SMARTENERGY

Green H2 adding value to local ecosystems

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2023 PORTUGAL RENEWABLE ENERGY SUMMIT

APREN Associação de Energias Renováveis

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Smartenergy at a glance

”**Since 2011 we have delivered renewable energy projects with sustainable cash-flows for our** clients, attractive profits for us and massive CO_2-savings to the benefit of our environment.

The present momentum opens **a once-in-a-lifetime opportunity for agile actors.”**

We are committed.

Horst H. Mahmoudi (H2M)

CEO & Executive Chairman
SMARTENERGY Group AG

Smartenergy at a glance

We invest sustainably by promoting renewable projects

12
Offices worldwide

>400
Employees

>7 GW
Built globally

~12 GW
Project Pipeline

We cover the entire green energy project value chain for key technologies required by the energy transition

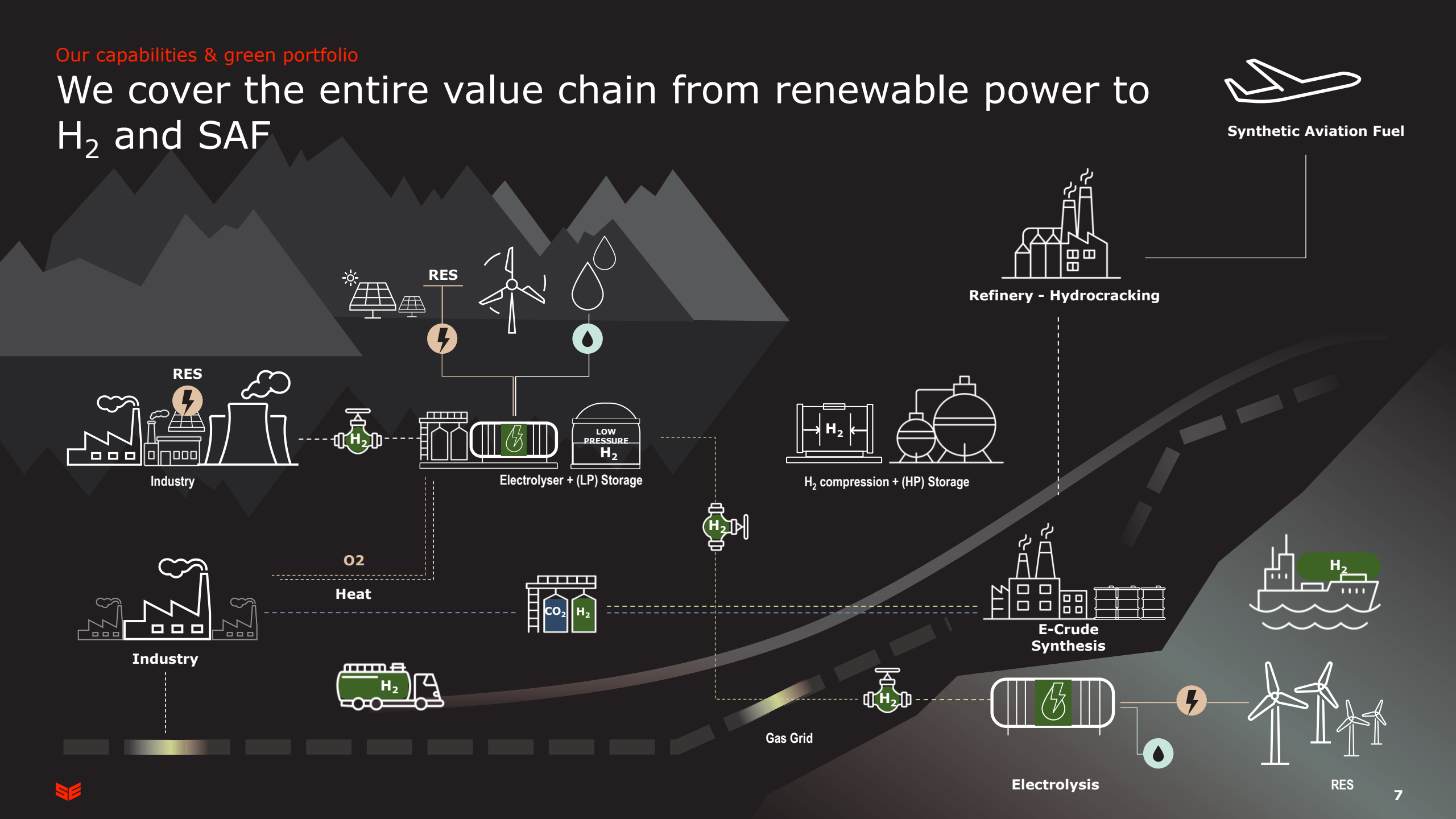
Extensive capabilities along the entire project value chain…

1	2	3	4
Project sourcing, structuring & development	Engineering, procurement & construction (management)	Operation & Asset management	Energy Trading & Sales
GREENFIELD, rewatt., SE	PRODIEL, SE	SE	MUON electric, haz*, SE

- Greening the skies: **SAF**
- The next frontier: **Hydrogen**
- The basis for all we do: **Renewable power**

…to deliver large-scale **clean energy technology assets**

We cover the entire value chain from renewable power to H_2 and SAF



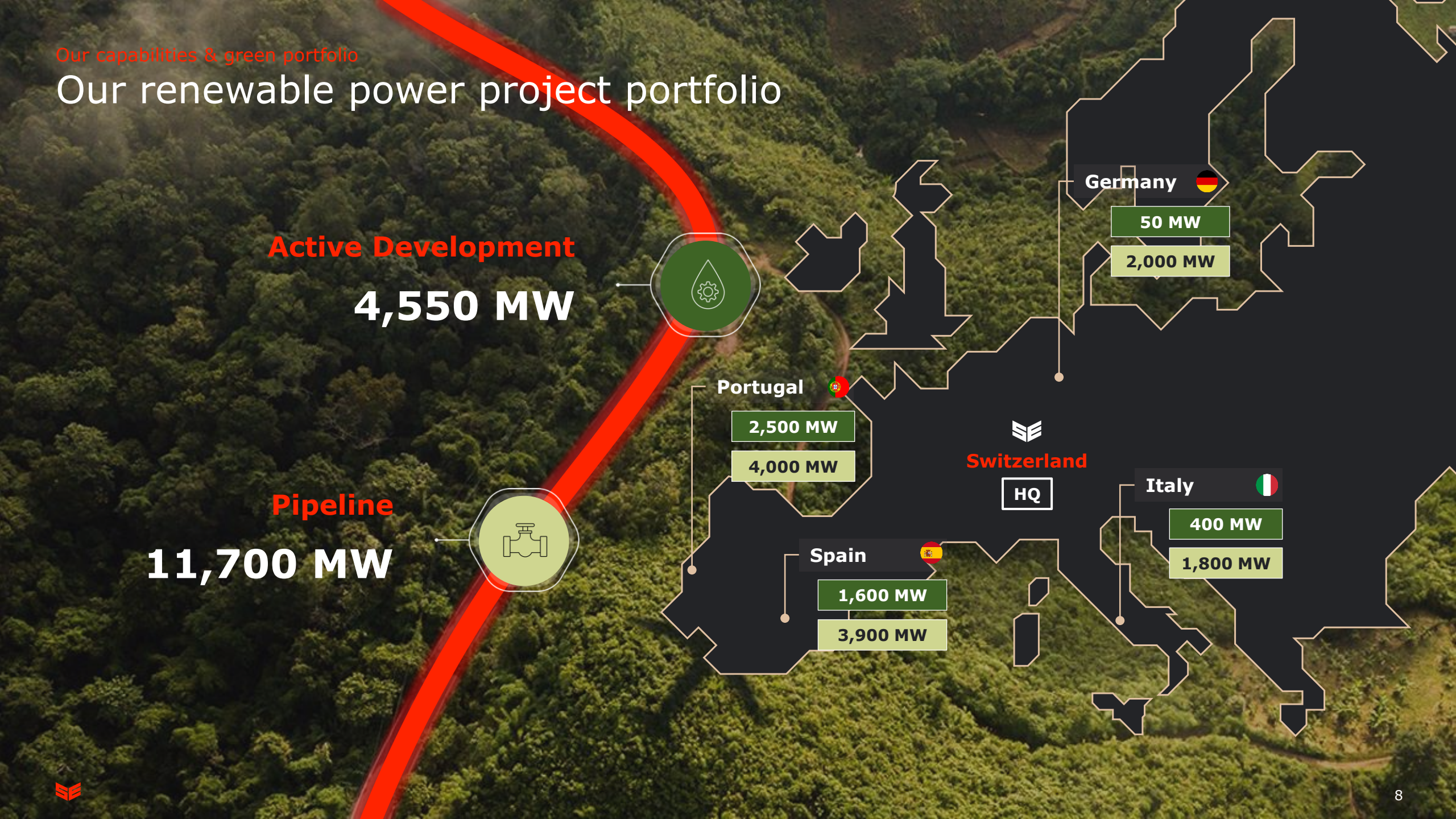
Our renewable power project portfolio

Active Development

4,550 MW

Pipeline

11,700 MW



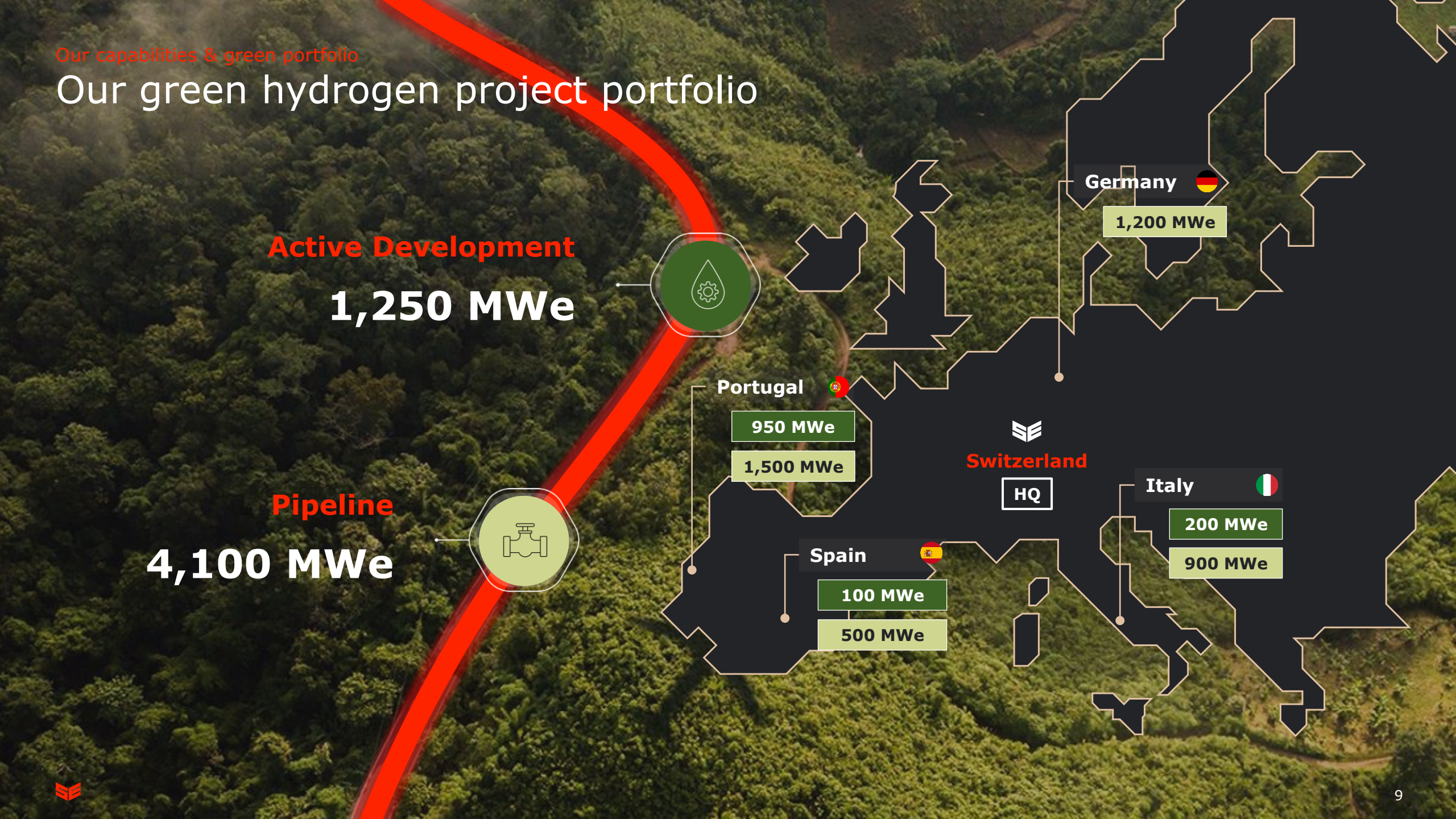
Our green hydrogen project portfolio

Active Development

1,250 MWe

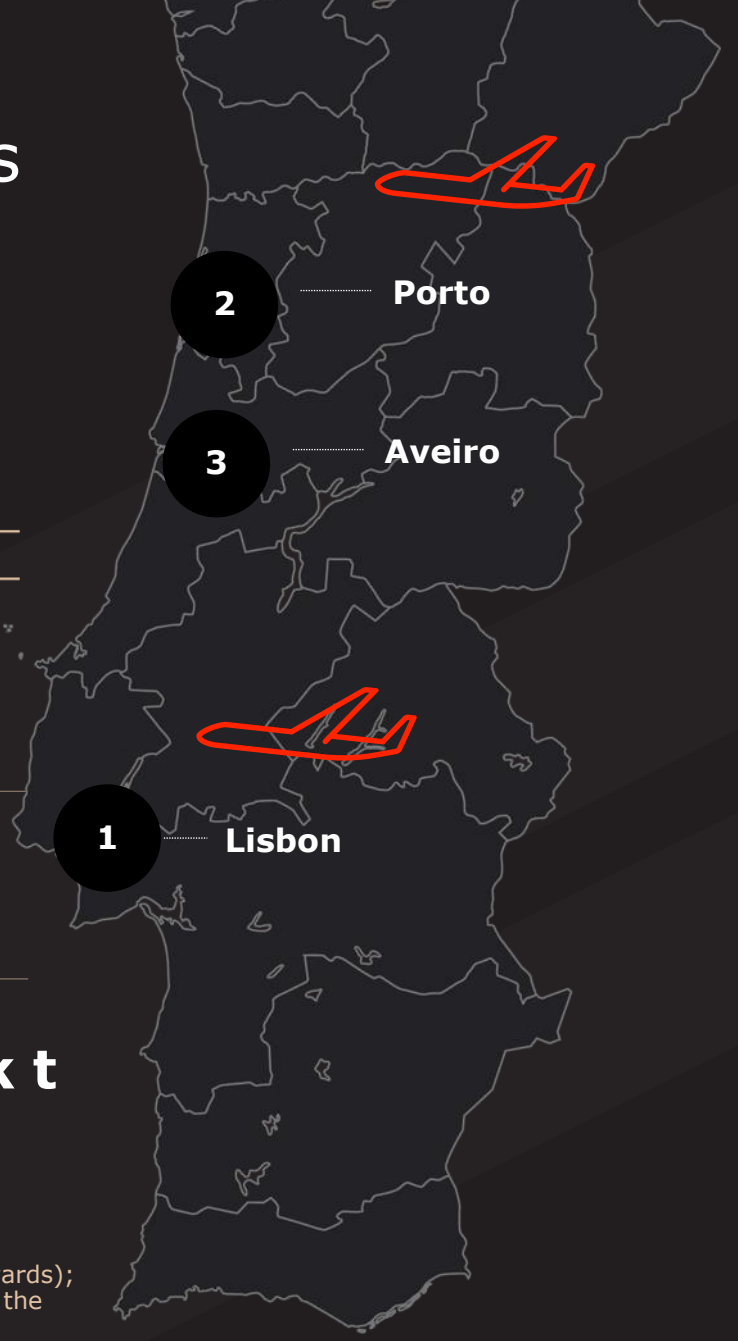
Pipeline

4,100 MWe



Our capabilities & green portfolio

Dedicated H_2-projects for sustainable aviation fuels



1 Project "Galileu"

c. 31 k t
SAF p.a. (2028-2029)

c. 49-80 k t
SAF p.a. (2030+)

2 Project "Leça"

c. 20 k t
SAF p.a. (2028-2029)

c. 31-49 k t
SAF p.a. (2030+)

3 Project "Mondego"

c. 69 k t
SAF p.a. (2028-2029)

c. 108-177 k t
SAF p.a. (2030+)

Notes:
1. Projects' COD planned before end-2027 to ensure exemption from the Delegated Act's "additionality" principle until end-2037;
2. Calculation assumes increasing load factor of electrolyzer production from 35% ('27-'29) to 55% with own renewables (from 2030 onwards);
3. Load factor of electrolysis can be further increased to c. 90% either through PPAs (ensuring hourly correlation, which are exempt from the additionality principle (see 1.), or once the Portuguese electricity mix reaches a 90% share of renewables

02

Renewables and Hydrogen in the European Union and Iberia

Solar, On- and Off-Shore Wind and H_2 targets in Europe

EU targets for 2030

2022: 22.5 %

42.5%
RES share

2022: 209 GW

750 GWp
Solar PV capacity

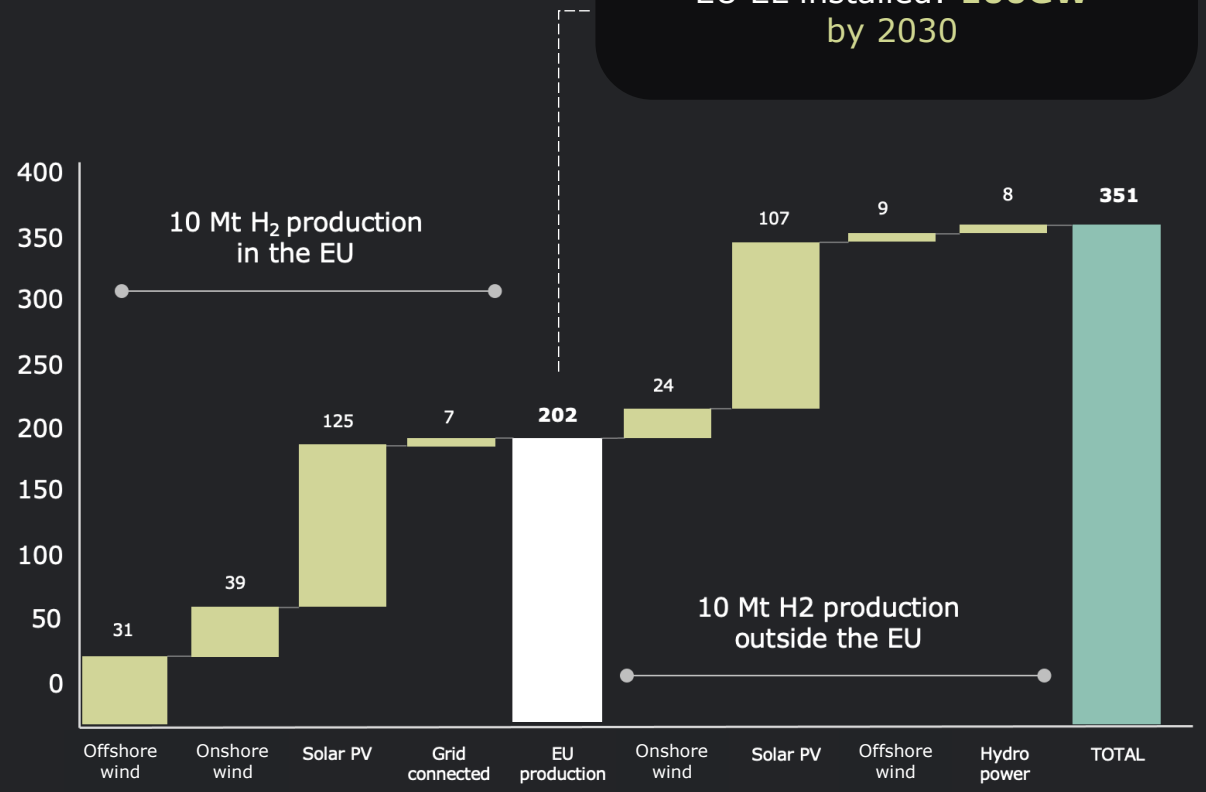
2022: 225 GW

440 GW
Wind capacity

20 Mt p.a.
Domestic and import

Required installed RES capacity for H_2 target
(in GW)

EU EL manufacturing: **40GW/a**
EU EL installed: **100GW**
by 2030

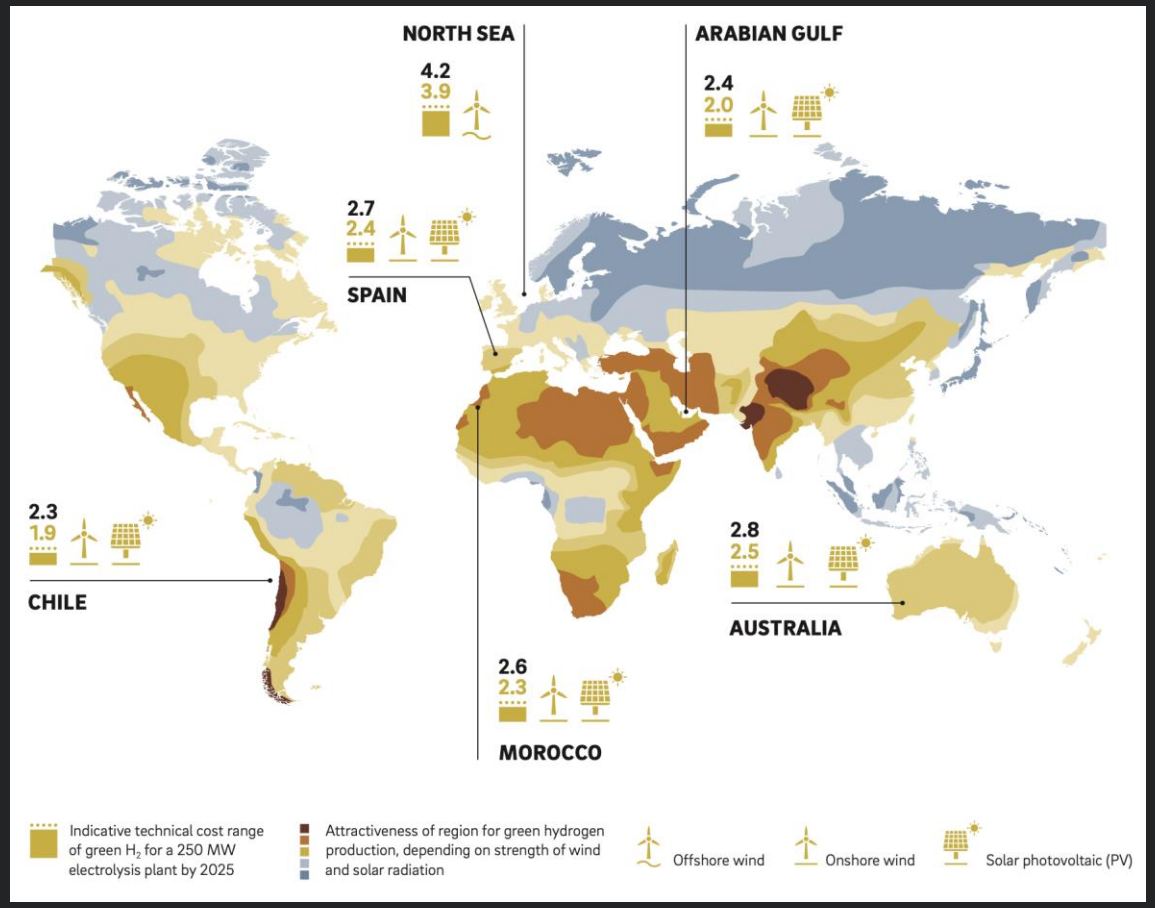


Source: Hydrogen Europe

Beyond Solar: To achieve carbon neutrality by 2050, the EU needs:

Source: EU Commission, EASE
Image source: iStock

IBERIA – Abundant Solar and On-shore Wind translate into competitive Green Hydrogen



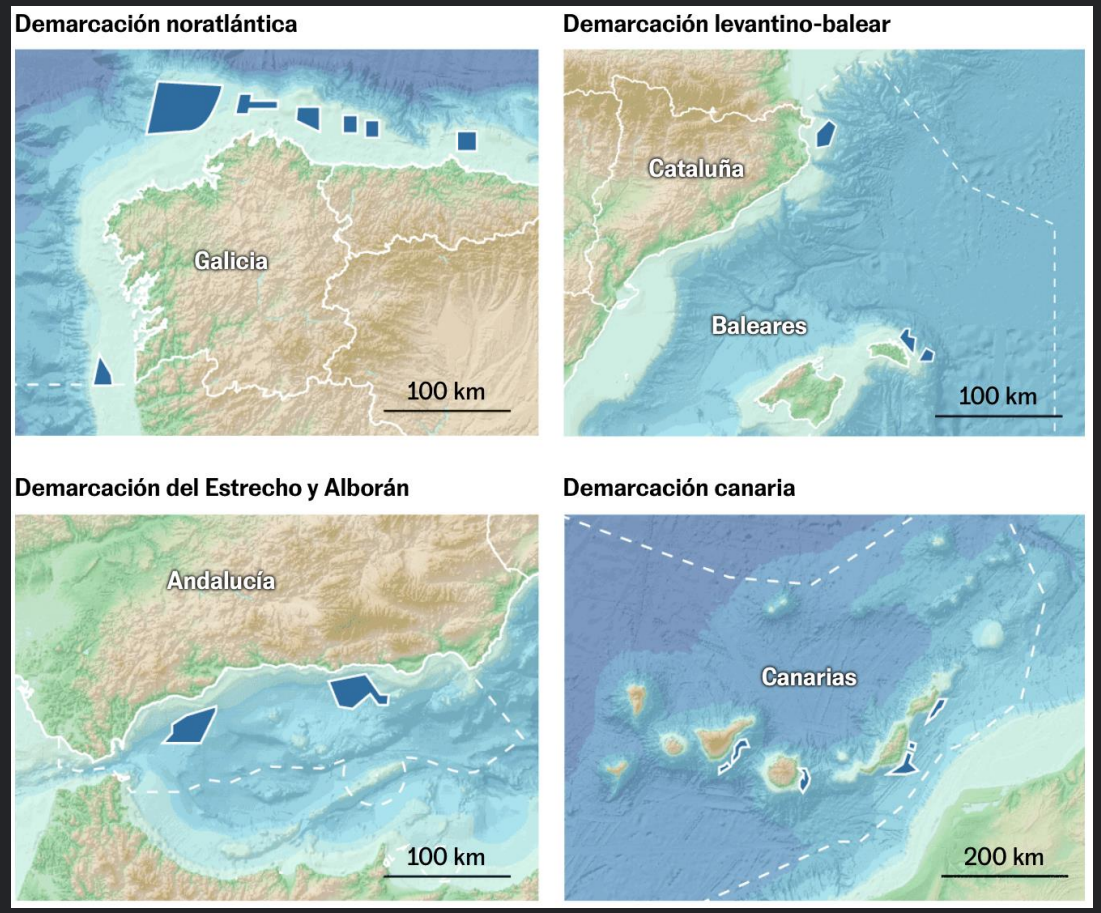
Source: Roland Berger

Cost-competitive renewable electricity and green hydrogen production in Iberia [EUR/kg]

IBERIA - Offshore Wind

PT: First auction in the next months
- 3.5GW
- Viana do Castelo, Leixões and Figueira da Foz (part)
- 10GW planned until 2030

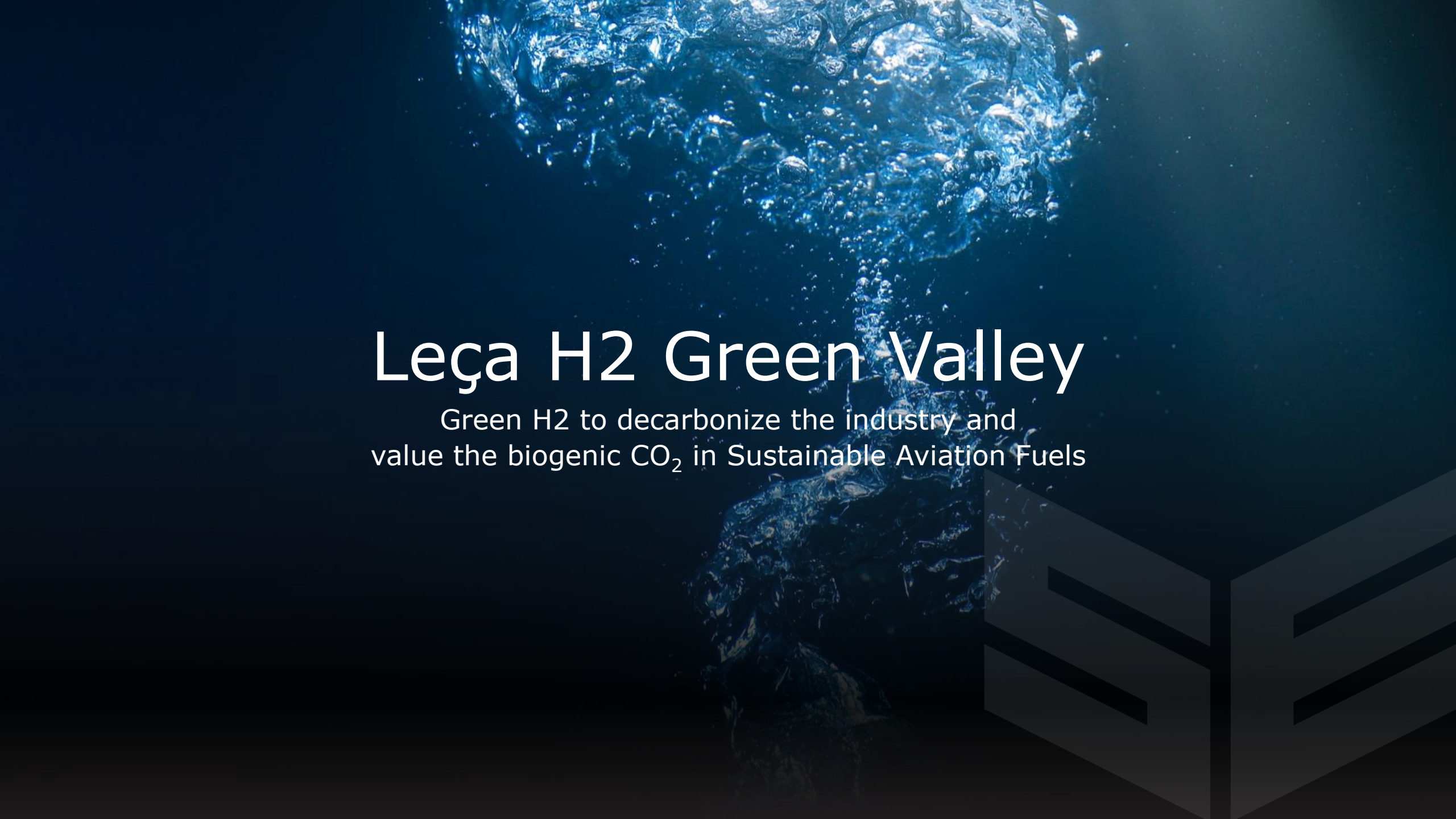
ES: 18 Areas pre-selected
- 4 Out of 5 macro area plans (1 million km^2) foresee Offshore Wind
- The 18 areas pre-selected set aside 4’948 km^2 for Offshore Wind (0.46%)
- Competitive procedure to still to be announced



03

Portugal case study:

e-Fuels



Leça H2 Green Valley

Green H2 to decarbonize the industry and
value the biogenic CO_2 in Sustainable Aviation Fuels

SAF is the future of clean aviation – Direct CO2 emission savings while using existing infrastructure

Sustainable Aviation Fuel (SAF) is jet fuel produced from bio feedstock **or renewable energy**

CO_2 emission savings

Direct CO_2 emission reductions of c. 80%

Proven technology

Globally approved by IATA[1)], SAF can be blended up to 50%

Ready to use

Can be used in existing aircrafts without any engine adjustments and with existing fuel handling infrastructure

1) International Air Transport Association: Guidance Material for Sustainable Aviation Fuel Management, 2nd Edition, 2015

Leça H2 Green Valley

Context and scope

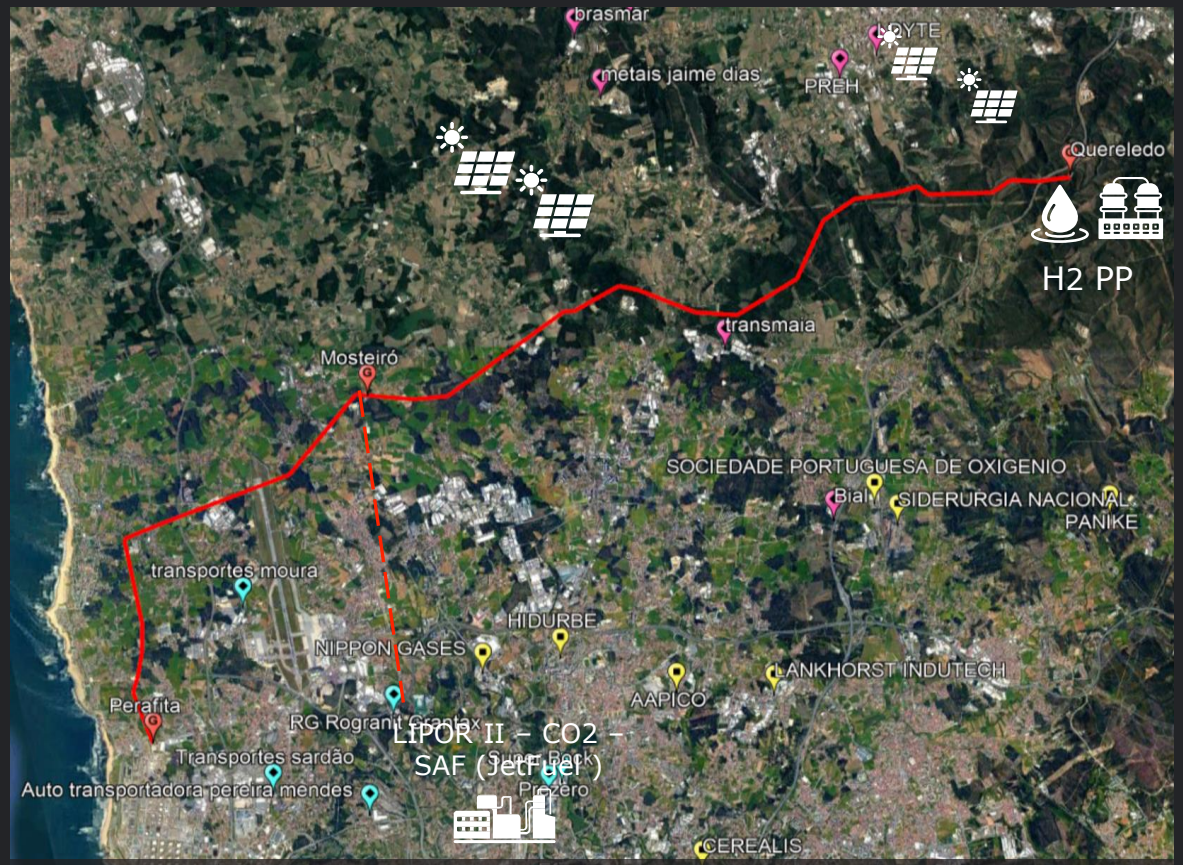
REN

- **REN Gasodutos owns concession to operate the existing natural gas pipeline** that connects Quereledo (JCT 4120) to Perafita (DP 4148), which served the former Matosinhos refinery, and is **suitable for repurposing to 100% H_2**
- This being potentially the **first repurposing of gas assets** into a pure hydrogen gas pipeline, linking green H2 producers with industrial consumers in the area.
- **Repurposed pipeline is a cost efficient enabler** for Smartenergy*/Lipor project and potentially for other production and consumption projects in the region, ensuring conditions for a **competitive green H_2 market development**

Smartenergy

Smartenergy analyzed different structuring and location scenarios of a potential project, embodied in the materialization of a Hydrogen Production Plant (H_2PP) and a Derivative Synthetic Fuels Production Unit (eFuels), considering:

- Proximity of the H_2PP to the REN gas pipeline, in particular to the Quereledo JCT
- Proximity to sources of necessary raw materials – water, renewable energy and biogenic CO_2
- Proximity to potential consumers – local industry and, in the case of eFuels, Port of Leixões and Sá Carneiro Airport
- Proximity to product transport & distribution infrastructures – Port of Leixões, Gas Pipeline Quereledo – Perafita, and existing Natural Gas distribution network



LIPOR II (one of the largest producers of biogenic CO_2 in Portugal) as the main supplier of the CO_2, a critical factor for SAF production

CCU enables circular economy, while decarbonizing heavy-duty and long-haul mobility (maritime; aviation)

*The interest of both parties in analyzing potential projects for an H2 Valley was formalized on October 14, 2022 with the signing of a Memorandum of Understanding between SMARTENERGY Group AG and REN Gás, SA.

Leça
Project structure

PHOTOVOLTAICS

390 MWp

WIND

75 MW

POWER GRID CONNECTION

On-grid

OFFTAKE MODEL

HPA Industry + HPA H2 Derivatives (e-Jetfuel)

ELECTROLYSER

230 MWe

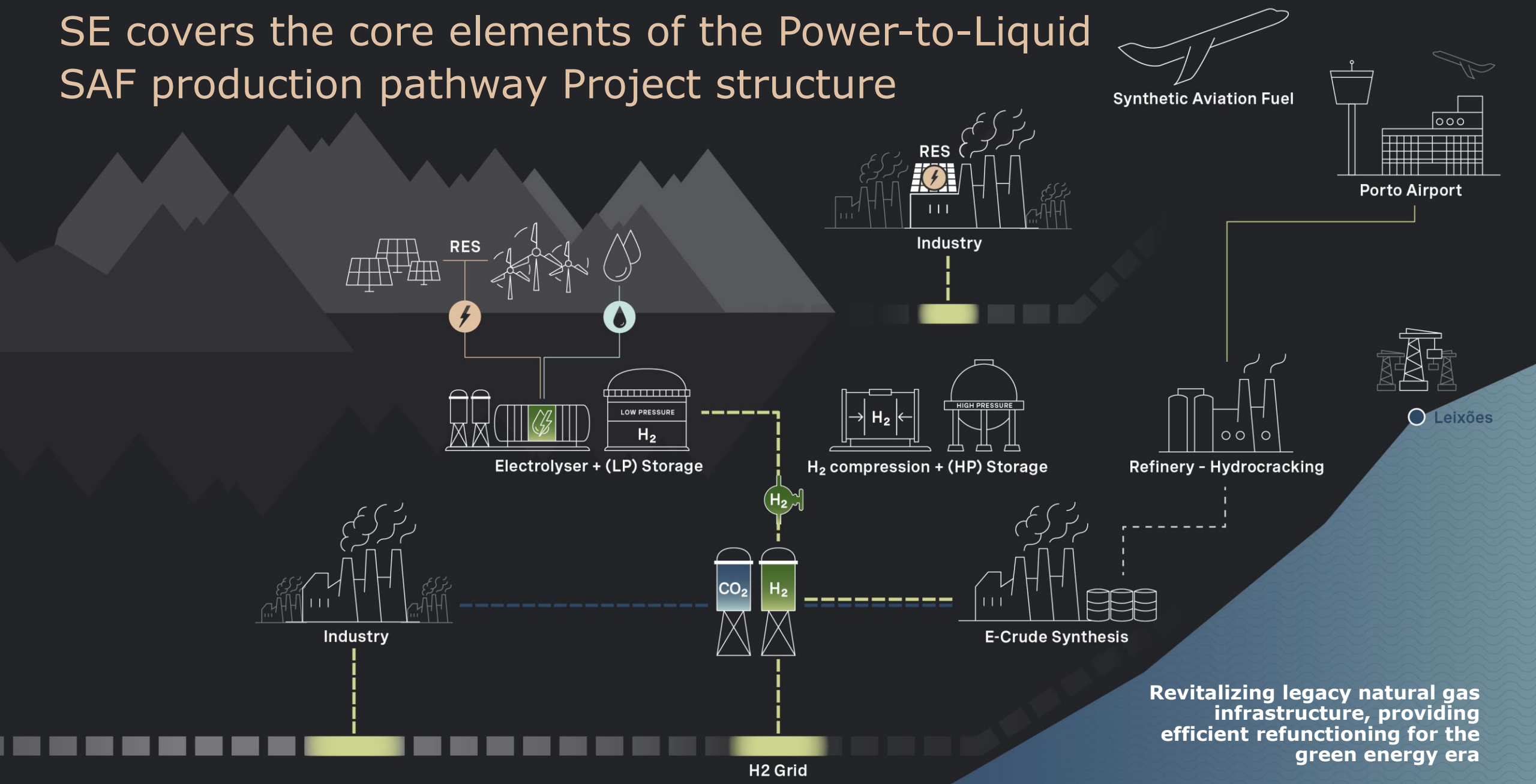
ANNUAL H2 OUTPUT

13’300-34’200 tons

ANNUAL e-JETFUEL OUTPUT

20’000-50’000 tons

SE covers the core elements of the Power-to-Liquid SAF production pathway Project structure

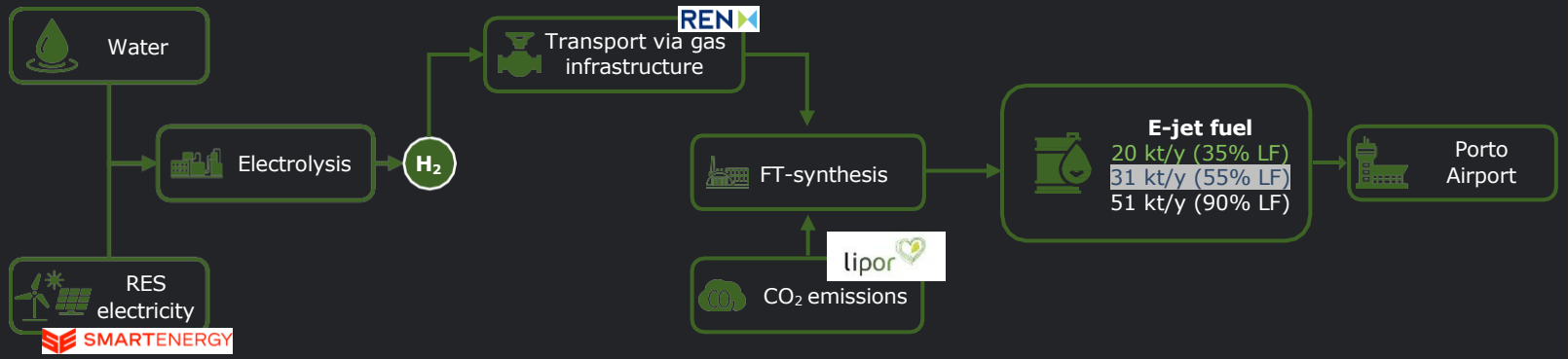


Revitalizing legacy natural gas infrastructure, providing efficient refunctioning for the green energy era

Leça project aims to repurpose NG infrastructure to transport green H2 (for Industry) and capture CO2 for SAF production

Biogenic-CO_2	**100,000 tpa** (LF 35%)	**155,000 tpa** (LF 55%)	**250,000 tpa** (LF 90%)
Photovoltaics	**390 MWp**		
Grid connection	**On-grid**		
Electrolyser	**230 MWe**		
H_2 output	**13,300 tpa** (LF 35%)	**20,900 tpa** (LF 55%)	**34,200 tpa** (LF 90%)

High-level project setup and partners



- **Project rationale**
- **Repurpose natural gas infrastructure** for green H_2
- SAF production via synthesis of **CO_2 from Lipor**
  - and **Green H_2 from SE**
- Supply of SAF to **Porto Airport**
- **SAF exports** via Port of Porto

MoU between Smartenergy and REN and **MoU between All** (being finalised)

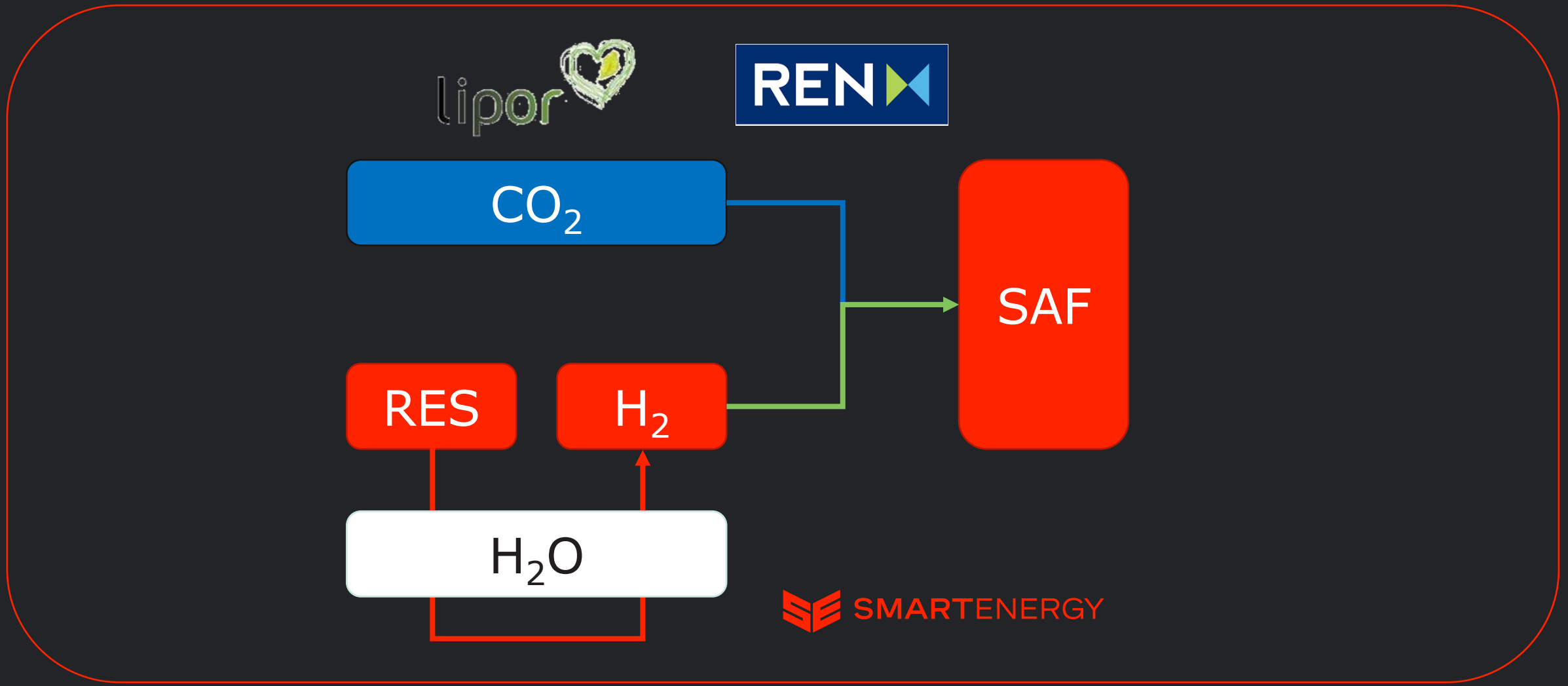
REN lipor

SMARTENERGY

Note: Regulatory discussions regarding additionality requirement for green hydrogen projects in RED II ongoing.

LEÇA - SAF’s value-chain control within the Partners

Partners’ roles in the SAF generation



Green H2
adding value to local ecosystems !

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