

WATSON FARLEY  
&  
WILLIAMS



# 2ND MUNICH HYDROGEN SUMMIT - PROJECTS, INVESTMENTS AND FINANCING

WEDNESDAY 5 JULY 2023

A close-up photograph of a white industrial hydrogen storage tank. The letters "H2" are printed in large, bold, blue font on the tank's surface. Below the "H2" label, there is a small yellow warning sign with a black triangle and the word "Danger" in black text. To the right, a circular metal flange with several bolts is visible, protruding from the tank. The background is slightly blurred, showing another part of the tank with "H2" written on it.

H<sub>2</sub>

# Agenda

15:00	<b>WELCOME</b> Dr Christian Bauer, Partner, Watson Farley & Williams Thomas Engelmann, Head of Energy Transition, KGAL
15:15	<b>UPDATE ON GERMAN HYDROGEN STRATEGY AND DISCUSSION (ONLINE)</b> Till Mansmann MP, Innovation Commissioner for Green Hydrogen, German Federal Ministry of Education and Research
15:45	<b>REGULATORY UPDATE</b> Dr Maximilian Boemke, Partner, Watson Farley & Williams David Diez, Partner, Watson Farley & Williams
16:05	<b>CASE STUDY: EU E-FUELS MARKET</b> Thomas Engelmann, Head of Energy Transition, KGAL Dr Maximilian Boemke, Partner, Watson Farley & Williams
16:25	<b>COFFEE BREAK</b>
16:55	<b>A ROADMAP TO SCALING UP GREEN HYDROGEN PRODUCTION</b> Luc Graré, Head of Central Europe, Lhyfe
17:15	<b>CHALLENGES IN THE PRODUCTION INDUSTRY (ONLINE)</b> Musbat Al-Mansour, Managing Director, DST Defence Service Tracks
17:35	<b>ACTIVITIES AND INFRASTRUCTURE FOR HYDROGEN TRANSPORT</b> Rafael Schmidt, Head of Business Development, Hydrogenious
17:55	<b>PANEL DISCUSSION</b> Udo Schneider, Financial Advisor, Green Giraffe Advisory Marcel Werner, Partner, Senco Capital Luc Graré, Head of Central Europe, Lhyfe Tim Cholibois, Green Hydrogen Strategist, Enapter (Online) Thomas Engelmann, Head of Energy Transition, KGAL (M) Dr Christian Bauer, Partner, Watson Farley & Williams (M)
18:30	<b>END / NETWORKING, DRINKS AND CANAPES</b>

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## REGULATORY FRAMEWORK GREEN HYDROGEN (UPDATE)

DR MAXIMILIAN BOEMKE, PARTNER, WATSON FARLEY & WILLIAMS

DAVID DIEZ, PARTNER, WATSON FARLEY & WILLIAMS



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# Delegated Acts

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# Delegated Acts

## Delegated Act on green hydrogen

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Sets four scenarios in each of which electricity for hydrogen production can be regarded as fully renewable resulting in “green hydrogen”

Requirements apply also to non-EU states wishing to import into the EU!

### SCENARIO 1: Renewable PPA (Standard case)

- Electricity supply from renewable source via PPA or own renewable plant!
- Amount of electricity produced in the RE plants has to be at least equivalent to the amount of electricity which is claimed for the RNFBO production.
- Requirements on **additionality**, **temporal correlation** and **geographical correlation** need to be met.

# Delegated Acts

## Delegated Act on green hydrogen

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- **Additionality Requirement (transitional rule applies)**
  - The renewable plant(s) may not come into operation more than 36 months before the electrolyser.
- **No public support for renewable plant (“no EEG-rule”) (transitional rule applies)**
  - The renewable plant must not have received operating or investment aid unless:
    - The aid was received before repowering;
    - The aid was granted for land or grid connection;
    - The aid does not constitute net support or;
    - the renewable plants supply electrolysers producing RNFBOs for research, testing and demonstration purposes.
- **Transitional Period**
  - 36-month rule and “no EEG-rule” do not apply until 1 January 2038 for electrolysers coming into operation before 1 January 2028.

# Delegated Acts

## Delegated Act on green hydrogen

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- **General Exemption (low carbon bidding zone)**
  - The 36-months rule and “no EEG-rule” do not apply to renewable plants for which a PPA has been concluded and that are located in a bidding zone where the emission intensity of electricity is lower than 18gCO<sub>2</sub>e/MJ (in the EU currently only Sweden reaches this threshold, although France is close).
- **Temporal correlation**
  - RFNBO must be produced:
    - Until 31 December 2029 within the same month (thereafter within the same hour, member states can decide to require hourly matching from 2027) as the electricity was produced in the renewable plant;
    - with electricity from an “new” onsite storage asset (behind the same network connection point of either plant or electrolyser; “new”, however, is not defined) that was charged within the same month (as of 2030 (2027): hour) as in which the plant was producing, or;
    - at times of low electricity prices in the bidding zone where the electrolyser is located (day ahead clearing price of  $\leq 20$  EUR/MWh or  $< 0.36$  times the price of an EU ETS certificate for 1t of CO<sub>2</sub>e).

# Delegated Acts

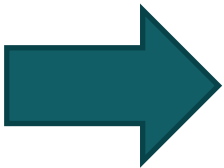
## Delegated Act on green hydrogen

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- **Geographical correlation**

- Renewable plant must be located:

- in the same bidding zone as the electrolyser;
    - in an offshore bidding zone interconnected with the electrolyser's bidding zone; or
    - in an interconnected bidding zone. In this last case the electricity used for the production of RNFBO may only be considered fully renewable if it is produced during times (and in line with the temporal correlation requirement) where the price of electricity is equal or higher than in the electrolyser's bidding zone.



**Member states are allowed to introduce additional criteria to ensure compatibility with their planning of electricity and hydrogen grids.**



# Delegated Acts

## Delegated Act on green hydrogen

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### SCENARIO 2: Bidding zone with >90% renewables

- Electrolyser is located in a bidding zone with an average proportion of renewable electricity of >90% in the previous calendar year
- Production of the RNFBOs does not exceed a maximum number of hours set in relation to the proportion of renewable energy in the bidding zone.
- Possible candidates to fulfil this criteria:
  - Iceland,
  - Norway,
  - Albania,
  - Uruguay or
  - Costa Rica.

# Delegated Acts

## Delegated Act on green hydrogen

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### **SCENARIO 3: Imbalance Settlement**

- Electricity taken from the grid for electrolysis can be considered to be fully renewable in a redispatch situation where renewable plant were redispatched (i.e. shut down) and the use of electricity for the production of RNFBOs reduced the need for redispatching.

### **Scenario 4 (Direct connection)**

- In case of a direct connection between renewable plant and electrolyser the following applies:
  - The 36-month rule (as described above) applies. However, there is no transitional period.
  - On the other hand, the no-EEG rule does not apply!
  - Should the renewable plant also have an external grid connection, the operator will need to prove via smart meters that no electricity from the grid was used for the production of the RNFBOs.

# Delegated Acts

## Delegated Act on Methodology

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- Sets the greenhouse gas savings threshold for RFNBOs and RCFs and outlines the methodology to determine when a given batch of renewable hydrogen meets the REDII's requirement of 70% greenhouse gas emissions savings.
- If the greenhouse gas emissions savings of a particular batch of hydrogen do not meet this threshold, it will still technically qualify as renewable hydrogen, but will not count towards Member States' EU target for renewable energy and, hence, is very unlikely to receive support at a national level (public funding, tax exemptions, etc.). However, this is to be decided by national law which does not yet exist.
- Sets the general methodology to calculate emission reduction over the life cycle of an RFNBO (from production until final use).
- Contains provisions for CO<sub>2</sub>-supply!

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# Hydrogen Projects Development

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# Delegated Acts

## Impact of the Delegated Act in Project development

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- Welcoming of the Delegate Act in Spain:
  - Positive points:
    - Legal certainty
    - Positive effect on the capex of large-scale self-consumption projects with and without surplus.
    - Grid requirements, flexibility
  - Outstanding points:
    - Coordination of delegated act requirements-guarantees of origin.
    - Applicability of Delegated Act requirements to hydrogen consumption for industrial purposes?

# Hydrogen projects development

## Main challenges & recommendations

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- The offtaker as the center of the Project. Important to collaborate from the early stages with potential consumers of gray hydrogen (metallurgy, steel industry, petrochemical industry, fertilizer manufacturing, etc.).
- Boom in renewable hydrogen production projects given the ambitious targets set by the Government (e.g. the draft update of the Spanish PNIEC raises the electrolyzer deployment targets from 4 GW to 11 GW).
- Preferences by offtakers/Administrations:
  - Mature and viable projects with availability of water and industrial land.
  - Visibility on the offtaker.
- Design of an optimized and well-proportioned supply strategy, balancing dedicated renewable generation with the subscription of renewable electricity PPAs.
- Importance of having good advisors and experts for optimal management of technology, permits, subsidies, project contracts (PPAs, HPAs, etc.), structuring of financing, identification of opportunities.



**KGAL GROUP**  
A LEADING EUROPEAN REAL ASSET MANAGER

# KGAL has successfully been investing in real assets for over 50 years



Headquarter in Grünwald / Munich Germany



Over 50 years of experience in real assets



€ 16 bn AuM & AuA



Team of 353 specialists



Signatory of UN PRI and a member of GRESB



## EXPERTISE

**3 asset classes:** real estate, sustainable infrastructure and aviation

**27 active funds,** club deals and separate accounts for **institutional** investors from **15 countries**

**Full-service platform across** all asset classes, client-facing and focused

Strong network and **excellent market access** across our three asset classes

ESG-oriented at group, product and asset level with a **comprehensive sustainability commitment**



## BY ASSET CLASS

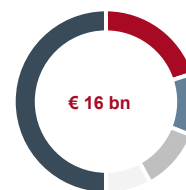
**52%** Real Estate

**22%** Sustainable Infrastructure

**15%** Aviation

**6%** Other business areas

**5%** Private Equity



## BY VEHICLE TYPE

**70%** Institutional Vehicles

**11%** Retail Funds

**2%** Private Placements  
**2%** Own Assets

**10%** Leasing

**5%** Other business areas





**THE AVIATION MARKET IS MORE THAN KNOWN TO US  
BUT WHERE IS SUSTAINABLE KEROSENE COMING FROM?**

## First : KGAL's focus

Real estate, sustainable infrastructure and aviation



### Real Estate

240 properties  
(AT/BE/CZ/DE/ES/HR/HU/IE/NL/  
PL/SI/UK)



### sustainable infrastructure

72 photovoltaic systems  
(BG/DE/ES/FR/GR/IT/PT/UK)  
51 wind farms (DE/FR/FI/PL/SE)  
4 hydroelectric power stations (IT)  
1,388 MW of total output



### Aviation

More than 900 transactions  
Global business



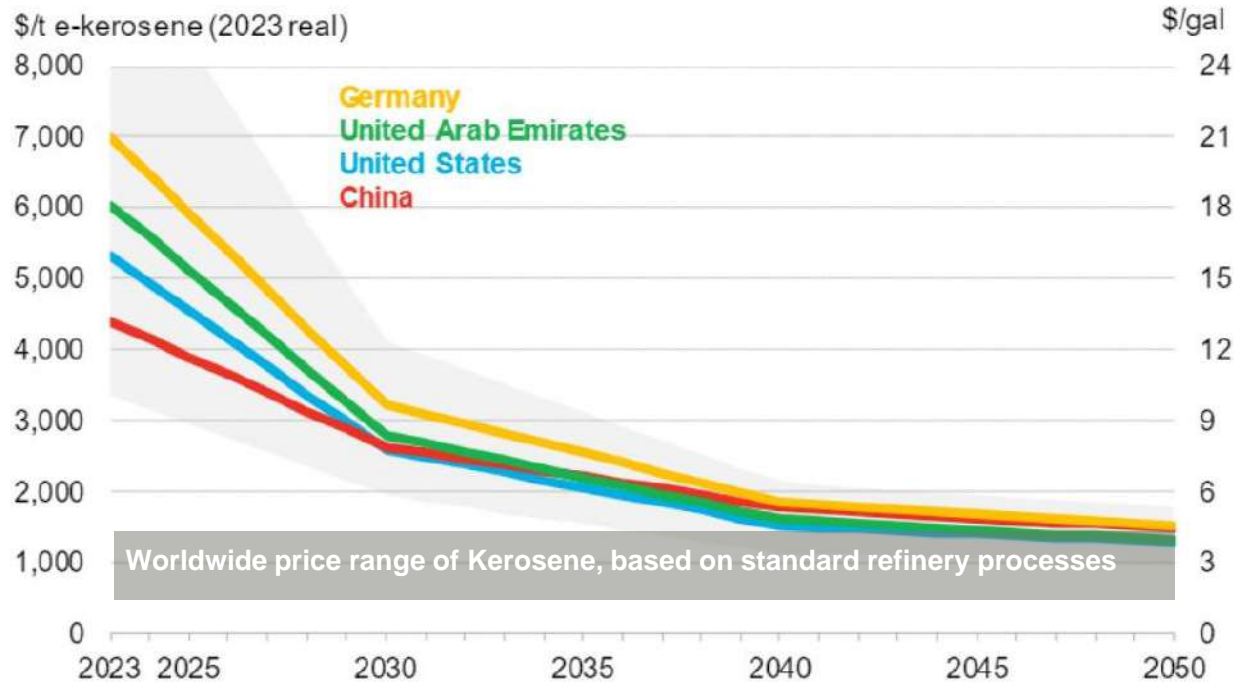


## E FUELS CASE STUDY

What are RFNBO's ?

## eFuels production costs are set to decline

But strong investments and production scale-up will be required



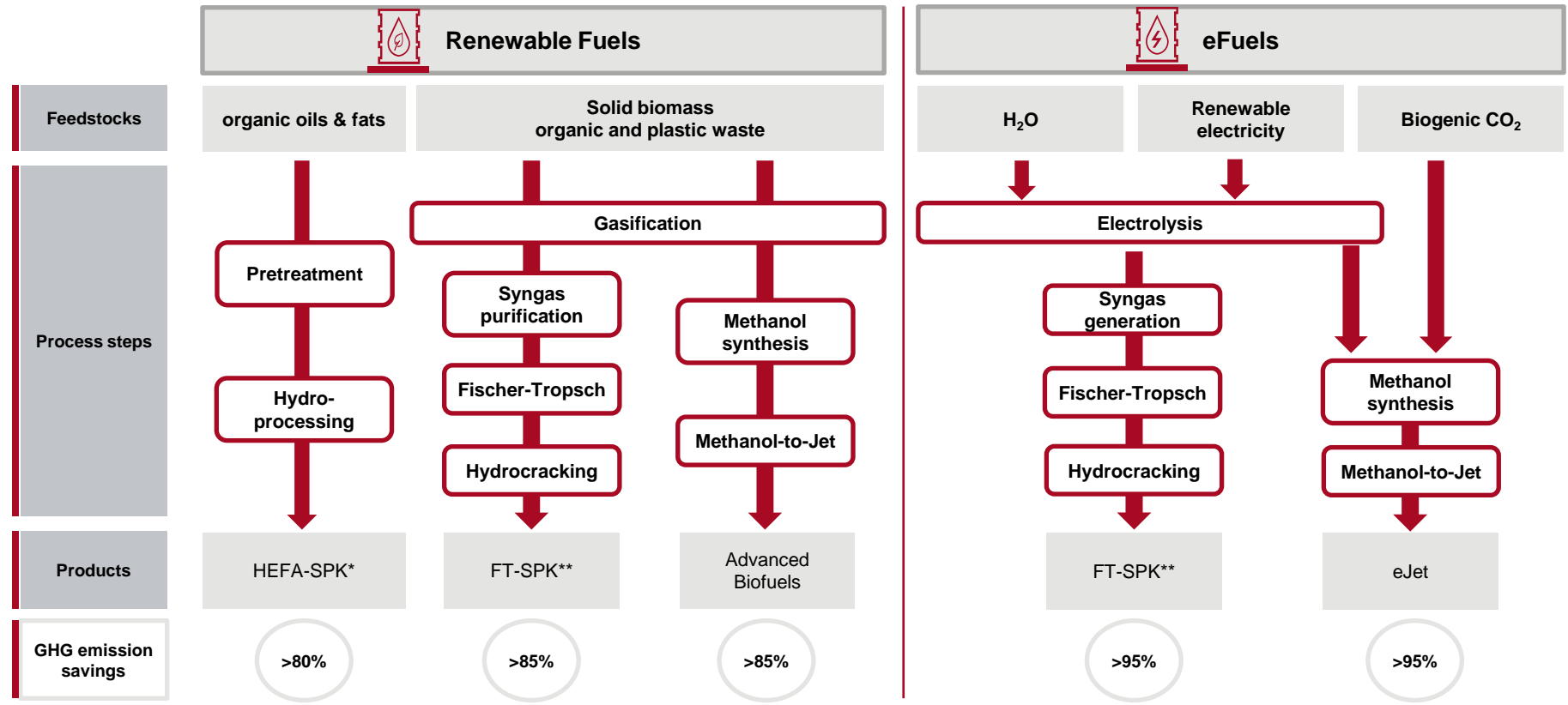
Source: BloombergNEF. & KGAL research

- eKerosene is currently 5-8 times as expensive as fossil Jet Fuel
- eFuels are likely to remain relatively expensive compared to other SAFs

BUT

- Other sustainability considerations such as land use, environmental impact, resource consumption or emission savings can favour eFuels
- Regulatory incentives such as blending targets can help bridging the cost gap and are already in place or planned in some markets (EU)
- Technological improvements could improve eFuel's competitiveness beyond expectation

# eFuels and renewable fuels



\*HEFA-SPK: Hydroprocessed Esters and Fatty Acids  
 \*\*SPK: Synthetic Paraffinic Kerosene (FT: Fischer-Tropsch)



# Investment Case: e Fuels Project



Green H<sub>2</sub> electrolysis & e-fuels

356 MW electrolysis and Fischer Tropsch synthesis

Development stage

Denmark



## Investment Description

Opportunity	Investing in an electrolysis and e-fuel project <u>under development</u> Like a PE case
Rationale	Participation in an electrolyser and e-fuel project in the mid development stage with strong project partners and favourable renewable electricity procurement
Developer	Danish / US developer , superb know-how based on former O&G general managers
Offtake opportunity	DCC/Shell and BASF, but also airlines
Electricity procurement	Renewable electricity procurement by way of a PPA (LOIs with Vattenfall and Energi Danmark)

## Business Rationale



**Electricity:** Green PPA (solar PV, onshore and/or offshore wind), low renewable LCOE in Denmark



**Offtake:** Kerosine producer like DCC and Shell will be forced by law to have a floor value of eFuels by 2030 as well as various airlines facing increased pressure to decarbonize their fuel procurement



**Regulatory:**

- RED II will force off-takers to buy around 1% as RFNBO by 2030

## Transaction Financials

TIC	Up to EUR 1.0 bn
Equity structure	Ca. EUR 50 mn for the Development phase plus EUR 400 mn (at FID)
Debt structure	Non-recourse project leveraged EUR 550 mn. (50%-55%)

## Expected Timeline and Duration of an e-fuels plant

Development phase	2-3 years
Construction phase	Depending on the size ca. 2-3 years
Operation phase	Up to 30 years

## Value Chain & Revenue Source

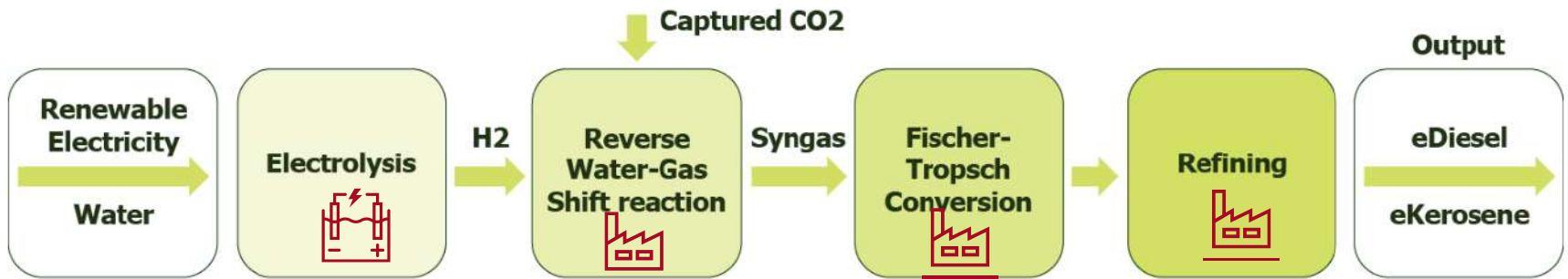


Sale of e-fuels (e-kerosine and e-Naphta)

All data provided on indicative terms only.

<sup>1</sup> RTB = Ready-to-build, COD = Commercial Operation Date

## One remark to the process ...



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This is a marketing communication. Please read the Investment Memorandum/Offering Memorandum, which contains a detailed illustration of the offer (and especially of the risks contained) only and can be supplied to you by KGAL Investment Management GmbH & Co. KG, before making a final investment decision.

The investment vehicle(s) described herein is an entrepreneurial investment with blind pool character which may result in a financial loss and may even be associated with the risk of total loss of the capital invested. The present document presenting the investment proposal is nonbinding and does not purport to be exhaustive. The document does not constitute an offer or investment advice and should not be used as the basis for an investment decision. No investment in the vehicle can be made on the basis of this document. Any investment in this investment vehicle should only be made by any potential investor based on prior Due Diligence by the investor and upon extensive prior advice by third party professional consultants for particularly legal and tax matters.

**Past performance is not indicative of future returns. The scenarios presented are an estimate of future performance based on past knowledge of the performance of this investment and/or current market conditions and are not an exact indicator. How much you actually receive will depend on how the market performs and how long you hold the investment/the product. Future performance is subject to taxation, which is dependent on the individual investor's situation and may change in the future.**

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## Delegated Acts – Contract Implementation

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# Delegated Acts

## Impact on PPAs

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- **PPAs (draft/term sheet) need to reflect the applicable provisions of the delegated acts**
- **Checklist:**
  - What type of delivery do I have (on-site or via grid)?
  - Based on current project timeline can I use grandfathering provisions?
    - Is “additionality” reflected?
    - Is “temporal correlation” reflected?
    - Is “geographical correlation” reflected?
  - What type of security do I have (guarantee, undertaking, obligation)?
  - What is my counterparty risk (delays, etc.?)
- **LAST NOT LEAST: DO I HAVE ANY INDICATIONS/KNOWLEDGE FOR ADDITIONAL REQUIREMENTS ON NATIONAL LEVEL?**

# Delegated Acts

## Impact on CO<sub>2</sub>-Feedstock Supply

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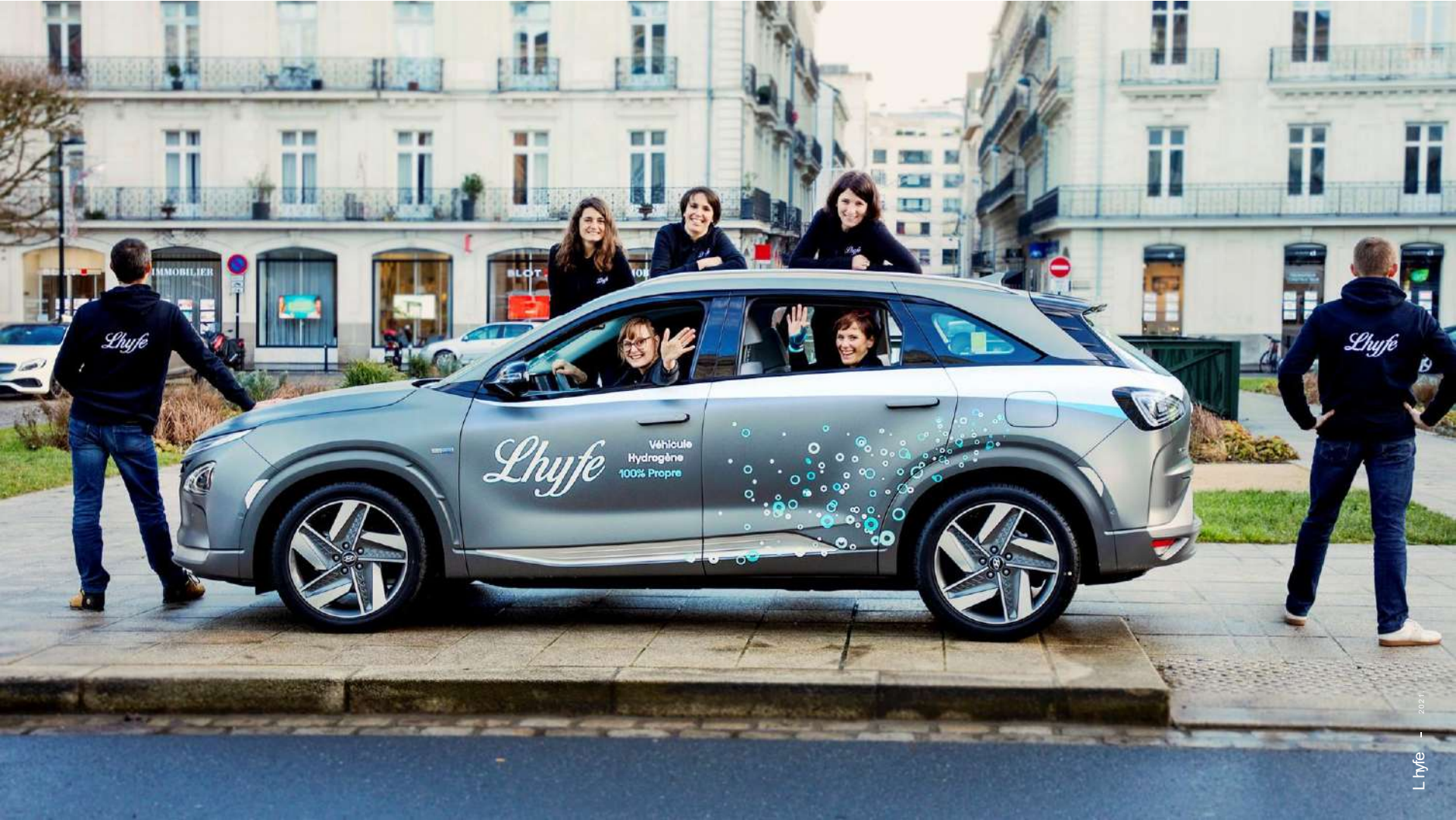
- **CO<sub>2</sub>-Supply Agreement (draft/term sheet) need to reflect the applicable provisions of the delegated acts**
- **Checklist:**
  - Does my CO<sub>2</sub>-source fulfill the requirements set by the DA
    - Captured from EU-ETS facility (before 2036)
    - Captured from air
    - Stems from the production or the combustion of biofuels, complying with the sustainability and greenhouse gas saving criteria and the CO<sub>2</sub> capture did not receive credits for emission savings from CO<sub>2</sub> capture; or
    - Stems from the combustion of renewable liquid and gaseous transport fuels of non-biological origin or recycled carbon fuels complying with the greenhouse gas saving criteria; or
    - Stems from a geological source of CO<sub>2</sub> and the CO<sub>2</sub> was previously released naturally.
  - **LAST NOT LEAST: DO I HAVE ANY INDICATIONS/KNOWLEDGE FOR ADDITIONAL REQUIREMENTS ON NATIONAL LEVEL?**

An underwater scene with a blue-green color palette. Light rays and numerous small bubbles are visible, creating a sense of depth and movement. The text is centered over this background.

# Lhyfe

Green hydrogen producer









*Lhyfe*

INTRODUCTION  
EN BOURSE

23 MAI 2022

EURONEXT

LHYFE  
LISTED  
EURONEXT

Paris







GREEN H<sub>2</sub> IS ALREADY A REALITY

1<sup>st</sup> industrial  
production H<sub>2</sub>  
2021







Lhyfe

Lhyfe

STAV

STAV

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## LHYFE, AN INTERNATIONAL GROUP

- Subsidiaries in 7 countries (end-2022)
  - Germany
  - Denmark
  - Netherlands
  - Sweden
  - United Kingdom (2022)
  - Spain (2022)
  - Canada (2022)
- Offices in 11 European countries
- Hydrogen projects in 12 countries



# PROJECT IN CONSTRUCTION STAGE: BESSIÈRES (FRANCE)





**PROJECT IN  
CONSTRUCTION  
STAGE: BOTNIA  
(SWEDEN)**





## PROJECT IN CONSTRUCTION STAGE: TÜBINGEN (GERMANY)

- Contract with DB signed
- Aimed at supplying hydrogen-powered trains on the Pforzheim-Horb-Tübingen line from 2024.

H2goesRail

**SIEMENS**

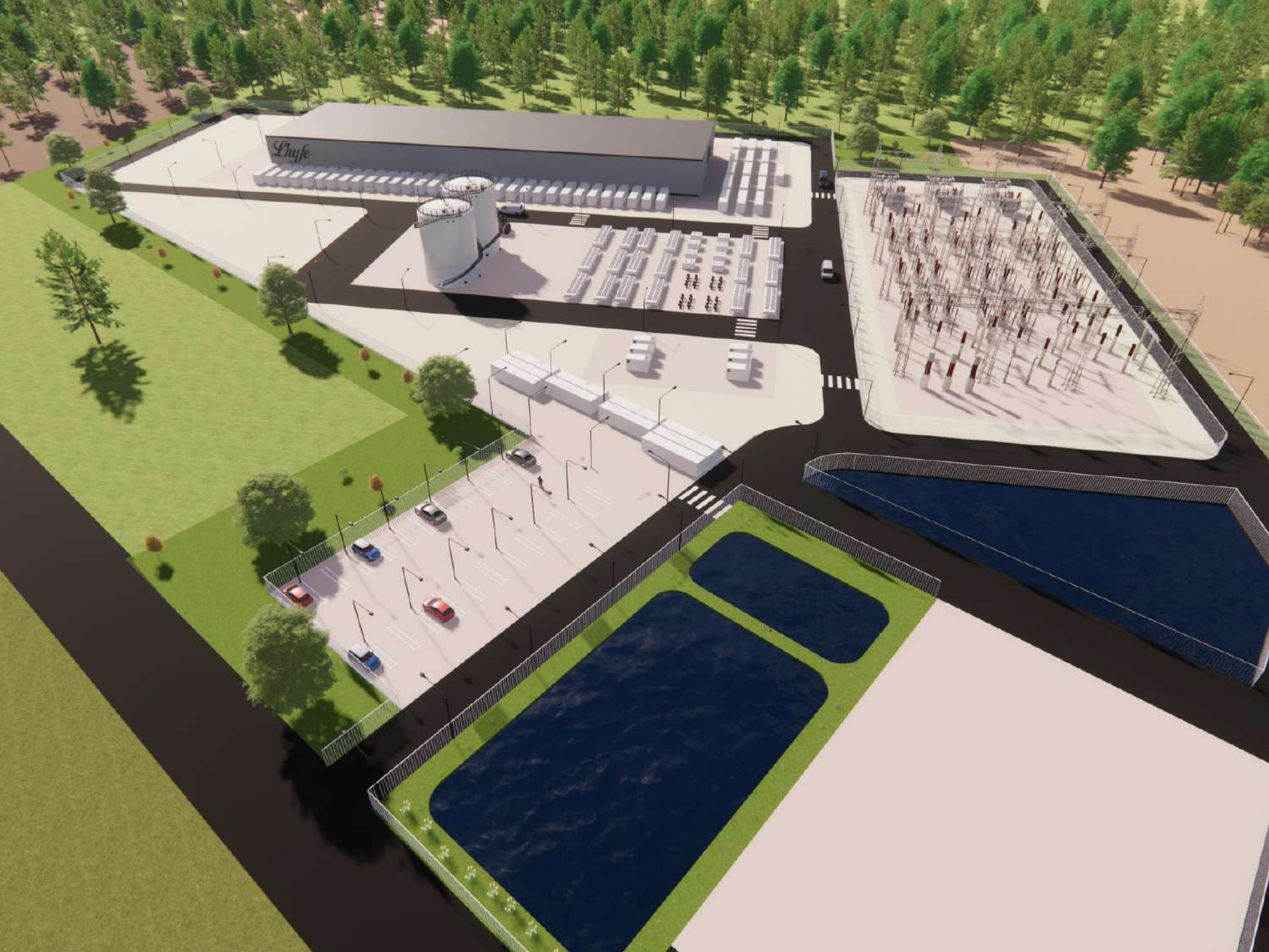
**DB** BAHN



**PROJECT TO START  
SOON  
CONSTRUCTION:  
SCHWÄBISCH  
GMÜND (GERMANY)**











Lhyfe is developing a 200 MW plant in Delfzijl Chemical cluster





## OFFSHORE WIND TREMENDOUS GENERATION POTENTIAL

### EU: POISED TO CONTINUE LEADING THE OFFSHORE WIND INDUSTRY

- Offshore wind capacity increase by at least fourfold by 2030
- Offshore wind: European Union's largest source of electricity in the 2040s

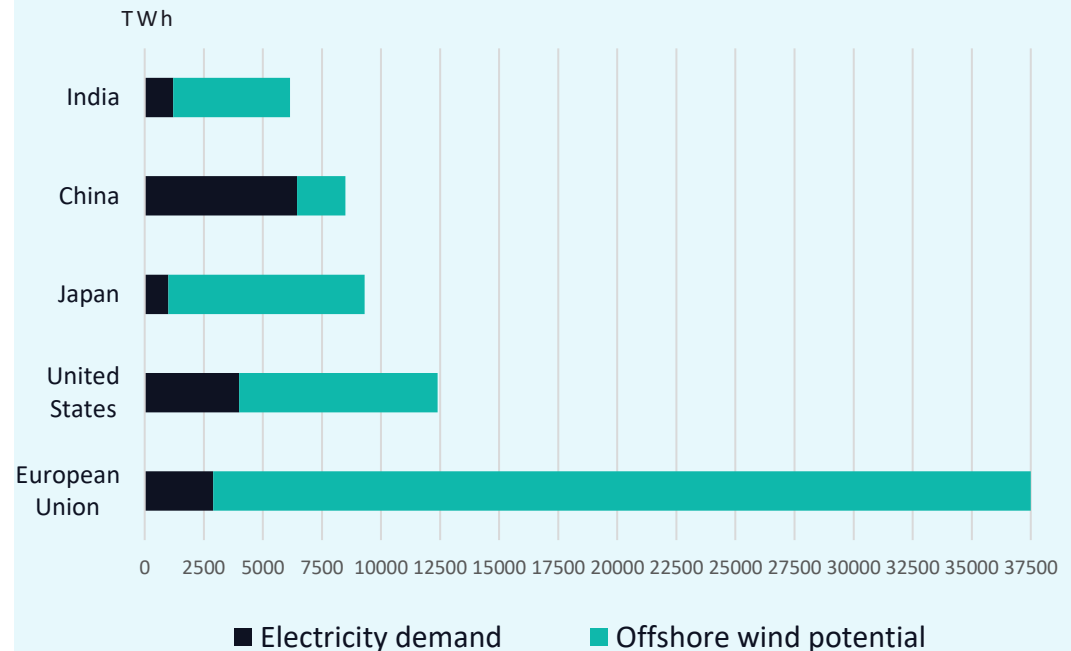
### HIGH-CAPACITY FACTORS AND FALLING COSTS MAKE A GOOD MATCH TO PRODUCE LOW-CARBON HYDROGEN

- 1 GW offshore wind project could produce enough low-carbon hydrogen to heat about 250 000 homes

### EUROPE IS LOOKING TO DEVELOP OFFSHORE "HUBS" FOR PRODUCING CLEAN HYDROGEN FROM OFFSHORE WIND

Source: IEA - Offshore Wind Outlook 2019  
[https://iea.blob.core.windows.net/assets/495ab264-4ddf-4b68-b9c0-514295ff40a7/Offshore\\_Wind\\_Outlook\\_2019.pdf](https://iea.blob.core.windows.net/assets/495ab264-4ddf-4b68-b9c0-514295ff40a7/Offshore_Wind_Outlook_2019.pdf)

### ELECTRICITY DEMAND VS. OFFSHORE WIND POTENTIAL



Source: IEA - Offshore Wind Outlook 2019

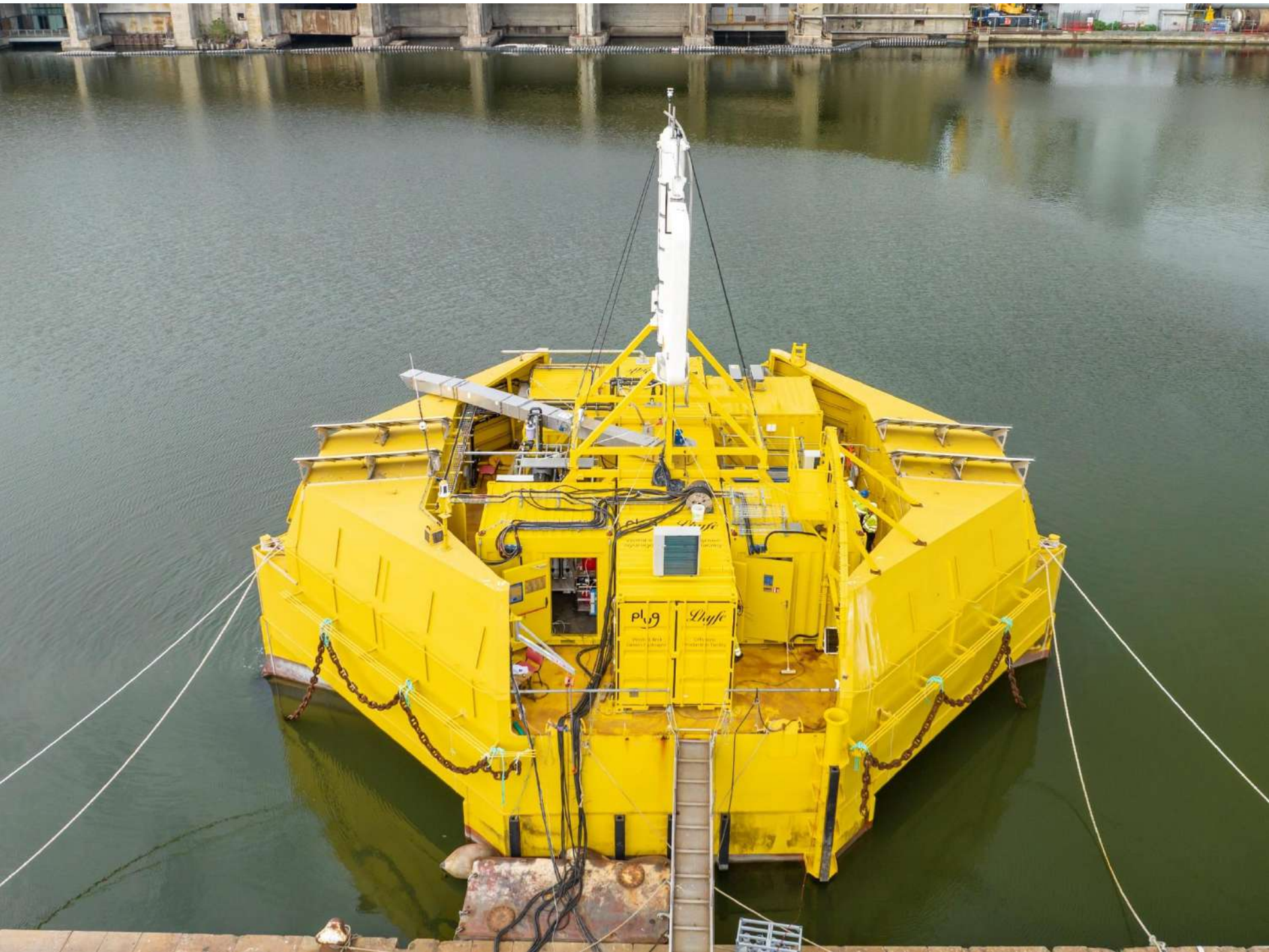


World premiere

# World premiere: First offshore pilot site Le Croisic (Loire Atlantique)







Pl 19

Duff

1000

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*Lhyfe*

- Thank you for your attention



# THE BASE FOR YOUR FLEET

2nd Munich Hydrogen Summit | 5 July 2023

# THE HISTORY OF DST



**1940**

Foundation of  
Diehl Remscheid  
*former Backhaus KG*

**1963**

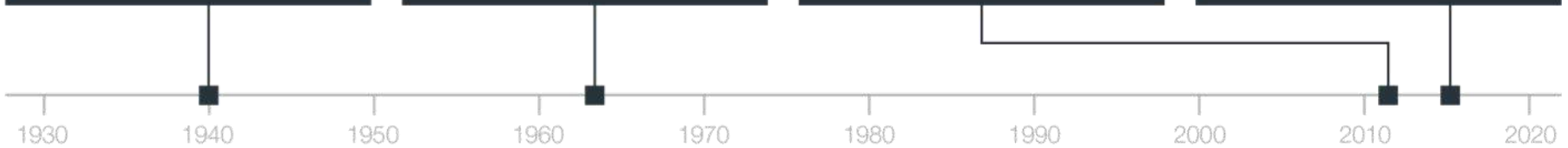
Foundation of  
Industriewerk Saar (IWS)  
*former Auto Union Saar GmbH*

**2011**

Merger to  
Diehl Defence  
Land Systems GmbH

**2015**

Acquisition by KMW Group  
and name change to  
DST Defence Service Tracks





# THE WORLD'S MOST TRUSTED TRACKS

- A world leader in track systems and running gear components for tanks and armoured vehicles
- The only supplier worldwide that develops, produces and delivers both steel and rubber track systems in-house
- Track solutions for every fleet in any terrain
- Over 100 different track solutions in use in more than 50 armed forces worldwide
- All tracked vehicles in service with the German Army run on DST tracks

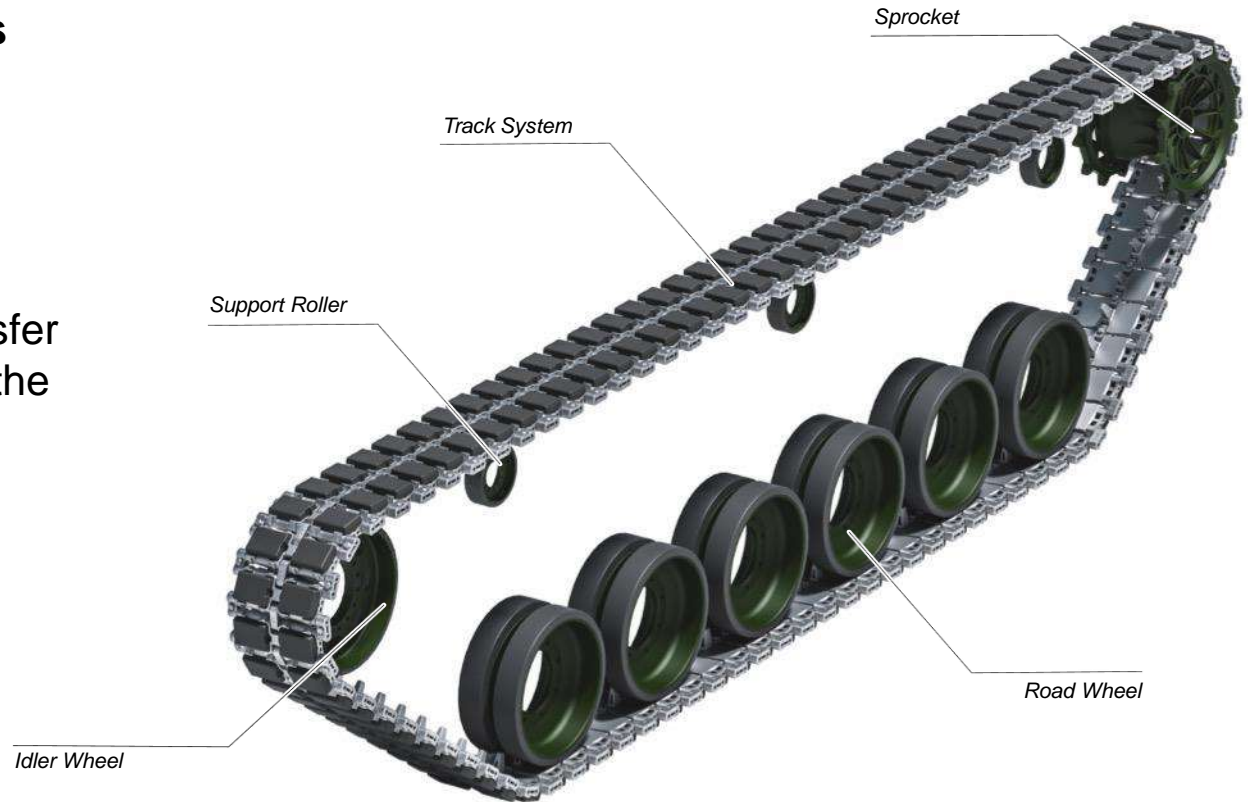




# CORE COMPETENCIES

## Track systems and running gear components

- High-quality components designed for optimal compatibility
- For the most efficient transfer of engine performance to the ground



# CORE COMPETENCIES

## Steel production

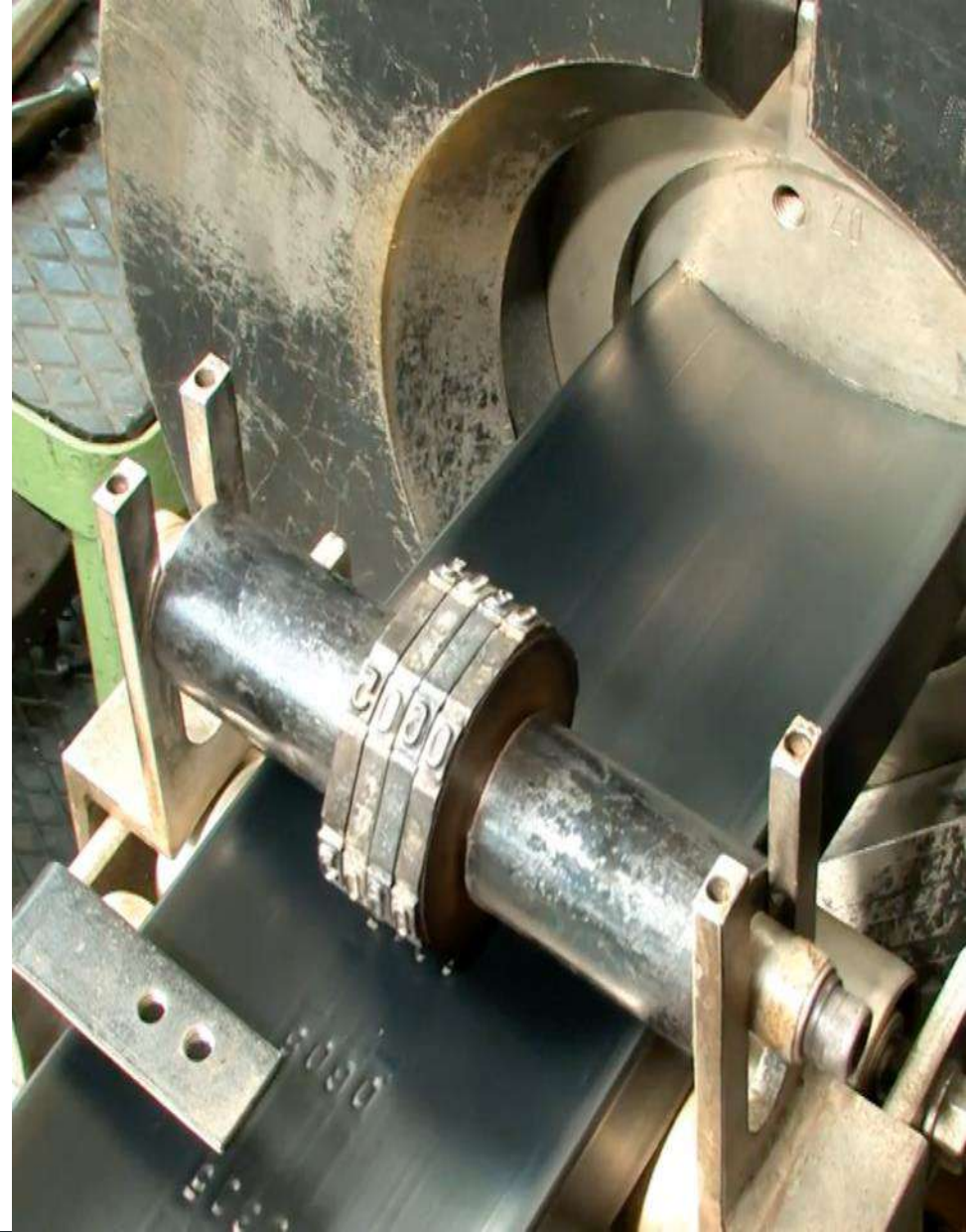
- Over 13,000 metric tons of steel produced annually
- Two electric arc furnaces with a capacity of 3.2 metric tons and a 1-metric ton induction oven
- Technical casting simulation of infeed and gating systems
- Simulation of distortion and internal stresses
- Construction and design of casting models
- Customer-orientated component optimisation
- Sample production



# CORE COMPETENCIES

## Rubber-metal conjunctions

- Rubber compounds for steel and rubber band tracks as well as rollers, damping elements and protective elements
- Products suitable for use in all climate zones and scenarios
- Small or large production series, based on existing plans or as customised solutions





# THE DST GLOBAL NETWORK

- Well-established contact centres in many countries worldwide
- Comprehensive after-sales service
- Strong and productive customer relations
- Native speakers with experience of the cultural norms and specific demands of their region



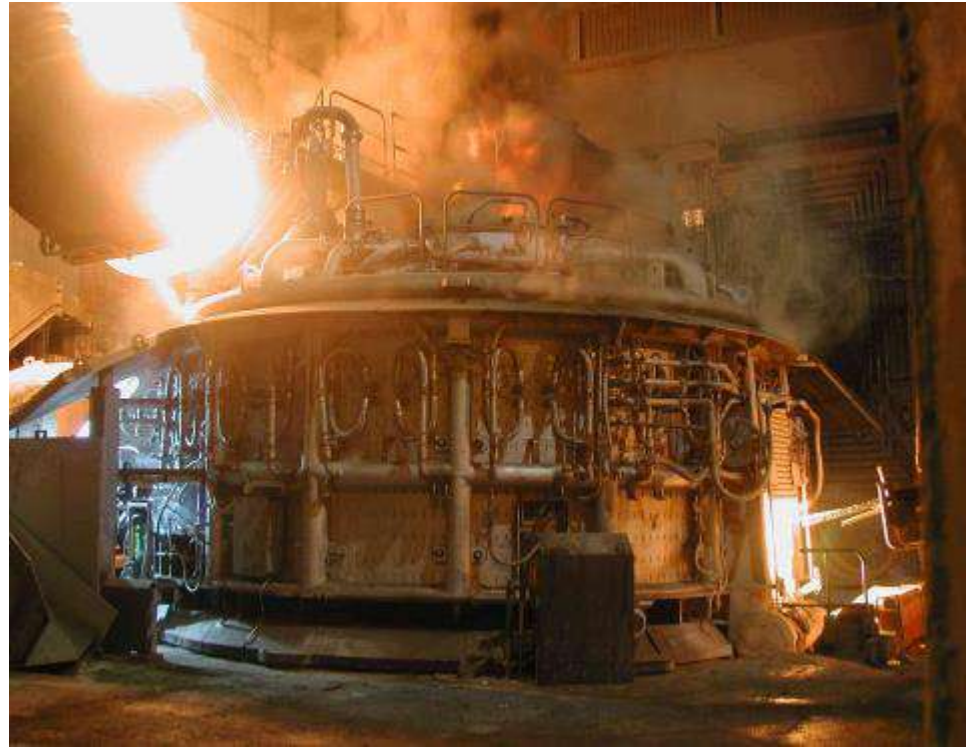
# HIGH ENERGY PRODUCTION

- Croning Sand Forms -> Gas!



# HIGH ENERGY PRODUCTION

- Electric Arc Furnace -> Electricity!





# HIGH ENERGY PRODUCTION

- Casting Ladle -> Gas!



# HIGH ENERGY PRODUCTION

- Harden and Temper -> Gas and Oil!



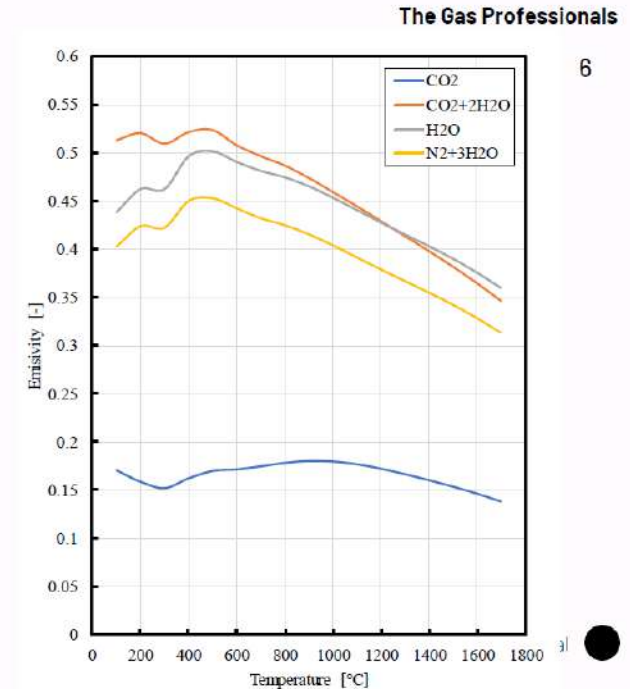
# CHALLENGES, NOT ONLY FOR DST

- If Hydrogen:
  - then when and to which price?
  - Investstrategy for DST

## General Information

The main challenge of moving over to 100% H<sub>2</sub> combustion without oxygen will be the dramatic reduction of furnace efficiency due to H<sub>2</sub> being a fuel that lacks radiation properties in comparison to fossil fuels (so only depends on convection).

And the trials has demonstrated that this problem can be overcome with H<sub>2</sub>-O<sub>2</sub> combustion.



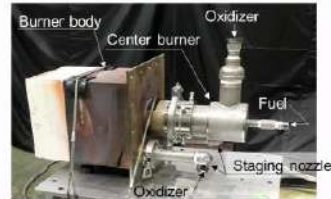


# CHALLENGES, NOT ONLY FOR DST

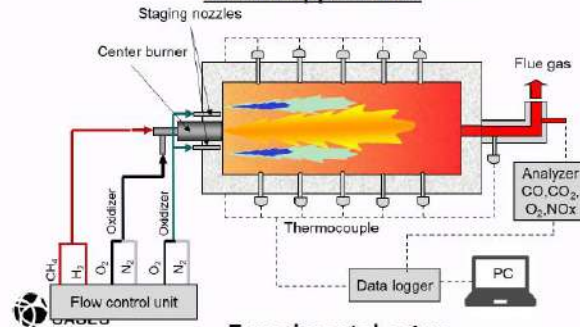
- If Hydrogen:
  - then when and to which price?
  - Investstrategy for DST

## Oxy-H<sub>2</sub>-NG Combustion (II)

### Experimental condition



**Burner appearance**



**Experimental setup**

The Gas Professionals

8

### Experimental condition

Item	Condition
Input [kW]	110
Fuel type	Methane, Hydrogen
Hydrogen mixing ratio [%]	0, 100
Oxidizer	
Oxygen in Oxidizer [vol%]	40, 100
Oxygen ratio [-]	1.05
Oxidizer from center burner [-]	1.0, 0.8, 0.5, 0.2

### Item

Item	Methane	Hydrogen
Fuel type	Methane	Hydrogen
Fuel flowrate [Nm <sup>3</sup> /h]	11.2	37.5
Oxygen in Oxidizer [vol%]	96.4	96.4
Fuel velocity U <sub>r</sub> [-]		
center burner nozzle C		
center burner nozzle D		

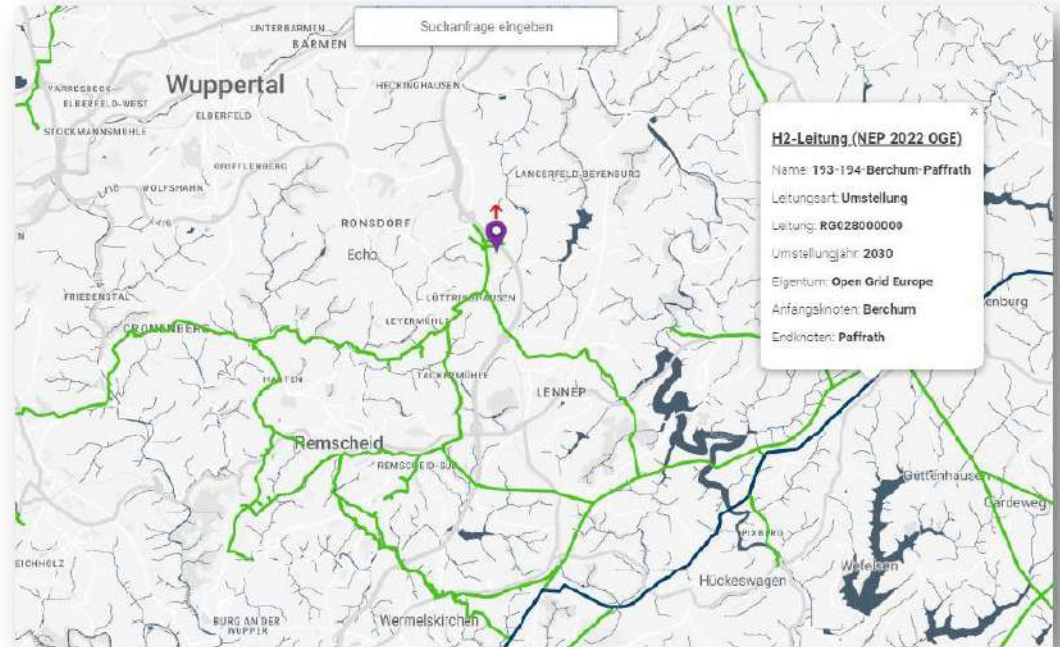
Nippon Gases Confidential

# CHALLENGES, NOT ONLY FOR DST

## Nahaufnahme: Erste Überlegungen Remscheid

- H2 Grid Connection

Das interessanteste sheet für uns ist Nr. 15. Die blaue Linie rechts unten ist die geplante H2-Leitung Ruhrgebiet – Köln, der Punkt mit dem roten Pfeil in der Mitte unsere Gießerei. Die grünen Linien stellen bestehende Fernleitungen im Erdgasnetz dar, welche ggf. in eine Wasserstoffleitung umgewidmet werden könnten. Man kann hier aber klar erkennen, dass die Entfernungen nicht so ganz so einfach zu überbrücken sein werden.



24.04.2023 H2 Kundendialog DST

# ENERGIZING REMSCHEID



Unternehmen	Standorte	Anzahl der Mitarbeiter	Verbrauch 2022 (Strom/Gas)	Verbände	Kontakte zur Politik
DST Defence Service Tracks GmbH	RS Vieringhausen	255	3.200 MWh (Strom) 11.400 MWh (Gas)	BDSV WDK BDG	OB Mast-Weisz, SPD MdBI. Schäfer, SPD MdB J. Hardt, CDU MdL J. Nettekoven, CDU BMVg, AA, Verteidigungsausschuss des Bundestages..... KMw Büro Berlin
	RS Lüttringhausen		8.300 MWh (Strom) 2.500 MWh (Gas)		
Karl Diederichs GmbH & Co. KG	Lüttringhausen	450	183.000 MWh Erdgas & 17.000 MWh Strom	IMU / WSM, VDEh / wV Stahl, AGV RS, Metall NRW, IHK / IHK NRW, Industriepakt NRW / Energy4Climate	MdBs: Hardt (CDU), Lindh und Schäfer (SPD), Liebert (Grüne), in den Beek, Lindner, Kronenberg und Todtenhausen (FDP); MdLs: Nettekoven, Nolten, Spiecker und Untrierer (CDU), Wolf (SPD), Hafke (FDP); OB Mast-Weisz, WiFö
GEDORE Werkzeugfabrik GmbH & Co. KG	RS Lüttringhausen	500	3.828MWh (Strom) 6.988MWh (Gas)	Industrieverband Massivumformung e.V.	
	RS Lange Straße		1.505MWh (Strom) 4.788MWh (Gas)		
HAZET-WERK GmbH & Co. KG	RS Reinshagen	596	3.949 MWh (Strom) 5.716 MWh (Gas)		OB Mast-Weisz, SPD MdB J. Hardt, CDU
	Heinsberg		2.057 MWh (Strom) 2.641MWh (Gas)		
<b>HEYCO Gruppe</b> (nur deutsche Standorte, incl. HEYCO-WERK Hegnens GmbH & Co. KG, HEYCO Qualitätswerkzeuge GmbH & Co. KG, HEYCO IML Kunststofftechnik GmbH & Co. KG, Carl Steinmann GmbH)	RS Haddenbach	300	0.250 MWh (Strom) 1.100 MWh (Gas)		OB Mast-Weisz, SPD MdB J. Hardt, CDU MdL J. Nettekoven, CDU MDL S. Wolff, SPD
	RS Bergisch Born		5.700 MWh (Strom) 1.700 MWh (Gas)		
	Tittling Ndb.	545	17.550 MWh (Strom) 3.600 MWh (Gas)		



# CHALLENGES TO DST

- Energy Prices
- Automatisations in combination to the energy strategy
- CO2 Footprint



RELAX – IT'S A DST TRACK.

Hydrogenious<sup>LOHC</sup>

# Activities and Infrastructure for Hydrogen Transport

2nd Munich Hydrogen Summit | 5 July 2023





Established in 2013, we are the global leading technology pioneer for LOHC

### Investors



### Key partners



### Technology cooperation partners

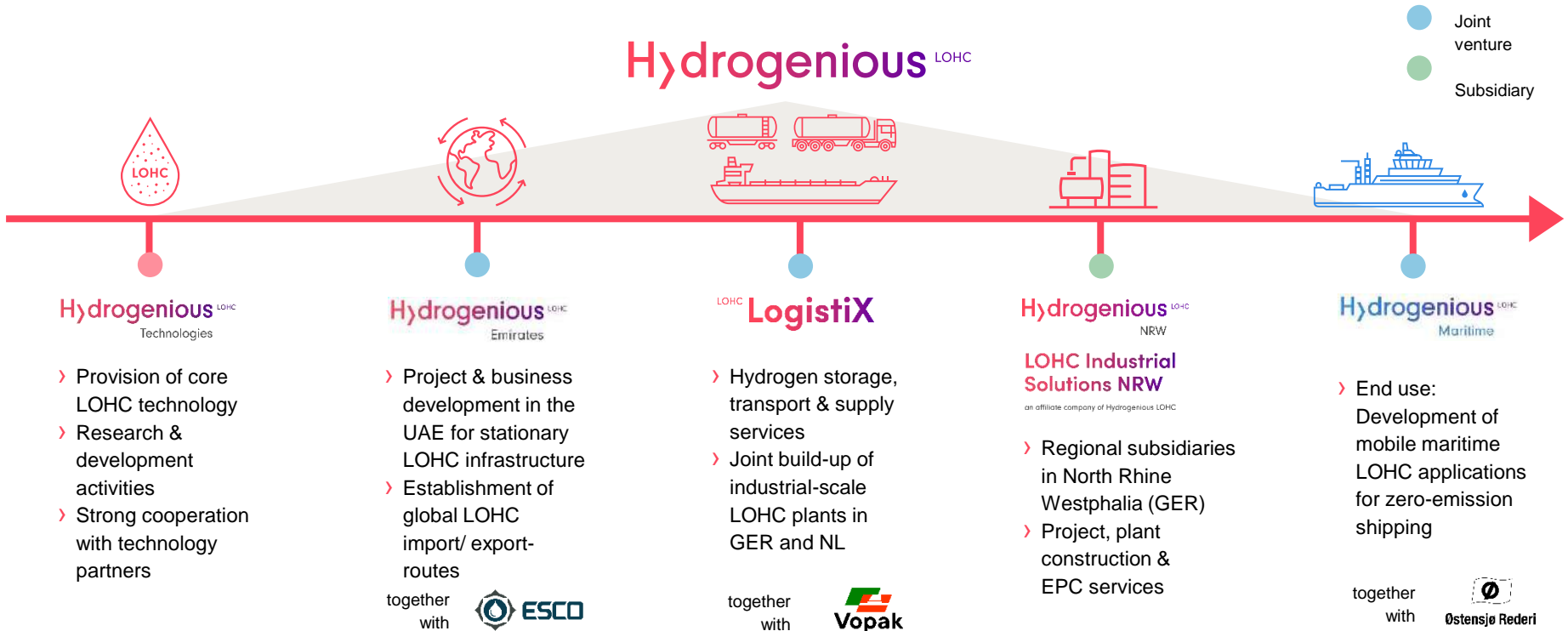


>200  
employees

>55  
patent families

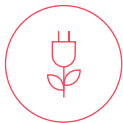
>80mn  
investor funding

Within our group of companies, we carry out the whole LOHC supply chain



## H<sub>2</sub> - Top of the agenda as never before

Strong momentum for H<sub>2</sub> across value chain requiring smart solutions



**H<sub>2</sub> as key decarbonization lever** addressing increasing pressure driven by public, regulators and customers

**55%**

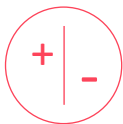
EU emission reduction target 2030



**(European) energy system under unprecedented pressure** given Ukraine crisis

**10Mt**

H<sub>2</sub> import target RePowerEU 2030



**H<sub>2</sub> supply capacity** lining up globally – following favorable renewables conditions

**175GW**

announced electrolyzer capacity



**Significant long-term upside** from establishing H<sub>2</sub> as core industrial energy vector

**\$1trn**

H<sub>2</sub> generation market potential by 2050



**H<sub>2</sub> supply** via local production and imports



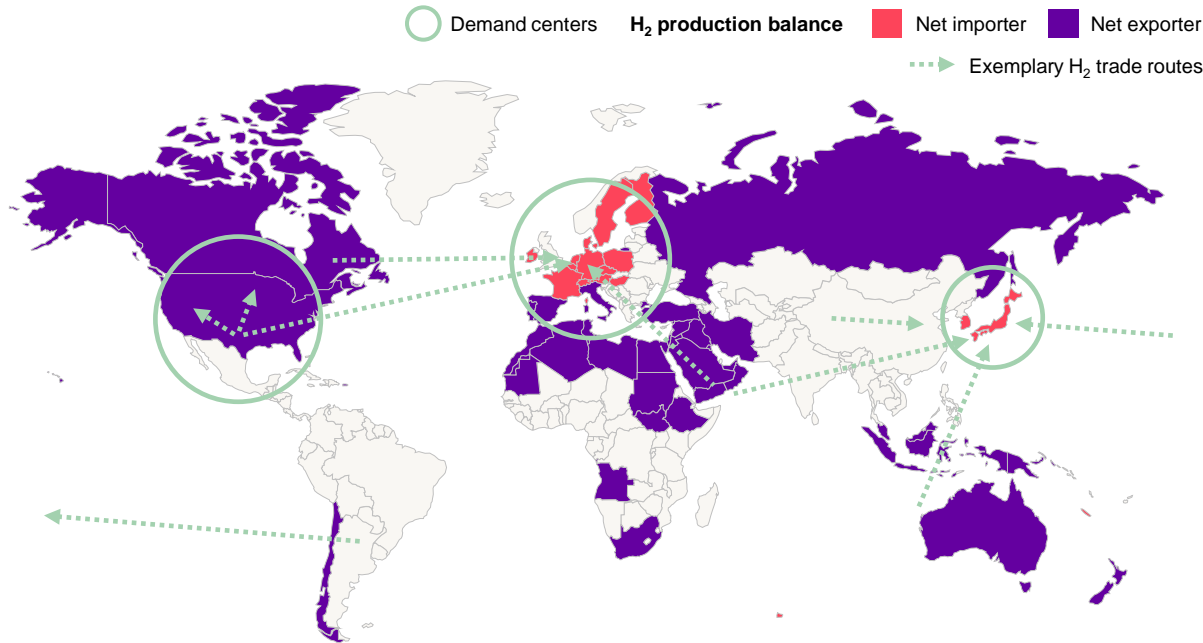
**H<sub>2</sub> transportation** for long distance and regional routes



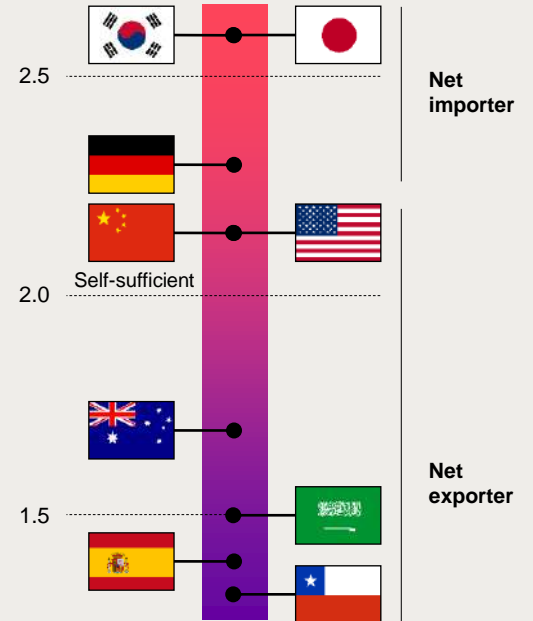
**H<sub>2</sub> end use** across various industries



# Mismatch of key supply and demand centers driven by capacity constraints and cost differentials will propel global H<sub>2</sub> trade

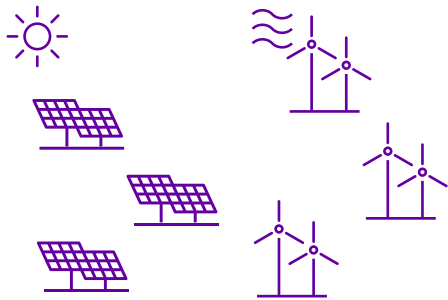


Green hydrogen cost in USD/kg 2030



# LOHC is the missing link for large-scale renewable energy imports

Abundance in remote geographies

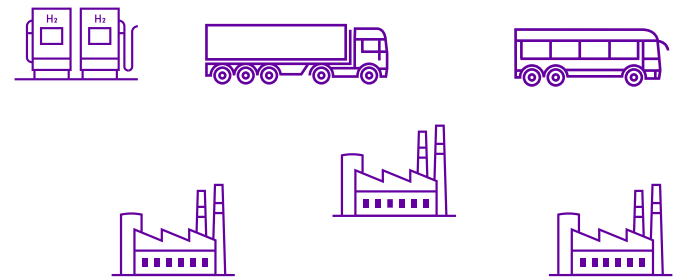


Energy supply from renewable energies

Disconnected supply and demand centers



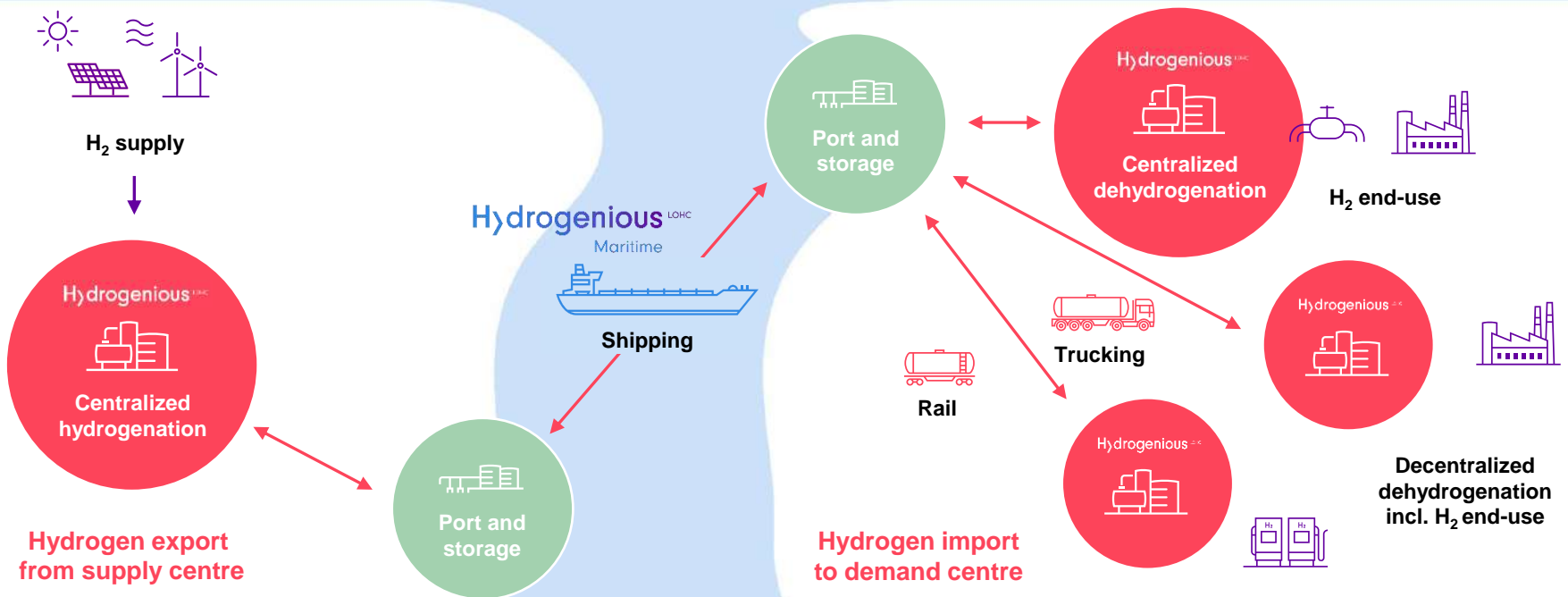
Constraints in populated geographies



Energy demand for renewable energies

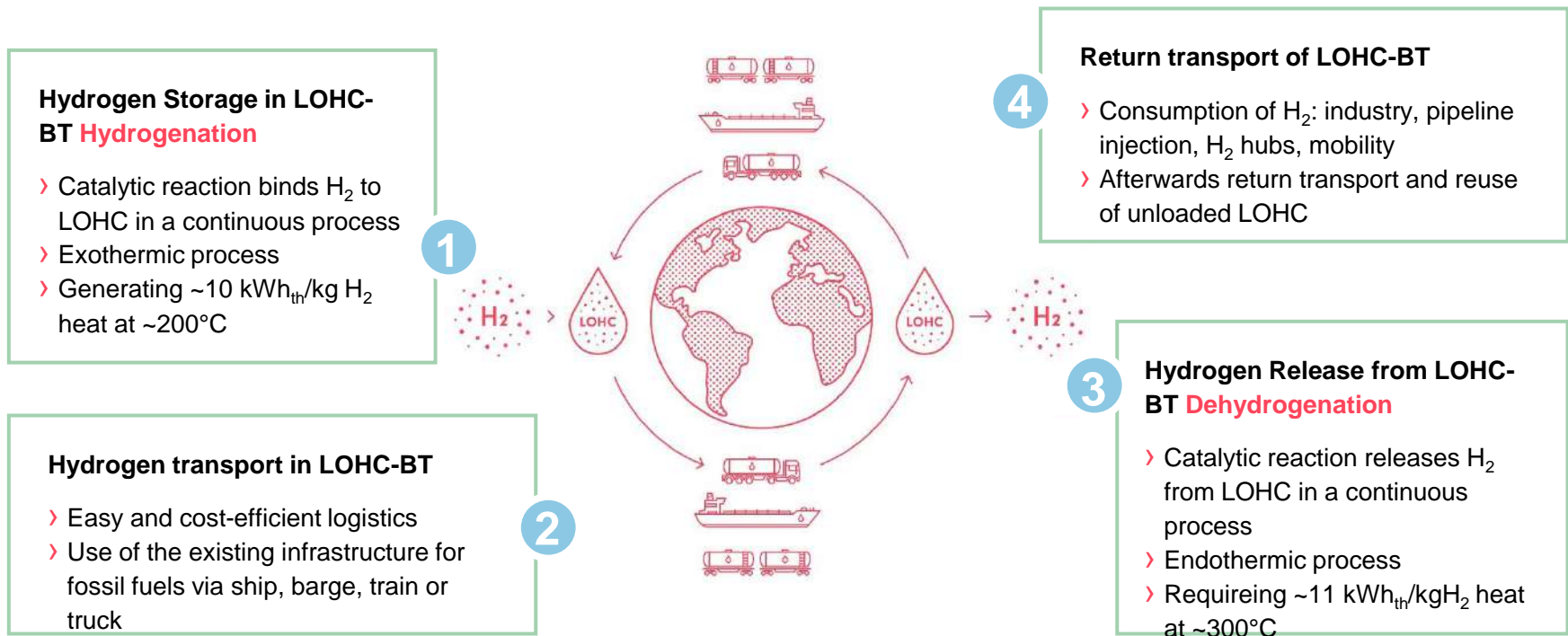
# LOHC enables H<sub>2</sub> end-to-end-import within one single carrier solution

● Involvement of HT proprietary technology    ↔ H<sub>2</sub> transported via LOHC-BT





## Our LOHC technology based on benzyltoluene (LOHC-BT) enables viable supply chains globally



## Storage Plants

- › Skid-based industrial hydrogenation unit to match with renewables
- › Direct coupling with SMR + with large-scale electrolysis
- › Underground stocking facilities

### Hydrogenation process

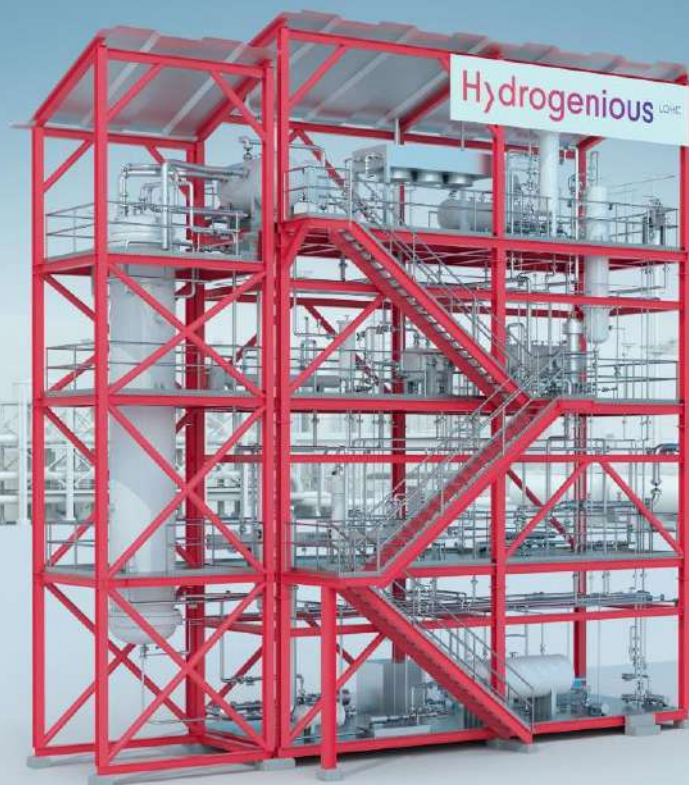
*Exothermic, with solid catalyst*

### Heat Release

Approx. 10 KWh/kg H<sub>2</sub>,  
200 – 250°C

### Elevated reaction pressure

Approx. 15 – 30 barg



Example: 5 tpd hydrogen  
as to be built in Chempark Dormagen/GER in 2024

## Release Plants

- › **Skid-based industrial dehydrogenation unit to be directly coupled with hydrogen hubs and pipeline networks**
- › To be combined with underground stocking facilities
- › Released hydrogen purity >99,9%

**Dehydrogenation process**  
*Endothermic, with solid catalyst*

**Heat Demand**  
Approx. 11 KWh/kg H<sub>2</sub>,  
250 – 300°C

**Elevated reaction pressure**  
Approx. 2 – 3 barg



Example: 1.5 tpd hydrogen  
as to be built in Rotterdam/NTL in 2025/26

## Our LOHC-BT technology is disrupting hydrogen infrastructure



### Superior safety

- › No handling of molecular hydrogen
- › Hardly flammable with flash point 130 °C, nonexplosive, even when loaded with hydrogen
- › Hazard potential comparable to Diesel and thus clearly superior to ammonia



### Enhanced flexibility

- › Conventional liquid fuel infrastructure usable
- › Handling at ambient temperatures and pressure during storage and transport
- › No self-discharge over time – multi-month storage without losses



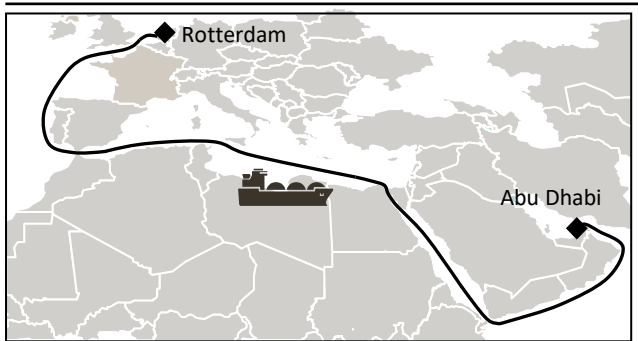
### High efficiency

- › Competitive volumetric storage density of 54 kg hydrogen per m<sup>3</sup> LOHC
- › Carrier material commercially available and reusable hundreds of times
- › Fuel cell grade hydrogen purity according to ISO 14687 by using off-the-shelf purification technology

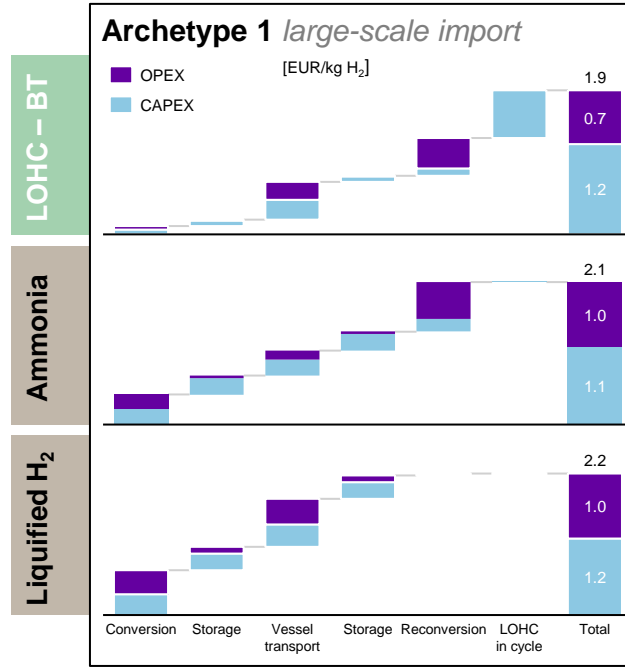


# LOHC-BT with strong TCO competitiveness in long-distance and upside from advantageous hazard and toxicity profile versus NH<sub>3</sub>

## Archetype 1: Large-scale import – year 2030

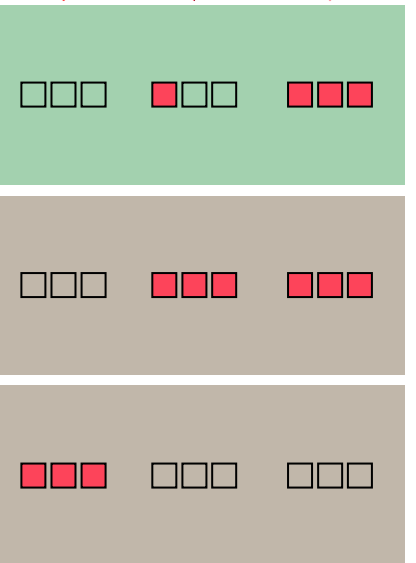


- 200 tpd
- 2 x 100 tpd
- ~12,000 km via vessel (one-way)
- ~46 days per roundtrip (incl. port days)
- ~50,000 DWT<sup>1)</sup> (vessel)
- 4 vessels
- 180,000 m<sup>3</sup> of storage capacity at each location
- ~236,260 t LOHC in the system



## Hazard and toxicity profile

Physical hazard      Acute toxicity      Environmental toxicity



**Hazard/toxicity level**  
 None    Low    Medium    High



1. Depending on technology    Source: Roland Berger 2021; 2030 TCO values from linear interpolation between 2025 and 2035


We have proven the LOHC value chain and are currently developing projects for international large-scale hydrogen trade routes



**Containerized systems**

- > Proven technology with systems in Germany, Finland and the US
- > Successful implementation of a comprehensive LOHC value chain

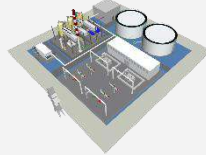
**12 systems delivered**



**Capacity scale up 5 H<sub>2</sub> tpd**

- > Capacity
  - > Storage: 5 H<sub>2</sub> tpd
  - > Release: 1,5 & 5 H<sub>2</sub> tpd
- > Reference Projects
  - > Project Hector 2024
  - > Green Hydrogen @ Blue Danube 2026

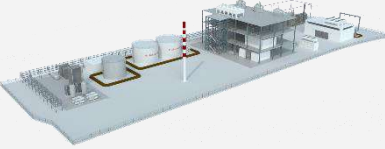
**In construction**



**Capacity scale up 24 H<sub>2</sub> tpd**

- > Capacity
  - > Storage: 24 H<sub>2</sub> tpd
  - > Release: 12 H<sub>2</sub> tpd
- > Reference Projects
  - > Northern Green Crane 2026

**Feed**



**Large-scale plants for int. H<sub>2</sub> import / export up to 500 H<sub>2</sub> tpd**

- > Capacity
  - > 100 to 500 H<sub>2</sub> tpd Storage & Release
- > Reference Projects
  - > H2A 2028
  - > Joint cooperation ADNOC-Jera-Uniper UAE ↔ Europe 2029
  - > Cooperation Greenergy Canada ↔ UK 2029
  - > 500 H<sub>2</sub> tpd project Saudi Arabia (partner undisclosed)

**Feasibility studies**



## World's 1<sup>st</sup> LOHC supplied hydrogen refueling station in Erlangen, Germany

Green H<sub>2</sub> supply chain scheme  
Solar Power – PEM Electrolyser –  
LOHC Storage – Transport –  
LOHC Release – HRS

HRS opened in 2022

Minimal footprint

Worldwide first underground  
storage of 1.5 tons of hydrogen  
via LOHC-BT (ambient conditions)

Hydrogen quality (fuel cell purity)  
according to ISO 14 687-2

## H2Sektor-HRS Erlangen GER/Erlangen

# World's 1st LOHC HRS

- › **Commissioning (official):** July 2022

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- › **Hydrogen supply:** Own production and storage @Hydrogenious headquarters, Photovoltaic

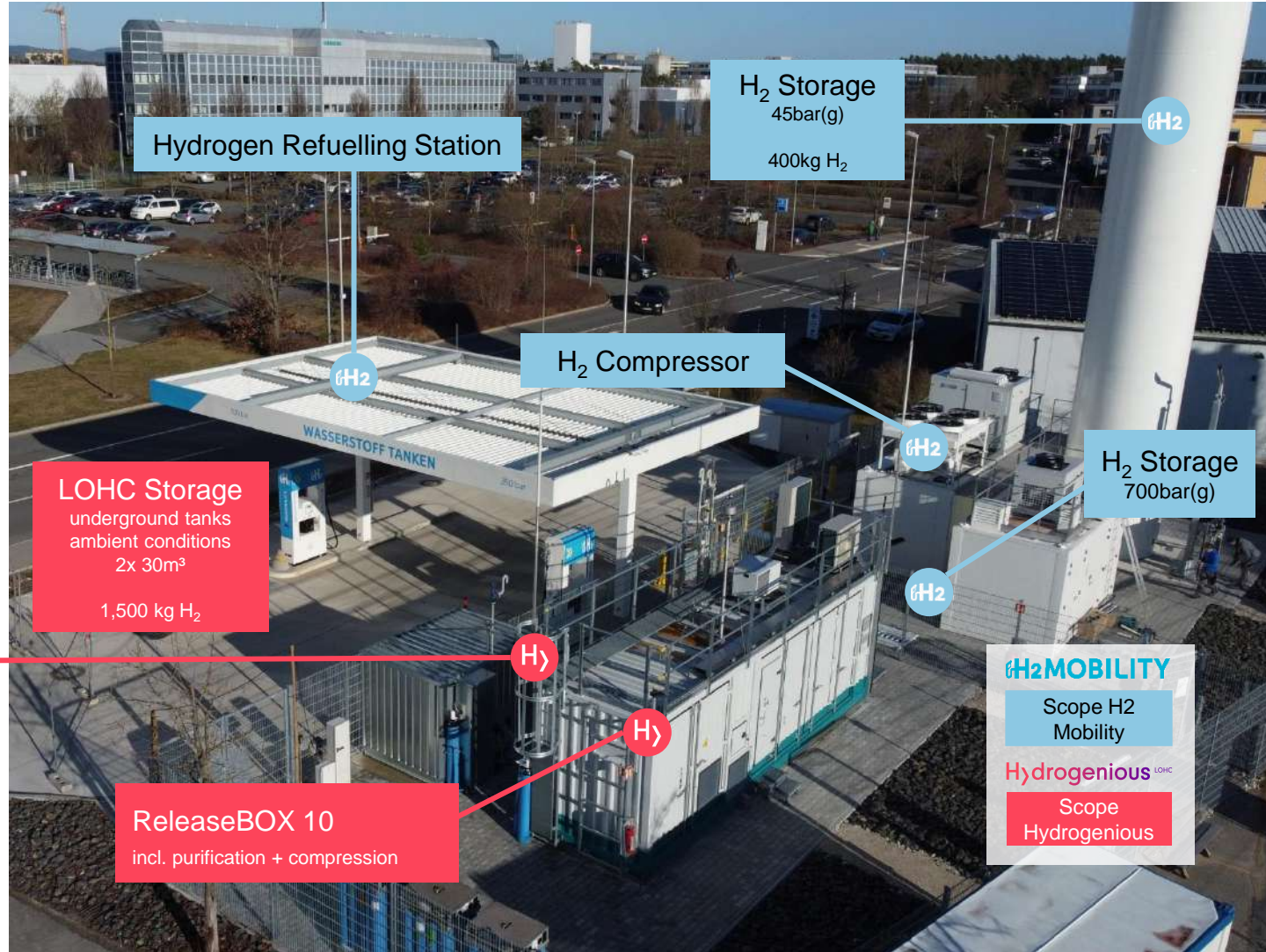
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- › **Hydrogen release (max.):** 9,000 H<sub>2</sub> kgpa [25 H<sub>2</sub> kgpd] ReleaseBOX 10





# H2Sektor- HRS Erlangen



World's largest LOHC storage plant  
GER/North Rhine-Westphalia



Hector

Going industrial scale in  
2023 at Chempark  
Dormagen (Cologne)

Blueprint for setting up  
large-volume LOHC  
storage infrastructure

Under construction



## Project Hector

GER/North Rhine-Westphalia (Chempark Dormagen)

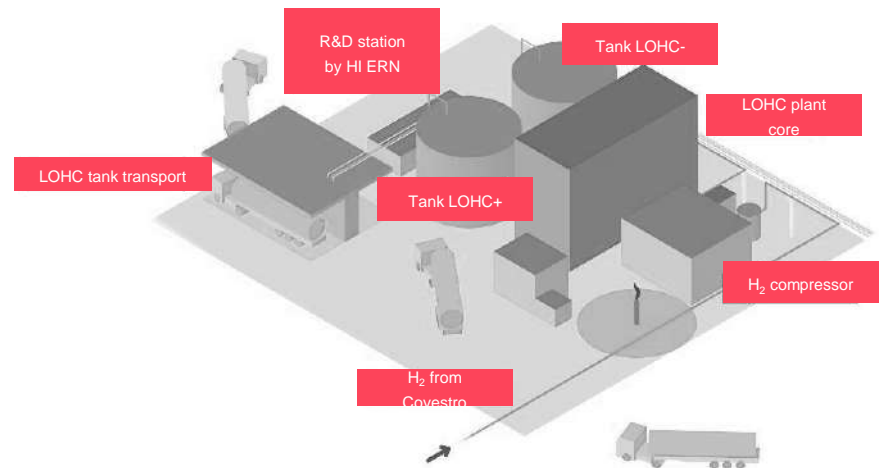
# 1,800 H<sub>2</sub> tpa storage

- > **Storage plant construction:** End of 2023 (expected)
- > **Commissioning:** 2025 (expected)
- > **Hydrogen supply partner:** Covestro Deutschland AG (industrial by-product)
- > **Hydrogen storage (max.):** 1,800 H<sub>2</sub> tpa [5 H<sub>2</sub> tpd]
- > **LOHC load:** < 39,430 m<sup>3</sup>pa



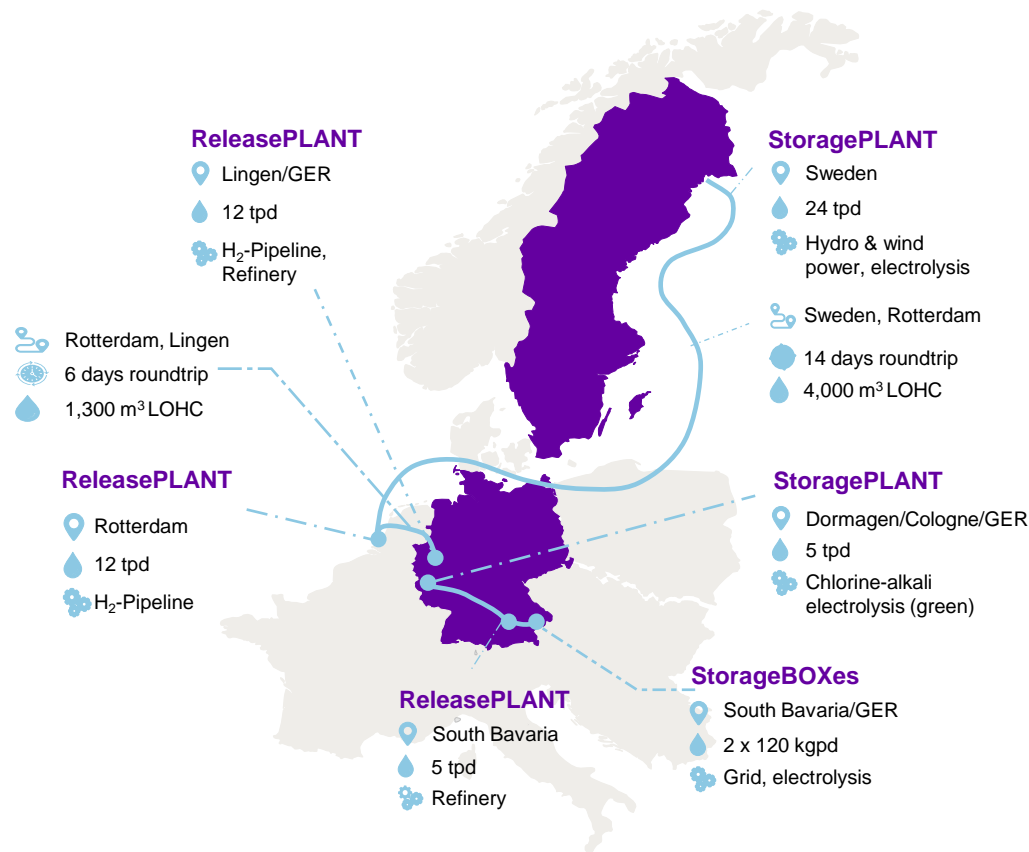
supported

Ministry of Economic Affairs,  
Industry, Climate Action and Energy  
of the State of North Rhine-Westphalia



## German IPCEI pre-candidates

LOHC supply chain Sweden <-> Netherlands <-> Germany  
 LOHC hub in South Bavaria/Danube triangle



Northern  
 Green Crane  
 &  
 Green Hydrogen@  
 Blue Danube

Building the LOHC infrastructure within Europe, erecting several storage & release plants

Both projects qualified in Germany in the IPCEI pre-selection process (among 62 others in Feb 2021) along with partner applications in Sweden and the Netherlands (part of fast moving RHATL wave)



## Green Hydrogen @Blue Danube

1<sup>st</sup> German LOHC hub for Eastern Europe  
GER/South Bavaria

Vision of green H<sub>2</sub> production  
in Eastern Europe

Storage in LOHC with transport via  
river Danube to off-takers in  
Austria and Germany

Initial roll-out in the South Bavarian  
Danube river triangle, establishing  
regional LOHC infrastructure  
(ReleasePLANTs as well as  
StorageBOXes for driving the field  
testing and further development of  
the release systems)

Verbund



1<sup>st</sup> LOHC seaport in progress  
NTL/Port of Amsterdam



## H2A

H2A bundles suite of multiple import projects that will be developed

The initiative initiates and supports consortia by defining, scoping and executing projects



Open for all safe and efficient technologies on the edge of system integration

Port of Amsterdam-Hydrogenious-Evos  
 NTL/Port of Amsterdam

# Up to 1 mn green H<sub>2</sub> tpa imports final size

- › **Feasibility study:** Conducted in previous H2Gate project with LOHC as ideal H<sub>2</sub> carrier option

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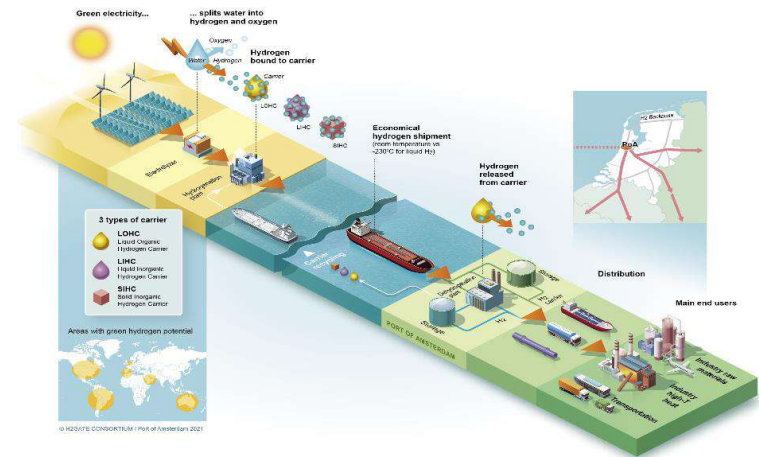
- › **Project consortium:**  

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- › **Commissioning:** Before end of decade

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- › **Hydrogen storage and transport:** Up to 30 H<sub>2</sub> ktpa [ $\sim$ 100 tpd]





1<sup>st</sup> Arab-German LOHC supply chain  
UAE/Abu Dhabi



Joint Cooperation  
ADNOC-  
Hydrogenious-Jera-  
Uniper

Integrating our storage  
plant systems and  
associated LOHC  
logistics/infrastructure

Sea transportation via  
crude oil carrier

Feasibility study finished



## ADNOC-Hydrogenious-Jera-Uniper UAE/Abu Dhabi

# 10,000 – 180,000 H<sub>2</sub> tpa imports

- › **Status:** Feasibility study finished in March 2023
- › **Hydrogen supply partner:** ADNOC
- › **Hydrogen storage, transport and release:** ~7-10 H<sub>2</sub> ktpa [20-30 H<sub>2</sub> tpd]
- › **Ports of destination:** Wilhelmshaven/GER Rotterdam/NTL, tbd
- › **Storage plant construction:** Abu Dhabi area
- › **Commissioning:** 2027 (planned)



Jera

uni  
per



Cooperation  
Greenergy and  
Hydrogenious

Commercial scale clean hydrogen supply chain  
Canada <> UK

Shipping low-cost green hydrogen from Canada to the UK using LOHC

Joint pre-feasibility study ongoing

Greenergy as committed partner for the build up of a viable supply chain

**Greenergy**



# Panel Discussion



JULY 2023 PROJECT TEASER - PRE NDA

# Project Nujio'qonik

Harnessing Canada's vast wind and water for global green hydrogen and ammonia markets





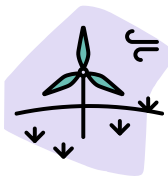
## With our pioneering and independent advice, we help our clients accelerate the energy transition at scale



More than **EUR 36 bn** funding raised over **13 yrs** of specialised advisory



**130+** professionals globally in 10 offices in 10 countries on 5 different continents



**294** transactions or projects  
**>239 GW** total capacity

### **A global and independent financial advisory firm launched in 2010**

- Part of the Green Giraffe Group, providing finance solutions for capital intensive renewable projects and energy transition initiatives
- Pioneer from the early days and today the largest financial advisor specialised in the energy transition
- One integrated team - acting on a global scale

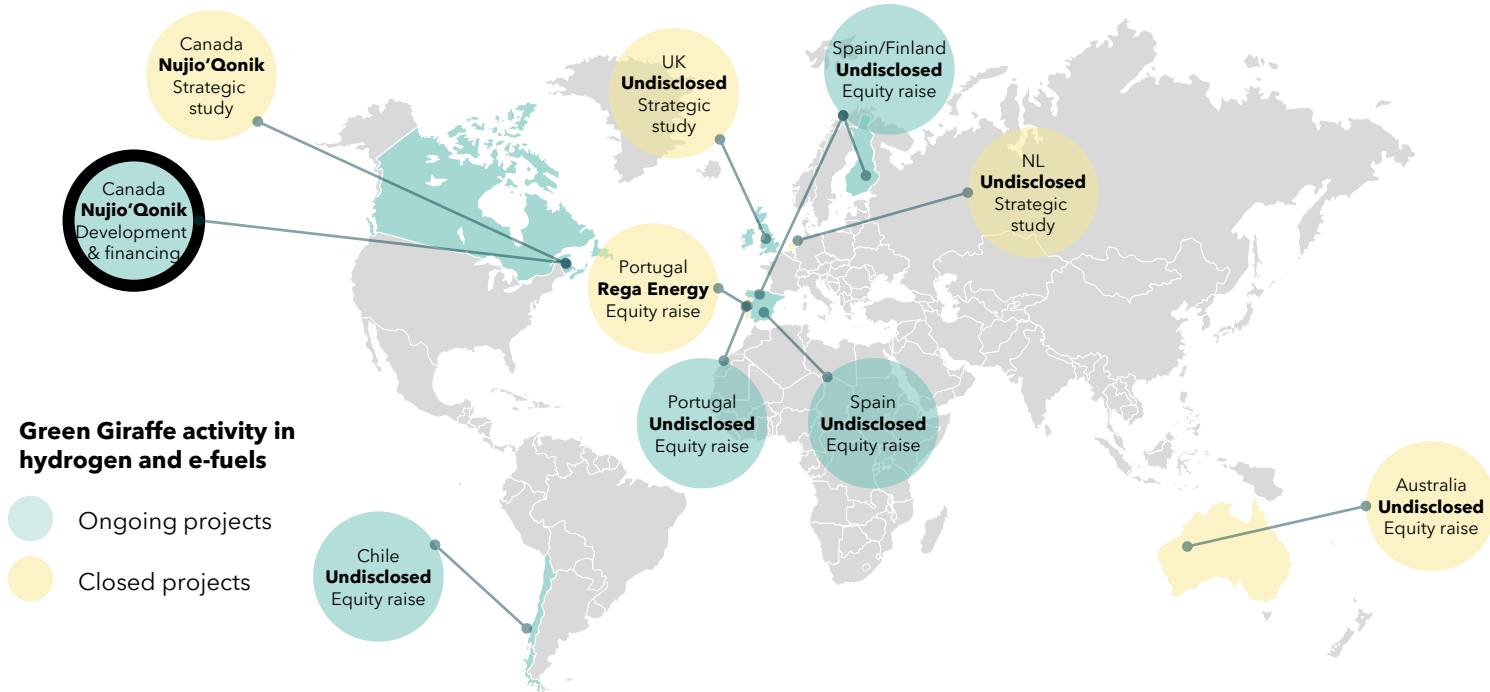
### **An ambition to provide high quality, specialised advice**

- Proven track record in renewable and energy transition technologies
- High value-added from our specialised expertise on all our missions
- We build long-term relationships with our clients

### **Green Giraffe Advisory follows a simple strategy**

- Provide a holistic and multi-disciplinary approach, coupling sector-specific tasks and traditional debt or M&A advisory services
- We are connected locally and globally to industry expertise, and we bring this pool of knowledge to you
- We are committed to the industry, we believe in the countries we are active in, and we have the skillset it takes to **get deals done**

We are proud to be actively supporting various hydrogen and e-fuels projects globally



# Project Nujio'qonik



Nujio'qonik is one of the **first Canadian, commercial-scale, green hydrogen production facilities** powered by onshore wind farms with a grid connection (155 MW)



Upon completion, it will produce up to **1,100 k MT of green ammonia (210 k MT of green hydrogen) from 3 GW of wind farms** along Newfoundland and Labrador's low-density populated west coast



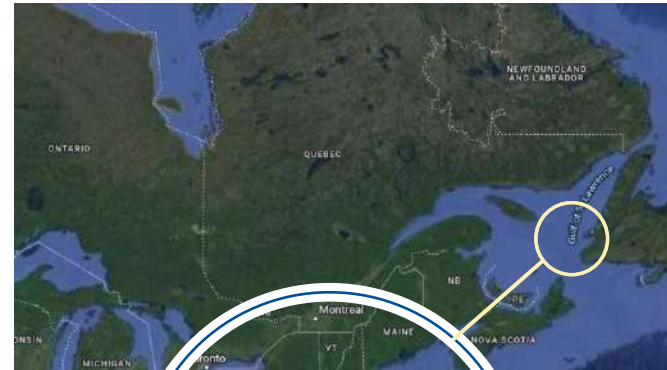
The power will be converted into green hydrogen, which will then be converted to green ammonia for transport to **global markets**



The **electrolyzer and ammonia facilities** will be located at the Port of Stephenville, which offers deep-water shipping access to the world



The project will be developed and financed in stages with a **staggered delivery schedule** for Port au Port and Codroy wind farms. Full commissioning of Port au Port project is expected early 2026



# Key project highlights

## Site characteristics

- **World-class wind resource:** strong and sturdy wind (10 m/s+), will allow the project to deliver cost-competitive hydrogen
- **Hydro-powered grid** will be used to optimize electrolyzer utilization maintaining green credentials, and mitigating capex
- **Access to fresh and good-quality water**, which is key for hydrogen production and electrolyzer efficiency production

## Geographic location

- **Deep-water marine facilities in the region** uniquely suited to hydrogen production & offloading
- **Attractive region with existing skilled labour** in fisheries, offshore oil & gas, energy / hydro
- **Located in a country with ambitious hydrogen targets**, the development of an at-scale, clean hydrogen economy is a strategic priority for Canada

## Project team

- **World-class execution team with local roots:** experienced developers who will leverage their home-grown oil & gas and hydro development expertise, and their knowledge of local markets and concerns
- **First Nations partnerships:** MOU with Qalipu First Nation, Three Rivers and anticipated from Benoit, Flat Head and Indian Head First Nations
- **Globally best-in-class team of advisors** with up-to-date industry views

## Global market opportunity

- **The significant supply-demand imbalance in green hydrogen and ammonia** provides substantial opportunity for the project as demand from Europe - in particular - is expected to increase rapidly
- **Innovative leaders:** Nujio'qonik will be one of the first large-scale projects to produce green hydrogen and export it to global demand centres, such as Europe



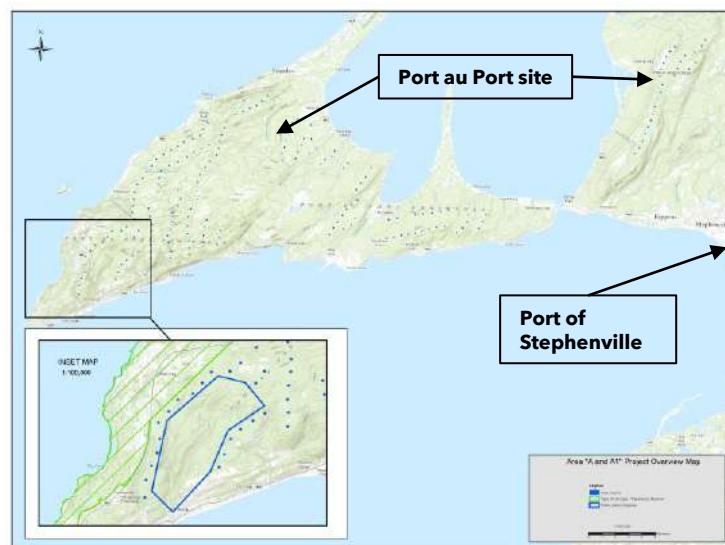
# Port au Port site (phase I)

## Project highlights

Project name	Nujio'qonik ('where the sand blows')
Developer	World Energy GH2
Onshore wind	Up to 1,000 MW
Grid connection	155 MW
Energy storage	350 MWh
Electrolyzer	600 MW
Hydrogen storage	14 MT hydrogen storage
Hydrogen production*	About 70 k MT per year
Ammonia production*	About 360 k MT per year
Expected COD	2026 (first green hydrogen in 2025)

**MT= metric ton, tpd= metric ton per day**  
**\*Anticipated production, being refined**

## Project location



# Nujio'qonik's location, speed to market, and volumes are attractive to offtakers

## Europe has defined the amount needed by 2030 and beyond to reach their climate and independency goals

- Import 10 M MT of hydrogen annually by 2030
- This is significant and requires 100 to 150, 1-2 GW facilities to produce this amount

## Nujio'qonik is targeting both the US and EU markets where near-term offtake options include

- Industrials, including fertilizer and steel manufacturers
- Commodity traders
- Power utilities, O&G companies
- Ports, maritime fuels

## Financial support is needed to kick start the industry

## From local to internationally traded commodities

- The majority of all grey hydrogen and ammonia is produced and consumed onsite. In contrast, the green variants will predominantly be produced in areas of low RE costs, and shipped to the demand centres
- Grey ammonia has been traded for decades, about 20 M MT of ammonia is traded annually (10%). There's a very well-established grey ammonia market, with spot prices in various regions (e.g., Western Europe, Tampa Bay, the Caribbean, and the Middle East)
- There is no green hydrogen / ammonia commodity market yet, hence the need to link pricing to project economics and sign bilateral offtake agreements for the first projects - it's how the LNG market first developed
- These long-term agreements will include pricing (including a fixed price portion) and requirements for the green certification of the hydrogen / ammonia

# German-Canadian partnership will boost the number of offtake agreements between the two countries

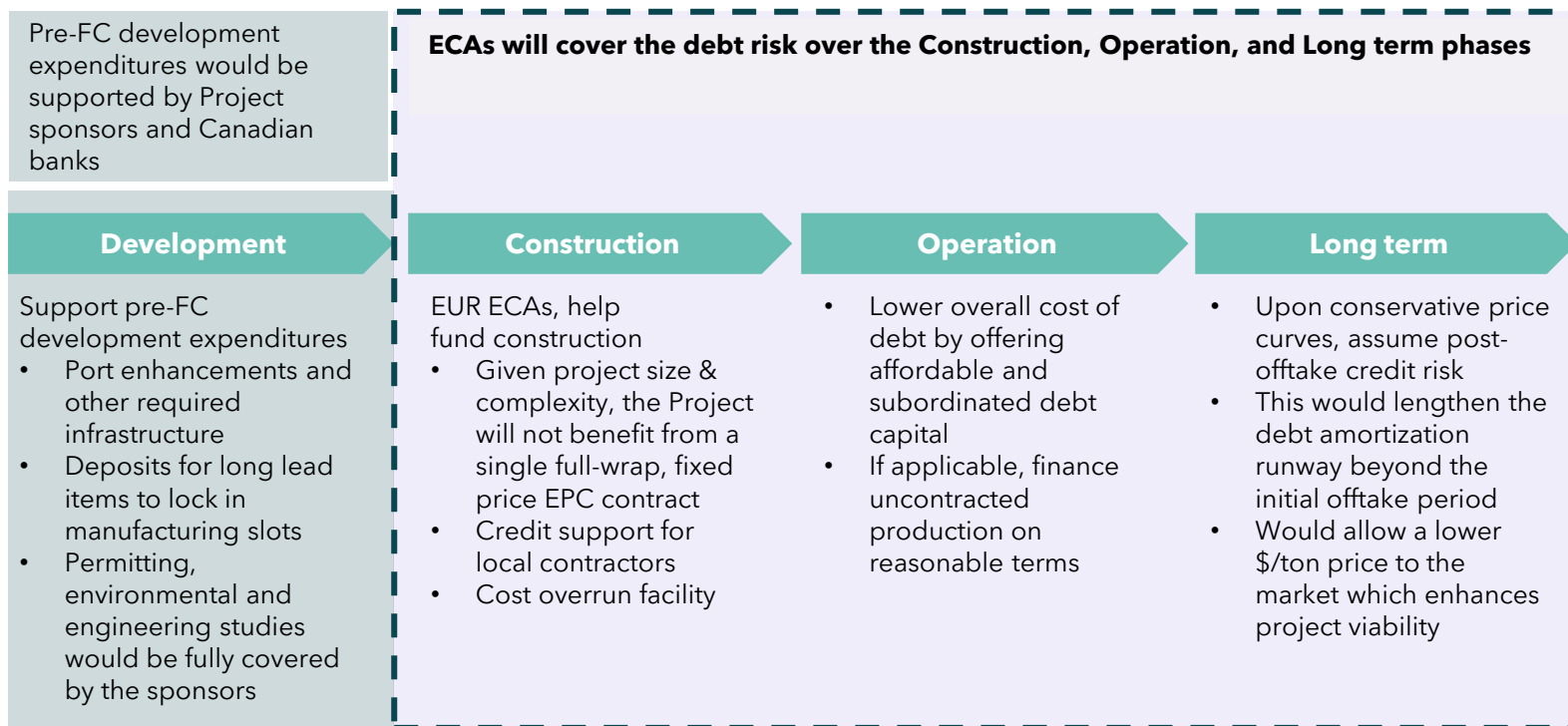
- Canadian Prime Minister Justin Trudeau and German Chancellor Olaf Scholz signed a joint declaration of intent on August 23<sup>rd</sup> at the Project Nujio'qonik site in Stephenville, Newfoundland & Labrador, to create a transatlantic green hydrogen supply chain between Canada and Germany with first deliveries aimed for 2025
- The agreement outlines Germany's intent to import wind-generated hydrogen from Canada as they intend to decrease dependency on Russian imports and find a long-term solution towards decarbonization
- Chancellor Scholz: "Germany expects a need of 90 to 110 terawatt-hours of hydrogen in 2030"
- Germany will spend more than EUR 4 bn on the scheme in the coming years. The first round will use EUR 900 M split roughly evenly between renewable ammonia, e-methanol and sustainable aviation fuel, while EUR 3.6 bn has been budgeted for future tenders



# Financing – Export Credit Agencies will be key

## Participation by ECAs might significantly enhanced the financing structure

- Reduced cost of debt, comfort for lenders and suppliers, increase appetite and competition
- Can support technologies not yet mature



Due to commercial banks requirements in the construction and operations phases, there is a need for support from ECAs to mitigate the debt risk during these phases





# Green Giraffe Advisory

[GREEN-GIRAFFE.COM](http://GREEN-GIRAFFE.COM)

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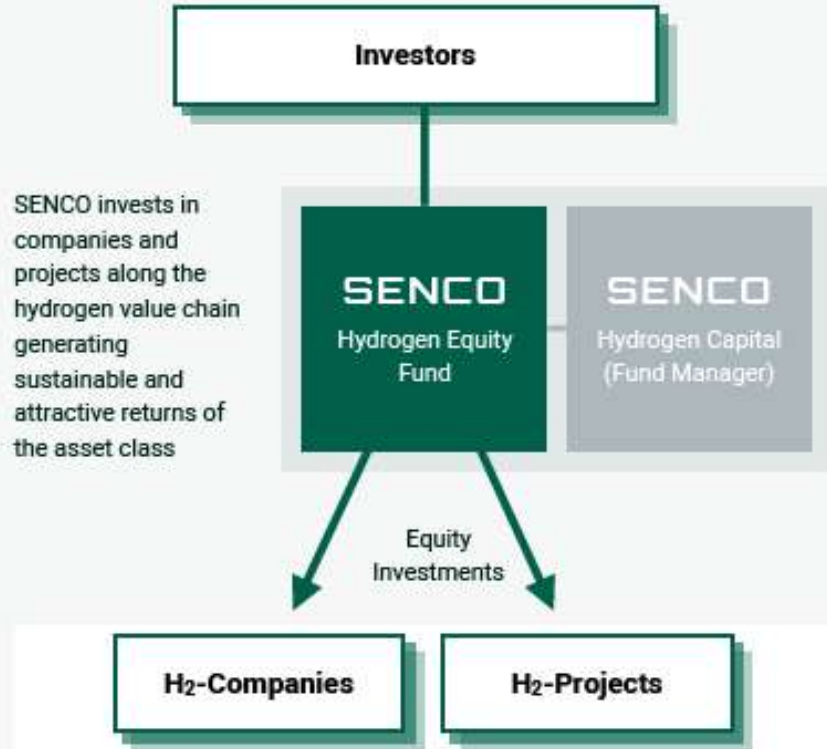
# SESCO HYDROGEN CAPITAL

## Private equity for the hydrogen sector

- Created by a passionate group of **experienced investment professionals** as well as **leading industry- and hydrogen experts** providing professional investors with **one-stop access** to the fast growing hydrogen economy
- As an **independent, sector focused investment firm** with deep hydrogen knowledge, SESCO drives **decarbonization** and creates **long-term values** for society, nature and its investors



Confidential



SESCO invests in companies and projects along the hydrogen value chain generating sustainable and attractive returns of the asset class



SESCO HYDROGEN CAPITAL

# Enapter manufactures modular AEM stacks for single- and multi-core applications for various applications worldwide

The AEM stack module is the center piece of our product platform, our minimum modular unit (MMU).

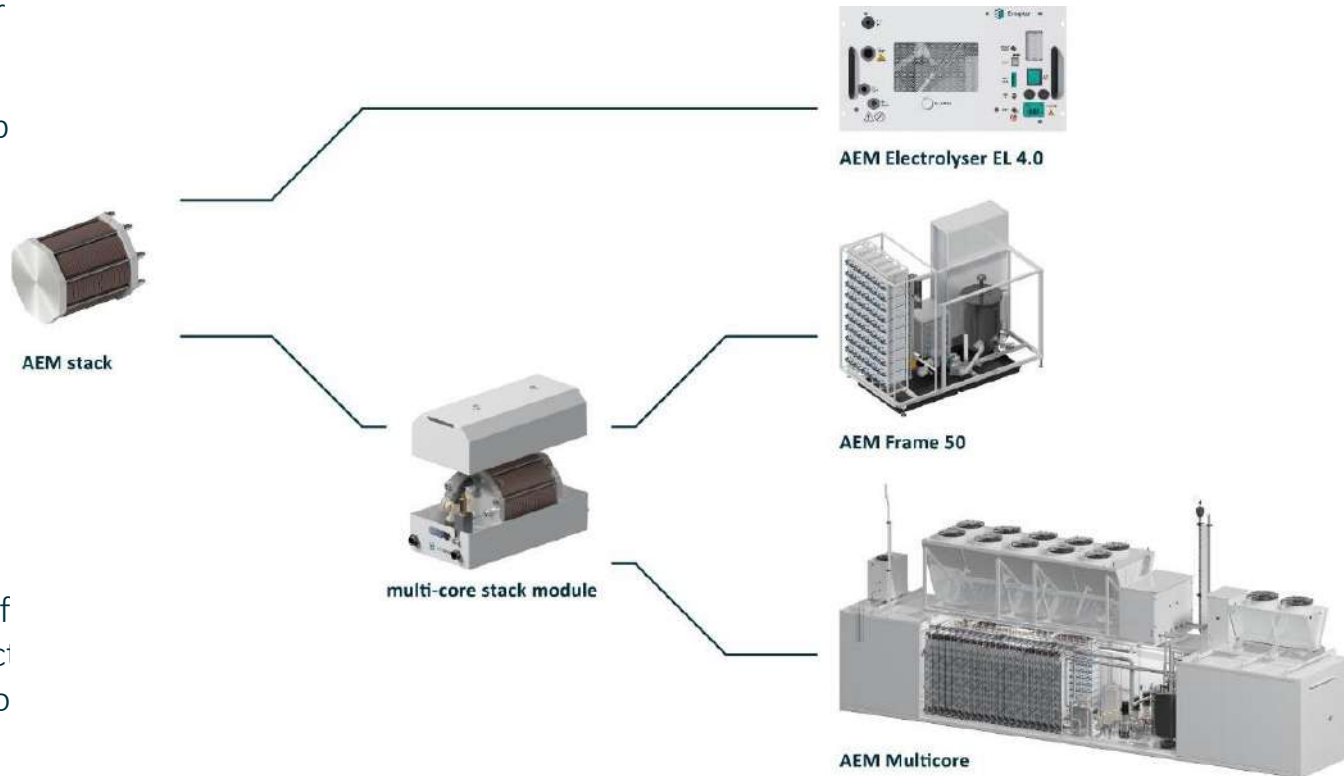
The AEM stacks can power a compact and modular single-core AEM electrolyser.

The same stacks can also deliver megawatt-scale green hydrogen in our multi-core setup.

Competitors have to develop different stacks for different products.

We can leverage our modular platform strategy designed for mass production to achieve significant cost reduction via economies of scale

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