

# H<sub>2</sub>ypic centers in the EU

*the challenge of building local hydrogen clusters*

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Waterstofregio

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## EHA: H2 *from where and when to here and now!*



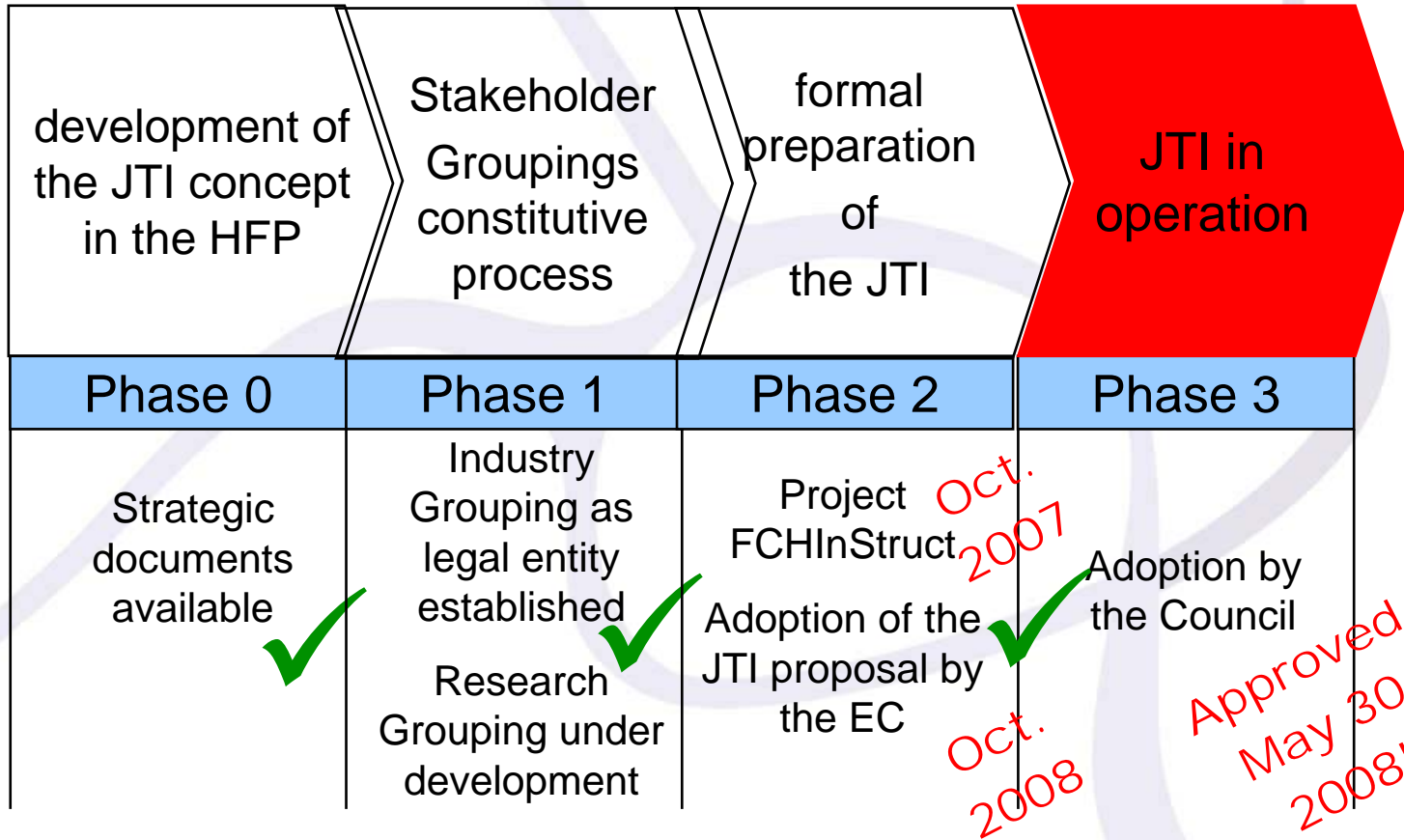
- **Mission:** *foster the development of hydrogen technologies and their use in industrial, commercial and consumer applications;*
- **Membership** includes 14 national associations and the main hydrogen production and distribution companies: allows for insight in local developments and facilitates communication of industry needs.
- EHA is actively following EU's Research, Energy and Transport policy; online database of policy affecting the use of hydrogen, EHA Taskforce on RE/H2 energy chains and EU Strategic Energy Technology Plan, EHA Brochure "Where does the energy for hydrogen production come from?" and "Hydrogen and fuel cells as strong partner of renewable energy systems".
- Collect insight in and support for local developments through involvement in EU and national projects of EHA national association members; EHA industrial members are member of Industrial Grouping of JU FCH.
- Through involvement of national associations coordinate promotional activities: EHA Taskforce "Hydrogen in the City": support coordination of regional activities; EHA is secretariat of HyRaMP since April 2008;

# JTI Gossip



2005

2008



JTI Gossip

## Innovation and Development Actions

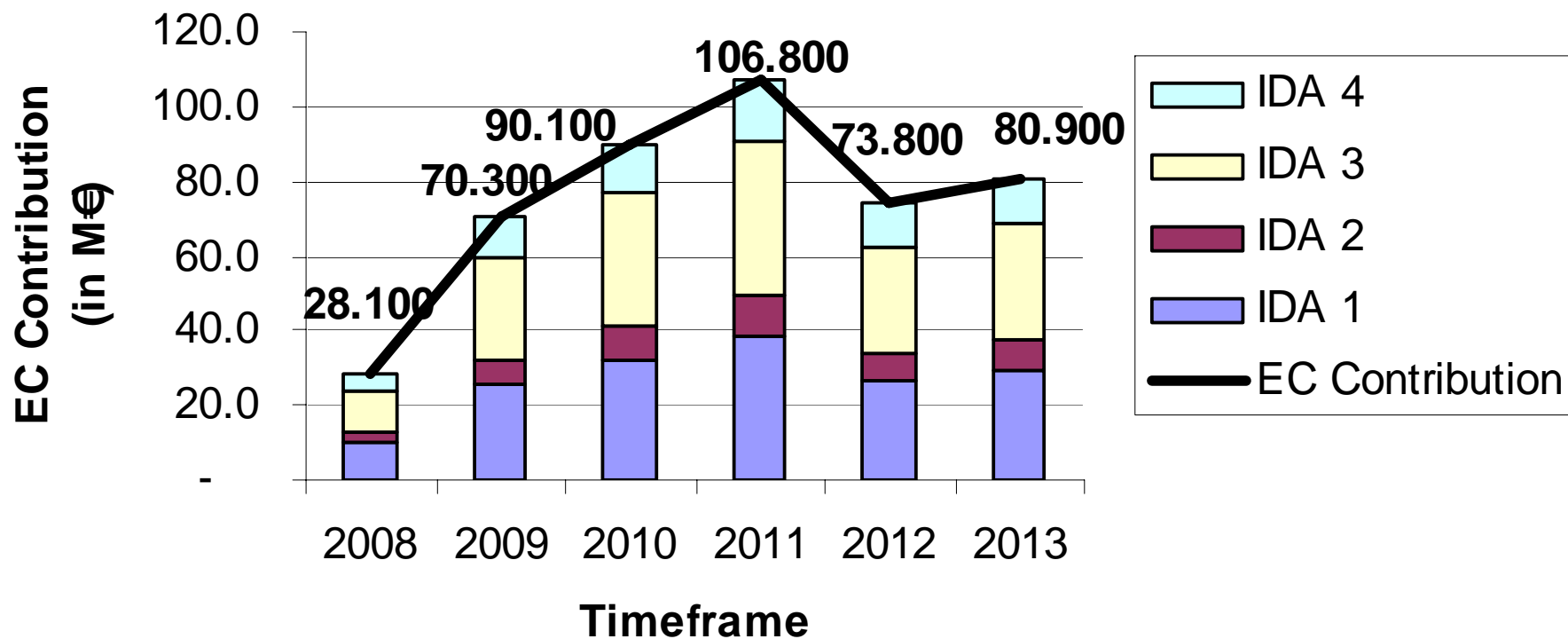
IDA 1 : Hydrogen vehicles and refuelling stations

IDA 2: Sustainable hydrogen production and supply

IDA 3: Fuel Cells for CHP and Power Generation

IDA 4: Fuel Cells for Early Markets (**Regios!**)

## Operational Resources Breakdown 2008-2013



# H2 production technologies most technically mature for early commercialization



	Demo	Early commercial	Commercial	Application	Comments
CCS + (gasification/reforming)	2011	+/-2015	+/- 2020	<ul style="list-style-type: none"> <li>• Shell Pernis (NL), RCI R'dam (NL), RWE Cologne (G)</li> </ul>	<ul style="list-style-type: none"> <li>• Capture cost with gasification is much lower, than for reforming</li> </ul>
Coal gasification with biomass cofeeding			2007	<ul style="list-style-type: none"> <li>• Nuon, Buggenum plant (NL)</li> </ul>	<ul style="list-style-type: none"> <li>• Buggenum coal gasification power plant can use up to 30% of biomass as feedstock</li> </ul>
Bio-gasification	+/- 2008	+/- 2014	+/- 2018	<ul style="list-style-type: none"> <li>• Freiburg (G), Choren,</li> <li>• Gussing (A)</li> </ul>	<ul style="list-style-type: none"> <li>• Beta plant being constructed; syngas supplied to Fisher-Trops reactor (15 KT/yr Bio-fuels ~ 4 KT/yr Hydrogen)</li> </ul>
Bio-gas reforming (small scale)	2006	+/-2013	+/-2018	<ul style="list-style-type: none"> <li>• Hynor (Norway)</li> </ul>	<ul style="list-style-type: none"> <li>• Biomethane as feedstock (land fills, Agriculture)</li> <li>• Gas impurity bad for catalyst, Discontinuous process issue</li> </ul>
Electrolysis large scale, using renewable electricity			2008	<ul style="list-style-type: none"> <li>• Sote Vento (Es), Gaz Naturel (120 m3, 250 kg/day)</li> </ul>	<ul style="list-style-type: none"> <li>• Large scale electrolysis is used for production of Chlorine, only appropriate when renewable electricity is abundant</li> </ul>
Electrolysis small scale, using renewable electricity	2003	+/- 2010	+/- 2016	<ul style="list-style-type: none"> <li>• Statoilhydro Hamburg, Reykjavik</li> </ul>	<ul style="list-style-type: none"> <li>• Reliability of the electrolyser (lye)</li> </ul>



# Hydrogen delivery mechanisms both to the fuelling station and the vehicle

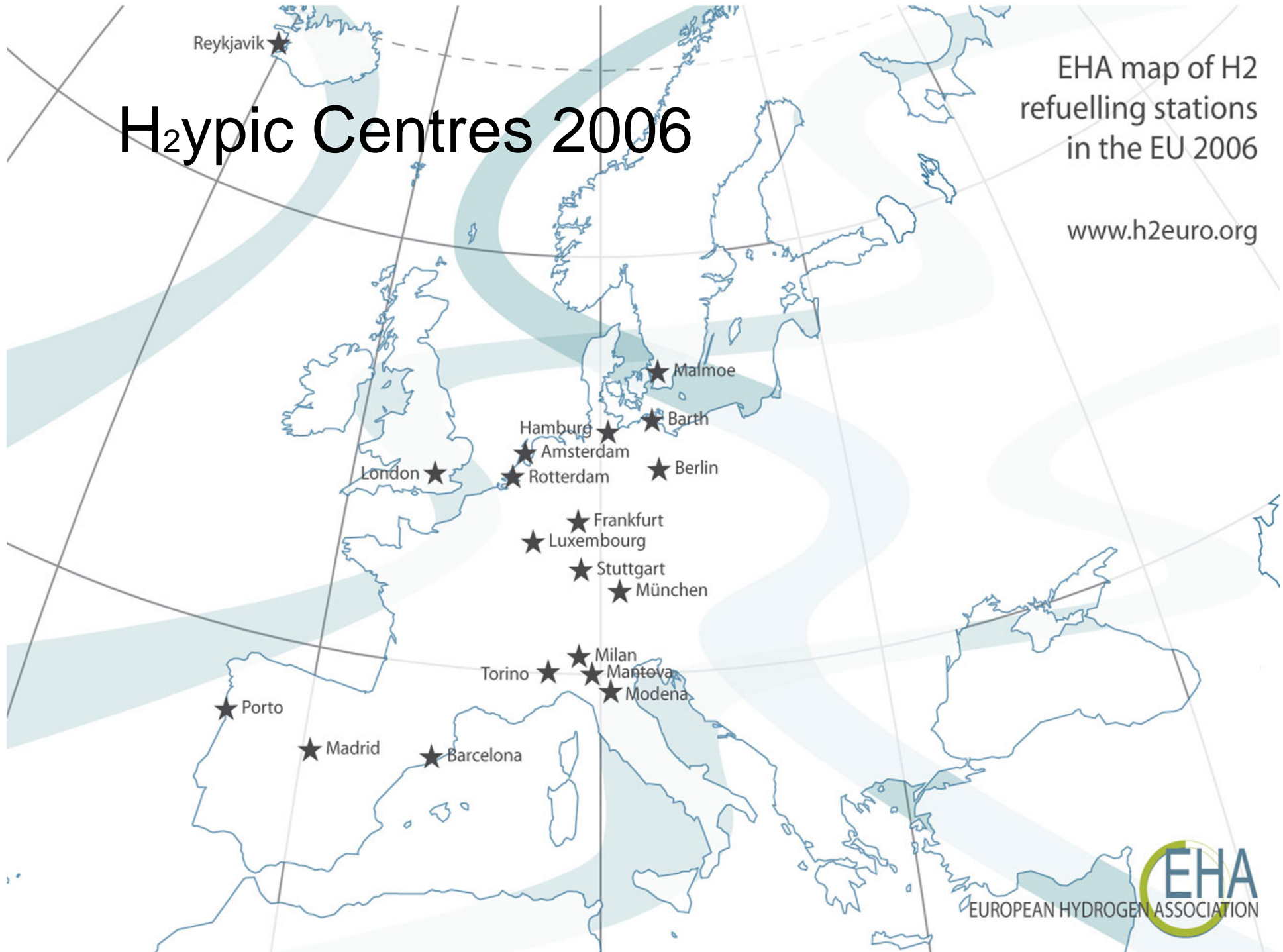


	Demo	Early commercial	Commercial	Application	Comments
Fuelling Station High Pressure Hydrogen Supply	2003	+/-2010	2015	•many	<ul style="list-style-type: none"> <li>• Robustness of components                             <ul style="list-style-type: none"> <li>• Safety</li> </ul> </li> <li>• Underground systems</li> </ul>
Fuelling Station Liquid Hydrogen Supply	2003	+/- 2012	+/- 2020	•Berlin	<ul style="list-style-type: none"> <li>• Robustness of components                             <ul style="list-style-type: none"> <li>• Safety</li> </ul> </li> <li>• Underground systems</li> </ul>
High Pressure Hydrogen (700bar+)	2005	+/-2013	+/- 2015	•Marl, Berlin ('09)	<ul style="list-style-type: none"> <li>• Composite storage, higher pressures, more robust components and processes</li> </ul>
Hydrides	2005	+/-2013	+/-2020	<ul style="list-style-type: none"> <li>•HyChain</li> <li>•some off road niche vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Continued development of hydride mix</li> </ul>
Pipeline	2020	+/-2025	+/- 2025	•-	<ul style="list-style-type: none"> <li>• Urban pipelines required</li> <li>Cost reduction for installation and maintenance of safety vs NG</li> </ul>
Liquid Hydrogen	2025		2030	•-	<ul style="list-style-type: none"> <li>• New LHY cycles, larger production trains, production integration with other processes, storage / component enhancements</li> </ul>

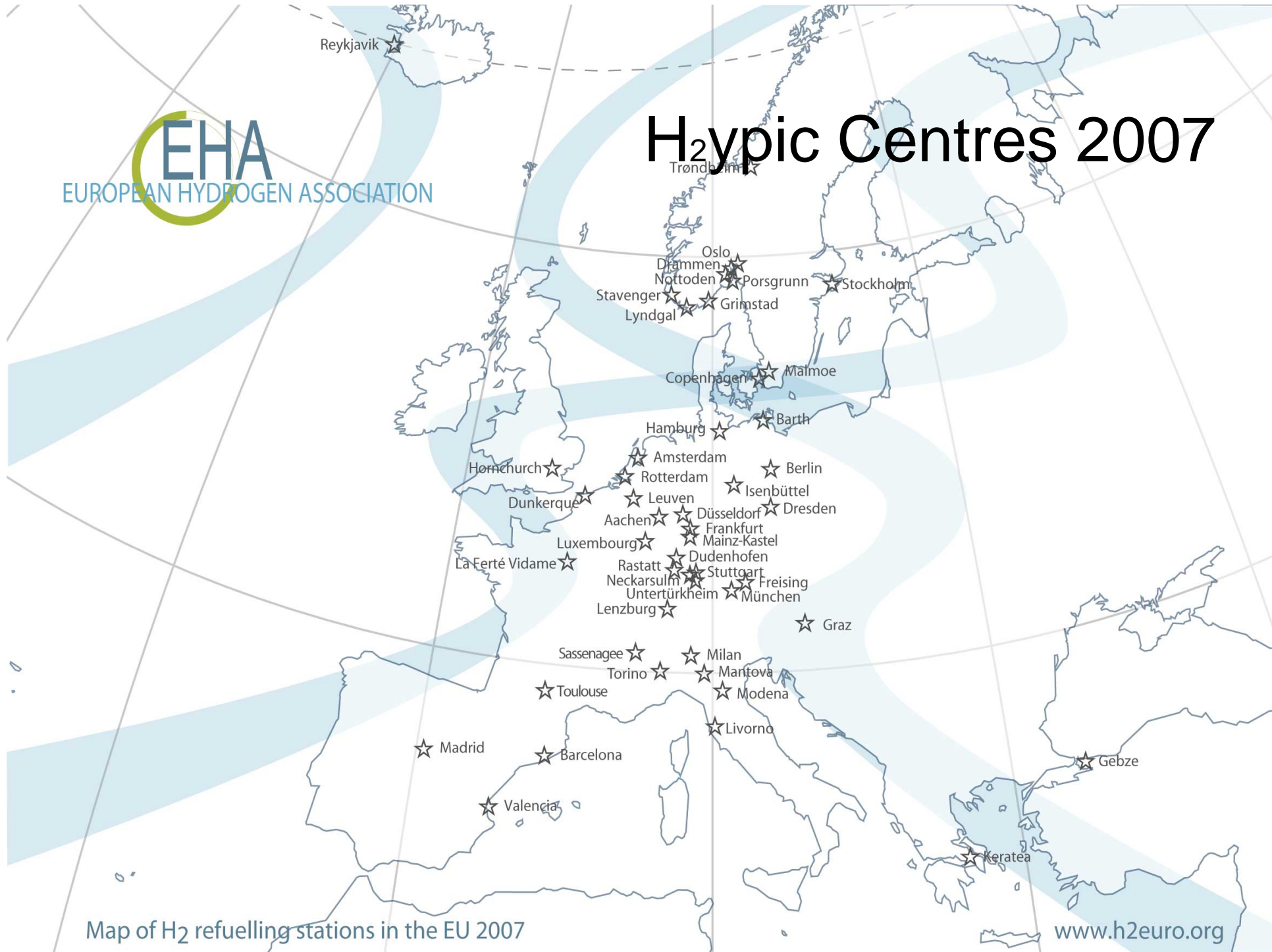
# H<sub>2</sub>ypic Centres 2006

EHA map of H<sub>2</sub>  
refuelling stations  
in the EU 2006

[www.h2euro.org](http://www.h2euro.org)



# H<sub>2</sub>ypic Centres 2007



Map of H<sub>2</sub> refuelling stations in the EU 2007

# H<sub>2</sub>ypic Centres



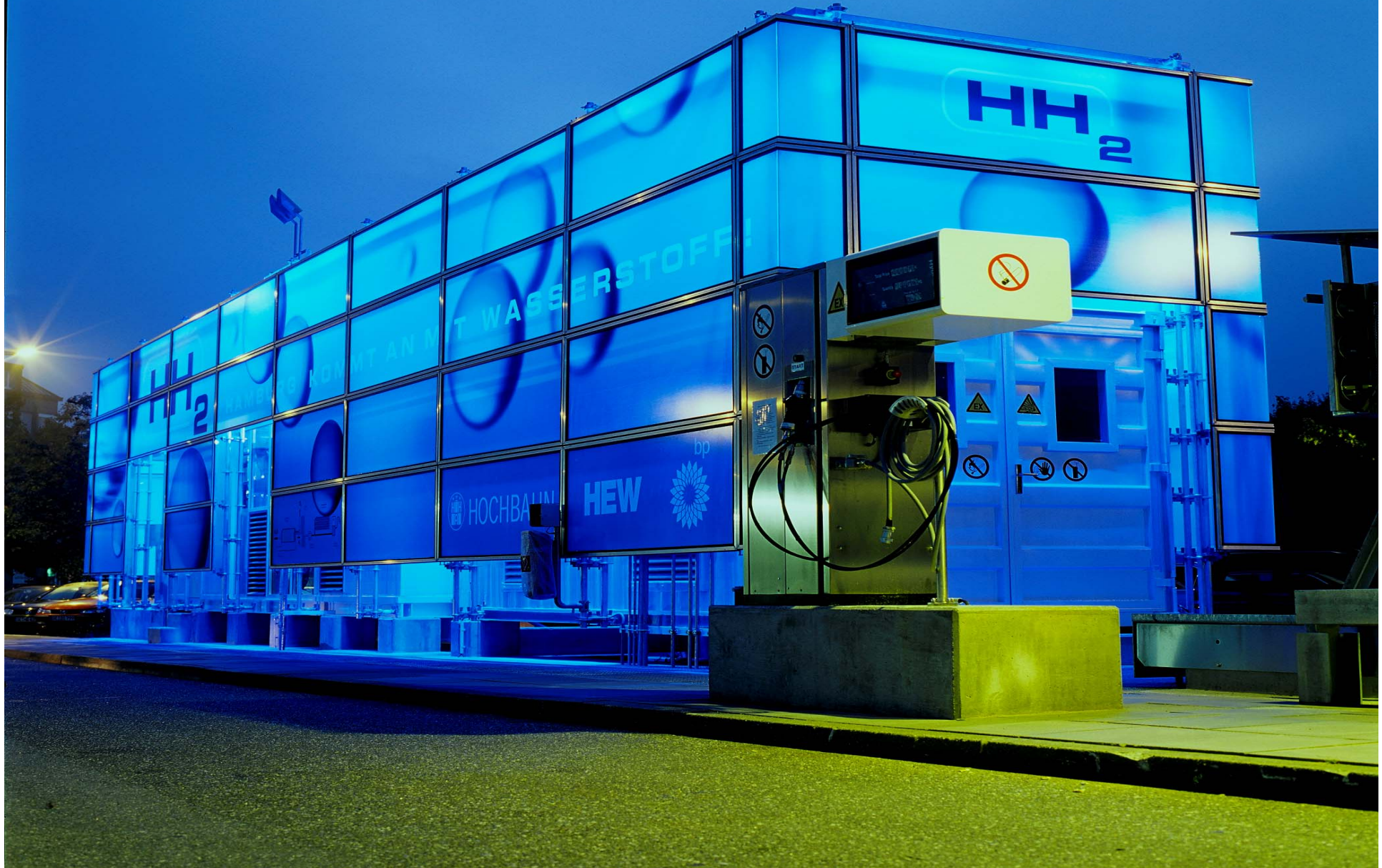
Milan Bicocca

## Milan, Bicocca, the oldest



- 1. Instigator:** president local power company 1999/ local petrol station owners
- 2. Investor:** Ministry of Environment, Regional and Local funding;
- 3. Coordinator;** Local Government Agency Zincar/ Comune/Region
- 4. Multiplier:** Italian Hydrogen and Fuel Cell Association, H2IT facilitates promotion at EU level.

H<sub>2</sub>ypic centre here to stay: Hamburg, Germany



# Here to stay: Hamburg, Germany



1. **Instigator:** Local Association: Hamburg Wasserstoff Gesellschaft has been promoting the use of hydrogen in Hamburg since 1989.
2. **Investor:** City of Hamburg/Hochbahn and private local investors;
3. **Coordinator:** Effective International Public Private Partnership has been set up involving local players;
4. **Multplier:** Extensive national/ international exchange: Hydrogen Bus Alliance: joint bus procurement initiative; always positive news!



**Featuring**  
**European Regional and Municipalities**  
**Partnership**  
**for Hydrogen and Fuel Cells:**  
**showroom of the JTI.**

HyRaMP will provide the European Regions and Municipalities with a representative body that can be coherent, distinguishable and influential towards the European FCH JTI and all relevant stakeholders and decision makers at both public and private level. The Partnership allows its Members to play a key role in the implementation of strategies that aim for the uptake of FCH technologies and particularly that of the Joint Technology Initiatives for Hydrogen and Fuel Cells.

# Objectives of HyRaMP



- Assume an active role towards the European FCH JTI and when appropriate participate in ad hoc Working Groups and/or Committees;
- Actively harmonize their activities and funds towards the development and deployment of Fuel Cell and Hydrogen Research, Development and Demonstration activities (referred to also as “FCH RD&D activities”);
- Utilize the potential of European Regions and Municipalities as incipient markets leading to large-scale deployment and uptake of Fuel Cell and Hydrogen technologies (referred to also as “FCH technologies”);
- Coordinate and propagate the collaboration with non-European activities;
- Accelerate the inception of Regulations, Codes and Standards (referred to also as “RCS”) as well as the harmonization of the homologation and permitting processes of products, applications and infrastructure;
- Facilitate the information exchange process among its Members prior to and towards the deployment of joint “green”, sustainable, public procurement strategies in the field of FCH technologies;
- Develop and apply benchmarks for economic and environmental evaluation of FCH RD&D projects in order to secure political acceptance and sustainability;
- Exchange knowledge and experience developed among its Members to actively promote FCH technologies and allow for a market breakthrough.

# HyRamp Board members



<b>Function</b>	<b>Name</b>	<b>Organisation/Region</b>
<b>Chair</b>	Andreas Ziolek	Ministry of Industry/Landesinitiative Nordrhein Westfalen
<b>Finances/membership/secretariat, Vice Chair</b>	Graham Hillier	Center for Process Innovation/NE England
<b>Status of RCS and certification, Vice Chair</b>	Xavier Navarro	Government of Aragon
<b>Regions activity overview</b>	Iris Flacco	Energy politics service/Regione Abruzzo
<b>Joint Procurement Issues</b>	Heinrich Klingenberg	HySolutions/Senate of the City of Hamburg
<b>Maintenance of regions address database</b>	Sven Wolf	Hydrogen Sweden
<b>Contents related issues with JTI</b>	Davide Damosso	Regione Lombardia/Piemonte
<b>Communication/dissemination</b>	David Vowles	Reg. Ministry for Industry/Greater London Authority

## Cooperation JTI and Regions

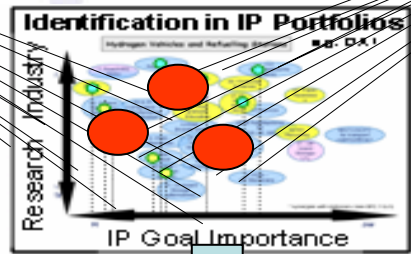
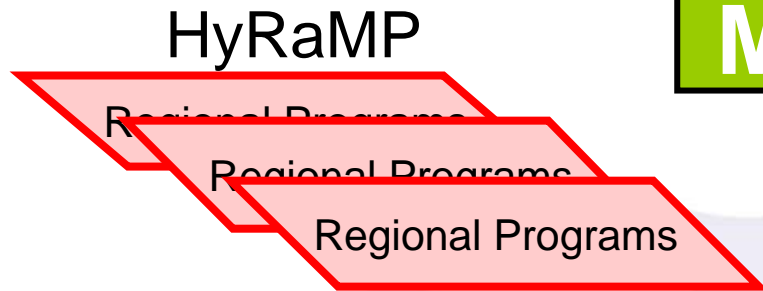
- Regional elements in large scale demo projects with combined funding schemes, joint bench mark and procurement;
- Regional support or initiatives for collaborative projects based on regional participation; creating PPP and industry clusters;
- Scoping and establishment of integrated hydrogen sites reflecting a variety of fuel cell and hydrogen components;
- Collaboration of regions for the dissemination of expertise, training and education...

# JTI and HyRaMP



Industry Research

**MARAP Portfolio**



JTI Net

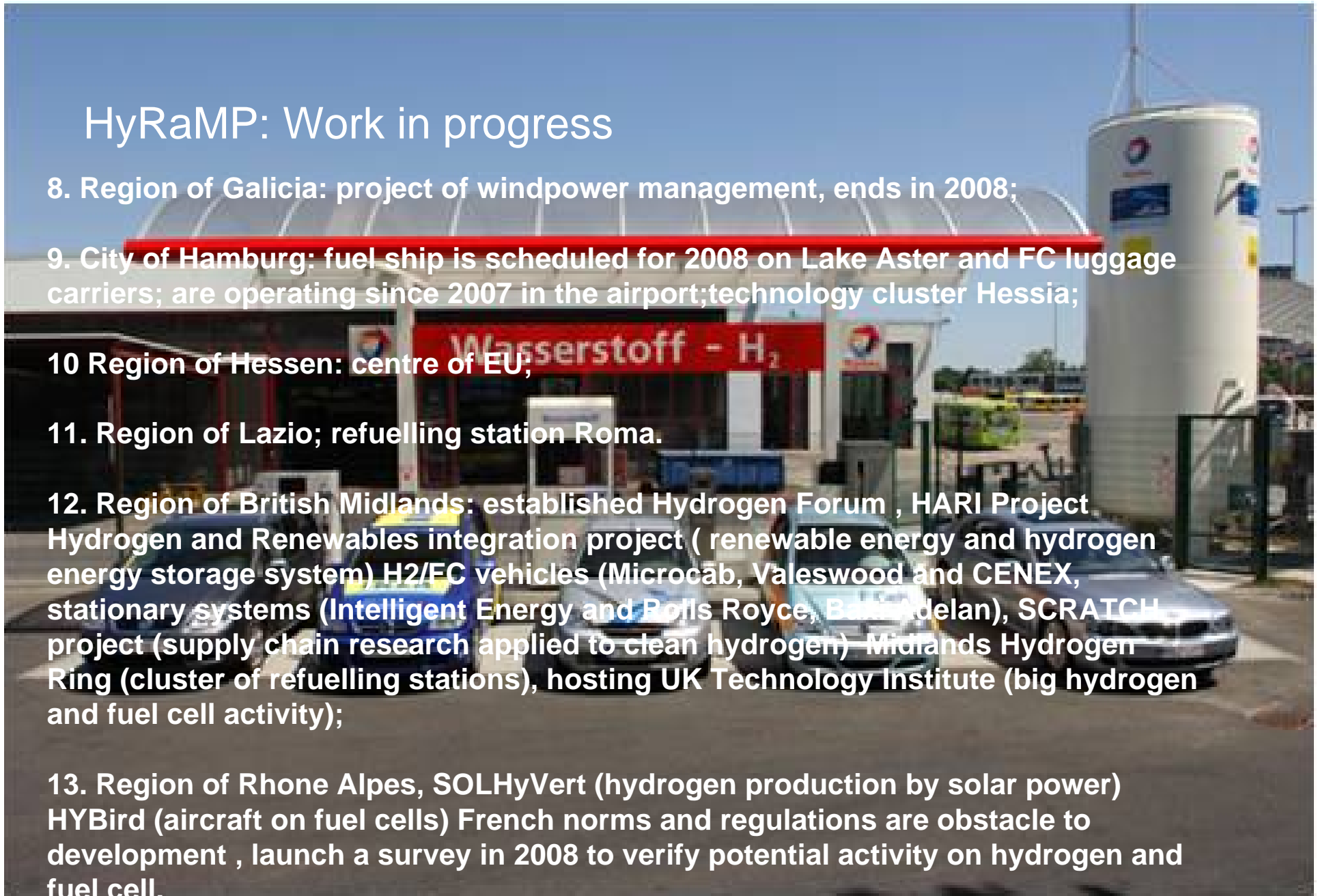
# HyRaMP: Work in progress



1. Region of Andalusia: Hercules project, SHEC Labs (solar and biogas landfill).  
Setting up Advanced technologies in Renewable Energy;
2. Region of Abruzzo: developed regional strategy for H<sub>2</sub>;  
interest in use of CNG/H<sub>2</sub> mixtures for transport, power applications for remote areas;
3. Region of Aragon: funding is € 1 mln per year for hydrogen and fuel cell projects;
4. Region of Trento is developing Hyway A22 and a fuel cell and hydrogen resort;
5. Region of Baden Wuerttemberg: hydrogen alliance;
6. Region of Castilla La Mancha ( where Madrid is located) hosts the national centre for hydrogen and fuel cell technology experimentation CNETHPC;
7. Region of Madrid: population is 6.8 mln: participated in CUTE and Hyfleet CUTE,  
3 more buses in 2008, R&D network of CO<sub>2</sub> free hydrogen production, decarbonization,  
solar thermal water splitting photocatalytic;

## HyRaMP: Work in progress

8. Region of Galicia: project of windpower management, ends in 2008;
9. City of Hamburg: fuel ship is scheduled for 2008 on Lake Aster and FC luggage carriers; are operating since 2007 in the airport; technology cluster Hestia;
- 10 Region of Hessen: centre of EU;
11. Region of Lazio; refuelling station Roma.
12. Region of British Midlands: established Hydrogen Forum , HARI Project Hydrogen and Renewables integration project ( renewable energy and hydrogen energy storage system) H2/FC vehicles (Microcāb, Valeswood and CENEX, stationary systems (Intelligent Energy and Rolls Royce, Balm Adelan), SCRATCH project (supply chain research applied to clean hydrogen) Midlands Hydrogen Ring (cluster of refuelling stations), hosting UK Technology Institute (big hydrogen and fuel cell activity);
13. Region of Rhone Alpes, SOLHyVert (hydrogen production by solar power) HYBird (aircraft on fuel cells) French norms and regulations are obstacle to development , launch a survey in 2008 to verify potential activity on hydrogen and fuel cell.



## HyRaMP: Work in progress



14. Region of Lombardy: Bicocca and mixture projects (short term development activities);

15. Region of Midi Pyrenées: an association was created in 2007 with 6 partners (department of municipal waste, general council of Tarn, Ecole des mines, Université de Paul Sabatier, N-HGY (2008/2009), Have contact with the University of Madrid;passenger vehicles additional two stations.

16. Region of Catalonia: government approved the Energy Park one week ago; hydrogen production for renewable energy, transport applications and development of fuel cells;

17. Region of Nord East of England: development agency and regional government are working closely together on hydrogen and fuel cell development, the regions already produces 75.000 tons of H<sub>2</sub> annually and H<sub>2</sub> is stored in the regions, CCS will offer an opportunity to produce a hydrogen as well, 130 companies are working in the H<sub>2</sub> and FC supply chain;

18. Region of North Rhine Westphalia: strong collaboration already established not only at national EU but also international level.

## HyRaMP: Work in progress



19. Region of Oldenburg-Wilhelmshaven: in Lower Saxony; project Hywind balance (hydrogen storage), H2Port synergy between chemical industry and container harbours (deep water port by 2010), energy cluster, 30 SME involved in RE and hydrogen and fuel cell (adoption of combustion engines to hydrogen), EWE established research center (stationary fuel cell project);
20. Scandinavian Regions: largest collaboration in Europe to create Scandinavian Hydrogen Highway Project status 3 HRS (one opening in Denmark this June) 15 Toyota Prius on H2, 7 niche vehicles and two hydrogen buses. 2015: 15 HRS, 500 cars and 100 buses;
21. Region of Piemonte: main concept in Piemonte is development of a cluster: Total Budget between 2003-2007 € 15 mln ; for 2008-2013 €300 mln set aside for renewable energy and hydrogen and fuel cells;
22. City of Ljubljana: first station has been approved, airport bus on hydrogen, 6 passenger vehicles, additional two stations.

Teaming up:



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