An international port's take on hydrogen

The „Hydrogen Alliance Hamburg“

ArcelorMittal

AIRBUS

GREENPLUG

GASNETZ HAMBURG

HHLA

HADAG

MITSUBISHI HEAVY INDUSTRIES

HPA Hamburg Port Authority

VATTENFALL

Wärme Hamburg

Metropolitan Region and Port of Hamburg

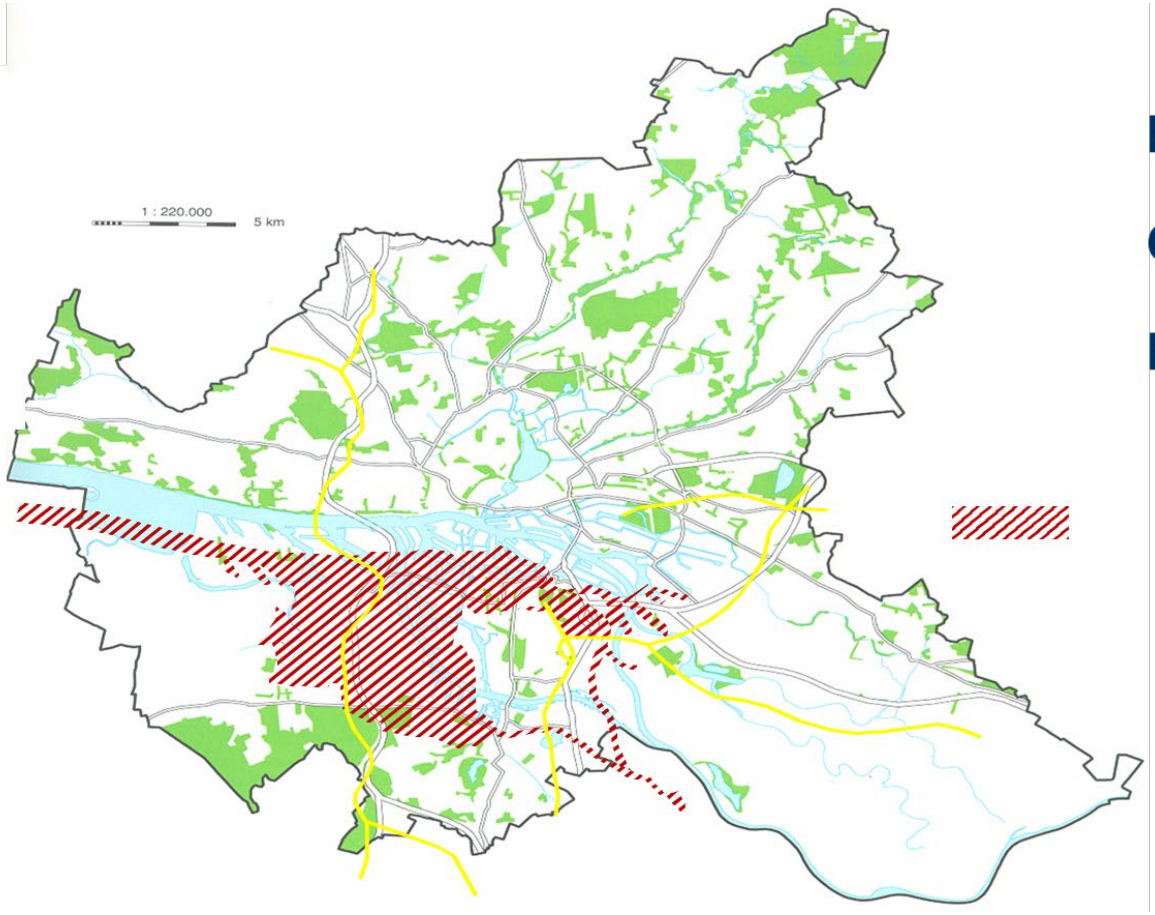
Unique preconditions for highly efficient nucleus of the hydrogen economy

- **Cluster for production, heavy and basic industry**
- **Spatial proximity to North German (offshore) wind farms**
- **Infrastructure for sea and pipeline imports of hydrogen**
  Port, European Hydrogen Backbone
- **Largest European rail port**
  sustainable interface to the European backcountry
- **Largest field for hydrogen applications in heavy logistics**
- **Strong business and research location**

image: Hamburger Hafen und Logistik AG

Metropolitan Region and Port of Hamburg

Unique preconditions for highly efficient nucleus of the hydrogen economy



Extension: 755 km²

City: 1,8 mio. inhab.

Region: 5,2 mio. Inhab.

Port: 72 km²

10% of surface

700 companies

Port Operations, H2-Import and Heavy Duty Logistics

H2Load, HyPA

Refueling infrastructure

Hydrogen applications

Trucks

HHLA

DAIMLER

MAN

Shunters

HPA Hamburg Port Authority

ALSTOM

evb

Ships

Pilot ship & Future launch

HPA Hamburg Port Authority

GREENPLUG

Push boat

Passenger ferry

HADAG

Terminal equipment

HHLA

HYSTER-YALE

KONECRANES

KALMAR

Ferrys and Inland-Shipping

HADAG and Greenplug

- Emission-free operation of five passenger ferries with hydrogen-hybrid power supply
  - conversion of three diesel-hybrid ferries to hydrogen-hybrid power supply
  - newbuilding of two ferries with hydrogen-hybrid power supply
- Including the modification and implementation of the necessary infrastructure
  - hydrogen handling infrastructure
  - operational plant infrastructure

- Potentials for cooperation
  - Technology suppliers for hydrogen-related equipment; i.e. fuel cells and storage racks
  - Resilient supply of gaseous green hydrogen
  - Knowledge exchange with ship owners; e.g. operation and maintenance of maritime fuel cells

  in accordance with European procurement laws

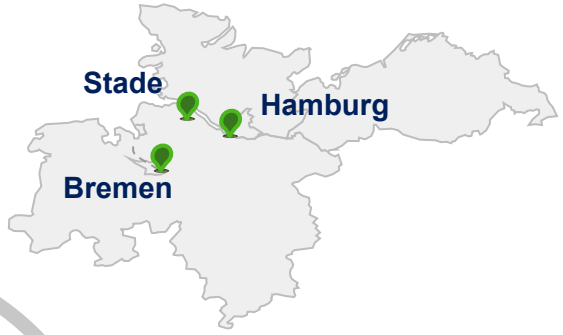
- HADAG, Hamburg, Germany
  - Waterborne public transport operator (public company)
  - 26 vessels, 8 routes, 20 stops
  - 10 Million passengers per year (commuters and leisure)

- Emission reduction goal
  - Reduce CO_2 emissions (per transported passenger) by approx. 50% in relation to the 1990 baseline

Aviation

Airbus WIPLiN Hydrogen in Production and Application

NORDDEUTSCHE WASSERSTOFF STRATEGIE



Hydrogen infrastructure

- Connection Storage Distribution
- Production: Logistics, Energy generation
- 2030 up to -40,000 tons of CO2 in northern Germany

Industrialization of liquid hydrogen (LH2) in northern Germany

- Fuel Cell & Thermal Management
- LH2 Storage & refueling system
- LH2 Integral system

Strengthening European aviation

- Key competencies H2
- Green Aviation
- 2050 up to -55 mil. tons of CO2 in Europe

The WIPLiN project means significant contribution to advancing the hydrogen economy across sectors in the transport and industrial sectors in (northern) Germany.

AIRBUS

Industry

H2Ready: Conversion and operation of the existing DRI plant with addition of hydrogen

ArcelorMittal

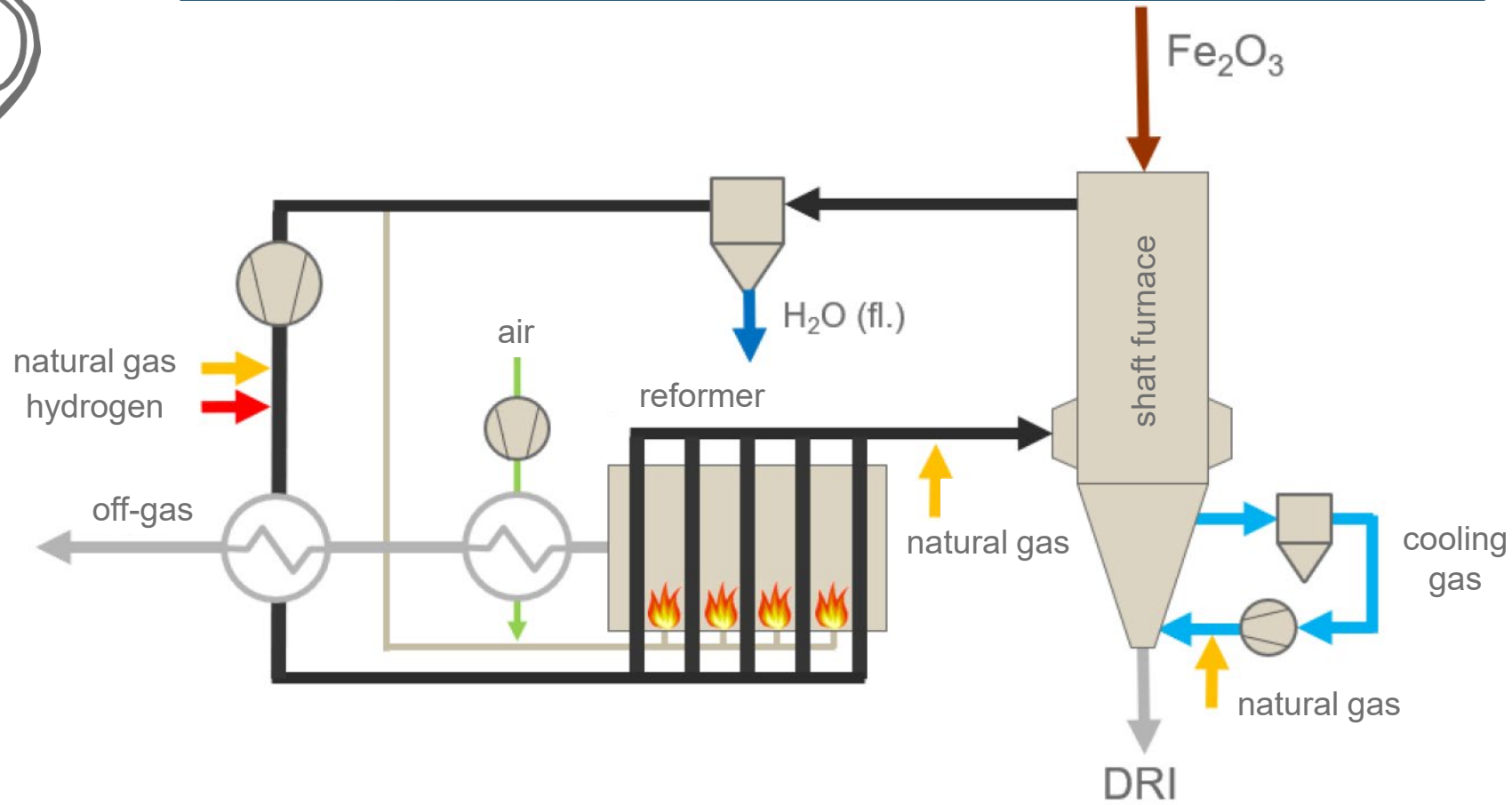
Goal

Production of CO2-neutral steel in Hamburg

IPCEI project

Hydrogen use in existing direct reduction plant for the production of sponge iron as an **intermediate goal on the way to a pure H_2 reduction plant**

- Replacement of 15% natural gas by hydrogen → **100,000 tons of green sponge iron per year** (out of a total of 700,000 metric tons per year)
- **CO_2 savings of 46.000 metric tons per year**
- Plant retrofit and six-month test operation included in 2025

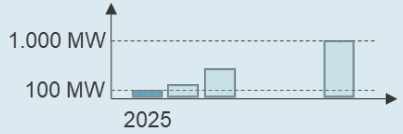


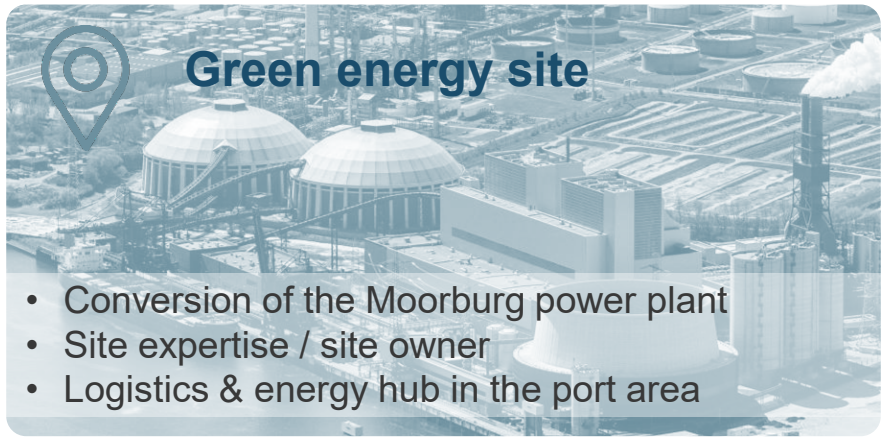
Production

Large-scale decarbonization of industry and transport through the production and use of green hydrogen

100 MW Elektrolyzer
11,500 t H_2 per year

- Commissioning 2025
- scaling potential:





Green energy site

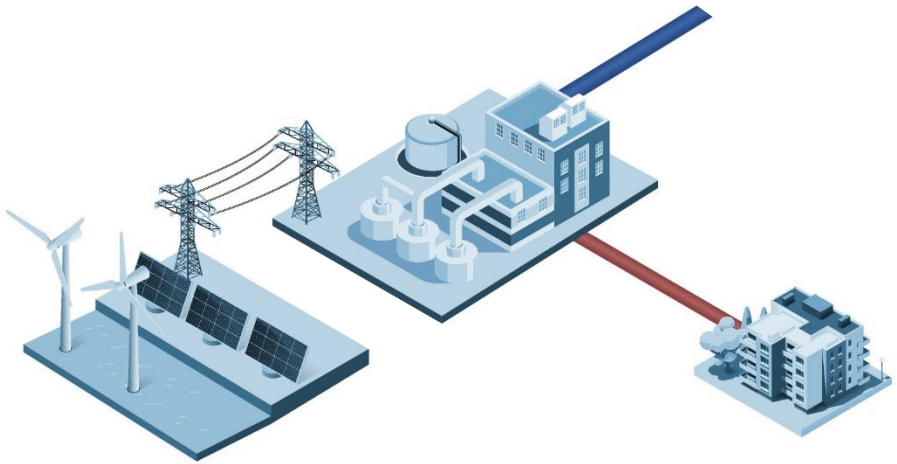
- Conversion of the Moorburg power plant
- Site expertise / site owner
- Logistics & energy hub in the port area

GHG-Reduction
92,000 t CO_2/year

in the sectors
- Industry
- Mobility / Transport
- Households

Renewable Energy

- Direct coupling
  - On-/Offshore Wind
  - Solar
- Existing 380 kV-power connection



End to end integration

- Wide-ranging networking, esp. industry and logistics
- H2 injection: HH-WIN
- Waste heat: Integration into district heating system
- Oxygen: potential industrial application

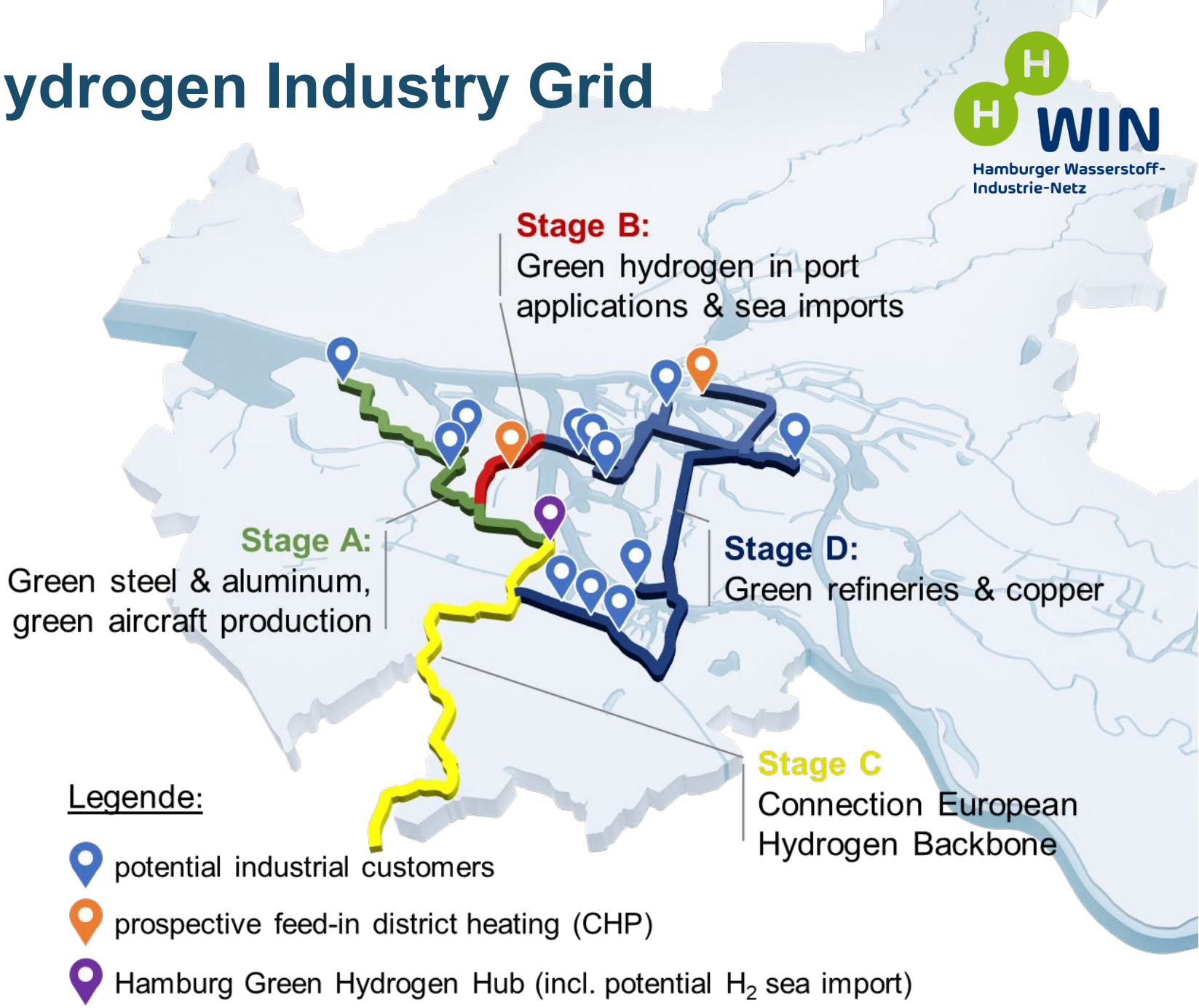
Booster for market ramp-up

- Filling station network and distribution to customers
- Expansion Option hydrogen storage
- Expansion option import/export terminal

HH-WIN: Hamburg Hydrogen Industry Grid

Expansion stages A to D

- A **hydrogen grid** for **industry** and **commerce** in the south of Hamburg (>200 RLM customers with 7.6 TWh)
- with **60 km hydrogen pipeline** around one third of Hamburg's natural gas consumption can be replaced, i.e. **570 million m³ natural gas p.a.** (6.4 TWh at 14 industrial sites)
- **Annual CO2 savings potential**
  ≈ 1.2 million metric tons of CO_2
  14 industrial sites
  > 1,4 million metric tons of CO_2
  all >200 RLM customers

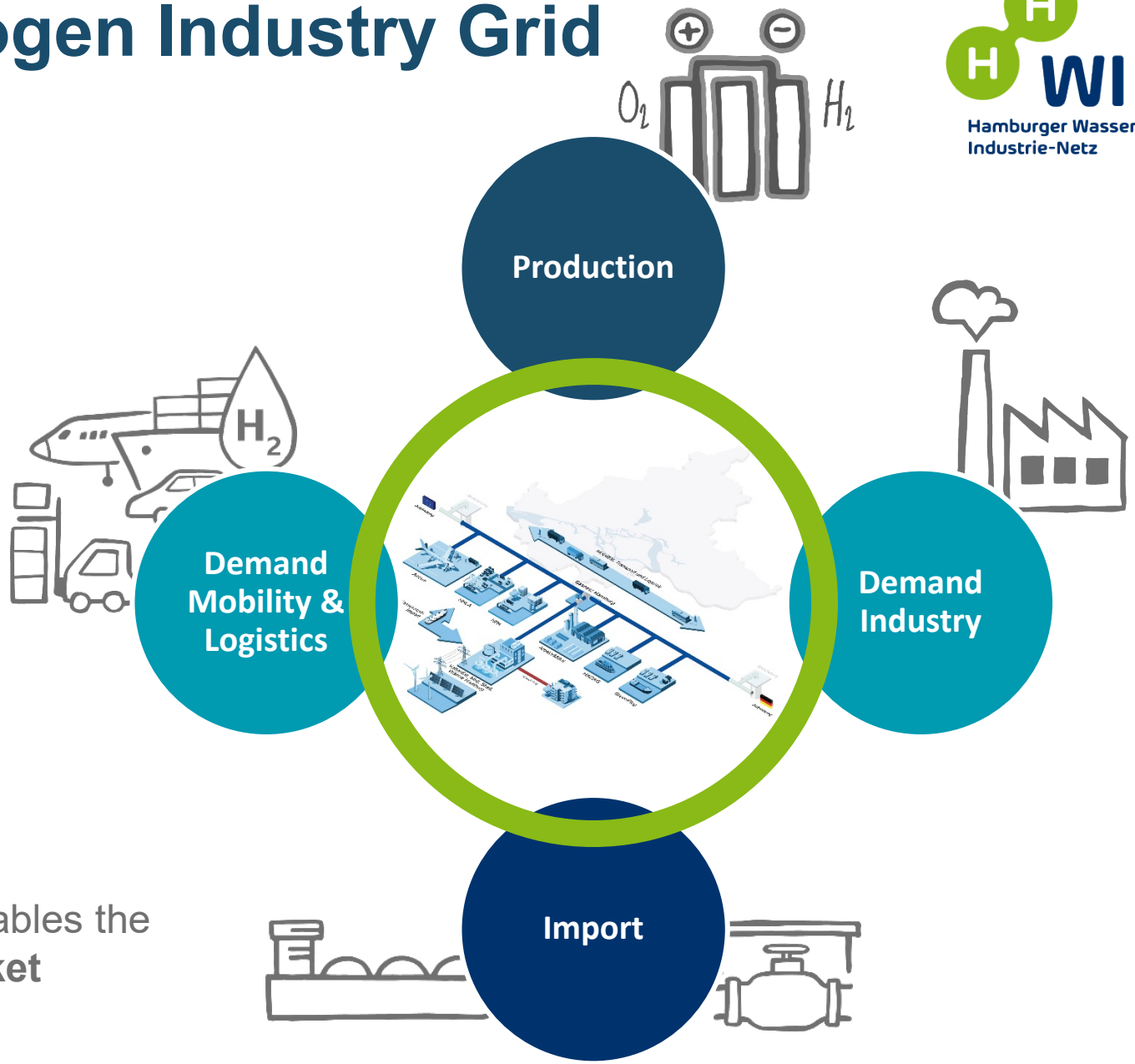


HH-WIN: Hamburg Hydrogen Industry Grid

The Connecting element

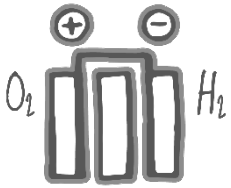
HH-WIN connects:

- **Industrial Sector**
  e.g. ArcelorMittal, Airbus
- **Local Production**
  at former coal power plant site
- **H2 Import via Sea**
- **H2 Import via Pipeline**
  European Hydrogen Backbone
- **Logistics and Mobility Sector**
- **further IPCEI projects**



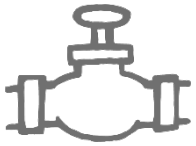
Non-discriminatory grid infrastructure enables the **ramp-up** of a real, flexible **hydrogen market**

Hydrogen Alliance Hamburg – starting Hydrogen



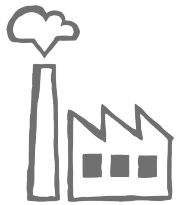
MITSUBISHI HEAVY INDUSTRIES · VATTENFALL · Wärme Hamburg

HGHH



GASNETZ HAMBURG

HH-WIN

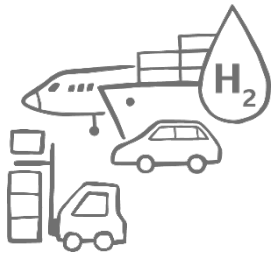


ArcelorMittal

H2H

AIRBUS

WIPLiN



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H2SB | H_2 HADAG | H2LoAD | HyPA

Hydrogen Alliance Hamburg

Covering the entire hydrogen value chain

Production of green hydrogen

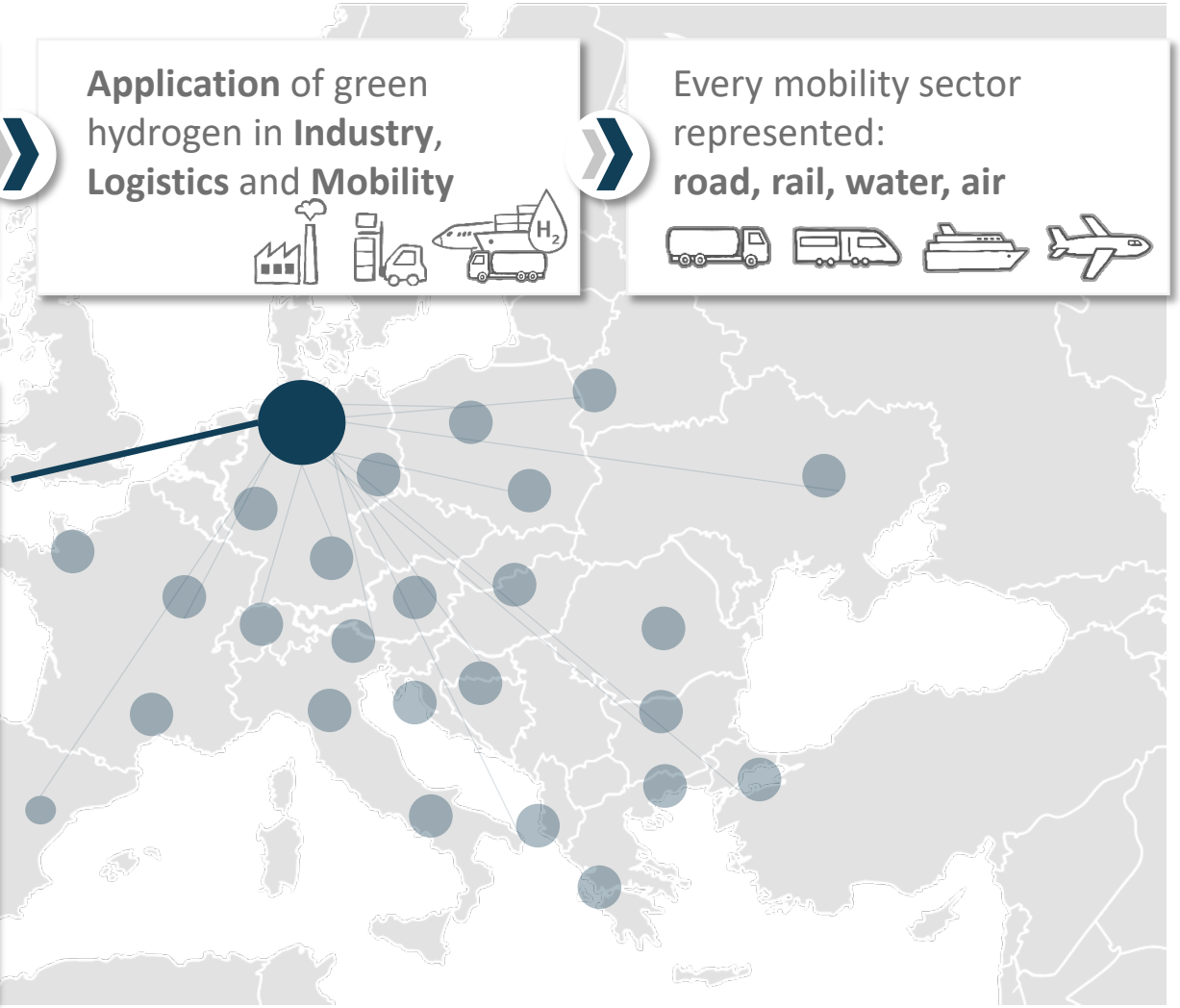
Infrastructure to connect supply and demand

Application of green hydrogen in **Industry**, **Logistics** and **Mobility**

Every mobility sector represented:
road, rail, water, air

image: Wärme Hamburg GmbH

Preparing European upscaling



Thank you

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HHLA DAS TOR ZUR ZUKUNFT