



Technico-economical Expertise to serve the industrial development of hydrogen energy

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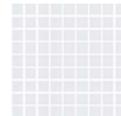
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**European Network
and Center of Expertise on Hydrogen and its Applications**

Why to use hydrogen ?



The world energy context is changing deeply.
Hydrogen as an energy carrier is one of the best answers.

- ▶ HYDROGEN is a clean and universal energy carrier. It can be produced anywhere and used in transport, stationary applications, portable applications, ...
- ▶ HYDROGEN shows high efficiency in the storage of renewables (wind, photovoltaic, ...).
- ▶ The FUEL CELL is an energy converter : hydrogen and air react to produce electricity, heat and water without any other emission. It's an energy-efficient technology.



Context



French energy policy does not consider hydrogen as a priority.

A few industrial developments :

=> SME's can not afford them

=> Industrial groups are not interested (small markets)

Many structures / associations / local initiatives

Numerous Research centers and laboratories

Thematic displayed in the **strategy of the Competitiveness Clusters**

Growing awareness of the need to realize demonstration projects oriented **APPLICATIONS** to guide the industrial, R&D and academic research choices

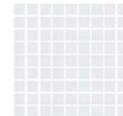
Creation of a national platform bringing together all the French players (HyPaC)

=> To develop a roadmap for the deployment of hydrogen and its applications



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Current situation



The hydrogen energy market does not exist
The industrial path does not exist

But hydrogen energy is an opportunity

To solve the Energy – Environnement problem



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ALPHEA in some figures



15 years experience

7 person team

An unique Documentary Data Base in France

More than 30 members network

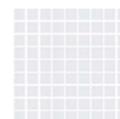
Nearly 40 studies realized in the hydrogen and fuel cell field

Active member in the main actors networks involved in the thematic (Afnor, HyPaC, AFH2, FCDIC, Tenerrdis, Materalia, ...)



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Short history

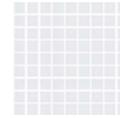


- Seventies:** Interest of the Lorraine region for hydrogen
Production possibilities (Cattenom nuclear power plant)
Support to the local industry (chemistry, steel)
=> New industrial path
- 1986:** Creation of the « Association Lorraine pour la Promotion de l'Hydrogène Et de ses Applications » (A.L.P.H.E.A.) – Lorraine Association for the promotion of Hydrogen and its Applications
- 1996:** ALPHEA Center of Expertise on Hydrogen
- 2005:** ALPHEA HYDROGENE, European Network and Center of Expertise on Hydrogen and its applications



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The ALPHEA HYDROGENE Network



The members :

- french and international Industrial Groups
- Small and Medium-sized Enterprises
- Instituts and Research Laboratories
- Local communities
- Colleges of Engineering / Universities



Industrial Groups



SME



Instituts and Research Laboratories



Local Communities



Colleges of Engineering / Universities

VISION



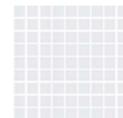
ALPHEA's technico-economic expertise has to support and promote the Hydrogen path development by:

- **Presenting an innovative and efficient technology:**
 - Demonstrate the technico-economic technology feasibility
 - Identify near term hydrogen applications
 - Contribute to the development of viable applications
- **Mobilizing industrial and public authorities:**
 - Knowledge of the actors and analysis of their development strategies
 - Mobilize the national and regional industries as well as the public authorities on R&D works
- **Contributing to the development of a French hydrogen strategy**
- **Contributing to the emergence of an industrial path on targeted applications in France via DEMONSTRATORS**



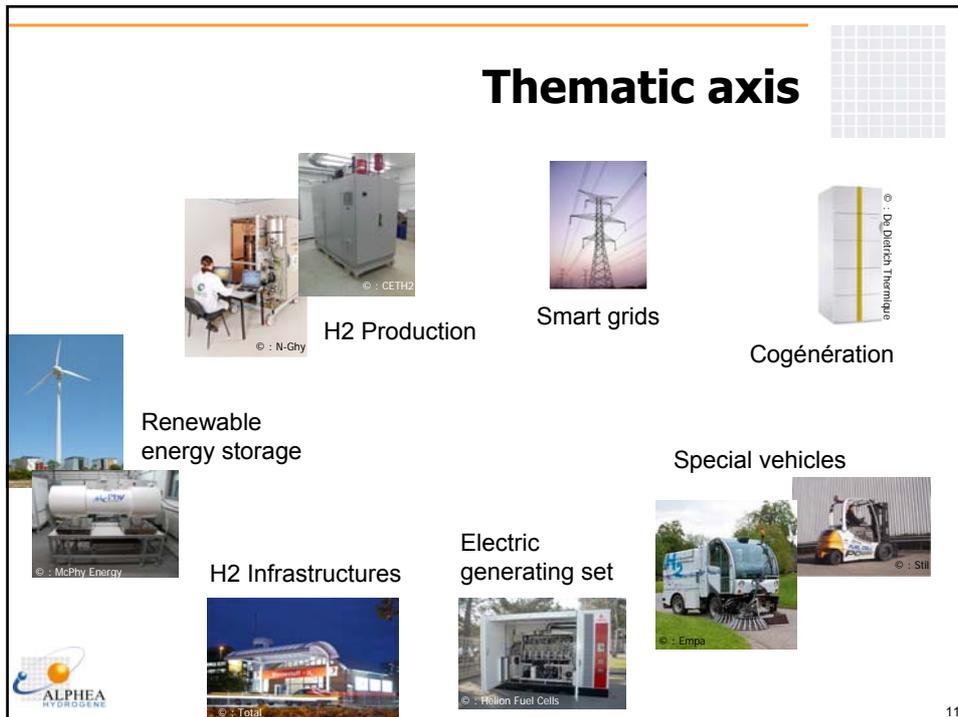
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ALPHEA HYDROGENE,
TECHNICO-ECONOMICAL EXPERT
covering all thematics related to hydrogen



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Thematic axis

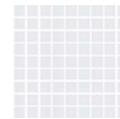


Services

Technico-economic survey

- **Sorting, analysis and publication** of scientific, technical, economical and regulation worldwide news/informations
- **Management of a specialized documentary data base** accessible via ALPHEA's website
- A list of survey topics is established **yearly in consultation with the members**
- **Publication of the survey results** in periodical or specific documents
- Published documents **are written in english or are containing an « executive summary » in english**

Technico-economical survey



Management of a documentary data base

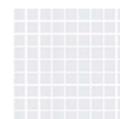
- **Unique in France**, specialized in hydrogen energy and its applications
- **Online database, daily updated, accessible via our website** for the members (nearly 6000 references)
- **All documents acquired and published by ALPHEA** within 15 years *and especially*:
 - Acquired documents: proceedings, studies, books, periodical, data bases,...
 - Participation to the works of organisms and networks (Afnor, VDI, FCDIC, DWV, AFH2, ...)
 - Technical visits, reports, ...
- Any specific question from our members are processed **in priority by our documentalist or engineers**



Available on our website

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Technico-economical survey



General survey

- **Gazette**: monthly publication containing political, technical, economical and strategic news on hydrogen and fuel cells
- **Calendrier des Evénements**: monthly inventory of the worldwide major events in the hydrogen and fuel cells field
- **Hydrogène Biblio**: periodical publication presenting by topics ALPHEA's recent documentary acquisitions
- **Hydrogène Infos**: synthesis and analysis of current news and studies concerning the hydrogen and fuel industrial development + grouping of all above publications
- **Reports of conferences, seminars, workshops**



Available on our website

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Technico-economical survey



Specific survey

The specific survey topics are defined by ALPHEA's members. The results of these surveys are published in specific documents.

2010 specific survey topics:

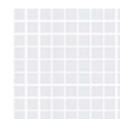
- **Low temperature electrolyzers** (alcalin versus PEM): technologies, performances, costs
- **High temperature electrolyzers:** technologies, performances, costs
- **Solid storage of hydrogen:** technologies, performances, costs



[List of all survey subjects available on our website](#)

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Services



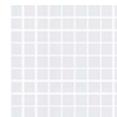
Studies and expertises

- **Nearly 40 studies realized** in the hydrogen / fuel cell field
- **A list of topics established yearly** in consultation with the members
- **Specifications are defined for each study** in consultation with the members
- **Each engineer is specialized** in one or several thematics
- **Studies published in french including an « executive summary » in english**



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Positioning study



FILOSOFIE study (2008)

Positioning study for industrial deployment of the SOFC industry in France

- Technico-economic state of the art of the SOFC path
- Specification of the applications
- Promising research programs
- Path recommendation in France

ALPHEA's contribution: state of the art and economic assessment of SOFC technologies

Partners of the study: CEA – EIFER- Gaz de France – HELION – De Dietrich Thermique – Centrale Recherche – ICMCB/CNRS – IFP – INPG/LEPMI – RECUPYL – SNECMA – Saint-Gobain CREE – UGINE & ALZ

Financial organization: ADEME

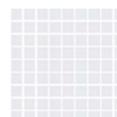
Duration: March 2008 – May 2009



[Available on our website](#)

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Technical study



State of the art of low temperature electrolyzers – coupling with renewable energies (RE) – 2009

Plan and content of the study :

- Features, performance and costs of alkaline and PEM commercial electrolyzers
- Problematic of coupling electrolyzers and renewable energies
- State of the art of worldwide renewable energies / hydrogen projects
- Technical and economic study of hydrogen production in an independent renewable energies / hydrogen configuration

PEPITE project subcontracting work (Projet d'Etude et d'expérimentation de Puissance pour la gestion des énergies Intermittentes par les Technologies Electrochimiques)

Aim of the project : Demonstrate the feasibility of a « renewable hydrogen hybrid electrification » as a solution for the management of intermittent renewable energies for :

- applications on a technical isolated site < 50 kW
- applications on an isolated micro network site < 100 kW
- current pics smoothing by injection of the produced electricity in a island network

Partners of the project : CEA – Helion – Laplace – ARMINES – Université de Corse



[Complete list of our studies available on our website](#)

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Studies related to economic development



Hydrogen and fuel cell Investments and expenditures in France Comparison with leader countries (ALPHEA, ADEME) - 2006

Development of an industrial and economical path toward hydrogen and fuel technologies

- Identification of know-how and skills required for the path development
- Identification of available skills and know-how in Lorraine Region
- Animation of the local identified players network
- Identification of collaboration and development possibilities

Partners: ALPHEA, DRIRE Lorraine (financer), FIBM (financer), Région Lorraine (financer)

Duration: october 2005 – décembre 2007

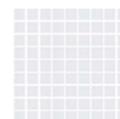
Publication: « Livre Blanc »



Available on our website

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Study related to economic development



Feasibility study of hydrogen production from renewables for local use – 2006

Applicant: Communauté d'Agglomération de Forbach Porte de France

Goal: proposing a demonstration project

Plan and contents of the study:

- Inventory and analyzes of the main projects dealing with the use of hydrogen produced from renewable energies (wind, solar, biomass...)
- State of the art of the main systems / material used currently
- Context and regulation constraints
- Energy, environmental and economic evaluation
- Development of a technical and financial proposal for a demonstration project locally feasible

Study carried out in partnership with EIDEN

Financing: Communauté d'Agglomération de Forbach Porte de France, ADEME and AREL

Duration: 6 month

Beginning: January 2006



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Communication and heightening public awareness



Communications and targeted awareness actions are organized on **a regional and a national level** to present the issues and the potential of the hydrogen path :

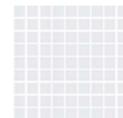
- Organization of conferences / thematic days / manifestations
- Targeted communications to the actors networks
- Communications to the public authorities representatives
- Communications in important national and international manifestations



All the presentations are available on our website

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Communication and heightening public awareness



Examples of organized manifestations:

- ▶ **2nd ALPHEA Network Day – 2010**
- ▶ **Renewable Energy Exhibition 2010**, organization of a half-day conference on the theme « Hydrogène, renewable energy carrier » – 2010
- ▶ **1st ALPHEA Network Day – 2009**
- ▶ **« Hydrogen path: stakes and perspectives – witch opportunities for East-Mosel companies? » workshop**, jointly organized by Communauté d'Agglomération Sarreguemines Confluences, AGEME and ALPHEA – 2007
- ▶ **« Sustainable Energy and Hydrogen Technologies » workshop**, jointly organized by AFH2 and ALPHEA – 2007
- ▶ **ALPHEA HYDROGENE Forum – 2005**



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Services



Employment, Training period and Thesis Exchange

Objective:

To give professional opportunities in hydrogen energy and related technologies to students and job seekers

To facilitate the connection between applicants and H2/FC key players.

Target:

- Students of Engineering Colleges and Universities member of our Network
- Job seekers with a 1st experience
- Researcher looking for a job in the hydrogen and fuel cell field

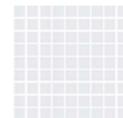
- Opportunities are collected through our members and contacts
- Applications are published on our website



Available on our website

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A « DEMONSTRATORS » strategy of hydrogen path development based on 3 levels ...



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« DEMONSTRATORS » strategy



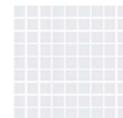
Process:

- Identification of emergent markets and niche markets
- Development of a roadmap for each application
- Study of technico-economic viability conditions
 - => Support of our survey/studies activities
 - => Demonstrators realization
 - => Research orientation
- Search of industrial and academic partners
- Industrial starting



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The ALPHEA Hydrogene Network



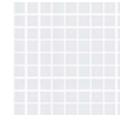
Bring together and connect all stakeholders interested by Hydrogen / Fuel cell technology:

- **Management of « Community of Practice »**: discussion space about studies topics only accessible to the members of the community
- **Development of research and demonstration projects** with the support of ALPHEA's survey and studies
- **Organization of « Network Days »**: with predefined themes to enable stakeholders establish contact and better knowing each other



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Involvement at National level



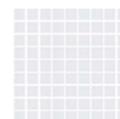
ALPHEA is an active member of the HyPaC Platform (*french hydrogen and fuel cell platform*). Composed of 70 members, its aim is to accelerate the industrial development of the hydrogen and the fuel cells technologies:

- Involvement in the **national roadmap** for hydrogen path development
- **Animation of French National Groups « Réglementat'Hy'on » and « Rég'Hy'on »**
- **Co-animation of the French Hydrogen and Fuel Cell Observatory** in collaboration with AFH2 and ADEME (www.observh2.org)



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French Hydrogen and Fuel Cells Observatory (Observatoire français de l'hydrogène et des piles à combustible)



Aim: gather and diffuse all worldwide available informations on hydrogen and fuel cells

Object:

- « **La Gazette de l'Hydrogène** » : monthly publication showing developments, realizations and projects in France and worldwide as well as books publications, upcoming events and an analysis on a specific item of the news
- **Thematics and synthetics documents** on hydrogen and its applications
- **Directory** on french actors, projects, commercial products
- An **annual report** on french activities

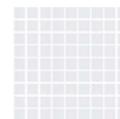
Partners: ADEME – AFH2 – ALPHEA Hydrogène

Website: www.observ-h2.fr

Common website for Observatory and HyPaC Platform



Involvement at Regional level



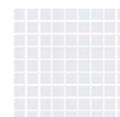
Creation of a **Hydrogen Group in the Lorraine Region** whose aim is to develop a hydrogen path roadmap for the Region:

- Sensibilization and mobilization of industrialists, academics and public authorities
- Identification and development of projects and deployment of applications
- Connection with other Regions (« big East of France »)
- Cross-border cooperation



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Projects



Development of new projects

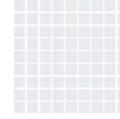
Coordination of projects

Participation in projects



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Development of new projects



« Fuel cell as back up / UPS system » Project

- Fuel cell demonstration in real conditions for backup power applications in hospital
- Implied actors: Hélion, 3M, France Telecom, Air Liquide, ALPHEA

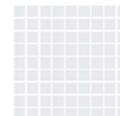
Other tracks explored

- SOFC fuel cell for electricity and heat cogeneration (reflections underway with ENIM)
- Fuel cell for special vehicles (forklifts, servitude urban vehicles, ...), in cooperation with Inéva



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Project coordination realized



“VELIN” PROJECT

Technical and economical survey on worldwide fuel cell activities for the french hydrogen and fuel cell community

Partners: ALPHEA, ADEME (financer)

Duration: since 2001 (2001-2005 for the French fuel cell network (Réseau PACo) – since 2005 for the community with extension to hydrogen since 2006

“PACBI” PROJECT

Urban demonstration project of an interactive parking terminal integrating a small fuel cell

Partners: ALPHEA (coordinator), RENAULT, CREED, LCMTR, PSA, INERIS, LRCS, CEA, LMI, ANR (financer)

Duration: December 2005 – November 2007

ALPHEA's contribution: State of the art of hydrogen storage systems : stationary and mobile applications

“HYDROGEN STORAGE IN CARBON MATERIALS” PROJECT

ALPHEA managed a research project on hydrogen storage in nanostructured carbon materials (carbon nanotubes, carbon aerogels, carbon black)

Partners: ALPHEA (coordinator), ARMINES, CNRS IMP Odeillo, GDPC Montpellier, LCSM Nancy, DALKIA

Duration: January 2002 - December 2004

ALPHEA's work: State of the art of hydrogen storage systems (stationary and mobile applications).



Complete list of our projects available on our website

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Technical Expertise in projects realized / ongoing



« **HYFRANCE 3** » PROJECT: Economic competitiveness of hydrogen energy: industrial hydrogen - hydrogen, wind and electricity network - Development of infrastructure: transportation and storage of hydrogen

« **AIDHY** » PROJECT: Decision-making aid for the identification and the accompaniment of the societal transformations induced by the hydrogen new technologies

« **ALHAMO** » PROJECT: New materials development for hydrogen storage (alanates and nitrides)

« **GENHSTOK 2** » PROJECT: Development of pure hydrogen remote polyfuel production units including CCS (Carbon Capture and Storage). Mainly targeted are future hydrogen refuelling stations

« **BAHIA** » PROJECT: Conception and development of a 1 kW fuel cell test bench for educational purposes. To be operated by students, this test bench will allow them to get familiar with the new technologies specifics of energy production.

« **HYFRANCE 2** » PROJECT: Improvement of the hydrogen energy French roadmap (french contribution to the HYWAYS project): validation of French energetic paths worked out during 1st phase of HYWAYS

« **HYFRANCE 1** » PROJECT: French hydrogen energy roadmap working out (French contribution to the HYWAYS European project)

« **EPACOP** » PROJECT: Field Tests of 5 PEMFC residential fuel cells

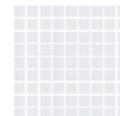
« **SEREPAC** » PROJECT: Fuel Cell systems regulations, codes and standards



[Complete list of our project available on our website](#)

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European Projects



« **ULCOS** » Project

Breakthrough technologies for the steel industry to adress the global warming challenge in Europe

Partners: 44 (ARCELOR (coordinator), Air Liquide, BRGM, Corus, EDF, MEFOS, Saarstahl, Voestalpine, ...)

Duration: 2004 – 2009

ALPHEA's contribution: state of the art of large-scale hydrogen production processes for the steel industry

« **FC TESTNET** » Project

Establishing recommendations for the development of harmonized test procedures for the performance tests of fuel cells and fuel cell systems

Partners: about 50 (VDI (coordinator))

Duration: 2003 – 2005

=> Participation to workshops organized within the “HyNet” project

=> Survey and active participation to the work of the Hydrogen and Fuel Cell Technology Platform :

↳ Member of the IG “Regulations, Codes and Standards” and “Training education”

=> Participation to the work of the platform for the 7th PCRD and for a joint Technological Initiative on hydrogen and the fuel cells (IP : “Cross-cutting issues”)



[Complete list of our project available on our website](#)

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More examples ...



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Studies related to HYDROGEN

- Comparison between electrical vehicles infrastructures and fuel cells electrical vehicles infrastructures – *in progress*
- Hydrogen produced with renewables in excess : business model, state of the art – *in progress*
- Benchmarking of hydrogen and fuel cell products and suppliers – *in progress*
- Coal, hydrogen and CTL - 2009
- State of the art of low temperature electrolyzers – coupling with renewable energies – 2009 (for the PEPITE project)
- Hydrogen markets in France and Europe except energy – 2009
- Systems coupling renewable energies and hydrogen – 2009
- Technical and economic survey of hydrogen use as a massive storage carrier of electricity – 2007 (to be done)
- Solar hydrogen production - 2007
- Comparison of electricity and hydrogen as an energy carriers – 2006
- Hydrogen production technologies - 2006
- Natural gas pipelines for hydrogen transportation - 2005
- Cold plasma assisted reforming of hydrocarbons : focus on automotive applications – 2005
- Large scale Electrolysers – 2005
- On-board reforming - 2005
- State of the art of hydrogen storage systems - 2005



List of all studies available on our website

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Studies related to FUEL CELLS



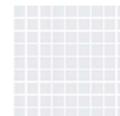
- Benchmarking of hydrogen and fuel cell products and suppliers – *in progress*
- State of the art of portable and microfuel cells - 2010
- Technico-economic study on fuel cell backup systems (generators) – 2008
- Comparison of the PEM fuel cells performances for mobile applications – 2006
- State of the art of SOFC systems - 2005
- First return of experience on residential fuel cell heating appliances in Germany - 2005
- LPG reformers for stationary fuel cells – 2004
- Using biogas as a fuel for fuel cells – 2002
- Fuel cells in the residential sector : technical and economic aspects - 2002
- Technical study of the ALSTOM BALLARD P2B system – analysis of incident scenarios – 2002 (study performed for the SEREPAC Project)
- Study on fuel cell related codes and standards (ANSI Z21.83, NFPA 853, VP119) - 2002 (study performed for the SEREPAC Project)



[List of all studies available on our website](#)

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ALPHEA Network Days



Objectives of the annual network meeting:

- promote relations between the members of the ALPHEA Network
- publicize ALPHEA's activities
- present current developments in hydrogen field
- present the members hydrogen activities to the local and regional stakeholders
- mobilize members and local stakeholders for the development of new projects

Targeted audience : industrials, public authorities, research laboratories, SME and colleges of engineering / universities

Content :

1/ ALPHEA's general meeting : presentation of the highlights of previous year, ongoing actions and projects and future directions

2/ Network news : presentation of new members and any other item at the request of the members

3/ Themes defined in advance and discussed during the conference such as:

- the ALPHEA's project process
- The creation of a Hydrogen Group in the Lorraine Region
- The national context
- Development of new projects by ALPHEA : deployment of fuel cell backup applications in hospital and industry, development of a SOFC micro-CHP with biogas, development of a project « biogas – H2 – transport »



[Presentations available on ALPHEA's website \(heading: "Manifestations organisées par ALPHEA"\)](#)

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ALPHEA HYDROGENE FORUM 2005

The 1st **ALPHEA HYDROGENE Forum**, week set of themes on hydrogen and fuel cells in Lorraine, was held from the 12th to December 18th, 2005 in Nancy and Metz and gathered the Schools and the Universities interested by new energies.

Each day of the week had a particular theme :

- Day 1 - ENSIC (Nancy): "Production - storage – hydrogen uses"
- Day 2 - ESSTIN (Nancy): "the fuel cell: examples of achievements"
- Day 3 - ENSEM (Nancy): "stationary and mobile applications of the fuel cells: production of electricity and heat, residential and transportation"
- Day 4 - ENSAM (Metz) : "Materials in the hydrogen and fuel cell path"
- Day 5 - ENIM (Metz): "Hydrogen and renewable energies" - "Hydrogen safety"

Conferences by representatives of industry, Research Laboratories and Universities

Industrialists : HELION – H-TEC – PAXITECH – CEA – Gaz de France – EDF – DALKIA – PSA – Renault – Delphi – AIR LIQUIDE – CRYOLOR – SOTEG – Euro-Innovation – CETH – H2 Développement - EIDEN – BETIC – PEM TEC

Research Laboratories : LSGS – GREEN – LEMTA – LCSM – LSG2M – A3SI – LSGC – LPMM – LFM

Others participants : ADEME – INERIS – INRETS – BRGM

Speakers of Saar, Luxembourg and Wallonia came also to present their activities and gave an international dimension to this week.

International participants : Ministry for the Walloon Area in Belgium – IZES – WBZU



Presentations available on ALPHEA's website (heading: "Manifestations organisées par ALPHEA")

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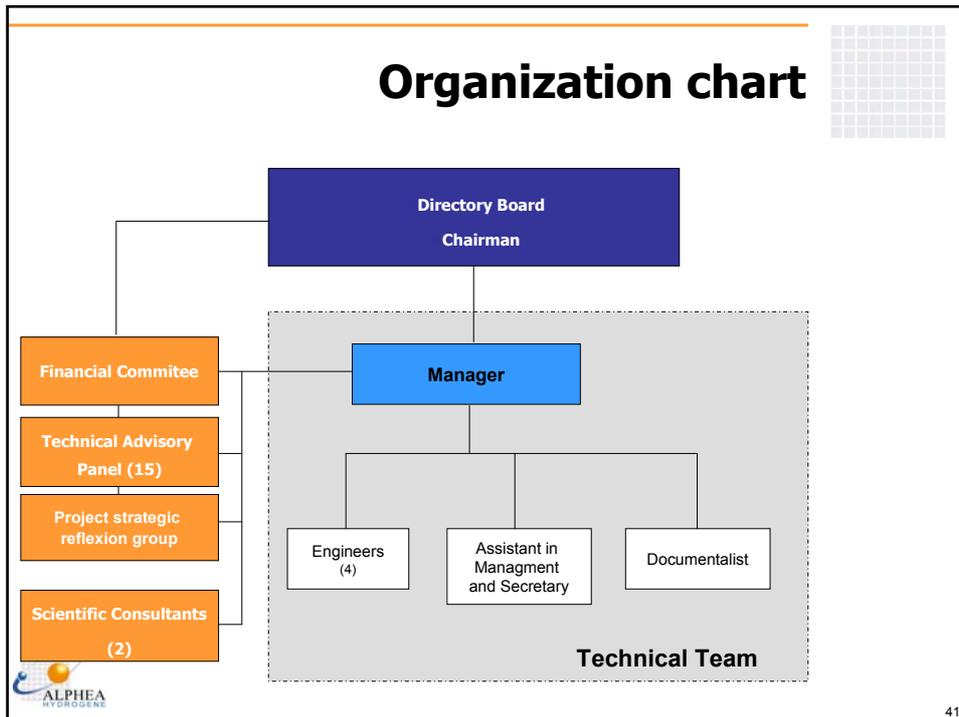
Recent communications presented at conferences

- « **Hydrogen production from renewables** » - Salon des Energies Renouvelables, june 2010, Paris
- « **Hydrogen : energy carrier of the future ?** » - Innovation Days Voliris, september 2009, Paris
- « **Path stakes and current developments** » - CASC, October 2007, Sarreguemines
- « **Perspectives development of the fuel cell industry** » - Summer Academy Fused, June 2007, Strasbourg
- « **Fuel cells – limitations, breakthrough to overcome in mobile and stationary applications – which future?** » - Colloque Energie Environnement, March 2007, Belfort
- « **Hydrogen : latest developments and outlooks** » - ECRIN Group, March 2007, Paris
- « **Hydrogen and vehicles** » - CES/Groupe automobile, February 2007, Metz
- « **Hydrogen prospects – current developments** » - Séminaire TOTAL, July 2006, Paris
- « **State of the art of biological hydrogen production processes** » - WHEC, June 2006, Lyon
- « **Fuel Cell heating appliances : activities in Germany** » - WHEC, June 2006, Lyon
- « **The role of Regions and Collectivities in the development of hydrogen and fuel cell technologies : the example of the Lorraine Region** » - WHEC, June 2006, Lyon
- « **Cold plasma assisted reforming of hydrocarbons : focus on automotive applications** » - WHEC, June 2006, Lyon (poster)
- « **Large scale electrolyzers** » - WHEC, June 2006, Lyon (poster)
- « **Hydrogen and Fuel Cell Investments in France** » - WHEC, June 2006, Lyon (poster)
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- « **Natural gas pipelines for hydrogen transportation** » - WHEC, June 2006, Lyon (poster)
- « **LPG fuel processors for stationary fuel cells : state of the art** » - WHEC, June 2006, Lyon (poster)
- « **The hydrogen industry : current developments – stakes – regional authorities'role – examples of hurdles to overcome** » - Mai 2006, Nantes

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Organization chart



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Pierre Beuzit

Hydrogène l'avenir de la voiture ?



Pierre BEUZIT
Chairman of ALPHEA Hydrogène
Chairman of INEVA-CNRT

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