Sector integration as the accelerator for a successful energy system transformation

Julian Steinmeyer | Energy Modelling Platform for Europe (EMP-E) 2019

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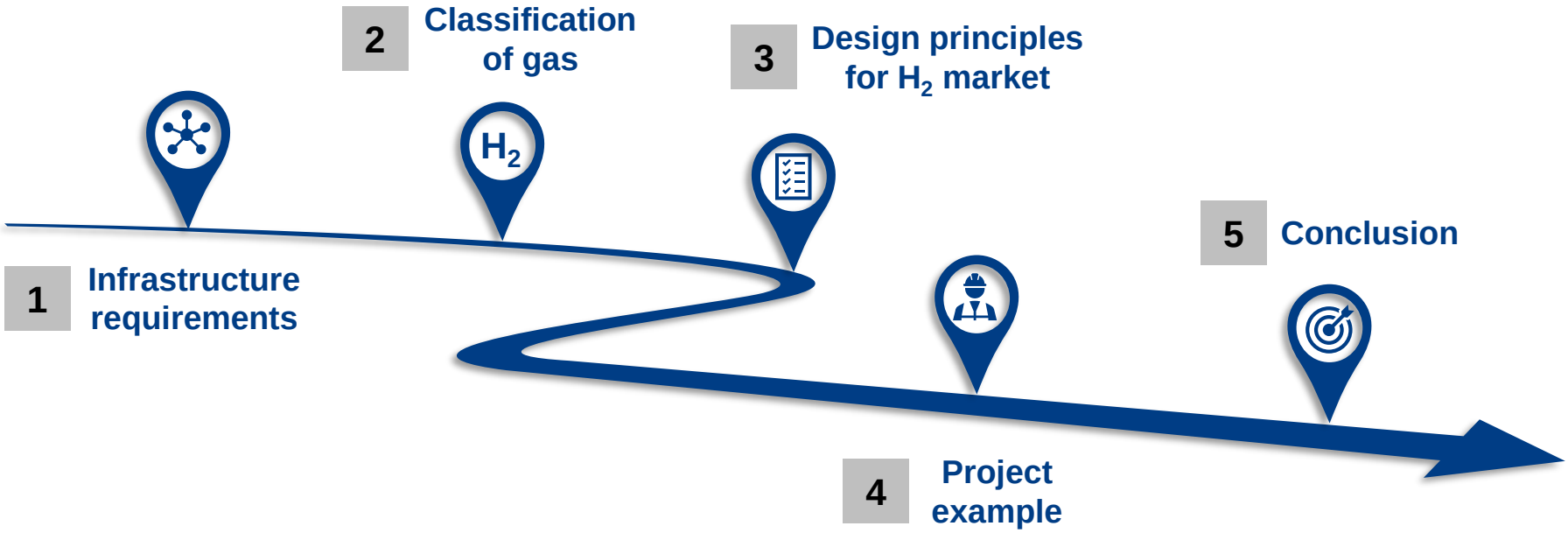
Agenda



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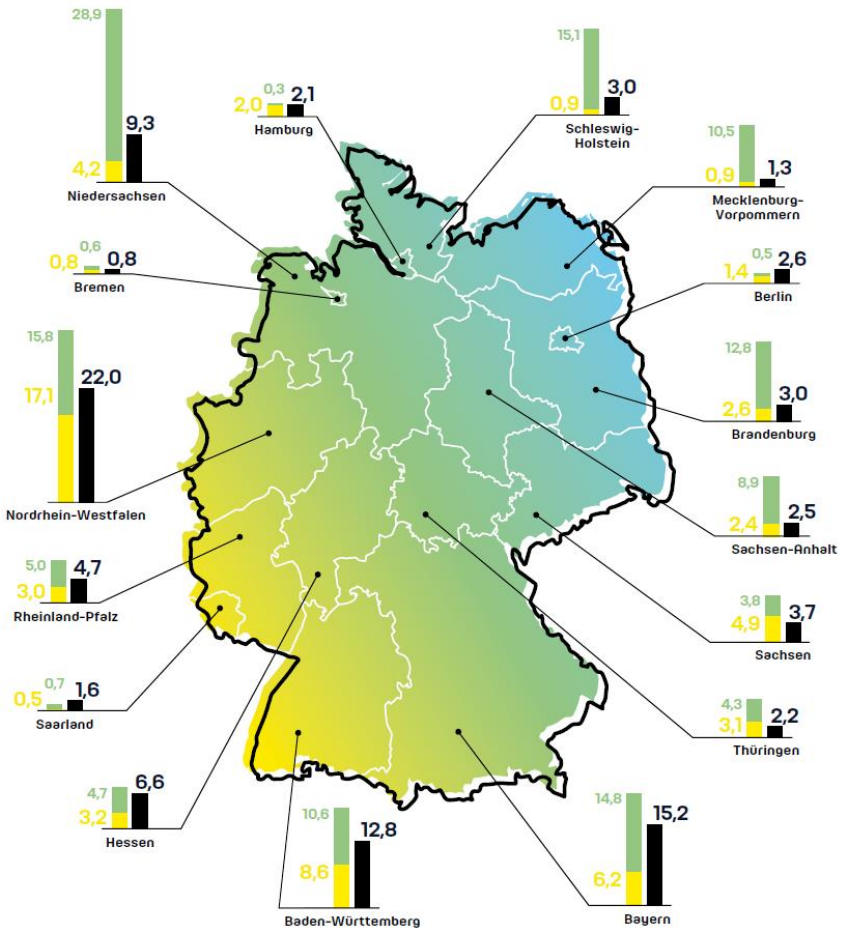
Local distribution of power generation 2030



- Strong changes in power generation structures
  - Expansion of wind power in the north
  - Installed generation capacity exceeds maximum consumption several times
  - At the same time strong decrease in secured power generation in the south
- Bottlenecks in the electricity grid, in particular north-south transport

- Installed capacity of conventional power generation in GW
- Installed capacity of renewable power generation in GW
- Maximum power consumption in GW

Infrastructure must follow changes in power generation (scenario 2030)

Source: https://www.hybridge.net/Concept/The-energy-world-of-the-future/

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1 Transport capacity gas and power

One (1) DN 1200 gas pipeline:
Maximum load ~ 24 GW

=

Eight (8) 380 kV power transmission line:
Maximum load ~ 24 GW

+ Existing use for long transport routes

+ High storage capacity
(e.g. 260 TWh_{th} in Germany)

The gas network is well-developed and connected throughout Europe

Source: BDEW and own calculations

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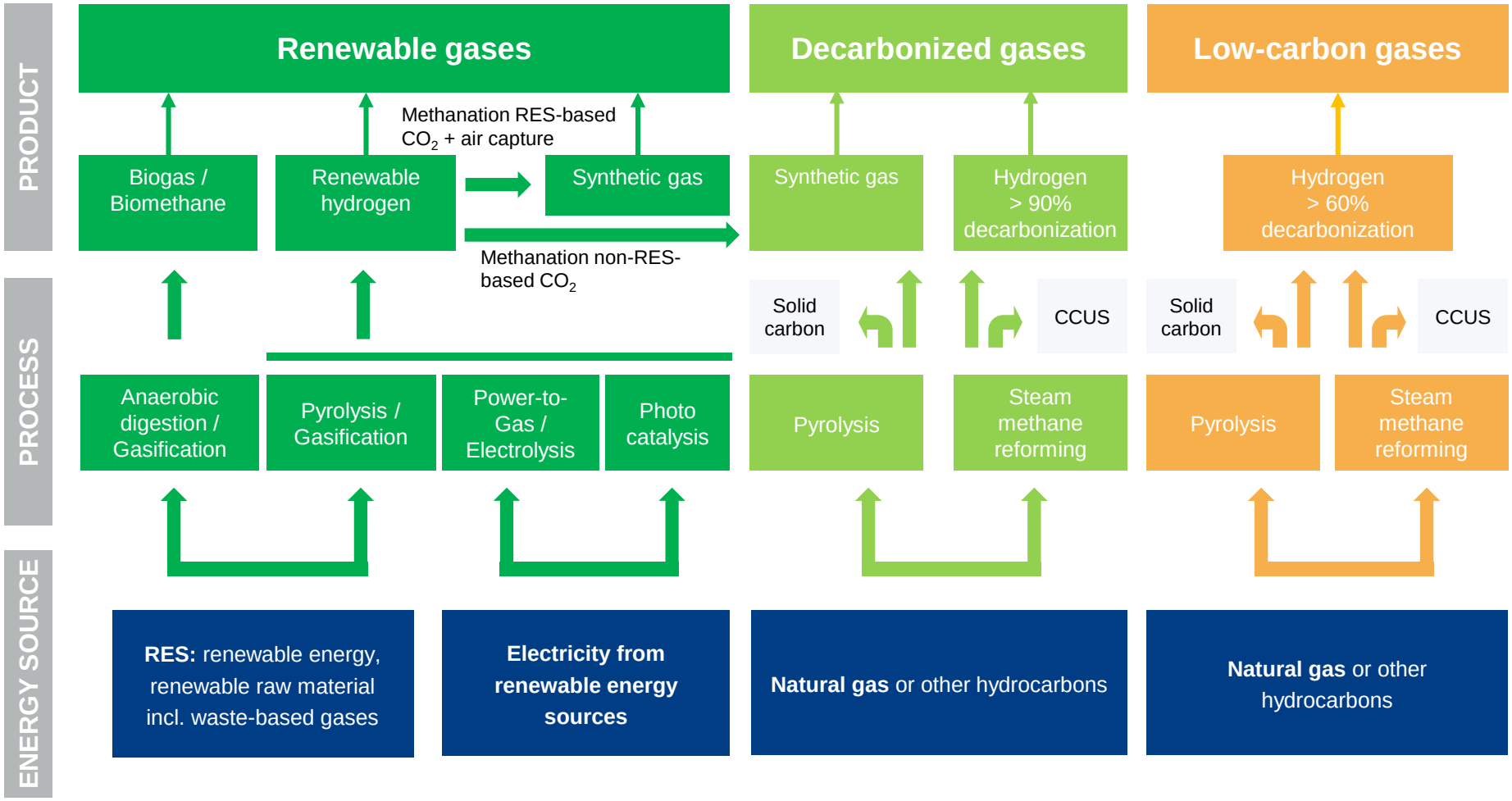
2 Classification of renewable and low-carbon gases



Source: Madrid Forum „Align Gas Terminology – Gas Industry Proposal“ (2019)

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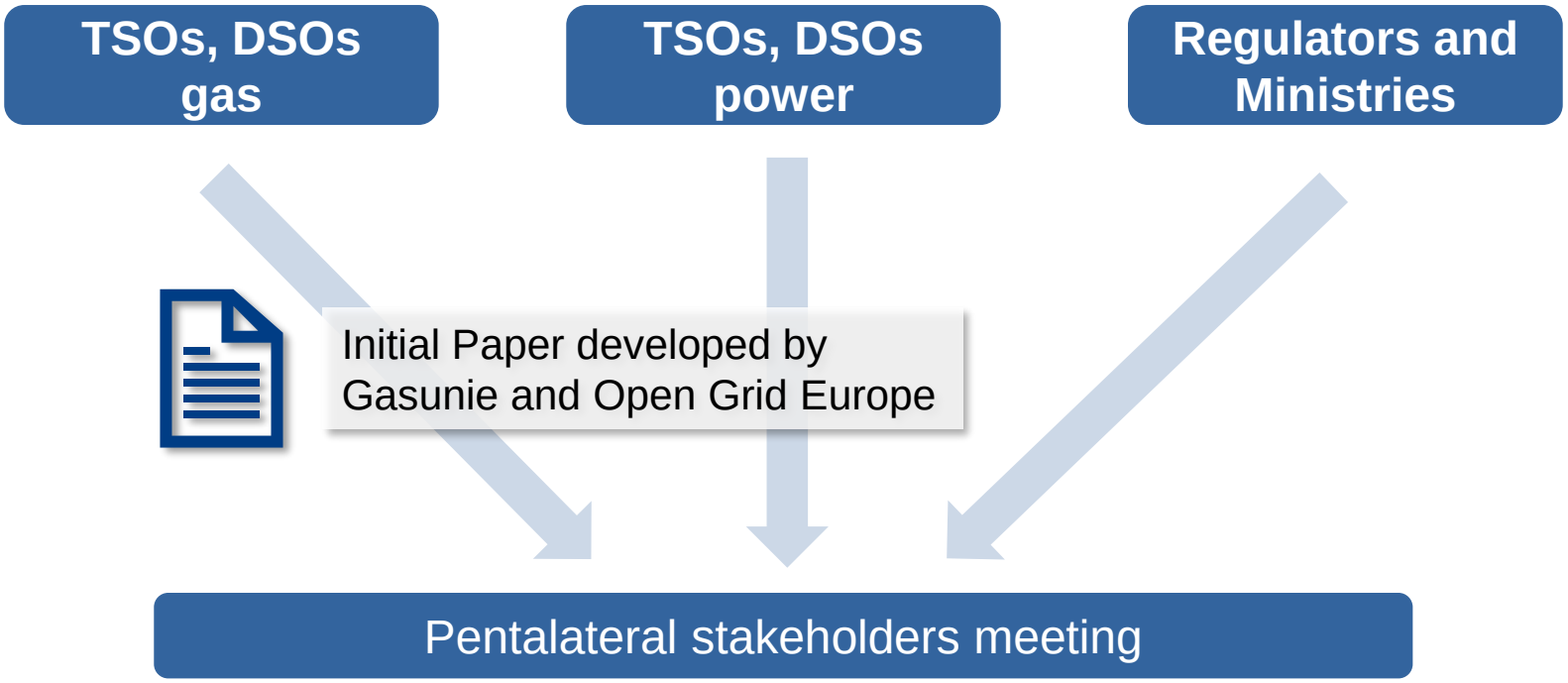
3 Upcoming EU energy package includes H_2 market principles



Common principles are required to offer end-users a stable and non-discriminatory environment

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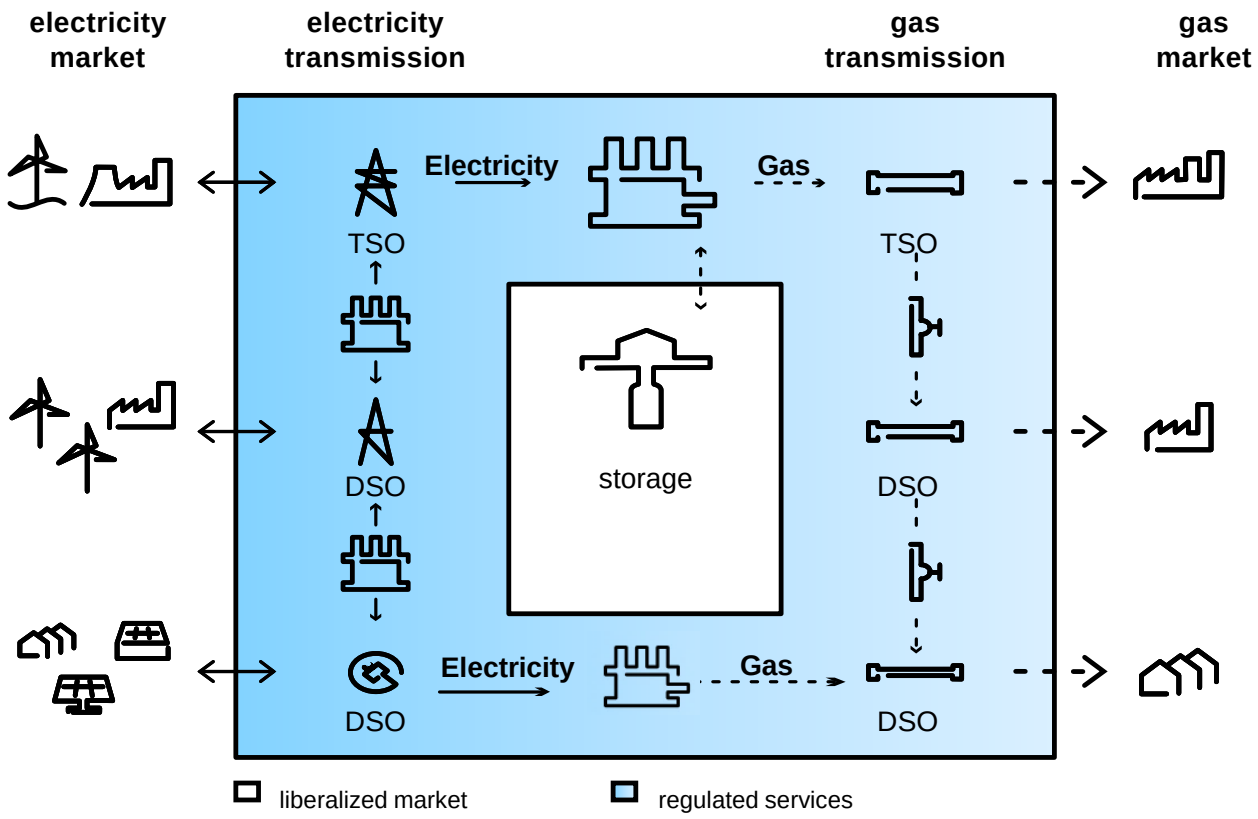
3 Regulated sector integration



For efficient sector integration rules a clear regulatory framework is needed

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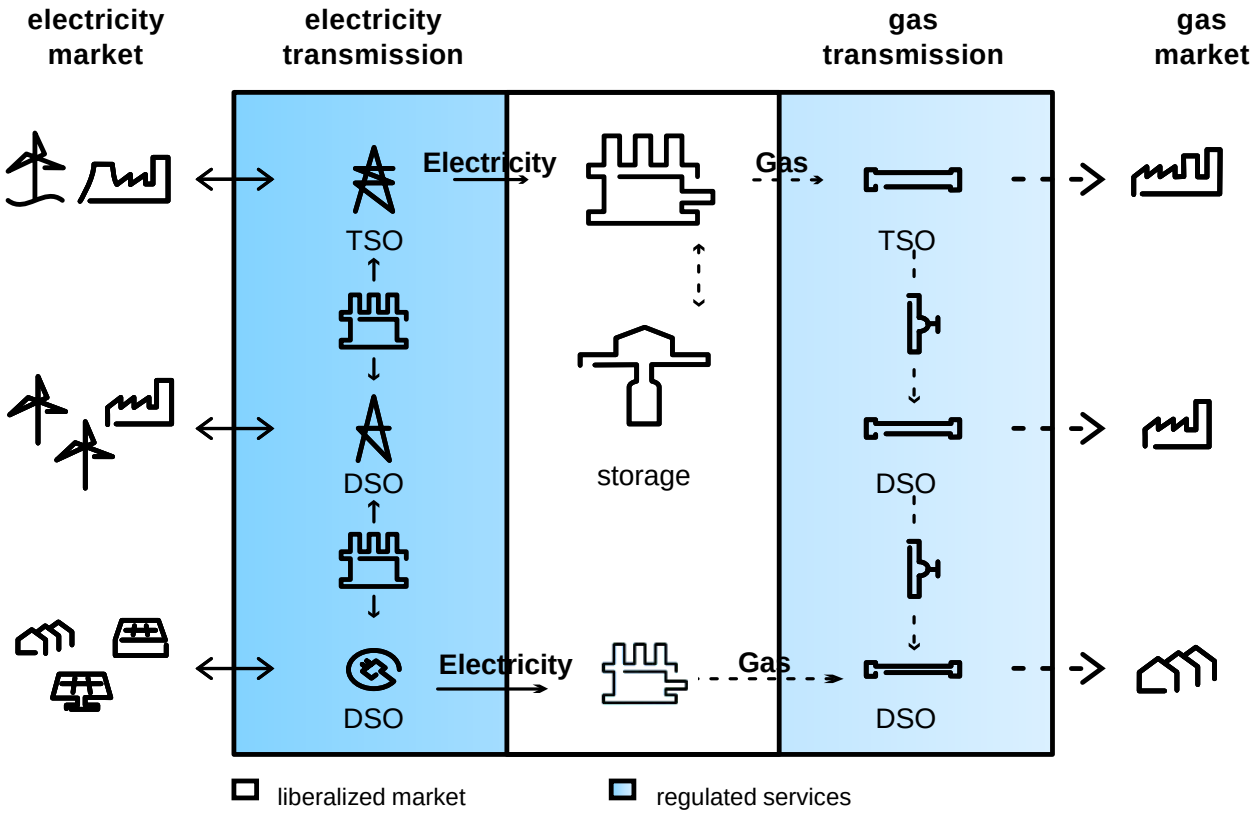
3 Market based sector integration



For efficient sector integration rules a clear regulatory framework is needed

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3 Power-to-gas (P2G) facilities

- The location of P2G installations is very important and need to be optimized with regard to the networks
- P2G capacity should be offered to the market as a conversion service on a non-discriminatory basis (open access)
- Conversion services can be provided by infrastructure companies to all market parties

- Costs should not be part of gas infrastructure tariffs (but can however be part of electricity grid tariffs)
- Conversion facilities shouldn't be treated as an end consumer of electricity and thus be excluded from end consumers taxes and levies by legislation

Power-to-gas technology is essential and needs scale-up

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3 Infrastructure planning process

Infrastructure planning must consider gas and electricity as one integrated energy system

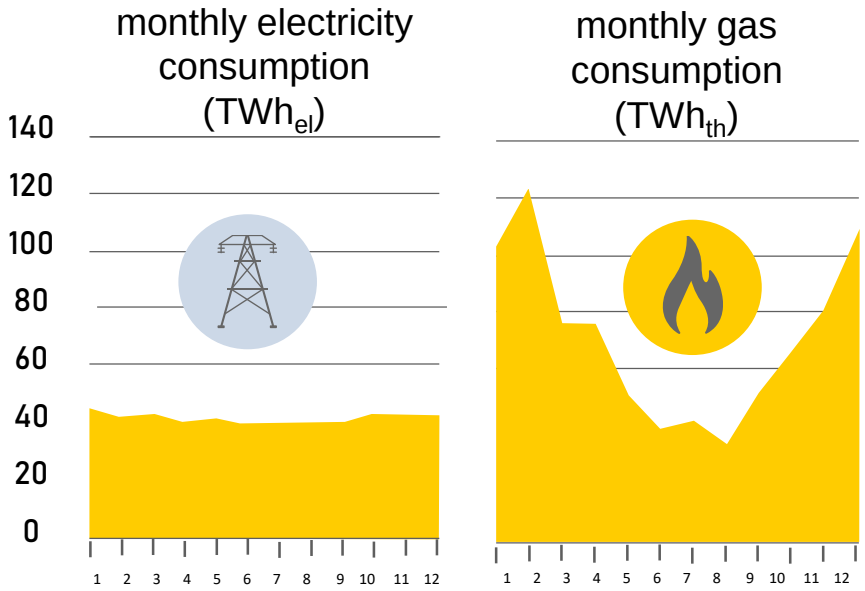
Aim: Include sector coupling and the integration of hydrogen within the framework of The Ten-Year Network Development Plans and the Network Development Plans

This includes e.g.

- Using common modelling to eliminate the outdated silo-approach
- Agreement on locations of P2G facilities (considering bottlenecks in the electricity grid and hydrogen readiness of the gas grid)
- Must-run scenarios of P2G as part of the network planning process (in order to reduce electricity grid expansion needs in the long run)
- Infrastructure related precondition: renewable electricity production and P2G facilities are located before electricity grid congestion

Coordinated EU-wide infrastructure planning is essential

3 Hydrogen Storage



- Storage provides system flexibility and seasonal storage
- Hydrogen storage can potentially be done via a carrier storage or as liquid or gas (gas field or cavern)
- Services can be provided by infrastructure companies to aggregate demand
- Hydrogen storage systems are open access
- Market players nominate volume and time of send-in/send-out
- The way the gas storage market is currently regulated could serve as a blueprint for regulation of the hydrogen storage market

Only hydrogen storage provides the amount of energy required to meet seasonal demand and supply patterns

4 Reallabor Westküste 100 (real lab west coast)

- Open Grid Europe participates in the real laboratory together with other project partners
- 30 MW Electrolysis plant operated with offshore wind power
- Process heat is decoupled into the existing heat network
- Hydrogen network between Heide refinery, cavern storage and existing natural gas network
- Conversion of green hydrogen into green fuels

Real lab shows practical application cases for green hydrogen on industrial scale

Source: https://www.westkueste100.de

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5 Conclusion

Energy infrastructure continues to be a long-term business with high investments

Politically reliable transformation paths give actors security when making decisions

For the necessary steps towards sector integration, political support is needed to quickly generate positive business cases

Cross-sector and cross-country network development planning is required to increase social welfare

Cooperation is becoming more important for the generation and implementation of necessary technical solutions