Hydrogen Valleys/ Hubs/ Clusters – an international perspective

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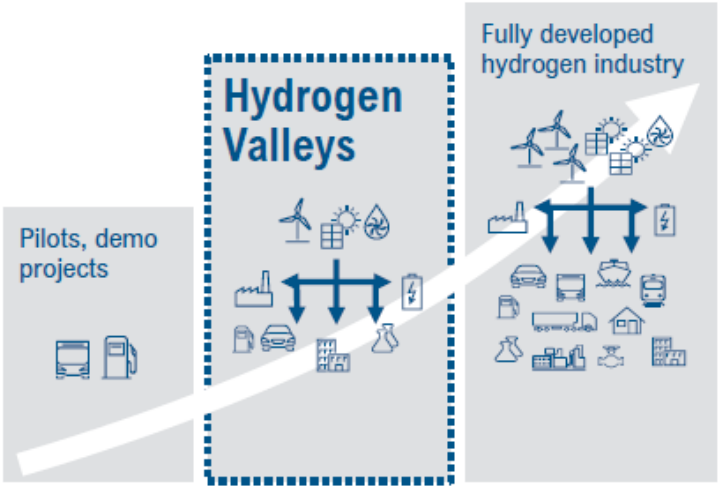
Definitions

„Hydrogen Valleys“ are local market makers for clean hydrogen – Integrated Infrastructure projects along the FULL VALUE CHAIN

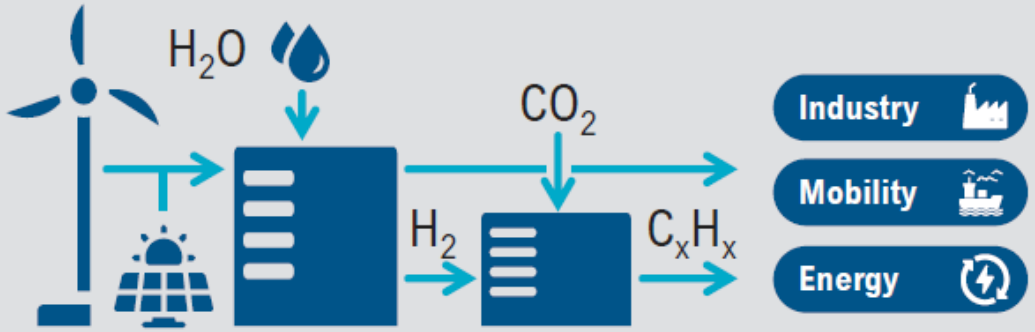
Hydrogen Valleys …

- Next-generation H2 market development
- Integrated (and larger-scale) projects covering more and more of the value chain – "mini hydrogen economies"



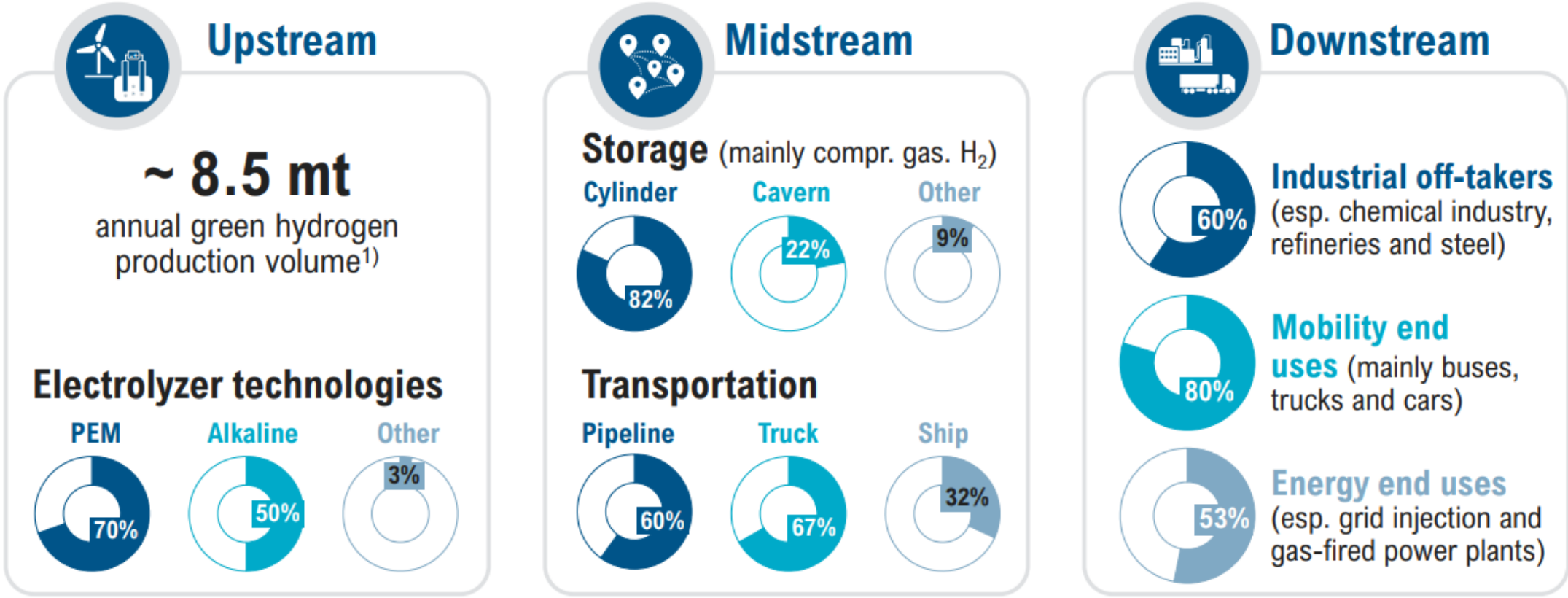
… and what they're made of

- **Large-scale joint investment** (> EUR 10 m and up to multi-bn EUR)
- **Full hydrogen value chain coverage**
  - Centralized clean hydrogen production (*de facto* mostly green H2)
  - Shared infrastructure (e.g., pipelines, refueling stations)
  - Multiple end-uses (e.g., steel industry, fuel cell trucks)
- **Clear regional scope** (e.g., around a major port)



Definition

„Hydrogen Valleys“ connect up-, mid- and down stream – for use in mobility , industry and energy, ……



1) After reaching maximum build-out stage

… based on a prior step of renewable energy.

Definitions
„Hydrogen Valleys“ - 3 archetypes

1. **Smaller-scale local mobility-centered Hydrogen Valleys**
   (typically 1–10+ MW of local electrolyser capacity).

2. **Medium-scale Hydrogen Valleys**
   focusing on industrial decarbonisation
   (typically 10-300+ MW of local electrolyser capacity)

3. **Large-scale and ultimately export-oriented Hydrogen Valleys**
   (typically 250-1,000+ MW of local electrolyser capacity):

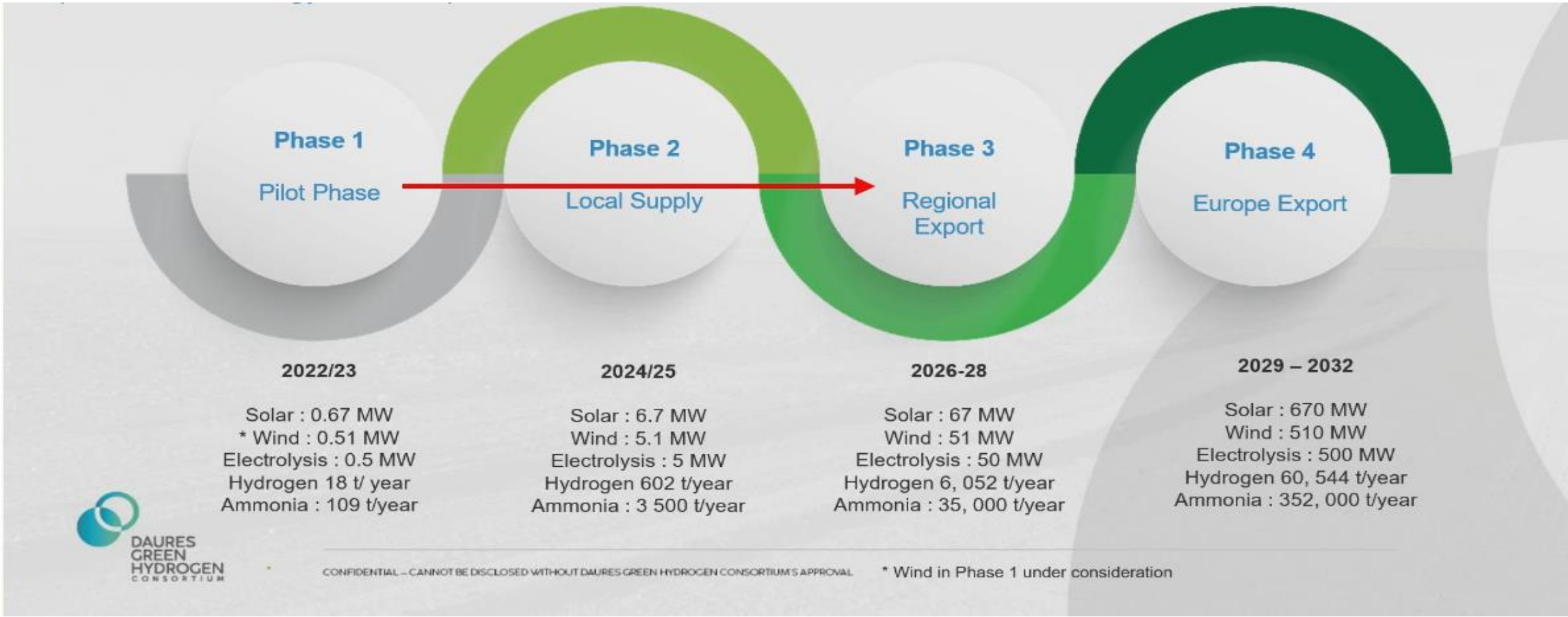
Definition
„Hydrogen Valleys“ – versus Clusters, Hubs and Anchors

Cluster	Hub	Anchor project
• “Clusters are agglomerations of interconnected companies and associated institutions.” • “Firms in a cluster produce similar or related goods or services and are supported by a range of dedicated institutions located in spatial proximity, such as business associations or training and technical assistance providers.” • Advantages: assess economies of scale, facilitate access to skilled labour, proximity to suppliers/customers, access to information networks, cost sharing for shared infrastructure ➔ **Paving the way for hub development, bundling activities around physical hubs**	• “Hubs are central collection or distribution points” • “By ‘hub’ is meant a very specific location, where physical activities are bundled” • “A point where many routes meet and traffic is distributed, dispensed or diverted.” • “Hubs are very common in the natural gas distribution industry, where pipeline networks interconnect in order to bring together gas from many different production fields, or to distribute gas to dispersed markets”	• “Large producer, usually in a single location, which provides a significant proportion of the H2 in a cluster of H2 projects” • First mover who takes the first step and subsequently attracts surrounding projects • Used to kick-off hub building

Sources: https://creativeconomy.britishcouncil.org/guide/hubs-clusters-and-regions/; https://wikidiff.com/cluster/hub; https://www.globalccsinstitute.com/wp-content/uploads/2019/08/Understanding-Industrial-CCS-hubs-and-clusters.pdf

Examples

Namibia –Dauras Green Hydrogen Village - in 4 phases, based on up to 1 GW RE potential



Examples

Germany – the Clean Hydrogen Coastline

Project Clean Hydrogen Coastline

Integrated approach for a European hydrogen economy

Image: EWE AG

- Create a hub, that will secure **hydrogen production capacities** for an Intra-European energy market with an electrolyser capacity of up to 400 MW by 2026
- Development of a **trans-european hydrogen infrastructure** for transport via pipelines and storage in salt caverns
- Enable **first markets for green hydrogen** in industry and in the transport sector
- Total investment in the technology of around **700 Million €** by the end of 2026
- Suitable **funding scheme and regulatory framework** is required (IPCEI status applied)

ArcelorMittal EWE FAUN KIRCHHOFF GRUPPE swb TenneT

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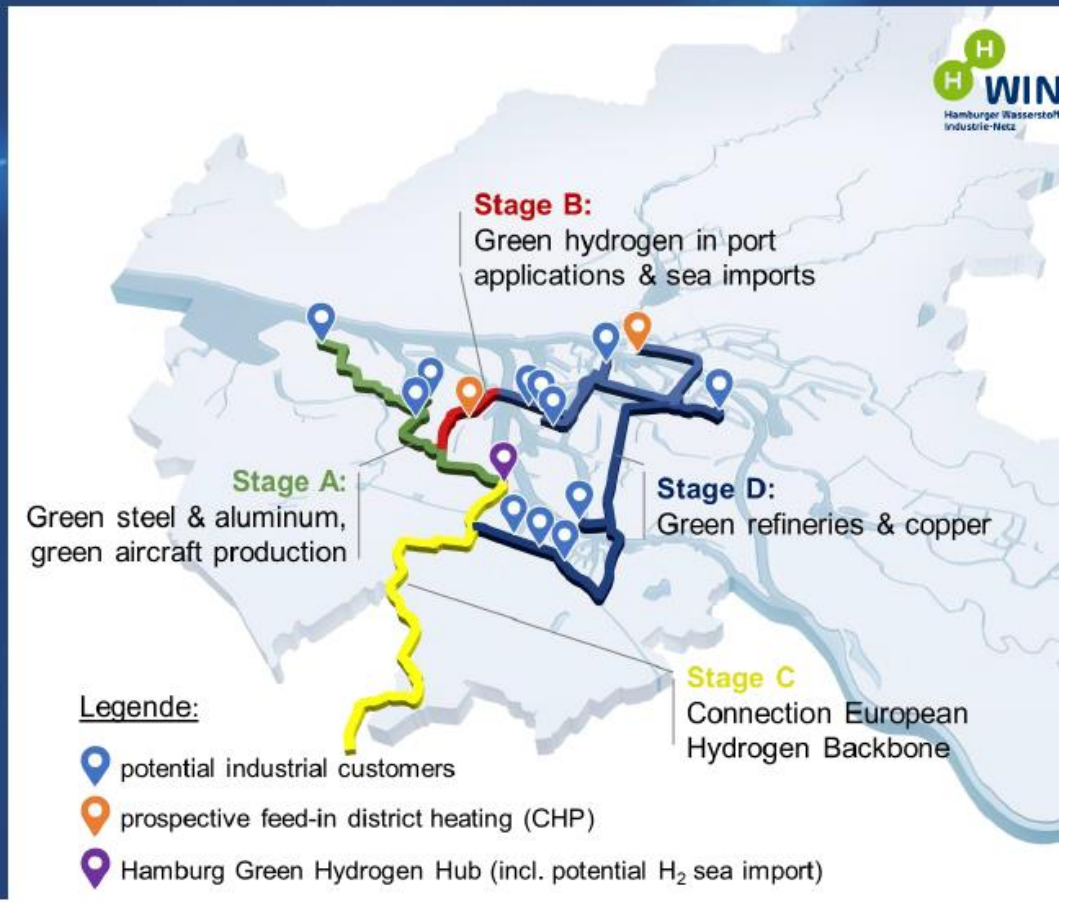
Examples
Hamburg Hydrogen Industry Grid

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

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



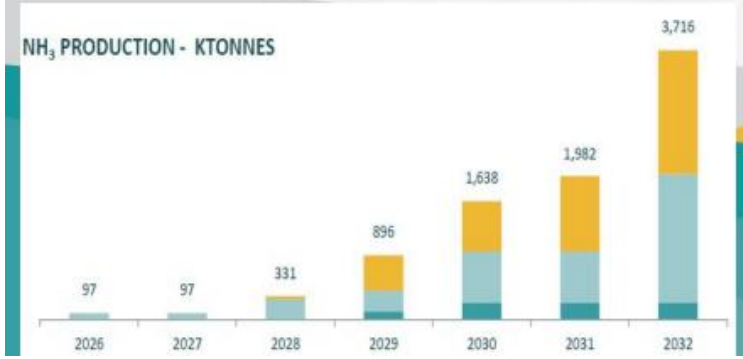
Examples

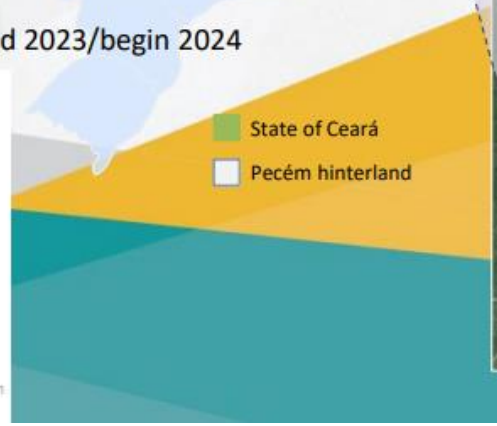
Brazil – The Port of Pecem in Cooperation with Port of Rotterdam

Port of Rotterdam | pecém COMPLEXO INDUSTRIAL E PORTUÁRIO | Governo do Estado do Ceará | H2V Hydrogen Valley

Unique Gh2 potential

- **Abundant potential of low cost Renewable Energy**; High full load hrs.
  - Solar; 28,500 GWp
  - Onshore Wind; 880 GW
  - Offshore Wind; 1,335 GW
- **Production water**; Abundant effluent water vs. desalination
- **High demand**; Export to EU & Local GH2 hub
  - Rotterdam 4 Mil. Ton – 2030 / 20 Mil. Ton 2050
    - *Distance to EU & Low transport cost vs. total cost*
  - Pecém Industry; Steel, Power Plants, Cement, Fertiliser
- **Stable investment climate**; Government, Education, Labour market, PoR
- **Commercial**; 20+ MOU's & 3 FEED studies – FID end 2023/begin 2024

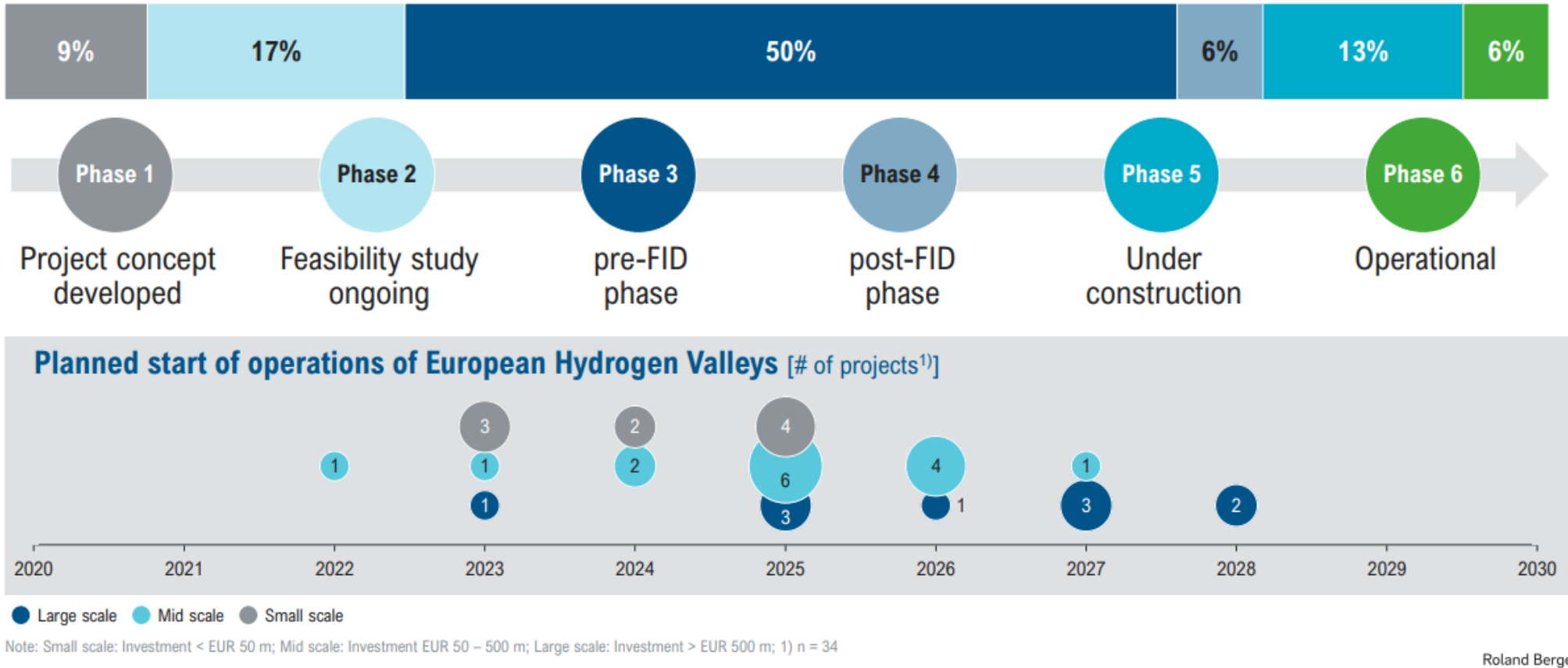




Challenges
„Hydrogen Valleys“ – still work in progress

Challenges …..

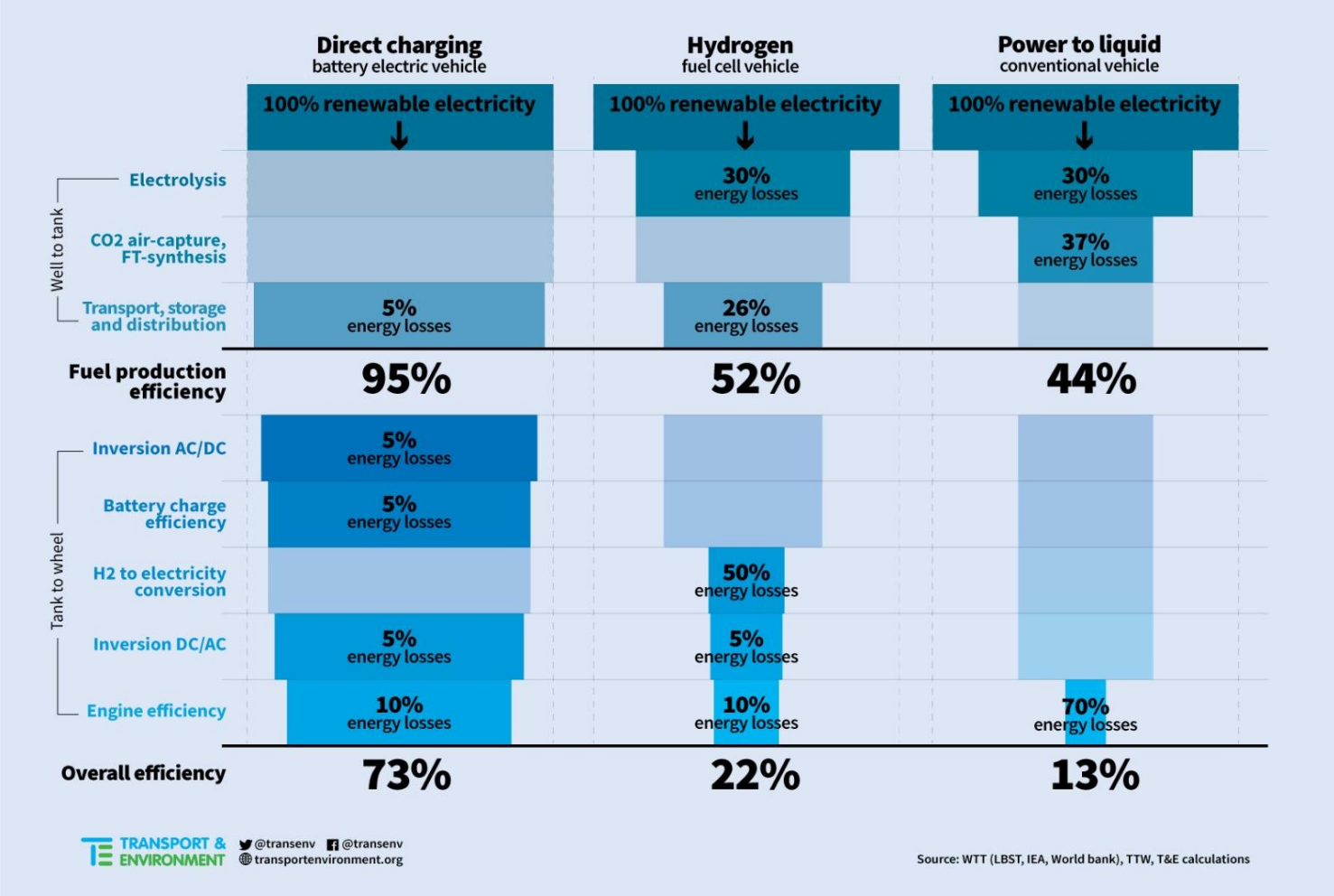
Most projects have not reached FID yet: < 25% of GH2 valley projects, < 10% of investment projects



Barriers are many, e.g. lack of offtake, financing, regulation, ….

Challenges

Offtake for Mobility (cars) – Battery electric is simply more efficient

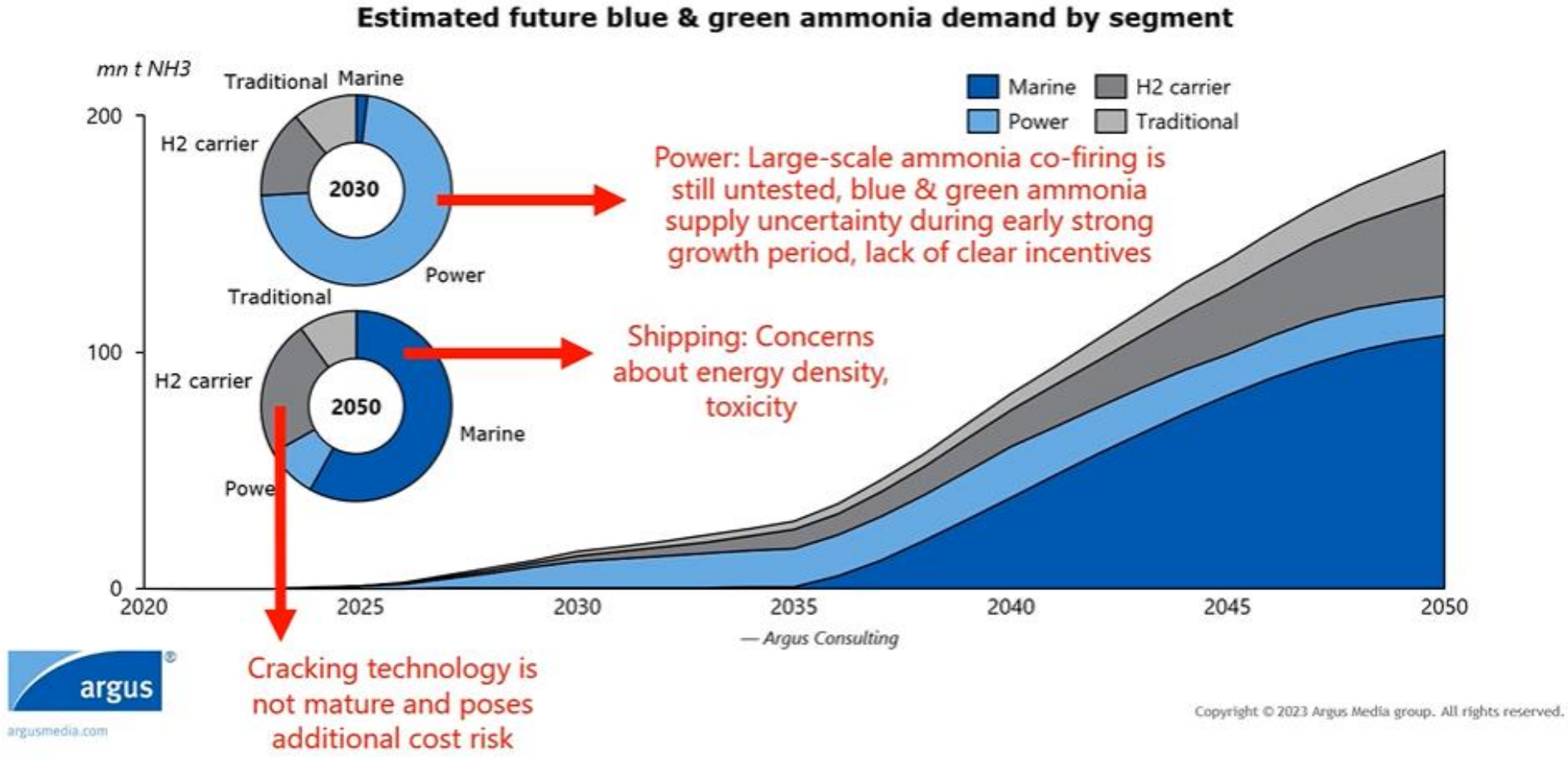


Hydrogen options are less efficient, and subsequently more costly

Challenges

Offtake for Green Ammonia for shipping and power

- Argus Media see great demand for ammonia, esp. starting 2037, ….



…… but acknowledges potential downsides to the projections

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