

MARKET INSIGHTS NRW: DEVELOPMENTS AND BUSINESS OPPORTUNITIES IN THE NORTH RHINE-WESTPHALIAN H2- AND FUEL CELL SECTOR

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March 14, 2022 – Market Opportunities in Germany's growing Hydrogen Ecosystem

AGENDA

- ④ NRW and Hydrogen
- ④ Objectives and Projects
- ④ Testimonials and Success Stories
- ④ Conclusion





NRW AND HYDROGEN

NORTH RHINE-WESTPHALIA (NRW)

No.1 energy state in Germany

- ⊗ Population: 18 m; GDP: No.1 in GER
- ⊗ 30% of German power generation
- ⊗ 20% of German transport
- ⊗ 200,000 employees in energy
- ⊗ 200,000 employees in automotive



Source: WDR, Zollverein, Windtest Grevenbroich, RVK

HYDROGEN IN NRW – TODAY:

Industry

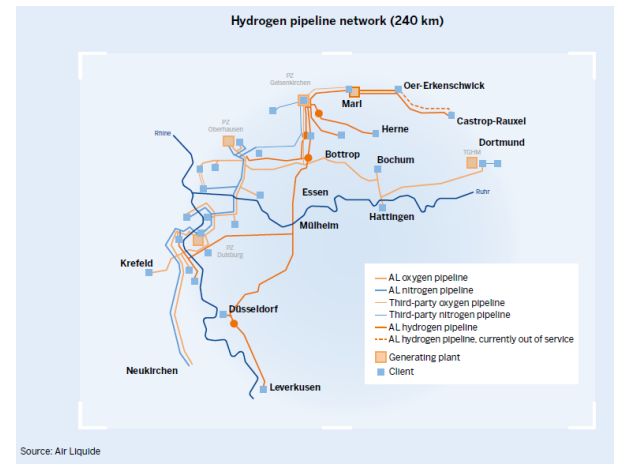
⊗ **Chemical industry, petrochemical industry and others:**
600,000 $\frac{t}{a}$ (1.7 million $\frac{t}{a}$ in Germany) mainly natural gas reforming

⊗ **By-product:**

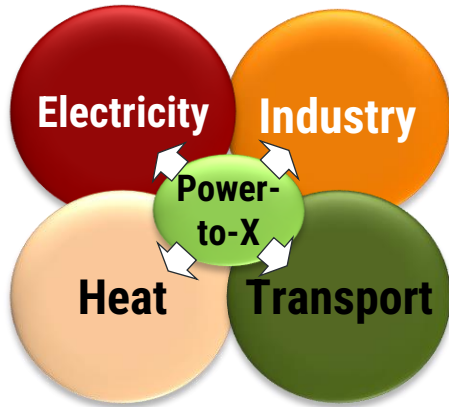
Chlor-alkali electrolysis (potential 35,000 $\frac{t}{a}$),
sufficient for 6,000 fuel cell buses

⊗ **Hydrogen pipeline (> 200 km):**

Length: 240 km
Pressure: 20 bar
Operation: since 1938
Operator: Air Liquide

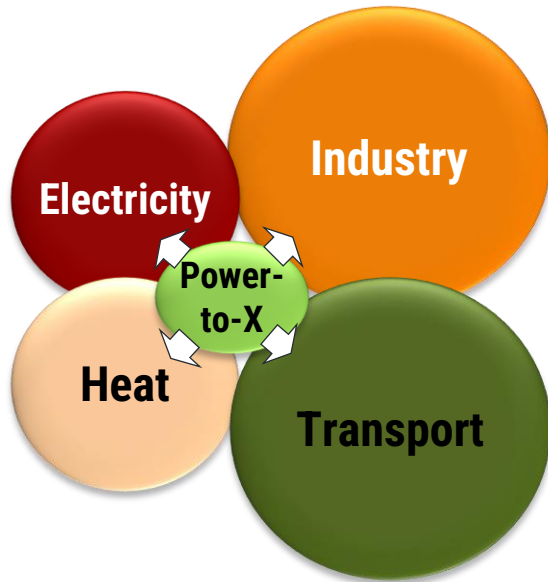


HYDROGEN AT ALL LEVELS



Source: MWIDE

HYDROGEN AT ALL LEVELS



Source: MWIDE

HYDROGEN ROADMAP NRW (2020)

Using hydrogen

- ⊗ **Industry:** Feedstock for energy-intensive industry
- ⊗ **Transport:** Fuel for trucks, buses, ships, aircraft and passenger cars
- ⊗ **Power and heat production**

Producing technology

- ⊗ **Value creation:** electrolyzers, fuel cells, pressure tanks, etc.
- ⊗ Expanding technological leadership and exploiting **export potential**
- ⊗ Up to **130,000 jobs**, especially in the supply industry

Basis: excellent boundary conditions in NRW

Energy infrastructure, repurposing of existing gas pipelines, proximity to North Sea wind site, salt cavern storage, demand industry and transport, manufacturers and suppliers, research institutes and universities





OBJECTIVES AND PROJECTS

OBJECTIVES AND ACTIVITIES NRW

Transport (1)

2025:

- 500 FC Busses for public transport

2030:

- 3,800 FC buses for public transport (45%)



Projects JIVE: Regional Transport Cologne

- 50 buses in operation
- Involved in tests/demonstrations since 2011
- Starting point by-product hydrogen

Source: RVK; WSW



Projects JIVE: Public Utility Wuppertal

- 20 buses in operation
- Green H₂: electrolysis with waste-fired power
- Special approach finds many followers

Bus initiative by VdV (association) and NRW Ministry

OBJECTIVES AND ACTIVITIES NRW

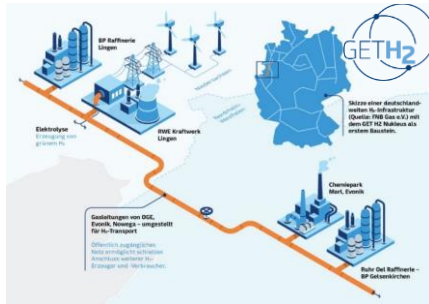
Energy and Infrastructure

2025:

- 500 km of H₂ pipelines, 120 km in NRW
- > 100 MW electrolysis capacity in industry

2030:

- H₂ pipelines 240 km in NRW
- 1 to 3 GW electrolysis capacity in NRW



GET H₂ Nucleus in Lingen and Ruhr

- 130 km grid with 100% H₂ to Ruhr area
- > 100 MW electrolysis for green H₂
- Production start: end of 2024

REFHYNE, Shell at Cologne refinery

- Use of green H₂ for refinery process & refuelling
- 10 MW electrolyser: 1,300 t of $\frac{H_2}{a}$
- In operation since July 2021

Source: GET H₂; Shell

HYDROGEN MODEL REGION/MUNICIPALITY IN NRW

- ⤵ Funding for feasibility studies (2018)
- ⤵ **Winner Düsseldorf**
„Düsel.Rhein.Wupper“
- ⤵ More than 30 municipalities with concrete hydrogen activities, e.g. **HyExperts** in national program NIP
- ⤵ Regions prepare **implementation** of H₂



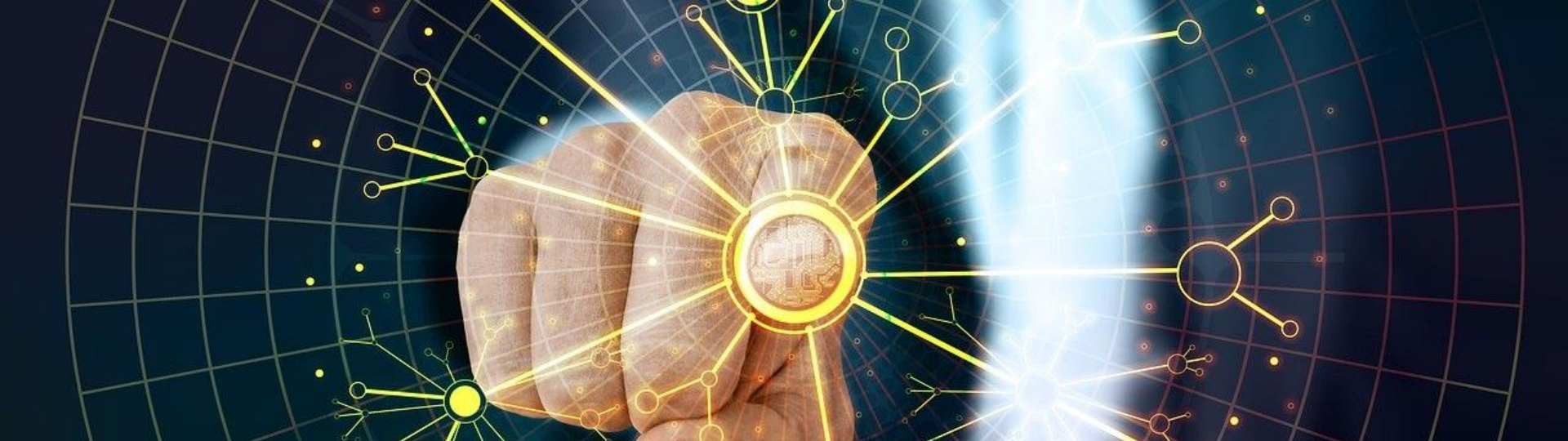
TECHNOLOGY AND INNOVATION CENTRE HYDROGEN TECHNOLOGIES IN DUISBURG

(ITZ West)

Competition of National Ministry of Transportation (BMDV)

- ⊗ Centre for Fuel Cell Technology (ZBT) as lead institute
- ⊗ Inspection, test and know-how centre for fuel cell-based propulsion systems
- ⊗ Applications: commercial logistics (shipping, rail, road and public transport)
- ⊗ NRW state government supports with up to 50 million Euros, BMVI with 60 million Euros
- ⊗ Over 100 companies, research institutions and associations involved





TESTIMONIALS AND SUCCESS STORIES

INTERNATIONAL REFERENCES OF NRW

- ① Asahi Kasei in Herten
- ① Mitsubishi Power in Essen
- ① MoU with Fukushima Prefecture
- ① MoU with Osaka Prefecture
- ① Settlement of Cummins in Herten
- ① Settlement of Plug Power in Duisburg



Quellen: Asahi Kasei, GWI, h2-netzwerk ruhr, EnergieAgentur.NRW, MWIDE NRW, Hans Blossey / dws Werbeagentur GmbH



CONCLUSION

ADVANTAGE NRW ...

Active NRW State Government

Regions and municipalities

Funding instruments

Research institutes, test centres



NRW and regional networks and clusters

Enterprises (manufacturer, supplier, user)

... in cooperation with partners from Japan!

TÜV NORD HYDROHUB – OUR 360° HYDROGEN STRATEGY

H₂ Production



- Price modeling
- Engineering support
- Safety engineering
- Strategic and financial consulting
- Technical assessments

Grid Operators



- Operating strategies
- IT security
- Operational monitoring and surveillance
- Route and pipeline engineering (routes and caverns)

Industrial H₂ Users



- Consulting and engineering in the field of plant, process and industrial engineering
- H₂ site concepts (technical, economic)
- Operator's obligations management

H₂ in Mobility



- Range calculations
- Consulting on investments in H₂ vehicle fleets
- CO₂ footprint calculations

Public Sector



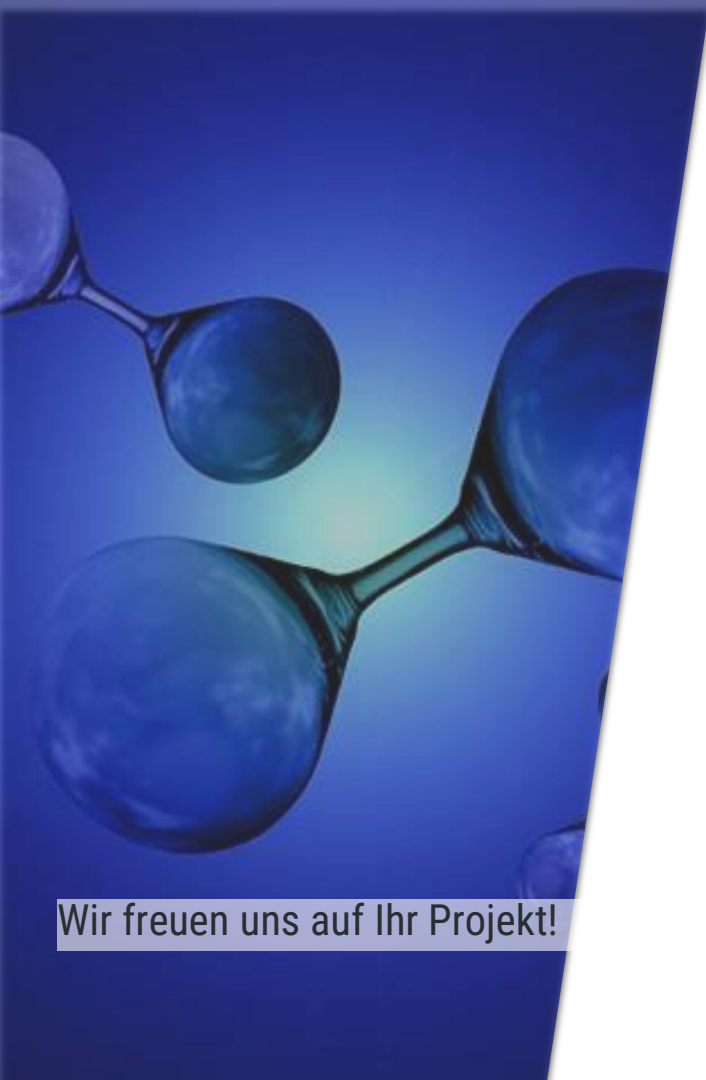
- Creation of local roadmaps
- Legal issues
- Environmental expertise

Investors



- Assessment of sustained value of concepts
- Due diligence
- Financial engineering
- Business models





Wir freuen uns auf Ihr Projekt!



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