

Transcending India into a global hydrogen hub - Examining demand pockets for green hydrogen offtake

Part-7 (Global demand clusters, international trade and development hydrogen strategy roadmaps for different geographies)

India as a global hub of hydrogen & exporter

Capability examination & likely demand pockets globally for green hydrogen as per existing, potential & high growth pockets

GLOBAL HYDROGEN LANDSCAPE

Underpinned by a global shift of regulators, investors and end consuming industries towards decarbonization, hydrogen (H₂) is receiving unprecedented interests and investments. With the onset of calendar year (CY) 2021 close to 30 nations have released their hydrogen strategy and roadmaps. More than 200 projects have been announced worldwide till March'2021 with a public funding of over USD 70 Billion. Although, the momentum exists along the entire value chain but its more skewed towards large scale industrial usage followed by transport and integrated H₂ cross industry projects. It is pertinent to note that of total announced H₂ projects in 2021, large scale industrial projects holds a lion share of close to 40%.

There exist about 228 hydrogen projects globally till March'2021 across the value chain, with nearly 56% projects are in Europe followed by Asia with 20% and 11% originating in Oceania covering Australia and New Zealand. If all the projects come to fruition, total investments will exceed USD 300 Billion by 2030, which equivalent to 1.5% of global energy funding. However, only USD 80 Billion of this investment can currently be considered mature which means that the investment is either in a planning stage, has passed a final investment decision or is associated with a project under construction already commissioned or operational.

This global shift towards decarbonization has only be seen due to strong financial & policy- regulatory backing from the respective governments worldwide. For example, the European Union has announced a 40-gigawatt (GW) electrolyzer capacity target for 2030.

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Featuring over 750 projects the pipeline is testimony to the size and dynamism of the European hydrogen industry. More than 600 projects are planned to enter operation by 2025 across Europe.

– Mr. Thierry Breton ,
Commissioner for Internal
Market, Europe

Increasing focus is placed on regionally integrated hydrogen ecosystems, so-called hydrogen hubs, hydrogen clusters or “ Hydrogen Valleys”

In addition to the “top down” measures, specific projects need to create the new hydrogen market from the “bottom up” . Here , increasing focus is placed on the regionally integrated hydrogen ecosystems, so-called hydrogen hubs, hydrogen clusters or “ hydrogen valleys”. Over recent years, the Hydrogen Valley concept has emerged as a firmly established term in the European funding and collaboration landscape. Although Hydrogen Valley concepts are always adapted to cater to specific regional circumstances and the overall objectives of a project, there are common characteristics of what constitutes a Hydrogen Valley.



Hydrogen is a promising energy carrier with multiple uses & the potential to play an essential part in achieving deep cuts in emissions & improved security and resilience of the global energy system at scale

-European Commission

WHAT MAKES A HYDROGEN VALLEY ?

A. Large in scale - The project scope goes beyond mere demonstration activities and entails at least a two-digit multi-million EUR investment. It typically also includes several subprojects that make up the larger Valley "portfolio".

B. Clearly defined geographic scope - Hydrogen Valleys are hydrogen ecosystems that cover a specific geography. Their footprint can range from a local or regional focus (e.g. a major port and its hinterland) to a specific national or international region (e.g. a transport corridor along a major European waterway).

C. Broad value chain coverage - Across their geographic scope, Hydrogen Valleys cover multiple steps in the hydrogen value chain, ranging from hydrogen production (and often even dedicated renewables production) to the subsequent storage of hydrogen and distribution to off-takers via various modes of transport.

D. Supply to various end sectors – Hydrogen valleys usually showcase the versatility of hydrogen by supplying ideally several sectors in their geography such as mobility, industry and end uses.

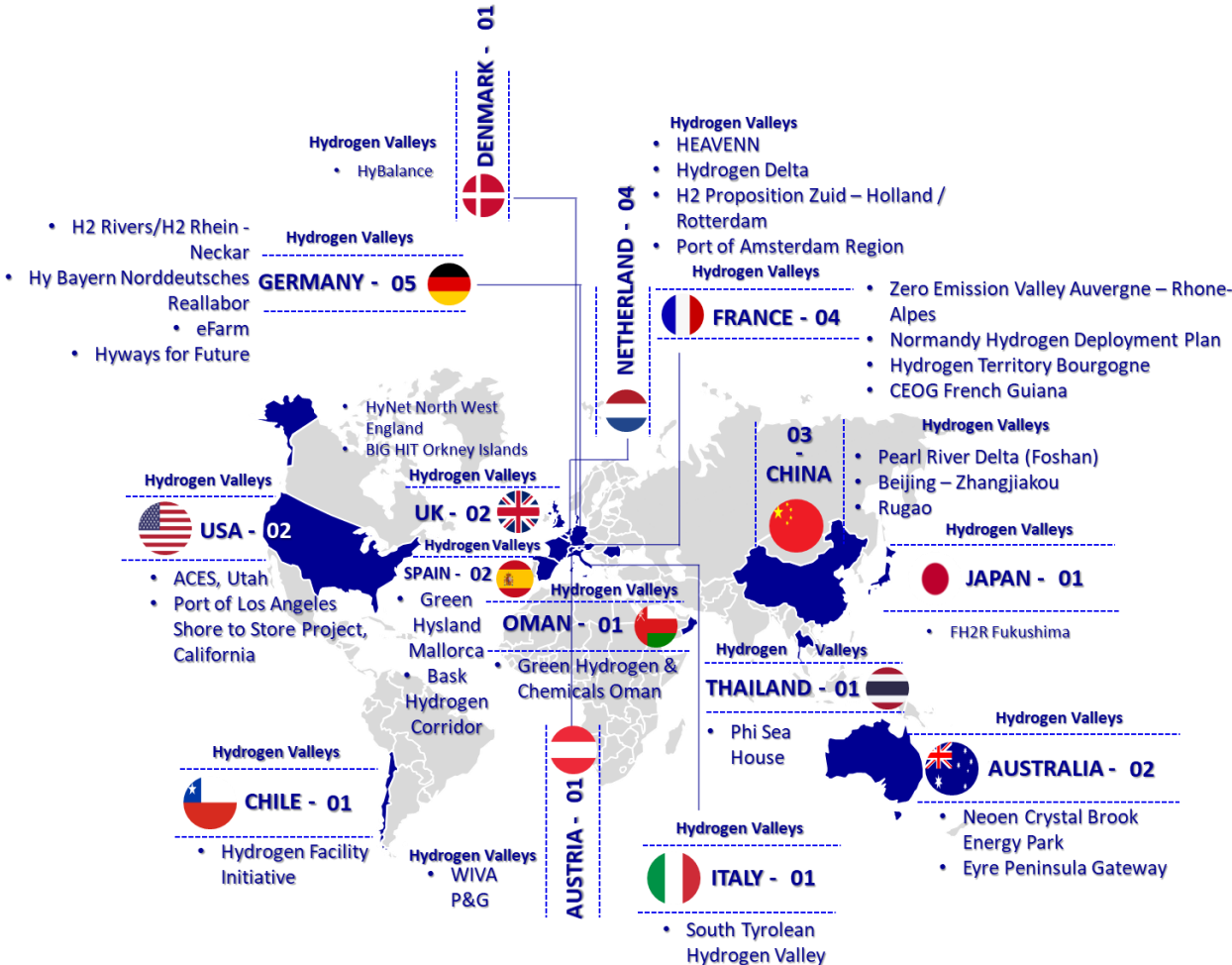
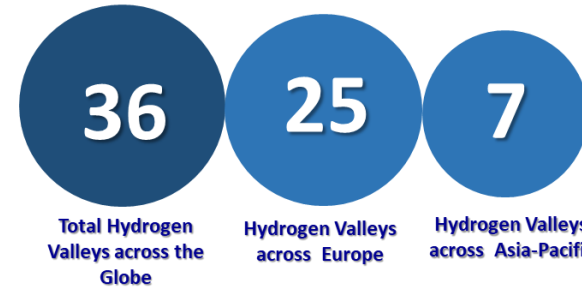
Hydrogen Valleys across the globe as on May'2021



EUROPE (IPCEI) - 04

Hydrogen Valleys

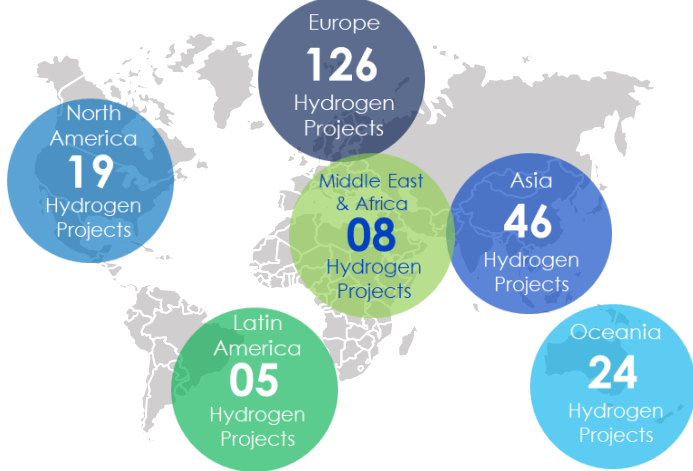
- Blue Danube
- Black Horse
- Green Octopus
- Green Crane
- Sines Industrial Hub



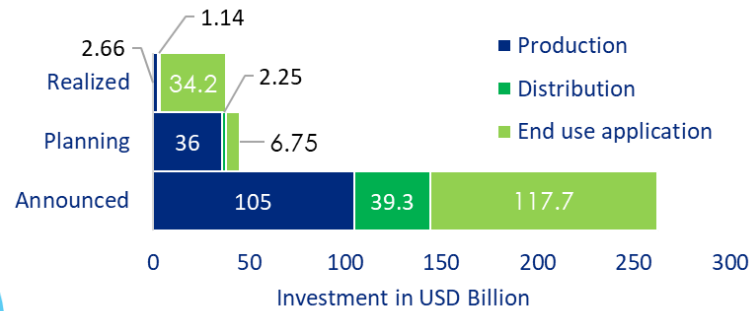
What makes a hydrogen valley ? (i) Large in scale – setting investments of two digit multi million euros in projects that are beyond piloting (ii) Broad value chain coverage – covering multiple steps of the value chain from hydrogen production to storage, transport and offtake (iii) Supply of more than one sector – Versatility in supplying the hydrogen to more than one end sector or application (iv) Geographically defined scope – creating hydrogen ecosystems that cover a specific geography from local/regional activities to international outreach

Key statistics for global hydrogen market

Total hydrogen projects announced globally till March 2021



Investment split of global hydrogen projects announced till March 2021



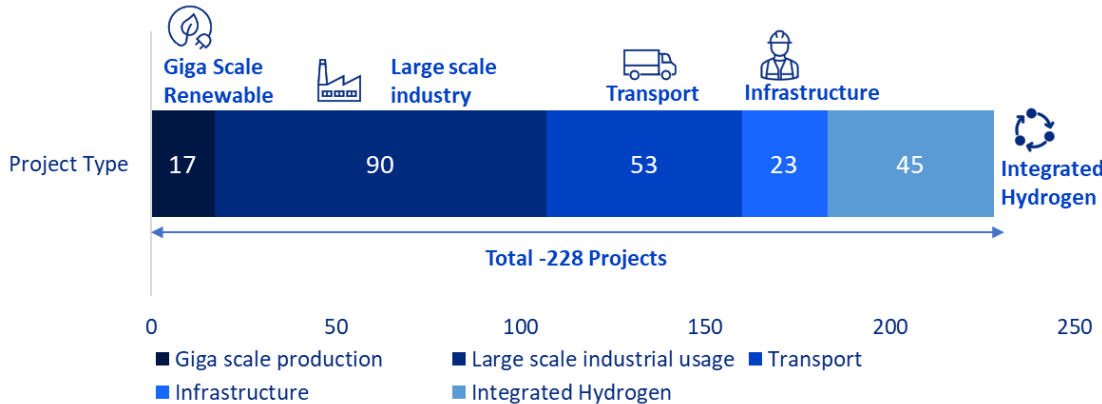
Announced - Projects in press announcements or preliminary study stage. Also includes required investment to reach national targets and government funding pledges

Planning - Projects that are at the feasibility study or front-end engineering and design stage

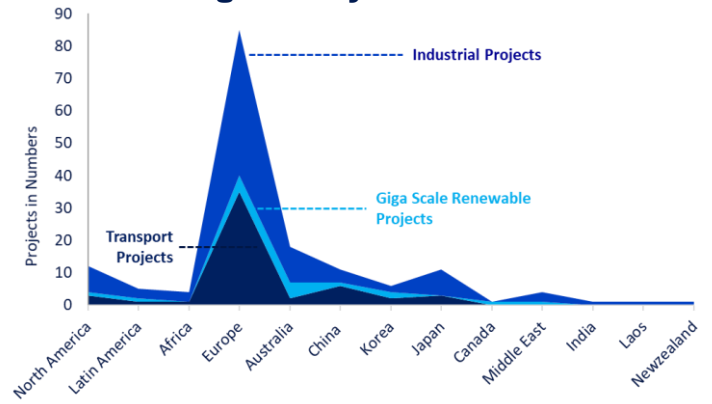
Realized - Projects where a final investment decision (FID) has been taken, under construction, commissioned and operational

Total hydrogen projects split as per end consuming industry

Giga scale production : renewable H2 projects > 1GW and low carbon H2 projects >200 kt p.a.



Split of globally announced hydrogen projects for few nations by key end consuming industry



Since 2017 till date , hydrogen industry stakeholders have announced more than 30 major investments globally





Hydrogen development across the globe is accelerating. Building on this momentum , governments have implemented a growing number of tangible policies promoting hydrogen. Since 2017 till first half of year 2021 nearly 18 governments (this is increasing), whose economies account for 70 per cent of global GDP, have developed detailed strategies for deploying hydrogen energy solutions. This includes recent announcements from the coalition of governments forming the Energy Ministerial to target the global deployment of 10 million fuel cell electric vehicles (FCEVs) by 2030 – a fourfold increase of the target over the last two years – and projects across China, Japan, the US, and South Korea to build 10,000 hydrogen refuelling stations by 2030.

More industry players are recognising hydrogen's versatility and falling cost, enabling investments in a growing range of sectors. One such global initiative, the Hydrogen Council, has seen its membership grow to 60 companies (till 2021). This is up from 13 at its founding in 2017, representing a combined market cap of USD 1.7 trillion with combined revenues of over USD 2.6 trillion and close to 4.2 million jobs around the world.

DRIVERS & INDICATORS OF HYDROGEN MOMENTUM

Over the same period, stakeholders have proposed more than 30 major investments globally in segments such as heavy-duty trucking, rail, and steel production from low-carbon or renewable hydrogen.

Drivers and Indicators of Hydrogen's Momentum

Drivers of renewed interest in hydrogen		Indicators of hydrogen's growing momentum	
			
Stronger push to limit carbon emissions	Falling costs of renewables and hydrogen technologies	Strategic push in national roadmaps	Industry alliances and momentum growing
8	80%	70%	60
Years remaining in the global carbon budget to achieve 1.5° C goal	Decrease in global average renewable energy prices since 2010	Share of global GDP linked to hydrogen country roadmaps to date	Members of the hydrogen council in 2021 up from 13 in 2017
66	55x	10 m	30 +
Years remaining in the global carbon budget to achieve 1.5° C goal	Growth in electrolysis capacity by 2025 vs. 2015	2030 target deployment of FCEVs announced at the Energy Ministerial in Japan	Major investments announced globally since 2017 , in new segments e.g. heavy duty & rail

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