CLEAN HYDROGEN MISSION

Building a global hydrogen economy

The importance of international cooperation

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CLEAN HYDROGEN MISSION

Mission Innovation

Shared global challenges of combating climate change, generating sustainable jobs and growth, and ensuring energy access and energy security.

- ✓ Making clean energy affordable, attractive and accessible to all.
- ✓ Mobilising and connecting global RD&D efforts to accelerate the implementation of the Paris Agreement
- ✓ Maximising the impact of research, development and demonstration investments, working together and with others.
- ✓ Supporting faster, cleaner, affordable energy transitions, increasing global confidence to set, or strengthen, ambitious climate and energy goals.

Clean Hydrogen Mission (CHM)

- Goal of the Clean Hydrogen Mission is to increase the cost-competitiveness of clean hydrogen by reducing end-to-end costs to a tipping point of 2 USD/kg by 2030.

- The Clean Hydrogen Mission Action Plan 2022-2024 is published to stimulate greater international cooperation on clean hydrogen technology and industrial processes


MISSION INNOVATION

June 2021

JOINT MISSION STATEMENT

Clean Hydrogen Mission: Building a global clean hydrogen economy

On behalf of the governments of Australia, Austria, Canada, Chile, China, the European Commission on behalf of the European Union, Germany, India, Italy, Morocco, Republic of Korea, Norway, Saudi Arabia, the United Kingdom and the United States of America ("Mission members") on 2 June 2021

The Clean Hydrogen Mission

Co-leads


Australia


Chile


European Union


United States


Jnited Kingdom

Members


Germany


Saudi Arabia


Austria


Morocco


United Arab Emirates


Spain


Canada


China


France


Norway


Finland


India


Italy


Japan


Republic of Korea


Netherlands

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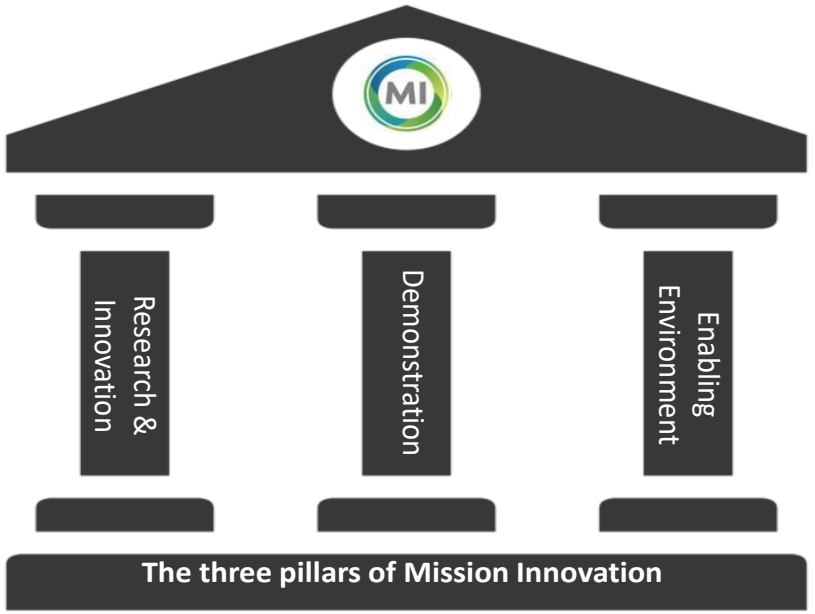
CHM - Action Plan

- The Mission's activities are organised into three key pillars, targeting:
  - the promotion of research, development and innovation, including across clean hydrogen production, distribution and storage, and end-use applications **(Pillar 1)**;
  - demonstration of different production, storage and transportation methods by working with relevant stakeholders to explore sector coupling and creating integrated clean hydrogen valleys **(Pillar 2)**; and
  - identifying 'demand-pull' efforts to diffuse and deploy solutions, facilitate the creation and dissemination of non-technological and non-commercial knowledge and create positive engagement from relevant stakeholders **(Pillar 3)**.



Pillar 1: Research & Innovation

- **Actions:**

1. Analysis of global hydrogen RD&D opportunities
2. Assessment of best-practice case studies
3. Working Groups

   i) clean hydrogen production, ii) storage and distribution, iii) end-use

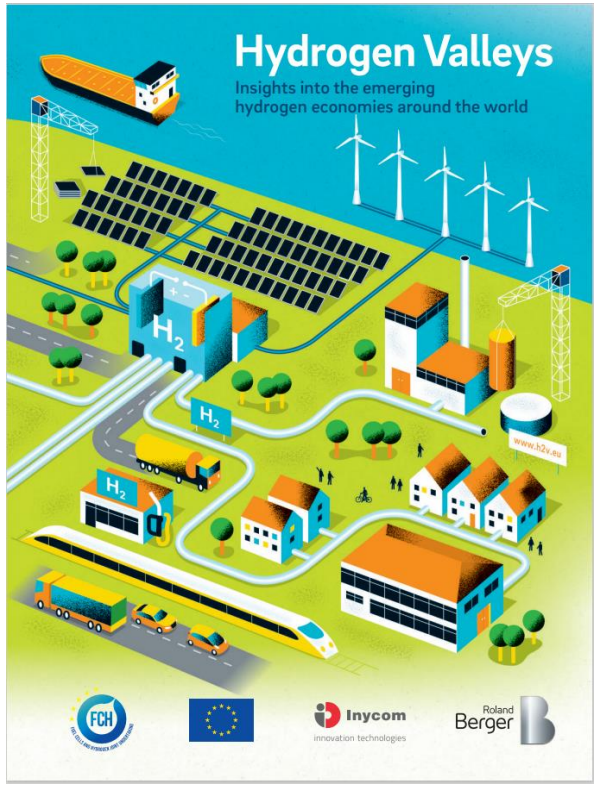
4. Clean Hydrogen Partnership Coalition

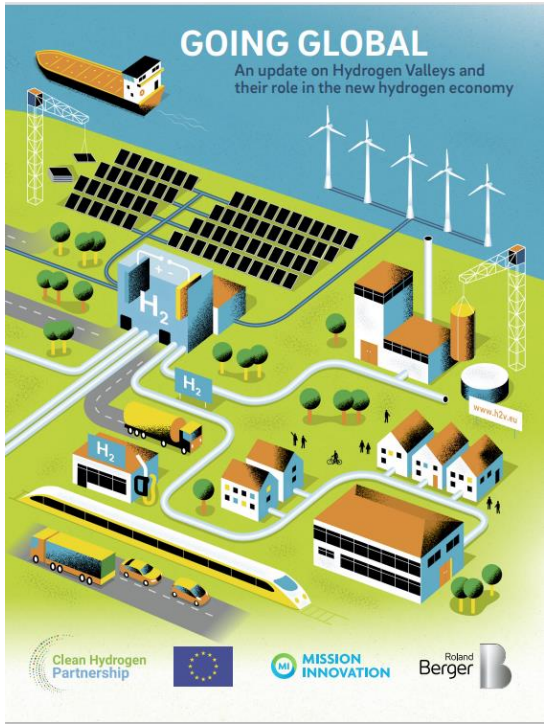
Pillar 2: Demonstration

- **Sprints:**

1. Identification of 100 Clean Hydrogen Regions: Enhancing the ambition to identifying 100 Clean Hydrogen Valleys, through partnerships and linkages

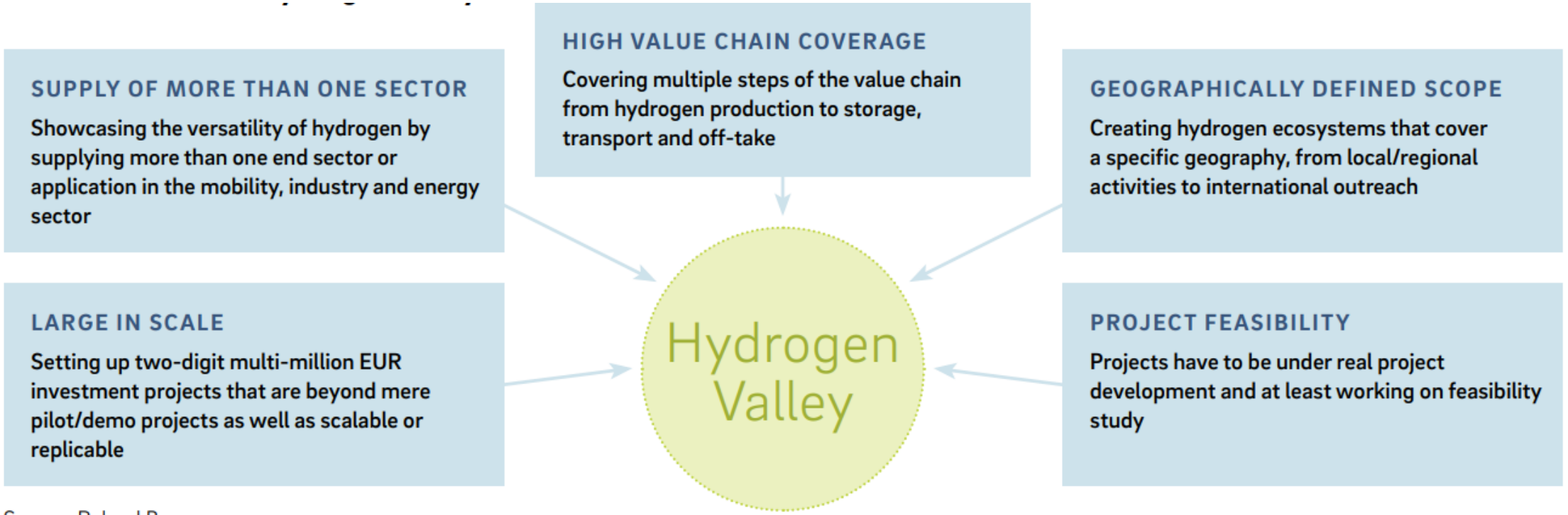
2. Hydrogen Exchange: Support of non-MI countries to develop Hydrogen Valleys





[Reports | H2Valleys](https://h2v.eu/analysis/reports)
https://h2v.eu/analysis/reports

What makes a hydrogen valley



Source: Roland Berger

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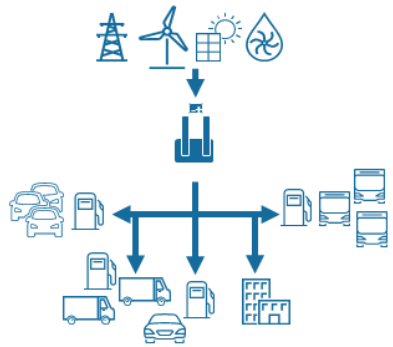
What is a hydrogen valley

Archetype 1:

Local, small-scale & mobility-focused

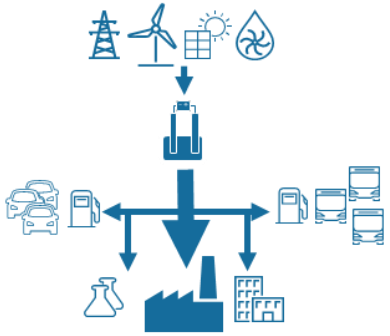


> Local (green) hydrogen production projects serving mobility applications
> Key focus is on aggregating consumption volumes and sharing refuelling infra (e.g. HRS)
> Legacy of mobility/electrolyzer demo projects
> Mostly led by public-private initiatives

Examples: Hyways For Future (Germany), Zero Emission Valley Auvergne-Rhône-Alpes (France), Hydrogen Valley South Tyrol (Italy)

Archetype 2:

Local, medium-scale & industry-focused

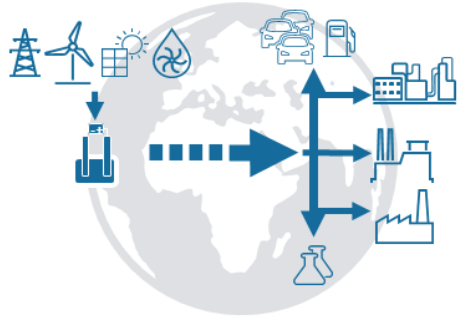


> Local (green or blue) hydrogen production projects centered around 1-2 large off-takers as "anchor-load", smaller mobility off-takers as add-on
> Making use of existing infra around industrial plants, often replacing grey H2 supply
> Mostly led by private sector

Examples: Basque H_2 Corridor (Spain), Advanced Clean Energy Storage (USA), HyNet North West England (UK)

Archetype 3:

Larger-scale, international and export-focused



> Large-scale projects with low-cost (green or blue) production, ultimately aiming for long-distance hydrogen transport to large off-takers abroad
> Focus on connecting supply and demand internationally
> Mostly led by private sector

Examples: Eyre Peninsula Gateway (Australia), Blue Danube (IPCEI), Green Crane (IPCEI)

Launch of Mission innovation 2.0

E: Global Hydrogen Valley activities and example projects from the Mission Innovation Hydrogen Valley Platform

United Kingdom
- → HyNet North West
- → BIG HIT Orkney Islands

Netherlands
- → HEAVENN
- → Hydrogen Delta
- → Europe's Hydrogen Hub: H_2 Proposition Zuid-Holland/Rotterdam

Belgium
- → Flemish Hydrogen Ports Valley

Germany
- → H2Rivers
- → HyBayern
- → eFarm
- → Northern German Living Lab
- → Hyways for Future

Italy
- → Hydrogen Valley South Tyrol
- → H2iseO Hydrogen Valley

Denmark
- → HyBalance

Austria
- → WIVA P&G: Hydrogen Flagship Region

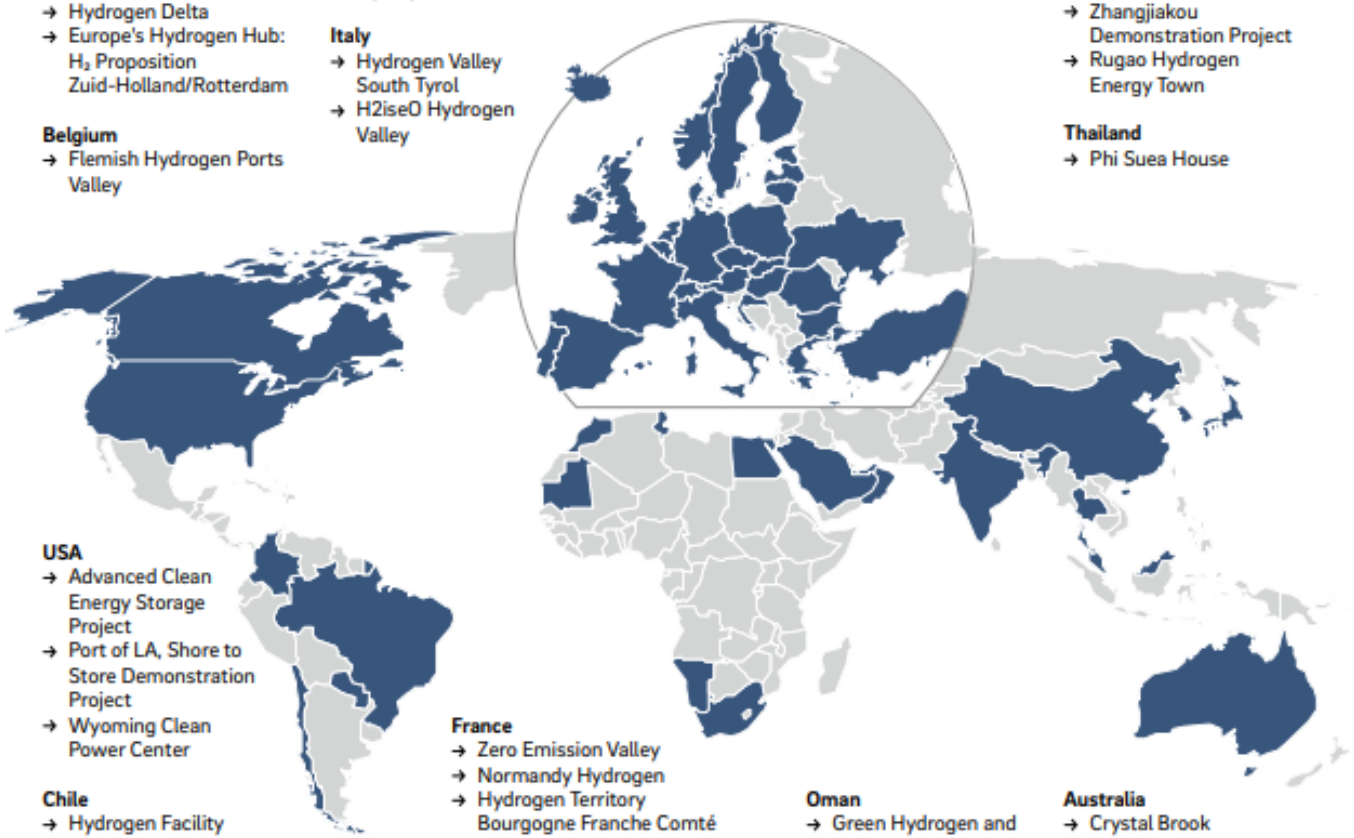
Portugal
- → Sines Industrial Hub

Spain
- → Green Hysland
- → Basque Hydrogen Corridor

Japan
- → FH2R Fukushima

China
- → Foshan Nanhai Xianhu Lake Hydrogen Valley Town
- → Zhangjiakou Demonstration Project
- → Rugao Hydrogen Energy Town

Thailand
- → Phi Suea House



USA
- → Advanced Clean Energy Storage Project
- → Port of LA, Shore to Store Demonstration Project
- → Wyoming Clean Power Center

Chile
- → Hydrogen Facility Initiative

France
- → Zero Emission Valley
- → Normandy Hydrogen
- → Hydrogen Territory Bourgogne Franche Comté
- → Centrale Electrique de l'Ouest Guyanais

Oman
- → Green Hydrogen and Chemicals Oman

Australia
- → Crystal Brook Hydrogen Superhub
- → Eyre Peninsula Gateway

Countries with ongoing Hydrogen Valley activities

Source: Clean Hydrogen JU, Roland Berger

WIVA P&G: Hydrogen Flagship Region

LEAD DEVELOPER

WIVA P&G

PROJECT PARTNERS

WIVA P&G combines the experience of more than 30 completed and ongoing projects and will implement approx. 25 sub-projects within the energy model region.

PROJECT SUPPORTERS

- Climate & Energy Fund Austria
- Research Program "Energy Model Region"

LOCATION

Austria

PROJECT DESCRIPTION

The energy model region WIVA P&G pursues demonstrating the conversion of the Austrian economy to a largely CO_2-neutral structure with the production and use of renewable hydrogen as an important component.

H_2 PRODUCTION VOLUME

3,650 tons/year

TOTAL INVESTMENT VOLUME

80 EUR m

FUNDING

Publicly and privately funded

PROJECT TIMELINE

2018 Start — 2025 Finalisation

PROJECT STATUS

Construction

VALUE CHAIN COVERAGE

H_2 production route
- PEM electrolysis

H_2 end uses (target off-takers)
- Industry
- Mobility
- Energy

H_2 storage / conversion
- Other

H_2 transport / distribution
- Trucking
- Ship

example

BIG HIT

LEAD DEVELOPER

Foundation for the Development of New Hydrogen Technologies in Aragon

PROJECT PARTNERS

FHA, ITM, Orkney Council, Calvera, SDT, CES, EMEC, DTU, SymbioFC, SFHCA, Giacomini, Ministry of Transport and Infrastructure – Malta

PROJECT SUPPORTERS

- Clean Hydrogen Joint Undertaking
- Scottish Government
- UK Government

LOCATION

Orkney Islands

PROJECT DESCRIPTION

BIG HIT is a six-year demonstration project which aims to create an integrated low carbon and localised energy system establishing a replicable model of hydrogen production, storage, distribution and utilisation for low carbon heat, power and transport.

H_2 PRODUCTION VOLUME

confidential

TOTAL INVESTMENT VOLUME

14 EUR m

FUNDING

Publicly and privately funded

PROJECT TIMELINE

2014 Start — 2022 Finalisation

PROJECT STATUS

Post-FID (financing, tendering, etc.)

VALUE CHAIN COVERAGE

H_2 production route
- PEM electrolysis

H_2 end uses (target off-takers)
- Mobility (cars)
- Energy (stationary fuel cells)

H_2 transport / distribution
- Ship

example

Basque Hydrogen Corridor

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LEAD DEVELOPER

Petronor (Repsol Group)

PROJECT PARTNERS

The project consortium consists of 78 entities, including research organisations, business associations, and private entities.

PROJECT SUPPORTERS

- Spanish Ministry of Industry, Trade and Tourism
- Basque Government
- Provincial Councils of Biscay, Gipuzkoa and Araba
- Bilbao City Town Hall

LOCATION

Bilbao

PROJECT DESCRIPTION

Large-scale project to develop a renewable hydrogen economy in the Basque Country and surrounding regions, proving hydrogen as enabler for the energy transition, with applications throughout the renewable hydrogen value chain, and boosting technological and industrial competitiveness.

H_2 PRODUCTION VOLUME

24,600 tons/year

TOTAL INVESTMENT VOLUME

3,000 EUR m

FUNDING

Publicly and privately funded

PROJECT TIMELINE

2020 Start — 2030 Finalisation

PROJECT STATUS

The in total 38 projects are all between project conceptualization phase and start of constructions.

VALUE CHAIN COVERAGE

H_2 production route
- Alkaline electrolysis
- Solid oxide electrolysis

H_2 end uses (target off-takers)
- Industry (refineries, steel)
- Mobility (cars, buses, trucks, forklifts, ships)
- Energy (gas grid injection)

H_2 storage / conversion
- Cylinder
- Cavern

H_2 transport / distribution
- Pipeline
- Trucking

Success factors and key barriers

- A **convincing project concept** with a value chain coverage and technology choices that leverage local assets and address local needs
- A **viable commercial structure** that enables first real business cases for developers (incl. any public funding)
- **Public-private financing from multiple sources** that includes enough public funding to close all gaps
- Partnering and stakeholder cooperation that covers the entire project scope and ensures **continuous commitment from all parties** involved
- **Political backing and buy-in of the general public** for smooth and continuous project development

- Obtaining (**public) funding support** to close the remaining funding gaps
- **Finding green hydrogen off-takers** and signing long-term contracts to make projects bankable
- Ensuring **Technology readiness** of all fuel cells and hydrogen applications required
- Ensuring adequate **legal regulatory support** (carbon pricing, standardization, fast permitting, etc)

Pillar 2: Demonstration

- **Sprints:**

1. Identification of 100 Clean Hydrogen Regions: Enhancing the ambition to identifying 100 Clean Hydrogen Valleys, through partnerships and linkages

2. Hydrogen Exchange: Support of non-MI countries to develop Hydrogen Valleys

https://h2v.eu/join-us
or send an email to: H2V@clean-hydrogen.europa.eu!

5 Join the platform!

The relaunched Hydrogen Valleys Platform intends to feature new, recently emerged Hydrogen Valley projects from around the world. As such, the project consortium has continued to contact potential project additions to evaluate their compatibility with the Hydrogen Valley definition and the platform's goals.

We encourage and invite all other projects at project development stage from around the world to reach out to join the platform. We firmly believe that by participating in the further development of the Hydrogen Valleys Platform, project developers will play a significant role in promoting the emergence of other hydrogen projects, and thereby facilitating the global clean energy transition as such. Above that, these projects will join an exclusive group of other leading hydrogen projects who can actively collaborate and exchange best practices.

If you are interested, please get in touch regarding your Hydrogen Valley via https://h2v.eu/join-us or send an email to H2V@clean-hydrogen.europa.eu!

HYDROGEN VALLEY · H2V · CERTIFIED BY MISSION INNOVATION

In a next step, our team will evaluate the fit of the project regarding the Hydrogen Valley definition, which includes a comprehensive survey on project fundamentals, technologies deployed, project development overall, financial aspects as well as hurdles and key success factors. Afterwards, the project will be featured on the platform and joins the circle of successful peers from around the world. Furthermore, all Hydrogen Valleys on the platform will receive an H2.0 Valley Certificate. They are thus recognised and certified by Mission Innovation and the Clean Hydrogen Joint Undertaking as a global Hydrogen Valley flagship.

We are very much looking forward to hearing from you!

Pillar 3: Enabling Environment

- **Actions:**
  - **Clean Hydrogen Knowledge Platform, covering the following topics:**
    - Regulations
    - Codes and Standards
    - Finance & Investment

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Building a global clean hydrogen economy

- Need for a Global energy transition

- Best practice exchange (regulatory issues, technical, ...)
- Building up hydrogen (manufacturing) value chains /supply chains (security)
- Creating business opportunities

Building a global hydrogen economy

Thank you!

CLEAN HYDROGEN MISSION

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