



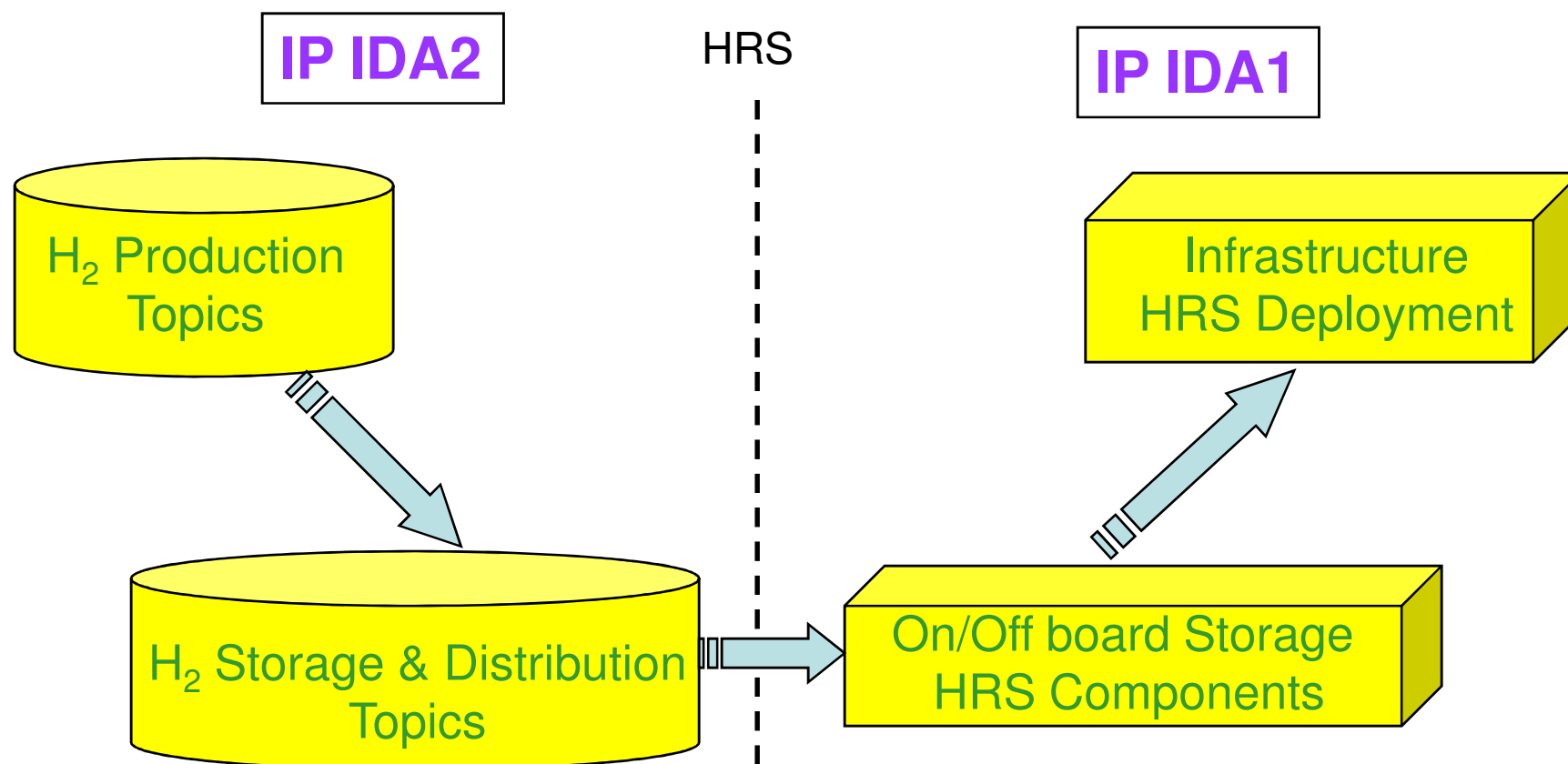
Hydrogen Production & Distribution

An Overview of the Challenges in Europe Perspectives

Scope & Objectives

- H₂ Production / Distribution :
 - To develop a portfolio of technologies able to provide 10-20% of the demand by 2015+ with Sustainable/Lean CO₂ Hydrogen.
 - To guarantee the Supply of the required Hydrogen Quality & Quantity for the various Application areas.
 - To contribute to the Deployment of Hydrogen fuelled vehicles by the timely setting-up of Hydrogen Refuelling Stations (Infrastructure).
 - To contribute overall to the Key EU Energy Targets (20/20/20...).

The Global Picture



Hydrogen Production/Distribution/Infrastructure targets in Europe
based on FCH JTI Work Programme (MAIP) & National/Regional projections

AA	Target Date	Description of Technical Program Targets
T	2010	<ul style="list-style-type: none">• Up to 10 road vehicles on 1 demo site with re-fuelling capacity for up to 100 road vehicles• Up to 20 buses on 3 sites with appropriate refuelling capacity
	2015	<ul style="list-style-type: none">• Up to 500 road vehicles and 3 additional demo sites with 3 new refuelling stations• Up to 500 buses on 10 EU sites with at least 7 new refuelling stations• System cost of 100 €/kW, durability 5000h for car propulsion systems• Ramp up scenario for European refuelling stations
H	2010	<ul style="list-style-type: none">• Appropriate hydrogen supply chain to match demonstration requirements
	2015	<ul style="list-style-type: none">• 10 - 20 % of hydrogen demand, carbon free/lean• Cost of delivered H₂ at fuelling station < 5 €/kg - centralized and decentralised, excl. taxes

- H2 Production & Distribution Topics (MAIP) :
 - Aimed at developing a portfolio of **Sustainable** Production, Storage & Distribution processes.
 - **Innovative** Production & Supply chains targeted.
 - Focus on Production from **Renewable** Energy Sources.
 - Solid state, Underground & Liquid **Storage** Technologies also developed.
 - **Efficiency** of existing Production processes to be improved.

Hydrogen Production/Distribution/Infrastructure Topics (MAIP)

No.	Activity	Cat	Rationale	
H01	Low-cost, low-temperature, high-efficiency electrolyser	BR AR	Research & Development activities on low-cost, low-temperature electrolysers systems & materials to enable the use of renewable energies like wind and PV for the production of hydrogen and demonstrate application and production readiness.	
H02	Fuel processing catalyst, modules & systems	AR D	Applied research on reforming technologies for hydrogen production in order to address short-term fuelling requirements based on conventional and alternative fuels incl. bio-fuels thus to enable initial ramp-up of numbers of hydrogen-fuelled vehicles in the market. Lead-coordination with H03 is required.	
H03	Gas purification technologies	AR	Applied research on gas purification technologies for hydrogen production and quality monitoring in order to address short-term fuelling requirements based on conventional and alternative fuels incl. bio-fuels. Coordination with H02 is required.	
H04	BTH thermal conversion process	D	Demonstration of application readiness of BTH thermal H ₂ production in order to allow hydrogen production from bio-mass, increase well-to-wheel efficiency and contribute to a sustainable energy portfolio. Progress expected in the area of Biomass gasification (Biofuels ETP) should support this activity.	
H05	New generation of high temperature electrolyser	AR	Applied research on high temperature electrolysis for the large-scale use of renewable solar and nuclear energy with substantial improvement of energy-efficiency.	
H06	Thermo-electrical-chemical processes for water decomposition	BR	Long-term basic research on thermo-electrical-chemical processes based on solar, nuclear or waste heat from other processes for increased efficiency of hydrogen production, i.e. 2nd generation of high-temperature water decomposition.	

Hydrogen Production/Distribution/Infrastructure Topics (MAIP)

H07	Underground H2 storage	D	Demonstration of technology options for underground storage and development of a strategic approach for the installation of efficient, safe and reliable large scale hydrogen storage as prerequisite to enable the introduction of a wide spread hydrogen infrastructure.	
H08	Low-temperature H2 production processes	BR	Long-term basic research on low-temperature, low-cost hydrogen bioprocesses in order to improve the efficiency of hydrogen production from renewable energies e.g. solar radiation, bio-feed-stocks, etc. leading among others to 2nd generation low-temperature BTH processes. Due to the long-term approach which requires further activities, pre-investments, strong commitments for enlarged long-term research and highest competences are crucial.	
H09	Solid and liquid H2 storage	BR	Long-term basic research on improved solid and liquid hydrogen storage options for increased efficiency and storage capability, i.e. 2nd generation hydrogen storage technology.	
H10	Large-scale H2 liquefaction	D	Demonstration of hydrogen liquefaction for large-scale hydrogen production and storage in order to establish an efficient high volume hydrogen distribution and fuelling system.	
H11	H2 pipeline field test & safety analysis	AR	Applied research, field test and safety analysis of hydrogen pipelines as an option for a safe and efficient high volume hydrogen distribution system.	

Hydrogen Production/Distribution/Infrastructure Topics (MAIP)

H - Support Activities to be included in Activities H1-H11					
H	PNR & RCS	S	Pre-normative research and RCS as part of the Activities No. H1-H11.		

C17	Socio economic planning tools for H2 infrastructure	S	Socio economic planning tools in order to build a hydrogen infrastructure deployment platform in MS, communities and regions.	
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Hydrogen Production/Distribution/Infrastructure Topics (MAIP)

T - Transportation & Refuelling Infrastructure

No.	Activity	Cat	Rationale	
T01	Road vehicle large scale demonstration including refuelling infrastructure	D	Large-scale demonstration of second-generation fuel cell vehicles fleets with improved duration, robustness, reliability and efficiency to prove application readiness of the technology; demonstrate feasibility of infrastructure for daily use; provide extended operating experience and awareness to customers and the public; provide a data base for the assessment of environmental benefits associated with the commercial introduction of fc vehicles and infrastructure.	
T09	HRS components	AR	Applied research on key components of hydrogen refuelling station components in order to ensure application readiness for large-scale, real-use market introduction.	
T13	Periphery H2 tank system & conditioning components	AR	Applied research on hydrogen storage and conditioning components of refuelling stations to further improve robustness, functionality and safety.	

Hydrogen Production/Distribution/Infrastructure Topics : The Next Steps (AIP2008)

For AIP2008, Hydrogen Production, Storage and Distribution activities will focus on the development and testing of new prototypes of low cost, low temperature, high efficient electrolysers to enable the increased use of renewable energy, such as wind and photovoltaics.

Moreover, Research activities will be conducted to demonstrate the technical and economical feasibility of thermo-electrical-chemical decomposition of water as a potential pathway for the renewable production of hydrogen.

Area Hydrogen Production, Storage & Distribution		
5	Development of low temperature, high efficiency electrolyser based on PEM technology	Development activities on low cost, low temperature electrolysers based on PEM technologies, including prototyping and testing; demonstration of the application and production readiness.
6	Development of low temperature, high efficiency electrolyser based on alkaline technology	Development activities on low cost, low temperature electrolysers based on alkaline technologies, including prototyping and testing; demonstration of the application and production readiness.
7	Thermo-chemical processes with solar heat sources	RTD activities on thermo-chemical processes coupled with solar including research on high temperature water decomposition processes

Hydrogen Production/Distribution/Infrastructure Topics : The Next Steps (AIP2008)

For AIP2008, The Infrastructure issue will be focussed as follows :

The new HRS shall qualify for the following performance targets:

- **Refuelling capacity** up to 200 kg H₂/day for a typical number of 50 vehicles/day, allowing to refill 5 vehicles within one hour.
- **Proof of technical concept** to reach a filling capacity of 400 kg/day and 100 vehicles as technical requirement for future calls
- Refuelling station **availability** 98%
- **Hydrogen cost** at station <€10/kg (*excluding tax*) at start of project with an ultimate target of €5/kg (*excluding tax*) based on sufficient numbers of vehicles to achieve the requested economies of scale
- Hydrogen **purity** according to Specification SAE J2719 and/or ISO14687 (TC197 WG 12) and **refilling** time according to SAE J2601 as guidance
- **Station energy efficiency** 50 – 70% : an assessment and validation framework shall be used, based on well validated procedures, such as those developed in the *HyLights* project.

The Policy Challenge or How to make it happen?

- FCH JTI Operations & Success are essential...
- In order to get a successful further Deployment of the H2 Technologies in Europe, a strong Policy Support Scheme will be required :
 - To attract Industry (investments),
 - To support both OEMs and Energy Providers in the field of Transport,
 - To consolidate the implication of Regions/MSs,
 - ...To support the upfront investments (Valley of Death).
- Bridging the Gap has a Cost, that of a Sustainable & Environmental friendly future Mobility.



Thank you for your attention...