AIR LIQUIDE

information

Paris, January 31st 2006

Press Release

Launch of the HYCHAIN Project: 150 hydrogen vehicles to be tested in 4 regions of Europe

The European Union has committed to using 20% alternative fuels by 2020 to address two goals: to reduce its member States' dependence on fossil fuels (petroleum, natural gas, coal) and to limit emissions of greenhouse gases and other pollutants, responsible for climate change and some respiratory illnesses.

Using hydrogen as a source of energy is a promising alternative solution. Used in a fuel cell, hydrogen combines with oxygen from the air to produce electricity, with water as the only emission, and has tremendous potential to provide **clean and silent energy.**

Today, only several hundred prototype vehicles powered by hydrogen fuel-cells are on the road across the world. In addition to their high cost, their widespread use is also curbed by their restricted operating range and by a limited infrastructure for hydrogen distribution, essentially a few dozen "pilot service stations" where it is possible to "fill up" with hydrogen.

The HYCHAIN-MINITRANS Project will allow users in four regions of the European Union to test 150 full size electrically-powered vehicles fuelled by hydrogen fuel cells: scooters, tricycles, wheelchairs, small utility vehicles and minibuses. The initial priority will be fleets belonging to municipal departments in the partner cities (maintenance workers, gardeners, etc.) as well as wheelchairs in use in partnership with some hospitals in the ***Rhône-Alpes region*** **of France** (the greater urban community of Grenoble Alpes Métropole), ***Emilia Romagna*** **in Italy** (city of Modena), ***Castilla y León*** **in Spain** (cities of Soria and León) and ***Nordrhein Westfalen*** **in Germany** (the greater urban community of the Emscher Lippe region). This Project, which will take place **over a 5-year timeframe**, consists of two phases: 2006 to 2007 will be spent on manufacturing vehicles and developing infrastructure; and from 2008 to 2010, the vehicles will be tested in the four regions under actual conditions.

To fuel these vehicles with hydrogen **simply and safely**, the HYCHAIN-MINITRANS Project will also permit the development of **innovative support services**: for example, vending machines will make it possible to recharge the vehicle's hydrogen fuel cell **by replacing an *empty* cylinder of hydrogen with a *full* cylinder of hydrogen** under very high pressure (up to 700 bar) in **complete safety** thanks to **technologies developed and patented by Air Liquide.**

The HYCHAIN-MINITRANS Project also has an important **social component**: it aims to promote the development of a new industry in Europe to a well educated public, notably by promoting the rules which will apply in the future to these environmentally friendly technologies.

François Darchis, member of the Executive Committee of Air Liquide, stated: ***"We are particularly proud to be the general coordinator of this great European project, a world first. Hydrogen as a source of energy is a solution for the future. This project will allow all the partners involved to carry out real-life tests, notably by relying on the hydrogen know-how we have been developing for over 30 years. HYCHAIN-MINITRANS is fully consistent with the sustainable development values at the very core of our business strategy."***

*Funded by the Directorate-General Energy and Transport of the European Commission for **17 million euros (out of a total budget of 37.6 million euros)**, **the HYCHAIN-MINITRANS Project is a world first. Coordinated by Air Liquide**, it comprises a network of **24 European partners : AXANE**, **BESEL**, **WIN**, **Air Liquide** Italia, **CEA**, **INERIS**, **INPG**, **PAXITECH**, **ASCOPARG**, **Air Liquide** Espana, **CIEMAT**, **DERBI**, **RUCKER**, **CEU**, **DOMENECH**, **IBERDROLA**, **WI**, **HYDROGENICS**, **MASTERFLEX**, **FAST**, **VEM**, **DEMOCENTER**, **Air Liquide** Deutschland.*

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Present in more than 70 countries, ***Air Liquide*** *is the world leader in industrial and medical gases and related services. The Group offers* ***innovative solutions*** *based on constantly enhanced* ***technologies****. These solutions, which are consistent with Air Liquide's commitment to* ***sustainable development****, help to protect life and enable our customers to manufacture many indispensable everyday products. Founded in 1902, Air Liquide has nearly 36,000 employees. The Group has successfully developed a long-term relationship with its shareholders built on* ***trust*** *and* ***transparency*** *and guided by the principles of* ***corporate governance****. Since the publication of its first consolidated financial statements in 1971, Air Liquide has posted* ***strong and steady earnings growth****. Sales in 2005 totalled 10,435 million euros, with sales outside France accounting for almost 80%. Air Liquide is listed on the Paris stock exchange and is a component of the CAC 40 and Eurostoxx 50 indices (ISIN code FR 0000120073).*

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Practically speaking, what is the HYCHAIN Project?

Answers to a two-pronged challenge

- **fight transportation-generated pollution in our cities**

Transportation in Europe is responsible for 25% of the total emissions of carbon dioxide (a greenhouse gas); the pollution resulting from transportation is estimated to cost 1.7% of Europe's GNP, or about 360 € per annum for each citizen[1] !
In Europe today, vehicles circulating in our cities are responsible for **40% of the carbon dioxide emissions generated by transportation.**[2]
These vehicles also emit nitrogen oxides and particulate matter (fine dust suspended in the air) that have a harmful effect on the health of urban residents. The nitrogen oxides (also called NOx) **exacerbate respiratory problems** and are especially problematic for the most vulnerable segments of the population: young children, elderly people, and persons in poor health. They are also responsible for "ozone spikes." The European Union also committed, through the Kyoto Protocol on climate change, to **reduce its greenhouse gas emissions by 8%** by 2008-2012 compared to 1990.

- **reduce our dependence on fossil fuels**

Today, urban transportation is **95% dependent on fossil fuels** (petroleum, natural gas, coal) that exist in finite quantities and are subject to supply uncertainties, combined with much higher energy costs. The increase in world population and the industrialization of developing nations will eventually increase energy requirements (electricity, etc.).

This is why **the European Union and its member States are committed to proposing new solutions for limiting greenhouse gas emissions, preserving the health of its citizens** and **reducing our dependence on fossil fuel imports.**

The use of **hydrogen as a source of energy is an alternative** that has been on the drawing boards for about ten years: now the European Union has embraced this approach and the European Commission has already funded several dozen projects at a cost of **over 250 million euros** since 1998. The HYCHAIN Project will be added to two other major European pilot projects. One is the CUTE Project, in which 30 buses and their associated filling stations are operating in 10 European cities (in 2004, these buses covered almost 300,000 kilometres, transporting 400,000 passengers). The other is the ZERO REGIO Project, which is developing a fleet of vehicles fuelled by service stations in Italy (Lombardy) and in Germany (Rhein-Main).

Used in a fuel cell, hydrogen combines with oxygen in the air to produce electricity with a high generating capacity of almost 50%, expelling only water. This has tremendous potential to supply **quiet, clean energy**, meeting both challenges that the European Union is facing in the area of transportation.

Today however, the number of vehicles with engines powered by electricity produced by a fuel cell is very small (a few hundred prototypes in the world). Their more widespread use is curbed not only by their availability but also by a hydrogen distribution infrastructure that is not adapted to this purpose.

[1] "Green week" European Commission, June 1st 2005
[2] White Paper of the European Commission, " European Transport Policy for 2010: time to decide"

While over **500 billion cubic metres of hydrogen is produced around the world each year**, its uses and means of distribution is primarily for industrial purposes: the chemical industry, refining. This hydrogen is supplied by pipelines, tanker trucks, etc.

The HYCHAIN-MINITRANS Project is proposing the **simultaneous establishment of fleets of urban vehicles powered by fuel cells** and an **innovative hydrogen distribution infrastructure.** It plans to promote the **development of a true industrial sector,** contributing to employment and growth in Europe.

158 vehicles in 4 regions of Europe

The electrically-powered vehicles now driven in our cities are powered by batteries that hold a limited amount of energy and which have a limited range, about 50 to 150 km.

The objective of the HYCHAIN-MINITRANS Project is **to incorporate into** these existing electrical vehicles used most often in city-owned fleets (that recharge at a single location), an **additional source of energy in the form of a hydrogen-powered fuel cell**. The **resulting hybrid vehicles will have an increased range (at least threefold)**, and will be instantly rechargeable when returned to their storage centres, for instance.

For example, hybridization (the simultaneous use of a battery and the production *in situ* of electricity using a hydrogen-powered fuel cell) in a small electrical utility vehicle will **reduce its weight by 25%** since the number of batteries (a large part of the vehicle's weight) it carries will be halved. **The hydrogen and the fuel cell will allow the vehicle to travel three times the number of kilometres before recharging.** Its range will increase up to about 300 km.

The time it takes to recharge these vehicles' power supply becomes a problem of the past! Charging a battery is a long process that immobilizes the vehicle for periods of 4 to 8 hours. "Filling up with hydrogen" using the innovative technology developed by this project is instantaneous.

Thus, **158 fuel cells**, of various power capacities, supplied by European manufacturers (MASTERFLEX, AXANE, MES-DEA, PAXITECH and HYDROGENICS) will be developed, manufactured and integrated into 158 small urban electrical vehicles:

- 40 0.250 kW fuel cells developed by MASTERFLEX incorporated into tricycles in Germany;
- 34 0.500 kW fuel cells developed by AXANE and PAXITECH incorporated into wheelchairs in Spain;
- 30 1 kW fuel cells developed by MES-DEA incorporated into scooters in Spain;
- 44 2.5 kW fuel cells developed by AXANE incorporated into light utility vehicles in Italy;
- 10 10 kW fuel cells developed by HYDROGENICS incorporated into minibuses in Germany.

A new and original hydrogen infrastructure

The hydrogen infrastructure that will be established in the four European partner regions will operate on the **concept of exchanging *empty* cylinders for *full* cylinders.** To achieve maximum use of the hydrogen, vehicles will be equipped with several tanks. The hydrogen will be drawn sequentially from each of these tanks. As soon as one is empty, the user will exchange it for a full tank at a "distributor" set up for that purpose. In the Project, vending machines will be developed and used to distribute cylinders. The user can then immediately leave with his vehicle.

These 158 vehicles will therefore be fuelled using over **2,000 cylinders developed by Air Liquide:**

- 900 20-litre cylinders of hydrogen filled to 300 bar;
- 1,120 2-litre cylinders of hydrogen filled to 700 bar.

These cylinders will incorporate a **new technology developed and patented by Air Liquide in its research centres, called "Clip On."** This **major innovation** puts the entire mechanical hydrogen delivery mechanism to use (regulators, safety devices and connectors) and makes it possible for any user to remove and replace the cylinder simply and safely.

Through its subsidiaries in Germany, Italy, Spain and France, Air Liquide will ensure the overall establishment of this **complete hydrogen chain**: production, transportation, refilling and distribution of the cylinders.

A study project … and a lever for changing mindsets

➢ ***collect technical data***

The use of this network of vehicles will make it possible **to gather a large amount of technical data in several European countries.** Analysis will improve the operation of the vehicles as well as the logistics of hydrogen distribution. It will facilitate future use by the greatest number of people.

In this way, the HYCHAIN-MINITRANS Project will lay the foundations of a preliminary economic model to prepare for the large-scale industrialization of vehicles powered by hydrogen as an alternative energy source.

➢ ***promotes changes in the regulations and acceptance by the general public***

This Project will also contribute to **removing social barriers** such as misconceptions about hydrogen and the absence of regulations. **An innovation, – including driving a vehicle with a hydrogen-powered fuel cell tomorrow!** – demands an educational program to help change mindsets.

The know-how of the Project's technical partners will be put to good use in identifying, analysing and **showing how hydrogen can be used with complete safety** as a power supply for specific vehicles.

The HYCHAIN-MINITRANS Project should also make it possible to set up, in agreement with the competent authorities, the **necessary certifications** for the use of hydrogen-fuelled vehicles in our cities.

This Project also provides for the creation of **training modules** to make the general public more familiar with hydrogen, to better understand how to use it, to handle it safely and to take advantage of its benefits.

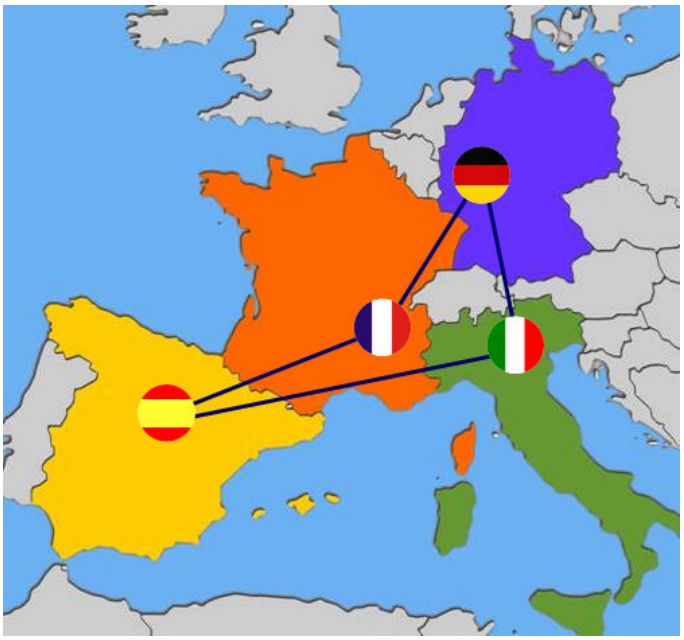
The HYCHAIN-MINITRANS Project is **a first step towards the more widespread use throughout Europe**, and beyond, of vehicles using hydrogen as a clean source of energy.

HYCHAIN statistics

158 urban vehicles:

- **40 tricycles** developed in Germany and powered by 0.25 kW fuel cells developed by MASTERFLEX,
- **30 scooters** developed in Spain and powered by 1 kW cells developed by MES-DEA,
- **34 wheelchairs**, developed in Spain and powered by 0.5 kW cells developed by AXANE and PAXITECH,
- **44 light utility vehicles** developed in Italy and powered by 2.5 kW fuel cells developed by AXANE,
- **10 minibuses** developed in Germany and powered by 10 kW fuel cells developed by HYDROGENICS.

4 regions of Europe:



- **Castille and León in Spain** (cities of Soria and León)

Surface: 94,193 km^2
Population: 2.5 million
Description: Historic center of the Spanish Golden Age, Castile and Léon consists of 9 provinces and is situated on the border with Portugal. It is mainly a mountainous region (more than 98 % of its territory is above 600 m).

- **Emilia Romagna in Italy** (city of Modena):

Surface: 22,124 km^2
Population: 4.0 million

Description: Located in Northern Italy, Emilia Romagna was exposed early on to the industrial revolution. This region is divided between the plains and the mountains. It is one of the richest regions in Italy with the highest export activity. The Emilia Romagna region consists of 9 provinces.

- **Nordrhein Westfalen in Germany** (Greater urban community of the Emscher Lippe Region)

Surface: 34,084 km^2
Population: 18.1 million
Description: The Northern Rhine Westfalia region is the most populous in Germany. The region is structured by the presence of the Rhine and presents a rather an uneven relief. It is one of the richest regions in Germany and the one exporting the most.

- **Rhone-Alps in France** (Greater urban community of Grenoble Alpes Métropole, France):

Surface: 44,000 km^2
Population: 5.9 million
Description: Rhone-Alps is the second region in France in terms of inhabitants and GAP. Its relief is contrasted, consisting of plains and high mountains. The Region consists of 8 regional departments and is situated on the borders of Switzerland and Italy.

More than 2,000 cylinders of hydrogen developed by Air Liquide:

- 900 20-litre cylinders of hydrogen filled to 300 bar
- 1,120 2-litre cylinders of hydrogen filled to 700 bar

A five-year project (2006-2010), in 2 phases:

- 2006-2007: vehicle manufacture and infrastructure development
- 2008-2010: testing the vehicles in four regions under real-life conditions of use.

A budget of **37.6 million euros,** including **17 million contributed by the European Commission**

24 partners coordinated by Air Liquide

AIR LIQUIDE (France, general coordinator), **AXANE** (coordinator for France), **BESEL** (coordinator for Spain, administrative coordinator), **WIN** (coordinator for Germany), **AIR LIQUIDE** Italia (coordinator for Italy), **CEA** (France), **INERIS** (France), **INPG** (France), **PAXITECH** (France), **ASCOPARG** (France), **AIR LIQUIDE** Espana (Spain), **CIEMAT** (Spain), **DERBI** (Spain), **RUCKER** (Spain), **CEU** (Spain), **DOMENECH** (Spain), **IBERDROLA** (Spain), **WI** (Germany), **HYDROGENICS** (Germany), **MASTERFLEX** (Germany), **FAST** (Italy), **VEM** (Italy) **DEMOCENTER** (Italy), **AIR LIQUIDE** Deutschland Gmbh (Germany).

Wheelchair

Scooter

Tricycle

Utility Vehicle

Minibus

HYCHAIN-MINITRANS Project Partners

1. AIR LIQUIDE

AIR LIQUIDE is the world leader in industrial and medical gases, present in more than 70 countries, with nearly 36,000 employees. Sales in 2005 totaled 10,435 million euros, of which sales outside France accounted for almost 80%. **AIR LIQUIDE** operates more than 200 hydrogen production plants and controls the entire logistic chain and safety system: distribution via pipeline (a 1700 km network), trucks and cylinders, in either liquefied or pressurized form. **AIR LIQUIDE** is involved with more than 10 European and French projects using hydrogen as a new energy vector (strategy, storage, fuel-cells, safety,…) coordinating part of them.

Main activities in the HYCHAIN-MINITRANS Project:

Coordination*: general coordinator*

Logistics: *design, development and homologation of the "clip-on" system, implementation of the hydrogen filling facilities and cylinder distribution logistics in France*

Deployment: *safety analysis implementation and certification of the hydrogen storage system, French training programs design, participation in the dissemination of the project in France, assistance to other partners in patent procedures*

2. AXANE

AXANE is a wholly owned subsidiary of the **AIR LIQUIDE** group, with the mission to develop and commercialize fully integrated systems that produce energy from hydrogen-powered fuel-cells. **AXANE** offers a range of turn-key energy solutions to emerging markets. **AXANE** has participated in several European projects and is currently working on the FEBUSS project, developing a 20 kW fuel cell power module for stationary and transport applications.

Main activities in the HYCHAIN-MINITRANS Project:

Coordination*: coordinator for France*

Vehicles: *development and manufacture of the 0.5 kW fuel-cell systems for the wheelchairs and of the 3 kW fuel-cell systems for the VEM utility vehicles*

Deployment: *homologation of the 0.5 kW and 3 kW fuel-cell systems, certification of hydrogen storage systems, coordination of the intellectual property activities, coordination of the French deployment strategy and of the French socio-economic studies*

3. BESEL

BESEL S.A. is a private R&D engineering and consultancy company founded in 1984 with 80 employees, playing an active role in developing new technologies in the energy and environment fields. **BESEL** holds the secretariat of the Spanish Fuel Cell Association (APPICE) and is an active member of the board of Directors of the Spanish Hydrogen Association (AeH). **BESEL** also participates on different structures of the European Platform for Hydrogen and Energy.

Main activities in the HYCHAIN-MINITRANS Project:

Coordination*: coordinator for Spain and administrative coordinator for the Project*

Vehicles: *participation in the scooter development, integration of the 0.5 kW fuel-cells in the wheelchairs and the 1 kw fuel-cells in the scooters.*

Logistics: *manufacturing of vending machines for the hydrogen cylinders*

Deployment: *coordination of the global deployment strategy, management of the Soria training centre*

4. WIN – Emscher-Lippe Gesellschaft zur Strukturverbessung mbH

The **WIN** Emscher-Lippe Gesellschaft zur Strukturverbessung mbH is the umbrella organization of the Emscher-Lippe-Region for the municipal associations of business promotion offices. In the context of the State Initiative on "Future Energy North-Rhine Westphalia", **WIN** provides solutions relating to the development of "Future Energy Technologies".

Main activities in the HYCHAIN-MINITRANS Project:
Coordination*: coordinator for Germany*
Deployment: *implementation of the deployment strategy in Germany, coordination of training activities in Germany*

5. AIR LIQUIDE Italia

AIR LIQUIDE Italia is the Italian subsidiary of the **AIR LIQUIDE** group, with 1,800 employees operating in 11 regions and serving more than 100,000 customers and with gas sales of approximately 425 million €. **AIR LIQUIDE Italia** operates a gas pipeline network of more than 600 km across the country.

Main activities in the HYCHAIN-MINITRANS Project:
Coordination*: coordinator for Italy*
Logistics*: implementation of the 300 bar filling station and hydrogen logistics in Italy*
Deployment: *studies on Italian standards requirements regarding hydrogen, safety analysis on hydrogen storage on utility vehicles*

6. CEA – Commissariat à l'Energie Atomique

CEA is a French research organization dedicated to basic and technological research in the fields of energy and new information and health technology. **CEA** is involved in hydrogen and fuel cell R&D. **CEA** defines and performs hydrogen and fuel-cell training programs for technicians, scientists and engineers.

Main activities in the HYCHAIN-MINITRANS Project:
Deployment: *assistance to INPG to perform the training sessions, participation in technical, economical and energy policy impact assessment studies in France, participation in the French exploitation strategy*

7. INERIS

INERIS is a French public research institute which assesses and prevents accidental and chronic risks to people and the environment due to industrial plants, chemical substances and underground operations. **INERIS** is an active member of the HYSAFE European Project dealing with safety of hydrogen as an energy carrier.

Main activities in the HYCHAIN-MINITRANS Project:
Deployment: *French standardization and regulation requirements study, development of safety procedures and training for operation of fuel-cell vehicles*

8. INPG – Institut Polytechnique National de Grenoble

Grenoble Institute of Technology (INP Grenoble) is an internationally recognized university of technology. **INPG** is involved in two French competitiveness centers: MINALOGIC for micro and nanotechnologies and chip-mounted embedded systems, and ENERRDIS for renewable energies.

Main activities in HYCHAIN-MINITRANS Project:
Deployment: *coordination of all the training activities in France*

9. PAXITECH

PAXITECH is a spin-off company from the French Atomic Agency, **CEA**. **PAXITECH** produces portable proton exchange membrane fuel-cells and components. **PAXITECH** has developed its own processes for producing fuel cells components, leading to higher performance and lower costs.

Main activities in the HYCHAIN-MINITRANS Project:
Vehicles: *development of the membranes electrode assemblies for the 0.5 kW fuel-cells.*

10. ASCOPARG

ASCOPARG is the local organization in charge of air monitoring and air quality information, in the Grenoble area. **ASCOPARG** studies atmospheric pollutants through a permanent monitoring air quality network, using

mobile equipment and air quality models. It contributes to the improvement of knowledge from pollution events, and to forecast the monitoring of air quality.

Main activities in the HYCHAIN-MINITRANS Project:
Deployment: *coordination of air impact assessment study*

11. AIR LIQUIDE España

AIR LIQUIDE España is the Spanish subsidiary of the **AIR LIQUIDE** group operating in 10 regions, with 675 employees, which supplies around 62,000 customers throughout the country. **AIR LIQUIDE España** has participated in numerous hydrogen projects, in particular developing the hydrogen filling station for the European CUTE and CityCell projects in Madrid.

Main activities in the HYCHAIN-MINITRANS Project:
Vehicles: *integration of the hydrogen storage system in the wheelchairs and scooters.*
Logistics: *implementation of the hydrogen distribution logistics and the 300 bar filling station in Spain. Homologation and installation of the vending machines*
Deployment: *Safety analysis on vending machines*

12. CIEMAT – Centro de Investigaciones Energéticas Medioambientales y Tecnológicas

CIEMAT is one of the most important Spanish Technological Research Public Institutions, with more than 600 researchers, promoting and carrying out research and technological development projects in the field of energy. **CIEMAT** runs a complete test facility for hybrid Photovoltaic-Wind Systems in Lubia, 20 km from the city of Soria.

Main activities in the HYCHAIN-MINITRANS Project:
Deployment: *participation in environmental impact assessment studies, coordination of the socioeconomic studies for Spain.*

13. DERBI

DERBI has been the top Spanish manufacturer in mopeds and light motorcycles for 80 years. It is identified as the sport trademark in PIAGGIO Group. It participated in the project "Development of low power hybrid fuel cell vehicles: Scooters FC".

Main activities in the HYCHAIN-MINITRANS Project:
Vehicles: *optimization of the base scooter for fuel-cell integration and supply of 30 scooters*

14. RUCKER

RUCKER is a development partner of several well known international automobile manufacturers and their suppliers as well as the aircraft industry. **RUCKER LYPSA,** the Spanish subsidiary, will be involved in this project.

Main activities in the HYCHAIN-MINITRANS Project:
Vehicles: *integration of the 1 kW fuel-cells in the base scooters*
Deployment: *safety analysis and homologation of fuel-cell scooters*

15. University Foundation San Pablo-CEU

The **University Foundation San Pablo-CEU** is a training and educational centre with centers in the main Spanish cities. The Solid State Chemistry team is involved in the HYCHAIN MINI-TRANS project, due to its wide experience in research and demonstration of different materials for fuel-cells.

Main activities in the HYCHAIN-MINITRANS Project:
Deployment: *implementation of the Spanish training center located in Soria and of the on-line training services*

16. DOMENECH

DOMENECH, an e-Learning Multimedia company, was founded in 1975 and offers a global service in the training world of high quality e-learning products – virtual teacher training – for customers such as institutions or private companies.

Main activities in the HYCHAIN-MINITRANS Project:

Deployment: *Development of the e-learning platform, implementation of the HYCHAIN-MINITRANS website*

17. IBERDROLA

IBERDROLA is one of the leading Spanish electricity utility companies, with services, reaching 16 million customers - over nine million in Spain. It produces and distributes electricity and natural gas. **IBERDROLA** is also the leading Spanish company in renewable energies. With 3,200 MWatts of wind power in Spain, it is the second largest producer worldwide.

Main activities in the HYCHAIN-MINITRANS Project:

Deployment: *coordination of the Spanish socioeconomics studies, participation in the technology validation activities and the Spanish exploitation strategy in Spain*

18. WI – Wuppertal Institute

The **Wuppertal Institute** for Climate, Environment and Energy is a German institute (120 employees) analyzing global ecological challenges together with the complex policy tasks and business models necessary to meet these challenges. Due to this position as an interface between research, policy and stakeholders from business, the **Wuppertal Institute** has a long experience in coordinating multi-disciplinary consortia at the national and European level.

Main activities in the HYCHAIN-MINITRANS Project:

Deployment: *coordination of socioeconomic studies for Germany. Analysis and forecast of HYCHAIN MINI-TRANS impacts, definition and implementation of the European and global dissemination strategy, set up of the exploitation strategy, coordination of German environmental and energy policy impact assessment studies*

19. HYDROGENICS

HYDROGENICS GmbH, the German wholly-owned subsidiary of the Canadian group HYDROGENICS Corporation is a leading clean power generation company, engaged in the commercialization of fuel-cell technology and test stations for fuel-cells. **HYDROGENICS**' main activities are complete systems integrating fuel cells with diverse applications in mobile, stationary and portable power.

Main activities in the HYCHAIN-MINITRANS Project:

Vehicles: *optimization and supply of electric minibuses integrating the 10 kW fuel-cells*
Deployment: *Safety analysis for minibuses using fuel cells*

20. MASTERFLEX

MASTERFLEX AG is a German group specializing in the production of polymers. **MASTERFLEX** AG has been successfully developing proton exchange membrane fuel-cells. **MASTERFLEX** has 445 employees worldwide and revenues of 67 million € in 2003.

Main activities in HYCHAIN-MINITRANS Project:

Vehicles: *supply and integration of 0.25 kW fuel-cell modules in the tricycles*
Deployment: *Safety analysis for tricycles using fuel cells*

21. AIR LIQUIDE Deutschland GmbH

AIR LIQUIDE Deutschland GmbH is the German subsidiary of the **AIR LIQUIDE** group, with almost 2,000 employees and total sales in 2004 in Germany of approximately 800 million €. **AIR LIQUIDE Deutschland**

GmbH operates a 240 km hydrogen gas pipeline network throughout the Rhine-Ruhr area together with a cylinder filling station at Marl.

Main activities in the HYCHAIN-MINITRANS Project:

Logistics: *implementation of the hydrogen distribution logistics in Germany, operation of the 700 bar hydrogen filling facilities to fill the 2 liter cylinders for all the regions, operation of the filling station for the minibuses*

22. DEMOCENTER

DEMOCENTER-Sipe is an Italian service company which distributes and promotes technological innovation and the promotion of the knowledge economy. **DEMOCENTER**-Sipe has more than 10 years experience in European Projects.

Main activities in the HYCHAIN-MINITRANS Project:

Deployment: *coordination of Italian intellectual property activities and the deployment strategy for Italy.*

23. VEM

VEM, Moroni Autoservice Srl, is an Italian company, manufacturing alternative, electrical and hybrid propulsion vehicles. The company mission is to design, construct, and convert conventional vehicles to electrical models. **VEM** is a member of the CIVES, the Italian Chapter of AVERE – European Electric Road Vehicle Association.

Main activities in the HYCHAIN-MINITRANS Project:

Vehicles: *supply of 44 utility vehicles integrating the 2.5 kW fuel-cell system*

Deployment: *safety analysis and homologation of the utility vehicles using fuel cells*

24. FAST

FAST is an Italian non-profit making organization which fosters information and scientific deployment. **FAST** is a founding member of H_2It, the Italian Hydrogen and Fuel Cell Association, and collaborates with the European Platform for Hydrogen and Fuel Cell Technology Initiative Groups, as well as with the EHA-European Hydrogen Association's activity. FAST is also involved in a number of different projects in this field which are co-financed by the European Commission, such as: HyApproval, Procura and HyCom.

Main activities in the HYCHAIN-MINITRANS Project:

Deployment: *coordination of the Italian training activities*

European Commission

AIR LIQUIDE

AXANE

BESEL

WIN

ASCOPARG

CEA

CIEMAT

DEMOCENTER

DERBI

DOMENECH

FAST

HYDROGENICS

IBERDROLA

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With the support of