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Challenges and solutions to finance green hydrogen projects

ETH Energy Week 2022

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Massive Investments into ESG.
Why do we still complain?

"Chicken and Egg problem?"

Readiness to take Risks?

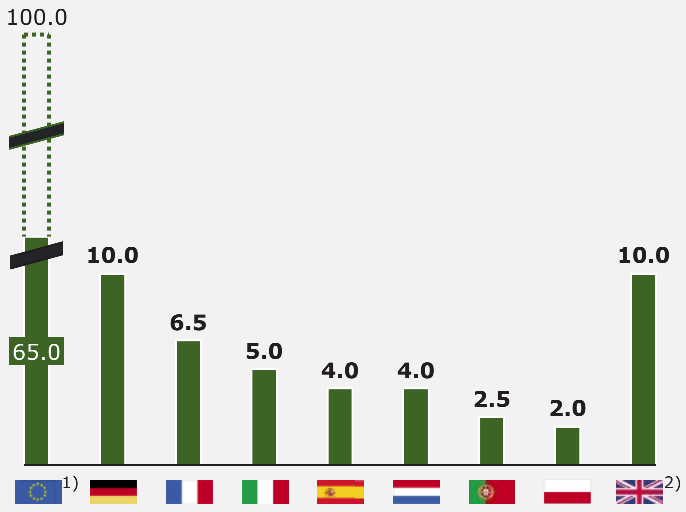
Cotovio, Portugal, 48.9 MWp

Status quo: Global ambitions for green H_2 projects are booming, but investment decisions for gigaprojects are running behind

Key hydrogen market observations

1 Ambitious policy goals for green hydrogen build-out are passed around the world

National electrolyzer capacity targets for 2030 in major European economies [GW]



2 Project announcements for green hydrogen production are steadily increasing

>500 announced[3] **green H_2 projects** with a total **credible electrolyzer capacity** of c. **200 GW**[4] as of today

3 But only very few large-scale projects are close to FID today

- **None of the globally announced gigaprojects** for export **have reached FID yet**
- The **largest green H_2 production project in post-FID**[5] stage today is Shell's planned **"Hydrogen Holland I"** in Rotterdam with **200 MW electrolysis capacity**

1) 10 Mt annual domestic production – necessary electrolyzer build-out depends on capacity factor assumptions of underlying renewables mix); 2) Including installed capacity for production of low-carbon hydrogen; 3) As of September 2022, including Green H_2 projects at very preliminary studies or at press announcement stages; 4) Projects that demonstrate certain level of credibility and for which a clear end date has been communicated; 5) Final Investment Decision

Source: European Commission, National hydrogen strategies, IEA

Why?

Key challenges for green H_2 projects

1 **High uncertainty around medium- and long-term green hydrogen prices and offtake**

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2 **Technology is not (yet) fully mature across complete value chain**

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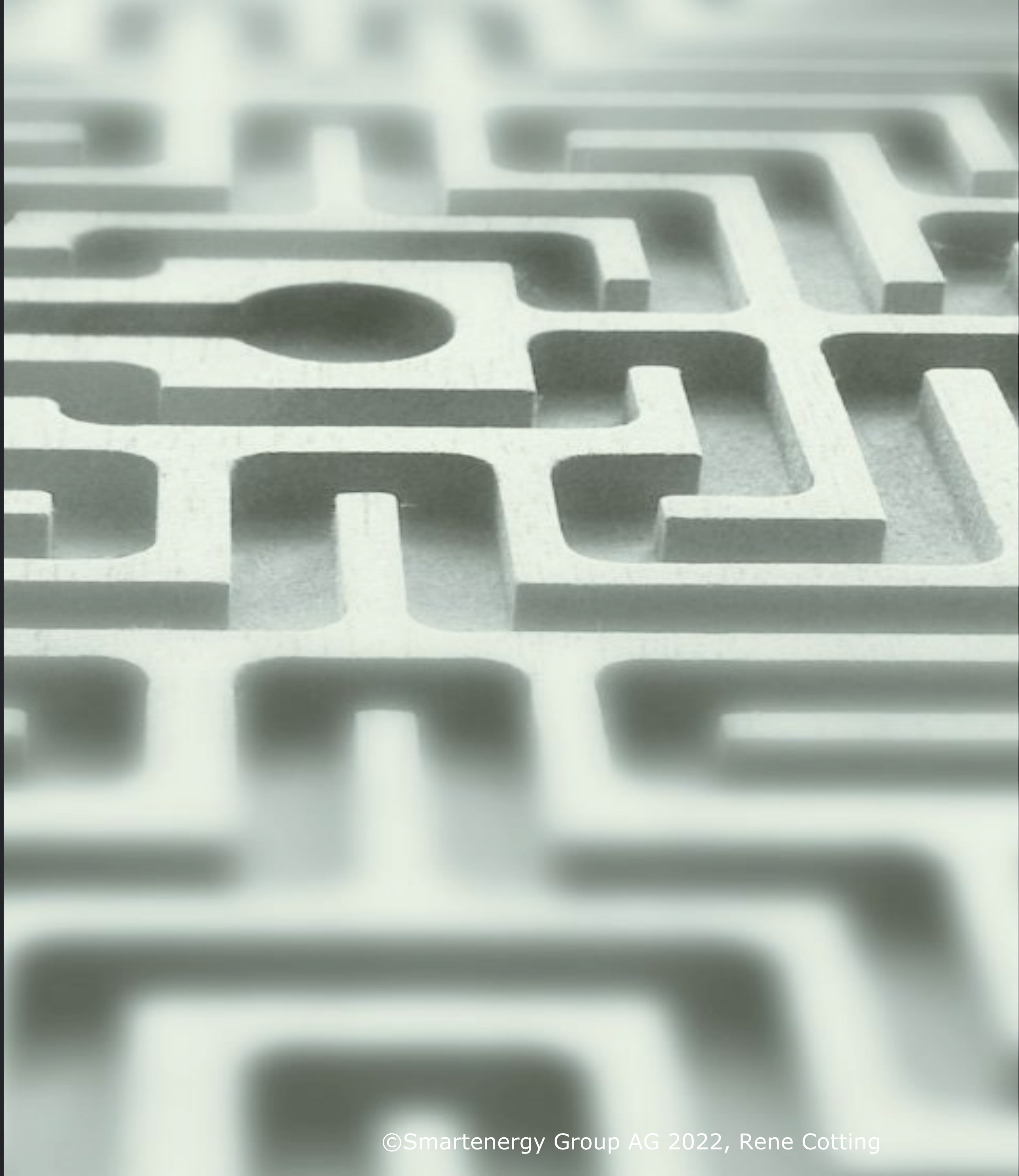
3 **Uncertain policy landscapes and different support approaches across geographies**



Source: SMARTENERGY Group AG

Europe pushes the clean energy transition through regulatory quotas as well as subsidies – Hydrogen plays a key role

Support policies and programs in Europe

Non-exhaustive

EU climate policy "journey"

- **12/19** "European Green Deal"
- **07/21** "Fit-for-55"
- **05/22** "REPower EU"

EU-Policies

A Regulatory quotas

- **50% green hydrogen** usage in **industry by 2030** (70% by 2035)
- **45% energy** production from **RES[1] by 2030**
- **RFNBO[2] quota of 5.7% for all fuels by 2030** (1.2% in maritime)
- **SAF[3] quota** of 5% by 2030, **20% by 2035**, 63% by 2050

> - "Additionality"-principle scrapped from RED II by EU parliament
> - Strong signal for simplified framework but also higher legal uncertainty

B Funding support

- **Innovation Fund** budget doubling (EUR 3 bn), to be leveraged via new **European H_2 Bank**
- **Carbon Contracts for Difference** to support switch to renewable H_2 in industry
- **Recovery and Resilience Facility** to channel member states investments to "REPowerEU" priorities
- **Cohesion Policy Funds** can be transferred to the RRF by up to 12.5% of Member States' national allocation (+ EUR 26.9 bn)

> - Concept details of European Hydrogen Bank as 'market maker' still to be developed
> - EUR 3 bn budget expected to be used for compensation of price differences between the import and sales price to European off-takers
> - Allocation to off-takers would be key task

National H_2 support policies

- H2 Global
- 2030 Investment Plan
- SDE++
- Energy Transition Fund
- Net Zero Innovation Portfolio

Financing challenge

- In the EU, project developers and investors face a **complex interplay of different policy instruments**
- Projects also have to adhere to **member states' respective policies** as well
- Further, remaining **uncertainties regarding actual implementation** lower investment momentum

1) RES = Renewable Energy Sources; 2) RFNBO = Renewable fuels of non-biological origin; 3) SAF = Sustainable Aviation Fuel

The recent Inflation Reduction Act in the US incentivizes green over blue H2 production through substantial tax credits

Support policies and programs in the US

Non-exhaustive

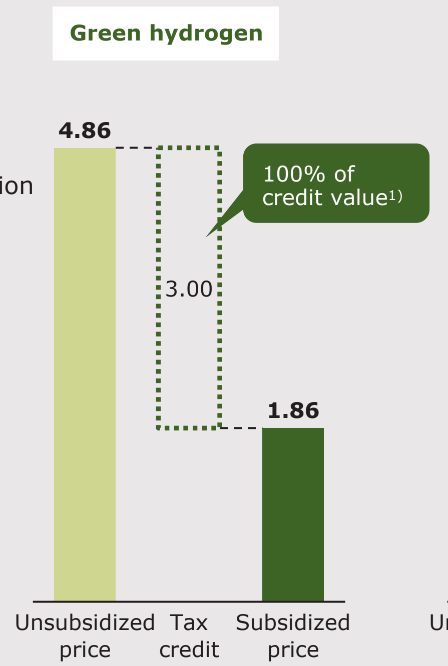
Federal policies

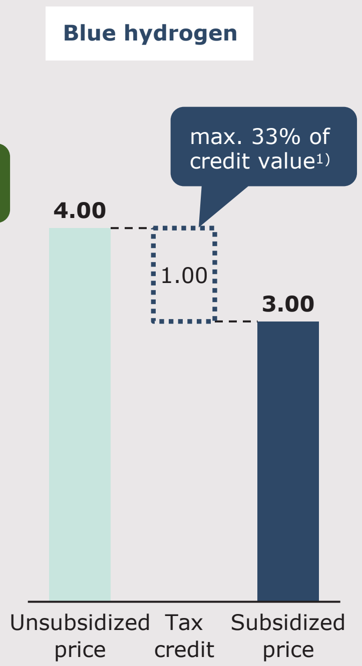
B **Tax credits (IRA)**

- The Clean Hydrogen Production Credit of the IRA is **tied to the carbon intensity of the production pathway**, providing greater benefits for green hydrogen than for blue
- **Green hydrogen production costs will thus decline significantly**, due to lower cost renewable energy, in addition to a large Production Credit – potentially accelerating the decarbonization of heavy industry and transport

State-pacific support policies

- Low-Carbon Fuel Standard
- Clean Transportation Program
- CHEAPR
- Texas Clean Fleet Program





Financing challenge

- In the US, **support policies** are primarily designed as **incentivizing subsidies** to increase hydrogen supply
- What about **CAPEX support**?
- However, **federal and state support policies** form a **complex interplay of policy instruments** as well

1) $0.60/kg base credit, max. $1.00/kg for blue hydrogen and max. $3.00/kg for green hydrogen projects that meet wage and labor requirements
Assumptions: 20 MW PEM electrolyser; 58 kWh electricity consumption per kg H_2, $1,110/kW installed cost; $0.36/kWh input electricity cost (pre-IRA), 50% load factor

Source: SMARTENERGY Group AG

Solution 1: Policies need to become leaner to support the H_2 economy

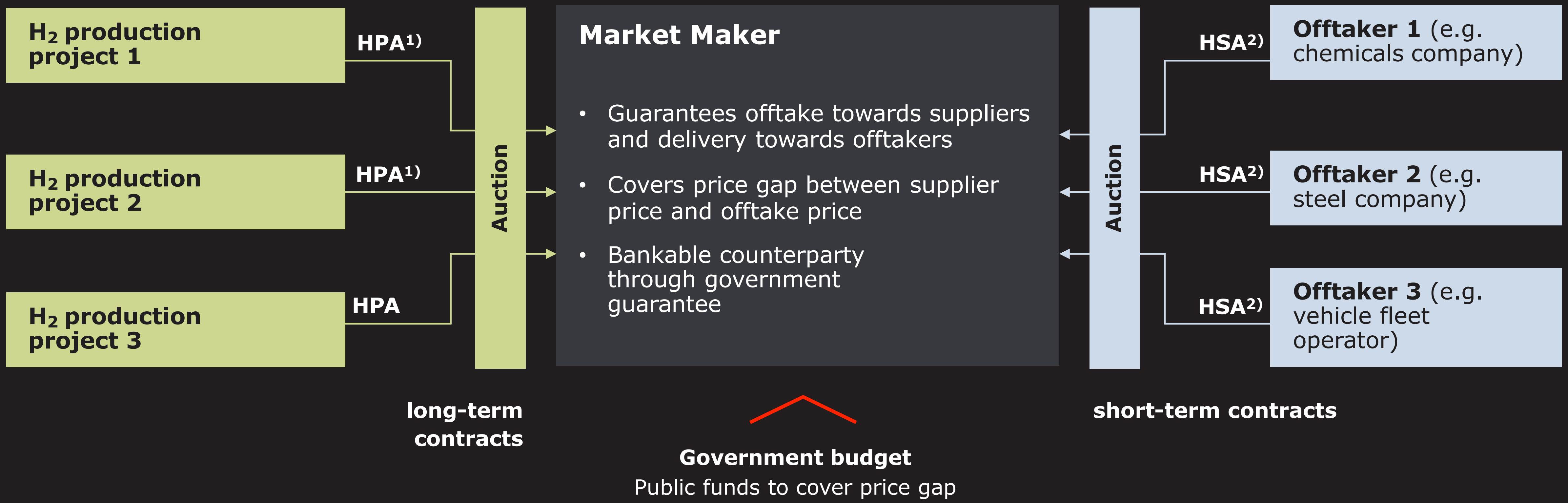
Status and vision of policy landscapes

Where we are today	Where we need to be
	
Fragmented, complex and lengthy permitting and regulation "jungle"	**Clear vision ahead with fast and standardized procedures**

Solution 2: Government-backed market maker for green H_2

Market Makers such as European Hydrogen Bank, H_2 GLOBAL" concept etc.

Illustrative



1) Hydrogen Purchase Agreement

Solution 3: Green H_2 show clear success factors along the value chain

5 Key success factors for green hydrogen projects

1. Energy supply → 2. Production → 3. Conversion → 4. Transportation, storage & reconversion → 5. Industry off-takers → 6. Mobility off-takers

Infrastructure/ asset operation

2nd: Upstream

- Efficient & high-load-factor renewable energy sources
- Efficient & at-scale reliable production

3rd: Midstream

- Mature and cost competitive transportation solutions, incl. (re)conversion and storage
- Long-term transportation agreements

1st: Offtake

- Proximity to large anchor off-takers
- Long-term, bankable off-take agreements
- Additional de-risking with public support (regulation, Market making - CCfDs, etc.)

Supply chain

4th: Supply chain delivery

- Experienced EPC Co's for turnkey delivery, proactive permitting and licensing
- Strong, industrialized technology suppliers, with proven track-record and local presence (e.g., O&M partners, Partnerships)
- Governmental support (e.g., permitting acceleration, market maker, credits…)

Finance

5th: Finance

- Early and easier access to public and private financing sources

Source: SMARTENERGY Group AG

Solution 4: Call for Actions to be done by Industry/R&D, Policy-makers and Investment community

1 What Industry and R&D can do

- Push further technology to maturity for green H_2 production
- Build integrated partnerships
- Conclude long-term green H_2 offtake agreements & Insurance
- Develop plans for step-wise asset scale-up

Technological readiness, partnerships and project de-risking measures are key

2 What Policy-makers can do

- Simplify financial support frameworks
- Provide stable and predictable regulation
- Break down practical regulatory hurdles and simplify permitting
- Drive standardization and create transparent playing field

Clear hydrogen strategy and regulations, lower hurdles and standardization are key

3 What the Investment community can do

- Provide syndicated loans, (e.g., together with public grants)
- Establish standard processes for green hydrogen financing
- Perform risk profiling for green hydrogen as asset class
- Target green H_2 assets with dedicated investment vehicles

Incorporate green hydrogen as asset class into standard financing processes

Source: SMARTENERGY Group AG

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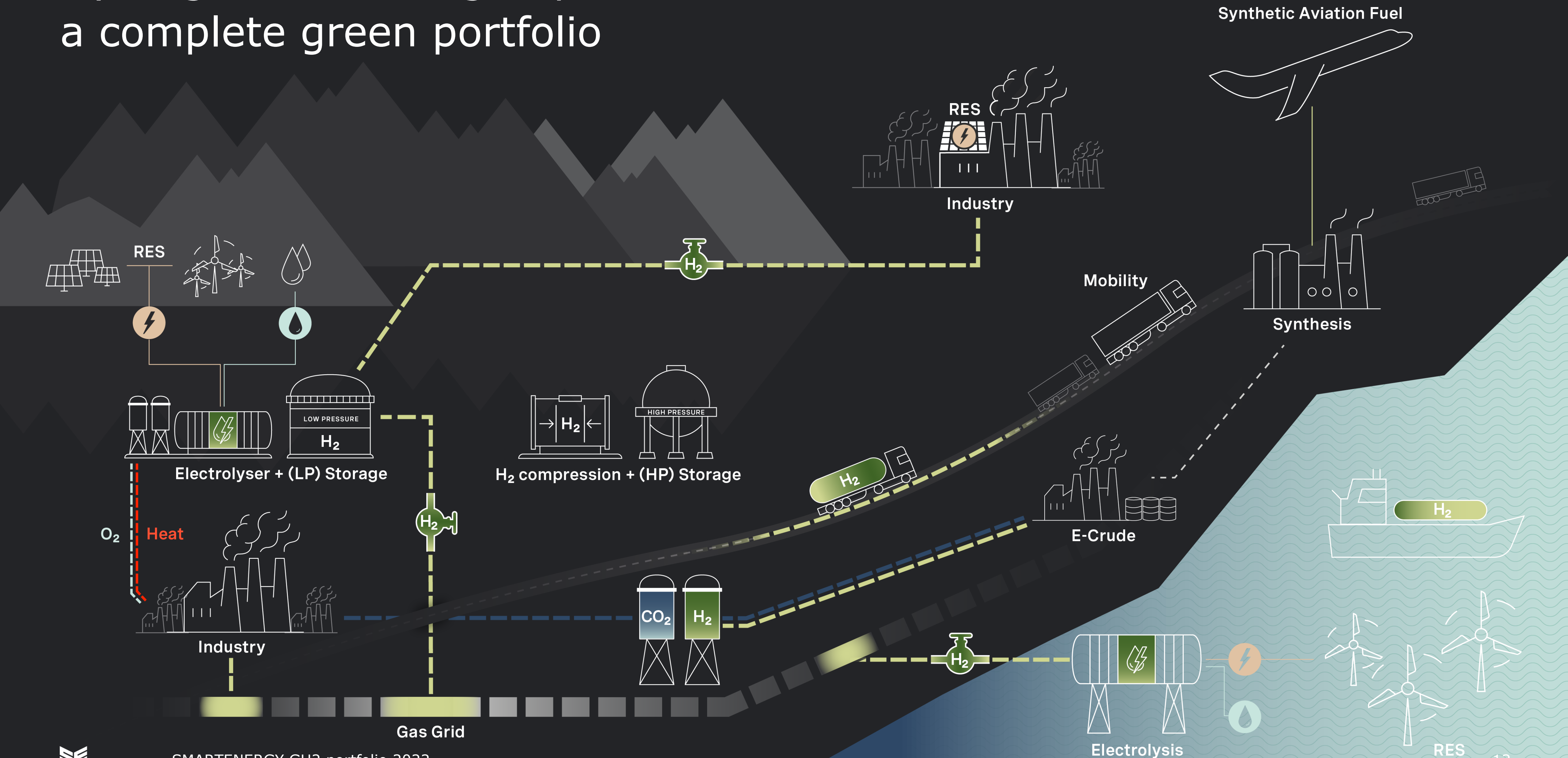
Green H2 portfolio 1.9 GW

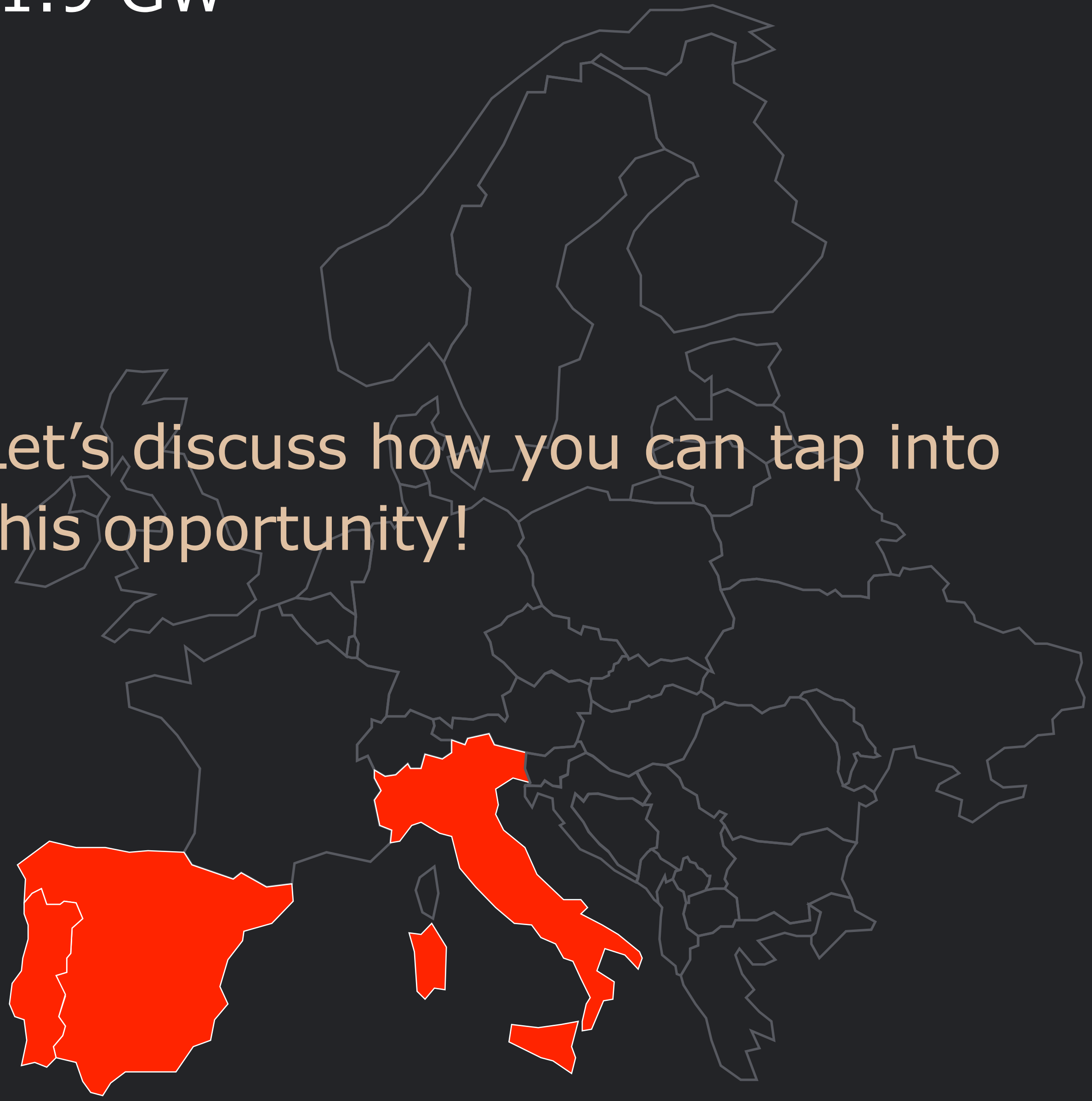
October 2022

Hydrogen is an integral part of a complete green portfolio



Green H2 | Project pipeline 2022 | 1.9 GW

PROJECT NAME	COUNTRY	ELECTROLYSER CAPACITY (MW)
Real	Portugal	100
Frio	Portugal	60
Magos	Portugal	40
Tagus	Portugal	10 → 30
Côa	Portugal	5 → 50
Sado	Portugal	60
Sizandro	Portugal	5 → 50
Galileu	Portugal	125 → 360
Sabor	Portugal	20 → 40
Seda H2	Portugal	300
Sines H2	Portugal	100
Aveiro H2 Valley	Portugal	100
Leça H2 Valley	Portugal	140
Orange.bat	Spain	100
Montealegre del Castillo	Spain	150
Escuriza	Spain	10
Porto Torres	Italy	20 → 200



Let’s discuss how you can tap into this opportunity!

We break new ground.

Thank you!

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