

HYLIGHTS Workshop –16th May, Berlin

Strategies for Successful Hydrogen Implementation in Transportation Sector

Piemonte and Lombardia Initiative on Hydrogen for Sustainable Energy and Mobility

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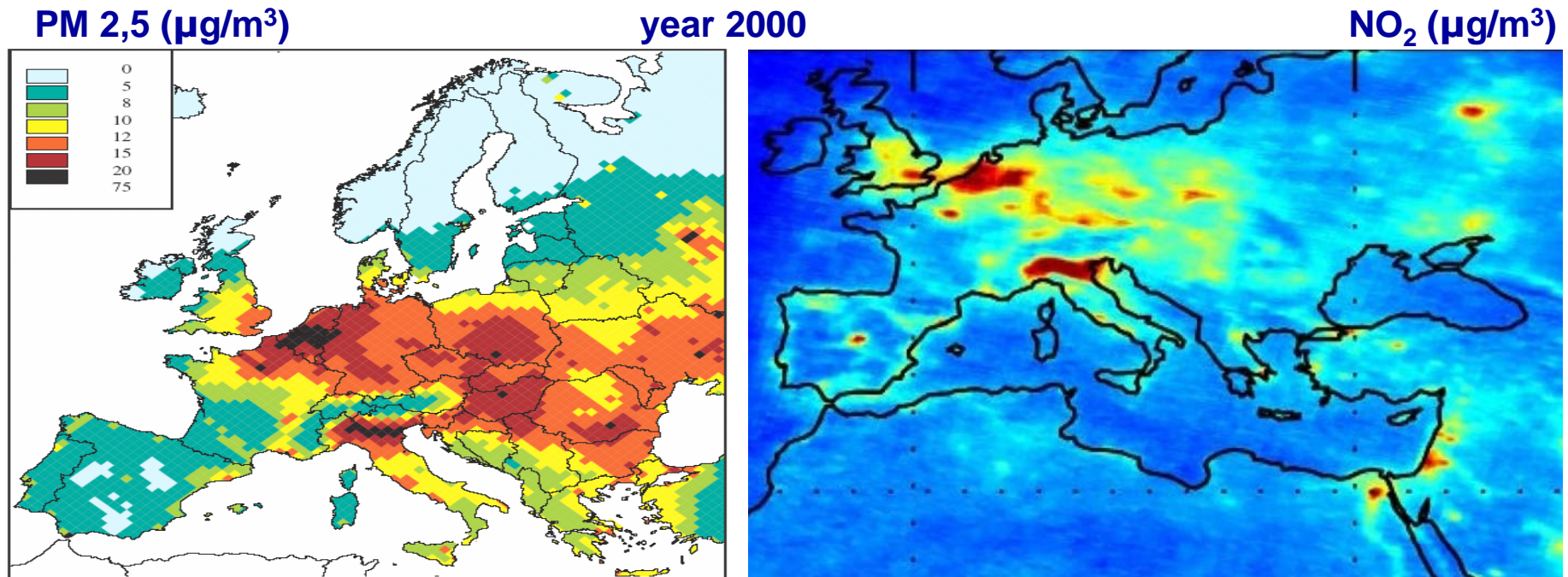
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Environment is the Key Issue

Italian Regions located along Po Valley suffer critical environmental conditions. Negative effects due to the high concentration of industries, population density and intensive mobility are accentuated by unique orography and weather conditions (fog, thermal inversion, air circulation limited by Alps and Apennines,..).



Source: Clean Air for Europe (CAFE) programme by IIASA

A Common Sustainable Mobility and Energy Strategy



Piemonte and Lombardia
(13 million residents, 9.3 million vehicles, 29% of Italian GDP)
on March 20, 2007 signed a strategic agreement on a common RTD effort for the deployment of H₂ and FC Technologies, in line with FP7 (HFC JTI) programs on sustainable Energy and Mobility (REGIO-ISEM).

Agreement is open to other Italian Regions, and to countries located along the 5th corridor in the Mediterranean area, willing to share RTD programs and infrastructures for the achievement of a common Energy & Mobility strategy with an effective critical mass in the ERA context.

H₂ in Italian Regions

Background-1

In early 2000s, **Piemonte and Lombardia** set up structured RTD programs on Hydrogen and FC, that include basic research, technology development and demonstration, involving Research Centers, Academia, large, medium and small Enterprises. In addition to the creation of competences, laboratories and new infrastructures, Regions are promoting new business opportunities by involving local Industries and Start-up Companies in the application of advanced Hydrogen technologies to Mobility and Power Generation fields.

Regions are also implementing support policies to RES development (particularly Biomass and Solar) and to the rational & efficient use of energy.

H2 in Italian Regions

Background-2

Other Italian Regions are also promoting the Research and Deployment of Hydrogen Technologies on their territory:

✓ **Regione Abruzzo.** This Region is coordinating a joint proposal of Regions to the Italian Environment and Transport Ministries for setting up and demonstration of a Multifuel Infrastructure for NG (and Biogas), Hydrogen and blending thereof. A cost-effective hydrogen infrastructure will supply NG vehicles – widely available in Italy - properly adapted to operate with HCNG blending up to 30% of Hydrogen. Piemonte, Lombardia, Toscana and Veneto are partners of this program together with industries (FIAT, ENI, ENEL, SAPIO) and Small and medium companies.

✓ **Regione Toscana** focuses R&D efforts on Hydrogen and FC applied to Mobility (Piaggio) and Residential applications. One specific program is devoted to aftermarket adaptation of CNG vehicles to HCNG blending. A public open Hydrogen refueling station is in operation near Livorno; Hydrogen is partially produced on site, from renewable sources. Local Medium and Small Industries are active in the development of Hydrogen components and systems (Electroliser, H-CNG blenders).

H2 in Italian Regions

Background-3

- ✓ **Regione Veneto** launched Research and Demonstration projects on the use of waste Hydrogen produced by chemical plants located in Mestre. Other projects include production of Hydrogen from “clean coal” processes (ENEL), use of HCNG blending in public transportation, and demonstration of FC Vaporetto in Venezia (Public Transport Boat).
- ✓ **Regione Lazio** is focusing on Hydrogen and Power cogeneration from coal (Civitavecchia). Local industry is involved in development of FC Minibus for public transportation and small FC generators for various application in niche and early markets (Valmontone demonstration site).

One specific objective of the **Program REGIO-ISEM**, promoted by Piemonte and Lombardia, is to **leverage synergies within Italian Regions** willing to share competences, resources and infrastructures **to reach the critical mass** on the same priority tasks; European Regions of the Mediterranean area are also invited to join.

Lombardia Background



ZERO REGIO

Lombardia & Rhein-Main towards Zero Emission:
Development and Demonstration of Infrastructure
Systems for Hydrogen as an Alternative Motor Fuel

Project start: Nov. 15. 2004
Project duration: 5 years
Demonstration sites: Rhein-Main, Germany & Lombardia, Italy

www.zeroregio.com



Regione Lombardia

Bicocca Project

The aim of the project is to set up a structure for testing and demonstration of H₂ technologies.

NG reformer (H₂ 1000 m³/h)

500 kW MCFC (with microturbine)

10 kW PEFC

Liquid and gaseous H₂ refuelling station

Fleet of H₂ cars (combustion engine)

Partners: Environment Ministry, Regione Lombardia, Instruction and Research Ministry, Comune di Milano, AEM s.p.a., Zincar s.r.l., SOL s.p.a., BMW italia, Ansaldo, ENEA, Università di Genova, Politecnico di Milano.

The EU- Zero Regio Program FC Vehicles fleet demonstration

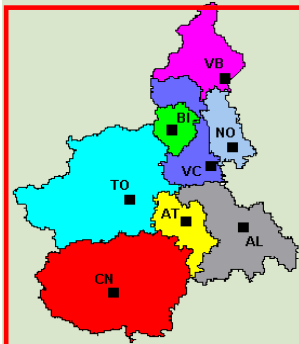
Project Goal

- Set up and test the Hydrogen chain for Transportation, from production to distribution
- Verify User Acceptance of Fuel Cell Vehicles, and functionality of related infrastructure and services
- Assess safety, cost issues, socio-economic and environmental impact

CONSORTIUM

Regione Lombardia	Rhein Main
Centro Ricerche Fiat	Daimler Chrysler
Eni Technology	Fraport AG
City of Mantova	Agip Deutschland GmbH
Sapio	Infraserv GmbH & Co.
JRC, Ispra	Hoechst KG
IEFE, Bocconi University	Linde AG
Lund University	Saviko Consultants
Roskilde University	TÜV Hessen GmbH

Piemonte Background



Sistema Piemonte Idrogeno

SPH₂

Goals of SPH2 are:

- Support and direct research in hydrogen technologies;
- Promote the professional growth of technical and management personnel in universities, laboratories, and in businesses;
- Promote hydrogen as a clean carrier alternative to fossil fuels
- Support the development of regional infrastructures using hydrogen;
- Promote the transfer of technology from laboratories to business and industries;
- Sustain the pre-competitive phases of technologies enabling hydrogen production from renewable sources.

PIEMONTE GOES HYDROGEN

Piemonte is the North-West Italian Region, with 4.3 million inhabitants and a gross domestic product of over 100 billion Euro (8.7% of Italian GDP), leading HighTech developments in Automotive, Aerospace and ICT fields.

A growing investment in research and development has reached 1.7% of Regional GDP toward the achievement of Lisbon and Gothenburg targets. This effort is remarked by 100 research and development laboratories, a system of Science Parks linked with the industrial districts and three universities.

Over 50 Micro, Small, Medium and Large Enterprises are employing skilled resources for the development of Renewable Energy, Hydrogen and Fuel Cell technologies, needed by the future sustainable Economy. Main applications in progress are in the field of Hydrogen production and distribution, micro and mini power generation, transportation, portable appliances.

More than 350 engineers and researchers, from Universities, Research Centres and Industries, are cooperating on RTD and Educational programs promoted by Regione Piemonte.

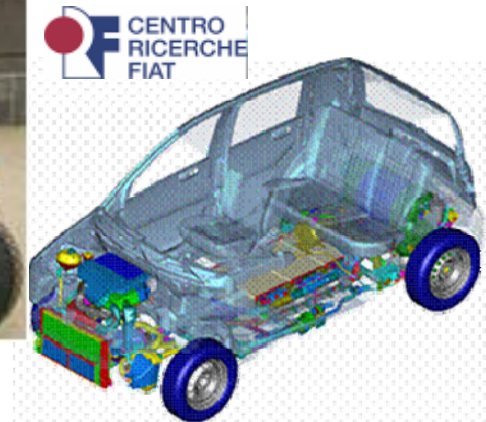
A cooperative multi-Regions Lighthouse Program, including open large demonstration sites, is promoted by Piemonte, to support, in alignment with EU FP7, the operational assessment of Renewable and Hydrogen Technologies in a joint effort to accelerate their market introduction.

For additional information contact:
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Regione Lombardia

SPH₂ Programs for Mobility and Power generation



EU funded projects:



Fiat Panda Cell Hydrogen

SPH₂ for stationary & portable powerGen



EU funded projects:

FlameSOFC



PEMTOOL

electro
power systems



Next step - Hydrogen for Energy and Mobility

Regions integrated approach

- Milano, March 20, 2007. Piemonte and Lombardia Presidents sign a Strategic Cooperation Agreement for a joint effort on RTD programs for the deployment of H2 technologies.
- The goal is to share resources, competences and infrastructures to achieve the critical mass required to accelerate the market commercialization of products and services based on Hydrogen technologies.
- The joint Program will focus on Hydrogen production (from RES included) and applications in support to the Regions Sustainable Energy and Mobility strategy (**REGIO-ISEM**).
- Alignment with EU FP7 and ERA partners has been anticipated.



From right to left. President Bresso of Piemonte and President Formigoni of Lombardia sign the strategic agreement in presence of EU Commissioner Potočnik and of Italian Minister of Infrastructure Di Pietro.

NEXT STEP: REGIO-ISEM

Italian Regions Lombardia and Piemonte are promoting Regional Initiative on Sustainable Energy and Mobility (REGIO-ISEM) with the participation of Academia, Local Industries and Research Centres. Activities include:

- **Basic research** on relevant energy and environment friendly technologies, including Hydrogen production from RES
- Development of **H2 and FC technologies for Transport and Power generation**
- **Technology transfer** actions aiming to enlarge the participation of SMEs in the business of H2 and FC technologies;
- **Demonstration** of promising technologies, products and infrastructures on large integrated areas open to the public;
- **Cooperative programs** with other EU Regions and Municipalities to share research results, to assess best practices, to perform joint demonstration programmes with a specific focus on the Mediterranean context.
- **Multi-stakeholder Observatory** to monitor program alignment with EU FP7, assess socio-economic environment and energy security impact of technologies under demonstration, advice on funding leverage to support SME and spin-offs, promote education and outreach programs, facilitate collaboration with other National and international Regions.

The Program REGIO-ISEM

The Joint Regional Initiative on Sustainable Energy and Mobility (REGIO-ISEM), call the local Automotive and Energy Industry, the Academia and Research Centres to cooperate in setting up a Lighthouse Program to demonstrate the achievement and opportunities of the Hydrogen and Fuel Cells applications.

ISEM GOALS - 2015

- ❖ Electricity from renewable sources, to cover 25% of Regions needs.
- ❖ Fuel diversification. In 2015 10% of new vehicles to adopt biofuel, biogas, CNG, H2 and H2-NG mixtures.
- ❖ Hydrogen from renewable sources, to cover 50% of Hydrogen use in power generation and transport applications.

ISEM ACTIVITIES

- Deploy and demonstrate Biofuel, Hydrogen and Fuel Cell technologies in Power Generation and Transport.
- Verify functionality and User Acceptance of Fuel Cell Vehicles and hydrogen related infrastructure and services.
- Assess safety, cost issues and environmental impact of alternative fuel technologies: from production to application.

Key ISEM Projects on Renewable Energy and Hydrogen

H₂ Production from RES

- Processes, Systems and components for efficient and cost effective hydrogen production from Biofuels (2nd generation), Mini Hydropower, Solar (thermal, HT and PV).

Infrastructures for Transportation

- Multifuel Stations including Biogas, NG and Hydrogen and their blending. NG flex-fuel vehicles fully compatible with hydrogen blending will support the growth of a cost effective Hydrogen infrastructure.
- Pipelines collecting Hydrogen from centralized production sites and waste Hydrogen from chemical industries located along Po Valley (Pipeline project: Torino to Mestre).

FC Vehicles

- Improved low cost technologies for FC powertrains (including advanced storage technologies) to meet targets of HFP Implementation Plan.

Stationary Power Generation

- Low cost, HT Fuel Cells (MCFC and SOFC) for stationary applications. PEMFC systems for residential, back-up and early markets products.

Demonstration Sites

Selected demonstration areas, located in Piemonte and Lombardia, are connected by highway (To-MI) and High Speed Train; Hydrogen infrastructures are in progress.

Infrastructures will support the demonstration of a variety of Hydrogen and Fuel Cell technologies, in private and public transportation, in buildings, offices, hotels, service centers, shopping areas...

Sites providing infrastructures and services, preliminarily identified are:

- **Torino - Mirafiori and Envipark.** Infrastructures and demonstrations will be extended in a 2nd phase to Cesana, Novara, Asti, Alessandria, Cuneo, Ivrea.
- **Milano - Bicocca and Mantova.** Extension to S. Donato, Brescia, Bocconi University location of the Hydrogen and Fuel Cells Business Observatory.
- **Highway connecting Torino-Milano,** with possible extension along the Transnational Corridor 5.
- **Hydrogen Pipeline infrastructure,** connecting Industries producing carbon lean and waste hydrogen along Po Valley.

All sites, services and infrastructures will be available to Regions joining the REGIO-ISEM Program. Informations will be shared among all partners through specific workshop and meetings; I.P. of members will be fully recognized and protected.

Structure and Management of ISEM

Timing and costs

The Regional Initiative on Sustainable Energy and Mobility (REGIO-ISEM), is open to cooperation with other Italian and Mediterranean Regions that share common interest and vision on Energy and Mobility aspects.

Trough proper alignment of programs and timing, **REGIO-ISEM intend to effectively contribute to the EU RTD-FP7 on Energy and Transport** and to the foreseen EU Hydrogen and Fuel Cells **Joint Technology Initiative** now under definition.

The Program Management structure will adopt the **reference model foreseen for EU JTI**. Two bodies/legal entities: Industry Grouping and Public Administration Grouping, equally sharing costs, will set up a Managing Board and a Program Office to manage and implement the Program.

Piemonte and Lombardia are constituting the “Strategic Board” (Cabina di Regia) that will preliminarily agree on the specific ISEM Implementation Plan, priorities and costs.

Based on preliminary evaluation, Piemonte e Lombardia Regions with other Regions could provide funds to support REGIO-ISEM Program up to 70-100 M€/year.

Timing of REGIO-ISEM will be aligned with the EUFP7 program (2008-2013).

Lessons learned and main Bottlenecks of Hydrogen Technologies Demonstration Programs-1

POLICIES

- Funding of hydrogen demonstrations programs is not easy for both, Public Administration and Industry, especially when multiple prototypes or small pre-production series are involved. Business plans do not help, if market demand is absent. **Funding schemes must be integrated in a road map** of coordinated actions agreed between Industry and Public authorities: **supported procurement pooling** - to create the market -, **incentives and/or perceived benefits** to buyers (mainly public or private fleet owners), **energy/environment credits** for both manufacturers and buyers,– and a clear **long term RCS policy**.
- **State Aid restrictions** limit funding, especially on industrial research, for prototypes and experimental development, i.e. demonstrations; this **could limit the interest of industry** in long term RTD programs if market-like solutions are not foreseen.

Lessons learned and main Bottlenecks of Hydrogen Technologies Demonstration Programs-2

OTHER ISSUES

- **Funding policies** for strategic projects of common European interest should be automatically **aligned for EU, MS and Regions**, avoiding additional bureaucracy, This would also effectively contribute to the alignment of MS and EU RTD programs on strategic priorities.
- The rules on **Intellectual Property** (I.P.) defined in **EU projects** should be **improved** at the level required **to become standard** also for National and Regional Projects. This would reinforce the ERA approach, making easier multinational cooperation.
- **Insurance and Liability** issues, associated to the use of advanced technologies in **prototypes demonstration** programs, **demand for a specific approach**. FOT programs, foreseen in FP7 for many ICT and safety technologies, emphasize this aspect. Today additional costs to properly train users, to provide continuous monitoring for systems and user behaviour is relevant and may limit demonstration sites open to public.

Lessons learned and main Bottlenecks of Hydrogen Technologies Demonstration Programs-3

OTHER ISSUES

- **Private customers cannot be fully involved** in early stages due to high cost of the technologies, use restrictions and potential risks. Perception of advantages offered by new products should be promoted through **assisted testing sessions**, incorporated in the Demonstration program (user awareness and acceptance tests).
- **Certification/Homologation of Hydrogen products is yet a lengthy and difficult process** in many Countries. EU should accelerate the European regulatory process, providing specific procedure support (temporary waivers) by promoting best practices.
- Large demonstration programs. If the **Public-Private-Partnership model** under definition **by EU** for JTIs could also be **applicable to National and Regional Partnerships**, this would reduce costs and need to duplicate lengthy verifications and risks associated to legal issues (members responsibility, conflict of interests...).