

Next Steps for Hydrogen as Transportation Fuel in Europe

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Overview

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- Current situation of hydrogen & transport in Europe
- The road to commercialization
- Industry criteria & drivers for identification of pilot region(s)
- On-going activity: The Clean Energy Partnership Berlin (CEP)
- Expected outcomes/benefits for the European regions

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Why a Joint Industry Approach for Hydrogen in Road Transport?

The challenge is too large for individual companies

- Current activities are in a pre-commercial & pre-competitive stage and are highly cost intensive
- Need to further improve cooperation between Energy companies & OEMs:
 - to combine skills & expertise and to look for synergies in the field
 - to make an aligned breakthrough approach
 - to cooperate in both development & testing of technologies
 - to enhance the chance to be successful

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Current Situation of Hydrogen & Transport in Europe

A small number of isolated demonstration sites around Europe characterized by:

- A limited number of vehicles (cars & buses)
- A limited number of hydrogen refueling stations (HRS)
- A scattered distribution of vehicles/HRS
- A low hydrogen demand leading to high hydrogen cost
- Limited opportunities for synergies
- Lack of focus
- Reduced visibility & limited contribution to social acceptance of hydrogen based technologies

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The Road to Commercialization

Goal for future activities: Extract maximum learnings from demonstration programs that lead to the right technologies and the most cost effective solutions

Moving from today's R&D and prototype demonstration activities towards commercialization requires not only a growing number of hydrogen vehicles but also a hydrogen supply concept that allows **organic growth within future pilot regions** as well as a later connection of emerging initial markets

It is anticipated that the number of vehicles and competitive supply of hydrogen will continue to be **limiting factors** on a global scale & for the coming years

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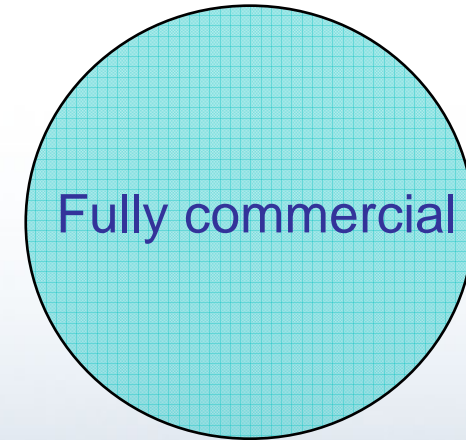
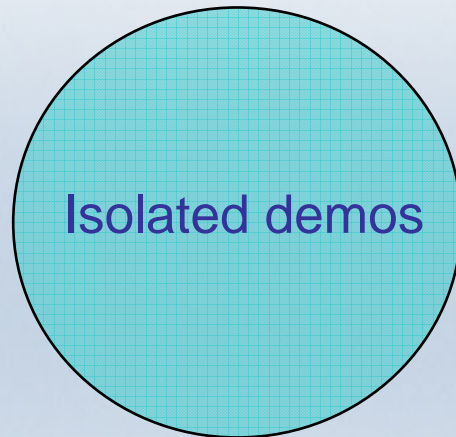


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...Build a Bridge



Make H₂ & H₂ fuelled vehicles available & accepted

- Organic growth (no. of vehicles/HRS): Network focus in key area(s)
- Infrastructure adapted to meet different customer needs (cars vs. buses)
- Create public awareness for new fuel/vehicles
- H₂ at pre-competitive price & at right quality

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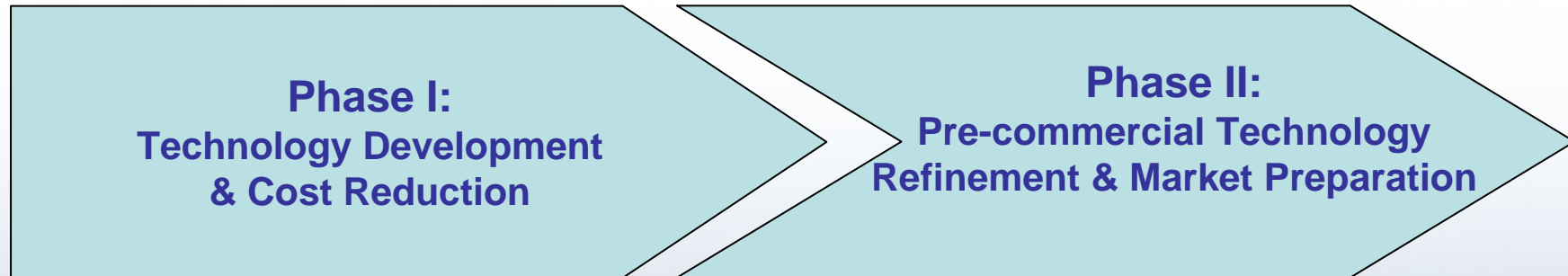


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Phasing the Deployment of Vehicles & Infrastructure: 3 Steps...



- Higher volumes of cars in the field
- Bundling of H₂ demand for cars in one pilot region
- Further technology development for cars & infrastructure
- Targeting cost reductions

- Further deployment of vehicles and HRS (700 bar CGH₂ + LH₂)
- For cars: Public access & integration into conventional RS
- For city buses: Dedicated HRS in a few selected European cities/regions
- Concentrating resources on customer convenience & consumer acceptance

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Phasing the Deployment of Vehicles & Infrastructure: 3 Steps...

Phase III: Commercialization

- Ramp up of vehicle production
- Moving towards mass production within ca. 10 years

Timelines for the various phases may be projected but depend strongly on the specific timelines of the different OEMs involved

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Industry Criteria & Drivers for Identification of Pilot Region(s)

- In order to minimize organizational efforts & financial risks, the starting point for H₂ car deployment in Europe is foreseen within **one pilot region** while – for captive fleets – **a few selected cities/regions** would be required
- A **set of technical, legal & political criteria** has to be met by the passenger car pilot region:
 - Existing hydrogen infrastructure (HRS, H₂ production/distribution close)
 - Favorable legislative environment/commitment of the region (e.g. financial commitment, RCS, approval/permitting procedures)
 - Potential for organic growth of the infrastructure (LHP function)
 - Relevance for market preparation (differentiated & balanced market)For city bus locations, some of the above criteria are also valid
- In order to reduce time to commercialization, dilution of resources must be avoided → **This is critical for the future of H₂ in Europe**

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On-going Activity: The Clean Energy Partnership Berlin (CEP)

- As of today, the German **National Hydrogen and Fuel Cell Technology Innovation Programme (NIP)** demonstrates a clear & concrete commitment for hydrogen
- Within the NIP, the next phase of the demonstration project **CEP** (Phase II) will address the aspects of hydrogen for transportation (cars & city busses)
- CEP Phase II will be meeting the “**one pilot region**” criteria; it is being finalized with strong industry & governmental support:
 - Phase I: 2002 – 2007
 - Phase II: 2008 – 2010 ⇒ ”Milestone 2010”
 - Phase III: 2011 – 2016
- CEP Phase II will interact with **HyLights** through the adoption of the Monitoring & Assessment Framework (MAF); it is intended to become a **European Lighthouse Project (LHP)** as soon as the necessary framework is in place

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Expected Outcomes/Benefits for the European Regions

- To get to the point of commercialization of hydrogen and fuel cell vehicles in Europe as quickly and as efficient as possible it is crucial to concentrate on one pilot region as a starting point
- Fostering hydrogen transport development in that one pilot region will help speed up further deployment of hydrogen and fuel cell technologies across Europe without diluting resources
- The expected learnings will be shared with the European regions and will help them to implement future LHPs easier, quicker & more efficient

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