

Redes Energéticas Nacionais, SGPS

H2REN Program

IPLOCA Regional Meeting - Europe Mediterranean

07 Jun'23

Lisbon

REN 

REN Group overview

H2 and Infrastructures overview

REN main activities for gas infrastructures decarbonisation



REN's Mission

To ensure an **uninterrupted supply of electricity and natural gas**, at the lowest possible cost, in line with quality and safety criteria, upholding a real-time balance between supply and demand, and ensuring system conditions that enable the energy market, as well as contributing to the development of communities and the improvement of the quality of life for the Portuguese people.



697

Employees



25.325

Training hours



117.262

Planted Trees



27%

Women in top
management positions



36,44

Training hours per employee



11%

Are volunteer

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Sole TSO and largest Gas DSO in Portugal, with international presence



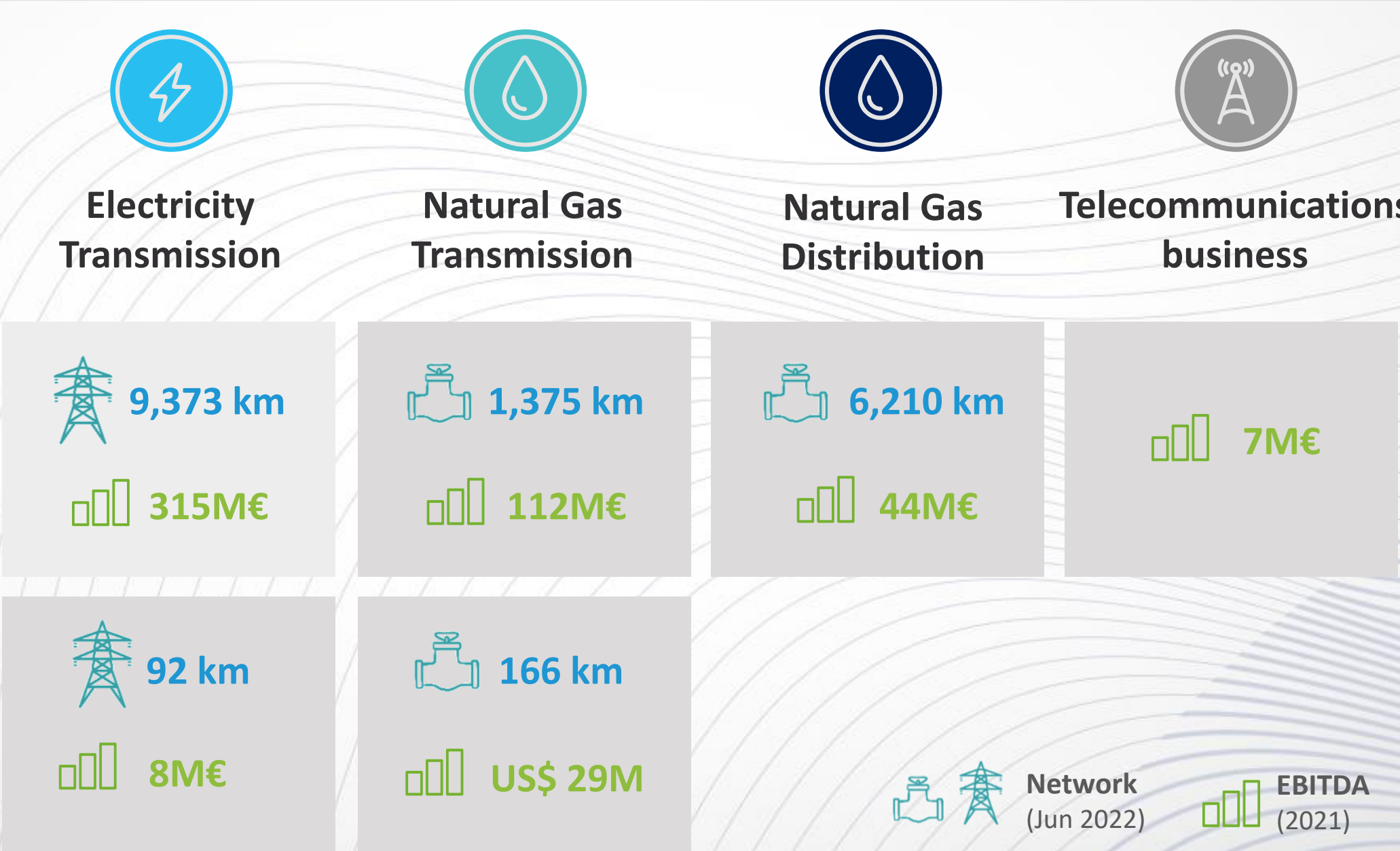
REN Business Portfolio



Portugal



Chile

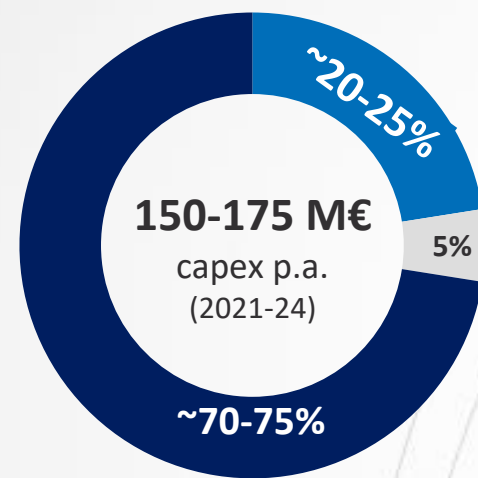


Redes Energéticas Nacionais

Network and infrastructure investments as a decarbonization enabler



Electricity



Expansion

To accommodate
new renewable
resources

Modernization, resilience and climate change

To deliver a resilient
service and keep
efficiency and quality



Solar
~5.1 GW

Wind
~1.4 GW

Hydro
~1.2 GW



Connecting
renewables

Natural Gas



Make H₂ a reality for
tomorrow

2022-2026

5% volume

Target H₂ blending by 2026

33%

Of total gas capex transmission
between 2022-26 dedicated to
investment in H₂ projects,
representing ~40M€

Pave the next wave
for gas

2026-2030

10-15%

Potential H₂ blending into grid
by 2030

Investment in additional
opportunities
(H₂ dedicated pipes in industrial
clusters, H₂ innovation blending
and deblending solutions)

With 10% in digitalization

REN is an H₂ deployment enabler in Portugal

In Chile



Chile has an ambitious
green H₂ agenda and
expected grid
expansion



REN is present



transemel

VHV Lines - Present in regions favorable to solar
PV and green H₂ development, namely in the
north



ELECTROGAS

Pipeline backbone - Gas is a
key element to enable energy
ransition

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Hydrogen, namely green is key to hard to abate sectors

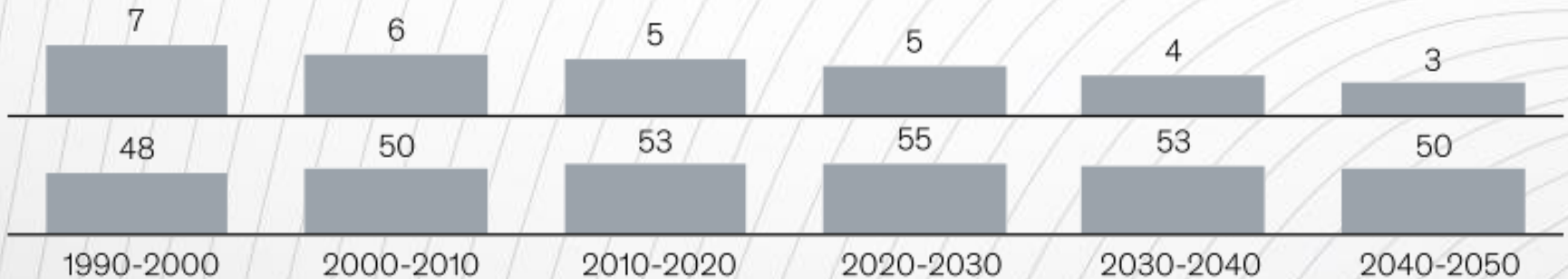
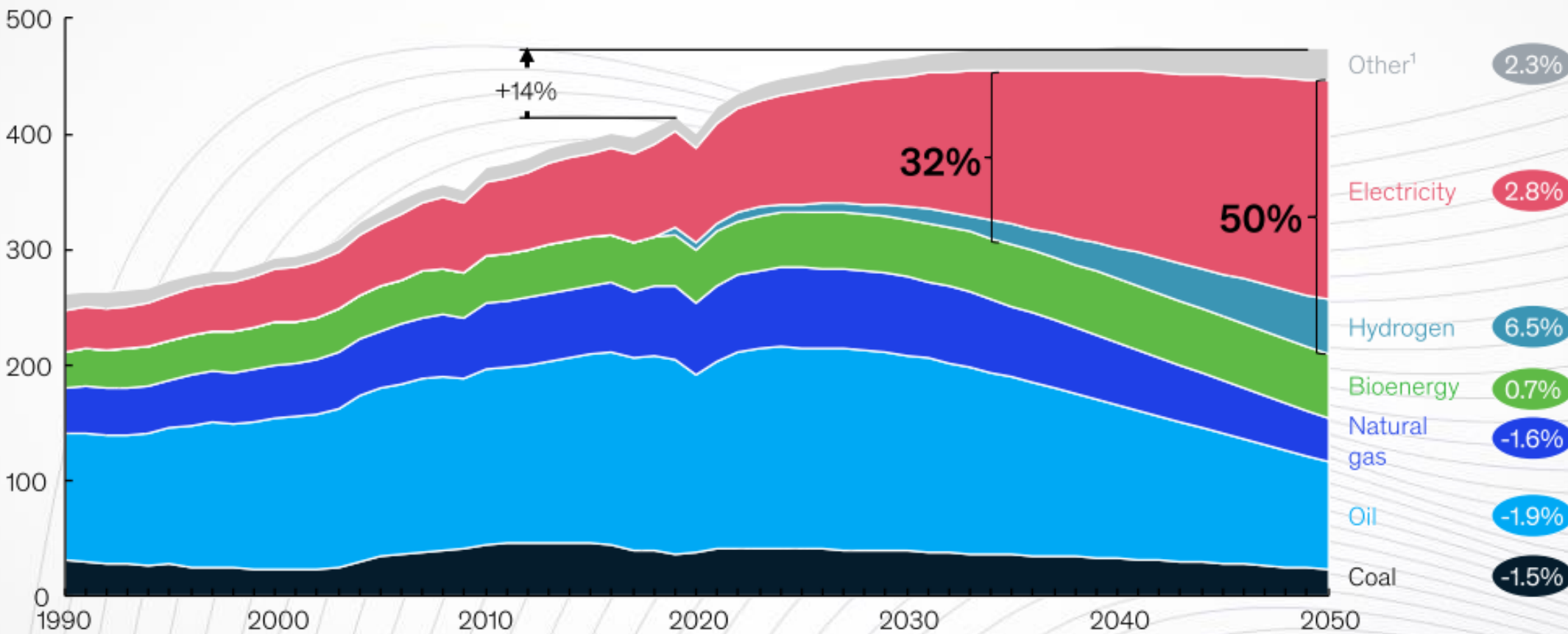


Highest Compound Annual Growth Rate (CAGR) for H2 in the upcoming 30 years

Further Acceleration

CAGR 2019-50

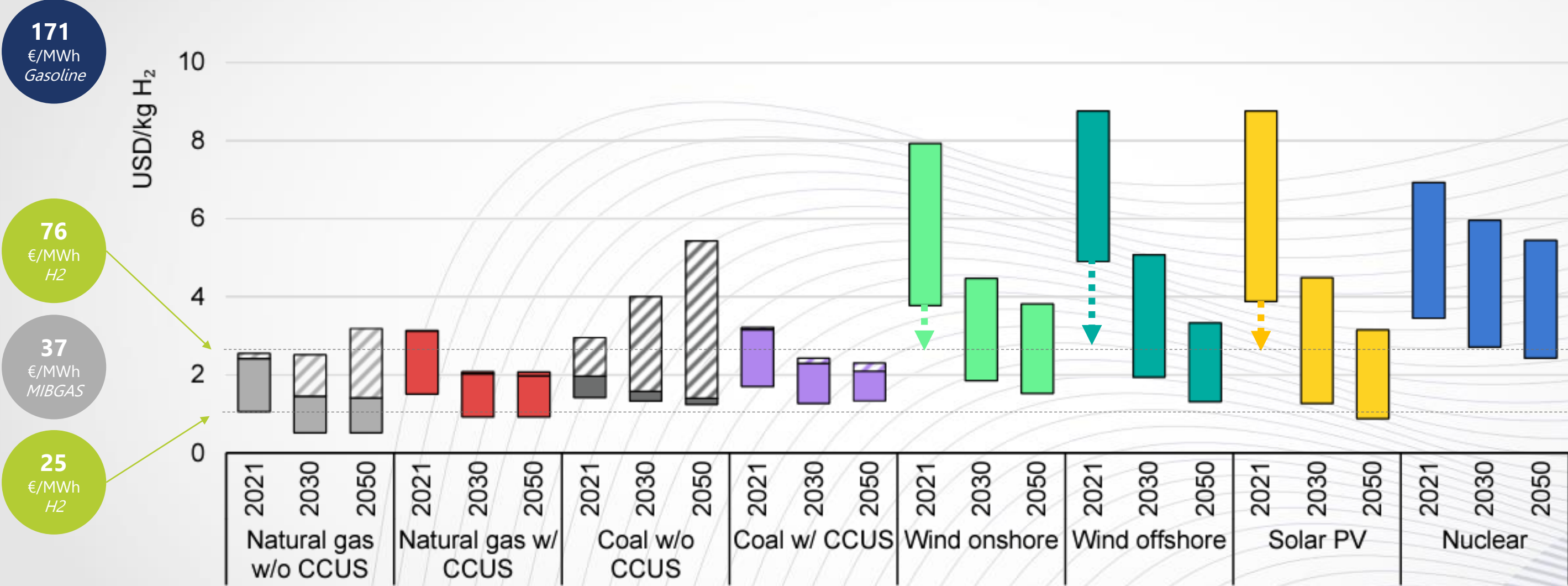
Final energy consumption by fuel, million TJ



Hydrogen: Production prices

H2 production massification and Guarantees of Origin will make H2 green competitive

Levelised cost of hydrogen production by technology in 2021 and in the Net Zero Emissions by 2050 Scenario, 2030 and 2050



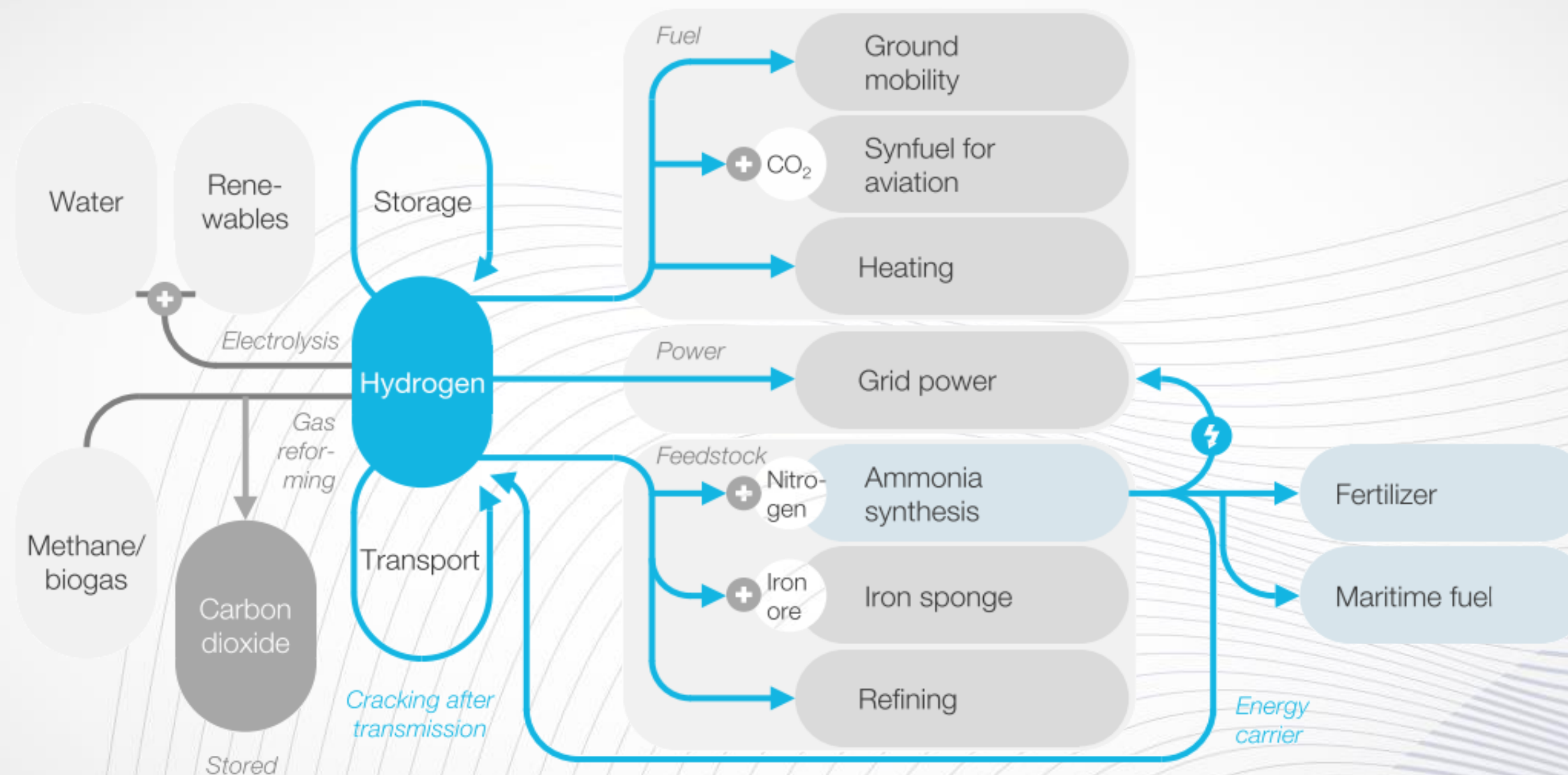
IEA. All rights reserved.

Notes: Ranges of production cost estimates reflect regional variations in costs and renewable resource conditions. The dashed areas reflect the CO₂ price impact, based on CO₂ prices ranging from USD 15/tonne CO₂ to USD 140/tonne CO₂ between regions in 2030 and USD 55/ tonne CO₂ to USD 250/ tonne CO₂ in 2050.

Sources: Based on data from McKinsey & Company and the Hydrogen Council; Council; [IRENA \(2020\)](#); [IEA GHG \(2014\)](#); [IEA GHG \(2017\)](#); [E4Tech \(2015\)](#); [Kawasaki Heavy Industries](#); [Element Energy \(2018\)](#).

Hydrogen pathways in the energy system

Clean hydrogen empowering sector coupling



- Clean H₂ produced from “stranded” renewables used as reductant in steel production - or to fuel ships and trucks. Chemicals and energy sectors are coupled - chemicals become energy carriers or fuels
- H₂ is an opportunity to network operators reach energy off takers that where not connected to infrastructures, namely: Mobility, Aviation, Ports for Maritime Fuels and Agricultural fertilizers factory (ammonia demand)

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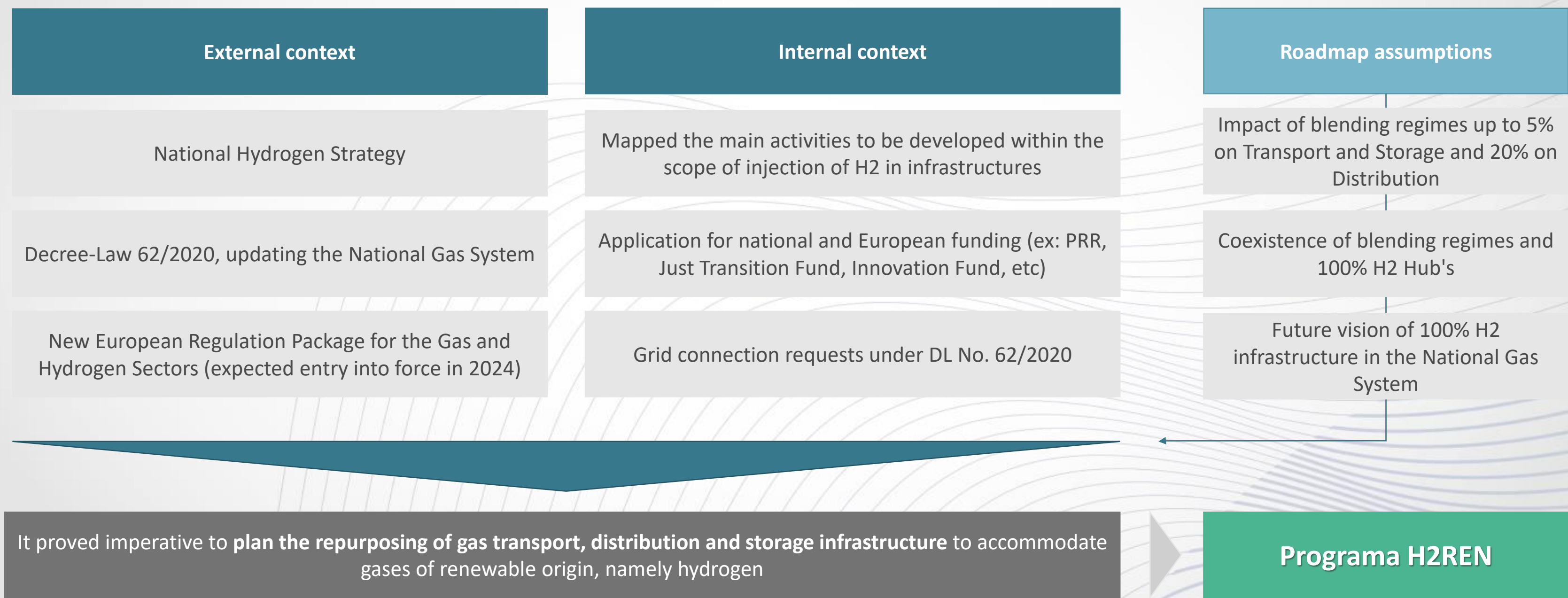
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H2REN Program

Motivation and main vectors



Asset Compliance Program (PCA)

- Includes engineering projects and the conformity assessment of the REN Group's infrastructures using multiple external partners
- Adequacy of transport, storage and distribution infrastructures for incremental **blending, compliance and asset certification up to 100% H2**
- Definition of **investment roadmap** for the management of network development plans within the scope of asset adequacy
- **Execution timing until the end of 2023** to align with the energy policy goals:
 - 5% on TSO until 2025, 10-15% until 2030
 - 20% on DSO

100% H2 Projects

- **Submission of the H2 Green Valley Agenda** to finance the Recovery and Resilience Plan for the development of **the first H2 hub in Sines**
 - *Public access infrastructure project for prod./cons. of H2*
 - *Scheduled deadline for execution until 2025*
 - *Financing approved pending contract signature*
- **Application of the H2 Celza** to be a Project of Common Interest of the European Commission
- **Feasibility analysis of other valleys in industrial zones in Portugal**



H2 REN program also includes R&D component:

- REN holds the presidency of Hylab, the Portuguese h2 Colab (collaborative laboratory)
- Platform for discussion and assessment of service delivery needs

REN's Asset Compliance Program (PCA)

Asset's Gap Analysis



- Asset adequacy analysis
- *Gap Analysis* for 10% & 100% transport in existing pipelines, 20% in distribution
- Identifying an investment roadmap

Operations & Engineering



- *Update* of technical requirements for 100% H2 gas pipelines and equipment
- Human Capital Training

Blending Capacity



- Assessment of network capacity
- Blending station design and engineering optimization
- Novelty process for new producers

Gas Tracking System



- Update Transmission gas tacking systems and to develop DSO's
- Develop the Gas quality monitoring procedures (pipeline & producers)

Investment



- Investment roadmap to 10% and 20% of H2 in transport and distribution and up to 100% of H2
- Repurposing plan for the pipeline network

3rd Party Certification



- Ensure infrastructure certification by 3rd Party towards the operation with blending of 10% of H2 in TSO and 20% in DSO
- Furthermore up to 100% of H2



Program Goals and Metrics

- **Assets qualified to transport and distribute 100% H2**
- **Creating competitive conditions for H2 market development and for REN's strategic position**
- **Ensure economic and technical roadmap for EHB vision and H2Med contribution**

3rd party Certification of the first stage of blending until Q4'2023

Overall investment roadmap to 100% H2 until Q4'2024

100% H2 valleys

Agenda H2 Green Valley

Promoters



Promoters contributions for the Agenda

- Consortium leader¹
- H2Backbone: Transmission and compression services + line pack storage
- H2Blend: Blending service for H2 injection in RNTG
- Co-promoter
- H2Village: Distribution network conversion + 30 clients to 100% H2
- Co-promoter
- H2Village: Development of 30 100% H2 water heaters
- Co-promoter (R&D)
- Numerical/lab modelling and validation
- Co-promoter (R&D)
- Lab validation and infrastructure sensing
- Co-promoter (R&D)
- Lab validation and end customers sensing

Supporters

Potential clients

Green H2 Atlantic



FUSION-FUEL™



H2 Sines (IPCEI)



-1%

CO2 emissions
reduction

-1%

Energy imports
(Portugal)

17

New
Products,
Patents and
Services

39

Scientific
Publications

8

Training
Sessions

4

Dissemination
Knowledge
Sessions

19

Direct jobs

Note:

1. REN Group represented by REN Gás (leader of the consortium and H2GBackbone project promotor) and by REN Gasodutos (H2Blend project promotor);

100% H2 valleys

Agenda H2 Green Valley

Agenda H2 Green Valley



PRR submission aiming to develop the first Portuguese Hub of green Hydrogen with public access for production and consumption in Sines (ZILS)

Phase 1: to be commissioned until 31/12/2025 (PRR)

- Around 9,1 km pipeline to collect H2 production and supply local H2 demand (e.g. refinery) as well as to inject H2 in Transmission network (RNTG)
- Mixing % injection Station and compression station for RNTG injection
- Create operational conditions for local H2 market development

Phase 2: Expected for 2030 (indicative)

- Around 17,2 km pipeline (in total)
- Development of dedicated storage to manage the variability of green H2 production and to ensure the security of supply

Scalable infrastructure with the capacity to transport up to 2GW of H2



Repurposing of existing pipelines

REN' bolstering H₂ market and H2Med

REN's H₂ projects under the Celza interconnection

Enabler A

- Enabler project for harvesting green H₂, complying with:
 - ≈ 120 km of repurposed existing pipeline
 - ≈ 55 km of new pipeline
- Green H₂ produced mainly by offshore and onshore wind and solar

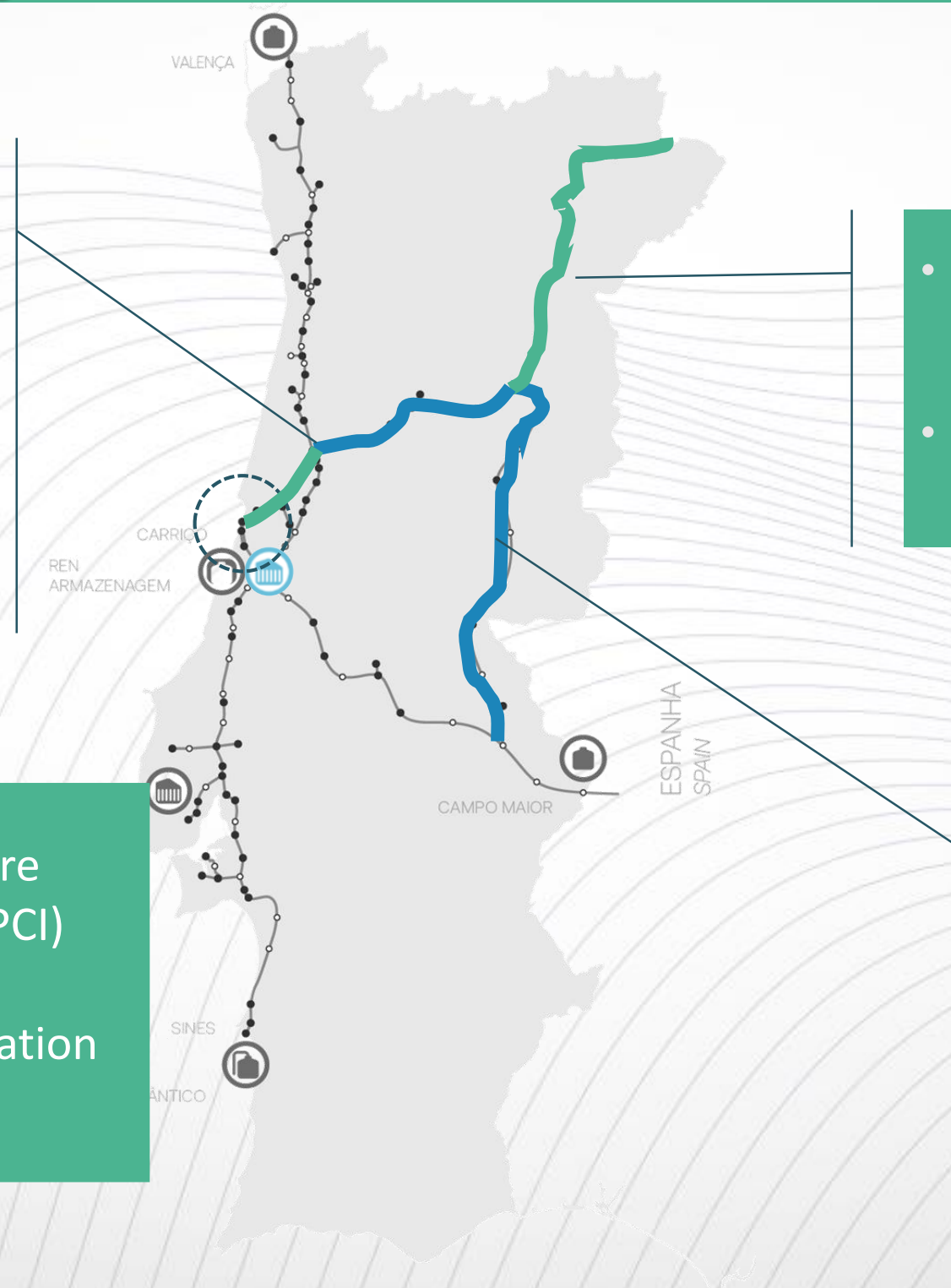
CelZa

- Interconnection Celorico da Beira - Zamora (Portuguese route ≈ 160km)
- H₂ maximum transmission capacity ≈ 750 kt/year

Enabler B

- Enabler project for harvesting green H₂, complying with:
 - ≈ 210 km of repurposed existing pipeline
- Green H₂ produced mainly by onshore wind and solar

- Interconnection Celza, Enablers A and B were submitted to Project of Common Interest (PCI)
- Commissioning date is expected by 2030
- REN Asset Compliance Program implementation is critical for Celza implementation



Hydrogen at REN

Our vision for Hydrogen development



- Accommodate power grid developments for the growth of renewable energy sources
- Adapt current transmission, storage and distribution infrastructures to accommodate mixtures of natural gas and hydrogen, boosting the development of gases from renewable sources
- Develop and optimize infrastructure solutions to integrate producers and consumers into the 100% renewable Hydrogen value chain, accelerating the energy transition



- Leveraging the current gas infrastructure to receive green Hydrogen (transport, storage and distribution), ensuring safety conditions
- Optimize infrastructure and accommodation costs for production from renewable sources
- Minimize the environmental impact of the asset exploration lifecycle



- Ensure an adequate supervision and control system for the National Gas System and for the 100% green Hydrogen infrastructures
- Guarantee the National Management of the Gas System, ensuring the balance of energy transmitted
- Ensuring quality control for consumers

Thank you very much

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*“The world needs dreamers and the world needs doers. But above all,
the world needs dreamers who do.”*

Sarah Ban Breathnach