WELCOME TO THE PORT OF ROTTERDAM

INTERNATIONAL CONFERENCE ON GREEN HYDROGEN 2024

Mark-Simon Benjamins

12 September, 2024

Port of Rotterdam

PORT OF ROTTERDAM FACTS

12,500 HA
TOTAL AREA

8,000 HA
LAND AREA

4,500 HA
WATER AREA

75 FT (= 24 M)
MAX DEPTH

AWARDED BEST
PORT INFRASTRUCTURE

€30.6 BILLION
ADDED VALUE,
3.2% OF DUTCH GDP

90,000
INLAND
VESSELS
PER YEAR

28,000
SEA-GOING
VESSELS
PER YEAR

FRONTRUNNER
IN SUSTAINABILITY

11TH PORT IN THE WORLD

439 MILLION TONNES
OF FREIGHT THROUGHPUT

LARGEST EUROPEAN PORT

CA. 193,000
DIRECT & INDIRECT JOBS

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ENERGY TRANSITION: BASED ON 4 PILLARS

EFFICIENCY AND INFRASTRUCTURE

PILLAR 1

A NEW ENERGY SYSTEM

PILLAR 2

A NEW RAW MATERIALS AND FUEL SYSTEM

PILLAR 3

SUSTAINABLE TRANSPORT

PILLAR 4

-55% CO_2 IN 2030

[COMPARED TO 1990]

CO_2-NEUTRAL IN 2050

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ENERGY TRANSITION: BASED ON 4 PILLARS

PILLAR 1

EFFICIENCY AND INFRASTRUCTURE

- Warmteling
- Porthos (CCS)
- Electricity grid
- Offshore wind
- Hydrogen network
- Delta Rhine Corridore

PILLAR 2

A NEW ENERGY SYSTEM

- Electrification industry; FLIE
- Production green hydrogen (Shell, BP-HyCC, Air Liquide, Uniper)
- H-vision
- Import hydrogen (ammonia, LOHC, ...)

PILLAR 3

A NEW RAW MATERIALS AND FUEL SYSTEM

- Producton biofuels (Shell, Neste, UPM)
- Biomethanol (Gidara)
- Plastic recycling
- Waste-to-jet
- TES battery recycling

PILLAR 4

SUSTAINTABLE TRANSPORT

- Zero Emission Services
- RH2INE
- Hytrucks, H_2 fuel station
- Shore power
- Green Corridors
- Digitalisation of logistics

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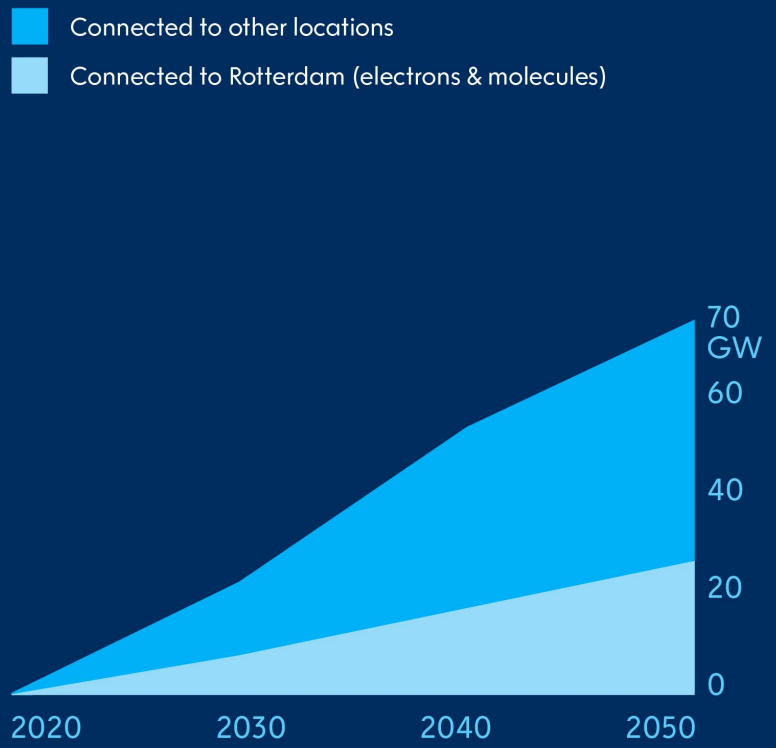
ROTTERDAM: EUROPE'S HYDROGEN HUB

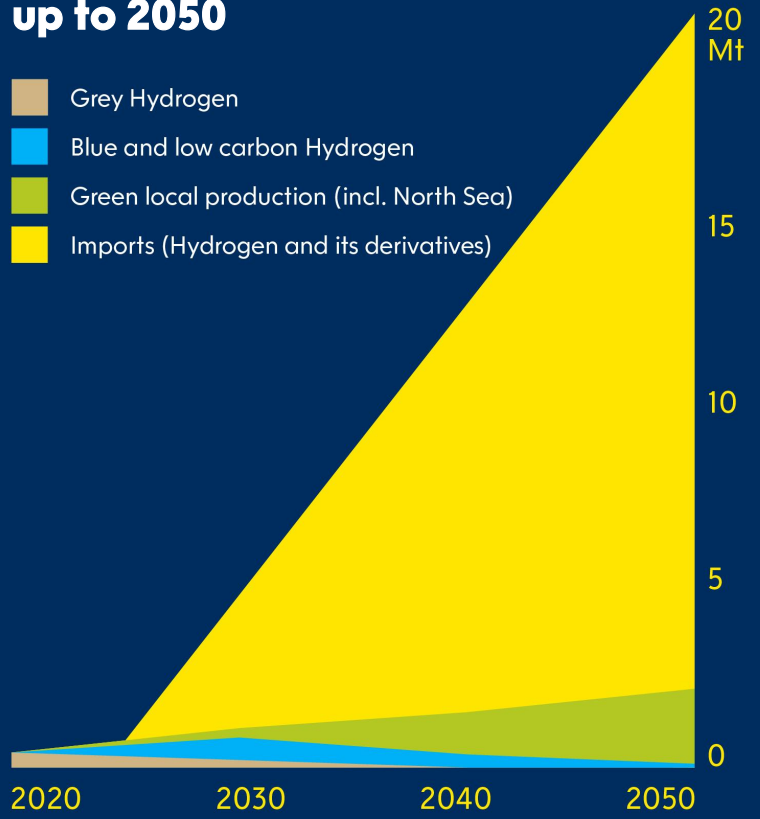
CO_2-reduction through offshore wind, hydrogen and its derivatives

NL offshore renewable energy up to 2050



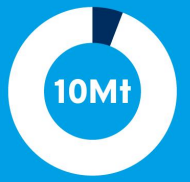
Source: Min. EZK, Kamerbrief windenergie op zee 20302050 (2022)

Hydrogen in Rotterdam up to 2050

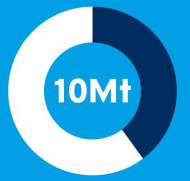


13% of total energy consumption EU goes via Rotterdam, Europe's largest energy port.

Rotterdam plays a huge role in fulfilling EU ambitions 2030 (RePowerEU)

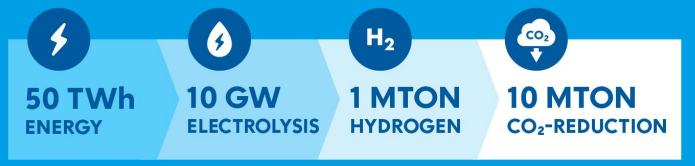


EU green hydrogen production
0.6 Mtpa Rotterdam green & low carbon hydrogen production



EU hydrogen import
4.0 Mtpa Rotterdam green hydrogen import

Rule of thumb:



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IMPORTS ARE ESSENTIAL FOR EUROPE, AS IT USES MORE ENERGY THAN IT CAN PRODUCE

High potential areas for green hydrogen export

PROGRESS AND PLANNING

- Expected import Hydrogen and its derivatives in Rotterdam: 4 Mtpa in 2030, 18 Mtpa in 2050
- Huge potential for production in many areas worldwide
- Imports Rotterdam are expected to start around 2025
- 9 terminals have announced plans for import facilities
- Rotterdam is preparing itself for Ammonia, Methanol and LOHC, Liquid Hydrogen, ...
- Multiple MoU's in place

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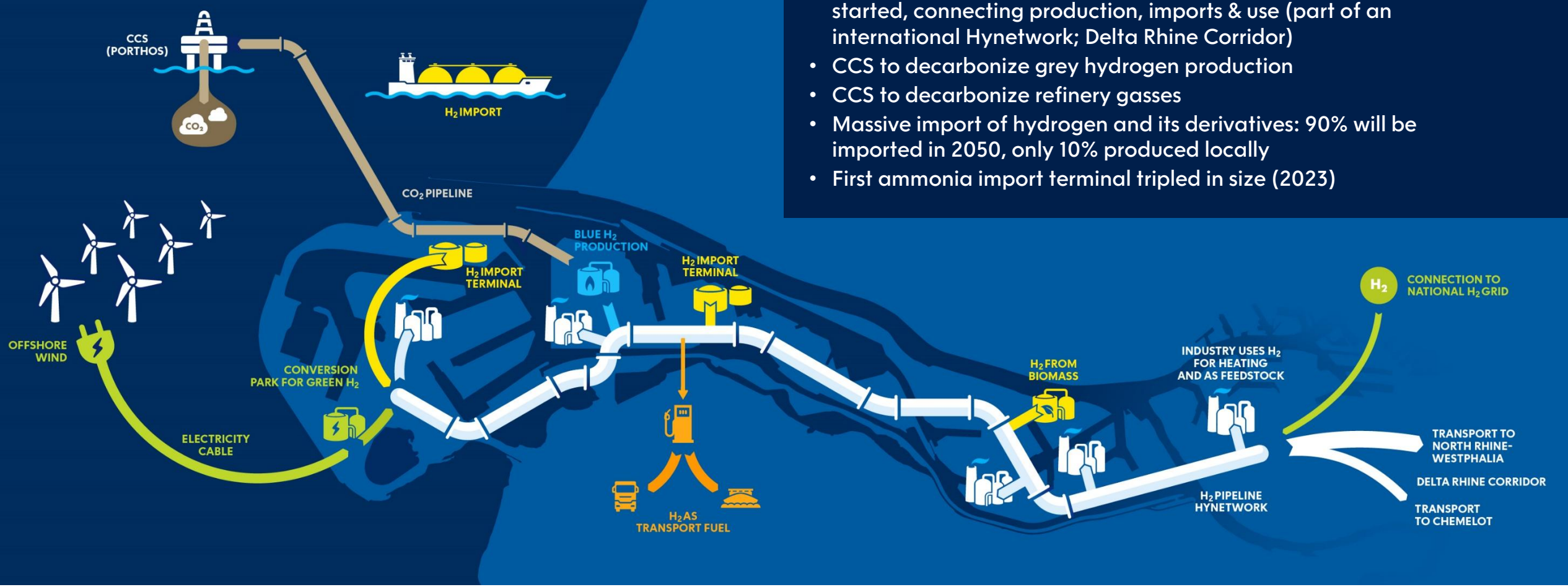
ROTTERDAM'S HYDROGEN ECOSYSTEM IS BEING BUILT RIGHT NOW

WE ARE MAKING THIS HAPPEN

- Offshore wind farms connected to Rotterdam: 7.4 GW in 2030
- Production of green hydrogen (first 200 MW electrolyser under construction): 2-2.5 GW in 2030
- Construction of open access Hydrogen pipeline across the port has started, connecting production, imports & use (part of an international Hynetwork; Delta Rhine Corridor)
- CCS to decarbonize grey hydrogen production
- CCS to decarbonize refinery gasses
- Massive import of hydrogen and its derivatives: 90% will be imported in 2050, only 10% produced locally
- First ammonia import terminal tripled in size (2023)



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MULTIPLE HYDROGEN PROJECTS THROUGHOUT THE VALUE CHAIN

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PORT OF ROTTERDAM IS READY TO RECEIVE ALL TYPES OF CARRIERS

Green ammonia
One existing terminal.
4 new ammonia terminals announced.

LOHC
Conversion of 2 existing terminals, first pilot in 2023.

LH2
2 Feasibility studies for new terminal completed.
Possible before 2030.

Green methanol
Multiple existing terminals.
Already a European methanol hub.

Powders
Other technologies are also being explored (e.g. NaBH2).

Cracking facilities in study.

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13 HYDROGEN TERMINAL PROJECTS ANNOUNCED

More initatives expected

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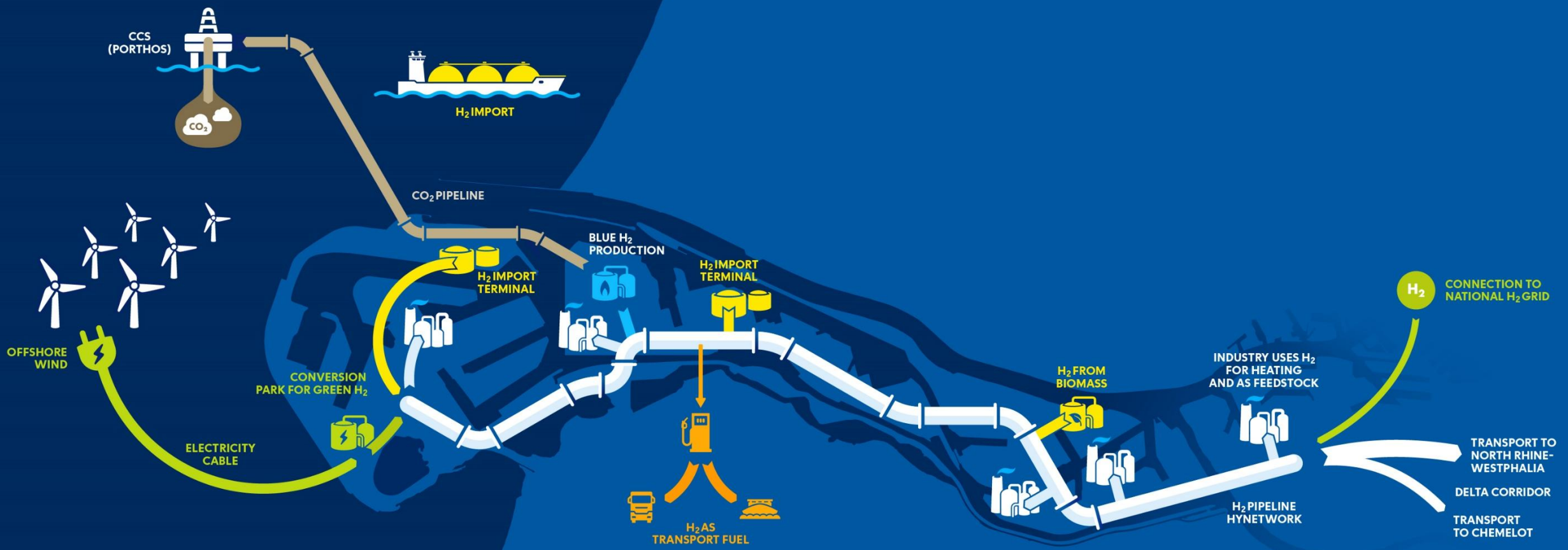
HYNETWORK, PIPELINE ROTTERDAM UNDER CONSTRUCTION



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Imported H_2 to decarbonize German industry and transport: 3 projects

DELTA RHINE CORRIDOR
Direct pipeline connection between the Port of Rotterdam and industrial clusters in the Netherlands, Germany and Belgium

RH2INE / CONDOR H_2
Barges sailing on H_2 in Europe

AMMONIA
Shipping clean ammonia and methanol Canada - Rotterdam – Duisport – Worms

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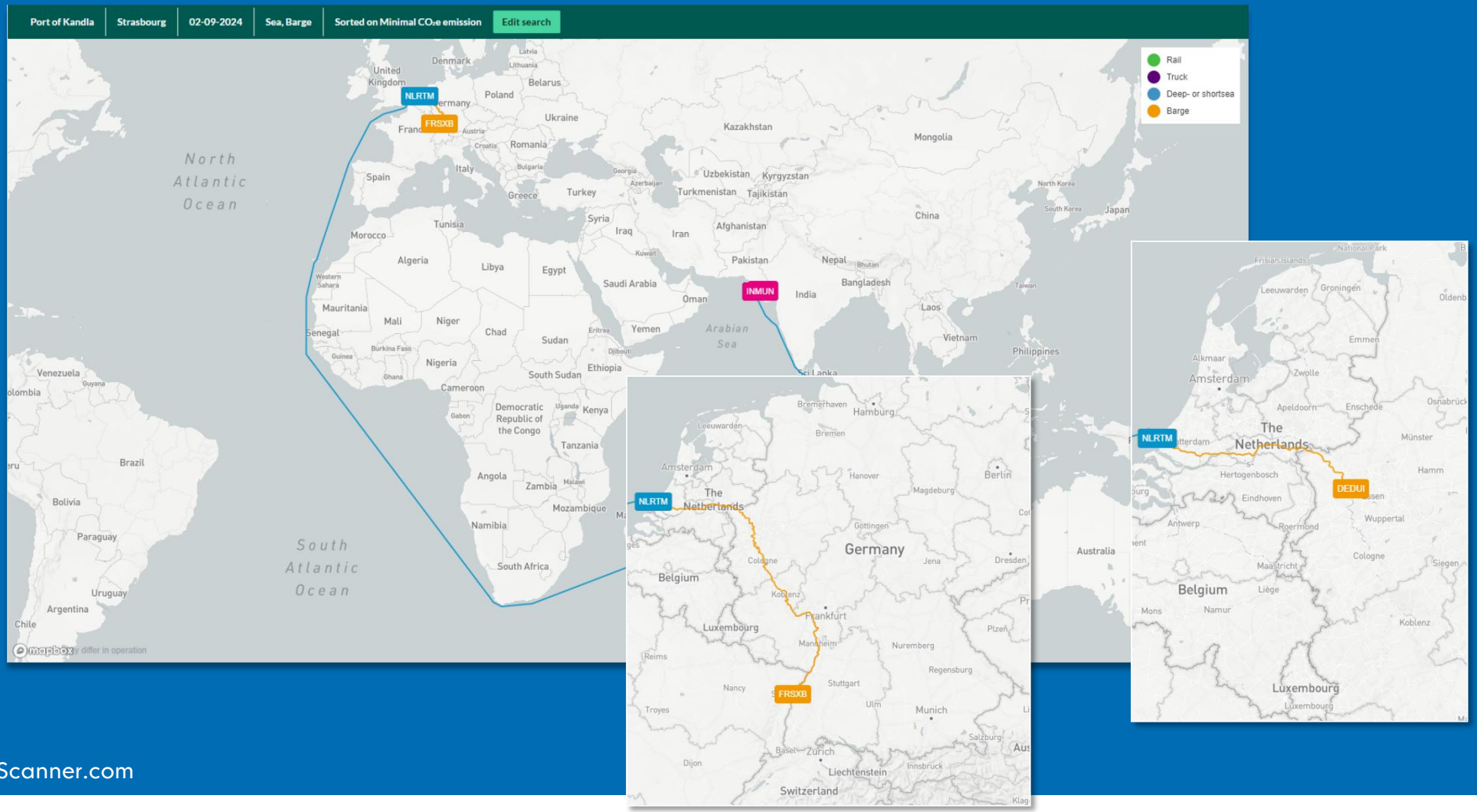
CONVENTIONAL INLAND WATERWAY CONNECTION

MOST EFFICIENT ROUTE, BY MINIMAL CO2 EMISSION



Source: RouteScanner.com

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ROTTERDAM LARGEST METHANOL HUB OF NW EUROPE

CH3OH

PoR annual **METHANOL THROUGPUT ~3 MT** - 2.5MT import and 0.5MT export. Methanol is Rotterdam's largest chemical commodity contributing to our leading methanol position.

METHANOL STORAGE INFRASTRUCTURE widely available at **EVOS – VOPAK – ETT – CHANE**
Storage capacity ~500.000cbm (grey & green methanol).

Methanol used as **FEEDSTOCK** for the production of **FORMALDEHYDE** (Hexion, EVOS) - **BIODIESEL** (Viterra) - **MTBE** (LyondellBasel, Shell, BP) and as **MARINE FUEL.**

World's leading **METHANOL PRODUCERS** & **TRADERS** are active in Rotterdam. Collaborating to launch a 90KT/Y **RENEWABLE METHANOL PLANT** and exploring two **E-METHANOL OPPORTUNITIES**

METHANOL BUNKERING in PoR is possible, allowed and encouraged as from 2022. PoR is one of world's leading bunker ports now offering monthly methanol bunkerings.

BUNKER INFRASTRUCTURE is available with planned investments in dedicated **METHANOL BUNKER BARGES** by **VT GROUP, UNIBARGE & VICTROL**

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IT'S HAPPENING!

Offshore wind landfall

Pipes for Hynetwork

4.6 Mton H2 in 2030 is feasible

Building site Conversion Park

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WANT TO LEARN MORE?

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BUSINESS MANAGER
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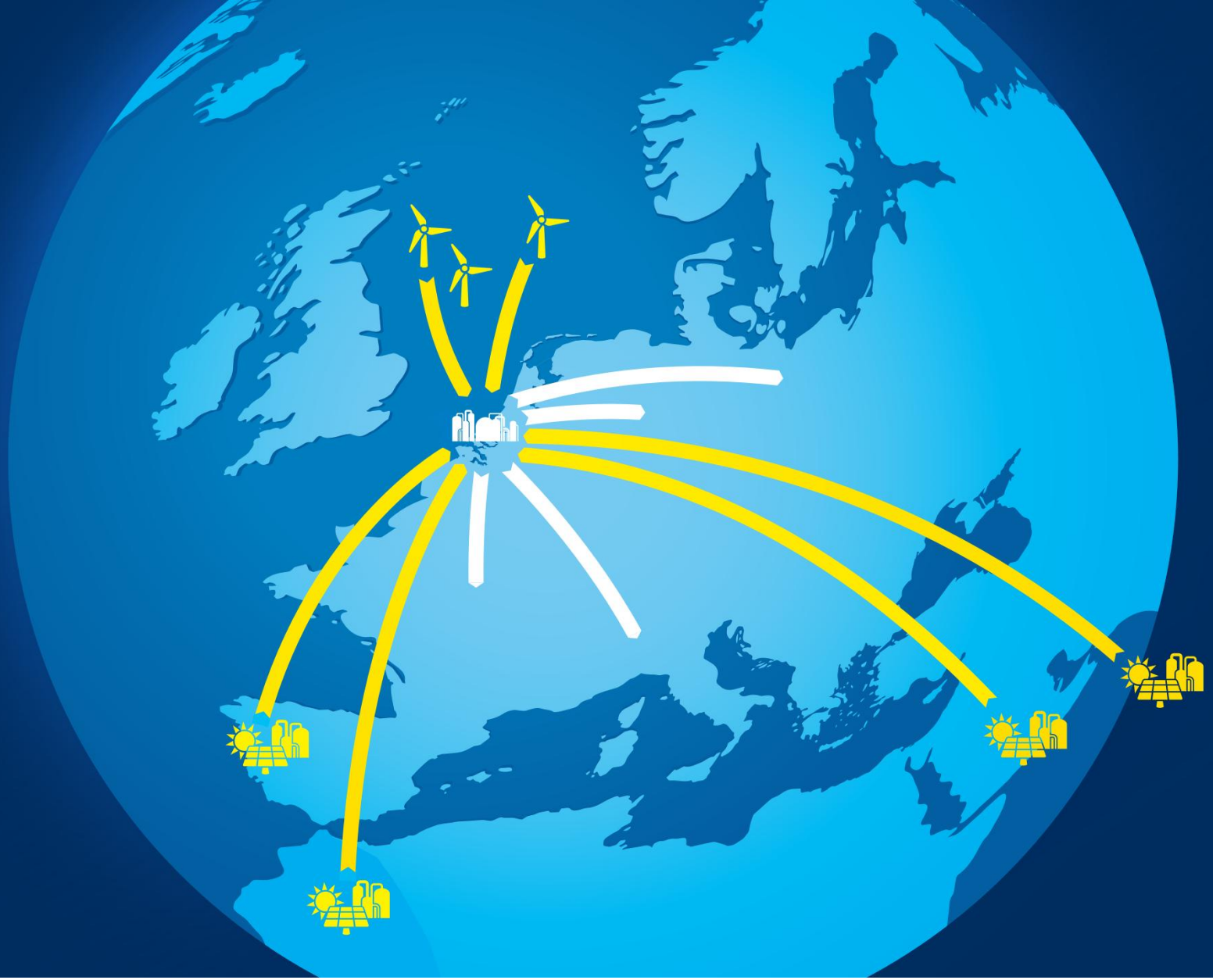

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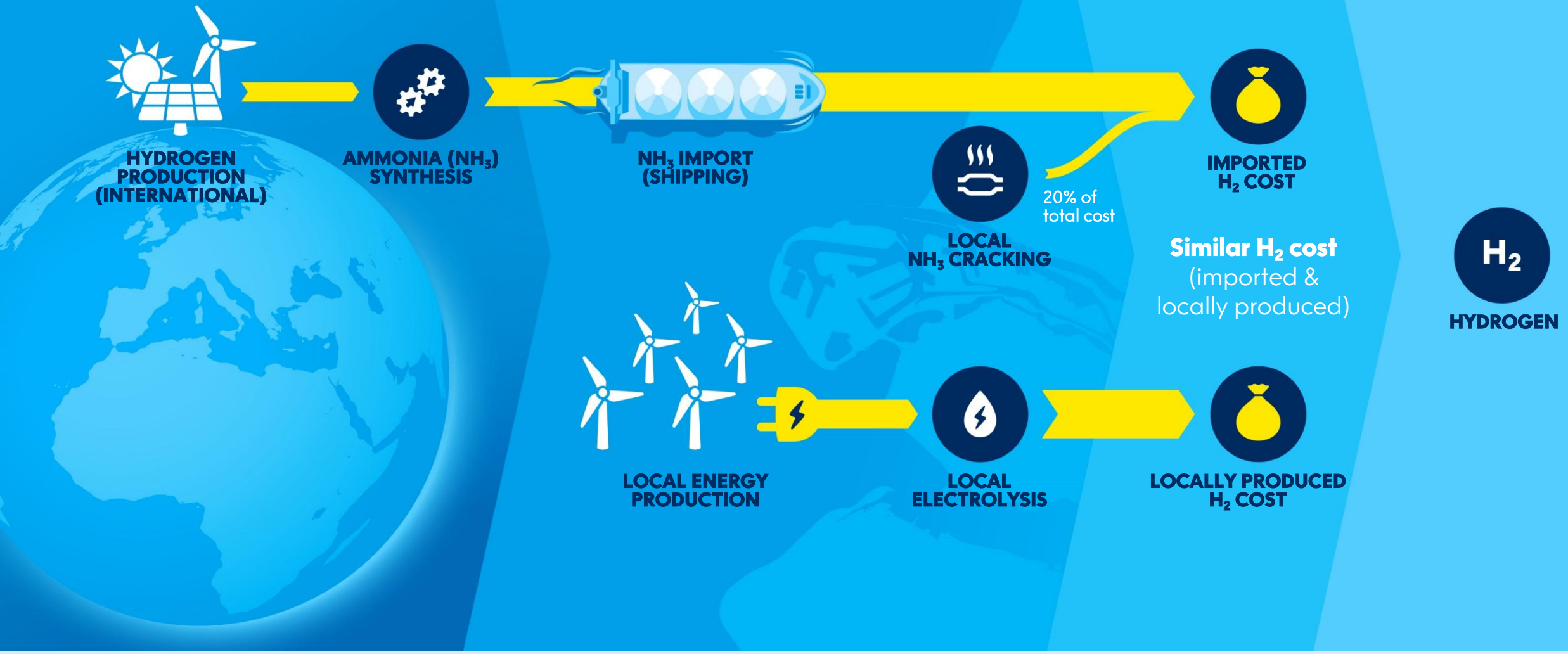
COST



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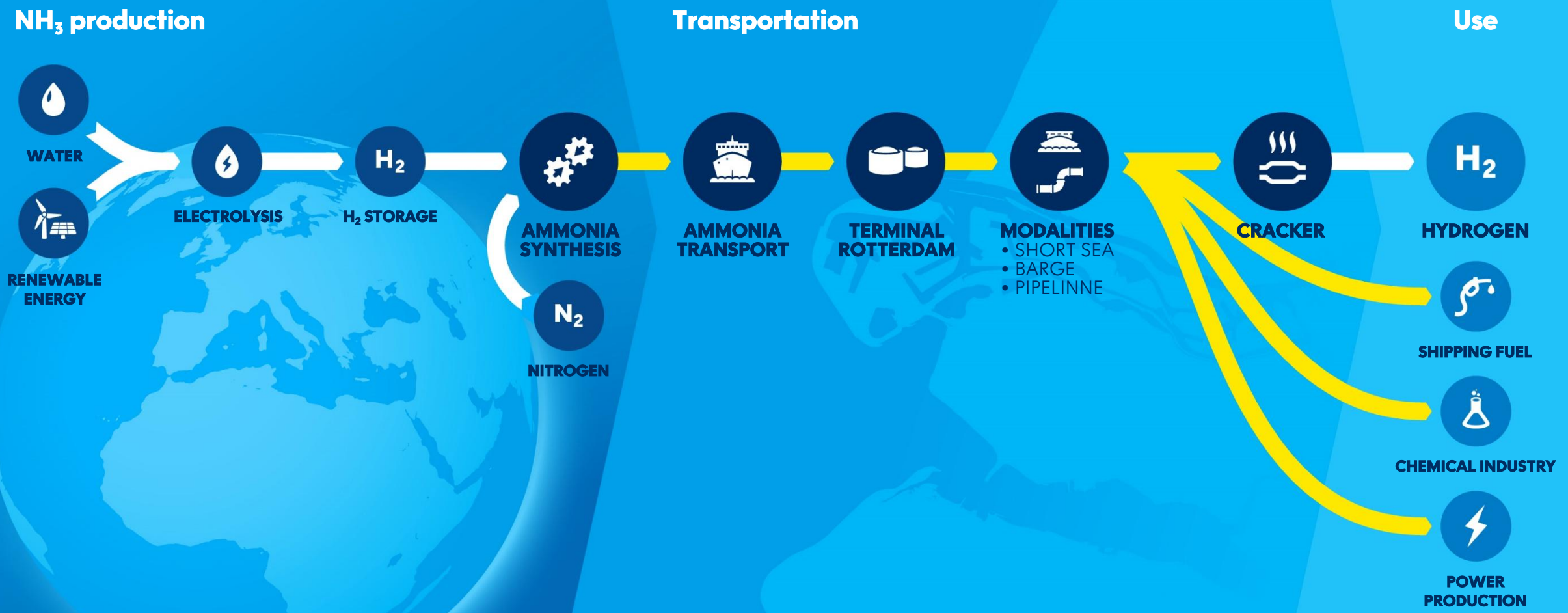
AMMONIA VALUE CHAIN



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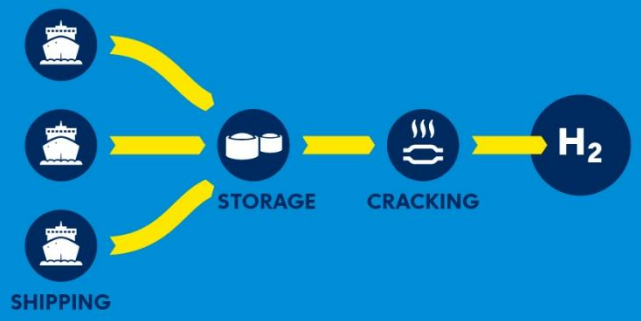
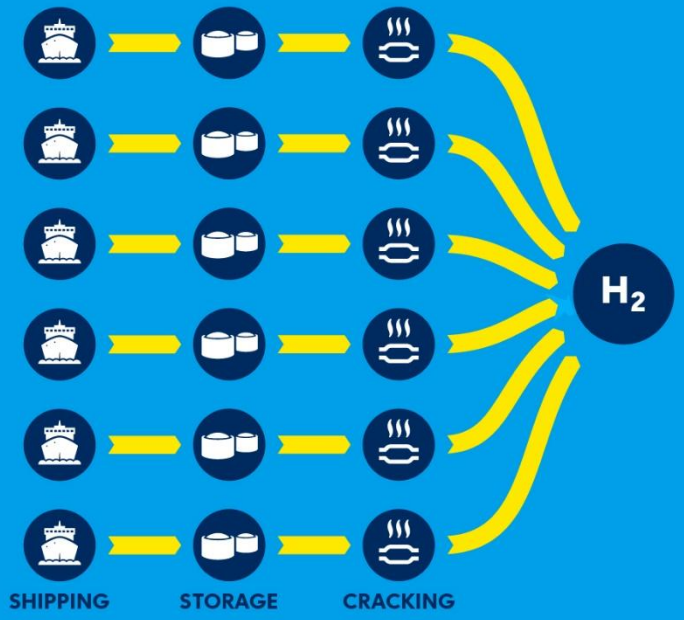
THREE CONFIGURATIONS

1. Centralised



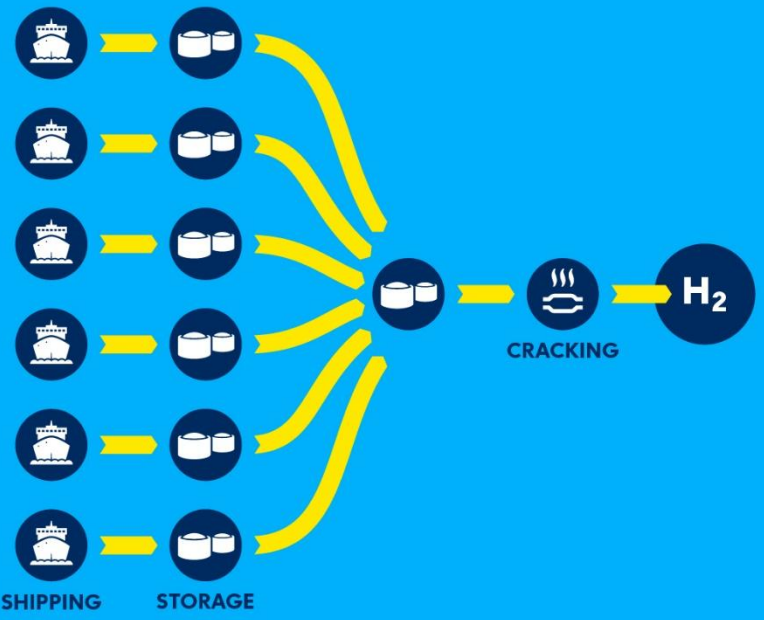
- High investment
- One large area
- Meets safety standards

2. Decentralised



- Very high investment
- Several smaller area's (brownfield)
- Meets safety standards

3. Mix



- Very high investment
- Combination of area's
- Meets safety standards

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GREEN HYDROGEN PRODUCTION STARTS AT DEDICATED SITES FOR ELECTROLYSIS

Ambition Rotterdam
2030: 2.5GW (onshore)
2050: 20GW (onshore & offshore)

Conversion park 1

PROJECT (COMPANY)	CAPACITY	PLANNED FID	OPERATIONAL
H2-Fifty (bp&HyCC)	250MW	2024	2027
Holland Hydrogen I (Shell)	200MW	**2022** ✓	2025
CurtHyl (Air Liquide)	200MW	2024	2027
Confidential	200MW	2025	2028

Conversion park 2

IJmuiden Ver GW-scale project	1000MW	2025	2029

Local developments

PROJECT (COMPANY)	CAPACITY	PLANNED FID	OPERATIONAL
H2Maasvlakte (Uniper)	500MW	2025-2026	2029-2030
Eneco Electrolyser (Eneco)	800MW	2025	2029

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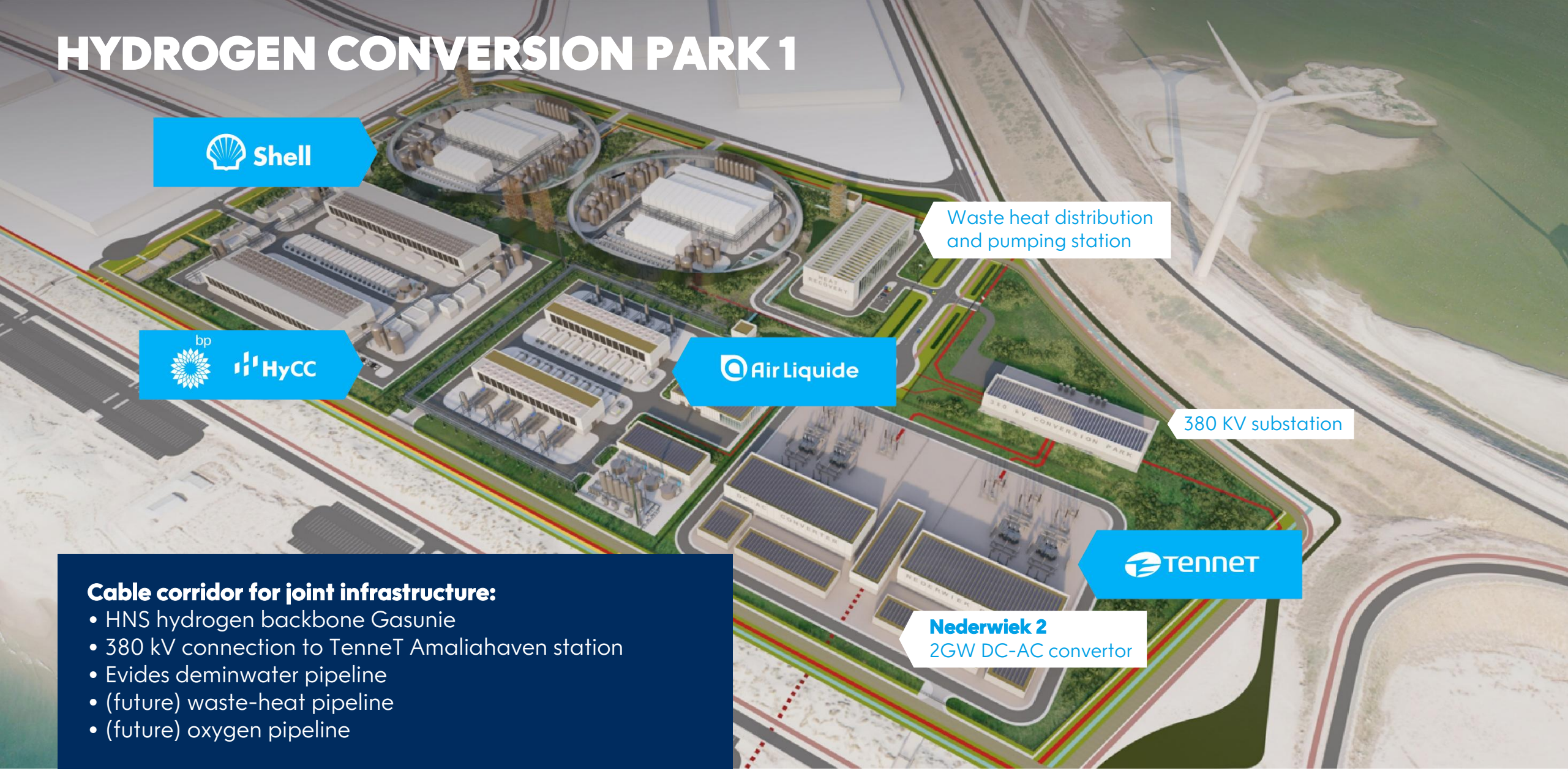
HYDROGEN CONVERSION PARK 1



Cable corridor for joint infrastructure:
- HNS hydrogen backbone Gasunie
- 380 kV connection to TenneT Amaliahaven station
- Evides deminwater pipeline
- (future) waste-heat pipeline
- (future) oxygen pipeline

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SHELL HOLLAND HYDROGEN 1

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UNIPER H2 MAASVLAKTE

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HYDROGEN CONVERSION PARK 2

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WHAT IS NECESSARY ?

Fast and reliable permitting
(incl. nitrogen regulations)

A robust H_2 certification scheme for imports

Stimulation of demand and closing the financial gap with CO_2-emitting alternatives
(like contracts for difference)

Parallel development of public and private H_2 infrastructure

Financing run-up risks
(especially for infrastructure)

Societal acceptance of new energy carriers

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Rotterdam aims to meet ~25% EU ambitions 2030 (RePowerEU) and become Europe's Hydrogen Hub

EU hydrogen production
0.6 Mtpa Rotterdam green & low carbon hydrogen production

EU hydrogen import
4.0 Mtpa Rotterdam import green hydrogen & derivatives

Europe is short on energy. Massive import of hydrogen and its derivatives needed

First projects are being built, many more upcoming: FID's taken for main H_2 infrastructure projects

- 1st Electrolyser
- H_2 Pipeline
- 1st Terminal
- CO_2 Pipeline

and Rotterdam is connected to the H_2 demand centers in North West Europe

Pipelines, Waterways & Rail Hydrogen network Netherlands & Delta Rhine Corridor

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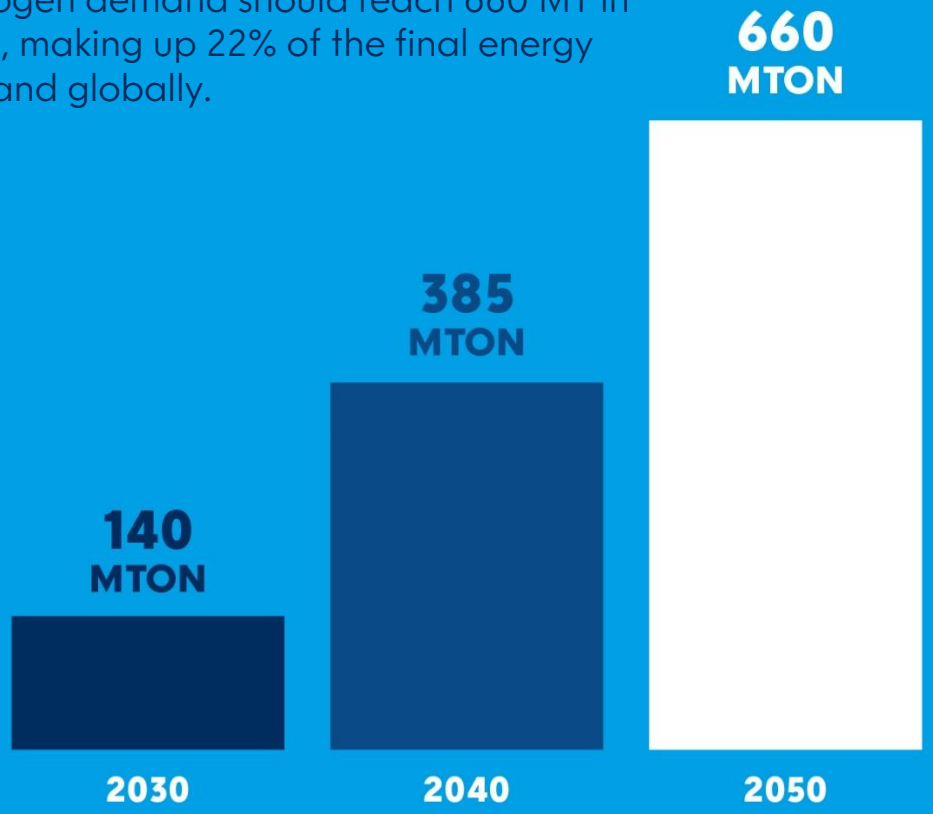
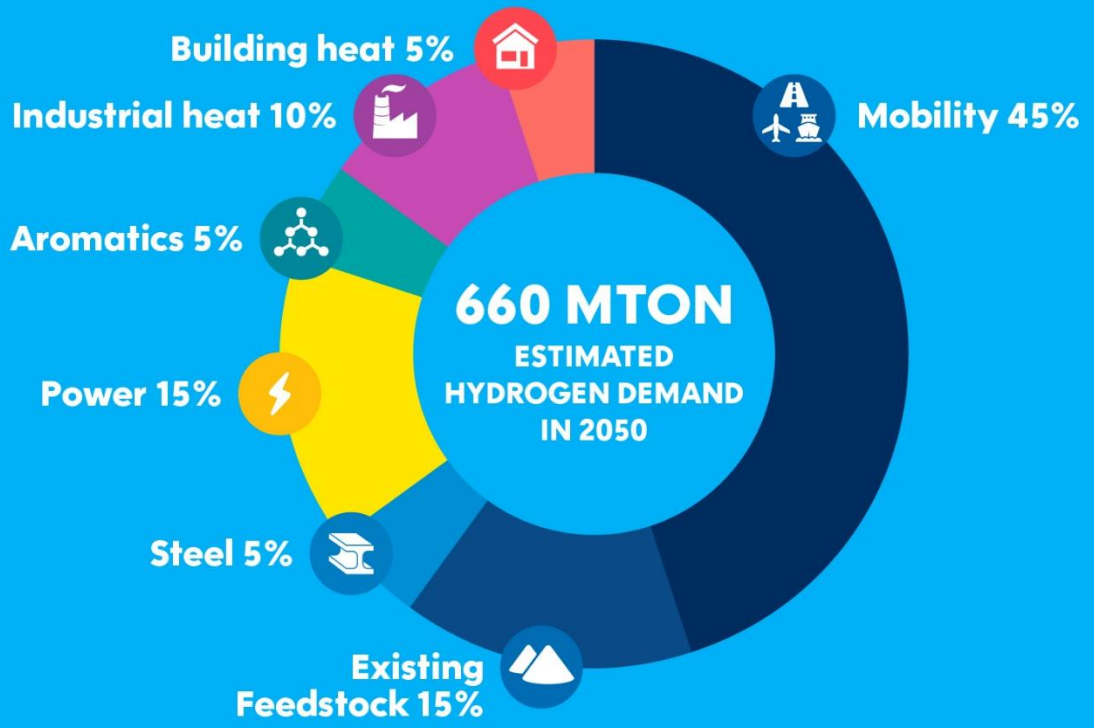
FORECAST DEMAND & USE OF HYDROGEN WORLDWIDE

THE GLOBAL HYDROGEN MARKET IN 2050

To meet net-zero targets, long-term hydrogen demand should reach 660 MT in 2050, making up 22% of the final energy demand globally.



Source: Hydrogen Council, McKinsey & Company, Hydrogen for Net-Zero (2021)



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