Low Carbon Day
Driving the Refining transformation

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#RepsolLowCarbonDay
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01. Low Carbon Fuels Framework

Transforming our business model

Raw Materials
Scope 3

&

Energy
Scope 1 - 2
01. Low Carbon Fuels Framework

Transforming our business model

1. Regulation
   - Anticipation + advocacy + local dialogue

2. Technology Development and Integration in the Value Chain
   - Cost and CO₂ Competitive
   - 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

The Repsol Commitment Net Zero Emissions by 2050
Regulation increases demand and promotes the development of raw materials

<table>
<thead>
<tr>
<th>Products</th>
<th>Raw Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>2020</td>
<td>2019</td>
</tr>
<tr>
<td>2021</td>
<td>2020</td>
</tr>
<tr>
<td>RED II</td>
<td>Waste Directive</td>
</tr>
<tr>
<td>FQD</td>
<td>EU Green Deal</td>
</tr>
<tr>
<td></td>
<td>Farm to Fork Strategy</td>
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<tr>
<td></td>
<td>Circular Economy Action Plan</td>
</tr>
<tr>
<td>EU Green Deal</td>
<td>H₂ Roadmap</td>
</tr>
<tr>
<td>NECP</td>
<td>Biogas Roadmap</td>
</tr>
<tr>
<td>RED III</td>
<td>ReFuel Aviation FuelEU Maritime</td>
</tr>
</tbody>
</table>

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

INECP: Spain’s Integrated National Energy and Climate Plan
Regulation can significantly boost the development of low carbon products market

**01. Low Carbon Fuels Framework**

- **13% GHG** reduction in transport
- **50% Renewable H₂** in the industry
- **2.6% RFNBO** in transport
- **2.2% Advanced Biofuels** in transport
- **5% Biojet** in aviation
- **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 2021 July 14*
# Technology Routes

## Low Carbon Liquid Fuels
- **2021**: Fermentation – Ethanol
- **2025**: Lipidic Route - HVO, Esterification - FAME
- **2030**: Anaerobic Digestion - Biomethane, Gasification and Pyrolysis – BTL and Pyrolysis Oils

## E-fuels

## Renewable Gases
- Gasification and Pyrolysis – BTL and Pyrolysis Oils
01. Low Carbon Fuels Framework

Products Portfolio evolution

- **Middle Distillates**
  - Coprocessed HVO 1G
  - Coprocessed HVO from UCO
  - FAME
  - UCOME

- **Biogas/LPG/H2**
  - Coprocessed BioC3
  - ETBE
  - Ethanol

- **Naphthas and Gasoline**
  - Coprocessed Biojet 1G
  - Advanced Coprocessed Biojet
  - BioCH₄ for NGV and H₂
  - H₂ from electrolysis
  - Advanced BioC3
  - BioCH₄ for NGV and H₂
  - E-Naphtha
  - Advanced Bioethanol
  - Bionaphtha

**Timeline**
- 1998-2018
- 2019
- 2020
- 2021
- 2022
- 2023
- 2024
- 2025

**Production**
- Gasoline
- Diesel
- LPG
- NGV/H₂
- Jet
- Marine
- Others
02.
Providing Short Term Value
02. Providing Short-Term value

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**

**H₂**

Leaders in renewable hydrogen: First production from biomethane in Cartagena steam reforming in October 2021
HVO, the best short-term route to grow in biofuels generating value

- 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
- 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
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

Source: Argus Consulting. REDII Based. June 2021
### 03. Our Pathway to 2030

**HVO+SAF**

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Raw Material</th>
<th>Final Uses</th>
</tr>
</thead>
</table>
| Renewable Energy Directive (RED) | Sustainable Vegetable Oils  
UCO + animal fats  
Other lipidic residues included in  
Annex IX Part A RED Directive | Transport (Road, Aviation and Marine)  
By-Products for:  
Renewable Hydrogen  
Chemical Industry |
| ReFuel Aviation  
FuelEU Maritime |                              |                                                 |

**Technology**

- Hydrogenation - *Commercial*
- New units or retrofitting

**Forecasted Margin**

- **Current Margin**: 250-750€/tep
- **Forecasted Margin**: 950-1,550€/tep

**2025**  
**2030**

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>+300 kta</td>
<td>+275 kta</td>
</tr>
</tbody>
</table>
New Advanced Biofuels Plant in Cartagena

<table>
<thead>
<tr>
<th>Investment</th>
<th>Capacity</th>
<th>Start - Up</th>
<th>Emissions Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>€188 M</td>
<td>250 kty Low Carbon Fuels</td>
<td>1Q 2023</td>
<td>- 900 kt/y CO₂</td>
</tr>
<tr>
<td></td>
<td>300 kty Waste and Residues Input</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Raw material pretreatment (Wastes + UCO)

- Operation modes:
  1. HVO
  2. Bio Jet

- Hydrotreatment + Isomerization
- H₂ Plant
- Bio Propane
- Bio Naphtha
- Biojet
- HVO

02. Providing Short-Term value
02. Providing Short-Term value

Wastes availability. Lipidic Route

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.

Source: Argus Consulting. June 2021
03. Our Pathway to 2030
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.

* Fuels Europe Clean Fuels for All Scenarios.
## Integration with the refineries

### Secondary Conversion

<table>
<thead>
<tr>
<th>Renewable raw materials</th>
</tr>
</thead>
</table>

### Products

<table>
<thead>
<tr>
<th>Low carbon, Liquid Fuels and Renewable Gases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material for the petrochemical industry</td>
</tr>
</tbody>
</table>

### Final Uses

- Sustainable Fuels for road transport
- Sustainable Fuels for aviation
- Sustainable Fuels for marine
- Petrochemical Industry
- Power generation, Heating, industry, residential
# Integration with the refineries

## Waste and raw materials
- Sustainable vegetable oils
- UCO
- Lipidic Wastes
- Municipal and Industrial Solid Waste
- Plastic Waste
- Forestry, agricultural, livestock and food industry wastes
- CO₂

## Primary Conversion
- Waste conversion to synthetic oils + Pretreatment
- Delocalized (National & International) Distributed Integrated

## Secondary Conversion
- Renewable energy and gas

## Products
- Low carbon, Liquid Fuels and Renewable Gases
  - Raw Material for the petrochemical industry

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

We are ready

03. Our Pathway to 2030

- **3.5+ Mty** Production Capacity
- **60+ Initiatives**
  - Multitechnology. Raw materials flexibility. Competitive
- **2 Mty**

Making use of the organization know-how and capabilities.
03. Our Pathway to 2030

BTL and Pyrolisis Oils

Est. Gross Margin
200 – 2,000 €/tep

Initiatives

Regulation
- Renewable Energy Directive (RED)
- ReFuel Aviation
- FuelEU Maritime
- Waste Directive
- Farm to Fork Strategy

Raw Material
- Municipal Solid Waste (MSW)
- Agriculture and forestry residues

Technology
- Gasification + Chemical synthesis/FT + Upgrading
- Pyrolysis + Upgrading

Final Uses
- Transport (Road, Aviation, Marine)
- Feedstock for chemical industry

2025
- Demo

2030
- Scale-up
+130 kta
## E-Fuels

### Our Pathway to 2030

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Raw Material</th>
<th>Technology</th>
<th>Final Uses</th>
</tr>
</thead>
</table>
| Renewable Energy Directive (RED)  
ReFuel Aviation  
FuelEU Maritime | CO$_2$  
Renewable Hydrogen | Reverse Water Gas Shift – Under dev  
+ FT + Upgrading - Commercial | Transport (Road, Aviation, Marine)  
Feedstock for chemical industry |

<table>
<thead>
<tr>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demo</td>
<td>Scale-up</td>
</tr>
<tr>
<td>+2.5 kta</td>
<td></td>
</tr>
</tbody>
</table>

### Initiatives

- **Est. Gross Margin**: 0 – 4,000 €/tep
- **Objective**: Scale-up
- **Timeline**: 2025 – 2030

**Initiatives**

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Year</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReFuel Aviation</td>
<td>2025</td>
<td>Demo</td>
</tr>
<tr>
<td>FuelEU Maritime</td>
<td>2025</td>
<td>Scale-up</td>
</tr>
<tr>
<td>Reverse Water Gas Shift</td>
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<td>+2.5 kta</td>
</tr>
<tr>
<td>+ FT + Upgrading</td>
<td>Commercial</td>
<td></td>
</tr>
</tbody>
</table>

**The Repsol Commitment**

Net Zero Emissions by 2050
# 03. Our Pathway to 2030

## Advanced Ethanol

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Raw Material</th>
<th>Technology</th>
<th>Final Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Waste Directive</td>
<td>- Agriculture residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Farm to Fork Strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demo</td>
<td>Roll out</td>
</tr>
<tr>
<td>+8 kta</td>
<td>+16 kta</td>
</tr>
</tbody>
</table>

**Initiatives**

5

**Est. Gross Margin**

1,100 – 1,800 €/tep
03. Our Pathway to 2030

Biomethane

Initiatives

Regulation
- Renewable Energy Directive (RED)
- FuelEU Maritime
- Guarantees of Origin
- Waste Directive
- Farm to Fork Strategy
- ETS

Raw Material
- Organic MSW
- Agriculture + Livestock residues

Technology
- Anaerobic Digestion + Upgrading – Commercial

Final Uses
- Transport (Road and Marine)
- Hydrogen production Industry – Heat, Power Residential

2030
- Commercial
- 400+ GWh/a

Est. Gross Margin
- 450 – 750 €/tep
03. Our Pathway to 2030

Renewable Hydrogen

**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
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.

Maximizing Value through partnerships

Raw material sourcing and pretreatment
- Waste management and pretreatment
- Biomass sourcing
- Agriculture and livestock producers

Technology & Operation
- Technologist and licensors
- Technology Centers
- Biomass plants operators

Final Use
- Airlines
- Shippers
- Fleet Operators
- OEMs

Demo plants

Public Funding
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.