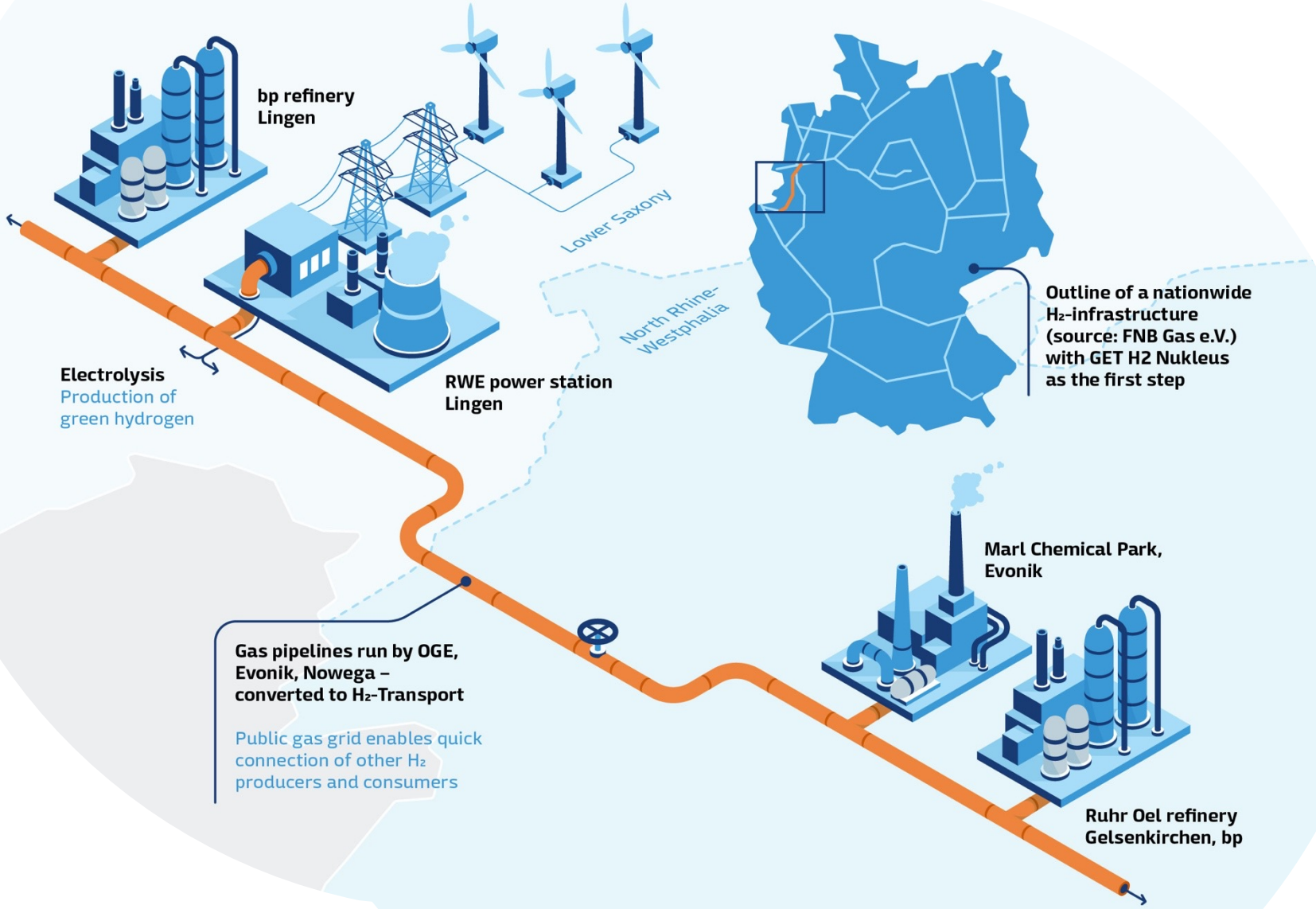
Kickoff for the H_2 Economy in Germany

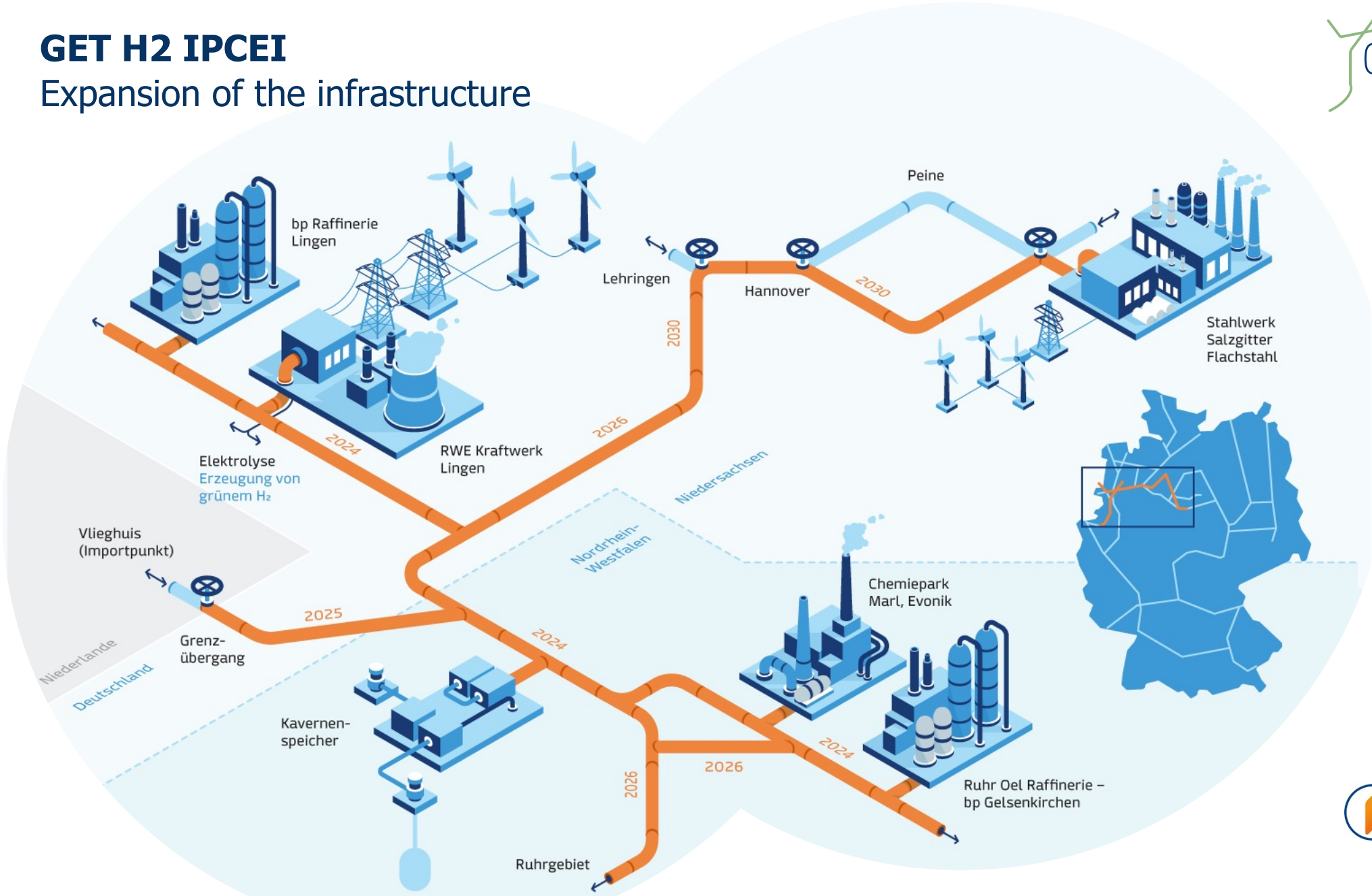
GET H2 Nukleus

The first dedicated H_2 infrastructure with non-discriminatory access



GET H2 IPCEI

Expansion of the infrastructure



GET H2 Nukleus

Reflection of the entire H_2 value chain

1 Production of green hydrogen at the RWE power plant site in Lingen using an electrolyzer **with a capacity of** at least 100 MW.

2 Conversion of existing gas pipelines of Evonik, Nowega and OGE to the **transport of 100% hydrogen**, additionally partial new construction of Evonik.

3 Transport of hydrogen via this **infrastructure** to the Evonik chemical park in Marl and BP refineries in Lingen and Gelsenkirchen.

4 Use of the green hydrogen in the existing production processes and as a result **significant reduction of CO_2 emissions**.

GET H2 Nukleus
Key facts

H_2 demand (acc. to NEP scenario 2020)

- bp refinery Lingen: up to 50,000 m³/h
- Marl Chemical Park, Evonik: up to 50,000 m³/h
- Ruhr Oel refinery Gelsenkirchen, bp: up to 80,000 m³/h

H_2 generation

- RWE Lingen: 100 MW electrolyzer, initially 22,000 m³/h, capacity increase along with increasing customer demand

Existing gas pipelines

- Converted for transport of 100% H_2

H_2 Cross-network operator market model

- Uniform regulations for all customers already in the early years of the hydrogen economy
- Patterns for future industry solutions

Target date for the transport customers

- Ready to operate at the beginning of 2024
- Temporary feed-in from existing H_2 production as back-up possible at all three sites (~ 80,000 m³/h)
- Connection to Epe gas storage facilities and existing H_2 transport system in the Ruhr area in Marl technically possible

bp EVONIK Leading Beyond Chemistry Wir transportieren Gas. nowega OGE RWE

Hydrogen offtake: Green hydrogen in refineries

1 Refineries are already among the **world's largest consumers of hydrogen**. Grey hydrogen, which releases CO_2 during its production, has so far been used.

2 The **use of green hydrogen is possible in the short term** – and thus a significant reduction in CO_2 emissions. An **economic gap** currently prevents this.

3 Nevertheless, no one is **as close to the economics** of using green hydrogen on an industrial scale as refineries. They are therefore **crucial for financing the system ramp-up of the hydrogen economy**.

4 The **profitability gap can be closed** by legal adjustments.

5 The refineries are therefore predestined to **drive forward the development of technology** and to develop the **transport infrastructure for the market as a whole** during the market upturn.

Create essential legal prerequisites for an H_2 economy before the German election and lay European foundations

GETH2 Nukleus

1a

EEG: Charges/ levies

- EEG 2021
- Exemption
- BesAR simplification
- Impact on CHP/offshore

Pending: Green Electricity Ordinance § 93 → Deadline June 2021

1b

EEG: Project company & levies

- Def. "company" in the EEG excludes H_2 joint ventures.
- Clarification: for the purposes of § 64a and § 69b, any legal entity producing H_2 applies.

Pending: clarification in EEG necessary

2

RED2: BImSchG and 37.BImSchV

- BImSchG Feb2021 → BT
- Creditability H_2, Ambition (22%), SAF ratio: positive

Pending: 37. BImSchV → Deadline?

3

Hydrogen networks/ EnWG

- EnWG Feb2021 → BT
- Funding instrument?
- Uniform network charges for gas and H_2?

Netzwork charges uncertain situation → Deadline June 2021

4

Delegated act criteria green electricity

- RED2 Art27
- Pragmatic criteria necessary (additionality, temporal/spatial correlation with EE)

Pending: KOM draft → Deadline Dec 2021

5

Investment aid for Early Mover

- Early movers at a disadvantage due to steep learning curves
- H_2 strategy June 2020 with substantial subsidies

Motions filed: IPCEI, EU IF

?

Federal level

EU level

BERLIN: Implementation of EEG levy reduction with Green Electricity Ordinance; no excessively narrow electricity procurement criteria

1a

Goal: Make the EEG apportionment as H_2-supportive as possible

1. § 93 EEG Green Electricity Ordinance only for full exemption § 69b
2. No limitation of full load hours; instead, create incentives for grid-serving operation through further measures
3. Company definition: consider project companies for § 64a and § 69b
4. Reduction of redistribution both for post-EEG plants and for plants in 'other direct marketing'.
5. The electricity consumption taken into account for full exemption should correspond to the BesAR regulation.
6. EEG full exemption only with 100% renewable electricity; guarantees of origin (GoO) sufficient

EEG/BERLIN: Clarification H_2 joint ventures
BesAR § 64a / full exemption § 69b also for H_2 project companies

1b

Goal: Make the EEG apportionment as H_2-supportive as possible

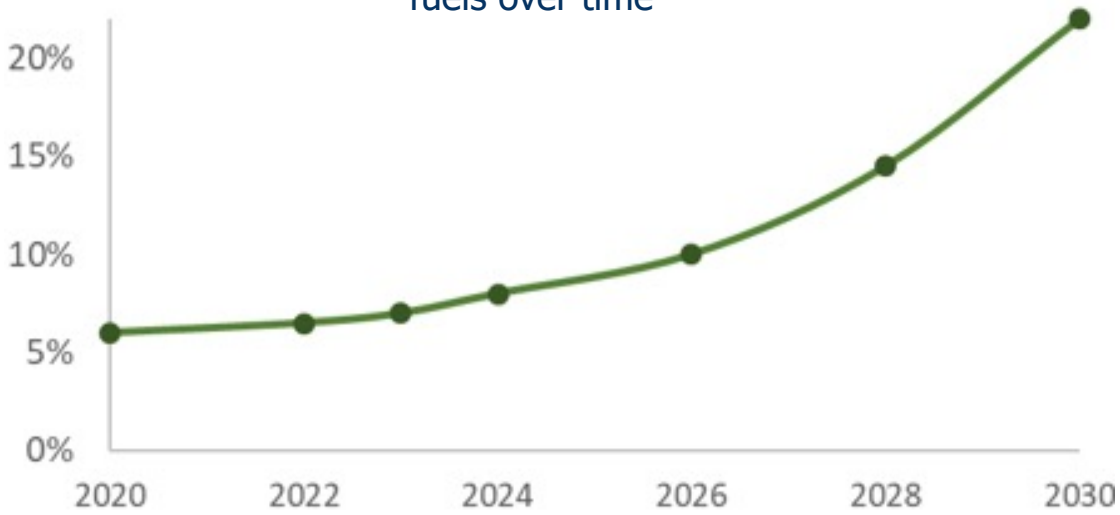
1. Limitation of the EEG levy §§ 64a, 69b EEG 2021 linked to the EEG's definition of an enterprise (§ 3 No. 47)
   → Individual enterprises or (non-)independent parts of individual enterprises that operate in established markets and participate in general economic transactions there.
2. H2 joint ventures but in the market ramp-up phase primarily production/supply of investment partners, no sales to third parties, market hardly exists; limited staffing etc.
   → Limitations §§ 64a, 69b legally uncertain.
3. Clarifying addition to the term "enterprise" in EEG § 3 No. 47 necessary. "Enterprise" = ... every legal entity that operates a business operation established in a commercial manner according to its type and scope, with participation in general economic transactions and with its own intention to make a profit; *for the purposes of a limitation under section 64a or a reduction under section 69b, an undertaking shall be any legal entity producing hydrogen.*

Implementation of RED II in the transport sector: Ambitious, but the central element is (still) missing

2

- **Ambitious GHG reduction rate of 22% in 2030**
- Multiple crediting of hydrogen, also in relation to the other fulfilment options.
- Correction factor if market ramp-up of electromobility is faster than expected
- Synthetic paraffin quota of 2% in 2030
- **But: 37th BImSchV is missing - without it, hydrogen cannot be credited**

Mandatory greenhouse gas reduction for fuels over time



Regulation of hydrogen networks:Focus on conversion of transport from natural gas to H_2

3

Goal: Rapid and legally secure entry into the development of a national hydrogen infrastructure

- Clear definitions: hydrogen networks, network operators
- Basic obligation to cooperate
- Unbundling requirements: Separation of networks from H_2 production and distribution
- Transfer of rights of way/basic services/ planning law

Unresolved issues:

- Network development planning: integrated planning of gas and hydrogen networks
- Introduction of uniform network charges for gas and hydrogen networks
- Medium-term: develop sector solutions for network access (analogous to natural gas)

BRUSSELS/RED2 Deleg. legal act Art27: Requirements for green H_2: No deceptive solution, no excessively narrow electricity reference criteria

4

Goal: Availability of sufficient quantities of RES-E at reasonable conditions through

- Additionality: existing plants can also be taken into account.
- Spatial proximity: same market area, no aggravation of structural network bottlenecks in neighbouring market areas.
- Temporal correlation: weekly or monthly balancing

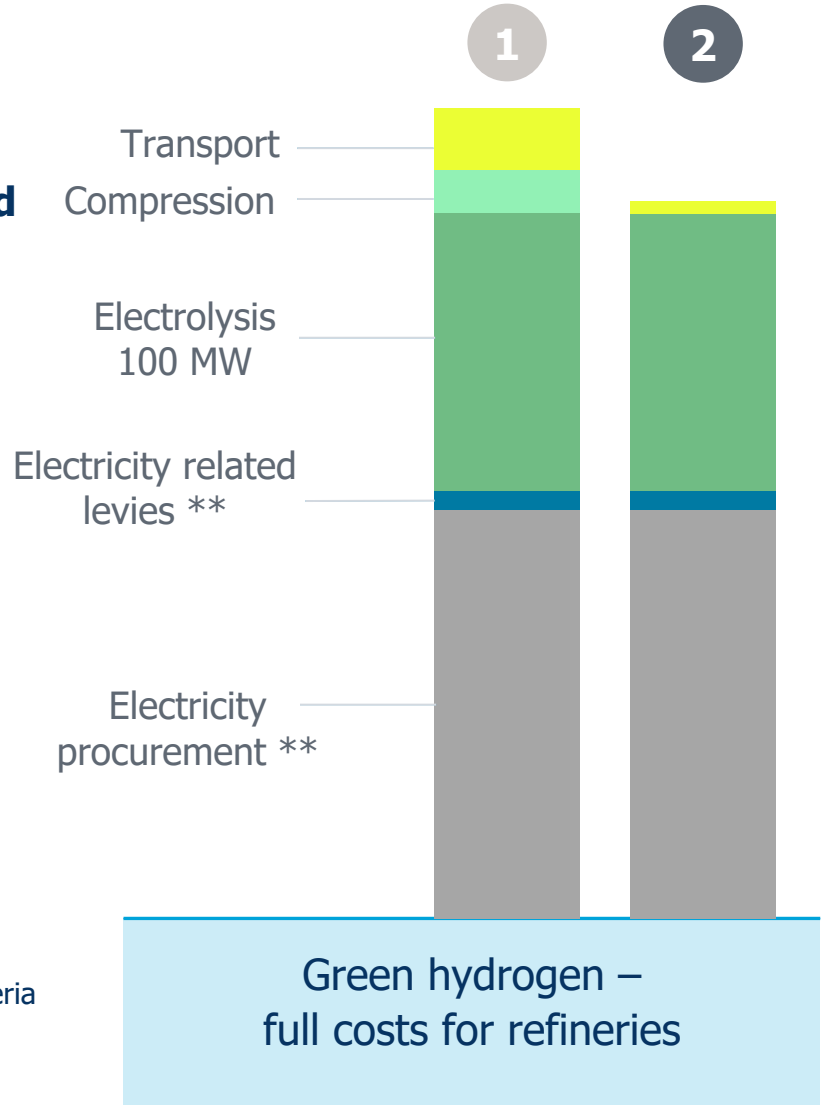
A focus on simultaneously constructed, unsubsidised new plants with ¼-hour correlation of electricity generation and electrolysis operation would extremely restrict electricity procurement

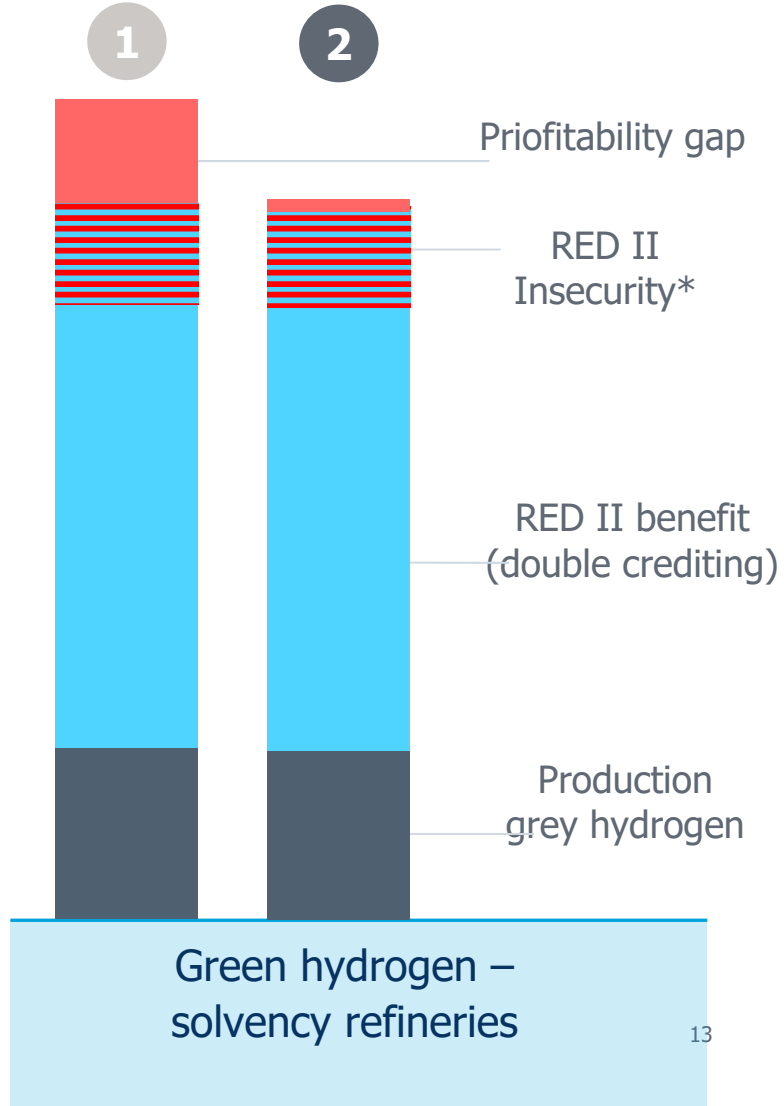
Example GET H2 Nucleus: Regulatory impulses can bring the project close to economic viability

Framework conditions:

1. **Separate hydrogen grid fee plus costs for compression vs.**
2. **uniform gas and hydrogen grid fee**

- **Apportionment exemption** according to current EEG amendment
- **Double creditability** of green hydrogen **within RED II** in accordance with cabinet decision
- **CAPEX subsidy** for electrolysis, transport/compression assumed





* Amount of the RED II benefit still unclear, as it depends on national implementation and the costs of other compliance options.
** Dependent on meeting the electricity purchase criteria for obtaining the EEG levy exemption for green hydrogen.

Key economic parameters

Regulatory factors:

- Largest influence: Creditability of green hydrogen to RED II
- Second largest impact: national implementation with multiplier for green hydrogen
- Third largest influence: Level of the ancillary electricity costs
- Fourth largest influence: Network costs - of which the highest influence: Network utilisation

→ Required funding depends on the structure of the regular funding programme influencing factors.

Investment costs:

- Electrolysis system approx. 120 Mio. €
- Compressor system approx. 20 Mio. €
- Transport system upgrading approx. 60 million € - of which approx. 30 million for the transport network and approx. 30 million for industrial customers

Hydrogen transport in Germany
Safe alternative

Experience of the project partners

- Safe operation of 230 km grid with 100% hydrogen (privately operated between Marl-Cologne) for 70 years
- 2019 commissioning of H_2 network (Godorf, Wesseling, Kalscheuren) by converting existing lines
- Existing H_2 pipelines are identical in construction to the majority of the pipelines used for other gases

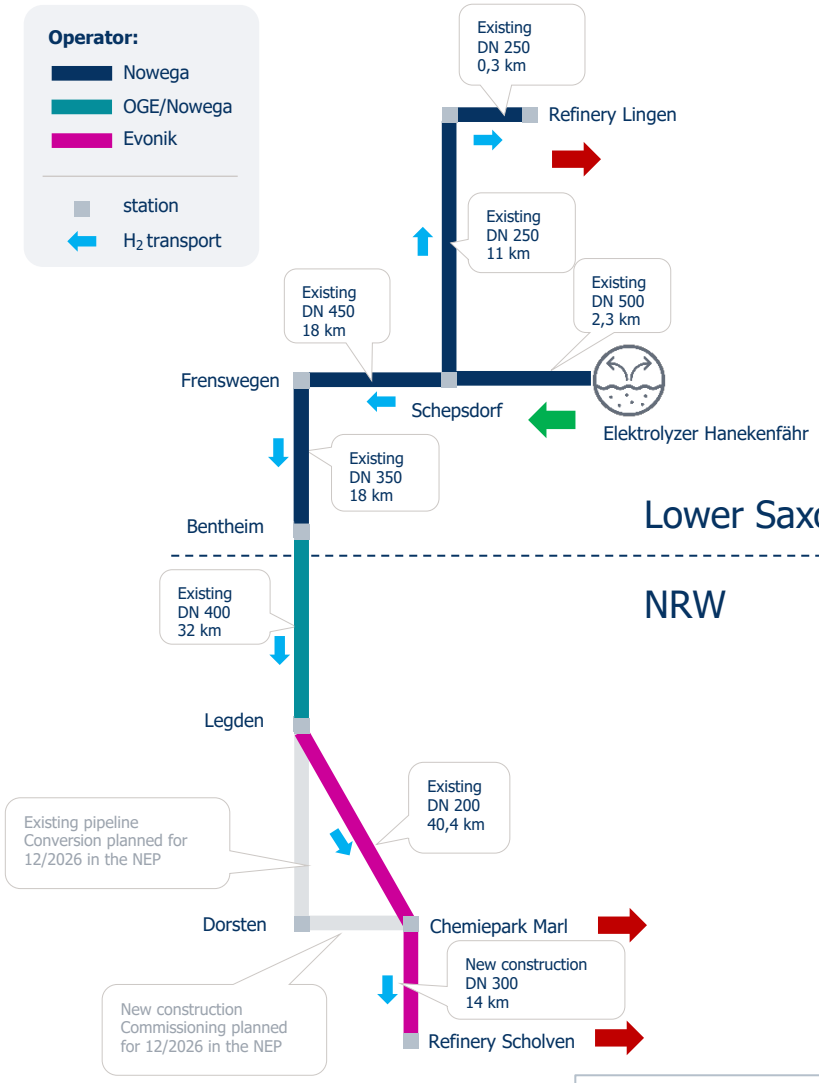
Scientific basis

- Studien zur Eignung der Leitungen im Gas-Fernleitungsnetz für die Umstellung auf Wasserstoff liegen vor

Detailed technical regulations of the DVGW for H_2 pipelines (new construction and conversion)

- Proof of compatibility of the materials used in all components for operation with H_2 required
- Proof of sufficient dimensioning of pipelines for max. operating pressure and operating load change required
- Pipelines to be equipped with cathodic corrosion protection
- Participation of independent experts (e.g. TÜV) required to confirm compliance with the requirements
- After, continuous monitoring of the pipeline network (similcommissioningar to natural gas pipelines)

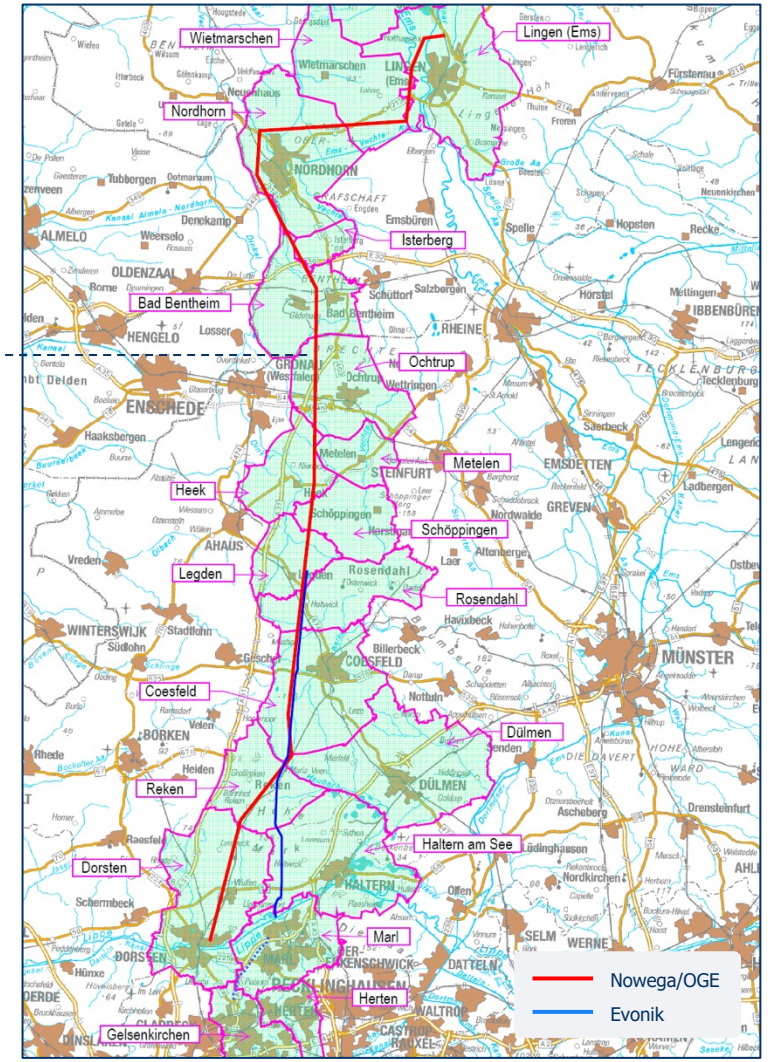
GET H2 Nukleus | Nukleus in detail



Lower Saxony

NRW

Up to DN 250 < 300 mm
From DN 300 > 300 mm



Numerous components have already been initiated

H_2 production und feed-in

- Site preparation and technical planning of the 100 MW electrolyzer in Lingen is underway.
- The feasibility study for the construction of the hydrogen feed-in station has been completed.
- The grid connection application for the feed-in of green hydrogen in Lingen has been submitted.

Authorisation

- The exchange of information with the approval authorities for the pipeline conversion, the new pipeline construction and the construction of the electrolyzer has started.

Pipeline conversion and construction

- Preparation of first measures for the conversion of existing natural gas pipelines to hydrogen will be undertaken.
- TÜV studies for the first of the pipelines to be converted are available.
- Construction of the connecting pipeline from Evonik's Chemical Park in Marl to bp's refinery in Gelsenkirchen-Scholven will begin in August 2020.
- The technical planning for the preparation of the bp Lingen grid connection point for the acceptance of the hydrogen has started.

The GET H2 initiative

GET H2 initiative

Platform of partners who support the goal of **building a nationwide H_2 infrastructure** and the implementation of the necessary regulatory changes.

Support Partners

EVONIK Leading Beyond Chemistry · nowega (Wir transportieren Gas.) · GASCADE · bp · BASF We create chemistry · ENERTRAG Eine Energie voraus · OGE · Thyssengas · uniper · H2 GREEN POWER & LOGISTICS · RWE

Associated Partners

SALZGITTER AG Stahl und Technologie · EMERGY · Air Liquide · ZBT · SIEMENS · Emsland Zuhause bei den Machern. · hydrasun · gwi · Bock Handelsvertretung · ALSTOM · IKEM · dralon · JÜLICH Forschungszentrum · 2G · Kraftanlagen München · Stadt Coesfeld · ROSEN empowered by technology · WIN Emscher-Lippe GmbH · ITAD · Kreis Steinfurt · Salzgewinnungsgesellschaft Westfalen · SWO Netz GmbH · Kerpen · hydrogenious LOHC Technologies · GMH Gruppe · Deutsche Post DHL Group · creos · IHK Nord Westfalen · Wirtschaftsbetriebe Duisburg · WESTNETZ · TU Clausthal · Stadtwerke Lingen · Messer Gases for Life · Technische Universität Berlin · E&R Energie und Ressourcen · IHK Industrie- und Handelskammer Emsland – Grafschaft Bentheim · ENGIE · Stadt Lingen EMS

Flagship project: GET H2 Nukleus

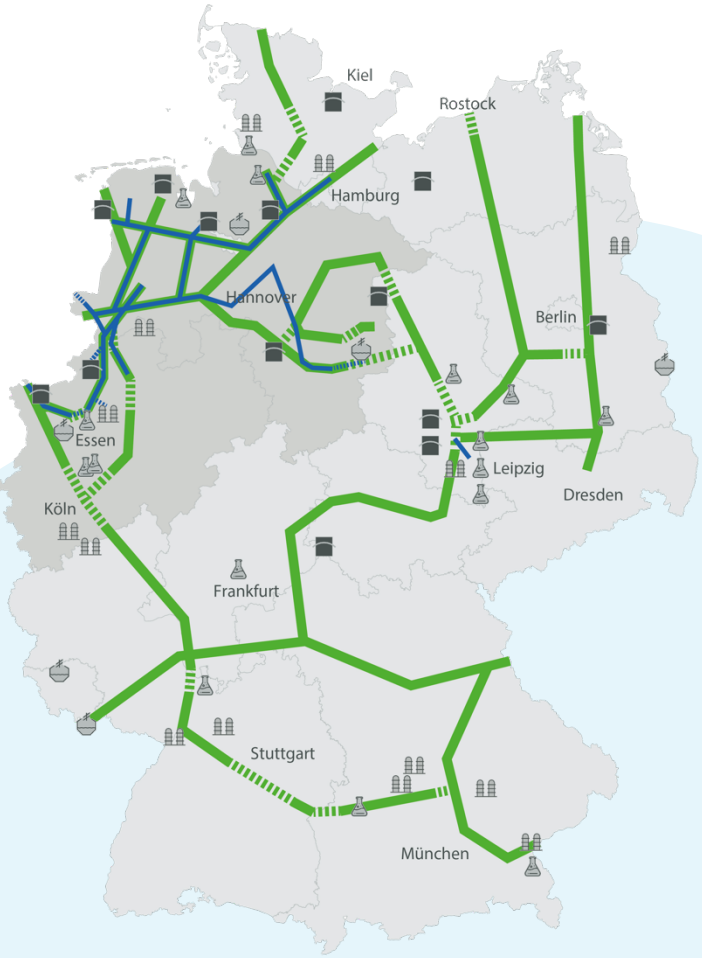
bp · EVONIK Leading Beyond Chemistry · nowega (Wir transportieren Gas.) · OGE · RWE

Many of the GET H2 partners are also active in other national and international H_2 projects.

The GET H2 initiative …

- aims to initiate a hydrogen economy in order to considerably reduce GHG emissions,
- deems it necessary to establish a nation-wide (European), non-discriminatorily accessible hydrogen infrastructure as a basis,
- is convinced that this infrastructure can be established in a timely and cost-efficient manner by employing existing gas grid infrastructure,

- already comprises more than 40 project partners
- is based on a cooperation agreement
- considers itself to be an open network of companies/organizations
- supports projects of its partners that back the initiative and facilitate its development.



Sketch of a Germany-wide hydrogen infrastructure based on the existing natural gas network. Marked in blue: the "Start-up Network 2030" with the GET H2 Nukleus as one building block.

Source: FNB Gas e.V.