



# Low Carbon Day

Hydrogen business strategy

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The Repsol Commitment  
Net Zero Emissions  
by 2050



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# 01.

## Hydrogen market vision



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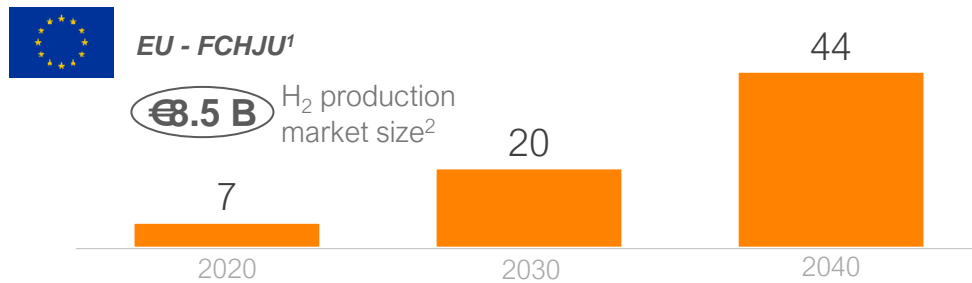


# 01. Market Vision

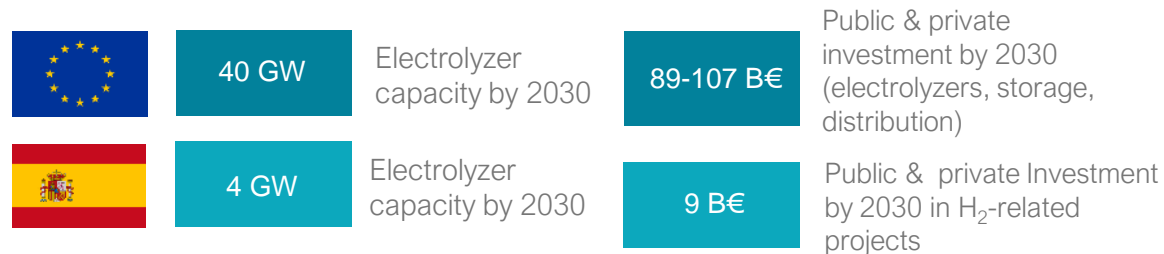
## Strong hydrogen market growth

### 1 Demand growth driven by low carbon H<sub>2</sub>

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



### 2 Ambitious H<sub>2</sub> development targets in the EU and Spain, supported by public and private funding



Spanish government supports deployment of low carbon H<sub>2</sub> under EU funds, with **€1.55 B before 2024**

### 3 Recently launched "Fit for 55" regulatory package with ambitious targets supporting H<sub>2</sub> development

- Strong 2030 penetration targets
  - Min. 50% share of renewable H<sub>2</sub> consumption in industry
  - 2.6% minimum quota of RFNBO<sup>3</sup> 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)

### 4 Further regulatory support still in progress

- Economic incentives to ensure low carbon H<sub>2</sub> competitiveness
- Secondary regulation for H<sub>2</sub> and the 3<sup>rd</sup> Gas Package review including the contribution of H<sub>2</sub> to decarbonization of gas markets to be launched in December.
- Technical requirements for production of H<sub>2</sub> and derivatives (e.g. renewable energy feed criteria, requirements on CO<sub>2</sub> for e-fuel production, etc.)

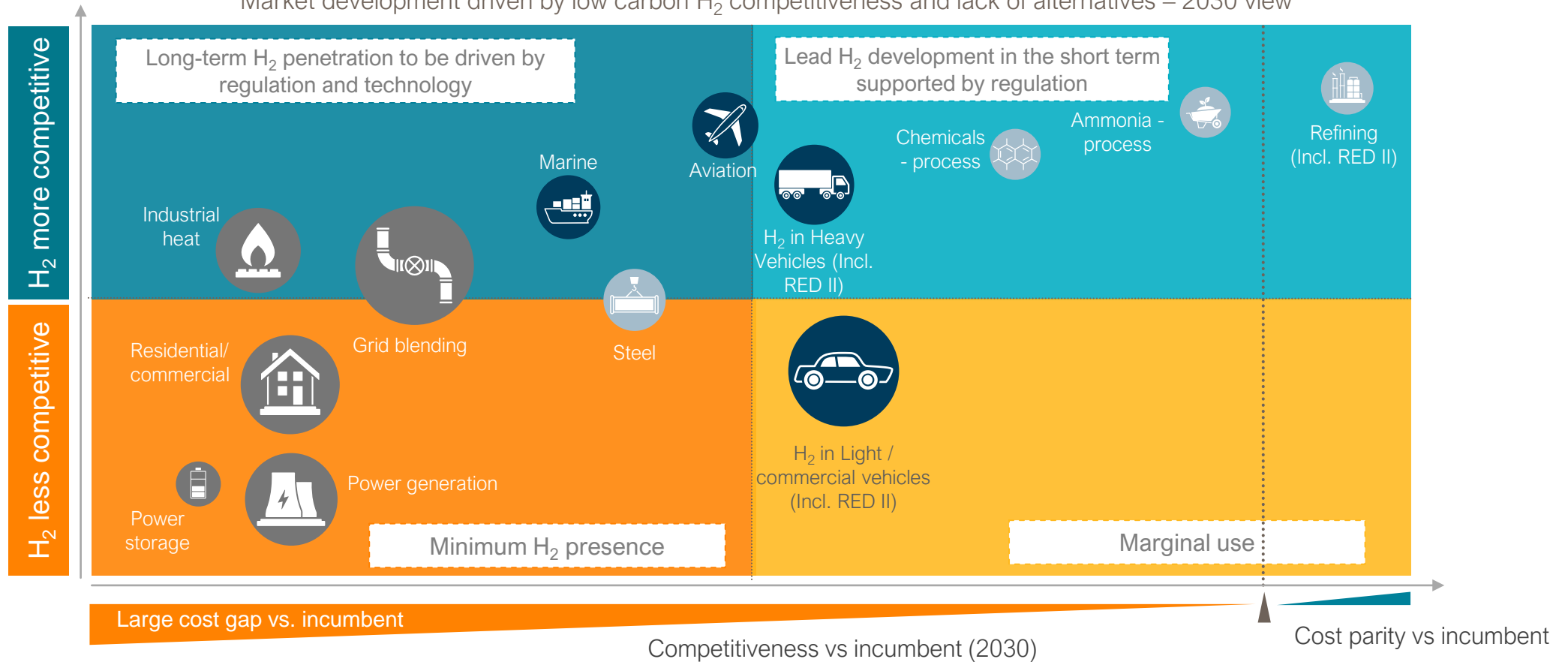
1. EU-FCHJU forecast (Fuel Cell and Hydrogen Joint Undertaking)  
 2. Market size estimated with 1.3 €/kg full grey (incl. capex) H<sub>2</sub> production cost (assuming natural gas cost of 20 €/MWh and excluding CO<sub>2</sub> price)  
 3. Renewable Fuel of Non Biological Origin – H<sub>2</sub> and H<sub>2</sub> derivatives (e.g. e-fuels)

# 01. Market Vision

## Industry & transport lead market for renewable H<sub>2</sub>

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

Market development driven by low carbon H<sub>2</sub> competitiveness and lack of alternatives – 2030 view



**Legend**

- Industry
- Transport
- Power & Heat

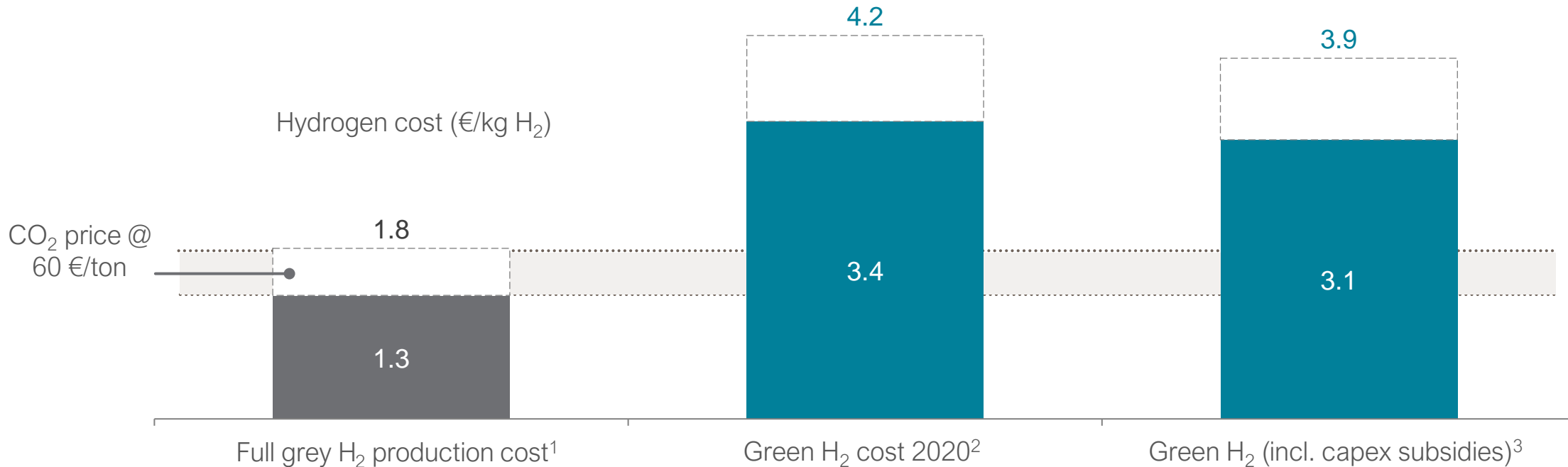
Bubble size is proportional to application's CO<sub>2</sub> emissions

## 01. Market Vision

# Regulatory support & Refining competitiveness

EU regulation (RED II&III) can bring competitiveness to renewable H<sub>2</sub> produced for refineries

Industrial processes: competitiveness achieved in refining due to H<sub>2</sub> for fuel production being included as part of renewable targets in transport



1. Natural gas price 20 €/MWh; range corresponds to CO<sub>2</sub> 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.

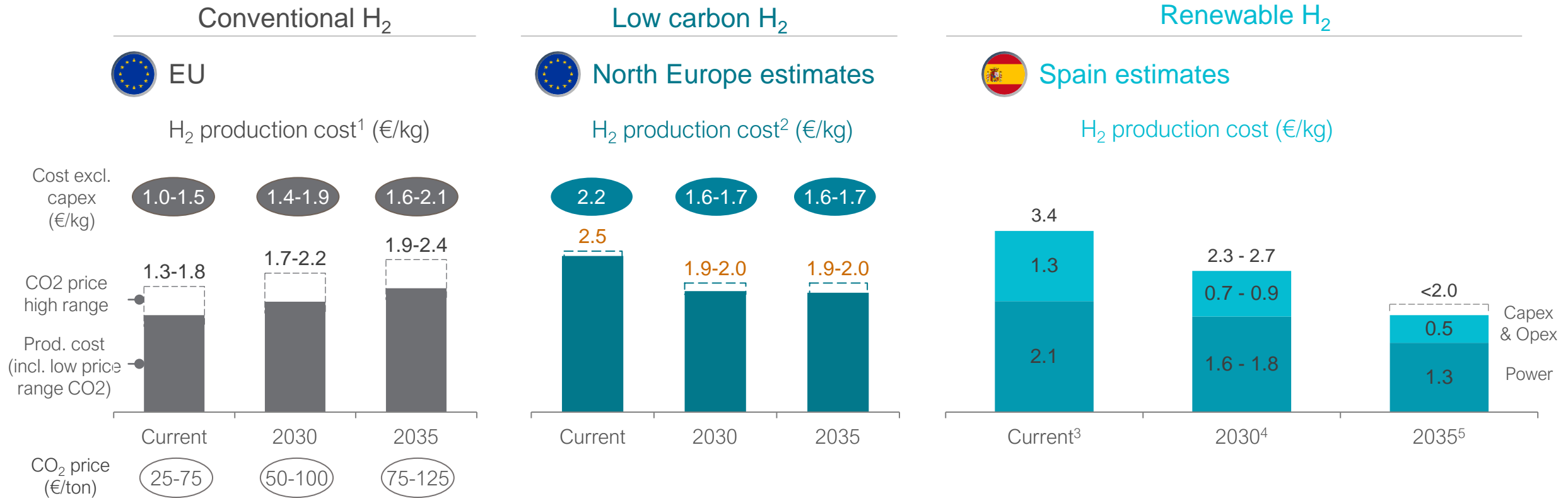
3. H<sub>2</sub> capex subsidies 25% : effective capex 900 €/kw (Total capex 1200 €/kw)



# 01. Market Vision

## Hydrogen competitiveness

Low-carbon H<sub>2</sub> expected to become competitive vs incumbent by 2030-35



1. 20 €/MWh natural gas price  
 2. Considers carbon capture of 90% of total CO<sub>2</sub> produced  
 3. 100 MW electrolyser, 1200€/kW of CapEx (full project costs incl. electrical connection, civil, H<sub>2</sub> 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



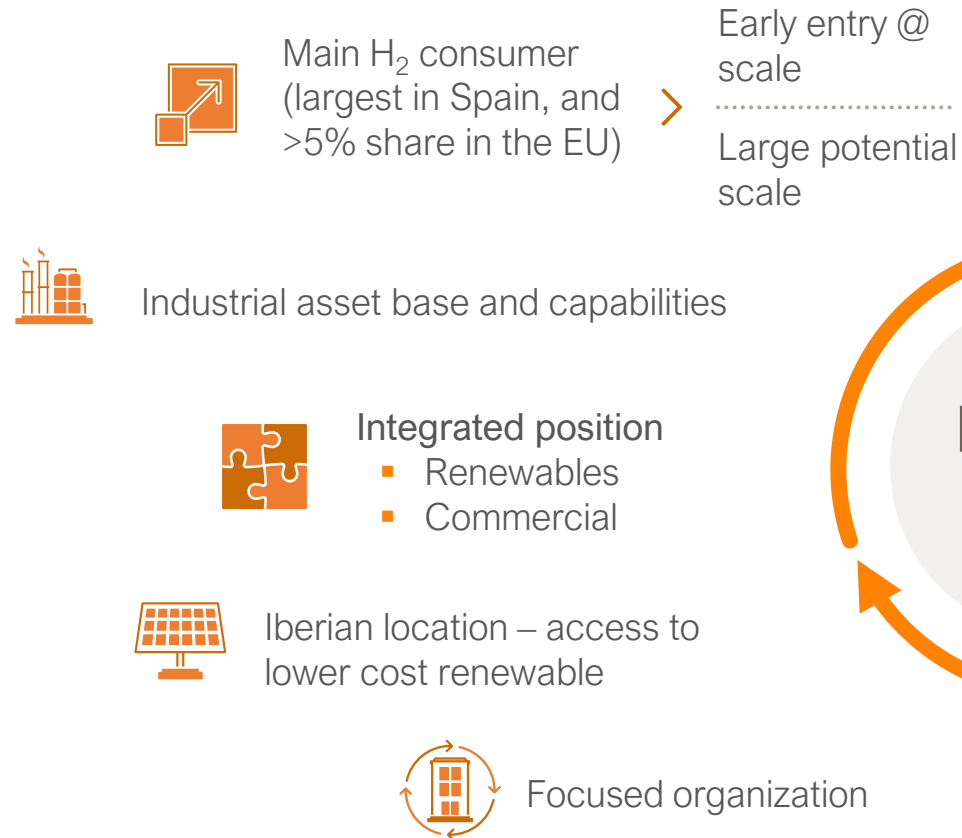
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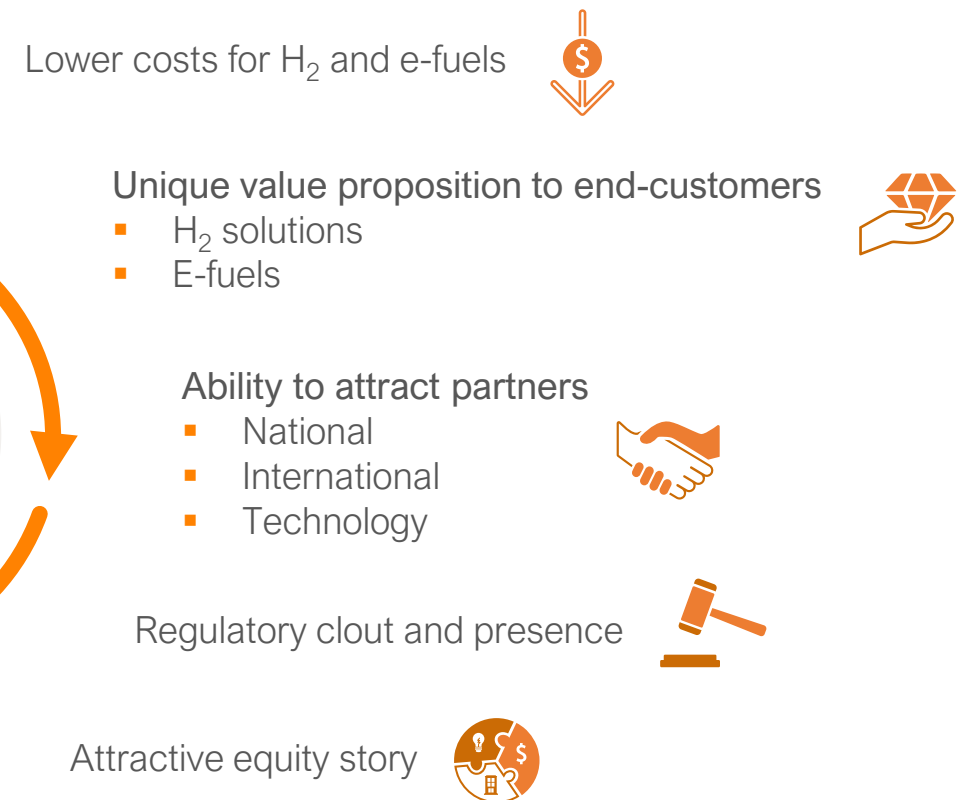
## 02. Repsol Position

# Repsol competitive advantages

### Leveraging sources of competitive advantage...



### ... driving a differentiated market position



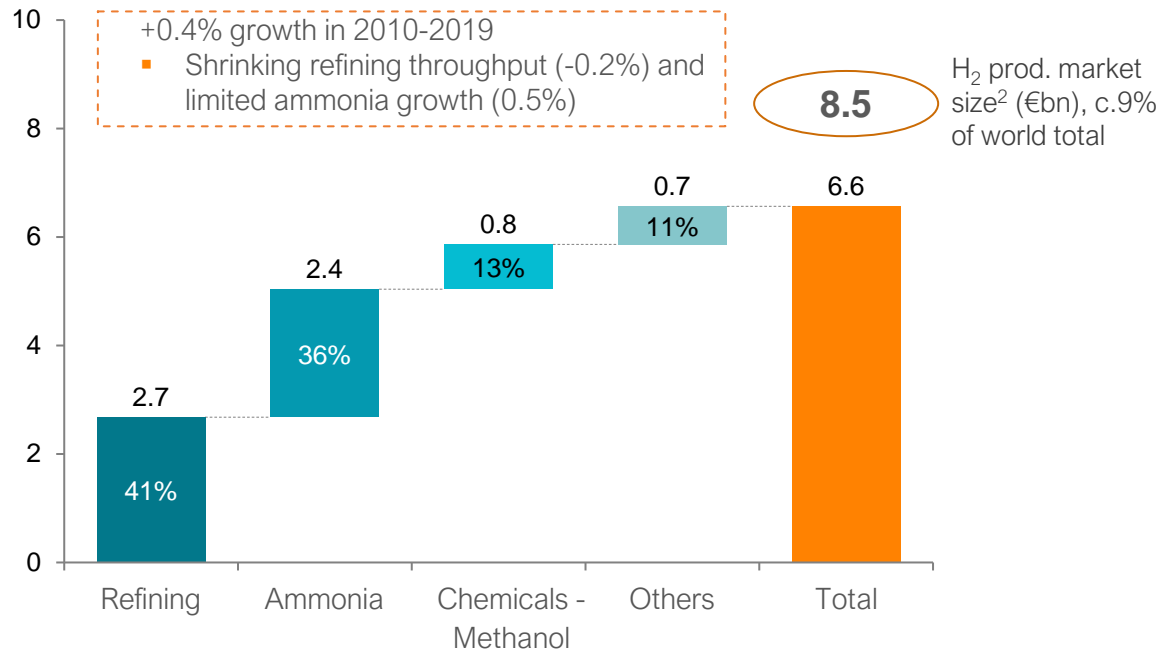
## 02. Repsol Position

# Hydrogen consumption in Europe & Spain



**Europe's H<sub>2</sub> market (~6.6 M tons/yr, €8.5 B) represents c.9% of world market and is concentrated on ammonia and refinery uses**

Hydrogen demand in Europe, 2020 (M tons/yr)

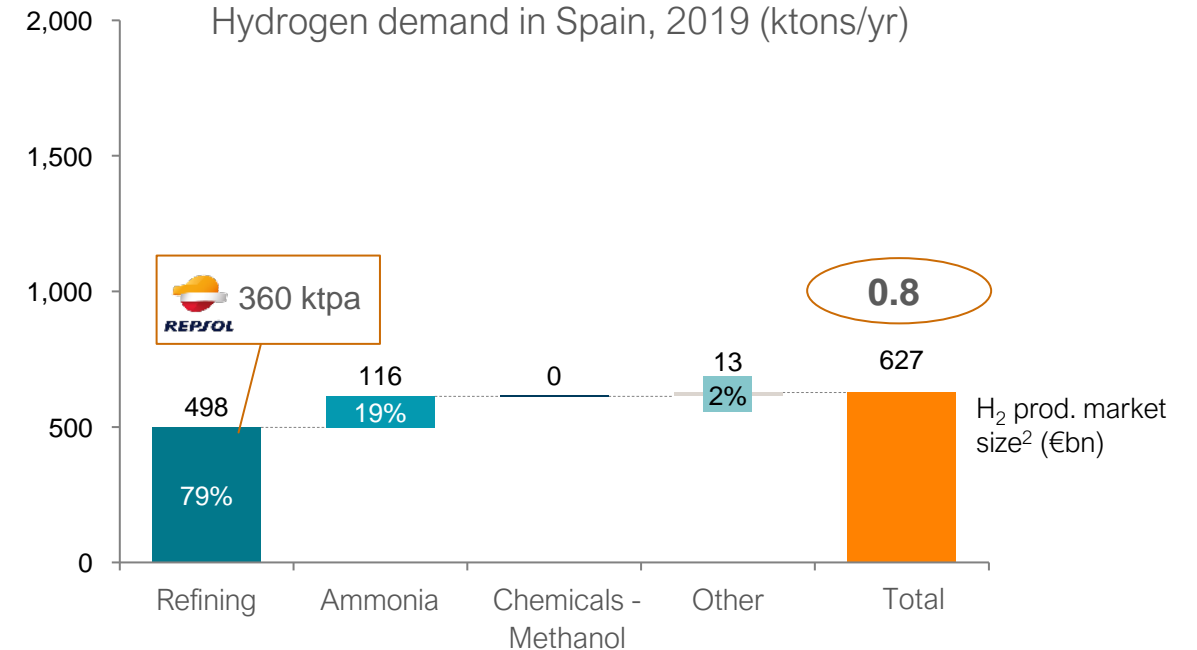


Equivalent electrolyzer capacity (GW): 41 CF<sup>1</sup> 95%, 56 CF 70%, 79 CF 50%



**Spain's H<sub>2</sub> market driven by refinery end-use, which accounts for 79% of total demand; market size ~ €0.8 B**

Hydrogen demand in Spain, 2019 (ktons/yr)

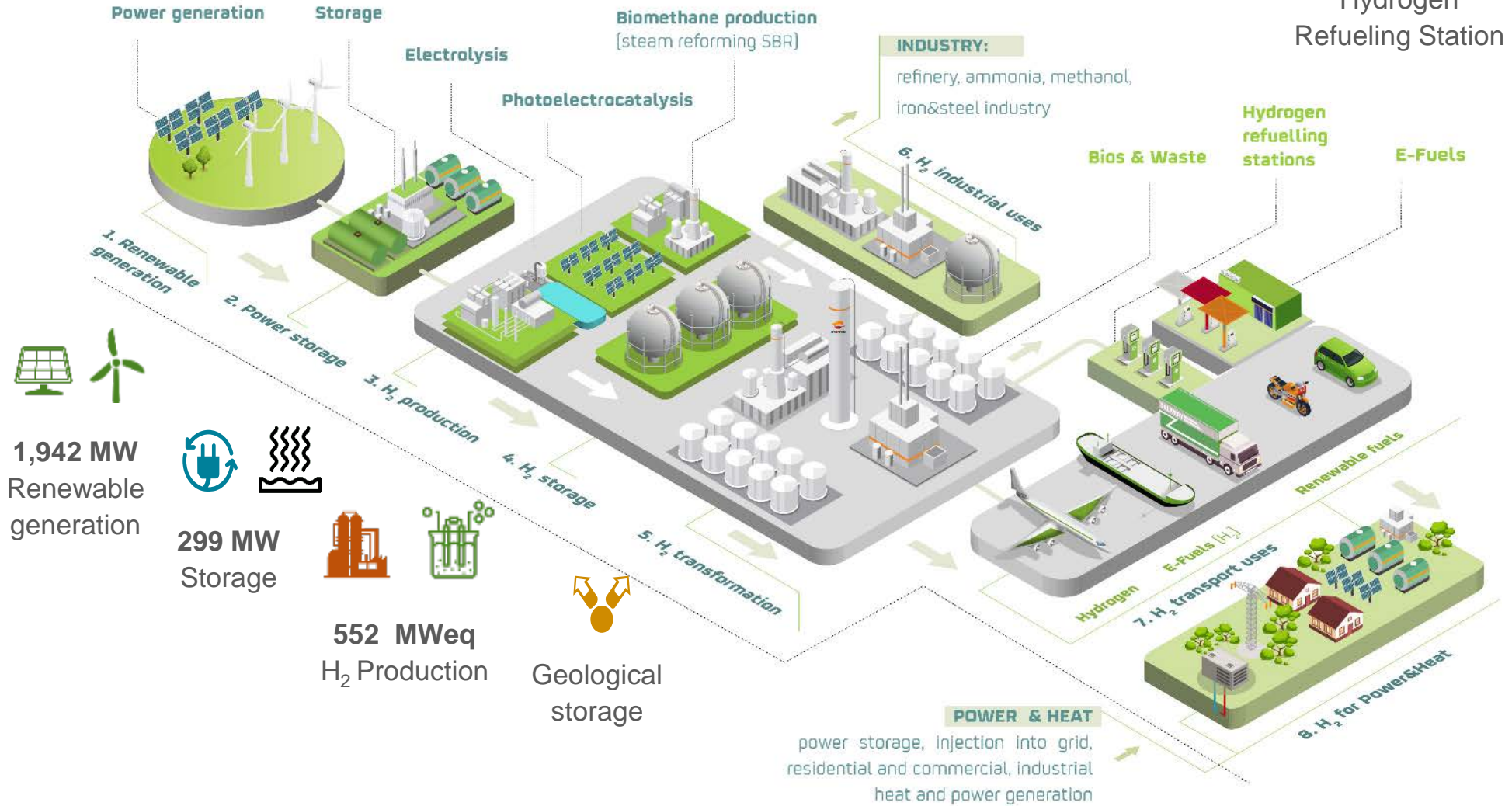


Equivalent electrolyzer capacity (GW): 3.9 CF 95%, 5.2 CF 70%, 7.3 CF 50%

1. Capacity factor; Electrolyzer efficiency ~65%  
 2. Market size estimated with 1.3 €/kg full grey (incl. capex) H<sub>2</sub> production cost (assuming natural gas cost of 20 €/MWh and excluding CO<sub>2</sub> price)  
 Source: IEA; Nexant

## 02. Repsol Position

# Present throughout the value chain



12  
Hydrogen Refueling Station



2,7 MM l/year of e-fuels



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1. Note: figures as of 2025



# 03.

## Ambition



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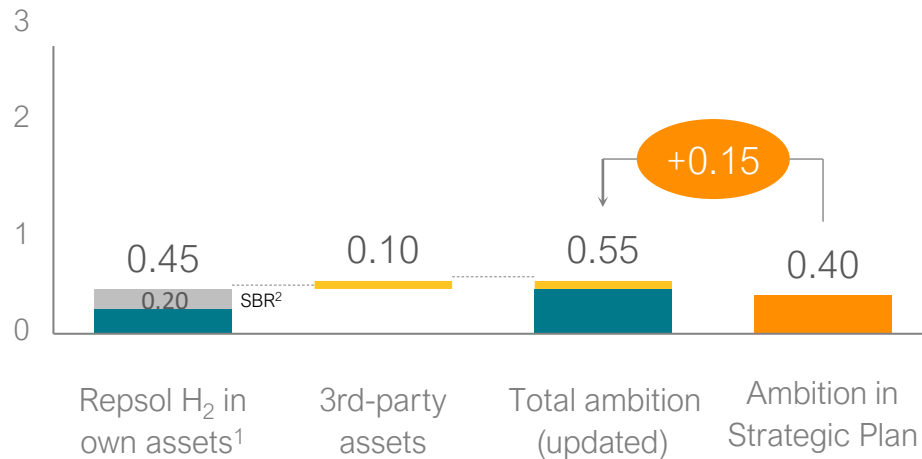


### 03. Ambition

## Current ambition aligned with “Fit for 55” targets

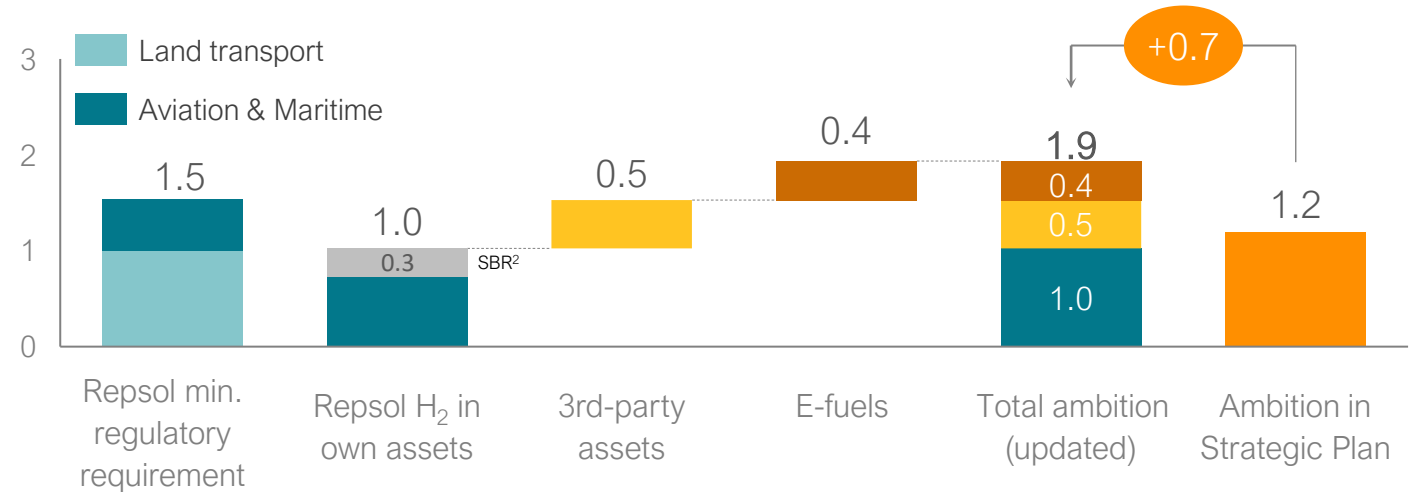
### 2025 objective

H<sub>2</sub> capacity objective, 2025 (GW)



### 2030 ambition

Required H<sub>2</sub> capacity vs. ambition, 2030 (GW)



- Deployment of **electrolyzer capacity in own refineries to develop experience and scale**
  - Developing H<sub>2</sub> hubs around own sites
- Participation in **pilots** with 3rd-parties to develop positioning and know-how in new applications

- Fit for 55 proposal strongly support renewable H<sub>2</sub> development in Europe:**
  - Transport:** 2.6% minimum quota of RFNBO<sup>3</sup> 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 H<sub>2</sub> used for final energy and non-energy purposes in industry
- Current **H<sub>2</sub> ambition in own-assets achieves minimum regulatory targets**
- E-fuels plant to strengthen Repsol H<sub>2</sub> position** and increase market share in a highly synergetic long-term business line
- Third party volumes to cover additional industrial needs**

1. Including the e-fuel pilot plant in Petronor  
 2. SBR: Steam biomethane Reforming, renewable hydrogen production from biomethane  
 3. Renewable Fuel of Non Biological Origin – H<sub>2</sub> and H<sub>2</sub> derivatives (e.g. e-fuels)

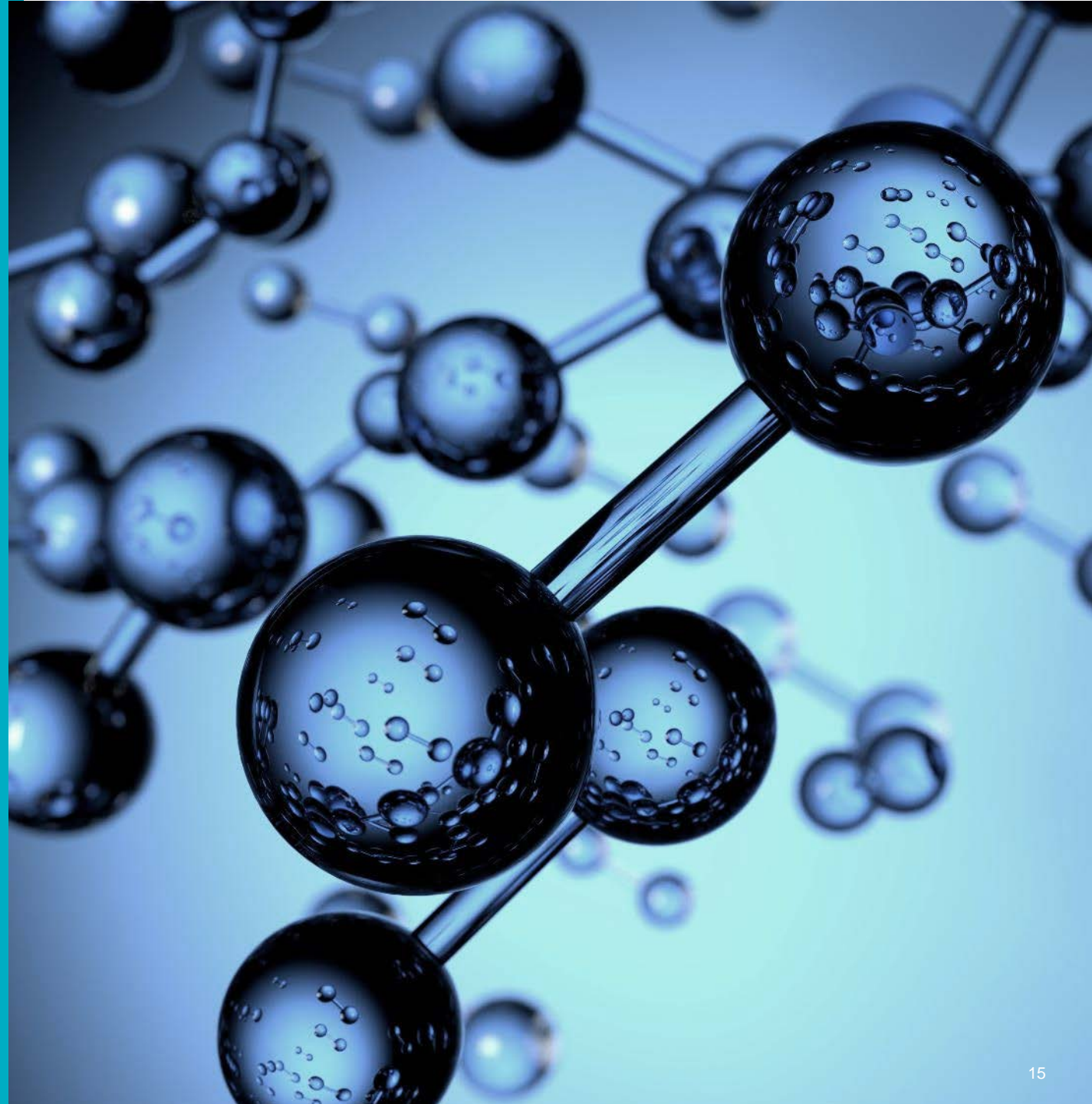


# 04.

## Business roadmap

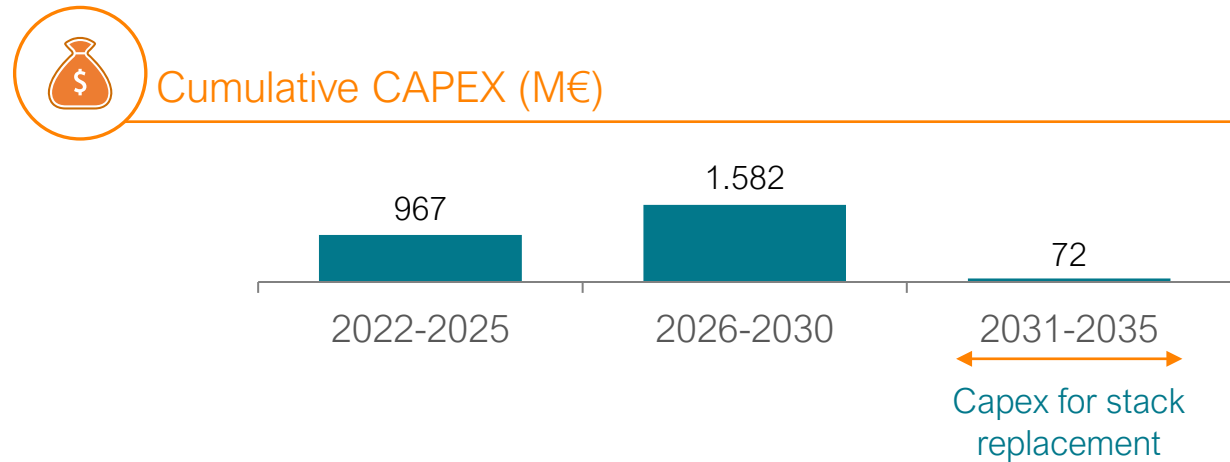
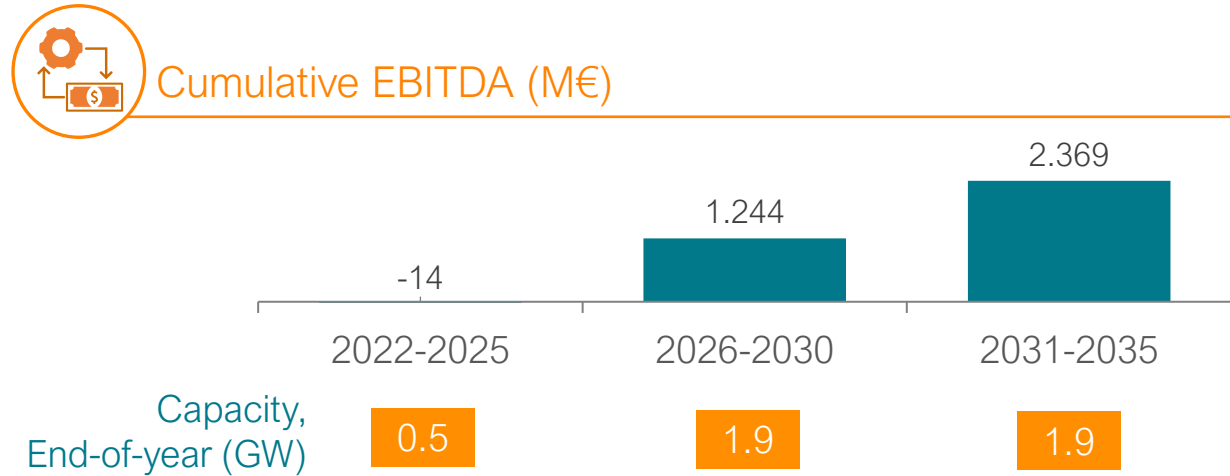


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## 04. Business roadmap

# Key financial metrics



Note: Considers 20 years lifetime for each project since commissioning, and no terminal value; does not include overhead costs; H<sub>2</sub> price estimated as cost of grey H<sub>2</sub> production alternative (steam reforming) + CO<sub>2</sub> 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)

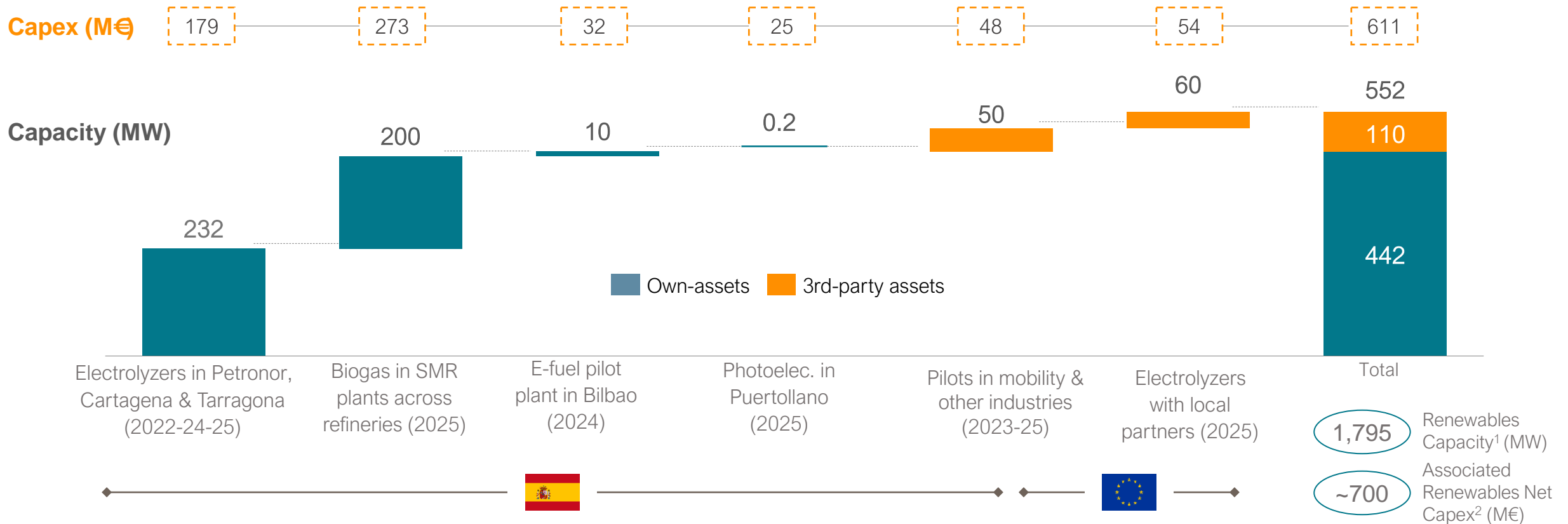


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## 04. Business roadmap

# Pipeline of projects up to 2025



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;

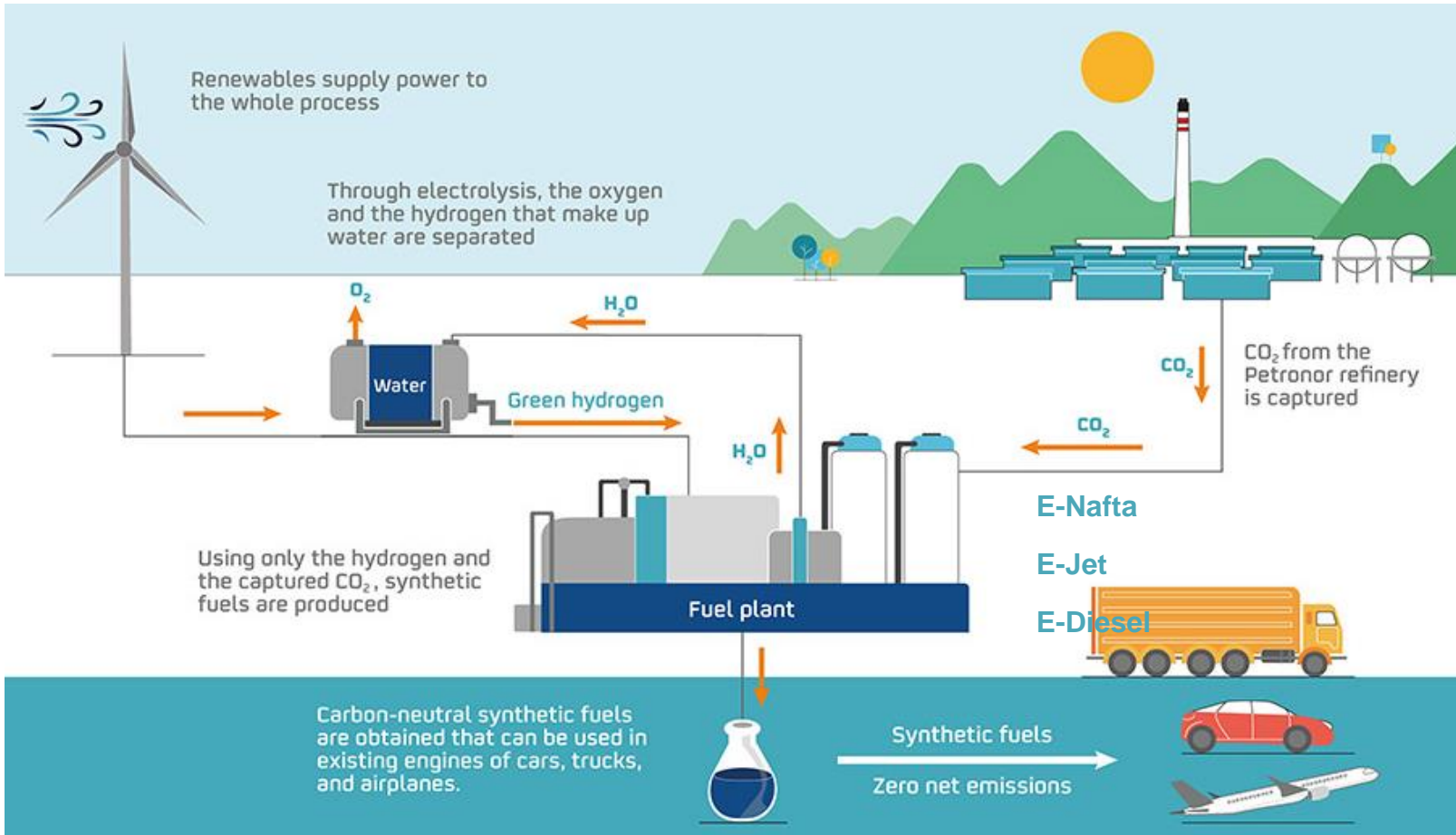
Note 2: Equity share between 50% and 100% in projects deployed in Repsol refineries before 2025. Equity share for projects deployed in third-party assets in Spain of 50%. Equity share for international projects of 30%;



## 04. Business roadmap

# 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



ENERGIAREN  
EUSKAL  
ERAKUNDEA



ENTE VASCO  
DE LA  
ENERGÍA

أرامكو السعودية  
saudi aramco

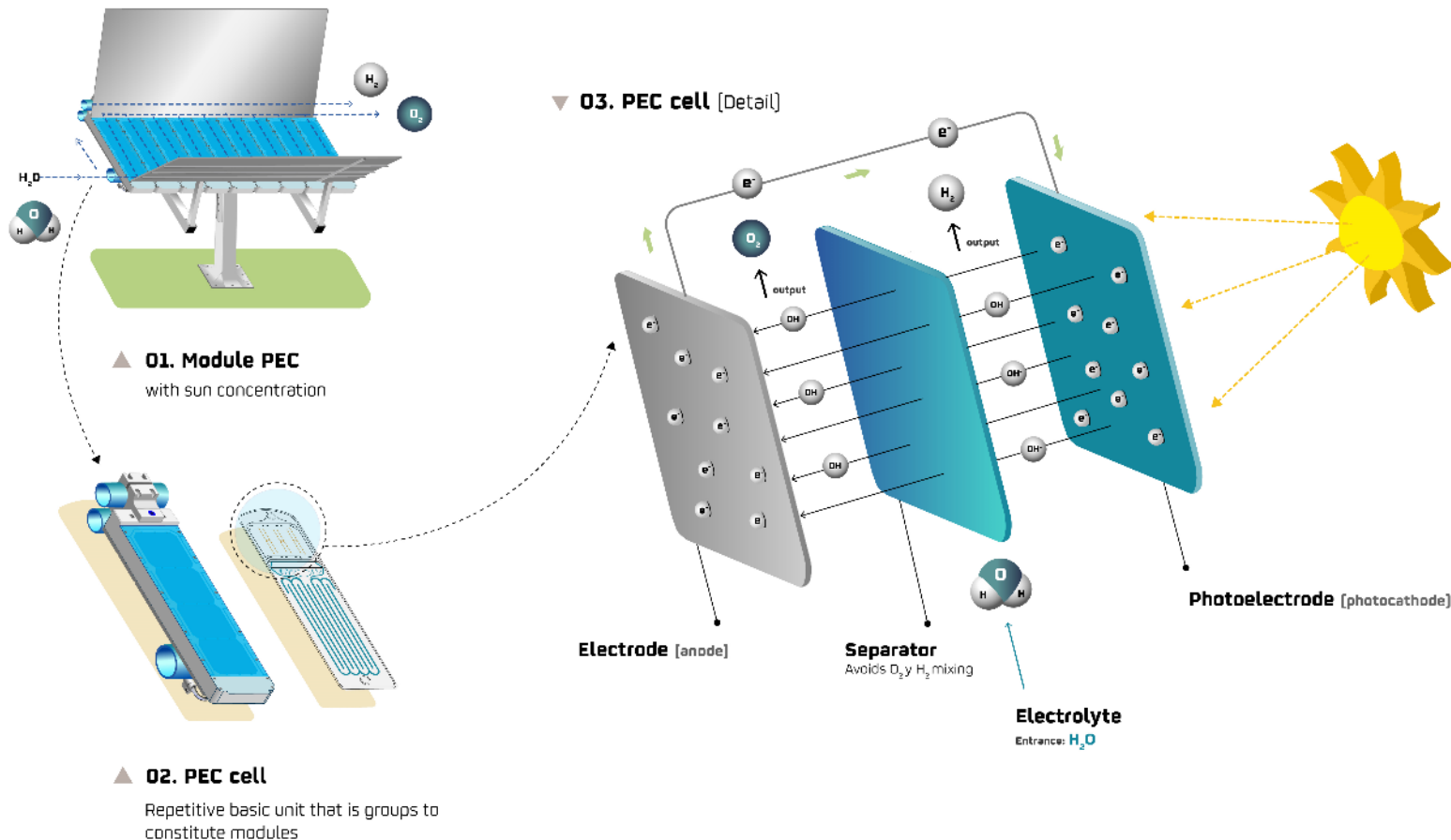


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## 04. Business roadmap

# SUNRGYZE – Renewable H<sub>2</sub> production technology

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



- 100% renewable
- 100% CO<sub>2</sub> reduction vs conventional hydrogen.
- Based on the **direct conversion of solar energy** into chemical energy
- Collaboration with different public and private entities



- Co-funded by European Regional Development Funds (**FEDER**) and EU Innovation Fund



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## 04. Business roadmap

# 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<sub>2</sub> in the coming years, and the role played by the European Funds, will lead Spanish national project.

1

Repsol's objective is to **develop a national project** for the deployment of the renewable hydrogen vector, supported by public-private collaboration, which will take the form of the creation/boosting of:

- **3 hydrogen valleys** where they will develop specific renewable H<sub>2</sub> production projects and end uses in industry and transport, in addition to renewable Electricity Generation and Storage Projects.
- **2 Transversal Innovation Hubs and 1 Digitalisation and Knowledge Management Hub** with R&D&I and technological development, Knowledge Management and Digitalisation projects that guarantee a sustainable economy based on this energy vector.

### Multi-sectoral vision

- Impacts in terms of ecology, job creation, knowledge and technological sovereignty
- Presence in 10 **Autonomous Regions**
- Investment of €3,230 M\*

2

Project **aligned with both the EEFF and the Spain Can Plan**, especially with component 9, based on **technological and sectoral diversification and a coherent systemic approach**

3

**Tractor effect of SMEs**, with **40 partners** involved in the project and will be conveyed through **two relationship models**, strategic agreements and declarations of interest, to **facilitate the governance** of the project and **unify interests** of entities from different sectors and along the value chain.

\* Total CAPEX. Repsol's CAPEX is approximately 2,250 M€





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