and fats processing

Eni biorefinery Palm Oil free

Significant future role of waste & residue, rotational crops and crops cultivated in marginal lands

In house R&D competence center fully equipped for testing of new feedstocks and for process optimization and development

WASTE GREASES

- Used Cooking Oil*
- Yellow Grease

BY-PRODUCTS

- PFAD*
- POME*
- Tall Oil
- Technical Corn Oil
- SBEO*

ALGAS AND MICROBIAL OILS

ANIMAL FATS

- Tallow *
- Choice White Grease (pork)
- Poultry Fat

PLANTS OILS

- Palm*
- Rapeseed/Canola
- Soybean*
- Carinata*
- Camelina
- Jatropha
- Tobacco Oil
- Salicornia
- Castor oil

UNRIVALLED R&D

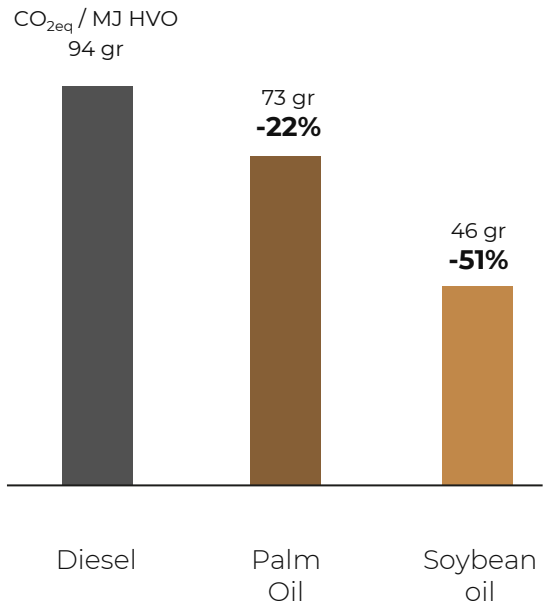
Unique bio crude assay database with more than 400 characterized feedstocks

* Tested in Eni Bio-Refineries.

Carbon intensity of Eni biofuels

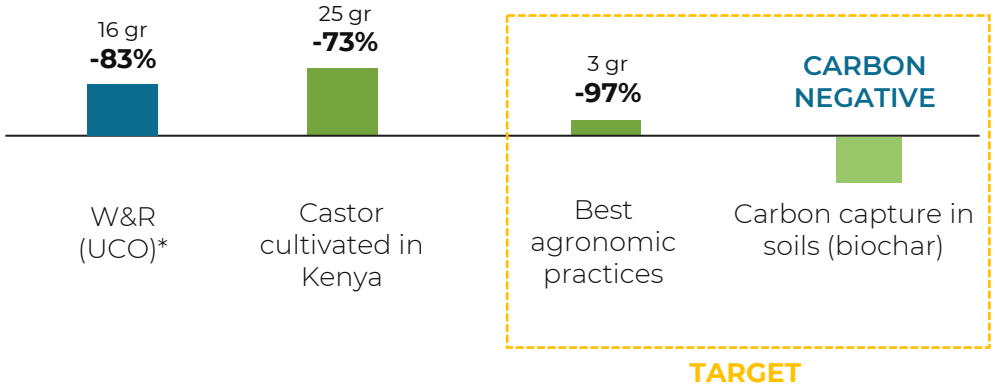
Targeting lowest emissions

MARKET BENCHMARK



HIGH RISK OF LAND USE CHANGE
CONFLICT WITH FOOD PRODUCTION

ENI DISTINGUISHING MODEL



TARGET

REFERENCED AND PROVED FIGURES

Validation of the Eni distinguishing model thanks to EU Funded projects by academic/R&D partners

Bio4A

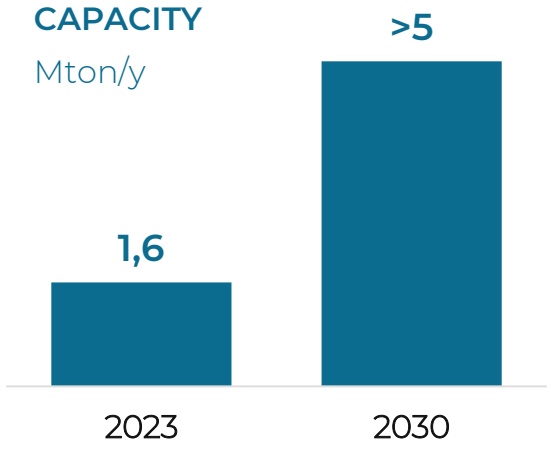
Bio-Jet produced by Eni from cover crops and carbon farming in EU (+110% carbon reduction vs diesel)

Eni committed to keep on growing in bio-refining

Focus on high-value added products optionality in a flexible production system

ENI BIOREFINING CAPACITY

Mton/y



HVO DIESEL

HVOlution

Arctic diesel from 2024

Pure HVO already available in 700 retail stations

Invested to improve cold properties to target other markets (e.g. Northern Europe)

Partnerships to target new or niche markets
(e.g. ships, rail, diesel power gens, data centers)

HVO NAPHTHA

Integration with Versalis crackers and JV with international chem partners

Gasoline blending optionality

Autoconsumption optionality to improve product GHG saving

SAF

SAF co-processing 0.5% UCO in Taranto (2021)

2026 SAF optionality
>0.5 Mton/y

2030 SAF optionality
>1 Mton/y

SAF upside based on demand
up to 2 Mton/y