CONNECTING THE WORLD
BUILDING TOMORROW'S SUSTAINABLE PORT

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11 NOVEMBER 2025

3rd INTERNATIONAL CONFERENCE ON GREEN HYDROGEN INDIA 2025

11-12 NOVEMBER, 2025 | BHARAT MANDAPAM, NEW DELHI

Port of Rotterdam

ROTTERDAM HYDROGEN HUB: THE ENERGY SYSTEM IS TAKING SHAPE

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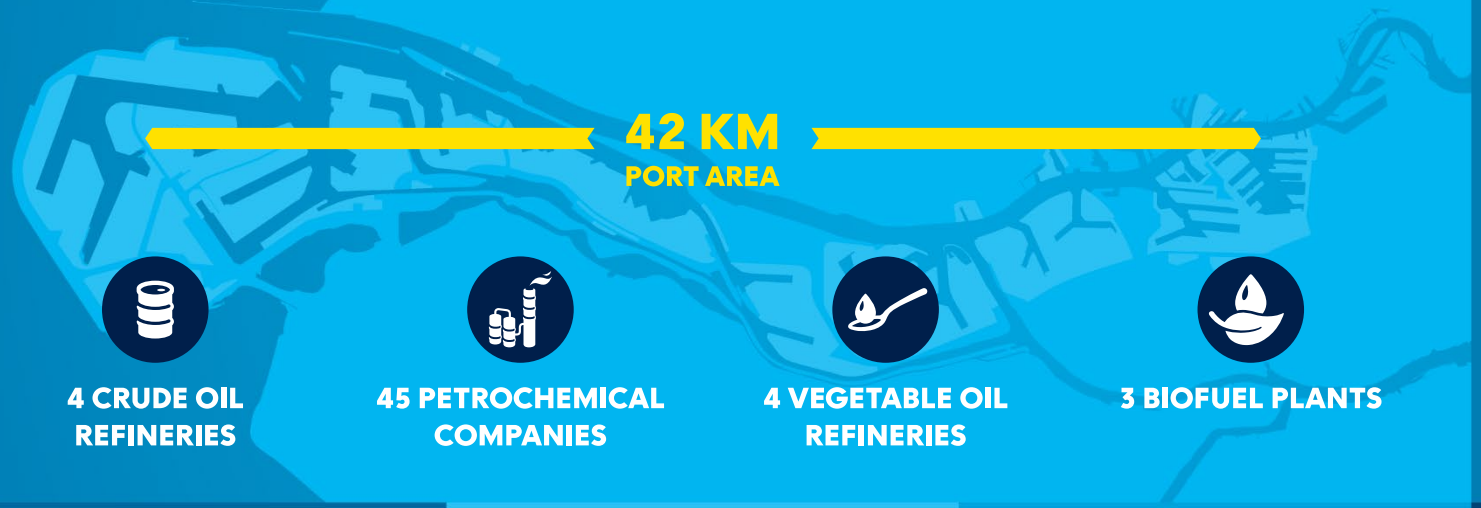
PORT OF ROTTERDAM

At a glance



42 KM
PORT AREA

4 CRUDE OIL REFINERIES

45 PETROCHEMICAL COMPANIES

4 VEGETABLE OIL REFINERIES

3 BIOFUEL PLANTS

€29.6 BILLION
ADDED VALUE
2.9% OF DUTCH GDP

91,000
INLAND VESSELS PER YEAR

28,000
SEA-GOING VESSELS PER YEAR

LARGEST EUROPEAN PORT

CURRENT HYDROGEN PRODUCTION 0.5 MTON

13% OF TOTAL EU ENERGY CONSUMPTION PASSES ROTTERDAM

EXCELLENT CONNECTIONS WITH OTHER EU CLUSTERS

CA. 192,000
DIRECT & INDIRECT JOBS

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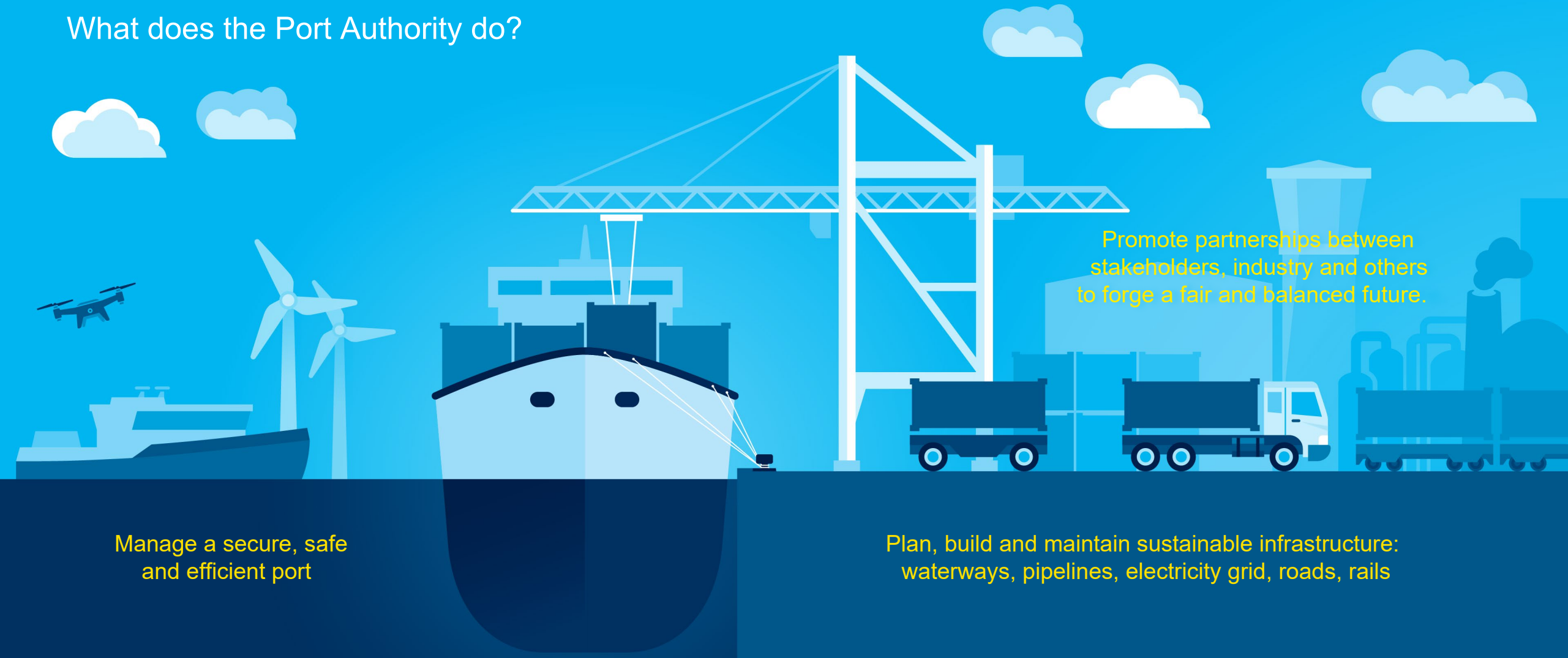
PORT OF ROTTERDAM

What does the Port Authority do?



Promote partnerships between stakeholders, industry and others to forge a fair and balanced future.

Manage a secure, safe and efficient port

Plan, build and maintain sustainable infrastructure: waterways, pipelines, electricity grid, roads, rails

ENERGY TRANSITION BASED ON 4 PILLARS

PILLAR 1

EFFICIENCY AND INFRASTRUCTURE

PILLAR 2

A NEW ENERGY SYSTEM

PILLAR 3

A NEW FEEDSTOCK AND FUEL SYSTEM

PILLAR 4

SUSTAINABLE TRANSPORT

-55% CO_2 in 2030

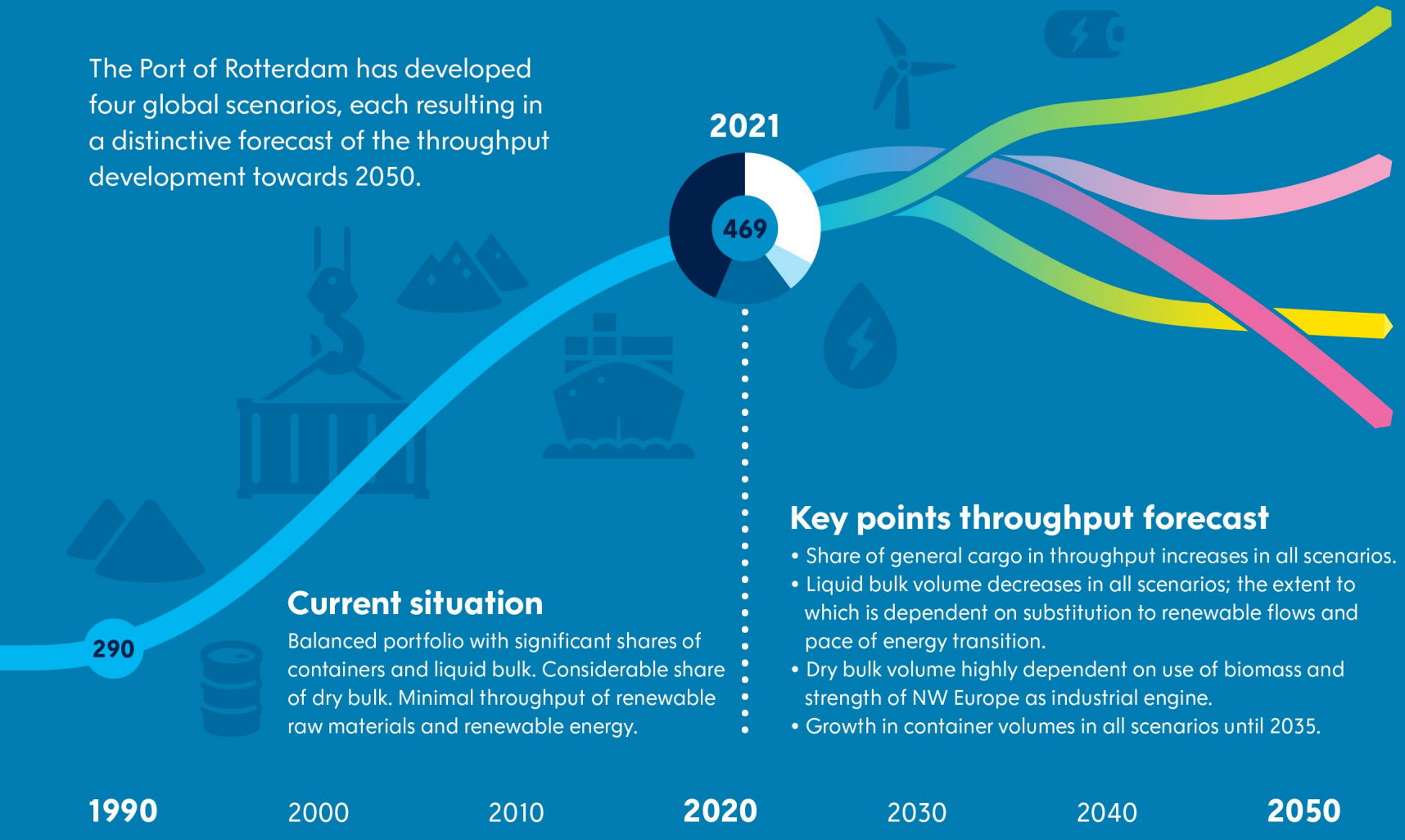
(compared to 1990)

CO_2 Neutral in 2050

THROUGHPUT PER SCENARIO TOWARDS 2050

In millions of tonnes

The Port of Rotterdam has developed four global scenarios, each resulting in a distinctive forecast of the throughput development towards 2050.



Current situation

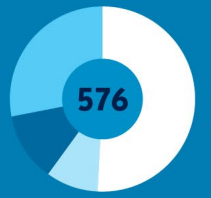
Balanced portfolio with significant shares of containers and liquid bulk. Considerable share of dry bulk. Minimal throughput of renewable raw materials and renewable energy.

Key points throughput forecast

- Share of general cargo in throughput increases in all scenarios.
- Liquid bulk volume decreases in all scenarios; the extent to which is dependent on substitution to renewable flows and pace of energy transition.
- Dry bulk volume highly dependent on use of biomass and strength of NW Europe as industrial engine.
- Growth in container volumes in all scenarios until 2035.

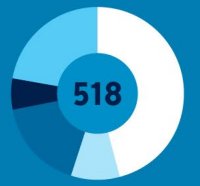
1990 2000 2010 **2020** 2030 2040 **2050**

CONNECTED DEEP GREEN



Fossil energy falls to zero in 2050; instead large amounts of renewable energy (e.g. H_2, NH_3). Strong increase in containers due to growing global trade.

WAKE-UP CALL



More biomass imports as feedstock for energy and chemicals. Late but rapid energy transition requires CO_2 storage. Increase in containers due to favourable economic climate.

REGIONAL WELL-BEING

Strong decline in crude oil, coal, iron ore due to contaction of energy-intensive industries. As a result, more general cargo volume due to imported semi-finished products.

PROTECTIVE MARKETS

Trade barriers lead to delayed substitution to renewable energy. Considerably less crude oil refining. Less general cargo due to reshoring and nearshoring.

LEGEND

- Containers
- Breakbulk
- Dry bulk
- Liquid bulk (fossil)
- Liquid bulk (non-fossil)

7.4 GW WINDFARMS NORTH SEA CONNECTED TO ROTTERDAMBY 2032

7.4 GW = 35% of all windpower projects in the Dutch part of the North Sea. These projects are to be realized by 2032.

Dutch ambition is to have 70 GW installed in 2050.
Rotterdam aims to connect 25 GW = 35% to the port.

WINDFARM CONNECTIONS	CAPACITY	OPERATIONAL
Hollandse Kust Zuid	1.4 GW	2023 ✓
IJmuiden Ver Beta	2.0 GW	2029
IJmuiden Ver Gamma	2.0 GW	2031
Nederwiek II	2.0 GW	2032
Total	7.4 GW H_2 production : 2-2,5GW	

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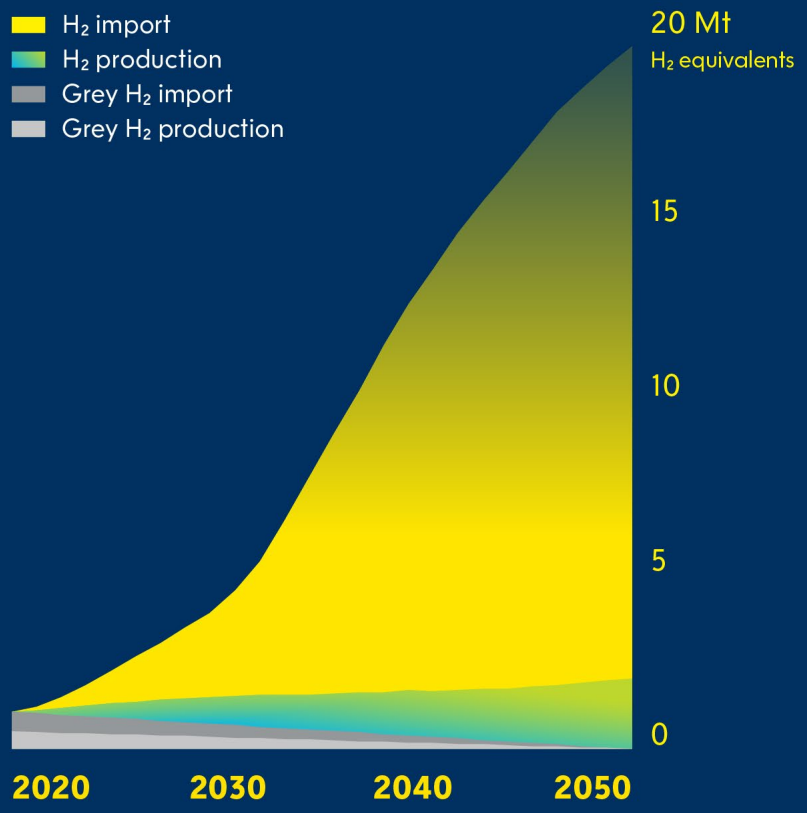
ROTTERDAM: EUROPE'S HYDROGEN HUB

CO_2-reduction with renewable & low carbon hydrogen and its derivatives, with a large role for imports

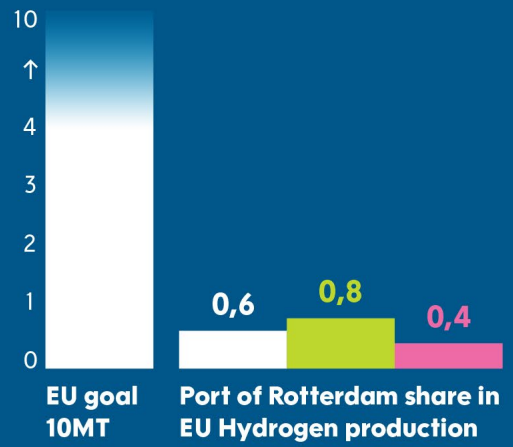
Net zero

Paris Climate Agreement

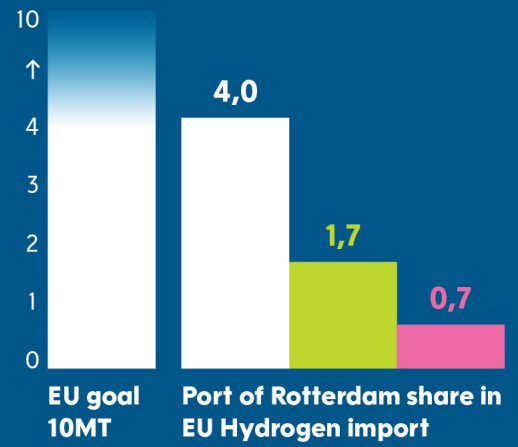


European hydrogen goals for 2030

Rotterdam plays a huge role in fulfilling EU ambitions of 20Mton: our aim is to deliver 25%.



- REPowerEU ambitie: 0,6Mton
- Connected Deep Green: 0,8 Mton
- Protective markets: 0,4 Mton



- REPowerEU ambitie: 4Mton
- Connected Deep Green: 1,7 Mton
- Protective markets: 0,7 Mton

HIGH POTENTIAL IMPORT AREAS

Green hydrogen import is essential for Europe,
as it uses more energy than it can produce.

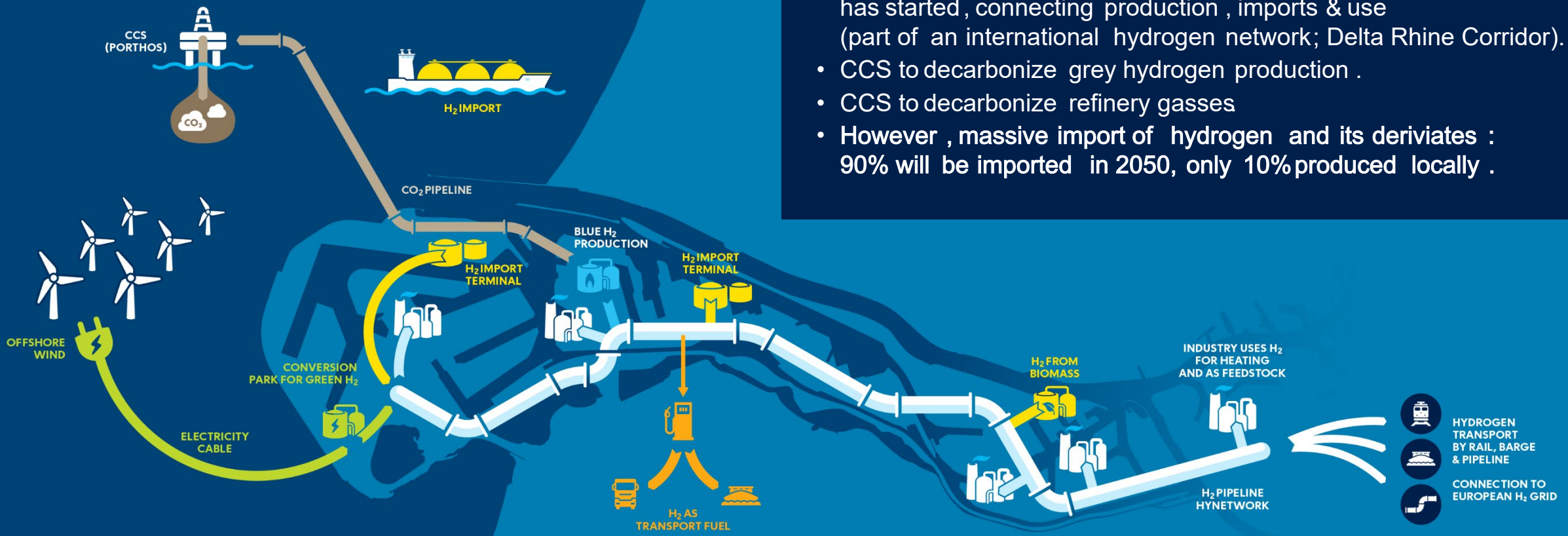
Progress and planning

- Expected import Hydrogen and its derivates in Rotterdam: 0.7-1.7 Mton in 2030, 18 Mton in 2050.
- Huge potential for production in many areas worldwide.
- Imports Rotterdam are expected to start around 2025.
- 14 terminals have announced plans for import facilities.
- Rotterdam is preparing itself for Ammonia, methanol, Liquid H_2, SAF and LOHC.
- Not in the last place, India is a front running country.

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 hydrogen network; Delta Rhine Corridor).
- CCS to decarbonize grey hydrogen production.
- CCS to decarbonize refinery gasses
- **However, massive import of hydrogen and its deriviates: 90% will be imported in 2050, only 10% produced locally.**



HYDROGEN PROJECTS

GREEN H_2 PRODUCTION STARTS AT DEDICATED SITES FOR ELECTROLYSIS

PROJECT (COMPANY)	CAPACITY	PLANNED FID	OPERATIONAL
Conversion park 1			
Holland Hydrogen I (Shell)	200MW	✓ 2022	2026
ELYgator (Air Liquide)	200MW	✓ 2025	2027
HyCC Project (HyCC)	250MW	2027	2030
Fourth plot	200MW		
Conversion park 2			
Zeevonk (CIP/Vattenfall)	~1000MW	2029	2032
MaasH2 (RWE)	~250MW	2027	2030
Brownfield			
Eneco Electrolyser (Eneco)	800MW	2028	2030
H2Maasvlakte (Uniper)	500MW	2028	2030

N.B. Indicative timelines

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HYDROGEN CONVERSION PARK 1

Progress and planning

- HNS hydrogen backbone.
- 380 kV connection to TenneT Amaliahaven station.
- Evides demin water pipeline.
- (Future) waste-heat pipeline.
- (Future) oxygen pipeline.

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HYDROGEN CONVERSION PARK 2

HYDROGEN IMPORT ARRIVAL LOCATIONS ROTTERDAM

14 hydrogen existing and announced terminals

	TERMINALS (COMPANY)	PLANNED FID	OPERATIONAL
AMMONIA	OCI	Operational	✓ 2026
	Air Products	2025	2028
	VTTI Amplifhy	2026	2029
	Chane	2026	2029
	ACE (Location undecided)	2027	>2030
	Global Energy Storage	2028	>2030
LH_2 LOHC METHANOL/SAF	Chane	Operational	✓
	EVOS	Operational	✓
	ETT	Operational	✓
	Liquin	Operational	✓
	Advario	2027	2030
	Vopak	t.b.d.	2029
	Chane	t.b.d.	2029
	Vopak (Location undecided)	t.b.d.	>2030

1 — expansion to 90,000 cbm

NEW BUILT AND EXISTING PIPELINE CONNECTIONS

PROJECT (COMPANY)	CAPACITY	PLANNED FID	OPERATIONAL
Open access			
Hydrogen network Rotterdam	1,200 ktpa	✓ 2022	2026
Delta Rhine Corridor*	2,000 ktpa	2026	2032
Hydrogen network Netherlands	2,000 ktpa	n/a	2033
Private (in Rotterdam)			
Air Liquide	confidential	n/a	✓
Air Products	confidential	n/a	✓

* Delta Rhine Corridor at P90 for being operational in 2032

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WELL CONNECTED TO H_2 DEMAND CENTERS IN NORTHWEST EUROPE

Offtakers in this region

Airports
8

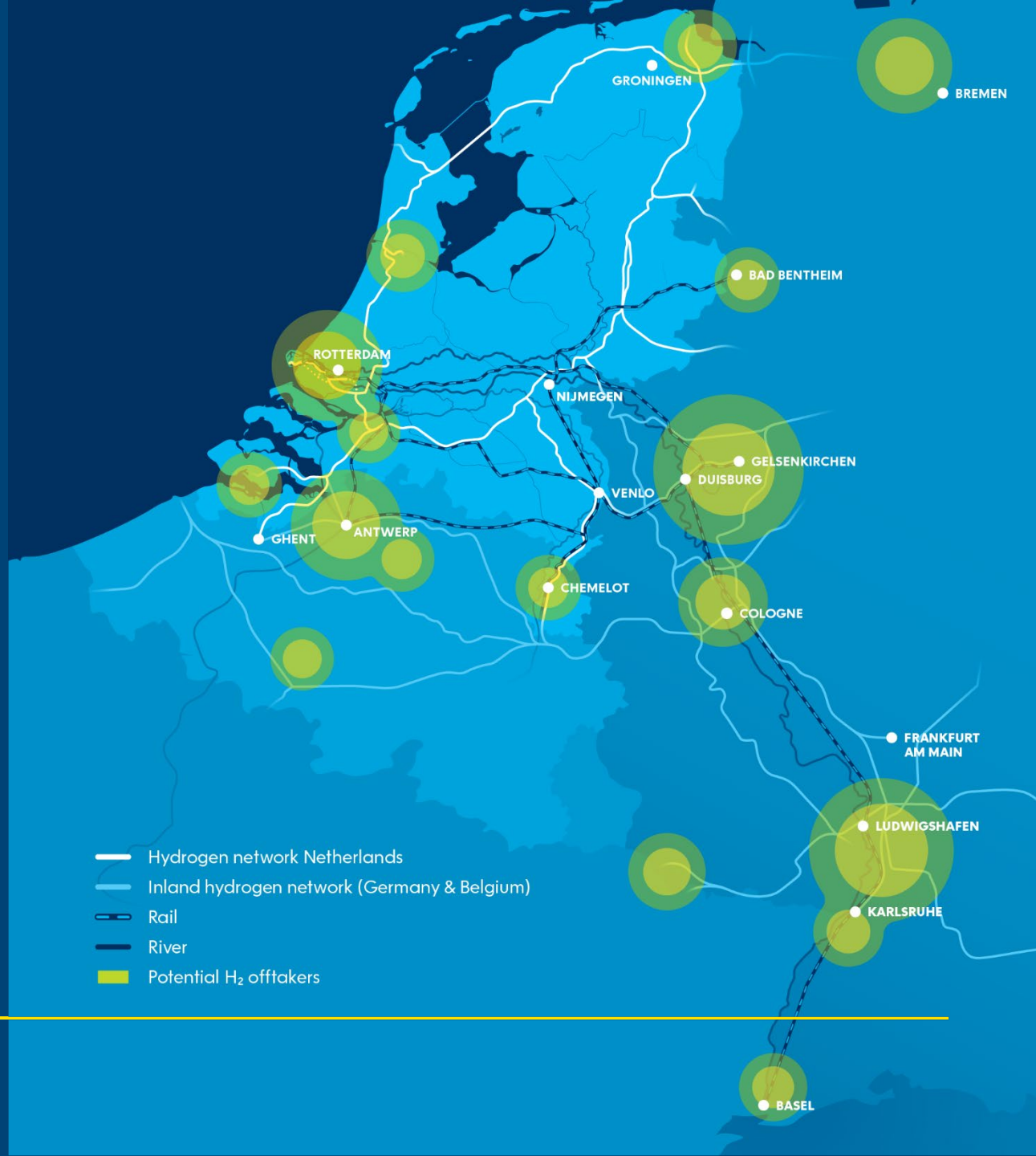
(Bio) Refineries
>20

Steel plants
>6

Chemical Parks
>25

Power Plants
>80

Bunkering
>28,000 vessels



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INLAND DISTRIBUTION

Hydrogen carrier are already distributed inland via barge and rail

91,000
VESSELS PER YEAR

1,000-5,000
SHIP CAPACITY

Multiple
OPERATORS

PRODUCT	# VESSELS	CAPACITY (TONNES)	OPERATIONAL
Ammonia [1]	10	1,000-2,000	✓
Methanol	20	1,000-2,500	✓
LOHC	n/a	3,000	✓
LH_2 (isotainers)			✓
CH_2 (containers)			✓

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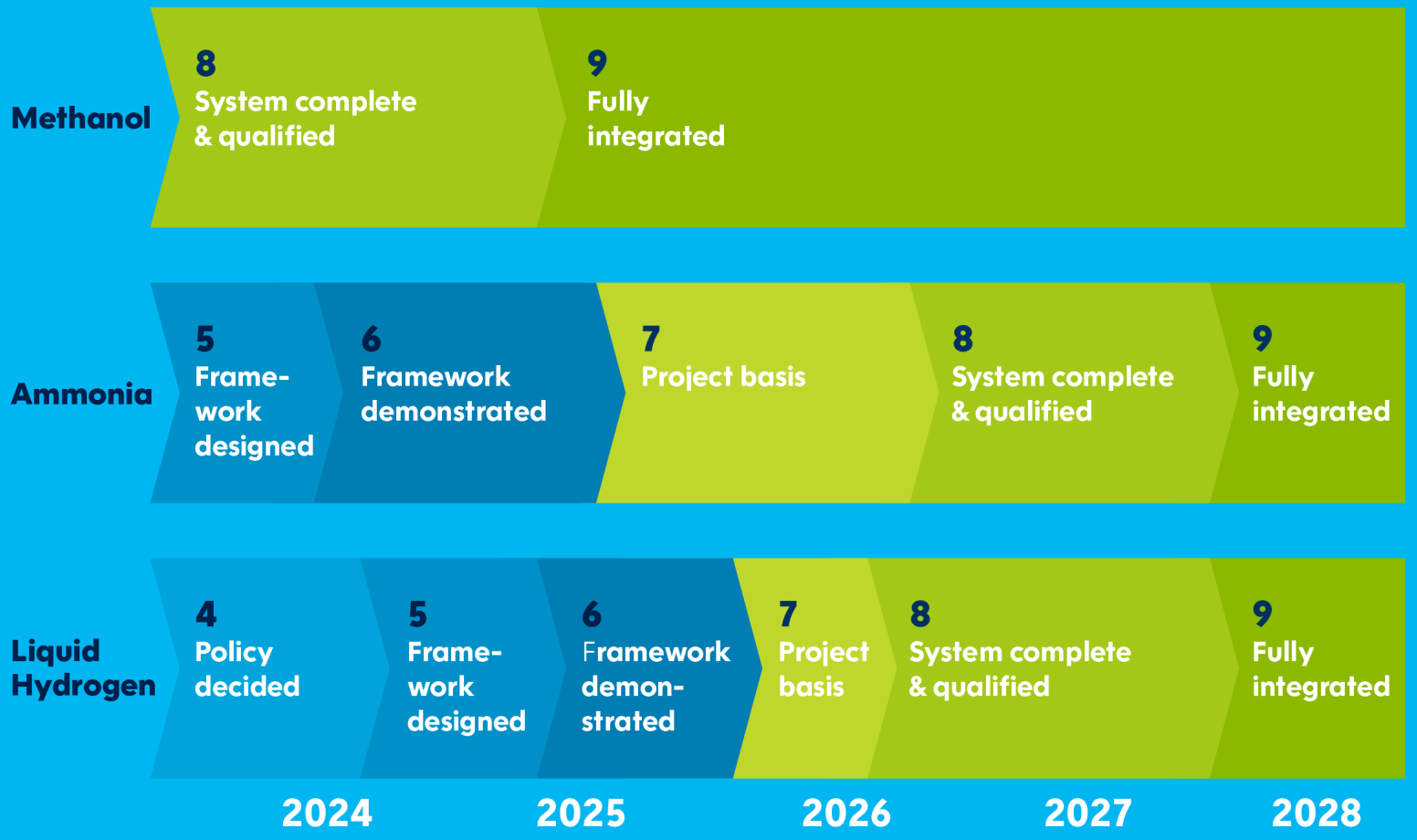
1 — Today pressurised ammonia barges.
Cold ammonia barges are being developed

PROJECTED PORT READINESS FOR SHIP-TO-SHIP BUNKERING

Port Readiness Level (PRL) for marine fuel

Research	PRL 1	Fuel relevance assessed
	PRL 2	Interest of port stakeholders determined
	PRL 3	Sufficient information gathered
Development	PRL 4	Policy for bunkering specific fuel decided, roadmap developed
	PRL 5	Framework for bunkering and associated activities of a specific fuel designed
	PRL 6	Framework for bunkering specific fuel demonstrated in a protected environment
Deployment	PRL 7	Bunkering of specific fuel established on a project base in an operating environment
	PRL 8	System for bunkering of specific fuel complete and qualified
	PRL 9	Bunkering of specific fuel integrated in regular port operations

LNG & fuel oil are mature



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AMMONIA BUNKER PILOT SUCCESSFULLY COMPLETED

Cold Ammonia ship2ship transfer

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LAURA MAERSK

1st methanol bunkering

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Building site Conversion park

Porthos &Hynetwork

Shell Holland Hydrogen 1

Offshore wind landfall

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Construction in progress

Holland Hydrogen 1 isplanned to be operational in 2026. Thispicture was taken March 2025.

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HYDROGEN CONVERSION PARK 2

Zeevonk 1GW electrolyser

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UNIPER H_2 MAASVLAKTE

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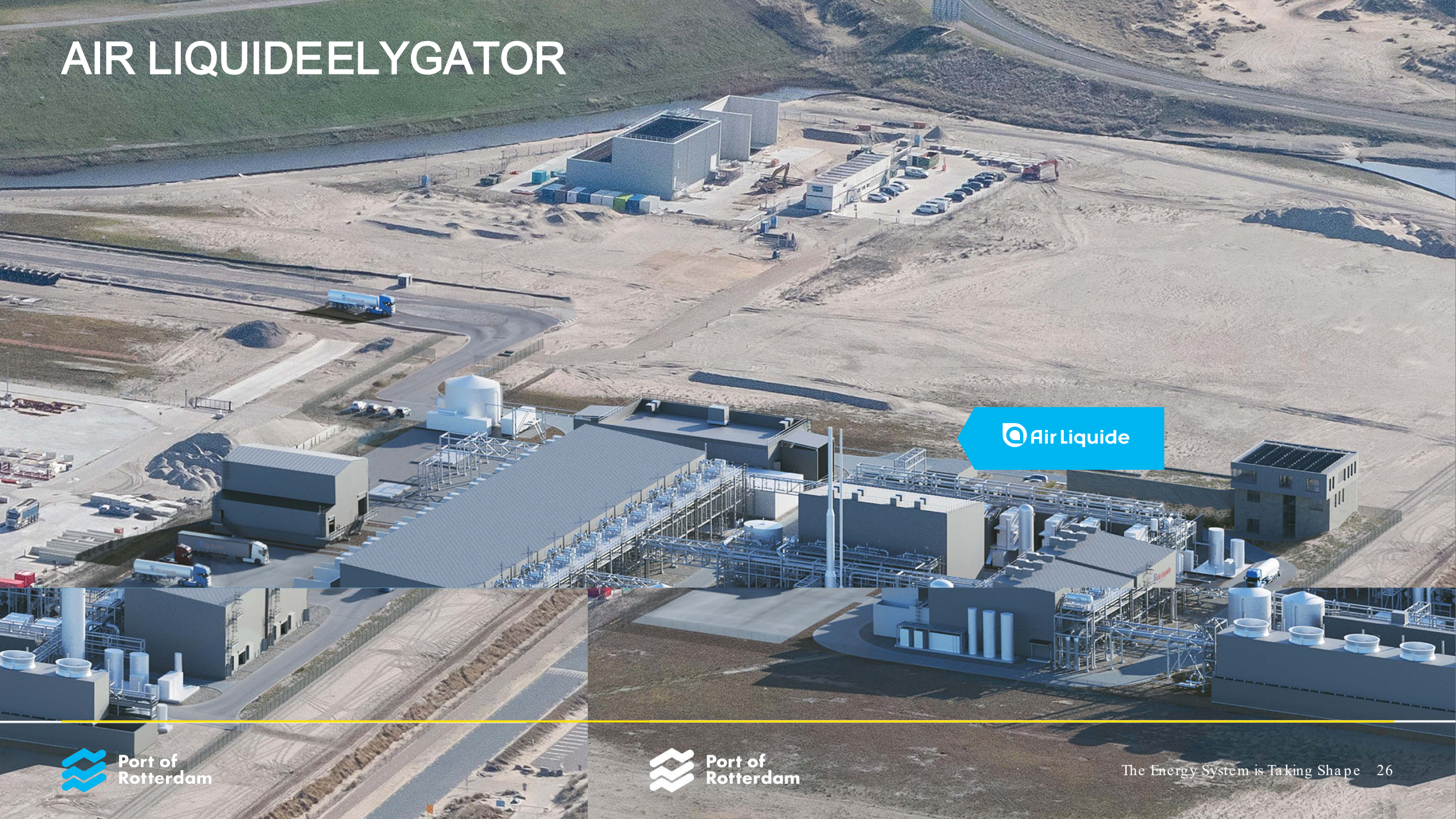
AIR LIQUIDEELYGATOR



ADVARIO AND POWER2X

Methanol Import Hub including Methanol-to-SAF plant

Construction in progress

Hydrogen backbone Rotterdam is planned to be operational in 2026. This picture was taken March 2025.

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PLANNING

2025

Import
First green ammonia imports.

Import
Expansion existing ammonia terminal operational.

Use
First H_2 fueling station for trucks in the Port operational.

Pilot ammonia ship2ship operation.

2026

Production
First 200 MW elektrolyzer operational (Shell Holland Hydrogen I).

Infrastructure
'Hydrogen network' pipeline in the port operational.

Use
First green hydrogen replaces grey in refineries

Use
CCS infrastructure operational (Porthos), grey hydrogen turns blue.

First 'Condor' hydrogen powered inland barges operational.

2028

Production
Conversion Park I elektrolyzer expansions ~400MW.

Import
2nd import terminal for ammonia operational, first ammonia cracker operational.

2030

Production
2,5 GW elektrolysers operational (~0.3 Mton H_2).

Import
0.7-1.7 Mton H_2 imports.

Road transport
1,000 H2 powered trucks.

Import
LOHC imports industrial scale.

2032

Production
First blue hydrogen plant operational using Refinery Fuel Gases.

Import
First LH_2 terminal operational.

Infrastructure
'Delta Rhine Corridor' pipelines to Chemelot, North Rhine-Westfalia operational **(P90)**

Infrastructure
National 'Hydrogen pipeline network' operational.

2035

Production
3,5 GW elektrolysers operational (~0.4 Mton H_2).

Import
4.0 Mton H_2 imports.

APPENDIX

THE PORT OF ROTTERDAM IS READY TO RECEIVE ALL TYPES OF CARRIERS

NH_3

Clean ammonia

One existing terminal. 5 new terminals announced.

Ammonia bunker pilot successfully completed.

CH_3OH

Clean methanol

Multiple existing terminals. Already a European methanol hub.

Commercial bunkering of methanol already available in the port.

LH_2

Liquid hydrogen

2 Feasibility studies for new terminal completed.

LH_2 bunkering is currently being studied for several clients in the port.

LOHC

Liquid organic hydrogen carrier

Conversion of 2 existing terminals.

• • •

Other

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

Sustainable Aviation Fuel (SAF) is also handled at Port of Rotterdam, it is considered a hydrogen based fuel and not per se a carrier

WHY HYDROGEN?

From the perspective of:

Production & storage

Transitioning from fossil energy sources to variable renewables like wind &solar, and decarbonizing fossil energy flows before use.

Electricity is costly and difficult to store in large quantities, and direct use of fossil energy emits CO_2.

Hydrogen, easier to store and potentially in derivatives like methanol, syn-NG, and ammonia, is the next best option from an energy quality perspective.

Demand

Electrification not always possible, available, reliable or still in low level of development.

Hydrogen and/or hydrogen carriers is the best option for:

- Aviation and shipping, heavy trucks.
- (High) temperature heating.
- Feedstock for (bio)fuel & chemicals, steel.

Infrastructure

Spatial use of and costs of electric infrastructure versus hydrogen infrastructure.

Combination of multiple carriers offers optionality and flexibility and serves multiple markets.

Security of supply

Diversification of countries (Expansion).

Diversification of sources: low-carbon (fossil + CCS and renewable).

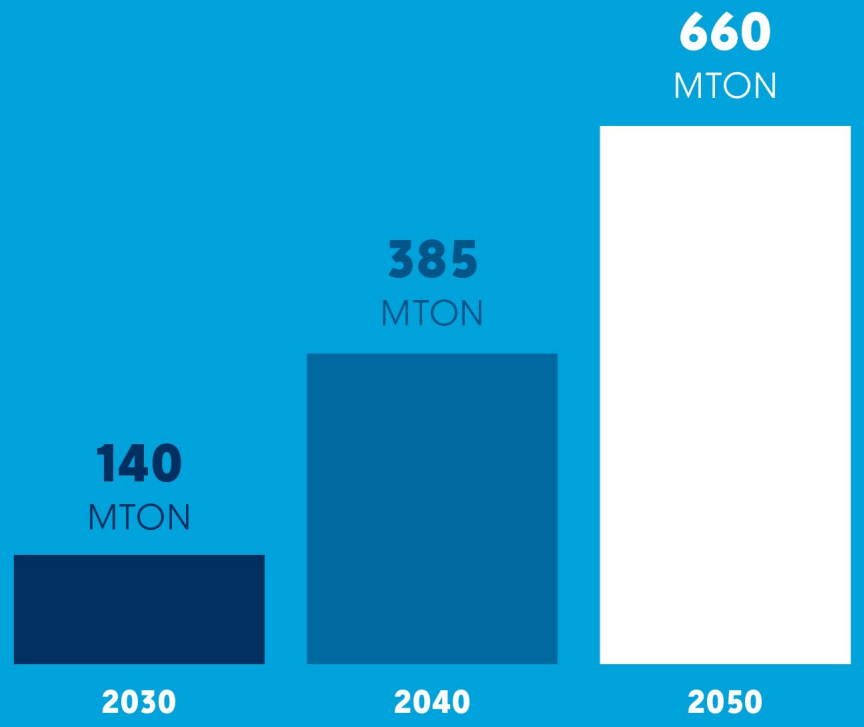
Potential of local production (independent).

Reducing the CO_2 footprint and production of low-carbon products.

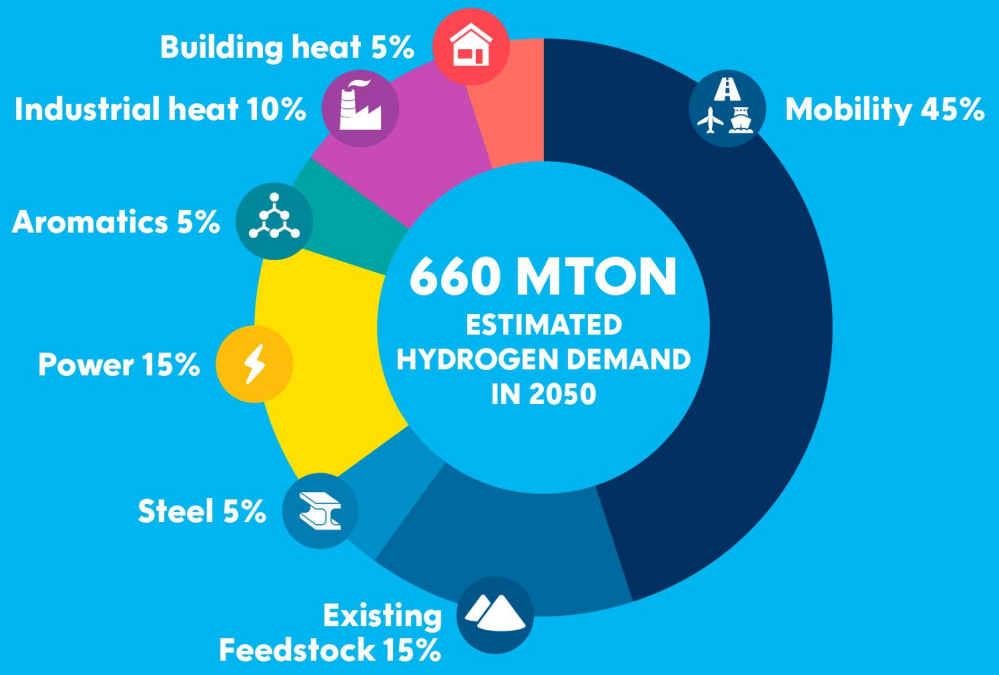
NET ZERO SCENARIO HYDROGEN WORLDWIDE

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)



FUTURE SCENARIOS TOWARDS 2050

Port of Rotterdam has developed possible global scenarios to explore ways forward and prepare for uncertainties ahead in a rapidly changing world.

EXTERNAL DRIVERS (VARIABLE)

- Geopolitical stability
- Government policy
- Consumer behaviour
- Global climate change measures
- Circular economy
- Corporate Social Responsibility
- True cost of production
- True cost of transport

GLOBAL SCENARIOS 2050

- CONNECTED DEEP GREEN
- REGIONAL WELL-BEING
- PROTECTIVE MARKETS
- WAKE-UP CALL

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INCREASING THE CAPACITY OF THE ELECTRICITY GRID

Large renewable H_2 production close to wind energy landfall