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Low Carbon Day

Hydrogen business strategy

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01. Hydrogen market vision

02. Repsol position

03. Ambition

04. Business roadmap





01. Hydrogen market vision





Strong hydrogen market growth

Demand growth driven by low carbon H₂

• EU hydrogen demand – Market forecasts (M tons/yr)





Ambitious H_2 development targets in the EU and Spain, supported by public and private funding



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Recently launched "Fit for 55" regulatory package with ambitious targets supporting H_2 development

- Strong 2030 penetration targets
 - Min. 50% share of renewable H₂ consumption in industry
 - 2.6% minimum quota of RFNBO³ in transport
 - 0.7% e-fuels share in the aviation fuel mix (5% in 2035)
- Discount tax rates for the use of renewable and low-carbon hydrogen for end-consumers (based on energy content)



3

Further regulatory support still in progress

- Economic incentives to ensure low carbon H₂ competitiveness
- Secondary regulation for H₂ and the 3rd Gas Package review including the contribution of H₂ to decarbonization of gas markets to be launched in December.
- Technical requirements for production of H₂ and derivatives (e.g. renewable energy feed criteria, requirements on CO₂ for e-fuel production, etc.)



3. Renewable Fuel of Non Biological Origin – H2 and H2 derivatives (e.g. e-fuels)

^{1.} EU-FCHJU forecast (Fuel Cell and Hydrogen Join Undertaking)

^{2.} Market size estimated with 1.3 €/kg full grey (incl. capex) H2 production cost (assuming natural gas cost of 20 €MWh and excluding CO2 price)



Industry & transport lead market for renewable H₂

Industrial processes and heavy vehicles are the most promising short-term applications

Market development driven by low carbon H₂ competitiveness and lack of alternatives – 2030 view



Regulatory support & Refining competitiveness



EU regulation (RED II&III) can bring competitiveness to renewable H₂ produced for refineries

Industrial processes: competitiveness achieved in refining due to H₂ for fuel production being included as part of renewable targets in transport



1. Natural gas price 20 €/MWh; range corresponds to CO₂ price (from 0 to 60€/ton)

2. 100 MW electrolyser, 1200€/kW of CapEx (full project costs incl. electrical connection, civil, intermediate storage, project costs), 65% electrolyser efficiency,

~70% load factor, range corresponds to power price between 32 and 50€/MWh; additionally considers 6.4€/MWh grid toll.

3. H₂ capex subsidies 25% : effective capex 900 €/kw (Total capex 1200 €/kw)



Hydrogen competitiveness

Low-carbon H₂ expected to become competitive vs incumbent by 2030-35



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1. 20 €/MWh natural gas price

2. Considers carbon capture of 90% of total CO₂ produced

3. 100 MW electrolyser, 1200€/kW of CapEx (full project costs incl. electrical connection, civil, H₂ intermediate storage, project costs), 65% electrolyser

efficiency, ~70% load factor, electricity price 32€/MWh, 6.4€/MWh grid toll.

4. Low range: 100 MW electrolyser, 579€//kW CapEx, 68% efficiency, ~70% LF, electricity price 25 €/MWh, 6.4€/MWh toll; high range: 100 MW electrolyser,

760€//kW CapEx, 68% efficiency, 70% LF, electricity price 30€/MWh, 6.4€/MWh toll.

5. CapEx 400 €/kw, 68% efficiency, LF ~70%; electricity price 20 €/MWh, 6.4€/MWh toll, OpEx 24 €/kW



02. Repsol position





02. Repsol Position Repsol competitive advantages

Leveraging sources of competitive advantage...



... driving a differentiated market position

The Repsol Commitmen Net Zero Emissions by 2050



02. Repsol Position





- 1. Capacity factor; Electrolyzer efficiency ~65%
- Market size estimated with 1.3 €/kg full grey (incl. capex) H₂ production cost (assuming natural gas cost of 20 €MWh and excluding CO₂ price) Source: IEA; Nexant

by 2050







03. Ambition





03. Ambition

Current ambition aligned with "Fit for 55" targets

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2025 objective







- Deployment of electrolyzer capacity in own refineries to develop experience and scale
 - Developing H₂ hubs around own sites
- Participation in pilots with 3rd-parties to develop positioning and know-how in new applications

- 2. SBR: Steam biomethane Reforming, renewable hydrogen production from biomethane
- 3. Renewable Fuel of Non Biological Origin H_2 and H_2 derivatives (e.g. e-fuels)



- Fit for 55 proposal strongly support renewable H₂ development in Europe:
 - Transport: 2.6% minimum quota of RFNBO³ for all transport modes and minimum quota of 0.7% of e-fuels used in aviation by 2030 (5% by 2035)
 - Industry: 50% minimum share of renewable H₂ used for final energy and non-energy purposes in industry
- Current H₂ ambition in own-assets achieves minimum regulatory targets
- E-fuels plant to strengthen Repsol H₂ position and increase market share in a highly synergetic long-term business line
- Third party volumes to cover additional industrial needs



The Repsol Commitment Net Zero Emissions by 2050

Required H₂ capacity vs. ambition, 2030 (GW)

^{1.} Including the e-fuel pilot plant in Petronor







Key financial metrics



Note: Considers 20 years lifetime for each project since commissioning, and no terminal value; does not include overhead costs; H_2 price estimated as cost of grey H_2 production alternative (steam reforming) + CO_2 cost + RED II green premium; e-fuel price estimated as diesel price alternative (including hydrocarbon taxes) + RED II green premium; amortization for projects with commissioning date before 2027 of 5 years, for other projects of 20 years; PPAs established before 2027 with high cost (+22€/MWh compared to the base cost of the PPAs signed afterwards)









1. Assumes sizing of 3.25 MW renewable generation capacity per MW of electrolyzer (70% of Renewables power generation is dedicated H2 production, with the rest fed to the grid); Gross capacity assumes 100% of renewables development in projects in which Repsol's stake is >=50%.

2. Renewables Capex assumptions: 2022-2025-> Solar: 595 €/kW Wind: 920€/kw.

Note 1: Capacities assume a 95% capacity factor;

Note 2: Equity share between 50% and 100% in projects deployed in Repsol refineries before 2025. Equity share for projects deployed in third-party assets in Spain of 50%. Equity share for international projects of 30%;





Production of e-fuels in Petronor

Development of worldwide reference plant to achieve commercial level and leading position in production of synthetic fuels





Investments:

Wind generation, electrolysis, e-fuels plant: €74 M

Production: 50 bbl/d

Partners





The Repsol Commitment Net Zero Emissions by 2050

SUNRGYZE – Renewable H₂ production technology

Repsol - Enagas partnership: technological development of disruptive and photoelectrocatalytic process for production of cost-competitive renewable hydrogen





- 100% renewable
- 100% CO₂ reduction vs conventional hydrogen.
- Based on the direct conversion of solar energy into chemical energy
- Collaboration with different public and private entities





Universitat d'Alacant Universidad de Alicante



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The Repsol Commitment Net Zero Emissions by 2050

🔺 02. PEC cell

Repetitive basic unit that is groups to constitute modules

Spanish Hydrogen Network (SHYNE) Project



Repsol with great strengths to be the backbone of the Renewable Hydrogen roadmap and its sectoral integration, together with growing demand for H_2 in the coming years, and the role played by the European Funds, will lead Spanish national project.





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