World Materials Forum

Top 10 Technologies





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Meta view of the electric mobility



BEV versus FCEV					
		BEV	FCEV		
Energy	Production		Opportunity with H2 for buffering the energy from renewables		
	Transportation and storage	Difficult or expensive to store	Opportunity for H2 offshore production & long distance shipping		
	Refueling	22, 50, 150, 350kW, Trade-off btw charging time, investments and energy cost	Fast refueling time (3mn) well adapted to high intensity usage		
Vehicle	Critical materials	NMC: Lithium, Nickel, cobaltOpportunity with Sodium-ion for low range cars	 Platinum for FC stack but with reasonable quantity Carbon fiber for tanks 		
	Product design	High battery weight which is an issue for payload of commercial vehicles	Shape of the tanks difficult to integrate in passenger cars but opportunity with conformable tanks		
Sustainability	Circular economy	 Second life out of the vehicle is necessary as well as recycling to manage the critical materials& compensate high emission intensity of battery cell production Possible second life of tanks in a second vehicle thanks to smart tanks and then carbon fiber recycling esp with thermoplastic resins Carbon fiber devt from renewable materials Platinum recycling for FC stack 			

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Costs of the refueling stations for the different powertrains



Simulation for 500km range on highway

	Gasoline	BEV	FCEV
Energy at the wheel	110kWh	110kWh	110kWh
Energy in the tank	310kWh/35,75l	115kWh	220kWh
Refueling time	2mn	20mn/350kW	2mn
Number of stations at iso delivered range	8	80 (28MW) Paris-Nice 27 refueling areas means 750MW	8
Cost of the station	2.8M€	12M€	4M€



Hydrogen infrastructure Type IV container



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Multi Element Gas Container (MEGC) to supply hydrogen and decarbonize heavy mobility



- Lightweight
 - **ight** Type IV tanks have the best H2 to weight ratio **ideal for mobile applications**
- Robust
- Extensive resistance to cycling and pressure variations ideal for refueling stations
- Standardized
- ed 20ft standard marine container onboarding 350-500kgs of H2 (scalable to 40/45ft) multi modal usage



Hydrogen distribution

- Momentum of hydrogen production worldwide accelerated by Ukraine crisis (e.g. REPowerEU plan)
- Limited H2 pipeline infrastructure before 2030
- Container to answer distribution demand: from production to end-user
- Lightweight container enabling fuel saving



Hydrogen refueling stations

- States pushes for HRS deployment (Alternative Fuel Infrastructure Regulation Directive to be adopted end of 2022)
- Stationary H2 Type I steel storage to be replaced by swappable
 Type IV containers
- Type IV enables higher pressure and better durability



Heavy mobility

- Focus on freight transport and in-land shipping decarbonation
- Heavy power requirements addressed by containers hydrogen storage
- Standardized dimension for marine bunkering & railway carriage



Projected cost comparison between BEV and FCEV powertrains in 2030



Simulation for highway





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