# Low Carbon Day

## Driving the Refining transformation

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The Repsol Commitment
Net Zero Emissions
by 2050

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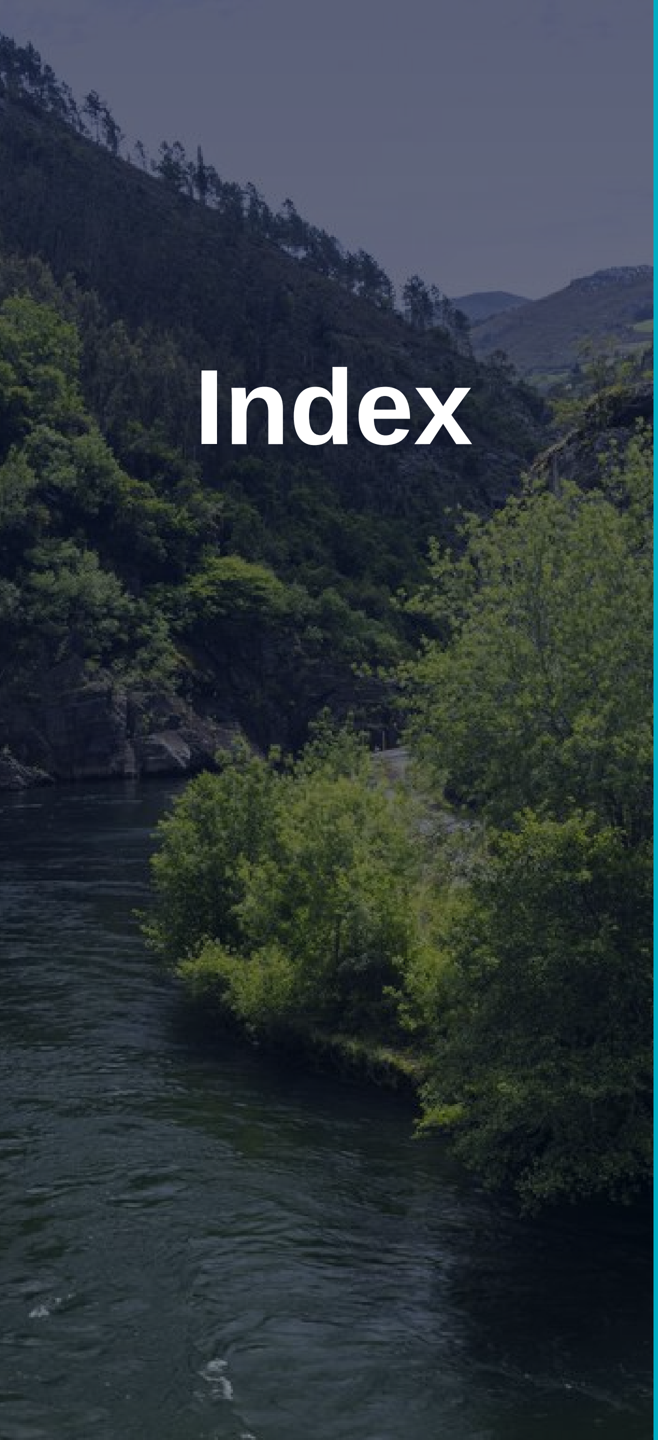

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Net Zero Emissions
by 2050

# 01.
# Low Carbon Fuels Framework

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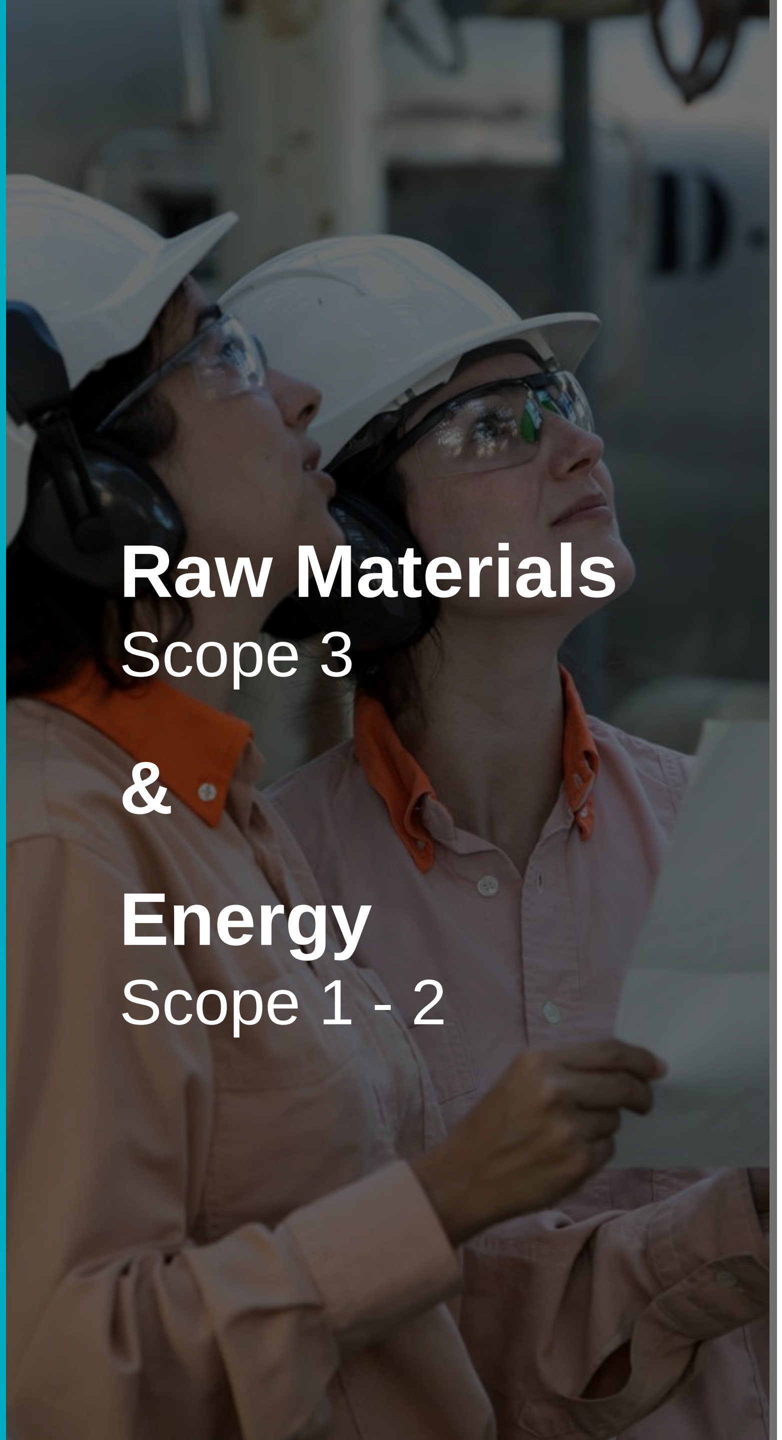
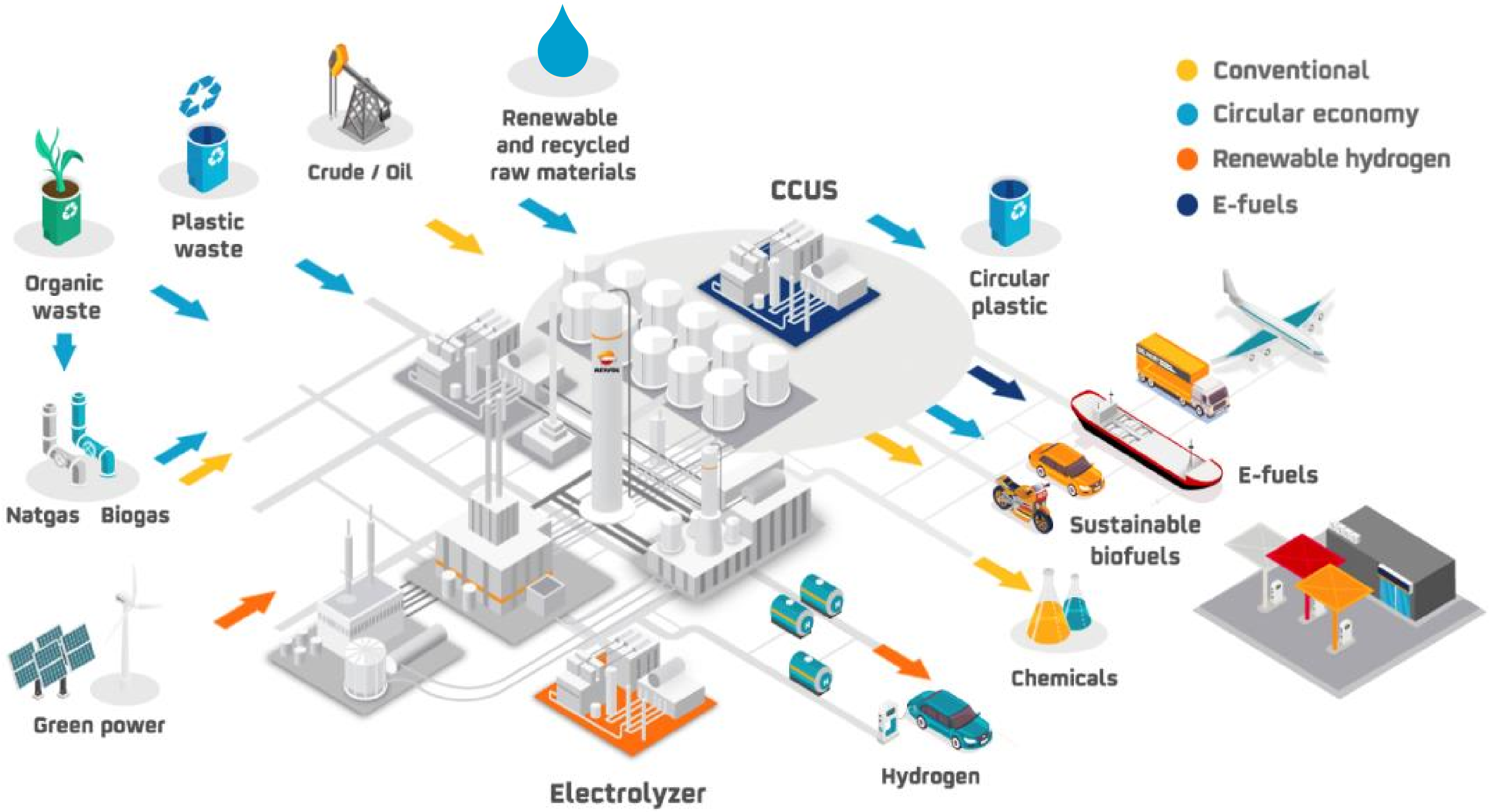
# Transforming our business model



## Raw Materials
Scope 3

## &

## Energy
Scope 1 - 2

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# Transforming our business model

| | | |
|---|---|---|
| 1 | Regulation | Anticipation + advocacy + local dialogue |
| 2 | Technology Development and Integration in the Value Chain | Cost and $CO_2$ Competitive<br>Optimum location and integration |
| 3 | Products Portfolio | Low Carbon Liquid Fuels and renewable gases + other products |
| 4 | Supply management and ecosystem development | Agriculture and livestock + forestry + agri-food + municipal and industrial waste |

**New Business Model**

Circular Economy

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# Regulation increases demand and promotes the development of raw materials

## Products

| | 2019 | 2020 | 2021 | |
|---|---|---|---|---|
| RED II | EU Green Deal | NECP | RED III | ReFuel Aviation FuelEU Maritime |
| FQD | | $H_2$ Roadmap | Biogas Roadmap | |

## Raw Materials

| 2018 | 2019 | 2020 |
|---|---|---|
| Waste Directive | EU Green Deal | Farm to Fork Strategy |
| | | Circular Economy Action Plan |

The regulatory framework in EU and Spain is promoting low carbon fuels and renewable gases as a decarbonization alternative for transport and other industries.

Regulation | Roadmap | Proposal to be discussed

INECP: Spain's Integrated National Energy and Climate Plan

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# Regulation can significantly boost the development of low carbon products market

2030

**13% GHG** reduction in transport

**2.2% Advanced Biofuels** in transport

**50% Renewable $H_2$** in the industry

**5% Biojet** in aviation

**2.6% RFNBO** in transport

**6% GHG** reduction in marine

* Proposal for the revisions and initiatives linked to the European Green Deal climate actions and in particular the climate target plan's 55 % net reduction target presented under the Fit for 55 package published on 2021July 14

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# Technology Routes

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## Low Carbon Liquid Fuels

E-fuels

Gasification and Pyrolisis – BTL and Pyrolisis Oils

Fermentation – Ethanol

Lipidic Route - HVO

Esterification - FAME

2021

2025

2030

Anaerobic Digestion - Biomethane

## Renewable Gases

Gasification and Pyrolisis – Syn Gas - Hydrogen

Electrolysis - Hydrogen

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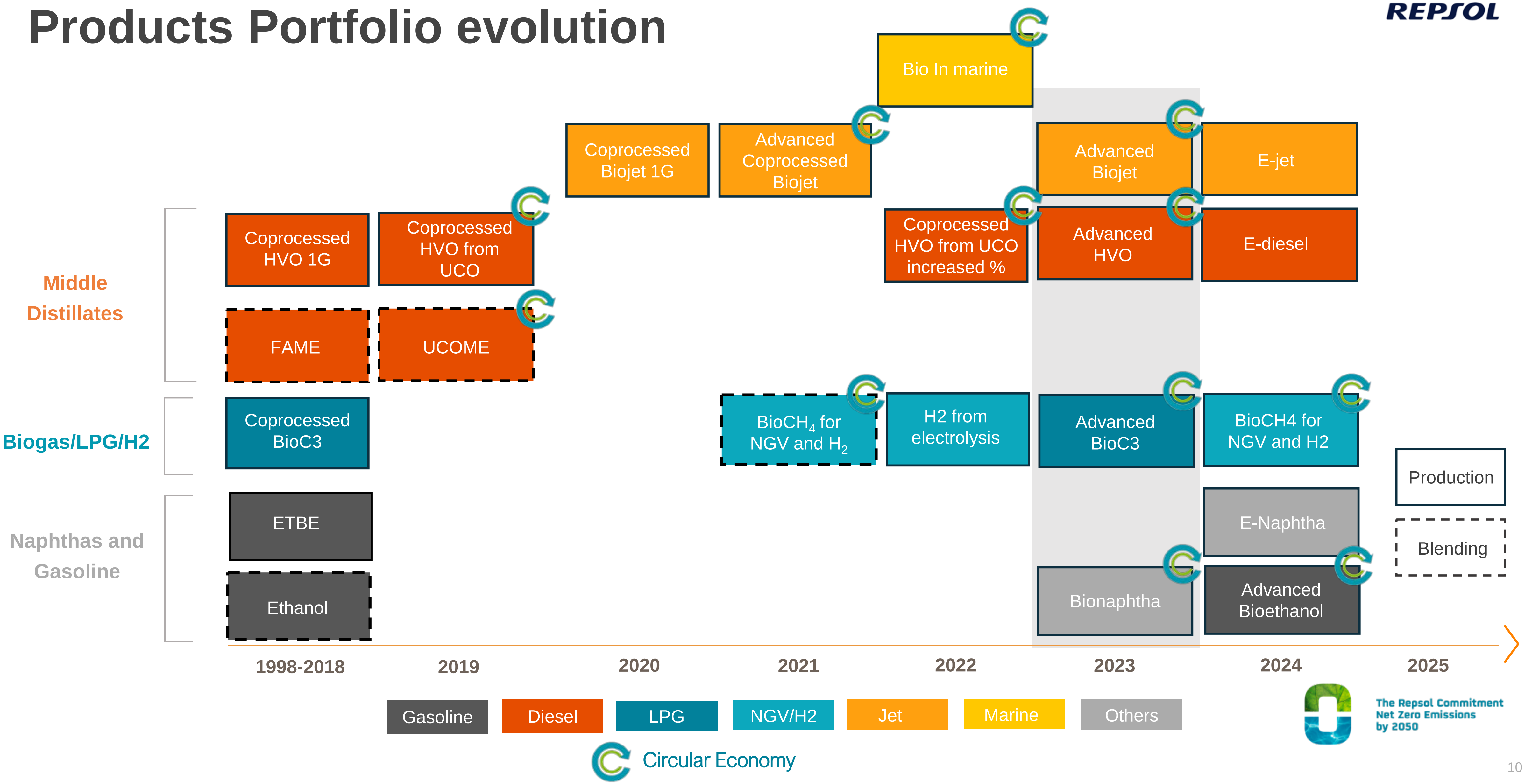
**01.** Low Carbon Fuels Framework

# Products Portfolio evolution

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# 02.

## Providing Short Term Value

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# Low Carbon Fuels. A reality

Already a **leading HVO and bio-ETBE producer in Iberia**, and **first biofuels marketer in Spain**

Producing bio ETBE since 1998 and HVO since 2011

**Boosting** production of **Bio Jet**

- **Puertollano**: 1st co-processed biojet batch produced in Spain. 7,000 Tn in July 2020
- **Tarragona**: Co-processed biojet batch production. 10,000 Tn in January 2021
- **Petronor:** 1st advanced co-processed biojet batch produced in Spain. 5,300 Tn in July 2021

**Testing** more than **40 wastes and technologies** for advanced biofuels and circular plastics

$H_2$

**Leaders in renewable hydrogen: First production from biomethane in Cartagena steam reforming in October 2021**

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# HVO, the best short-term route to grow in biofuels generating value

**Chosen path**

Gasoline

Middle distillates

- The higher energy content of biofuels and the higher demand for diesel allow to maximize the content of renewable fuels in the market
- Greater flexibility in raw materials for advanced BIOS production

FAME

HVO / Biojet

- No technical limitations for HVO
- Technical barriers to manufacturing allow higher margins
- Technologies compatible with Biojet production

Production of advanced HVO is **the best option to comply with the legislation and grow in biofuels** generating value

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**From 2025 additional drop-in biodiesel and biojet production is needed to comply with biofuels mandates**

**02.** Providing Short-Term value

# HVO and SAF demand

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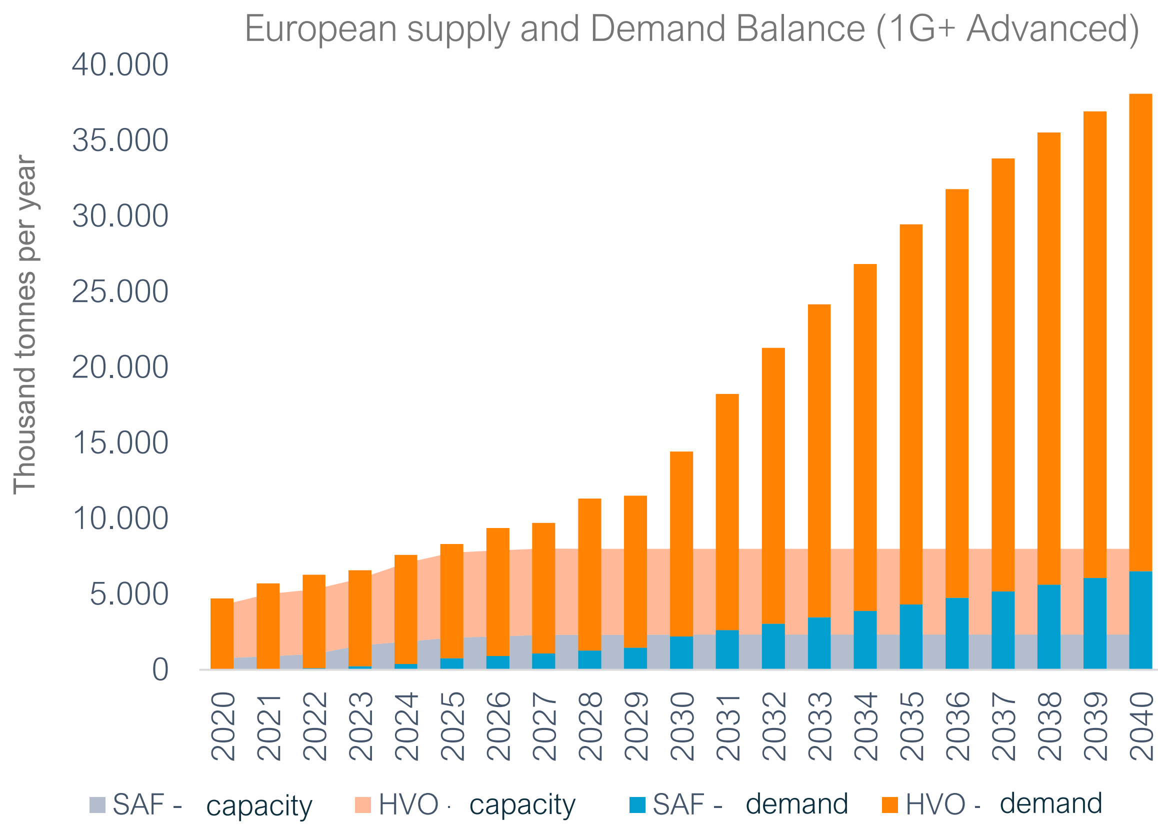


Source: Argus Consulting. REDII Based. June 2021

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**03.** Our Pathway to 2030

# HVO+SAF

| | 2025 | 2030 |
|---|---|---|
| Commercial | +300 kta | +275 kta |

**Regulation**

Renewable Energy Directive (RED)
ReFuel Aviation
FuelEU Maritime

**Raw Material**

Sustainable Vegetable Oils
UCO + animal fats
Other lipidic residues included in Annex IX Part A RED Directive

**Technology**

Hydrogenation - *Commercial*
New units or retrofitting

**Final Uses**

Transport (Road, Aviation and Marine)
By-Products for:
Renewable Hydrogen
Chemical Industry

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## Initiatives

21

Current Margin
250-750€/tep

Forecasted Margin
950-1,550€/tep

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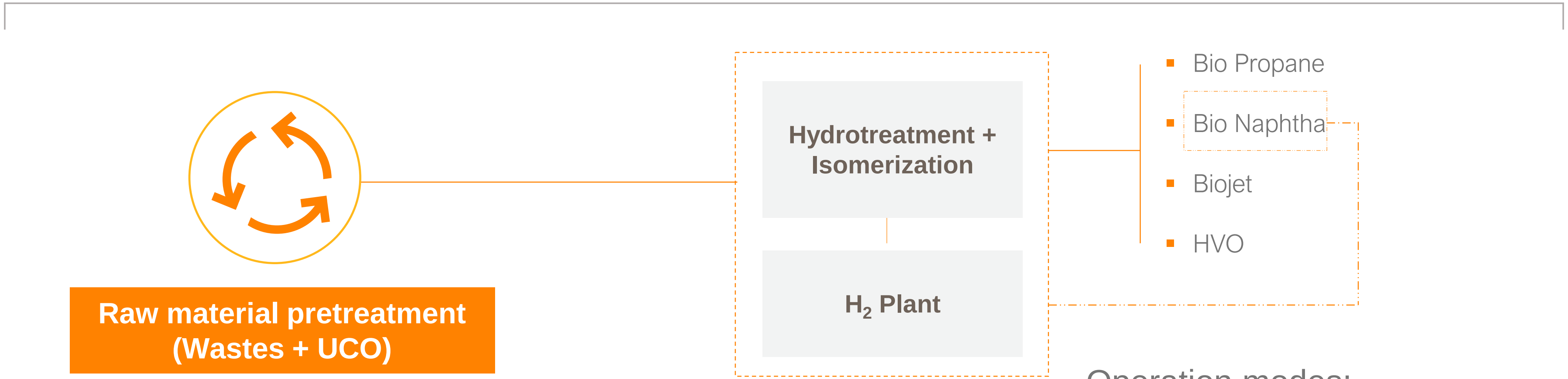
# New Advanced Biofuels Plant in Cartagena

| Investment | Capacity | | Start - Up | Emissions Reduction |
|---|---|---|---|---|
| €188 M | 250 kty | Low Carbon Fuels | 1Q 2023 | - 900 kt/y $CO_2$ Emissions |
| | 300 kty | Waste and Residues Input | | |




Operation modes:

1. HVO
2. Bio Jet

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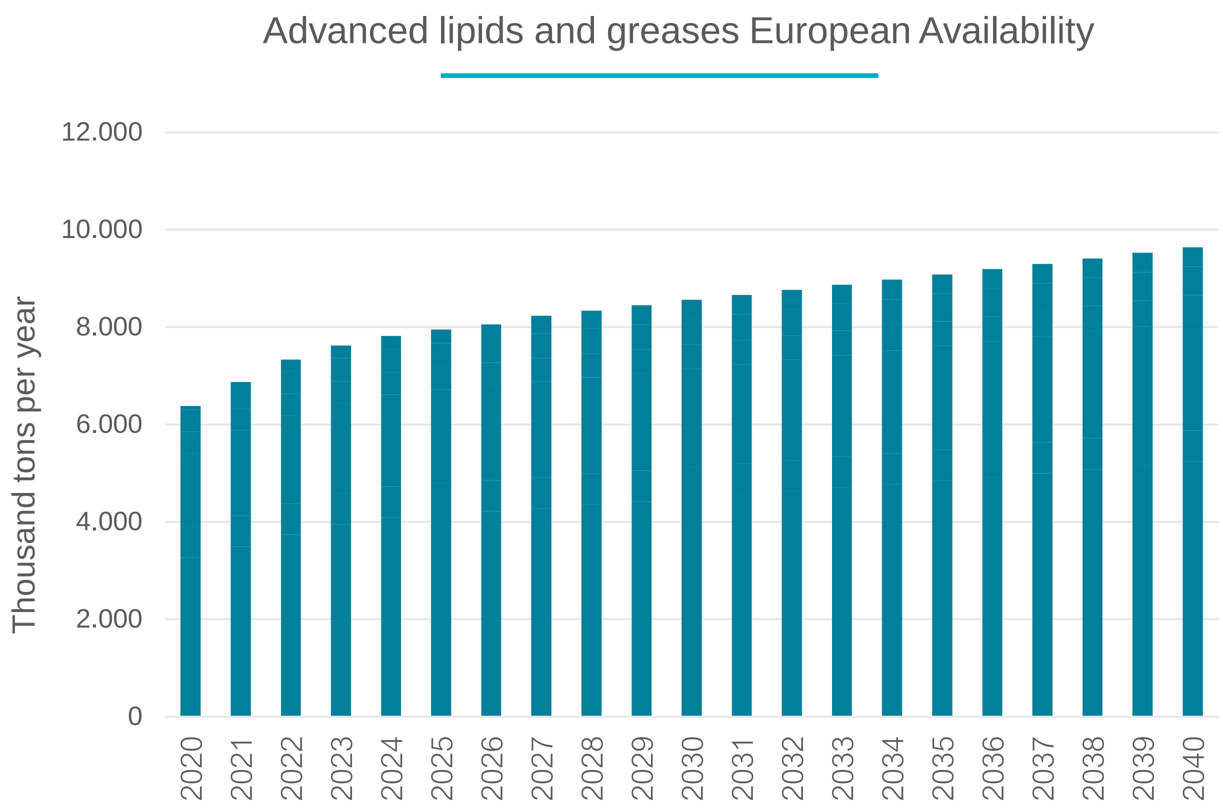
# Wastes availability. Lipidic Route




**Source: Argus Consulting. June 2021**

To go further in this route, raw material availability is key.

**Already closing raw material agreements locally and internationally**

The demand for these raw materials will stimulate its availability.

**Before exhausting this route we are exploring others.**

# 03.

## Our Pathway to 2030

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# Additional potential from solid wastes and $CO_2$

There is enough sustainable biomass (organic waste from any kind) in Europe for obtaining the expected advanced biofuel demand in 2050*.

**To realise this potential, additional R&D would be required as well as the implementation of improvement management strategies. The supply chain would need to be developed to mobilise all these resources.**

Source: Sustainable biomass availability in the EU to 2050. Imperial Collage 2021

| Waste availability for energy uses (Mty) | | |
|---|---|---|
| Type of Waste | 2030 | 2050 |
| Municipal & Industrial Bio-waste | 44 – 80 | 33 – 61 |
| Forestry Waste | 204 – 370 | 215 – 408 |
| Agriculture Waste | 272 – 410 | 291 – 447 |

+ $CO_2$

* Fuels Europe Clean Fuels for All Scenarios.

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# Integration with the refineries

| Secondary Conversion | Products | Final Uses |
|---|---|---|

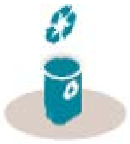
**Renewable raw materials**

**Current refinery**

Renewable energy and gas

**Low carbon, Liquid Fuels and Renewable Gases**

Raw Material for the petrochemical industry



- Sustainable Fuels for road transport
- Sustainable Fuels for aviation
- Sustainable Fuels for marine
- Petrochemical Industry
- Power generation, Heating, industry, residential

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# Integration with the refineries

**Waste and raw materials** › **Primary Conversion** › **Secondary Conversion** › **Products** › **Final Uses**

- Sustainable vegetable oils
- UCO
- Lipidic Wastes
- Municipal and Industrial Solid Waste
- Plastic Waste
- Forestry, agricultural, livestock and food industry wastes
- $CO_2$

**New units**

Waste conversion to synthetic oils
+
Pretreatment

Delocalized (National & International)
Distributed
Integrated

**Renewable raw materials**

**Current refinery**

Renewable energy and gas

**Low carbon, Liquid Fuels and Renewable Gases**

Raw Material for the petrochemical industry

Sustainable Fuels for road transport

Sustainable Fuels for aviation

Sustainable Fuels for marine

Petrochemical Industry

Power generation, Heating, industry, residential

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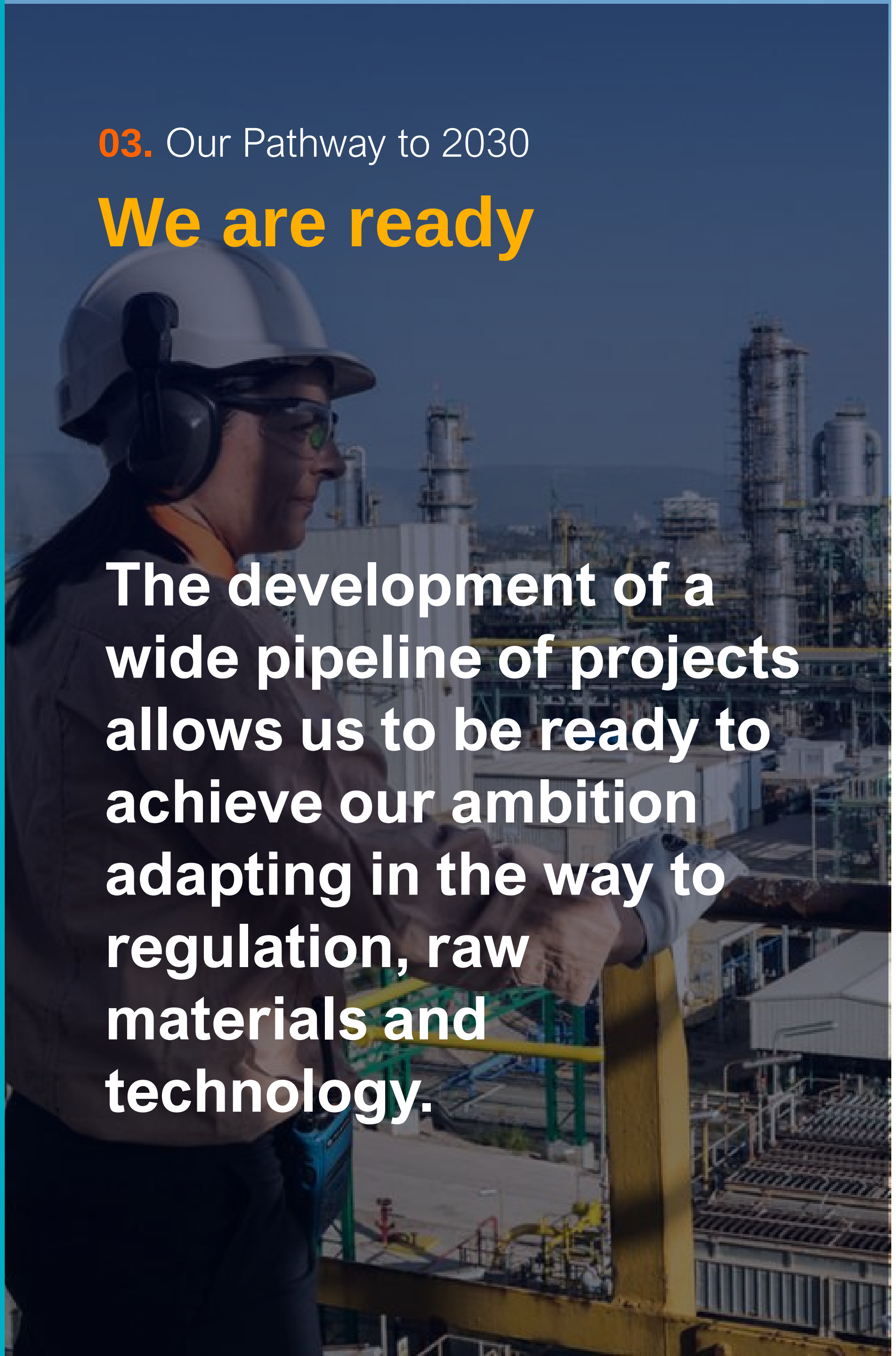

03. Our Pathway to 2030

# We are ready

**The development of a wide pipeline of projects allows us to be ready to achieve our ambition adapting in the way to regulation, raw materials and technology.**

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| Long List | Ongoing projects | 2030 Ambition |
|---|---|---|

Low Carbon Fuels Production Capacity

**3.5+ Mty** > **2 Mty**

## 60+ Initiatives

**Multitechnology. Raw materials flexibility. Competitive**

**Making use of the organization know-how and capabilities**

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**03.** Our Pathway to 2030

# BTL and Pyrolisys Oils

| 2025 | 2030 |
|---|---|
| Demo | Scale-up |
| | +130 kta |

| Regulation | Raw Material |
|---|---|
| Renewable Energy Directive (RED)<br>ReFuel Aviation<br>FuelEU Maritime<br>Waste Directive<br>Farm to Fork Strategy | Municipal Solid Waste (MSW)<br>Agriculture and forestry residues |

| Technology | Final Uses |
|---|---|
| Gasification + Chemical synthesis/FT + Upgrading<br>Pyrolysis + Upgrading | Transport (Road, Aviation, Marine)<br>Feedstock for chemical industry |

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## Initiatives

4

Est. Gross Margin
200 – 2,000 €/tep

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**03.** Our Pathway to 2030

# E-Fuels

2025 Demo → 2030 Scale-up

+2.5 kta

| Regulation | Raw Material |
|---|---|
| Renewable Energy Directive (RED)<br>ReFuel Aviation<br>FuelEU Maritime | $CO_2$<br>Renewable Hydrogen |

| Technology | Final Uses |
|---|---|
| Reverse Water Gas Shift – Under dev<br>+ FT + Upgrading - Commercial | Transport (Road, Aviation, Marine)<br>Feedstock for chemical industry |

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## Initiatives

2

€ Est. Gross Margin
0 – 4,000 €/tep

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**03.** Our Pathway to 2030

# Advanced Ethanol

| 2025 | 2030 |
|---|---|
| **Demo** | **Roll out** |
| +8 kta | +16 kta |

### Regulation

Renewable energy Directive (RED)
Waste Directive
Farm to Fork Strategy

### Raw Material

Organic MSW
Agriculture residues

### Technology

Fermentation –
Scaling up

### Final Uses

Transport (Road)
Intermediate Product for:
Renewable Hydrogen
Jet production

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## Initiatives

5

€ Est. Gross Margin
1,100 – 1,800 €/tep

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# Biomethane

2030

**Commercial**

**400+ GWh/a**

| Regulation | Raw Material |
|---|---|
| Renewable Energy Directive (RED)<br>FuelEU Maritime<br>Guarantees of Origin<br>Waste Directive<br>Farm to Fork Strategy<br>ETS | Organic MSW<br>Agriculture + Livestock residues |

| Technology | Final Uses |
|---|---|
| Anaerobic Digestion + Upgrading – Commercial | Transport (Road and Marine)<br>Hydrogen production Industry – Heat, Power Residential |

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## Initiatives

21

Est. Gross Margin
450 – 750 €/tep

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# Renewable Hydrogen

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## Regulation

Renewable Hydrogen EU Strategy
Renewable Energy Directive (RED)
ETS

## Raw Material

Renewable power and water
Biomethane
Biogas
Bionaphtha

## Technology

Electrolysis - Scaling - up
Steam Reforming - Commercial

## Final Uses

Intermediate for fuels production
Transport
Industry
Residential

## Initiatives

# Maximizing Value through partnerships

**We have over 45 partnerships in the whole value chain to develop decarbonization projects.**

**The partnership model is flexible including co-investing, long term contracts, etc.**

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| Raw material sourcing and pretreatment | Technology & Operation | Final Use |
|---|---|---|
| Waste management and pretreatment<br>Biomass sourcing<br>Agriculture and livestock producers | Technologist and licensors<br>Technology Centers<br>Biomass plants operators | Airlines<br>Shippers<br>Fleet Operators<br>OEMs |

**Demo plants**

**Public Funding**

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# Summary

Repsol is the **leading HVO and bio-ETBE producer in Iberia**, and **first biofuels marketer in Spain.**

We incorporate biofuels in our products since 1998.

Clear pipeline to 2025 with **Cartagena advanced biofuels plant** as main project ready in 1Q23.

**Wide pipeline of initiatives** to achieve our 2030 goals:

- Application of different technologies
- Flexibility in raw materials
- Strategic partnerships

Applying **strengths** and **know how** of the traditional business to new developments: Competitiveness, integration and flexibility.

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