

Pisa September 8-10, 2005

Congress Palace - Pisa - Italy



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Scientific Draft PROGRAM

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SCIENTIFIC DRAFT Program

The European Network of Excellence



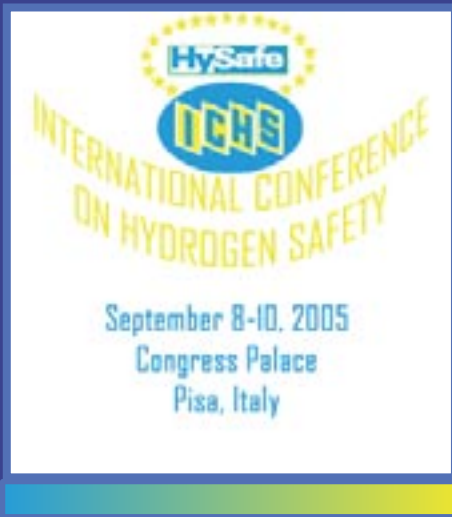
"Safety of Hydrogen as an Energy Carrier"

Invites you to the:

1st International Conference on Hydrogen Safety

September 8-10, 2005
Pisa, Italy

SCIENTIFIC DRAFT PROGRAM



SCOPE

The safety of hydrogen as an energy carrier is subject to intensive global research efforts. There are still significant gaps in basic knowledge and safety solutions that must be addressed to allow the development of acceptable legal requirements and standards.

The International Conference on Hydrogen Safety (ICHS) will focus exclusively on hydrogen safety issues and will:

- Assist the removal of safety-related barriers to the implementation of hydrogen as an energy carrier
- Contribute to methods used for assessing the associated risks
- Promote public awareness and trust in hydrogen technologies

The Conference is aimed at all stakeholders in the field of hydrogen safety, including universities, research institutes, industry, government and regulators.

CONFERENCE HIGHLIGHTS

The ICHS will include:

- Opening plenary session
- Oral and poster presentations
- Topical discussions
- Concluding round table
- Extensive social programme

Elena ROSSI >> Secr. ICHS - c/o Prof. Ing. Marco Carcassi

Dip. Ing. Meccanica, Nucleare e della Produzione - Università di Pisa - Facoltà di Ingegneria

Via Diotisalvi, 2 - 56126 - PISA - E-mail: ICHS@hysafe.org - Off. +39-050-836656 - Fax. +39-050-836665

THEMATIC SESSIONS

(List of selected Papers: 74 over 129 submitted)



Opening International key notes (EU, J, CAN, US):

- EU Representative
- Japan Representative
- Canada Representative: **MacIntyre Ian**: "Canadian Hydrogen Safety Program"
- US Representative: **Kinzey Bruce**: "Hydrogen Safety Program of the U.S. Department of Energy"

Hydrogen Hazards & Risks



Hydrogen release **H. Paillere, HySafe - S. Dorofeev, FM Global Research**



- **Verfondern, K.** : "Pool Spreading and Vaporization of Liquid Hydrogen"
- **Cheng, Z., Agranat, V.M., Tchouvelev, A.V., Houf, W. and Zhubrin, S.V.** : "PRD Hydrogen Release and Dispersion, a Comparison of CFD Results Obtained from Using Ideal and Real Gas Law Properties"
- **Venetsanos, A.G. , Bartzis, J.G.** : "CFD modelling of large-scale LH2 spills in open environment"
- **Molkov, V.V., Makarov, D.V., and Prost E.** : "On numerical simulation of liquefied and gaseous hydrogen releases at large scales"
- **Gallego, E., Migoya, E., Martín-Valdepeñas, J.M., García, J., Crespo, A., Venetsanos, A., Papanikolaov, E., Kumar, S., Studer, E., Hansen, O.R., Dagba, Y., Jordan, T., Jahn, W., Hpiset, S., Makarov, D.** : "An Intercomparison Exercise on the Capabilities of CFD"
- **Ambrosini, W., Forgiione, N. Oriolo, F., Parozzi, F.** : "Mixing of Dense or Light Gases with Turbulent Air: a Fast-Running Model for Lumped Parameter Codes"
- **Cheng Z, Agranat V.M. and Tchouvelev A.V.** : "Vertical Turbulent Buoyant Helium Jet - CFD Modeling and Validation"
- **Mukai, S., Suzuki, J., Mitsuishi, H., Oyakawa, K., and Watanabe, S.** : "CFD Simulation on Diffusion of Hydrogen Leakage Caused by Vehicle Accident in Tunnels"
- **Xu, B.P., Zhang, J.P., Wen, J.X., Dembele, S. and Karwatzki, J.** : "Numerical Study of a Highly Under-expanded Hydrogen Jet"
- **Paillère, H., Studer, E., Beccantini, A., Kudriakov, S., Dabbene, F., and Perret, C.** : "Modelling of H2 Dispersion and Combustion Phenomena Using CFD Codes"
- **Angers, B., Hourri, A., Bénard, P., Tessier, P. and Perrin, J.** : "Simulations of hydrogen releases from a high pressure reservoir: dispersion and consequences of ignition"
- **Takeno, K., Okabayashi, K., Ichinose, T., Kouchi, A., Nonaka, T.** : "Phenomena of Dispersion and Explosion of High Pressurized Hydrogen Gas"
- **Granovskiy, E.A., Lyfar', V.A., Skob, Yu.A. and Ugryumov, M.L.** : "Numerical Modeling of Hydrogen Release, Mixture and Dispersion in Atmosphere"
- **Vasil'ev, A.A.** : "Hazard Estimations of Hydrogen Mixtures"

Ignition & flammability K. Takeno, Mitsubishi Heavy Industries, LTD



- Schroeder, V., Holtappels, K. : "Explosion Characteristics of Hydrogen-air and Hydrogen-Oxygen Mixtures at elevated pressures"
- Chaumeix, N., Pichon, S., Lafosse, F., Udari, N. and Paillard, C.E. : "Role of Chemical Kinetics on the Detonation Properties of Hydrogen/Natural Gas/ Air Mixtures"
- Astbury, G.R., and Hawksworth, S.J. : "Spontaneous Ignition of Hydrogen Leaks: a Review of Postulated Mechanisms"
- Mogi, T., Nishida, H. and Horiguchi, S. : "Flame Characteristics of High-Pressure Hydrogen Gas by Rapid Leak"
- Di Sarli, V., Di Benedetto, A. : "Study of Hydrogen Enriched Premixed Flames"
- Weiser, V., Roth, E., Kelzenberg, S., Eckl, W., Eisenreich, N., Langer, G. : "Measuring and modelling unsteady radiation of hydrogen combustion"

Explosions Experiments & Modeling T. Hirano, Chiba Institute of Science -H. Pasman, TNO

- Tanaka, T., Azuma, T., Evans, J.A., Cronin, P.M., Johnson, D.M. and Cleaver, R.P. : "Experimental Study on Hydrogen Explosions in a full-scale hydrogen filling station model"
- Wakabayashi, K., Mogi, T., Kim, D., Abe, T., Ishikawa, K., Kuroda, E., matsumura, T., Nakayama, Y., Horiguchi, S., Oya, M., And Fujiwara S., : "A field explosion test of hydrogen-air mixture"
- Groethe, M., Merilo, E., Colton, J., Chiba, S. , Sato, Y. and Iwabuchi, H. : "Large-Scale Hydrogen Deflagrations and Detonations"
- Breitung, W. : "Analysis Methodology for Hydrogen Behaviour in Accident Scenarios"
- Schneider, H. : "Large Scale Experiments: Deflagration and Deflagration to Detonation within a Partial Confinement Similar to a Lane"
- Gallego, E., García, J., Migoya, E., Crespo, A., Kotchourko, A., Yanez, J., Beccantini, A., Hansen, O.R., Baraldi, D., Høiset, S., Voort, M.M., Molkov, V.V. : "An Intercomparison Exercise on the Capabilities of CFD Models to Predict Deflagration of a Large-Scale H₂-Air Mixture in Open Atmosphere"
- Hansen, O.R., Renoult, J., Sherman, M.P. and Tieszen, S.R. : "Roald Validation of Flacs-Hydrogen CFD Consequence Prediction Model Against Large Scale H₂ Explosion Experiments in the Flame Facility"
- Molkov, V.V., Makarov, D.V. and Schneider, H. : "Hydrogen-air deflagrations in open atmosphere: large eddy simulation analysis of experimental data"
- Vaagsaether, K., Knudsen, V. and Bjerketvedt, D. : "Simulation of flame acceleration and DDT in H₂-air mixture with a flux limiter centred method"
- Kirillov, A. I., Strelkova, M.I., Panasenka, A.V., Roekaerts, D. : "Sensitivity to detonation and detonation cellular structure of H₂-O₂-Ar-H₂O₂ gas mixtures"
- Nozu, T., Tanaka, R., Ogawa, T., Hibi, k. and Sakai, Y. : "Numerical Simulation of Hydrogen Explosion Tests with a Barrier Wall for Blast Mitigation"
- Kotchourko, A. : "Methodology of CFD Safety Analysis for Large-Scale Industrial Structures"

Risk Assessment & Mitigation - S. Selmer-Olson, DNV - V.V Molkov, HySafe



- **Funnemark, E. and Engebø, A.** : "Development of Tools for Risk Assessment and Risk Communication for Hydrogen Applications"
- **Andersen V., Paulsen J.L. and Markert F.** : "Safety Related to the Use of Hydrogen as an Energy Carrier"
- **Delichatsios, M.A. and Fardis, M.N.** : "A Reappraisal of Containment Safety Under Hydrogen Detonation"
- **Dorofeev, S.B.** : "Evaluation of Safety Distances Related to Unconfined Hydrogen Explosions"
- **Baronov, G.S., Grigoriev, S.A., Kalinnikov, A.A. and Fateev, V.N.** : "Safety problems of hydrogen energy"
- **Hoevenaars, A.J. and Kirchsteiger, C.** : "Agent-based as an Alternative to Prognostic Modeling of Safety Risks in Hydrogen Energy Scenarios"
- **Linssen, J., Diarra, D.** : "Development of a Methodology for Safety Analysis of Fuel Cell Heating Appliance"
- **Wu, Y., Al-Rahbi, I.S., Lu, Y. and Kalghatgi, G. T.** : "Effect of Carbon Dioxide, Argon and Hydrocarbon Fuels on the Stability of Hydrogen Jet Flames"
- **KeBler, A., Ehrhardt, W., Langer, G., Bouchet, S. and Perrette, L.** : "Hydrogen detection: Visualisation of Hydrogen using non invasive optical schlieren technique BOS and properties of available and future Hydrogen Sensors"
- **Castello, P. and Salyk, O.** : "Testing of Hydrogen Safety Sensors in Service Simulated Conditions"
- **Cercignani, G., Cozzani, V., Nicoletta, C. and Zanelli, S.** : "Innovative Passive Protection Systems for Hydrogen Production Plants"

Hydrogen Vehicles - C. Rasche, Dynetec



- **Schneider, J.M., Impullitti, J., Khayyat, Y. and Swain, M.** : "Hydrogen Detection and Mitigation System for Hydrogen Vehicle Maintenance Facilities"
- **Papanikolaou, E.A. and Venetsanos, A.G.** : "CFD modelling for slow hydrogen releases in a private garage without forced ventilation"
- **Watanabe, S., Tamura, Y., Suzuki, J.** : "The New Facility for Hydrogen and Fuel Cell Vehicle Safety Evaluation"
- **Rybin, H., Krainz, G., Bartlok, G., Kratzer, E.** : "Safety demands for automotive hydrogen storage systems"
- **Mitsubishi, H., Oshino, K., Watanabe, S.** : "Dynamic Crush Test on Hydrogen Pressurized Cylinder"

Hydrogen Transport, Distribution & Stationary Application

O. Florisson, NaturalHy - S. Nilsen, HySafe



- Pilo, F., Munaro, L., Zanardo, A. : "Case of compressed gaseous tube trailer"
- Alliat, I. and Heerings, J. : "Assessing the Durability and Integrity of Natural Gas Infrastructures for Transporting and Distributing Mixtures of Hydrogen and Natural Gas"
- Wilkening, H. and Baraldi, D. : "CFD modelling of accidental hydrogen release from pipelines"
- Markert, F., Nielsen, S.K., Paulsen, J.L. and Andersen, V. : "Safety Aspects of Land-Use Planning Scenarios for a Future Infra Structure with Hydrogen Re-Fuelling Stations"
- Faudou, J-Y., Lehman, J-Y. and Pregassame, S. : "Hydrogen Refuelling Stations: Safe Filling Procedures"
- Cali, M., Fontana, E., Giarretto, V., Orsello, G. and Santarelli, M. : "Solid Oxide Fuel Cell Pilot Plant: The EOS Project – Safety aspects"
- Galatola, E., Nava, R., Di Clemente, L. : "Potential Models for Stand-Alone and Multi-Fuel Gaseous Hydrogen Refueling Stations: Assessment of Associated Risk"

Education, Training & Lessons learned

T. Jordan, HySafe



- Weiner, S.C., Kallman, R.A., Ruiz, A. and Schneider, J.M. : "Hydrogen Safety: From Policies to Plans to Practices"
- Bjerketvedt, D. and Mjaavatten, A. : "A Hydrogen-Air Explosion in a Process Plant: A Case History"
- Chernikoff, W. : "Facilitating the Safest Possible Transition from Fossil to Hydrogen Fuels: the Hydrogen Executive Leadership Panel (HELP)"
- Dahoe, A.E. and Molkov, V.V. : "Towards Hydrogen Safety Education and Training"
- Kinzey, B.R., Fassbender, L.L. and Akers, B.M. : "Hydrogen Safety Training at HAMMER"
- Aprea, J.L. : "Safety Issues for a Hydrogen Energy Demonstration Plant in Patagonia"

Production & Storage

L. Basili, ENI



- Sindelar, R., Kaufmann, H., May, U., Krainz, G., Hofmeister, F. : "Characterization of Materials in Pressurized Hydrogen Under Cyclic Loading at Service Conditions in Hydrogen Powered Engines"
- Haraldsen, K., Leth-Olsen, H. : "Caustic Stress Corrosion Cracking of Stainless Steels in High-Pressure Electrolysers"
- Bassi, A., Bertrand, F., Barbier, D., Aujollet, P., Anzieu, P. : "Massive H₂ production with nuclear heating, safety approach for coupling VHTR with an Iodine Sulfur process cycle"
- Wada, Y., Ishigaki, R., Tanaka, Y., Iwadata, T., Ohnishi, K. : "Evaluation of Metal Materials for Hydrogen Fuel Stations"
- Seco, F., Agote, I., Guisasaola, I.N., Lagos, M.A., Kharatyan, S.L., Sargsyan, A.R. : "Novel Method of Manufacturing Safe Hydrogen Storage Metallic Hydrides by SHS"

Legal Requirements & Standards

M. Steen, EUR. Comm, DG JRC - P. Davis, US DoE



- Howard, G.W., Tchouvelev, A.V., Cheng, Z. and Agranat, V.M. : "Defining Hazardous Zones – Electrical Classification Distances"
- Tchouvelev, A.V., Benard, P., Agranat, V. and Cheng, Z. : "Determination of Clearance Distances for Venting of Hydrogen Storage"
- Grasso, N., Ciannelli, N., Pilo, F., Carcassi, M.N. and Ceccherini, F. : "Fire Fighting Technical Rule for Gaseous Hydrogen Refueling Stations"
- Ohi, J., Moen, C., Keller, J and Cox, R. : "Risk Assessment for Hydrogen Codes and Standards"
- Halvorsen, B.G. and Høiset, S. : "Hydrogen Filling Station, CEP-Berlin – Safety Risk Assessment and Authority Approval Experience and Lesson Learned"
- Marangon, A., Carcassi, M.N., Engebo, A., Nielsen, S. : "Safety Distances: Definition and Values"
- Stephenson, R.R. : "Fire Safety of Hydrogen-Fueled Vehicles: System-Level Bonfire Test"
- Dub, M., Gruber, M., Lechner, W. and Müller, C. : "Safety of hydrogen-fueled motor vehicles with IC engines"
- Mair, G.W. : "Hydrogen Storage- An Introduction to Probabilistic into Standards and regulations"

Safety Related Initiatives

A. Tchouvelev, A.V.Tchouvelev & Associates, Inc.



- Komori, M., Yoshida, T., Onoue, K. and Kikukawa, S. : "Safety Study of Hydrogen Supply Stations for the Review of High Pressure Gas Safety Law in Japan"
- Florisson, D. and Huizing R.R. : "The Safe Use of the Existing Natural Gas System for Hydrogen (Overview of the NaturalHy-Project)"
- HySafe
- IEA task 19: "Hydrogen Safety"



Round Table

"Industrial Prospective"

Representatives of Industrial World from different Countries

- CONFERENCE PROCEEDINGS

The proceedings will be published on a CD-ROM. Selected papers will be also published in the International Journal of Hydrogen Energy and in the Hysafe Biennial Report of Hydrogen Safety.

- CONFERENCE ORGANIZING COMMITTEE

L. Bauwens, M. Carcassi, G. Chimenti, P. Davis, S. Grigoriev, M. Grosse, G. Hankinson, T. Jordan, I. MacIntyre, G. W. Mair, D. Makarov, A. Marangon, H. Paillere, D. Pfund, D. Pritchard, G. Romano, Y. Sato, M. Schuckert, M. Steen and N. Versloot.

- CONFERENCE SCIENTIFIC COMMITTEE

P. Adams, D. Baraldi, G. Cacciola, F. Ceccherini, N. Chaumeix, N. Ciannelli, H. Crutzen, M. A. Delichatsios, S. B. Dorofeev, M. Fairweather, B. G. Halvorsen, G. P. Haugom, T. Hirano, C. Kirchsteiger, F. Markert, V. V. Molokov, H. J. Pasma, J.L. Paulsen, C. Rasche, E. A. Reinecke, U. Schmidtchen, V. Tam, A. V. Tchouevlev, A. Teodorczyk, R. Vellone, K. Verfondern and F. Williams.

CONFERENCE LANGUAGE

The Conference language is English. No translation will be provided.

CONFERENCE CENTRE

Congress Palace, Pisa (I)

CONFERENCE REGISTRATION

The full Conference Fee is: 450 Euro before July 1st - after July 1st 500 Euro - Students 350 Euro - Conference Dinners Excluded - Accompanying Person 150 Euro - Only Conference Dinners - The Fee includes: Proceedings, Transport, Attendance at all Conference Sessions, 3 Lunches, 2 Conference Dinners and refreshments (coffee) during session breaks. The Registration Form can be downloaded in the Official website: www.hysafe.org/conference

CONFERENCE INFO

Secretariat e-mail: ICHS@hysafe.org

Address: Dip. Ing. Meccanica, Nucleare e della Produzione - Università di Pisa

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PROJECTS & ORGANIZATIONS



ARDENTHY NEDO JAPAN PROJECT

Development of Safe Utilization and Infrastructure of Hydrogen. New Energy and Industrial Technology Development Organization (NEDO), Aichi Steel Corporation, Hitachi, Ltd., Iwatani International Corporation, Japan Aluminium Association, Japan Automobile Research Institute, Japan Energy Corporation, Japan Industrial Gases Association, Kobe Steel, Ltd., Mitsubishi Aluminum Co., Ltd., Mitsubishi Heavy Industries, Ltd., National Institute of Advanced Industrial Science and Technology, Nippon Light Metal Company, Ltd., Nippon Steel Corporation, Obayashi Corporation, Osaka Gas Co., Ltd., Petroleum Energy Center, Riken Keiki Co., Ltd., Shimizu Corporation, Showa Denko K.K., Sumitomo Light Metal Industries, Ltd., Sumitomo Metal Industries, Ltd., Tatsuno Corporation, The Furukawa Electric Co., Ltd., The High Pressure Gas Safety Institute of Japan, The Institute of Applied Energy, The Japan Research and Development Center for Metals, The Japan Steel Works, Ltd.

CUTE EU PROJECT

AVL (L), BL (E), BPA (UK), DE (D), EMT (E), Evo (D), FirstGroup (UK), FLEAA (L), GVB (NL), HHA (D), HEW (D), IST (P), London Buses (UK), MDA (NL), MF (S), MVV (D), Norsk Hydro (N), PE (D), Planet (D), Polis (B), Shell (NL), SL (SE), SSB (D), Statkraft (N), STCP (P), Sydkraft (S), TB (E), USTUTT (D).

HYSAFE EU PROJECT:

Forschungszentrum Karlsruhe GmbH (D), Air Liquide (F), Federal Institute for Materials Research and Testing (D), BMW Forschung und Technik GmbH (D), Building Research, Establishment Ltd (UK), Commissariat à l'Énergie Atomique (F), Det Norske Veritas AS (N), Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.V. (D), Forschungszentrum Juelich GmbH (D), GexCon AS (N), Foundation INASMET (E), Institut National de l'Environnement industriel et des RISques (F), Instituto Superior Tecnico (PT), European Commission - Joint Research Centre - Institute for Energy (NL), National Center for Scientific Research Demokritos (GR), Norsk Hydro ASA (N), Risø National Laboratory (DK), The United Kingdom's Health and Safety Laboratory (UK), TNO (NL), University of Calgary (CND), University of Pisa (I), Universidad Politécnica de Madrid (E), University of Ulster (UK), Volvo Technology Corporation (S), Warsaw University of Technology (PL).

IPHE INTERNATIONAL PROJECT

Australia, Brasile, Canada, China, European Commission, France, Germany, Iceland, India, Italy, Japan, Republic of Korea, Norway, Russian Federation, United Kingdom, United States.

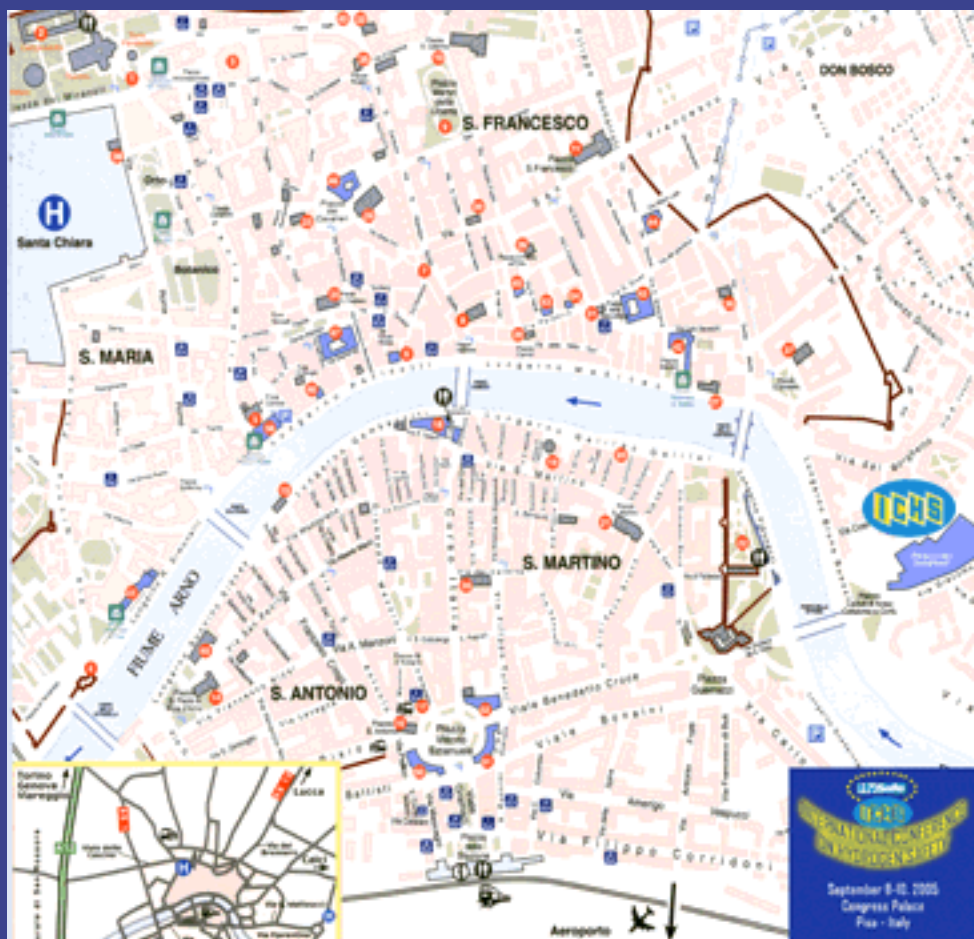
NATURALHY EU PROJECT:

Borås (S), BP (UK), Commissariat à l'Énergie Atomique (F), CETH (F), CMI (UK), COGEN (B), CSM (I), DBI (D), DEPA (GR), DGC (D), ECN (NL), ENIM (F), Exergia (GR), Gasunie (NL), GdF (F), GE PII (UK), GERB (B), IFP (F), IGDAS (TR), ISQ (P), Leeds (UK), Loughborough University (UK), Midt-Nord (DK), NEN (NL), NTNU (NO), NTUA (GR), PLANET (D), Saviko (DK), Sheffield Hallam University (UK), Shell Global Solutions (UK), SHELL H2 (UK), SDS (P), STATOIL (NO), The United Kingdom's Health and Safety Laboratory (UK), TNO Industrie (NL), TOG (UK), Total (F), Transco (UK), TU Berlin (D), Tubitak (TR), WPTG (UK).

STORHY EU PROJECT:

ADETE - Advanced Engineering & Technologies GmbH (D), Air Liquide (F), Austrian Aerospace GmbH (A), BMW Forschung und Technik GmbH (D), Bundesanstalt für Materialforschung und -prüfung (D), Centre National de Recherche Scientifique / Université de Franche Comté (F), Comat Composite Materials GmbH (D), Commissariat à l'Énergie Atomique (F), Contraves Space AG (CH), Daimler Chrysler AG (D), Dynetek Europe GmbH (D), ET-Energie Technologie GmbH (D), European Commission - Directorate General Joint Research Centre (NL), Faber Industrie Spa (I), Ford Forschungszentrum Aachen GmbH (D), Forschungszentrum Karlsruhe GmbH (D), Fundacion para la investigación y el desarrollo en Automoción (E), GKSS Forschungszentrum Geesthacht GmbH (D), Institut für Verbundwerkstoffe GmbH (D), Institute for Energy Technology (N), Institute for Protection Systems - Prochain e.V., Instituto nacional de técnica aeroespacial (E), Linde AG (D), MAGNA STEYR Fahrzeugtechnik AG & Co KG (D), MAN Technologie AG (D), Material S.A. (B), Air Liquide Deutschland GmbH (D), National Center for Scientific Research Demokritos (GR), Öko-Institut e.V. (D), PSA Peugeot Citroen Automobiles (F), University of Nottingham (UK), Volvo Technology Corporation (S), WEH GmbH (D), Wrocław University of Technology (PL).

ITALIAN NATIONAL FIRECORPS (Italian Ministry of Interior Department): 35.000 Personnel, 1.500 Engineers, 600 Fire stations (land, ports, airports), 3 training centres.




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CONGRESS PALACE



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 Pisa - Via Multedo, 1 -
 56124 Pisa



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ITALIAN NATIONAL FIRECORPS

With the Collaboration of:

INTERNATIONAL
ASSOCIATION FOR HYDROGEN ENERGY



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