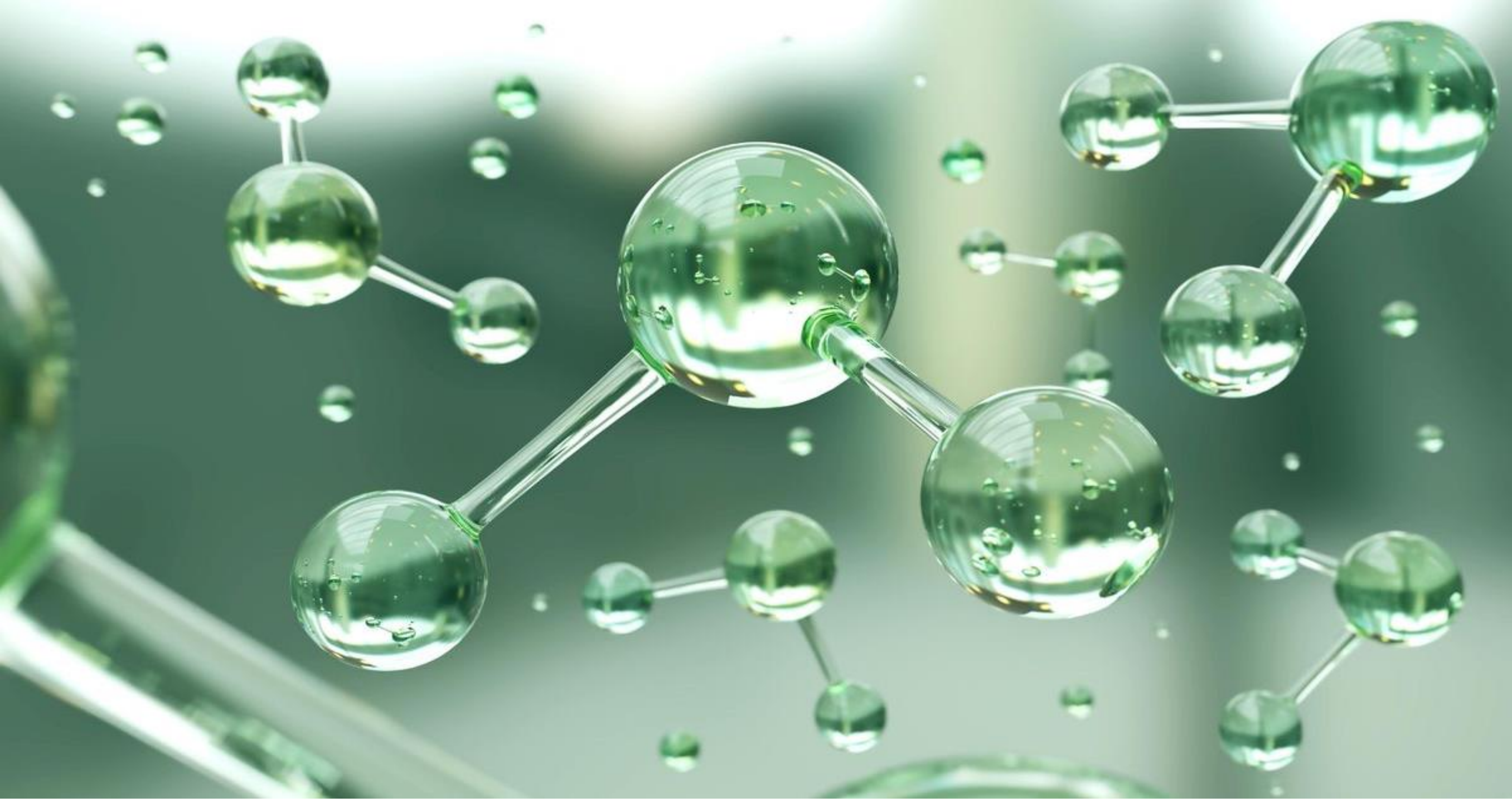
ING – Financing innovative clean tech projects

19th January 2023

do your thing



1. New Energy Technologies Overview

Energy Transition is the core of ING's Energy Sector coverage and beyond

Leading the Terra approach

Started in late 2017 in collaboration with:

2° Investing Initiative

PARIS2015 COP21·CMP11

... and in late 2018

The Katowice Commitment

At COP24 in Katowice, four international banks joined ING in pledging to align their loan portfolios with global climate goals. Currently there are over 30 international banks affiliated with this initiative that aims to bring the **balance sheet of banks in line with the well below 2 degrees scenario of the Paris Climate Agreement**

ING

BNP PARIBAS

BBVA

SOCIETE GENERALE

Standard Chartered

Supporting our client`s transition journey

As a leading global energy bank, ING engages across the value chain

"The global energy system is the main cause of climate change through the greenhouse gas emissions it produces but it also offers the main means to combat climate change and for the future sustainable development of the global economy. At ING, we remain committed to supporting the Energy Transition, and to engaging with clients as they build the business models of a net zero economy. We prioritise an inclusive approach to ensure that all stakeholders move forward together, thereby creating impact in the real economy."

Michiel de Haan,
Global Head of Energy Sector, ING

ING climate action: 5 of 9 sectors are on track with climate alignment pathways

on track	**Power generation**
on track	**Upstream oil & gas**
on track	**Residential real estate**
on track	**Automotive**
on track	**Shipping**
close to on track	**Commercial real estate**
close to on track	**Cement**
close to on track	**Steel**
not on track	**Aviation**

Documenting the progress

ING recently published the 2021 integrated climate risk report

In 2020, ING closed **139** sustainable finance transactions, including supporting the largest ever sustainability-linked RCF for AB Inbev

Renewables account for **64%** of our power generation financing at YE2020.This includes wind solar, water and geothermal.

Began using **100%** renewable electricity in our own buildings in 2020, and reduced carbon emissions by 75% since 2014.

Lending to thermal coal mining has reduced more than **90%** to 30m at year end from 316m in 2017.

Set new target to reduce funding to upstream oil & gas by **12%** by 2025 from 2019, in line with the IEA-NET-zero 2050 scenario.

Our reporting scope for mortgages reached **70%** from 50% by including Poland and Belgium.

Climate risk heatmaps completed for over **83%** of assets in WB.

The COP26 GFANZ is the logical continuation of the transition path that ING already embarked on several years ago.

New energy technologies – ING is an early adopter

1. Driven by trillions of investments required for new energy technologies to support the **Paris 2°c** pathway and to meet growing energy demand, ING established a strategy to harness innovation and disruption in the energy sector
2. Three emerging technologies have been selected based on research and dialogue with a range of clients on their strategies for embracing the energy transition
3. **To engage and think along with our clients**, build awareness around bankability topics, and identify where ING can add value in realizing their strategies
4. ING has established a €650m lending envelope for new energy technologies including Hydrogen. Further demonstrating our support and commitment to a sustainable future

Hydrogen

- **20% of global CO_2 emissions** from fossil fuels can be eliminated by using hydrogen, the clean-burning molecule that could become a zero-carbon substitute for fossil fuels in hard-to-abate sectors of the economy
- With comprehensive policies, over **US$11trillion of investment will be required** in production, storage and transport infrastructure resulting in annual sales of hydrogen of US$700bn by 2050

Carbon capture & utilisation storage

- **10% of global CO_2 emissions** can be eliminated by using CCUS which captures CO_2, transports and stores in underground geological formations or to be used in various applications
- **More than 2,000 large scale (>0.4 Mt/year) plants need to be built** by 2050 while there are currently only 21 plants operational. IEA estimates that projects nearing FID as of September 2020 represent a total potential investment of ~US$27bn

Energy storage

- Focus on 2 main emerging solutions: Stationary and EV Batteries
- **Stationary:** Investment of c.US$650bn needed to grow production accordingly (investment of c.US$75m/GWh) by 2030 driven by higher renewables penetration into the grid
- **EV Batteries:** US$176bn in investments will be required to scale cell manufacturing capacity from today's 432GWh to the more than 2TWh in 2030

Completed mandates

US 08/21
RAD Bloom Class B LLC
USD 134m
Finance for the construction of a portfolio of 56 solid oxide fuel cells
Joint Lead Arranger
Energy Renewables & Power

Sweden 08/20
Northvolt Ett AB
USD 1,360m
Multi-ECA covered senior secured term loan
MLA, Documentation Agent, Insurance Bank, Intercreditor Agent, Facilities Agent, FX Coordinator
Energy Renewables & Power

The Netherlands 08/20
Porthos
Financial Adviser on a C02 capture, transport and storage infrastructure system in The Netherlands
Financial Adviser
Energy Project Advisory

Canada 01/22
Ionomr Innovation
USD 15m
Capital raising
Corporate Finance
Energy - Hydrogen

Australia 12/20
Wandoan South Bess
AUD 107m
Project Finance Facilities for a 100MW/150MWh Battery Energy Storage System
MLA, Hedge Provider, Technical Bank
Energy Renewables & Power

US 03/19
Sparks Battery Holdings LLC
US$ 136m
Senior Secured Credit Facility
Joint Lead Arranger & Co-Lender
Energy Renewables & Power

Current mandates

Germany Current
German LNG
LNG import terminal with add-on investment to allow H2 imports
Advisor
Energy Project Advisory - Hydrogen

Europe Current
M&A Advisory
Minority stake divestment
Undisclosed
Energy Hydrogen

Belgium 06/22
Nala Renewables Belgium
EUR 21m
Nala Renewabels mandated ING to arrange financing for its 25MW/100MWh BESS project
Mandated Lead Arranger, Hedging Bank
Renewables & Power

EMEA Current
Equity
Hydrogen production plant
Undisclosed
Energy Hydrogen

Nordincs Current
H2 Project
Project Financing
Undisclosed
Energy Hydrogen

Nordics Current
Green steel plant
EUR 3bn
State of the art steel factory with largest electrolyser built-in capacity to date
Pathfinder and Documentation bank
Metals and Mining / Hydrogen

Be the partner of choice for our clients to innovate in the energy transition by retaining the relevant knowledge and providing best-in-class solutions into a sustainable future

ING's strong in-house capabilities to offer integrated service on NETs

Combining the strong expertise of a market-leading debt advisory team and an in-house energy technical team, ING brings an integrated, multi- disciplinary advisory service offering to clients' CCUS pursuits

- ING is **among the first banks in Europe to establish a team of dedicated H_2, CCUS and Energy Storage specialists** under a New Energy Technology platform
- Developing **institutional knowledge on CCUS**
- Harnessing in house expertise in technology & innovation
- Collaboration with specialist product teams to better support ING clients' in financing and advisory needs

Dedicated H_2 / CCUS Work Group

In-house Energy Technical Team

Energy Project Advisory *

- Strong, experienced in-house team of 3 Reservoir Engineers based in Amsterdam with **over 55 years of combined experience**
- **Lead role as Technical Bank in almost all major O&G upstream** financings
- Leveraging **expertise in Geology, Chemical Engineering and Oil & Gas operations** to facilitate ING's New Energy Technology Initiative ambitions including H_2 and CCUS

Sector Focus	Coverage Details
Oil & Gas	Upstream, Pipelines, LNG terminals, Refining, Processing and PetChem
Renewables & Power	Gas power plants, Wind, Solar, and other sources of renewable energy
New Energy Technologies	Hydrogen, Carbon Capture (Utilisation) & Storage, Batteries

Service Offering

- **One of the largest dedicated debt advisory teams,** working in integrated deal teams with other specialists in the bank when an expanded skillset is required.
- Supporting clients in **all stages of the funding process up to financing close**
- **Identifying the optimum financing structure** to suit the particular stage of the asset's lifecycle, e.g. greenfield or the refinancing of operating assets

* ING was ranked #1 Financial Advisor by IJ Global as of September 2020

Hydrogen

Hydrogen production costs under two key technologies

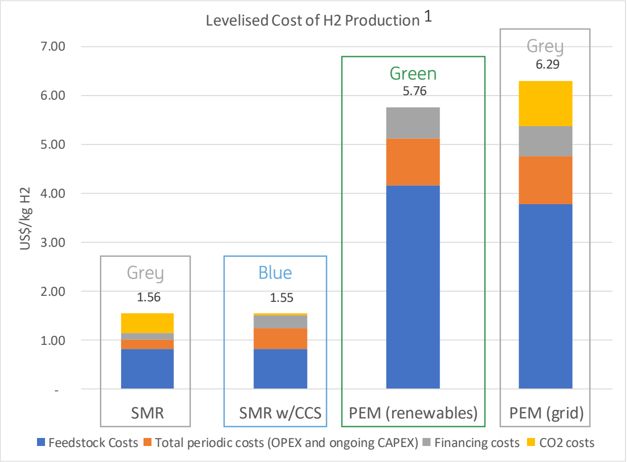
Carbon-free sources - electrolysis

- Electrolysers are in wide use in industry for production of chemicals like oxygen and chlorine.
- The source of electricity differentiates the relative ‘cleanliness’ of the process.

Carbon emitting sources – steam methane reformation

- The vast majority of hydrogen production today is via fossil fuel reformation (without CO_2 capture).
- The localised separation that occurs in this process make it ideal of incorporation of CCS

Green hydrogen	Grey hydrogen / Blue hydrogen
Proton Exchange Membrane (PEM) – green H2 pathway represented by ‘PEM (renewables)’ in the chart Grid-powered PEM for comparison	**Steam methane reformation (SMR) – grey and blue (with CCS) H2 pathways**
Efficiencies around 60%, requiring c. 54.6 kWh per kg of H2	Efficiency of over 70% - 1 mmBtu H2 requires 1.4 mmBtu natural gas (c. 46.4 kWh per kg of H2)
Currently small to medium scale, from 5 tons to 20 tons H2 per day (2 MW to 150 MW)	Large scale, 200 tons to 1,300 tons H2 per day (400 MW to 2,500 MW)
Capex @US$ 1,400/kW	Capex @US$ 400/kW without CCS @US$ 800/kW including CCS
Assuming power price of US$ 0.05/kWh.	Gas price US$ 3.50 /mmBtu



Blue hydrogen (SMR with CCS) closest to commercialisation and seen as accelerator – subject to CCS challenges (permitting, “Not In My Backyard”).

Chicken and egg: capex reduction for electrolyser is required at the same time, distribution and transport infrastructure investments are required for this to happen

Key sensitivities of the above analysis

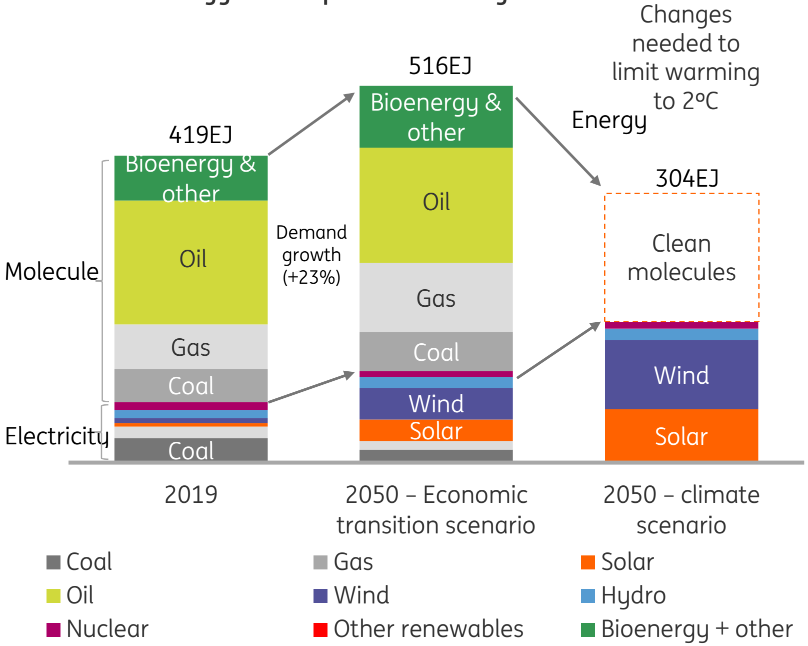
Tech costs	CO2 prices	Feedstock costs	Outcome
SMR - mature tech – costs stable PEM - likely to see significant decreases e.g PEM CAPEX of US$ 500-1,000/kW in 2030 (BNEF)	Strongly influence relative cost of blue vs grey hydrogen production E.g. CO2 at 35 US$/ton – blue hydrogen is the cheaper option	Feedstock, gas or electricity, represent the vast majority of the levelised unit cost – note interrelation between gas, power and CO2 prices in Europe	Blue hydrogen represents the most cost effective production pathway of the technologies analysed, while addressing CO2 mitigation, **today**

1. Levelised cost: the price per unit at which H2 would need to be sold in order to cover capital investment and operating costs and provide a target IRR (10%); CO_2 Price of US$ 35/t assumed

The Hydrogen equation: A few figures

Meeting climate targets is likely to require a clean molecule and USD 11trn investment by 2050 if that molecule is hydrogen

Global final energy consumption: outlook by scenario



Source: BloombergNEF 2022 New Energy Outlook

By 2050, the cost of manufacturing hydrogen will be ~ US$1/kg

Steel

US$582
per ton of hot rolled coil
(Using coking coal: US$495-US$651)

Ammonia

US$368
per ton of ammonia
(Using natural gas: US$244-US$574)

Cement

US$7
per gigajoule of heat
(Using coal: US$1.40-US$4.30)

Aluminium recycling

US$7
per gigajoule of heat
(Using natural gas: US$1.90-US$11.40)

Source: BloombergNEF. Note cost of producing goods using fossil fuels assuming prices of US$60-US$310/t for coking coal, US$2-US$12/MMBtu for natural gas and US$40-US$120/t for thermal coal

The cost of producing Hydrogen in Industry is becoming economically competitive in the mid to long term

Hydrogen: promising applications in the medium to long term

Displacing conventional fuel sources is dependent on the application

Based on the research conducted to date, we have identified several potential major end users/market segments. For each, we provide a brief overview of the technical and economic potential of hydrogen and we apply a star rating capturing their relative technical and economic viability, while we acknowledge that regulatory support is likely to be a decisive factor in the ultimate success of hydrogen in the application listed

Sector/application	Subsector/end use		Today	2030-2050
Power	Fuel cell power	• Expensive but highly flexible power source – reduced H2 and electrolyser (same tech) cost could result in competitive peak power source	★	★★
	Hydrogen-fuelled turbine	• Technically feasible, Mitsubishi have released first commercial unit using 30% H2 and first project incorporating it to start operations in 2025 – generally, however, H2 cost per MW at current prices uneconomical vs gas	★	★★
Storage	Storage for power generation/industrial use/e-fuel production etc	• A key strength of H2 is the ability to store energy. Technical challenges face H2 storage, but as a medium to store variable power it holds the potential to contribute to grid security, store energy that would otherwise be curtailed, possibly bridging supply/demand gaps across energy use in several applications	-	★★
Industrial Heat & Processes	Existing H2 users	• Green/blue H2 will compete directly with grey H2 in applications such as refining, fertilizer and methanol production – projects like Puertollano green hydrogen plant demonstrate the potential for green H2 in these cases	★	★★★
	High quality heat	• Cement, aluminium and glass sectors are dependent on high-temperature heat – case for H2 needs to overcome costs associated with conversion of plant (burners, turbines, furnaces) and conventional fuel cost	-	★★
	Steel production	• Pilot projects underway – benefits from both replacing fossil fuel for furnace heat and reducing agent but capital intensive in a marginal business	★	★★★
Domestic Use	Blending with natural gas	• Many existing gas-based appliances can operate using a proportion of hydrogen feed. Gas grids worldwide permit % of hydrogen content. Grid upgrades may permit increased volumes in future. Significantly more expensive than the gas it would replace today but potential in the future. Hydrogen to gas conversion possible but expensive	-	★★
	Domestic water heating	• See above for blended NG/H2. Pure H2 will require significant capital investment as distribution infrastructure and boilers would need to be replaced – long-term potential	-	★
Transport	Private vehicles, haulage, aviation, shipping, rail	• Explored in detail. Highly application dependent, but liquid hydrogen's energy density has potential for high energy requirement sectors	★ (application dependent)	★★★ (application dependent)

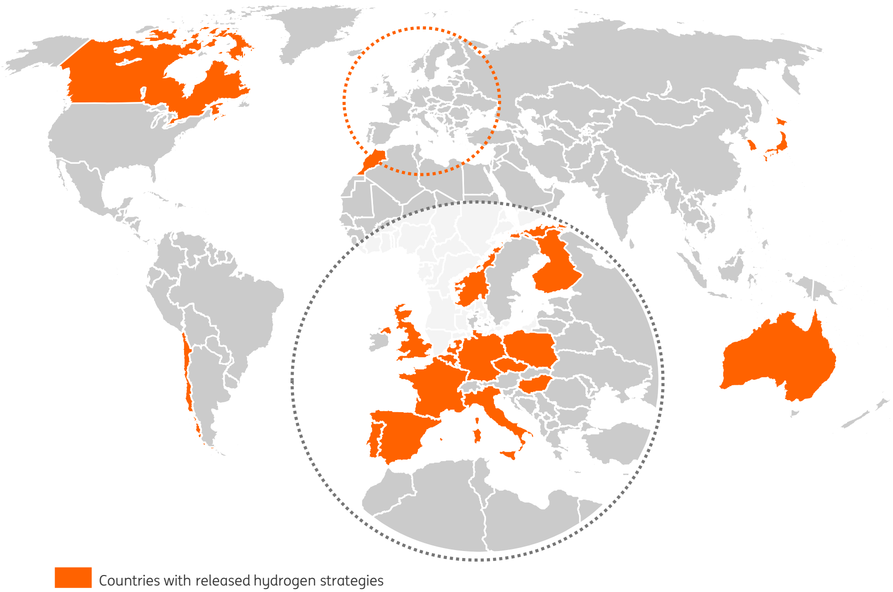
Hydrogen: regulatory support programmes for H2 announced around the globe

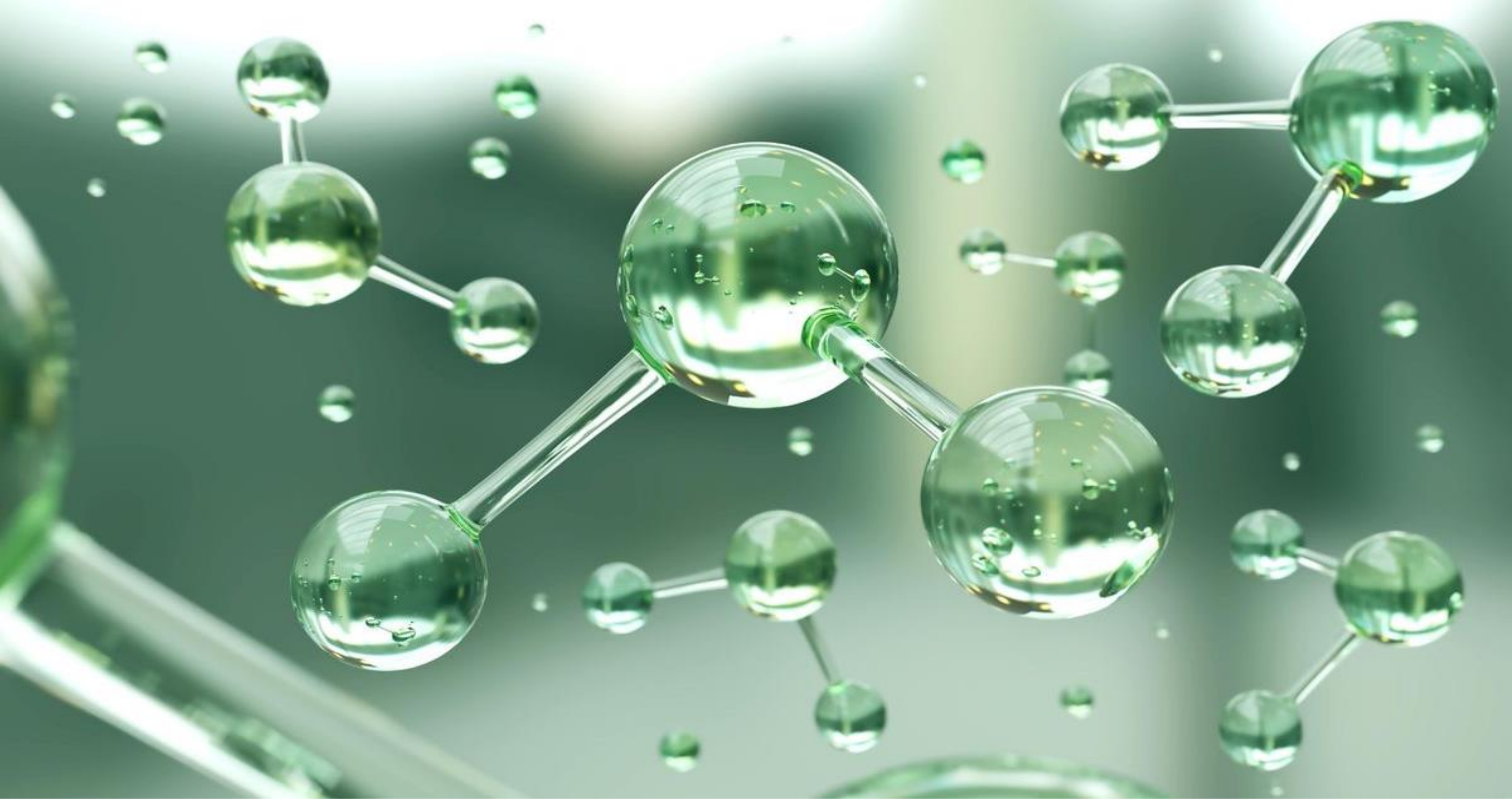
Government Support

- **Over 20 countries** have released **strategies** for Hydrogen Production including Germany, UK, France, Netherlands and Spain
- **Demand Side Support policies** are starting to be introduced and discussed such as minimum quotas of renewable Hydrogen or its derivatives in specific end-use sectors. At the EU level, the major advance has been through the announcement of the Hydrogen Bank which will effectively guarantee an offtake price for any renewable hydrogen produced.
- **Supply side** policies have been developed through the EU's Fit for 55, RePowerEU and Delegated Act on Hydrogen production.
- The European Commission announced this week an increase in awards from the Innovation Fund with the next call for large scale projects totaling EUR 3bn.
  - Vice President of the European Commission, Frans Timmermans is a big proponent of renewable Hydrogen production within the EU (as well as import from outside) and there is therefore strong support at the highest levels of the commission.
- The objective of this strategy is to accelerate the technological mastery in order to industrialize hydrogen and enable a significant reduction in production costs.

Other subsidy Examples

- In the Netherlands four large industrial companies (ExxonMobil, Shell, Air Liquide and Air Products) have successfully applied for SDE++ subsidy scheme (€2.1bn), under which Dutch government supports energy transition projects including CCS and Hydrogen.
- The German Government's H2Global scheme provides €900m (as part of a broader €4bn package) to support investments in the production of renewable hydrogen in non-EU countries, which will be then imported and sold in the EU. The scheme aims at meeting the EU demand for renewable hydrogen that is expected to significantly increase in the coming years, by supporting the development of hydrogen production outside the EU.





Bankability considerations

Key Bankability Considerations for New Energy Technologies (I/II)

Topics	Bankability Considerations
Policy & Regulatory	• Regulatory schemes are currently under development for New Energy Technologies, a specific focus of current consultation rounds are the mechanics of the revenue mechanism and the risk allocation between government and industry participants • Available Subsidy / Support Schemes - **Hydrogen:** Different regulation schemes are under development in various countries and CfD schemes are being developed **CCUS:** Regulation is developed in various countries, subsidies have been successfully applied for under Dutch SDE++ program
Geopolitical risk	• Russian gas supplies are inherently risky due to political tensions between Russia and Western European countries • A state of 'cold war' continues to exist in Eastern Ukraine with a recently heightened risk of a full-on Russian aggression and fighting which could implicate several countries lending different levels of support to Ukraine
Contractual & Legal	• Lenders would require, amongst other things: - All permits in place - **Robust supply and offtake contracts** - External debt to be structurally senior and has first lien security over (critical) assets - In-depth understanding of the rights and obligations under each commercial agreement - In-depth understanding of the legal and regulatory framework surrounding the project → **Early engagement of a financial advisor and a legal advisor to review draft project agreements from commercial / financing and legal perspectives to ensure bankability**
Technological	• The choice of technology will impact Bankability significantly. The most established, commonly developed and cost competitive will always have less risk associated to it from a financing perspective • **Hydrogen:** There is currently very limited operating history of any electrolyser above 10MW. The ability to scale up whilst remaining cost competitive and delivering the necessary volumes of energy will be a crucial part of the technical review. • **CCUS:** CO_2 Transport and storage requires limited use of new technologies however the choice of carbon capture can vary depending on the industry in question, unfamiliarity with CCUS and lack of financing precedents present challenges to lenders' internal approvals → **Early engagement of a financial advisor** to prepare **education material** for potential lenders + **early involvement of key lenders** in the financing process

Key Bankability Considerations for New Energy Technologies (II/II)

Topics	Bankability Considerations
Completion	• Lenders unlikely to take completion risks without strong sponsor support (e.g. completion guarantee) in case of construction phase financing. Alternative arrangements based oversized contingencies base on extensive technical review also an option. • Operational phase financing, lenders still expected to require assurance of quality of EPC work (e.g. reputable contractor, rigorous completion test regime etc.)
Technical	• Technical risks need to be assessed in full and appropriately mitigated. They can include - **Hydrogen:** Type of Electrolysis method, supplier track record for H2 purity, Transport methodology - either liquified or using a transport medium, Reliability of green / blue power supply is of crucial importance - **CCUS:** Interface of CCUS with emissions unit, carbon capture efficiency, transport methodology – either offshore, onshore or ships and storage capacity or usage for EOR → **Early involvement of independent technical advisors** to ensure project documents bankable from technical perspective. → **Operational track-record** prior to financing would give comfort to lenders and minimize sponsor support
Environmental & Social	• Lenders / investors will require local national environmental and social guidelines are strictly adhered to given the importance of these technologies within the energy transition, expectation of enhanced scrutiny and reporting mechanisms for effectiveness • Equator Principles (EP): compliance required (by most bank lenders) in case of construction phase financing, or operational phase (re-)financing with upgrade work occurring in parallel. For operational phase financing with no on-going upgrade/expansion work, EP compliance would not be required
Project on Project	• There should be clear separation of work scope and responsibility between different parts of the project, in the case of hydrogen, the supply of electricity for electrolysis could be under a separate project, in the case of CCUS, the storage or transport could again be under a separate project • Coordination of completion, testing, commissioning and maintenance would be required as well as due diligence activities across the entire value chain of the project including dependent projects

Q&A

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