A regulatory framework for power to hydrogen in Germany and the Netherlands

Presentation at the webinar series "Energiesystem der Zukunft"

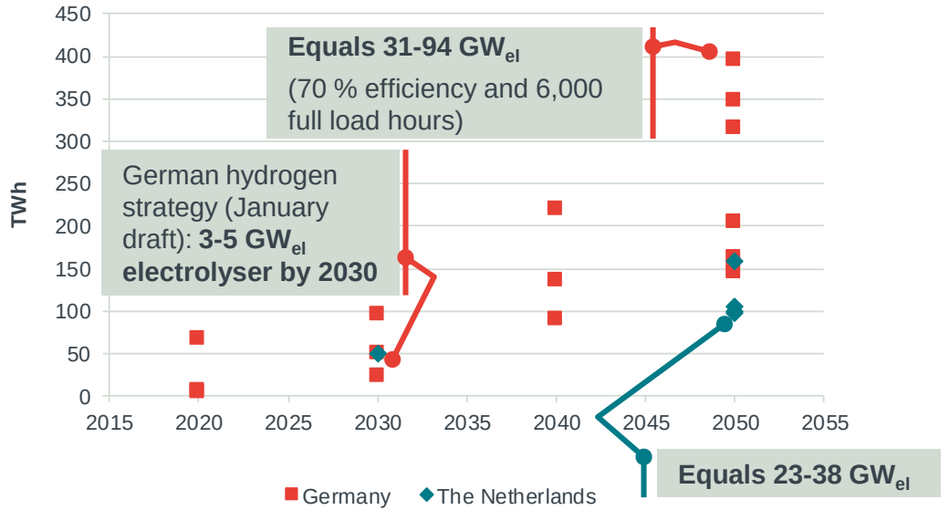
4th June 2020

Background and objective of the report

Green hydrogen is one important pillar for decarbonisation of economy

- **EU-wide and national strategies foresee a future hydrogen economy**
  - EU: “Green Deal”
  - Germany: Draft of a national hydrogen strategy*
  - Netherlands: Klimatakkord
- **Hydrogen economy imposes several questions**
  - What is the **current regulatory framework** that drive the commercial business for green hydrogen and where are important gaps?
  - Who is or should be allowed to **own P2H2 units**?
  - What are existing or potential instruments to **influence location or dispatch of P2H2 units?**

In several studies hydrogen demand is expected to increase substantially only in the long-term



Source: Frontier Economics based on TenneT/Gasunie (2019), Forschungsgesellschaft für Energiewende (2019) based on FfE (2017) and Dena/EWI (2018), FZ Jülich (2019) and DNV GL (2018).

Scope of the study

- Focus of our study on **green hydrogen** (not grey nor blue)
- Differentiation between

Greenfield P2H2 units

(reasonably free in terms of location and dispatch)

Industrial P2H2 units

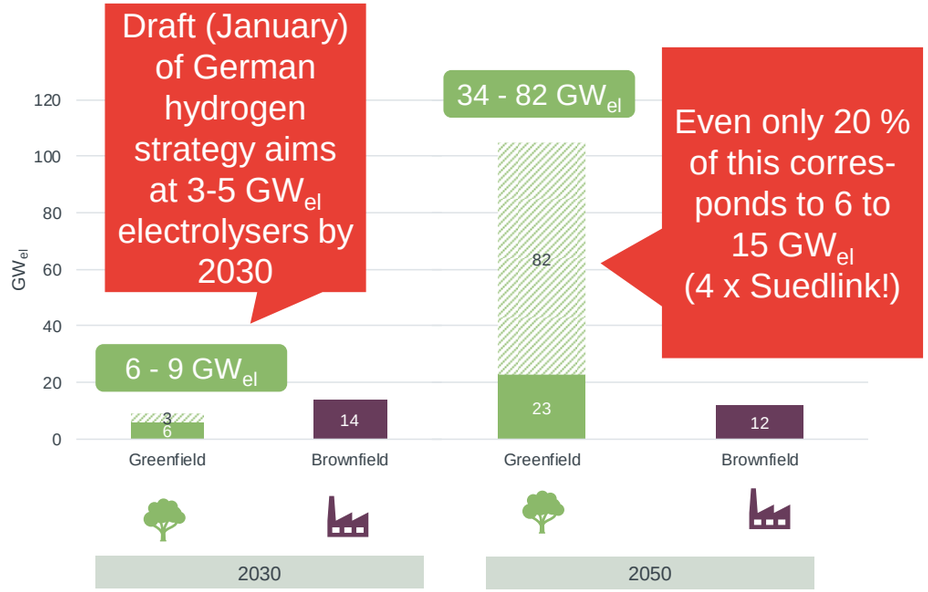
(linked into existing industrial production processes and infrastructure)

* The draft of the German hydrogen strategy from January 2020 aims at 3-5 GW of domestic electrolysers by 2030, but in an updated version also higher values of 10 to 15 GW_{el} were proposed by e.g. the federal ministry for research.

Excursus: Why is locational influence important?

Example Germany

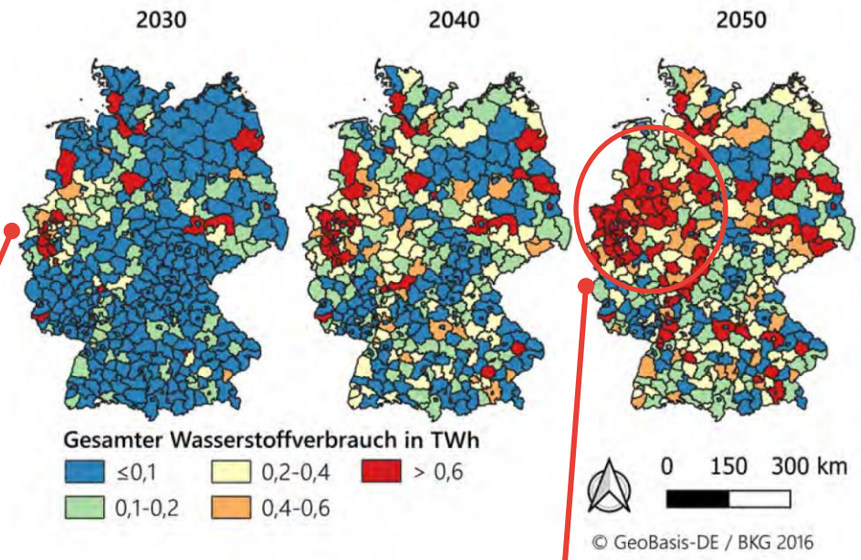
Forecasted electrolyser capacity of greenfield and brownfield projects (various recent studies*)



Calculation of electrolyser capacity is based on 70 % efficiency and 6,000 full load hours

** Source: Frontier Economics based on TenneT/Gasunie (2019), Forschungsgesellschaft für Energiewende (2019) based on FfE (2017) and Dena/EWI (2018), FZ Jülich (2019) and DNV GL (2018).*

Forecasted distribution of the future demand for hydrogen



RED II (currently) incentivises location of P2H2 units close to the RES units/potential.

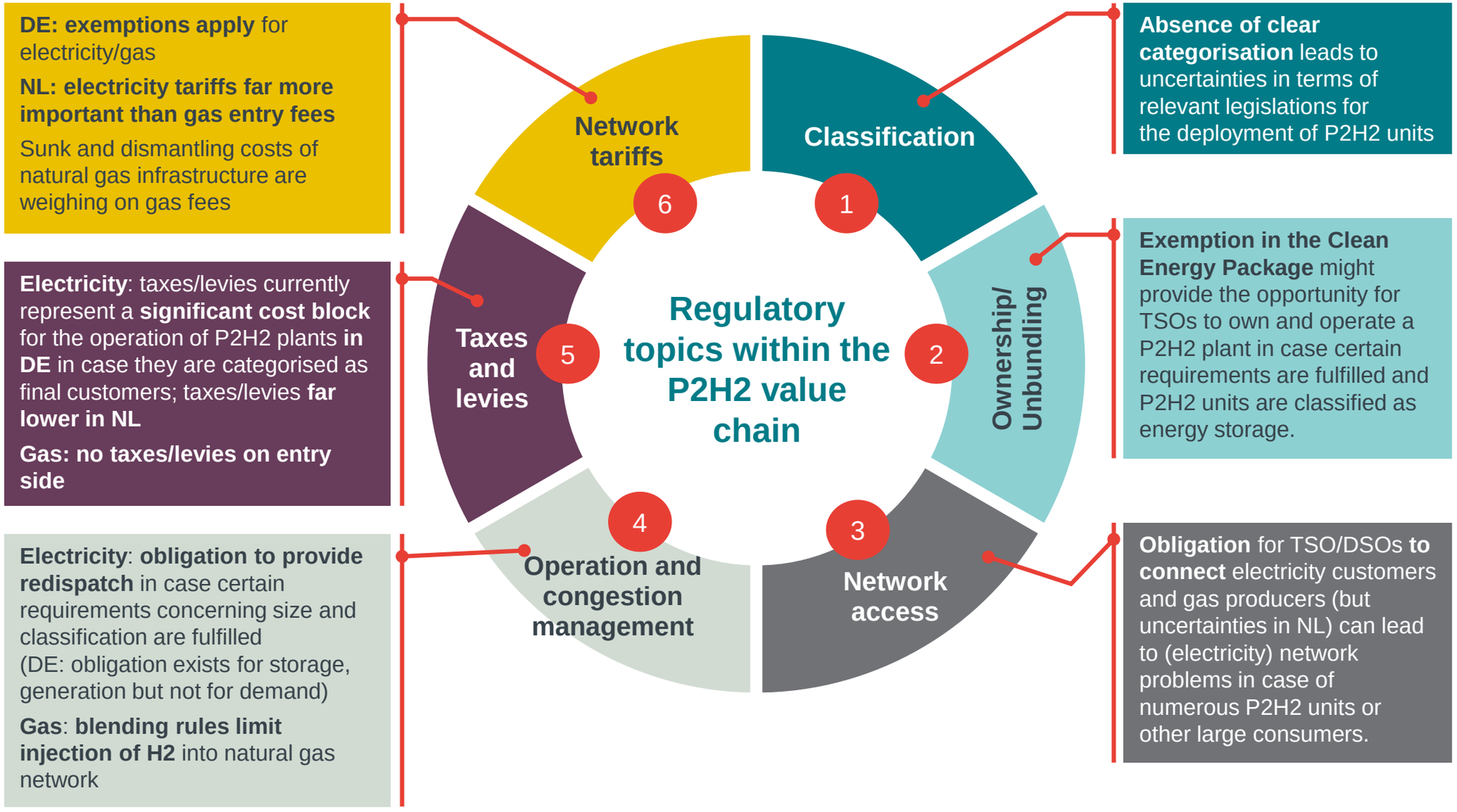
2030 influenced by industrial P2H2 units

RED II effect decreases if RES-E share increases

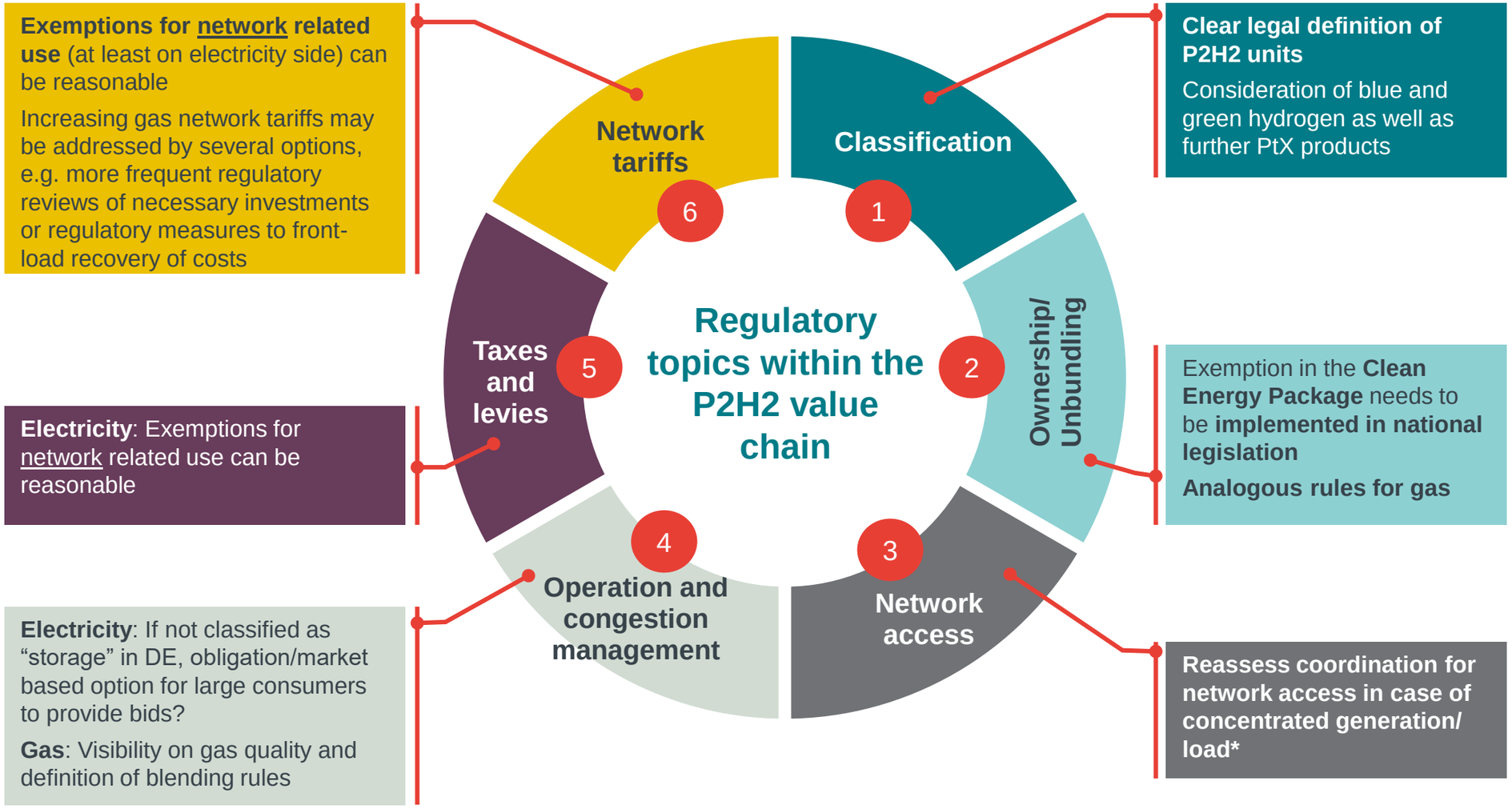
Some P2H2 units will probably also be located in the South due to PV potential

Source: Forschungsgesellschaft für Energiewende (2019).

Several regulatory gaps and hurdles exist across all topics and regions…

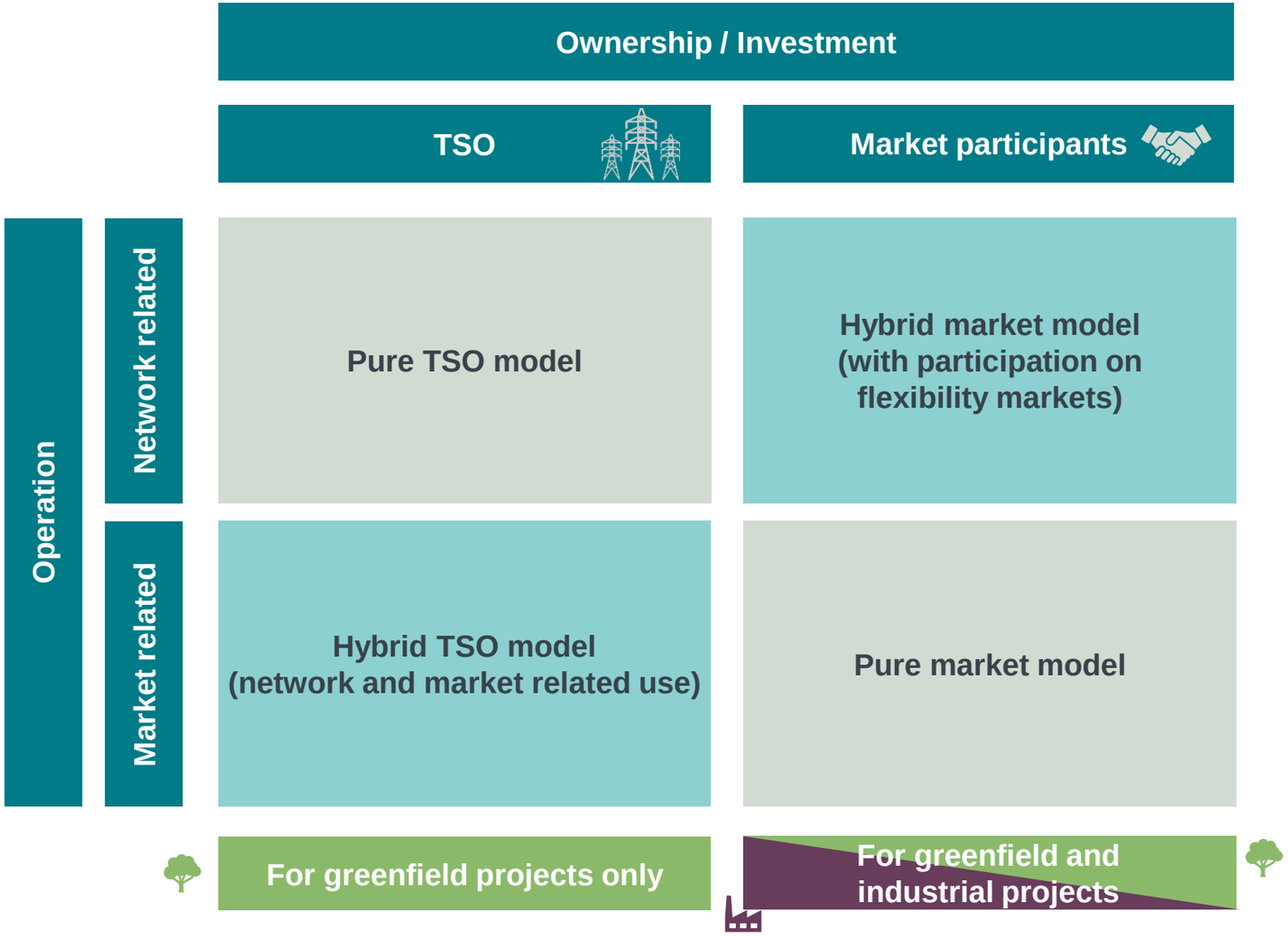


…which could be addressed by the following suggestions for improvement



* To be seen in context of wider discussion around regional tariffs, bidding zones and also other concentrated large scale demand.

Based on ownership and operation, there are four potential target models



The envisaged and desired ramp up will require both revenue streams and maybe even need further support in the short- to medium-term

Levies, taxes and network fees not even included in this calculation

A positive business case for electrolysers is difficult to make in short- to medium-term

Parameter	Short-term		Medium-term	
Electrolyser technology	Alkaline		Alkaline	
Electrolyser efficiency	67 %		**71 %**	
Total investment per MW_{el} capacity	800,000 €		**600,000 €**	
Electrolyser lifetime in years	20		20	
Interest rate p.a.	6 %		6 %	
Annualized CAPEX per MW_{el} capacity	69,748 €		52,311 €	
Price of hydrogen per MWh_{H2}	**25 €**	**55 €**	**25 €**	**55 €**
Total profit generated per MW_{el} capacity	**-61,143 €**	**9,937 €**	**-43,521 €**	**48,538 €**

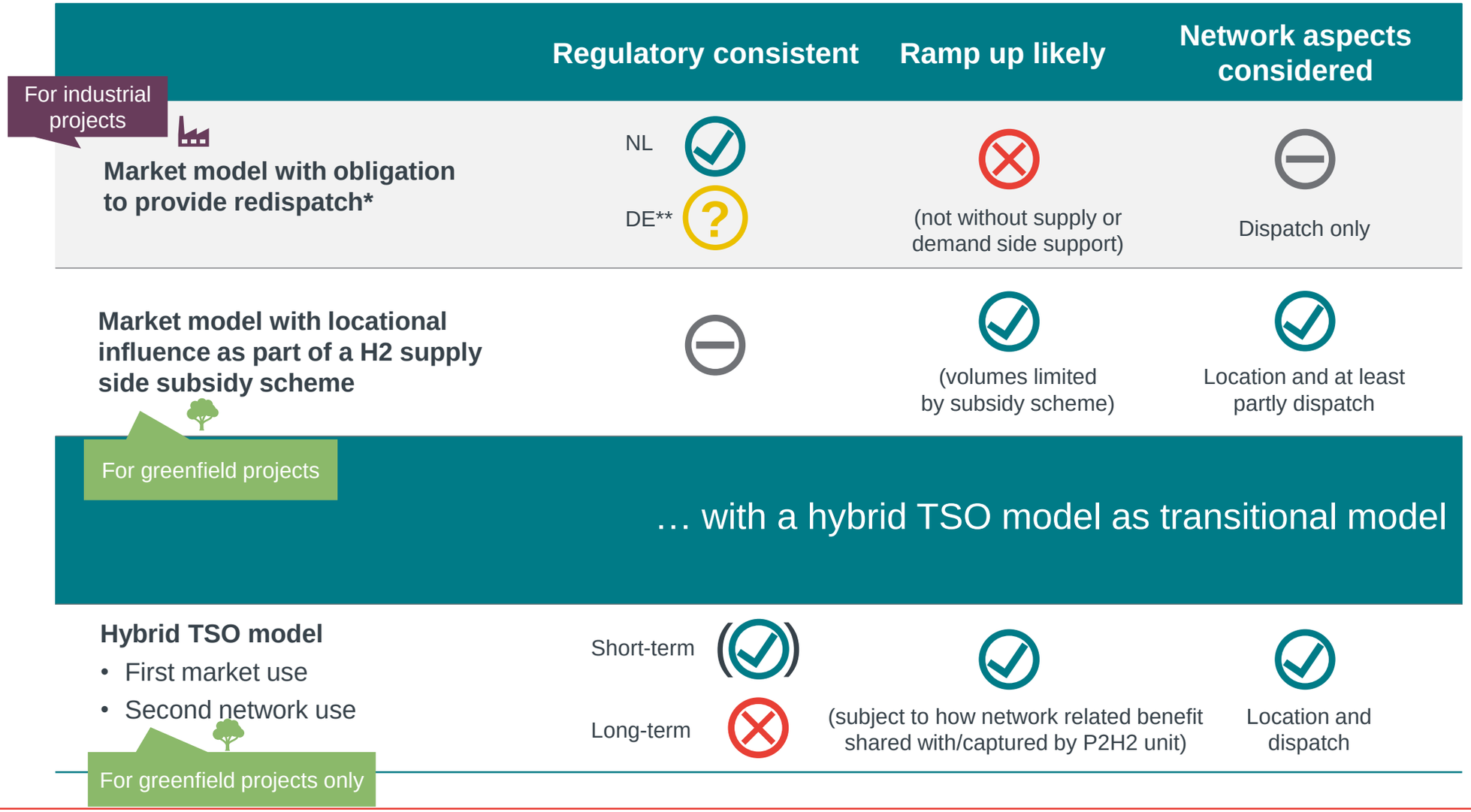
Without additional support the desired ramp up of green hydrogen might not be developed

- **Long-term: Carbon pricing schemes***
- **Short- to medium-term:** Support mechanisms
  - on the **demand side** (e.g. fleet targets for OEM or obligation for fuel suppliers in RED II) or
  - on the **supply side** or
  - **via congestion management rules, e.g.**
    - Use surplus energy free of charge – similarities to the Power to Heat scheme debate („Nutzen statt Abregeln“)

Pure TSO or pure market model are usually not reasonable – at least not in the short- to medium-term.

* Can be cap-and-trade or tax schemes. Requires some form of certification scheme to operate it (like Guarantees of Origin or Evidence of Sustainability)

Hybrid market models as target models…



* In case of cost based redispatch the estimation of costs will be complex.

** Depends on whether P2H2 units are classified as installations for the storage for electrical energy.

There are different options for move from a hybrid TSO model to a hybrid market model (from transition to target model) over time…

Hybrid TSO model → **Hybrid market model**

Market test every 5 years

- TSO could be obliged to redo the market test, that means to tender **the plant after (e.g.) 5 years** to market players
- To avoid losses for the TSO and the network users, a **minimum price** in form of the **asset value** needs to be set in order to avoid free riding and losses for TSO/network users
- Outcome is expected to reflect the earnings value: This means that all estimated future profits are paid back to the TSO and (should be) passed on at least partially (depending on former risk sharing) to the network users

Limitation to a certain number/ capacity of TSO owned P2H2 plants

- P2H2 plants are owned by the full life time, but after the construction of a certain number/capacity of TSO owned P2H2 plants, no further TSO owned plants are allowed
- Option to extend converter model in case no market player has the right to own, develop, manage or operate such P2H2 plant (market test)

Energy transition is a complex and challenging task with strong impacts on society - let‘s do it in an open minded and cooperative manner!

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