Piemonte Hydrogen System

CENTRO ESTERO INTERNAZIONALIZZAZIONE
PIEMONTE *Agency for Investments, Export and Tourism*
Promoted by Regione Piemonte and Chambers of Commerce

CAMERA DI COMMERCIO
INDUSTRIA ARTIGIANATO E AGRICOLTURA
DI TORINO

in collaboration with

ENVIRONMENT PARK

Piemonte, an attractive place

Piemonte facts & figures

- *4.4 million inhabitants*
- *€ 119 billion GDP*
- *€ 37 billion exports of goods and services*
- *1.7% of GDP invested in R&D (about 80% comes from the private sector)*
- *Over 200 public and private R&D centres, 380 laboratories, 4 universities, 6 science and technology parks*
- *1st Italian region for private investment in R&D*
- *1st Italian region for expenditure on innovation in the manufacturing sector*
- *1st Italian region to have established a regional agency dedicated to inward and outward investment*
- *1st and unique Italian region to have created a dedicated financial tool for attracting and supporting FDI*
- *Torino 1st Italian city in terms of FDI inflows*
- *Torino second centre in Italy for venture capital operations*
- *Torino host city of Euroscience Open Forum - ESOF 2010*

Driving force in Europe

With over 4 million inhabitants, a per capita income that is 14% above the European average and a solid economic structure, Piemonte produces 8% of Italy's national wealth and is one of Europe's driving forces. The strong industrial vocation of the region remains the rich soil from which innovation keeps springing up and growing.

Leader in innovation

Piemonte has been a hub for major technical innovations from the electric engine in the 19th century, to the MP3 file format in the software industry, and the common rail for diesel engines in the automotive industry. In recent decades, Piemonte, traditionally the Italian center of the automotive industry, has diversified its own economic structure, directing itself more and more toward sectors tied to the economy of knowledge. It focuses on R&D activities and invests in strategic sectors such as renewable energy, sustainable mobility, ICT, life sciences, logistics etc. New technologies are developed with the backing of major companies, as well as SMEs.

With France on its western border and Switzerland on its northern one, Piemonte is naturally endowed with a strategic position in Europe and in the Mediterranean area, right at the crossroads of the main routes between the north and south, east and west. Thanks to its 1,000 km of motorways, 2,000 km of railways, its closeness to the Ligurian Sea and two international airports, Piemonte is an easily accessible place, ready to face up to the European market. About 700 foreign companies have already set up operations here, where the quality of life is a key factor. Piemonte offers a first class environment for living as well as doing business. There's plenty to suit everyone. Opportunities for leisure activities are plentiful and varied, with a rich variety of scenery and cultural attractions.

Strong commitment to R&D

Piemonte invests 1.7% of its GDP in innovation, more than triple the Italian average, like the most highly developed areas in Europe. It is the Italian region with the highest share of private R&D expenditure, and also leads in terms of patents registered at the European Patent Office.

Top-ranking R&D centres

Over 200 private and public R&D centres specialised in automotive and information and communication technology, as well as in many innovative sectors such as bio and nanotechnologies, offer a network of topquality skills and facilities. Among them are: CRF - Fiat Group Research Lab (www.crf.it), GM Powertrain Europe (www.gm.com) research centre, Telecom Italia R&D centre (www.telecomitalia.com), Motorola Technology Centre (www.motorola.com), CRIT - Technological Innovation and Research Centre of the national broadcasting company (www.crit.rai.it), Istituto Nazionale di Ricerca Metrologica-INRIM (www.inrim.it).

Technological and environmental strength

The technological and environmental calling of Piemonte is confirmed by a number of important objectives reached:

- the most efficient plant of energy recovery from waste in Europe and one of the top five in the world for the quantity of energy produced is run in Torino by Amiat
- 400 biomass heating and thermo-electric plants are active in the region, one of the largest co-generation/district heating network in Europe
- over 250 low impact vehicles in the region's cities fleets
- a high number of eco-industries.

In addition, the regional authority has strengthened the fight against greenhouse gas with specific policies and actions, in particular in the transport sector (incentives for public transport, incentives for the improvement of the gas network, action to streamline traffic and reduce journeys, "bollino blu" exhaust emission certification throughout the region), in agriculture and forestry (support for the sector, improvement of crop production for the production of biofuels and biocombustibles, action for the correct management of livestock farms), in the energy sector (environmental energy plan, incentives for energy saving, production and use of renewable sources) and in the production sector (action in favour of industrial cogeneration, support for technology innovation, incentives for low impact vehicles, energy recovery of the biogas produced by controlled waste tips).

Piemonte hydrogen system

Hydrogen is destined to play an important role in the future of our energy system. It is unanimously acknowledged as one of the most promising sources of energy, capable of enabling sustainable energy development in the near future.

In Italy, similarly to what happens in the most industrialised countries, there is a growing interest in hydrogen and related technologies and, in the last few years, to give impetus and cohesion to Piemonte's strong industrial presence, the regional government has strongly committed itself to the development of this sector, setting up a series of initiatives aimed at creating the Piemonte Hydrogen System and a fully-fledged network that makes it possible to make the most of the synergies possible and to outline broad-ranging strategies. Substantial resources have been invested in the sector in research and demonstration projects, technology transfer and education, a commitment that has enabled Piemonte to reach a position of leadership in Italy and to obtain representation in the HyRaMP–Regions and Municipalities Partnership on Hydrogen and Fuel cells, created in Brussels in April 2008 with the goal of providing consistent guidelines and strategies for the promotion of hydrogen technologies and to enable a constructive debate with the Hydrogen and Fuel cell JTI. Many reasons underpin this decision: first of all there is an urgent need for diversification of primary energy sources, trying to reduce the share of fossil fuels. Moreover, the reduction in air pollution (especially in urban areas) and of greenhouse emissions represents a shared goal that, coupled with the opportunity to increase the competitiveness of the national and local industry, originate this strong interest in hydrogen. At the local level, the novelty of the sector was immediately acknowledged and, coupled with the region's deep hi-tech tradition and commitment, made the hydrogen sector easily perceived as strategic for future local development.

The Piemonte Hydrogen System–SPH2 involves all the relevant local society leaders, such as local authorities, academic institutions, schools and universities, private companies belonging to international groups and a number of SMEs with hi-tech capabilities and state of the art expertise.

The objectives of the Piemonte Hydrogen System:

- to support and direct research in hydrogen technologies
- to promote the professional growth of technical and management personnel in universities, laboratories, and businesses
- to promote hydrogen as a clean carrier instead of the continued use of fossil fuels
- to support the development of regional infrastructures that use hydrogen
- to promote the transfer of technology from laboratories to businesses and industries
- to sustain the pre-competitive phases of technologies that produce hydrogen from renewable sources.

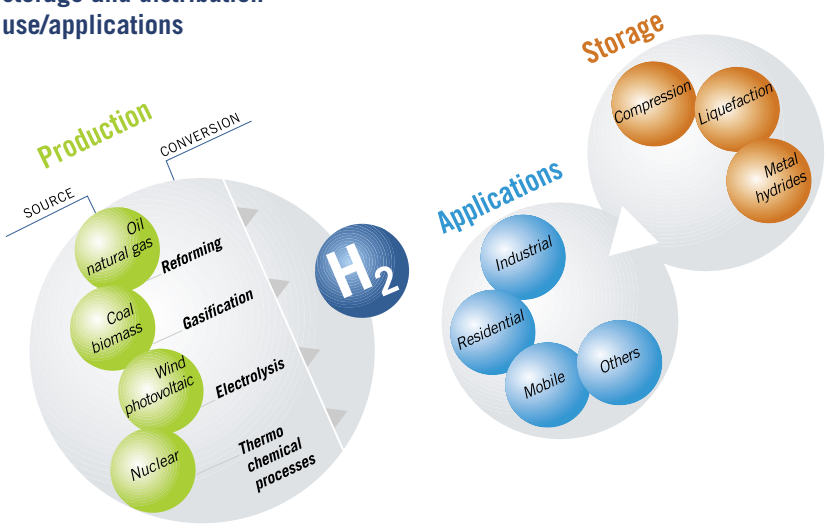
Piemonte Hydrogen System

In 2007 the Presidents of Regione Lombardia and Regione Piemonte signed a strategic agreement to develop the LPHP (Lombardia-Piemonte Hydrogen Partnership), a partnership specifically conceived for the study, development and demonstration of hydrogen technologies. The philosophy of this strategic agreement is the synergy in the process of planning and structuring applied research in order to reduce time to market of new technologies and give clear indications for decision makers in the field of energy and environmental policies.

The LPHP cooperates with many European projects (HYTRAN, ZERO REGIO, PEMTOOL, FLAMESOFC etc.), has enabled significant experience in the territory on the themes of mobility, distributed cogeneration, production of hydrogen from renewable sources, and began a process aimed to create suitable infrastructures for hydrogen production and distribution to support the deployment of these technologies.

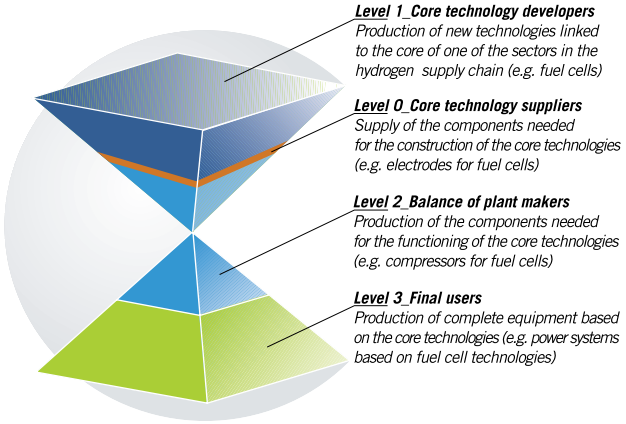
The hydrogen development process, is divided into three main sectors:

- production
- storage and distribution
- use/applications



All three sectors imply technological development and the production of components that will have a considerable fall-out effect on industry.

The industrial activities that could potentially be involved in the market dedicated to hydrogen technology have very different backgrounds and diverse levels of involvement, that can be summarised in 4 levels



Levels 0, 2, 3 include existing production activities that, following the development of the hydrogen society, could see new markets open up in which to diversify their own product lines. As regards level 1, this concerns mainly production dedicated to new technologies.

Activities are present across all the levels linked to the standardisation and regulations of the new technologies as well as safety, education and awareness-building of the general public.

The hydrogen sector embraces a broad range of products, components, systems and technologies, is profoundly interdisciplinary and has a wealth of opportunities for firms in various sectors.

Research on hydrogen *in Piemonte*

Over recent years, research and in-depth studies dealing with a wide range of issues have been undertaken. These issues cope with production, purification, hydrogen storing, increased knowledge of PEM (PEFC, Polymer Electrolyte Membrane Fuel Cell), high temperature models like MCFC (Molten Carbonate Fuel Cell) and SOFC (Solid Oxide Fuel Cell), energy management problems and experiences with specific applications.

This research has been carried out through a network of laboratories dedicated both to fundamental (Politecnico di Torino, Università di Torino, Università del Piemonte Orientale) and applied research (Environment Park-HySy Lab, Fiat Research Centre, Enea-FN Nuove Tecnologie, Edison Research Centre).

R&D projects

Environment Park through its centre of excellence on hydrogen technologies Hysy Lab, works as a coordinator of different R&D initiatives joining together the other main players of the Piemonte Hydrogen System - Università di Torino, Politecnico di Torino, Università del Piemonte Orientale and several local enterprises.

In this way the Piemonte Hydrogen System involves local industries with a view to emphasizing the potential practical applications of hydrogen technologies, as in the case of most of the following projects.

- ***Micro CHP*** Development of low power CHP units (Combined Heat and Power generation) based on the combination of different technologies applied to a NG feedstock (steam reformer/PEM fuel cell stack, SOFC CHP unit) [partners: Environment Park-Hysy Lab, Merloni, Termo Sanitari, Arcotronic Fuel Cells, HySyTech, Enerconv, Politecnico di Torino]
- ***Celco Yacht*** Development of a fuel cell system for the auxiliary power supply of yachts [partners: Environment Park-Hysy Lab, Azimut Benetti, Arcotronic Fuel Cells, HySyTech, Enerconv, Politecnico di Torino]
- ***Microcell*** Development of a methanol fuel cell system for computer and mobile phone power supplies [partners: Environment Park-Hysy Lab, Merloni, Termo Sanitari, Arcotronic Fuel Cells, HySyTech, Enerconv, Politecnico di Torino, Università di Torino, Università del Piemonte Orientale, CNR di Messina-Institute of Advanced Energy Technologies Nicola Giordano, CNR di Catania-Institute for Microelectronics and Mycrosystems]
- ***Multi.s.s.*** In house production, design and experimental analysis of solide oxide fuel cell (SOFC) stacks of planar geometry dealing with multiple fuels [partners: Politecnico di Torino, Università del Piemonte Orientale, Turbocare]
- ***EOS - Energy from solid oxide*** Fuel cell generator CHP100 [partners: Turbocare, Politecnico di Torino, Environment Park-Hysy Lab]
- ***EBE (Low Emission Energy)*** Micro cogeneration with solid oxide [partners: Turbocare, Piemonte Region, Politecnico di Torino]
- ***FISR*** Innovative systems of hydrogen production from renewable sources [partners: IPASS Consorzio Ingegneria per l'Ambiente e lo Sviluppo Sostenibile, FN Nuove Tecnologie, CIRIAF Centro Interuniversitario di Ricerca, Environment Park]
- ***BioH2Power*** Feasibility study of a power unit based on MCFCs integrated with a biogas processor for decentralise methane and hydrogen production [partners: Sapio Produzione Idrogeno Ossigeno, Asia Ambiente Italia, CNR-ISAC, Ansaldo Fuel Cells, Environment Park-Hysy Lab,Politecnico di Torino]
- ***PFHC (Poly-Fuel Hot Cell)*** Design, production and experimental analysis of single solid oxide fuel cells of planar geometry; design of a small stack of planar cells [partners: Politecnico di Torino, Università del Piemonte Orientale, FN Nuove Tecnologie]

Innovation & technology transfer

The strategy for the creation of an effective system to support the deployment of hydrogen technologies includes the activation of programmes aimed to involve of the companies that could constitute the hydrogen industry supply chain.

The Sistema Piemonte Idrogeno has invested in this action by promoting three different programmes: HySy Vision, FCAuto and HyTetra.

They are all Technology Transfer Projects related to the hydrogen sector focused on local small and medium enterprises and supported by different funds: regional funds (HySyVision and FC Auto) and European funds (HyTetra).

The overall project value is around € 5.0 M in three years.

HySyVision and FC Auto aim to create and develop a regional hydrogen cluster operating at a regional level.

HyTetra, led by Torino Chamber of Commerce, is a EU-funded network project with the aim to share, offer and request technological know-how among different European regional systems active in the hydrogen sector.

As a major effect of these actions, a regional cluster has been established and connected to other regional clusters in an effective network.

HySyVision and FC Auto, managed by Environment Park in partnership with the regional Universities and Fiat Research Centre, are projects aiming to support the creation and strengthening of the hydrogen chain in Piemonte.

The operational workflow passes through the following actions:

- *Technology assessment checking out the promising H2 technologies and products in relation with local skills*
- *Industrial scouting to select SMEs able to offer competencies and know-how*
- *Technology audit to check up the SMEs' interest and availability to enter into demo actions*
- *Feasibility studies of possible demonstration activities through technical and economical analysis*
- *Pilot demo projects having as a goal the realisation of systems, prototypes and components by local SMEs*

Through these actions performed over two years, the following results have been achieved:

CONTACTED SMEs **557**

AUDITED SMEs **108**

SMEs INVOLVED IN PILOT PROJECTS **23**

The regional system takes advantage from the results of these actions having developed pilot demo initiatives that brought local SMEs to prototype different components: bipolar plates for PEM fuel cells, valves, BOP elements, power electronics devices, etc.

The HYTETRA project

www.hytetra.eu

Hytetra is part of a group of projects, funded by the European Commission, in the 6th Framework programme, which aim at developing and verifying new technology transfer methodologies and tools.

The Hytetra project approaches a technology sector in an early stage, where a lot of developments and know-how are needed. All project partners are both experienced in technology transfer and located in regions or countries where many activities in the hydrogen field are in course.

Hytetra creates opportunities for a mutual interaction among companies and technology providers. It provides tools that enable the companies to become aware of the market and of the technology trends in this sector. In the meantime Hytetra puts them in touch with the most competent Hydrogen Centres of Excellence which can support them in the implementation of technical solutions.

Project Consortium

- *Torino Chamber of commerce, Italy (coordinator), within the ALPS Innovation Relay Centre*
- *SWEREA Industrial Research and Development Corporation, Stockholm, Sweden*
- *Midlands Innovation Relay Centre located at Coventry University Enterprises Ltd., Coventry, United Kingdom*
- *Innovation Relay Centre North Rhine-Westphalia/ Malta, located at ZENIT GmbH, Mülheim an der Ruhr, Germany*
- *The Foundation for the Development of New Hydrogen Technologies in Aragon, Huesca, Spain*

Hytetra partners cooperate with a pool of technology providers, which are fundamental in the right choice of technologies to be diffused to companies, and for monitoring the SMEs needs.

The following technology providers are furthermore involved:

HySy Lab, located at Environment Park, Torino, Italy

Center for Fuel Cell Technology (ZBT GmbH), Duisburg, Germany

Hannover Messe

Among the activities planned and realised within the frame of Hytetra the participation in the 2008 edition of Hannover Messe, is relevant.

The Energy fair provides a complete overview of the market in technologies and services - from the generation, supply, transmission and distribution of energy to consumption by the end user. The sector of energy generation and supply has a special focus on hydrogen and fuel cells. This is the most important exhibition on hydrogen worldwide.

The Hytetra - Brokerage Event at Hannover Messe represented a unique opportunity for participating companies to establish cross-border contacts and find international business partners for cooperation as well as partners for research and development projects with regard to hydrogen and hydrogen related technologies.

Results

- *78 firms from throughout Europe took part in the brokerage event, with the assistance of all the partners in the project*
- *over 140 bilateral meetings organised, split between companies that already work with hydrogen and those examining the situation, for the first time providers of technologies potentially applicable to the sector*
- *12 Italian companies participated (10 from Piemonte and 2 from Lombardy, divided between control and simulation systems, design, research, engineering and production)*

Products & prototypes

Presently SPH2 brings together different industrial expertises having achieved results in developing products and prototypes in the hydrogen sector.

Some different cases are listed below indicating both FC early market products (Electro 7™) and prototypes for medium term applications.

- ***Electro 7™*** *Multi-output fuel cell system for business continuity applications suitable for any business requiring efficient, reliable, cost-effective, clean energy. Developed by Electro Power Systems and distributed on the market since two years.*
- ***Hyphone*** *Hydrogen-fuelled, portable power supply for cellular phones. [Partners: OZ Fuel Cells, Università del Piemonte Orientale]*
- ***Hysyrider*** *Prototypes of fuel-cell hydrogen scooters for small mobility applications. The prototypes have been developed in three versions (HR1, HR2, HR3) with power systems from 300 to 1500 W. [Partners: Environment Park - HySy Lab , SAPIO, Arcotronics Fuel Cells]*
- ***Fiat Panda Hydrogen*** *Development of a city car powered by H2 fuel cells. [Partners: Fiat Research Centre, Nuvera, Fiat Auto, Fiat Powetrain]*
- ***Hydrogen Bus*** *Realisation and experimentation of a hydrogen-powered, fuel cell bus tested along urban routes. [Partners: GTT, FIAT Research Centre, SAPIO, Politecnico di Torino, Compagnia Valdostana Acque, ENEA, IRISBUS, Ansaldo Ricerche, International Fuel Cell]*
- ***H-due*** *Ecological vehicle sponsored by the Torino Chamber of commerce. It is aimed at public and private use, runs on two 450 watt traction wheels, has a maximum speed of 20 Km/h and is powered by a hydrogen fuel cell system, which was developed by the Politecnico di Torino and HySy Lab, with the contribution of several From Concept to Car companies (www.fromconcept-tocar.it). When fully charged, it has a two-hour drivability range. The prototype was engineered using the most sophisticated technologies, recyclable and low-environmental-impact material.*

EU funded projects

- *HYTRAN (www.hytran.org) Hydrogen technologies for road transport tools for PEM fuel cell component and stack*
- *PEMTOOL (www.envipark.com) Development of a new, efficient and validated software-based modeling tool for fuel cell design*
- *MCWAP (www.mc-wap.cetena.it) Application of Molten Carbonate Fuel Cells (MCFC) technology on-board large ships, as Ro-Pax, Ro-Ro and Cruise, and fast vessels for auxiliary power generation purposes*
- *ENFICA (www.enfica-fc.polito.it) Design and development of a fuel cell-based power system to be installed in an ultra-light aircraft in order to achieve the first fuel cell-manned flight*
- *FLAMESOFC (www.flamesofc.org) development of an innovative SOFC-based micro-CHP system capable to operate with different fuels and fulfilling all technological and market requirements at a European level*

Key scientific players

Within the Sistema Piemonte Idrogeno four of the main players - Università di Torino, Politecnico di Torino, Università del Piemonte Orientale and Environment Park - share the common goal of transferring hydrogen research results into industry relying on their specific competencies and expertise.

Università di Torino

www.unito.it

The research at Università di Torino on topics related to hydrogen regards to the investigation of new methods of production, purification and storage. The three chemistry departments are involved, as well as the NIS (Nanostructured Interphases and Surfaces Centre, recognised as a National Excellence Centre, collecting more than 90 affiliates belonging to Chemistry, Physics and Biology departments of Università di Torino), specifically on the role played by superficial and interfacial phenomena. The research is based on the availability of a wide variety of experimental techniques. Among them: X-ray diffraction, HRTEM and SEM, Atomic Force Microscopy, optical and metallographic microscopy, FTIR spectrophotometers operating in the range 15000-100 cm-1, under controlled atmosphere at variable temperature (12-300K) in transmission, diffuse reflectance and ATR mode. Raman spectrophotometers with NIR sources (FT-Raman), visible and UV-sources. IR and Raman microscopies. EPR in the X band between 4 and 400K. ESCA-XPS, PIXE and cathodoluminescence, Calvet microcalorimetry; thermal analysis (TG, DTA, DSC at low and high temperature), microgravimetry. Tensiometry. Analytical and preparative chromatography. Mass spectrometry. Conductivity and photo-conductivity measurement. Laser light scattering. Volumetric adsorption techniques. Dynamic-mechanical testing of materials.

Projects and activities in the hydrogen field

- *Materials for hydrogen storage (including alloys and intermetallic compounds, complex hydrides, inorganic and metal-organic microporous solids, polymers, high surface area nanostructured oxides)*
- *Catalysts and adsorbents for hydrogen purification, Catalysts for water gas shift and methanol reforming, for purification of CO*
- *Ab initio modeling of hydrogen interaction with microporous materials. Fundamental studies for the understanding of the hydrogen/material interaction (adsorption, dissociation and diffusion); development of computer codes for the quantum mechanical description of solid matter; applied computational chemistry and molecular graphics; simulation of phase diagrams and phase transitions*
- *Development of solid state sensors for hydrogen detection*
- *Materials for Fuel Cells (electrodes, catalysts, membranes); synthesis of new precursors and protonic conductors, characterization of membranes*
- *Catalysts and photocatalysts for hydrogen production; nano-structure development for better light absorption and reduced charge carrier separation*
- *New processes and technologies for materials synthesis, coatings and thin films (sol-gel), deposition of metallic, semiconducting, superconducting, insulating and hard materials by CVD and PVD, advanced metallurgy for alloys and coatings, catalysis and photocatalysis, radiative treatments of materials*

Politecnico di Torino

www.polito.it

The Politecnico departments of Electric Engineering, Energetics, Physics, Material Science and Chemical Engineering, Mechanics and the Aeronautics, Aerospace are involved in hydrogen R&D.

On the average, the Politecnico earmarks about 5-6 million of Euro for hydrogen R&D and bestows more than 20 Master degrees and 10 Ph.D. degrees per year.

Projects and activities in the hydrogen field

Basic Technologies

- *Planar geometry cells for SOFCs and mesoscopic modeling of porous electrodes of SOFCs*
- *High pressure water electrolysis from renewable sources*
- *Metal hydrides and carbon nanotubes for hydrogen absorption*
- *Development of sealant materials for SOFCs*
- *Improvement of membrane electrode assembly for low temperature FCs*

Fuel Cells systems & components for the balance of plant

- *Energetic, fluid-dynamic, chemical and electric study and modeling of the SOFCs generator and of the balance of plant*
- *Electronic converters for FCs power conditioning in transport and stationary applications*
- *Electric machines for FCs high speed compressors for automotive applications*
- *Oil-free bearings for FCs high speed compressors for automotive applications*
- *Fuel processors for vehicles applications*
- *Micro-FCs and micro-combustors for portable applications*

Fuel Cells applications

- *Hydrogen village-laboratory: integration of renewable energy sources and an hydrogen system, for mobility and residential use in an alpine village*
- *Design of the laboratory and analysis of experimental data of SOFCs pilot CHP plants*
- *Micro/mini unmanned aerial vehicles powered by FCs*
- *High maneuverability remotely-controlled airship powered by FCs*
- *FCs auxiliary power unit in more/all electric aircrafts*
- *FCs auxiliary power unit in yacht applications*
- *Micro CHP units for domestic applications*
- *Electric-motor-driven two-seat airplane powered by FCs*

Dedicated Laboratory IN.TE S.E. (TEchnological INnovation for Energetic Sustainability)

Test benches and instrumentations for the experimental characterization

Università del Piemonte Orientale

www.unipmn.it

The DISAV (www.disav.unipmn.it), Department of Environmental and Life Sciences of the Università del Piemonte Orientale, was established in 2004.

It has a staff of 30 people distributed in the chemistry, physics and biology areas. Research activities are focused on topics of environmental relevance, among which energy.

The DISAV has several research laboratories focused on fundamental chemistry research and one is specifically dedicated to fuel cells, (FC) equipped with facilities for fabricating, testing and characterizing FC components.

Fundamental research on specific aspects of interest for FC also is conducted in the DISTA - Dipartimento di Scienze e Tecnologie Avanzate (http://dista.unipmn.it), particularly in the field of reformer catalysts for molten carbonate FC.

Projects and activities in the hydrogen field

- *Optimisation of MEA (membrane-electrode assembly) manufacturing, both for polymer electrolyte (PEM) and solid oxide fuel cells (SOFC)*
- *Design and realisation of prototypes:*
  - *1 to 15 watt power, hydrogen and direct methanol fuel cells systems for portable applications*
  - *hydrogen fuelled air-breathing stacks (1-20 W)*
  - *electronic control and power conditioning units*
- *New techniques for synthesizing platinum-based electrocatalysts on conducting substrate*
- *New synthesis techniques of carbon based, conducting materials for gas diffusion layers and catalysts production*
- *Ionic conductivity and methanol permeability studies of membranes for PEM*
- *Hydrogen production from renewable sources*
- *Synthesis and characterization of nickel oxide based catalysts for internal reforming in molten carbonate cells*
- *Development of nanostructured catalysts based on metal particles/clusters confined in zeolites and mesoporous silica structures, and of composite polymer membranes containing layered inorganic compounds*

Environment Park

www.envipark.com

A joint initiative of Piemonte Region, City of Torino and European Union, Environment Park is an innovative experience in the European context of Science and Technology Parks because it matches technological research and eco-efficiency.

The Park's mission is to provide small and medium-sized enterprises with advanced solutions and innovative technologies in the fields of energy and the environment through partnerships, special projects, specific training activities and the organisation of thematic events.

Among the different activity sectors of the Park, hydrogen and fuel cell technology plays a preminent role with the development of HySy Lab (Hydrogen System Laboratory) which is now a centre of excellence for Hydrogen technology. It supports enterprises in the deployment of the technologies and acts as an ideal complementary actor working together with research institutions.

With the main goal to support the growth of the applied knowledge of industries about hydrogen related issues, HySy Lab run activities spread over 3 macro objectives:

- *hydrogen production*
- *hydrogen storage*
- *applications through different fuel cell systems*

HySy Lab's services and main skills cover the following areas:

- *tests on components and systems of the hydrogen chain*
- *design and production of systems subsystems and test benches*
- *educational systems*
- *project planning and feasibility studies*
- *technology scouting*
- *training for technicians, teachers, students*

Besides these activities, Environment Park is active in the development of novel surface plasma-based technologies for different applications in the hydrogen sector (PVD coatings for metal bipolar plates, atmospheric plasma processes for electrode deposition and MEA production).

Environment Park focuses also on hydrogen production from renewable sources.

At Environment Park's Bioenergy Laboratory is performed the design and development of a pilot plant for H2 production via dark fermentation of organic biomass and aims to evaluate feasible processes allowing H2 generation to be integrated with biogas production starting from different kinds of waste.

The availability of a 450 kW mini-hydro power plant allows Environment Park to demonstrate the use of hydrogen as a clean energy vector through an electrolysis H2 production system working with the surplus energy production.

The clean hydrogen is pressurized up to 350 barg and will feed a refueling station able to fill FC vehicles for urban circulation.

Research Centres

CENTRO RICERCHE EDISON

www.edison.it

Edison is the second largest Italian utility with operations in the procurement, production and sale of electric power and natural gas. Edison R&D centre focuses on research, development and innovation programs that involve many areas of science, testing new energy technologies (such as advanced photovoltaic and FC systems, advanced UPS and storage, superconductivity) that provide competitive and sustainable development opportunities. Research and development programs are coordinated from the Milan-based headquarters. The main operating unit is the Trofarello centre (in the province of Torino), opened in 1993. Important research is also carried out in other centres of excellence in Italy and abroad under cooperation agreements with public and private institutions and universities. This approach helps to create a vast network of competencies, technical resources and tools coordinated by Edison research specialists.

The research centre and hydrogen

- *Fuel Cell Testing Laboratory evaluates the available state of the art of both SOFC and PEMFC technologies and their maturity for the relevant market by testing materials, components and systems that use hydrogen or natural gas*
- *Testing activities provide data for the development of simulation software for high-temperature cells*
- *5 test benches, designed to study single cells, stacks and systems fed both with pure hydrogen and ad hoc gas mixtures*
- *All testing systems allow continuous unattended operation over thousands hours*
- *2 test benches dedicated to the characterisation of commercial and new generation PEMFC, also suitable for working at high temperature (160 °C) and with reformate fuel*
- *2 test benches dedicated to testing long time behaviour of SOFC of different geometries (tubular or planar)*
- *A test bench dedicated to durability tests on SOFC stacks*
- *An outdoor area dedicated to test prototypal natural gas fuel systems for distributed cogeneration*

CENTRO RICERCHE FIAT

www.crf.it

Centro Ricerche Fiat (CRF) was established in 1976 to enable innovation and satisfy R&D needs of the Fiat Group. The main site of CRF is located near Torino (Orbassano) with 4 branches and a satellite facility (R&D in lighting and the welding of plastics). With a workforce of more than 850 highly trained professionals, CRF offers a wide range of technical competencies and is equipped with laboratories for the testing of powertrains, electromagnetic compatibility, experimental noise and vibration analysis, driving simulation and virtual reality, in addition to facilities for the development of new materials and manufacturing processes, opto-electronics and microtechnologies. CRF uses innovation as strategic lever and attributes value to its results by promoting, developing and transferring innovation in order to enhance product competitiveness and distinctiveness. The development of effective, creative and competitive solutions is matched by direct technology transfer (it also includes "on the job" training of specialised personnel in different areas). CRF provides support for growth to Fiat Group, its partners and different regions by conducting R&D activities related to improving the efficiency and safety of mobility and transportation by focusing on: development of vehicles with new architectures and powertrains, innovative materials, advanced solutions for telematics and communications, mechatronics and optics.

CRF collaboration network: more than 750 industrial partners and 150 universities all around the world. The Powertrain Research and Technology (PR&T) Division has in charge R&D activities on: ICE (gasoline, diesel and CNG), hybrids and advanced transmissions (manual, AMT and DCT) and the H2 ones for ICE (Hyper Panda supplied with a mixed NG and H2) and FC applications.

The research centre and hydrogen

- *FC System & Powertrain specific solutions developed*
  - *for passenger cars: from the Seicento Elettra H2 (FC range extender) to the Seicento Hydrogen (FC full performance) using Nuvera PEM FC stacks*
  - *for urban buses: IVECO Cityclass FC Hybrid for Torino and Madrid (UTC PEM FC Systems)*
- *CRF-PR&T has completely developed the new generation FC Systems (with Nuvera FC stacks) and is applying it to the new Panda Hydrogen (FC full power)*
- *CRF-PR&T is involved in EU (Fuero, Fueva, Optimerecell, FCTestnet, Direct, HyTran, HySYS, Autobrane, Roads2Hycom, HarmonHy…) and national (FC1, FC2, FC3…) R&D projects*

Companies

by activity/technology sector

Core Technologies Developers

FC Based Systems

A group of SMEs are actively involved in the creation and strengthening of the hydrogen chain in Piemonte, acting as real pioneers and innovators in the field.

ELECTRO POWER SYSTEM S.p.A.

www.electrops.it

H_2 green business continuity

Electro Power Systems founded in 2005 and based in Torino is an established player in the fuel cell systems sector having developed the Electro 7™, the first multi-output fuel cell system for business continuity applications. Electro PS was awarded the "Italian National Award for Innovation" in 2005 and received CE certification for the Electro 7™ a year later. The company is dedicated to expanding its offer through advanced research and development activities. In 2007 ElectroPS received an important round of funding from 360° Capital Partners, a leading French-Italian venture capital company, and is focused on international development.

The Electro 7™ is installed as a business continuity and supplemental power solution within telecommunications, public utilities, IT and broadcasting companies, and is suitable for any business requiring efficient, reliable, cost-effective clean energy. It delivers up to 7kwe energy and, unlike a traditional battery-based UPS, it is an emission and lead-free alternative for any mission-critical application.

In March 2008 ElectroPS unveiled Electro 7™ 19" Rack Mountable, which has been specifically designed for streamlined integration with the new generation of shelters being deployed within the telecom industry and can provide cost-effective, 24/7 on demand power for critical backup applications in any number of business sectors.

Key features of the Electro 7™ 19" Rack Mountable:

- Lighter, smaller and more economical than alternative, long-lasting solutions
- 100% clean energy - polluting emissions, only water
- Start-up in 10mm" and long, modular autonomy
- Remote real-time systems diagnostics for 42/7 reliability and performance monitoring

OZ FUEL CELLS S.r.l.

www.ozfuelcells.eu

Design and production of portable FC systems and portable hydrogen generators

The company, established in 2006 as a spin-off of Università del Piemonte Orientale, deals with the design and production of 1-1000 W portable FC systems and chemical portable hydrogen generators based on proprietary technologies and patents, utilizing single-use, chemical hydride cartridges, replaceable. The company exploits the academic research findings knowledge achieved by the University's Fuel Cell Laboratory, and can manufacture MEAs, Pt/C and Pt-Ru/C catalysts, low-power PEMFC stacks and components for FC systems. In addistion, OZ Fuel Cells can provide facilties for research, particularly ion exchange membranes characterization and tests.

The company and hydrogen

Development and production of: low power (1-100 Watt) fuel cell portable systems; hydrogen generators with single-use, replaceable cartridges; control systems for portable applications; test and integration of FC systems and components.

FN S.p.A New Technologies and Advanced Services

www.fnspa.com

Development, testing and manufacturing of new materials and new technologies

FN, established in 1967 in order to produce combustible for nuclear power plants, was a joint venture of General Electric Co. and Ansaldo Meccanico Nucleare (Genova). Currently its shareholders are: 98.65 % ENEA, 1.28 % Deposito Avogadro Srl, 0.07% Ansaldo Energia. FN develops, tests and manufactures new materials (advanced ceramics and composites) and technologies in partnership with university institutes and international research centres. The company deals with prototype plants set up (in particular High Temperature Small Size FC) and plants pre-industrialisation checks. FN, that designed and built a tape casting machine for FC porous component fabrication, is setting up a new technology based on plastic forming. The company is dealing withy R&D activities on hydrogen production within the project "Vettore idrogeno - Innovative systems for hydrogen production from renewable energy", financed by the Ministry of Research, together with Politecnico di Torino, Environment Park, IPASS and CIRIAF. Thanks to its experience in ceramic matrix composites (SiCf-SiC, Cf-SiC, Cf-C), FN has developed ceramic matrix composite fabrication technologies. FN, qualified by EFDA (European Fusion Development Agreement), has collaborated with CIRA (Centro Italiano Ricerche Aerospaziali) and is currently involved in a partnership with La Sapienza university in Roma.

The company and hydrogen

SOFC and MCFC technology developer.

TURBOCARE S.p.A.

www.siemens.com

Repairing and replacement of gas turbines - Energy power systems based on SOFC

TurboCare SpA, an Italian Siemens PG Subsidiary and member of TurboCare Group, was set up in 2003 as Gas Turbine Technologies SpA; the company name was changed in the actual one in 2006. The activities of the Fiat Group Energy Division have come together with those of TC SpA, in particular the ones connected with the manufacturing of industrial turbines for the production of electricity. Fiat, together with Grandi Motori, that became TTG, began producing gas turbines in 1956 through a license agreement made two years before with the American Company Westinghouse. After the acquisition of Westinghouse, the Siemens Group, energy world leader, has also absorbed Fiat turbogas activities. The company is divided into 2 business lines: Service and Systems. Service: business dedicated to support industrial turbines for the production of electric power: spare parts, repair, maintenance, modernization. The acquisition of an agreement for the rehabilitation of 2 turbogas plants for the production of electric power in Iraq is an example of the relationship between TC SpA and the Ministry of Electricity in Iraq, a new opportunity for Torino industrial area development in the local energy field. Systems mission: exploring new opportunities in power generation (the acquisition and selling of the turbines of Edipower power plant of Turbigo, Milano). Project activities: disassemble, reconditioning and transportation of 4 gas turbines from Turbigo to Port Elizabeth (South Africa).

Estimated activities: supplying of materials for the rehabilitation of 7 turbogas units and training of people of the Torino plants (first step for a new line of business: in Europe, above all in Italy, there are a lot of power plants no longer working that could usefully be re-installed in other countries). This business unit collaborates with the Division of Siemens-Westinghouse "Stationary FC" in Pittsburgh (USA), to organize in Torino a centre for the development of power generation units with SOFC technology. For this purpose a research agreement was signed with Politecnico di Torino and Environment Park (EOS and EBE Projects).

The company and hydrogen

Currently testing 2 SOFC Fuel Cells in cogerenative set up; this experience could enable the company to function as technical assistant for other technology users. Thanks to ripe experience in gas turbine and recent commitment in FC the company could specialise in distributed power generation based on FC-gas turbine systems.

Hydrogen Production, Storage, Distribution

GRUPPO SAPIO S.r.l.

www.grupposapio.it

Technical and medical gas field

Operating since 1922 Sapio, a member of Assogastecnici (Federchimica association for technical and medical gas field), grants a capillary diffusion all over Italy supplying: technical and medical gas (oxygen, hydrogen, azote, acetylene, carbon dioxide, argon, helium, mixtures, ultra pure gas, F.U. gas and mixtures); high technology systems for cut and welding; coolant gas; azote, oxygen, hydrogen on site production plants; design and manufacturing of gas application and delivery plants; hospital and house services in public/ private sanitation field; support for innovative applications in the energy field. The company is already involved in most of the Italian demonstration projects including H2 and FC; it has specific experience about hydrogen production, purification and storage.

The company and hydrogen

Production and delivery of pressurized hydrogen; design and manufacturing of: hydrogen storage systems, in situ production plants; consulting in plants-safety.

TECNODELTA S.r.l.

www.tecnodeltaimpianti.com

Special plants and fluid systems design

Tecnodelta has been established by its current owners who have a long experience in fluid plants design. The company does not have a standard production: it designs and manufactures plants on demand dealing with fluid regulation, delivery, control and analysis systems (especially focusing on gas for industrial processes, analysis, research and special uses). In particular the company products are: systems to control the fluids; example: rack for heat-treatments, purifier, cooling system for research centres, mixers, liquid pumping systems; distribution pipeline; ultrapure gas plants.

The company and hydrogen

Design and manufacturing of hydrogen storage, utilization and delivery plants; plants design consulting; R&D, prototypes development, patenting; involved in a project aimed at designing and manufacturing a metallic hydride tank prototype.

TERMOMACCHINE S.r.l.

www.termomacchine.com

Induction technology heating plants

Established in 1978, Termomacchine has been continuously involved in designing, manufacturing and providing electromagnetic induction heating equipment to meet market requirements. Based on experience gained in these years, the company has developed a range of machines usable in many applications; it means a continuous drive to uphold its products reliability and quality. Termomacchine main sectors of application are: installations for electromagnetic induction heat surface treatments, installations for welding and heat treatment of tubes, electromagnetic induction heating systems for the electrical motor industry, electromagnetic induction heating systems for the power, fibre optic and telephone cable industry.

The company and hydrogen

Experience in metal fusion and thermic treatments; potential developer of metal hydride systems.

Core Technologies suppliers

Other Technologies

HYSYTECH S.r.l.

www.hysytech.com

Solution for energy and environment

HySytech, acting in chemical process efficiency improvement since 2003, sets its activity on technological transfer from university to industries, producing day by day R&D for industrial customers and research centres. Its main activities refer to chemical engineering, above all chemical plants, industrial catalysis, and energy production/transformation, with a special focus on hydrogen production from hydrocarbons, fuel cell systems and production/use of renewable energies such as biofuels (bioethanol, biomasses and biodiesel, biomasses, wind and photovoltaic energy). In the process plant field HySytech provides companies with technological and engineering consulting, procurement of equipments and plants, and IPC contracting.

The company and hydrogen

Manufacturing of hydrogen production plants (through gas and liquid fuel reforming); manufacturing of 5-15 kW reformer prototypes fueled by methane and gasoline; design and manufacturing of: test benches for atmospherics and pressurized molten carbonate monocells, test benches for monocells and PEM small size stacks (< 150 W) fueled by hydrogen and direct methanol, test benches for monocells and SOFC stacks fueled by hydrogen and methane (with internal reforming), test plant for atmospheric molten carbonate stack, patent for alkaline FC electrolyte pressure regulation system.

GIACOMINI S.p.A.

www.giacomini.com

Hydro-thermal-sanitary field

Established in 1951 by Alberto Giacomini as a small workshop manufacturing brass taps, the company - 800 employees - exports about 80% of its production to more than 100 countries all over the world, and is now one of the leaders in the hydro-thermal-sanitary field. It has 3 factories manufacturing its own products internally and 10 distribution branches processing 100 ton of brass every day. The hot forging takes place at Castelnuovo del Garda while manufacturing, assembling, testing, packing, stocking and shipping are based in San Maurizio d'Opaglio (in the province of Novara), the headquarters. Manufacturing unit in Sazza deals with pipes and synthetic fittings production. Thanks to the coherence of company strategies with international environmental models, such as UNI EN ISO 9000 and UNI EN ISO 14000, Giacomini has obtained the certification of the Management System for Quality and Environment.

The company and hydrogen

Development of a 35 kW H2 catalytic burner for residential application; development of a metal hydride storage system; design of integrated H2 based systems from clean production to use in residential applications.

CRIOTEC IMPIANTI S.r.l.

www.criotec.com

Cryogenic constructions and special plants

The company includes in its organisation all operative phases: project, construction and site installation. The company, founded in 1988 by a group of specialists with more than 20 years experience in the cryogenic field, designs, realises and assembles plants according to customer's order requirements and is highly competitive both on the Italian and the European market.

The company and hydrogen

Advanced technology knowledge in hydrogen compatible materials; design and manufacturing of experimental test benches and ad hoc core components development; involved in a project aimed at realising a 20 kW PEM Fuel Cells test plant.

LATTES S.p.A.

www.lattes.it

Anodic oxidation and chemical treatments on aluminium and alloys

Lattes is specialised in anodic oxidation and chemical treatments on aluminium and alloys and in the production of plates, panels, signals. Furthermore the company deals with oxidation until 150 µm on aluminium alloys and other particular processes on light metal alloys, according to international rules (UNI, ISO, DIN, AFNOR, ASTM, MIL) and special processes worked out into the company. Lattes has more than 1,500 customers; many of them are leaders in automotive, aeronautical and rail industry. The company applies advanced technologies in light alloys superficial treatment, prototypes production, treatment cycles optimization and mechanical design.

The company and hydrogen

Manufacturing of metallic bipolar plates (stainless steels, alluminium alloys) through chemical engraving of gas and cooling system flow fields; long experience in lightweight alloys selection for special uses and manufacturing; R&D in parameters and process techniques for FC components technical specifications (geometrical tolerance, surface roughness, surface treatments); bipolar plates manufacturing through dehydrogenation treatments and electrochemical plating; currently involved in a project aimed at the manufacturing of FC stack aluminium bipolar plates.

NEW RUBBER TEX s.r.l.

www.newrubbertex.it

Manufacturing of rubberized textures

The company, established in 1949, is involved along the entire process of rubberized textures manufacturing. The company is divided in different areas: R&D, coalescence for materials direct production, solutions for semi-finished preparation, rubber spreading on textile support, rubber calendaring, vulcanization and control on manufacturing processes and finished products. It has plants and machineries producing rubberized materials and different kinds of rubber foils: smooth, imprinted, vulcanized, raw, from 0.2 to 4mm thick and up to 2m high.

Textile supports mainly used by the company are: nylon, polyester, cotton, glass textures, aramidic fibres and ceramics, silk, non woven, while the elastomers (spread on textile inserts) mainly used are nitril, neoprene, natural rubber, Hypalon®, Viton®, butyl, silicon, epicloridrine, rubber latex.

New Rubbertex manufactures rubberized textures for the following sectors:

- Industrial: rubberized textures for specific usages membranes; gas, oils and hydrocarbon resistant rubberized textures, cover for electric cables
- Electro-medical and health: rubberized sheets, ice bags, conductive and insulating rubberized textures
- Nautical: pneumatics for pleasure and military craft market
- Auto-railway: sheets for trucks, covers for railway wagons, tops for spider cars, airbags
- Aeronautics: special tissues for ultra-light aircraft tanks

The company and hydrogen

The company has the technical skills to realise tissues for protons exchanger membrane or gas diffusion layers.

SPESSO GASKETS s.r.l.

www.spesso.com

Gasket Specialists since 1926

The company specialises since 1926 in the manufacturing of flat gaskets, traditionally for the automotive-engine sector but also for other sectors. It is a small company but its capacity for innovation, supported by international partnerships has enabled it to become the first Italian Manufacturer of Multi-Layer-Steel Cylinder Head Gaskets for Original Equipment. Following the management philosophy of the Toyota production system (lean manufacturing) the company has developed its own Spesso Manufacturing system, which allows it to guarantee flexibility and high standards of quality to its customers.

The company and hydrogen

The technology used daily for producing metal gaskets is going to be transferred for the realization of Bipolar Metal Plates which compose fuel cells' stacks. The company is realising the first Bipolar Metal Plates in cooperation with Environment Park-HySy Lab, Arcotronics Fuel Cells and the Politecnico di Torino. Moreover, thanks to the cooperation with Politecnico di Torino, Spesso Gaskets is present in the Piemonte's aerospace supply chain for the realisation of Bipolar Metal Plates in the development of a FC system for the auxiliary power supply (APU) for aircrafts.

Balance of plant makers

Fluid control and handling

AMBRA SISTEMI S.r.l.

www.ambrasistemi.it

Gas and Criogenic fluids Control Systems

The company has developed a line of specific products including systems for local and telemetric monitoring of cryogenic and compressed gas storages, on-site plant remote-control systems, remote alarm and remote control systems for medicinal gas storage and distribution systems in hospitals. Ambra Sistemi provides advisory services and "turnkey" design and manufacture of customised and special systems (automatic systems for ternary mixes, microbiological freezer monitoring and control systems). Besides its specific activities in chemical and biomedical fields, the company realises automation and remote control systems for drinking water treatment plants, natural gas distribution networks, heat and conditioning management networks. Currently Ambra Sistemi is involved in a project of the Seventh Framework Programme in the medical sector.

The company and hydrogen

It is specialised in technical, pure and ultra-pure gas processes treatment; it has experience in hydrogen treatment (safety and compliance laws); it is involved in hydrogen and pressurized mixtures (250 bar) treatment in a Snam pilot plant.

IDROSAPIENS S.r.l.

www.idrosapiens.it

Flexible elements and expansions joints

Idrosapiens deals with flexible elements since its establishment in 1927. Currently the company is a part of Witzenmann Group (Germany), leader in metallic flexible elements. HYDRA® brand and Idrosapiens supply mass products for automotive and ad hoc components for aerospace. Idrosapiens in its development programme devotes its best energies to the research and application of advanced systems for a safe handing of corrosive, hazardous, flammable or otherwise dangerous fluids, with particular attention to nuclear and aerospace components. Idrosapiens has been manufacturing (both under licence and to its own design) and marketing a wide range of sophisticated industrial components: metal expansion joints according to AD-B13, EJMA, CODAP and ASME sct. III and VIII; stainless steel flexible hoses; rubber and fabric expansion joints; pipe supports and shock absorbers; pipe rolls; chemical resistant systems for carrying corrosive media; metal bellows.

The company and hydrogen

The Aerospace Division has a great experience in bellows expansion joints and flexible metal hose assemblies, medium and high pressure for cryogenic space systems (including liquid hydrogen and oxygen applications); production of REX-INOX and HYDRA® flexible hoses (resistant to aggressive chemicals and solvents and applicable in extreme hot or cold temperature conditions).

MATRIX S.p.A.

www.matrix.to.it

Innovation and technology

Matrix is headquartered in Ivrea (Torino) and operates in mechatronic high-tech fields with three divisions.

- Textile Division: specialised in the development and production of needles electronic selection systems. These systems, which involve a large use of piezo-ceramic technology, equip latest generation textile machines and credit the company a leadership position in Europe.
- Automotive Division: specialised in the development and production of gaseous fuel systems for motor vehicles. Matrix's injectors, both in OEM and aftermarket versions, represent the top level of innovation in the alternative fuel field.
- Pneumatic Division: Matrix's technology allows use of the most modern techniques in controlling flow and pressure of gaseous fluids. Industrial automation, process control, pressotherapy, robotics, selection, artificial respiration and endermology are fields which involve a large use of Matrix's products, a wide range of solenoid valves and electronic pressure regulators.

The company and hydrogen

The company's technical know-how in the pneumatics and automotive fields is directly transferable in the H2 supply chain, in the management and control of the H2 feeding and the pressure stabilisation system.

Power And Control Electronics

AMET S.r.l.

www.amet.it

Solutions in industrial mechatronic engineering

AMET, established in 1999 as a spin-off of Politecnico di Torino, is a highly innovative engineering company active into the design and development of mechatronic products and processes, thanks to the most advanced virtual testing and optimisation techniques The company provides advanced solutions in industrial mechatronic engineering dealing with several markets (transportation, manufacturing, general industry, electric...). It is certified ISO 9001 and is associated to From Concept To Car (www.fromconcept-tocar.it). Fiat Group, General Motors Powertrain Europe, PSA Group, Magna Steyr and many universities in Italy and abroad are among its customers. Amet Group is located in Italy in Torino, Modena and Nardò and has direct international sites in the Slovak Republic, in Kosice and in Turkey, in Bursa. AMET has strong skills into the modelling and numerical simulation, design, rapid prototyping, testing and validation through hardware-in-the-loop techniques of automatic control logics, that can be applied for instance to energy management systems.

The company and hydrogen

The company could develop real time control systems and simulators suitable for managing and emulating different types of FC systems; it could be involved in automotive electronic control units integration with FC power generation systems; its strong modeling and numerical simulation skills allow it to contribute to the development of FC based new products and components.

CAPETTI ELETTRONICA S.r.l.

www.capetti.it

Designing and manufacturing of custom electronic equipments

The company founded in 1973 as a consultancy firm for the design of electronic equipments, has a prototyping laboratory and a production division, offers several services and works exclusively on behalf of third parties; it is particularly interested in projects and in their following productions. Capetti Elettronica customers are dynamic leader firms who work towards the world trade and who look for innovation and updating. In these firms the electronic equipment is a peculiar point of their products even though it is not the most significant. In this way they can concentrate their efforts on their own "core business" without minding the problems relating to the electronic part.

Indeed the company uses to work as an inner specialised division which offers a whole assistance for the electronic component.

The company and hydrogen

The company can develop and supply: electronic converters for light vehicles (i.e. scooters) propelled by FC; electronic converters for "high speed" electric drives in the gas feeding plant of FC systems for traction applications; monitoring systems based on the wireless sensors network technologies.

DMD S.r.l.

www.dmd.it

Development of standard products (SBC cards and industrial computers), custom products

Established in 1976, the company develops and produces standard products such as SBC cards and industrial computers, as well as customised products. DMD offers to OEM customers its own hardware and software expertise not only in products design and production, but also in their adherence with specific technical rules in automation, robotics, process control, testing and diagnosis in automotive field, infomobility, retail field, based on PC and Embedded platform. DMD offers to its customers competitive costs and "time to market", thanks to its production and engineering expertise, that grant conspicuous time and resources saving and the improvement of design, development and production skills.

The company and hydrogen

Development and manufacturing of: electronic control system dedicated to FC systems, DC/DC converter dedicated to PEM FC, integration of control system and electric powertrain; involved in a project aimed at manufacturing an electronic control system and a DC/DC converter for the FC system of hydrogen electric fueled scooters.

Components

ENERCONV S.r.l.

www.enerconv.it

Design and production of power electronics

The company, born from the initiative of a group of engineers with a long experience in the digital and power electronics field, operates in several areas: power electronics design (High efficiency DC-DC Converter and Inverter); digital electronics design; realisation of automation and control firmware; realisation of communication and management software; industrialisation and start-up production; components purchase and management for boards production; realisation of Automatic Test Equipments (ATE). In order to guarantee the state of the art in electronic design, the company invests in innovative technologies research. In particular equipment design profits by advanced technologies such as: simulation software for the analysis and the synthesis of electronic systems; control cards based on Texas Instruments Digital Signal Processor (DSP); design and validation systems for FPGA and CPLD; superficial mounting power components; low profile magnetic materials; use of new thermal dissipation systems (Heat-Pipe); remote management and control of the devices through communication lines; data management by dedicated database.

The company and hydrogen

Active in R&D programs devoted to FC generators for transport and stationary (cogeneration) applications; it can develop and supply electronic converters (both DC-DC and DC-AC converters) dedicated to the power conditioning of the energy produced by FC systems up to several tenth of Kw

MECCANICA BICCHI s.r.l.

www.meccanicabicchi.it

High precision mechanical manufacturing

The company, established in 1947, is involved in research, design and realisation of high precision mechanical manufacturing, including micron sized. Meccanica Bicchi, equipped with high performance machineries and with a measure room, produces its manufacturing on demand, nevertheless it is possible to list as principal products: honing tools, expanding sleeve mandrels, diaphragm mandrels and hydraulic expanding mandrels, insert-type mandrels.

The company works in partnership with the department of Mechanics of the Politecnico di Torino (DIMEC) as a supplier of rotating machineries on gas supports (designed by the DIMEC and manufactured by Meccanica Bicchi).

The company and hydrogen

Thanks to its great experience in compressing and gas storage, the company could be a manufacturer of piping components, valves and gas supports and respective rotors for compressors to be employed in mobile applications.

ROTFIL S.r.l.

www.rotfil.com

Cartridge heaters

Rotfil, established in 1977, is the leader of a high quality group that includes Rotfil s.r.l, Rotfil NA, Jeka, Termax, Infraker and Elmat. Rotfil, ISO 9001:2000 certified, is the No.1 manufacturer of cartridge heaters in Italy. It offers a wide range of electric heaters, temperature sensors and temperature controllers for industrial applications: mini-coil heaters, nozzle heaters, band heaters, heating cables, infrared heaters, custom heaters, flexible heaters, PTC heaters, air heaters, mica and ceramic heaters, cast-in heaters, drum heaters, finned heaters, immersion heaters, tubular heaters, high power density cartridge heaters, middle power density cartridge heaters, low power density cartridge heaters, etc.

The company has invested much on R&D to reach the excellence in its specific field, as a consequence it owns a wide number of patents. This is the result of the work done together with the customers in order to find the best solutions for each specific situation.

The company and hydrogen

Special materials setting up for high temperatures and corrosive atmospheres warming systems; manufacturing of micro coils resistances aimed at warming up high humidity grade technical gas.

Engineering services

ANTI S.r.l.

www.antisrl.it

Plastic materials manufacturing and presswork

Anti S.r.l., with a long experience in plastic materials manufacturing and presswork, produces a wide set of high and medium precision components moulds, ranging from 0.2 grams to 2 kilos. Its products are mainly used in automotive, but also in electronics and telecommunications. Anti has chemical and metrological laboratories, where car interiors plastic components and car light components are daily tested (carters, fans, safety belts' covers etc.). The company, ISO 9002 and ISO 14001 certified, supplies big companies such as Pininfarina, Magneti Marelli, Delphi etc.

The company and hydrogen

FC components manufacturing through thermoplastic polymers injection moulding with high level of charge (fibreglass, carbon); manufacturing of components dedicated moulds; experience in production of different percentage charge compound; funded knowledge in co-moulding (inclusion in thermoplastic components of metallic elements as: electric contacts, connection elements etc)

BLUE ENGINEERING S.r.l.

www.blue-group.it

Applied engineering for industrial design

Thanks to its specific skills in both numerical and computational analysis, Blue Engineering, born in 1993, is to be considered as an important player among consultancy companies for major industrial groups. The company is involved in the main transportation fields: automotive, railway, aerospace and shipbuilding. Multipurpose activities grant to the company a high level know-how and give it the opportunity to work with a solid and heterogeneous technological background. From the very start Blue Engineering considered internationalisation as a winning factor for its growth and development. The company, which operates linked together with customer wherever it is, has local offices in Italy (Torino and Napoli), France (Saint Etienne and Paris) and Jordan (Amman). Recently the company is investing in FC technologies.

The company and hydrogen

Involved in CAE simulation (especially structural and thermofluid dynamic simulations); ideal candidate in order to solve industrialisation problems connected to hydrogen vehicles power system.

BYTEST S.r.l.

www.bytest.it

Non-destructive test and control trial for metallic, and composite materials

The company deals with non-destructive tests and technological tests on metallic and composite materials. In addition, it offers different services in the same field: training for staff operating in non-destructive tests and special processes (welding etc.), control tests, consulting, audits and inspections. Thanks to its experience and technology, Bytest is a reference partner for non destructive tests and material tests in the aerospace field, for example it has performed non-destructive tests on sheets purchased by Alenia Spazio in order to realize hydrogen tanks for space applications - Delta II launcher. In 2005 Bytest dealt with hydrogen tanks control in the NASA Centre (Cape Canaveral-USA) in partnership with Alenia Spazio (Torino); currently it teams up with CERN (Geneva). It has carried-out radiographic inspections on "booster" for the projects Ariane IV & V.

The company and hydrogen

Non-destructive testing for certification of process (ex. welding) pertaining to: components manufacturing, hydrogen utilisation and storage systems, R&D in hydrogen supply and storage manufacturing system.

COMPUMAT S.r.l.

www.compumat.it

Design, modelling and optimisation of industrial processes and materials production in metallurgy

Compumat aims at refining the design of metallic alloys and related manufacturing processes. Its tools are calculus and simulation instruments (for thermodynamic, thermal treatments, materials process studies) and laboratory analysis. These software tools represent the state of the art in the computer simulation of thermodynamics, phase transformations, heat treatments and materials processes (heat and mass transfer phenomena, fluid flows phenomena). The company makes also use of experimental techniques of materials characterisation (for example microscopic technique of microstructure analysis) which are complementary to software design techniques. To this purpose, the company can access the equipments available of Metallurgy Laboratory and NIS (Nanostructured Interfaces and Surfaces Centre of Excellence of the Università di Torino).

The productive activities (consultancy services) can be envisaged along three main services: thermodynamic and kinetic simulation of materials and processes, Finite Elements Method (FEM) simulation of materials and processes, experimental measurements for materials characterisation (microscopy, X-ray diffraction, calorimetry).

The company and hydrogen

The company could be potentially involved in: evaporation and thermic control for FC feeding, design of gas distribution lines.

MECAPROM TCO ITALIA S.r.l.

www.mecaprom.com

Automotive engineering

Born in 1995, the company deals with engine and transmissions, supporting its customers with expert inputs. Mecaprom Italia is a high-grade company in auto-propellors and moto-propellors design, engineering, prototype forms manufacturing, process analysis and validation. Recently a new R&D area has been created in order to develop and improve technical skills on internal combustion engine and to spotlight new sources and low environmental impact energetic vectors.

The company and hydrogen

Thermo-fluid dynamic modelling of FC systems reagents and cooling system flow field; manufacturing of components and mechanical systems prototypes dedicated to automotive and applicable on hydrogen factory; FC systems and balance of plant optimisation; engineering processes and products oriented to prototype/ commercial product passage.

XYNERTECH

www.xynertech.it

Special plants, engineering, educational equipment

Xynertech, established on January 2002, is a point of reference for customers who need tailored-made machines or special plants, for production or research, not available in the market. Chemical engineering, automation, process control, fluidics, food technologies, ecology, environment and didactics are the fields of activity covered.

Xynertech operates in the development of basic engineering and cooperates with reliable partners in manufacturing products.

Also, the engineering department is equipped with the most advanced and sophisticated development instruments under a data system and performance point of view.

The company and hydrogen

Xynerctech can work in different areas of the H2 supply chain. Currently the company is involved in the designing and realisation of a training Alkaline Fuel Cell System device.

Final users

AZIMUT BENETTI S.p.A.

www.azimutyachts.com

Luxury motor yachts and motor cruisers

In 1969 Paolo Vitelli before taking his University degree started his own company in Turin, Italy. The business purpose was to charter sailing boats, therefore he transformed his passion into a luxury motor yachts business. Amerglass, a modern Dutch shipyard producing boats in fibreglass, conferred the first dealership contract in Italy on the newly founded power boat manufacturer Azimut. The business developed quickly, adding the distribution of sailing boats, motor cruisers and finally motor yachts from different makers: British Powles, Westerly, and others.In 1985 Paolo Vitelli acquired the other excellence company in the field, Benetti, shipyard established in 1873. The applied research program is one of the highpoints of Azimut production system.

The company and hydrogen

Model K, as the yacht test is called, offers the company an opportunity to try out different yacht design proposals, contributing to the introduction of innovative solutions that improve both performance and quality of life on board. This innovative approach to the boating industry has given a strong contribution to Azimut in becoming the leading luxury boat and mega yacht builder.

The company takes part to Celco Yacht, an applied research project based on the development of an FC system for the auxiliary power supply and propulsion of yachts (APU, auxiliary power unit, for mobile application). Other partners are: Environment Park-HySy Lab, Merloni Termo Sanitari, Arcotronics Fuel Cells, HySyTECH, IREM, Politecnico di Torino.

NAUTILUS S.p.A.

www.nautiluspace.com

Design and production of aerostats and airships for different applications

Nautilus is an innovative company that deals with the design and production of: systems based on radio-controlled airship; systems composed by aircraft, ground station, radio-link and support equipping; systems based on standard and self-stabilised aerostat; systems composed by tethered aerostat, ground station, radio-link and support equipping; CAE developing and design with components specifications, subsystems and complete systems, of new generation airships including testing. This products are sustained by Helium, inert and non-inflammable gas (neither fuel nor flame on board), so they are safe and environment compatible (propulsion provided by electric engines with ducted propellers and energy provided by rechargeable batteries). Nautilus offers a full-spectrum service for designing, developing and manufacturing of radio-controlled airship.

The company and hydrogen

Potentially user of hydrogen power systems for aerostats and airships; involved in a project aimed at developing an aerostat with an hydrogen fueled propellor.

SOWIND S.r.l.

www.sowind.it

Design and production of innovative systems for alternative energy use

Sowind develops and manufactures several renewable energies lighting plants that reduce traditional energy consumption: Jonathan (streetlamp), Oasis (energy station for remote areas far from public network) and Ballast (electronic lighting regulator). Both Jonathan and Oasis come from an integration between high technical know-how and a dressy aesthetic study aimed at understating the environmental impact. They use both Aeolian and Solar energy and have a sophisticated charge and discharge process control system for energy build up battery. It means 7-day autonomy even in unflattering weather conditions (neither sun nor wind). The electronic lighting regulator, Ballast, (that is going to be industrialised), will grant energy saving on traditional streetlamps. The product is coming from an ACEA (Roma) tip and it is confirming a high efficiency and an effective energy saving (owing to night planned modulation of streetlamps lightness).

The company and hydrogen

The company could be involved in the development of integrated systems for off-grid applications based on hydrogen/FC technologies; specific skills in development of electronics for Energy Management systems.

CENTRO ESTERO INTERNAZIONALIZZAZIONE
PIEMONTE *Agency for Investments, Export and Tourism*
Promoted by Regione Piemonte and Chambers of Commerce

Piemonte Agency for Investments, Export and Tourism is the first Italian agency dedicated to internationalisation, focusing chiefly on attracting foreign direct investment, increasing the presence of local companies and their competitiveness on international markets, and promoting the region's tourist offer and products worldwide.

Invest in Torino PIEMONTE

Piemonte Agency is the unique, free reference point for companies wishing to locate in Piemonte.

The inward investment team can advise you on every aspect of starting and running a business in Piemonte, providing assistance at every stage of the project. The team also supports foreign companies which have already invested in Piemonte, in order to facilitate operations and development in the region.

How we can help

- **assessment and information phase**
  - *specific economic and market data*
  - *legal / labour / tax*
  - *incentives, grants, fiscal bonuses*
  - *economic and industrial climate, competencies, know-how and key sectors*
  - *skilled workforce, specialist training programmes*
  - *real estate*
- **start-up and assistance**
  - *advice on how to set up a legal entity in Italy*
  - *site selection for production, services and R&D activities*
  - *selection of grants and incentives for investment, R&D, training*
  - *introduction to local and regional institutions, science and technology parks, R&D networks, innovation hubs*
  - *links to universities and centres of excellence*
  - *pre-feasibility studies*
  - *Regional Investment Contract*

Our services are free, responsive, tailored to your needs and totally confidential. We can provide assistance at every stage of your project.

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CAMERA DI COMMERCIO
INDUSTRIA ARTIGIANATO E AGRICOLTURA
DI TORINO

The Torino Chamber of Commerce is a public institution with autonomous statute, regulations, management and accountability, and relies on a flexible, innovation and efficiency-based structure.

The mission of the Chamber is to foster the growth of the local economy and enhance it through effective and targeted initiatives, speaking on behalf of nearly 200,000 companies working in the Province and registered with the Torino Chamber of Commerce with the relevant authorities.
The Torino Chamber of Commerce has support and promotion competencies for the general interests of the companies under its territorial jurisdiction.

The promotional activities are focused on local economic development: services for the production system, for the market, sharing of infrastructure companies, grants, etc.

They aim to promote and stimulate the local entrepreneurial system through:

- *training*
- *access to financing*
- *access to technological innovation*
- *information and consultancy for companies involved in foreign trade*
- *help desks*

ALPS Enterprise Europe Network

The ALPS consortium, part of the Enterprise Europe Network, provides information on EU legislation and on funding opportunities and encourages transnational technological and commercial cooperation.

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Realised within the frame of the INNOV 7 project HYTETRA
(Hydrogen Technologies Transfer Project)

Inside Out