



Hydrogen and Fuel Cells in The Netherlands

Who's who?

Second Edition
November 2005

Colophon

Information provided by all participating companies and SenterNovem

Texts Henk Barten (SenterNovem)

Final editing HM Communication and SenterNovem

Electronic data collection DConsult

Photo standard format Dr. Lange Nederland B.V.

Translation SysComm Editing & Translation

Creation and implementation Ministry of Economic Affairs, PGF department

This guide has been produced by the Hydrogen Network Programme, which is implemented by SenterNovem for the Ministry of Economic Affairs.

• SenterNovem is the result of a merger between Senter and Novem. • SenterNovem is an agency of the Ministry of Economic Affairs • SenterNovem carries out governmental policies in the field of innovation, energy & climate and the living and working environment, thereby contributing to innovation and sustainability. • More information: www.senternovem.org

The authors cannot guarantee that all parties currently working on hydrogen have been included in this guide. This guide can be ordered via the SenterNovem Publications Centre. E-mail: publicatiecentrum@senternovem.nl.

Although this publication has been collated with the great possible care, SenterNovem cannot be held responsible for any errors contained herein.

*A SenterNovem publication
Hydrogen Network Programme
Utrecht, November 2005*

*Catharijnesingel 59
PO Box 8242
3503 RE Utrecht, The Netherlands
tel.: +31 30 239 3493
fax: +31 30 231 6491*

*Internet: www.senternovem.org
e-mail: info@senternovem.nl*

*Publications number 02DEN05.12
Circulation 2,500 copies*

All rights reserved © 2005 SenterNovem



Hydrogen and Fuel Cells in The Netherlands

Who's who?

Second Edition
November 2005

Contents

Foreword	5
1 Introduction.....	7
2 The role of the government.....	9
3 Collaborations in the Netherlands	13
4 An overview of the stakeholders involved and their activities.....	15
5 Stakeholders	20
Adjuvant BV	20
Advanced Lightweight Engineering BV	21
Air Products Nederland B.V.....	22
Akzo Nobel Base Chemicals BV	23
Altran Technologies Netherlands BV	24
Arnhem Hydrogen Network.....	25
Ballast Nedam International Product Management.....	26
Blomenco BV.....	27
BOVAG	28
BTG Biomass technology Group BV	29
CEA, communication & advice on energy and the environment.....	30
CEPARation BV.....	31
Corus	32
Deerns consulting engineers	33
Delft University of Technology, Applied Sciences, Dept R3	34
Delft University of Technology - Delft Institute for Sustainable Energy (DISE).....	35
DeMaCo Holland BV	36
DSM Solutech BV	37
Dutch Biological Hydrogen Foundation.....	38
Duurzaamheidscentrum Lauwersoog	39
DWA installation and energy advice	40
ECM Technologies.....	41
ECO Ceramics BV	42
Ecofys	43
Energieonderzoek Centrum Nederland	44
Energy +i.d.....	46
ENGVA, European Natural Gas Vehicle Association	47
Ernst & Young Grants and Incentives.....	48
Europe's Energy Point.....	49
EXENDIS	50
Formula Zero BV.....	51
Gasunie Engineering & Technology (GET)	52
Green Vision	53
GTC Almere Pressurecontrols.....	54
HAN University Arnhem (Mobility Technology Research)	55
Homeowners Association 'De Stoere Houtman'	56

Hydrogen Network Enterprise (H2NE)	57
HyGear	58
Informatiecentrum Duurzame Energie Technieken/Information centre for sustainable energy techniques (Idet)	59
Innovation Support & partners	60
Institute for Energy, Directorate-General Joint Research Centre, EU	61
Integral	62
Inventech Benelux BV	63
IWO, Institute for Science and Development	64
KEMA	65
Kiwa Gastec Certification	67
Kiwa Gastec Technology	68
Laboratory High Temperature Gas Kinetics	69
Linde Gas/Hoekloos	70
MAGNETO special anodes BV	71
MAN Truck & Bus b.v.	72
Mesos Management BV	73
NBT (New Business and Technology)	74
Nederlandse Contactgroep Bio. waterstofproductie/Netherlands Biohydrogen Network	75
Nederlandse Waterstof en Brandstofcel Vereniging/Dutch Hydrogen and Fuel cell Association	77
NedStack BV	78
NEN, Dutch Standardization Institute	79
Nexus Global B.V.	80
NovioConsult Van Spaendonck BV	81
NV Nedap	83
Plug Power Holland BV	84
Prins Autogassystemen b.v.	85
Procede Group BV	86
Proton Ventures BV	87
Royal Haskoning	88
Sensistor-Technologies	89
SenterNovem	90
SenterNovem/EG-Liaison	91
Shell Hydrogen	92
Siemens Nederland NV	93
SPARQLE International	94
Stork Product Engineering BV	95
Susebeek Technical Consultants (STC)	96
Technische universiteit Eindhoven	97
Thomassen Compression Systems BV	98
TNO, Organisation Applied Scientific Research	99
Twente University, department of communication science	101
Utrecht University, Innovative Studies	102
VHK BV	103
VVM, Vereniging van Milieuprofessionals	104
Wageningen UR, Environmental Technology section	105
Wageningen UR, Agrotechnology & Food Innovations	106
Westfalen Gassen Nederland BV	108





FOREWORD

This is the second edition of the Who-is-Who overview of Dutch organisations that specialise in developing hydrogen as an energy carrier. The first edition of the Hydrogen Guide was a huge national and international success. SenterNovem has now expanded this second edition in order to meet the continuing demand for more information.

Hydrogen is the focus of considerable attention throughout the world, and is seen by many as an important energy carrier for the future, when we will use energy that is largely derived from renewable energy sources.

Using hydrogen as an energy carrier requires both innovative technologies and huge investments for implementation. The Netherlands invests around € 35 million each year in the development of hydrogen energy, often via joint public-private projects. These activities have a strong international flavour: the European Commission encourages this collaboration via its Framework Programmes as well as the European Hydrogen and Fuel Cells Platform.

In developing a sustainable energy economy there are considerable opportunities for both old and new industries, plus new business initiatives. The government encourages companies to create such opportunities, e.g. by providing subsidies. The Netherlands is therefore seen as a leading player in this sector.

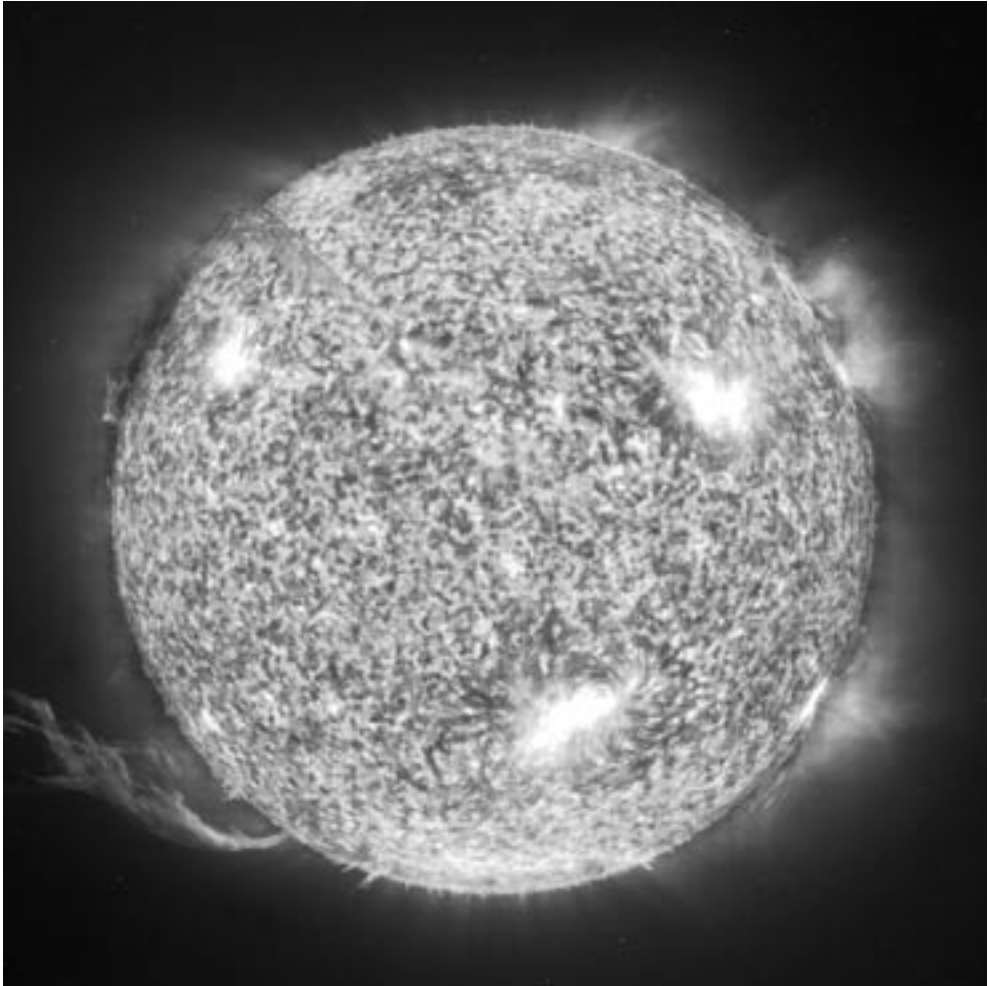
Hydrogen development now includes many stakeholders, all with varying capacities and objectives, which carry out a wide range of activities. This hydrogen guide clusters information on the parties currently active in developing hydrogen energy in the Netherlands. The aim is to allow these national stakeholders to contact each other more easily and to build up better international contacts. In this way the government hopes to increase the cohesion, skills and effectiveness of the various activities, as well as encouraging Dutch powers of innovation with regard to hydrogen.



This guide will undoubtedly play a supporting role in this important process.

A handwritten signature in black ink, consisting of several fluid, overlapping loops and lines, positioned above the printed name.

Drs. J.B.V.N. Pleumeekers
Managing Director SenterNovem
Sittard, November 2005



Our furthest energy source (photo NASA 2004).



1 Introduction

We are increasingly coming to terms with the fact that fossil energy sources are quickly becoming depleted, and that environmental effects from using fossil energy sources are causing serious problems, both locally and on a global scale. Important solutions to this problem include: using cleaner technology and saving energy. The latter can be achieved by reducing the demand for energy, as well as generating and using energy more efficiently.

The transition to a sustainable energy system is seen as the only long-term socially responsible way of meeting the future demand for energy. The conditions for this include: reliability, efficiency and solving the current climate problems.

Natural gas and oil are currently our most important sources of energy. By using these in a cleaner and more efficient manner we can make them more sustainable, thus reducing their damaging effects, as the CO₂ released is captured and stored.

Renewable energy sources, such as sun, wind and water, will be used more increasingly. As greater amounts of renewable sources are used, hydrogen can play an important role as storage medium, thus solving the problem of untimely supply and demand of electricity. Hydrogen can also be produced through electrolysis for traffic and transport purposes.

Next to that biomass can play an important role as renewable source. There is no net CO₂ emission, as the CO₂ formed is quickly absorbed. Biomass can be used to produce various 'green' fuels, e.g. biodiesel, methanol, di-methyl-ether, biomethane and hydrogen. These 'green' energy carriers will probably be used alongside each other.

In summary: our long-term energy supply generally consists of sustainable sources. Hydrogen can play a significant role in this concept. However, in order to use hydrogen as an energy carrier, new techniques, components and infrastructure are necessary. This offers excellent opportunities for innovative companies and leads to more employment.



Solar panelled roof of a fire station in Houten, The Netherlands (photo SenterNovem/Hans Pattist).

2 The role of the government

The Netherlands

The Dutch government strongly supports the transition towards a sustainable energy system. This is necessary because traditional policies need to be renewed to meet current unusual conditions.

Transition management differs from our traditional policy by its size, duration and approach. It means a change in many strategic areas over a long period; longer and wider than most policies. The required transition is market-oriented: government, industry and social organisations are all working towards the same objective.

The Ministry of Economic Affairs started the Energy Transition programme in 2001. Under this Energy Transition framework various paths have come to light that together lead to a sustainable energy management system. These had been concluded as five so-called 'main routes':

1. Efficient and green gas
2. Chain efficiency in industry
3. Green raw materials
4. Alternative motor fuels
5. Sustainable electricity (biomass, wind)

In four of these five main routes hydrogen plays a role. This underlines the importance of developing hydrogen technology.

Several programmes, including Innovative Cooperation (Innovatieve Samenwerking, IS) and Energy Research Strategy (Energie Onderzoek Strategie, EOS) and the Unique Opportunities Scheme (UKR) offer subsidies to support hydrogen initiatives. Check the SenterNovem website (www.senternovem.nl) for the latest information.

Europe

Hydrogen is receiving strong attention at a European level. Over the past two years the European Commission has undertaken an intensive preparation for the role of hydrogen as an energy carrier. The Sixth Framework Programme (FP6) offers good support for this subject, and the Seventh Framework Programme is expected to offer even more opportunities for hydrogen-based projects.

This is further underlined by the fact that two 'Quick Start' programmes have already been started in the GROWTH-programme with regard to hydrogen (HYPOGEN and Hydrogen Communities; HYCOM), which strengthen the European competitive position. In total the European Commission has reserved around 2.8 billion euro for these hydrogen projects.

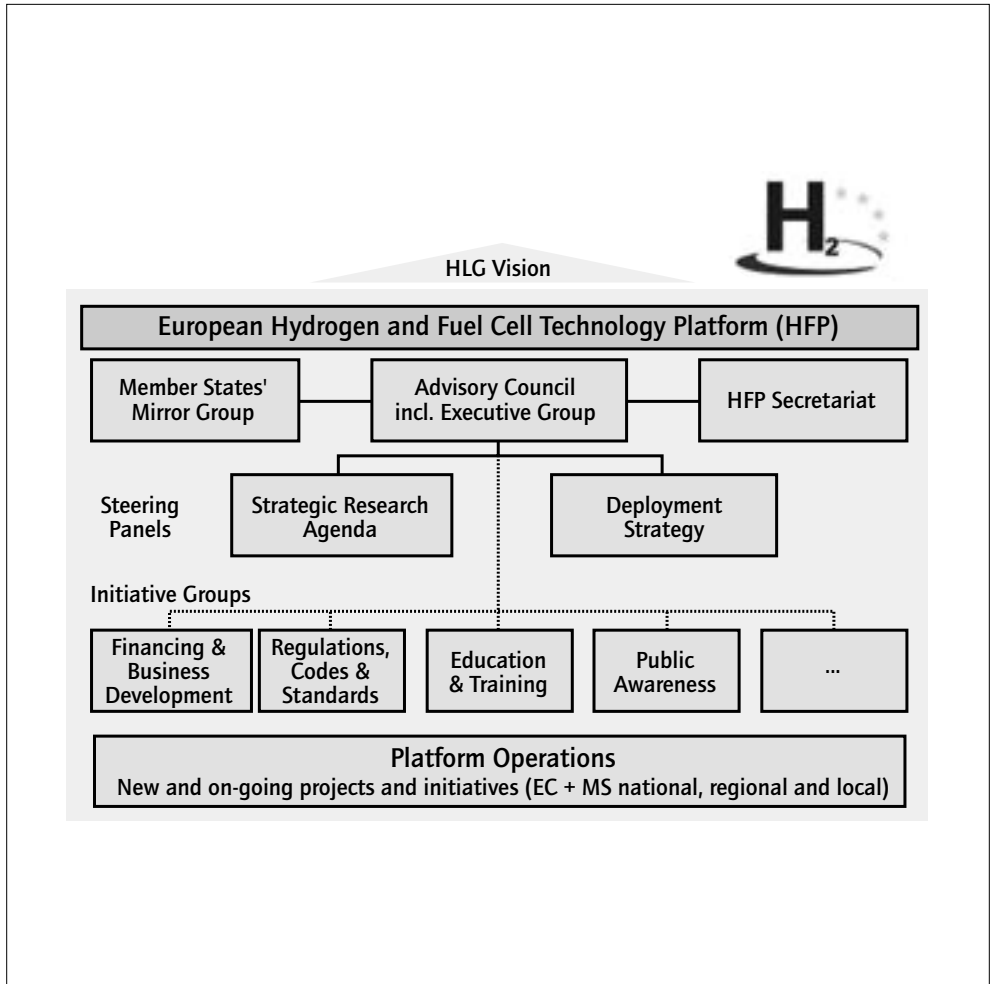


Figure 1: Organisation scheme of the European Hydrogen and Fuel Cells Technology Platform.

The European Commission is also working on the 'Technology Platform Hydrogen and Fuel Cells' (see-figure 1). This platform is a building block of the umbrella organisation 'European Research Area'. The objective is to have all European research carried out here. More information on the European Platform Hydrogen and Fuel Cells: www.HFPeurope.org.

Various European countries are investing heavily in hydrogen. Germany is particularly active in this area. Important stakeholders come from the car manufacturing industry.

Worldwide

The USA, Canada and Japan spend a lot of time and money developing hydrogen. As comparison: the USA/Canada, Japan and the EU each invest around the same amount. Of the new and upcoming countries, China is becoming increasingly prominent.

There are two worldwide collaborative agreements on hydrogen: through implementing agreements of the International Energy Agency (IEA) and the International Partnership for Hydrogen Energy (IPHE). Both agreements work primarily on specific projects that are non-competitive, e.g. production and use of hydrogen, storage, transport, safety and regulations. Collaborative field tests and demonstrations are increasingly being realised with combined private-public funding. Cooperation within the IEA also applies to joint developments with regard to fuel cells, to make them available as soon as possible.

Despite worldwide energy problems and globalisation, the balance between local energy sources and the demand for energy carriers, actual research and developments are determined per region. A-typical example of 'think global, act local'.

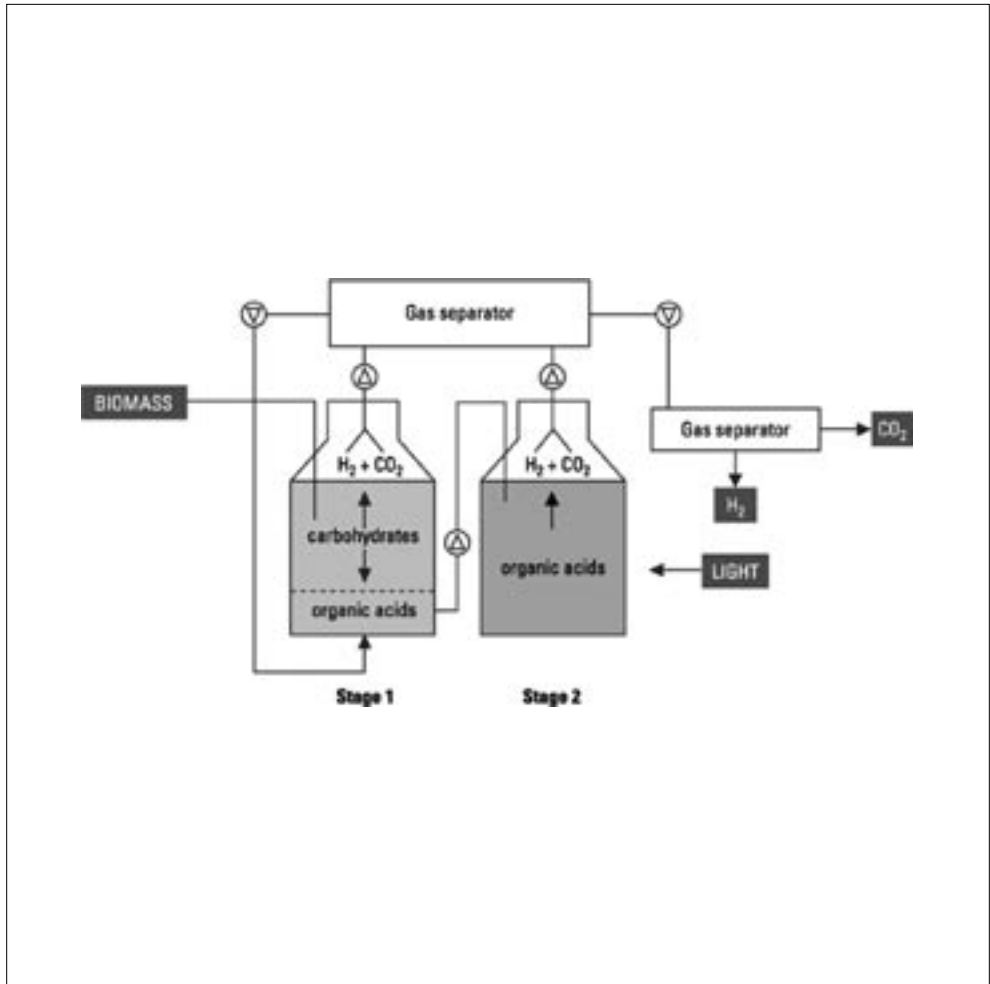


Figure 2: Production process for biological hydrogen (Dutch Biological Hydrogen Foundation).

3 Collaborations in the Netherlands

The Netherlands includes several types of collaborations. The following list provides a brief overview.

Associations

The Dutch Hydrogen Association (or NWW) was set up to encourage the use of clean hydrogen in an increasingly sustainable energy system package. Its strategy is to act as broker between the various stakeholders in the field, and exchange knowledge and information between the relevant target groups, including consumers. The association feels its main task as network organisation is to strengthen the cohesion in the Netherlands with regard to hydrogen and fuel cells.

Opportunity-based collaboration

Specific projects result in specific collaborations in order to complete the chain of skills required. This helps parties to get to know each other better, sometimes resulting in more permanent clusters of skills. Examples includes the Greening of Gas project and, in an international context, the NATURALHY project. Both work towards making natural gas more sustainable by adding hydrogen.

Horizontal collaborations

Some knowledge areas are spread over various locations and include a number of stakeholders. A-type of 'virtual knowledge centre' is created by seeking synergies between the various groups. These are horizontal collaborations.

Examples include:

- *Supercritical biomass gasification*

Supercritical biomass gasification produces hydrogen via a chemical reaction between water and biomass. A central core of skills has now been created through the following parties:

Organisation	Name	E-mail
Biomass Technology Group; BTG	Dr. B. van de Beld	vandebeld@btgworld.com
Sparqle	Prof. Dr. J.M.L. Penninger	spql@introweb.nl
Twente University	Ir. S.R.A. Kersten	s.r.a.kersten@utwente.nl
TNO-MEP	Dr. J. Zeevalkink	jan.zeevalkink@mep.tno.nl
Energieonderzoek Centrum Nederland, ECN.	Dr. K. Hemmes	vriendjes@ecn.nl

- *Biological hydrogen production*

Various universities and institutes are currently conducting research into the possibilities of converting biomass into hydrogen. Further contact led to collaboration via the 'Contact group for biological hydrogen production', which contains 12 stakeholders. This has now been expanded into the Dutch Biological Hydrogen Foundation; participants and contact information can be found in the table below, or on the website www.biohydrogen.nl.

Organisation	Name	E-mail
Wageningen University	Dr. A.J.M. Stams (Chairman)	Fons.stams@wur.nl
ATO Business Unit Renewable Resources	Dr. ir. P.A.M. Claassen	Pieternel.claassen@wur.nl
Wageningen University;	Dr. ir. R.H. Wijffels	Rene.wijffels@wur.nl
ECN (Netherlands Energy Research Centre), Petten	Drs. J.H. Reith (Secretary)	Reith@ecn.nl
ECN (Netherlands Energy Research Centre), Petten	Ir. A. de Groot	a.degroot@ecn.nl
Delft Technical University	Prof. Dr. W. R. Hagen	W.R.Hagen@tnw.tudelft.nl
Nijmegen Catholic University	Dr. J. Keltjens	jankel@sci.kun.nl
Groningen University	Dr. ir. T.A. Hansen	T.A.Hansen@biol.rug.nl
Groningen University	Prof. Dr. L. Dijkhuizen	l.dijkhuizen@biol.rug.nl
TNO MEP Apeldoorn	Dr. J. W. Van Groenestijn	J.W.vangroenestijn@mep.tno.nl
Wageningen University	Prof. Dr. C. Buisman	cees.buisman@wur.nl
Groningen University	Prof.dr. B. Hessen	b.hessen@chem.rug.nl
SenterNovem Utrecht	Dr. H. Barten (Observer)	h.barten@senternovem.nl



4 An overview of the stakeholders involved and their activities

This guide uses the following sections to describe hydrogen applications but does not pretend that this is complete. The following provides a brief description of the activities and applications, and the type of stakeholders involved. See also the brief overview of the various stakeholders and their activities (Table 1). This is followed by the detailed information for each organisation.

A Research and Development

This concerns fundamental and applied research, material research and functional testing, as well as first-generation working prototypes. Stakeholders include: universities, research institutes, and the R&D departments of large companies.

B Components

Components refers to parts of equipment that are developed and tested, then built into new equipment such as fuel cells, reformers, storage vessels, sensors etc. Stakeholders include: research institutes and innovative companies.

C Systems

This concerns stand-alone equipment, e.g. fuel cell systems (primarily based on PEMFC) and hydrogen combustion engines and turbines; for stationary use as well as traffic and transport. Other examples include APS, UPS and portable applications.

D Infrastructure

Infrastructure is of major relevance to energy suppliers; both the current gas suppliers and oil companies. Research institutes often make observations and calculations necessary in order to select the best local structures. This also often occurs in an international context.

E Commercialisation

This concerns selling the products, and often includes developers and manufacturers of innovative products. These are often small companies with a lot of courage.

F Demonstration

It concerns systems that are beyond the development phase and that work at a specific site, and need to demonstrate that they work. This area is difficult to differentiate from field tests. In all cases this provides feedback on the experience gained to both manufacturers and users.

G Services

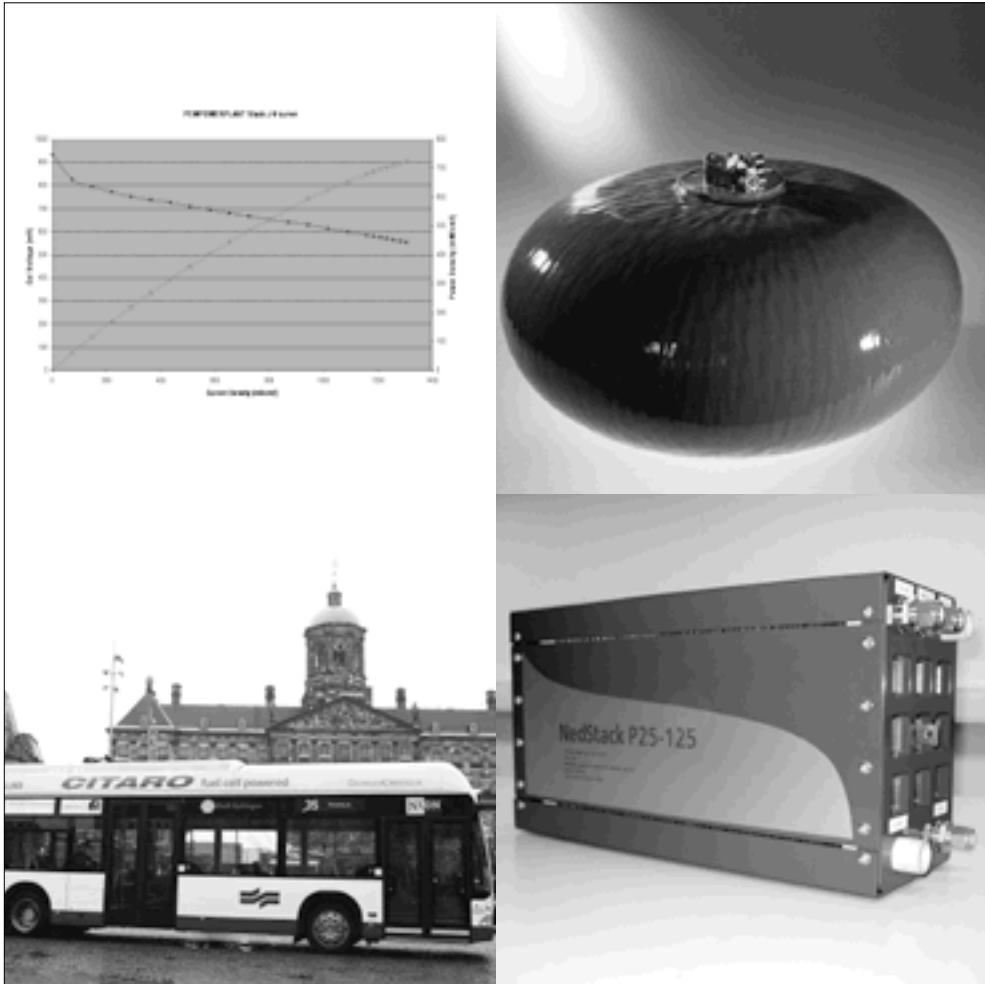
These are supporting activities such as calculating, project acquisition, management and communication.

Table 1 Overview of the stakeholders involved and their activities.

	Hydrogen and fuel cell activities											Hydrogen chain				Other		
	Page number	R&D*	Components	Infrastructure	Commercialisation	Demonstration	System and integration					Production	Storage	Distribution	Observations**	Applications	Financing	Services
							– Stationary	– Mobile	– APS	– UPS	– Portable							
* R&D: research and development																		
** Observations: chains, technical economic evaluation, policy																		
Adjuvant BV	20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Advanced Lightweight Engineering BV	21	x	x					x				x			x			
Air Products Nederland B.V.	22	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Akzo Nobel Base Chemicals BV	23	x			x						x	x						
Altran Technologies Netherlands BV	24	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Arnhem Hydrogen Network	25					x	x	x	x	x	x	x	x	x	x	x	x	x
Ballast Nedam International Product Management	26	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x
Blomenco BV	27			x	x	x	x				x	x			x		x	x
BOVAG	28			x				x							x			
BTG Biomass technology Group BV	29	x			x	x						x						
CEA, communicatie & advies over energie & milieu	30				x	x	x								x		x	
CEPARation BV	31	x			x							x						
Corus	32	x	x		x	x												
Deerns Consulting Engineers BV	33	x			x	x	x	x	x		x				x	x		x
Delft University of Technology, Applied Sciences, Dept. R3	34	x											x				x	
Delft University of Technology, Delft Institute for Sustainable Energy	35	x	x									x	x	x	x	x		
DeMaCo Holland BV	36	x	x	x	x		x	x			x	x	x	x		x		
DSM Solutech BV	37	x	x		x	x	x	x		x					x	x	x	x
Dutch Biological Hydrogen Foundation	38	x										x					x	
Duurzaamheidscentrum Lauwersoog	39	x			x	x		x		x					x		x	
DWA installation- en energy advise	40	x	x	x		x	x		x	x					x		x	x
ECM Technologies	41	x	x			x						x					x	
ECO Ceramics BV	42		x															x
Ecofys	43	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Energieonderzoek Centrum Nederland (ECN)	44	x	x	x		x	x	x	x			x		x	x	x		
Energy +id	46	x															x	x
ENGVA, European Natural Gas Vehicle Association	47	x	x	x	x	x						x	x	x	x	x		
Ernst & Young Grants and Incentives	48																	x
Europe's Energy Point	49	x		x	x	x		x				x	x	x	x	x	x	x



	Hydrogen and fuel cell activities										Hydrogen chain				Other				
	Page number	R&D*	Components	Infrastructure	Commercialisation	Demonstration	System and integration					Production	Storage	Distribution		Observations**	Applications	Financing	Services
							– Stationary	– Mobile	– APS	– UPS	– Portable								
* R&D: research and development																			
** Observations: chains, technical economic evaluation, policy																			
EXENDIS	50	x	x		x	x	x	x	x	x	x								x
Formula Zero BV	51				x	x		x											x
Gasunie Engineering & Technology	52	x	x	x	x	x					x			x	x	x			
Green Vision	53	x										x	x	x	x	x			
GTC Almere Pressurecontrols	54		x																x
HAN University Arnhem (Mobility Technology Research)	55	x				x	x	x	x	x		x	x		x	x			
Homeowners Association 'De Stoere Houtman'	56	x		x	x	x						x	x	x	x	x			x
Hydrogen Network Enterprise (H2NE)	57	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x
HyGear	58	x	x	x	x	x	x	x	x	x	x	x	x						
Informatiecentrum Duurzame Energie Technieken (Idet)	59				x	x	x	x					x		x	x			x
Innovation Support & partners	60					x		x		x				x					
Institute fo Energy, Directorate-General Joint Research Centre	61																		
Integral	62					x													x
Inventech Benelux BV	63	x				x	x				x	x	x	x					
IWO	64	x				x		x		x					x	x			x
KEMA	65			x											x	x			x
KIWA Gastec Certification BV	67																		x
KIWA Gastec Technology	68	x	x	x		x	x					x		x	x				
Laboratory High Temperature Gas Kinetics, RUG	69	x													x	x			
Linde Gas / Hoek Loos	70	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
MAGNETO special anodes BV	71	x	x		x								x						
MAN truck & bus BV	72				x	x		x											x
Mesos Management BV	73	x		x												x			x
NBT	74	x	x					x					x	x					
Nederlandse Contactgroep Bio. waterstofprod.	75	x		x		x	x					x	x						x
Nederlandse Waterstof Brandstofcel Vereniging	77	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
NedStack BV	78	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x
NEN, Nederlands Normalisatie Instituut	79	x		x															x
Nexus Global B.V.	80			x		x	x	x			x				x	x			



Top left and bottom right: Current voltage curve and fuel cell (Nedstack). Top right: lightweight pressure container for natural gas and hydrogen (Advanced Lightweight Engineering BV). Bottom left: CUTE project: hydrogen-fuelled city bus in Amsterdam (René van den Burg).

organisation: **Adjuvant BV**

address: Brienschofsingel 1

postal code: 6662 MG

town: Elst

contact person: ir. E.A.M. de Nie

telephone: +31 6 532 02 088

fax: +31 481 350 449

e-mail: e.denie@adjuvant.nl

products:

- Adjuvant BV supplies experienced interim managers to corporate and non-profit institutions.
- The company also develops collaborative organisations, such as trade associations and business cooperatives.
- Adjuvant is involved in building up the Hydrogen Network Enterprise and the Dutch Hydrogen and Fuel cell Association.

organisation: Adjuvant BV is a freelance organisation that was set up in 2000, and is associated with the Cum Suis Group in Zutphen.

networks: External evaluation commission for clean fossils (ECN)
Cum Suis Group

projects: Using hydrogen in gas distribution, GGR-GAS 1997.
Hydrogen Network Enterprise, an industrial estate for the hydrogen equipment industry, located in Arnhem.

organisation: **ALE (Advanced Lightweight Engineering BV)**

address: Rotterdamseweg 145

postal code: 2628 AL

town: Delft

website: www.ale.nl

contact person: Jan-Jaap Koppert

telephone: +31 15 251 3430

fax: +31 15 251 3439

e-mail: koppert@ale.nl

products: Lightweight onboard hydrogen storage tanks that are ultra lightweight, impact resistant, gastight, and can be recycled.

organisation: ALE is located in Delft, where it designs and develops lightweight constructions. In 2000 ALE won the IDNL annual prize for the best innovation, and in 2003 the company received the award for Best Composite Product for its new generation of lightweight composite pressure vessels.

At its new location, at Delft Technical University, ALE now has a private laboratory where new tanks are tested, certified and manufactured.

organisation: ***Air Products Nederland B.V.***

address: Klaprozenweg 101

postal code: 1033 NN

town: Amsterdam

website: www.airproducts.nl

contact person: Mr Pim Meyboom

telephone: +31 10 296 1300

fax: +31 10 296 1450

e-mail: meyboop@airproducts.com

products: Air Products Netherlands B.V. supplies industrial gases, process, medical and specialty gases, performance materials and selected specialty chemicals. The company's hydrogen portfolio includes gaseous and liquid hydrogen, storage and transport systems, small-scale and large-scale production plants and engineering consultancy for the petrochemical and chemical industry, as well as turnkey fuelling stations for the automotive market.

Air Products Nederland B.V. serves the Dutch market for industrial and medical gases by supplying via pipeline and/or in bulk and cylinders. The company's sales organisation is located in Amsterdam, plus over 120 local sales outlets and production locations in Pernis, Rozenburg and Terneuzen.

organisation: Air Products Netherlands B.V. is part of the global organisation Air Products & Chemicals Inc. On a world scale Air Products is one of the largest hydrogen producers and plays a leading role in the development of hydrogen technologies and applications. To emphasise this leading role Air Products participates in numerous hydrogen-related commercial and demonstration projects in the US, Europe and, more recently, in India.

networks:

- Dutch Hydrogen and Fuel cell Association
- Air Products also contributed towards various European projects such as EIHP2, HYWAYS, HYAPPROVAL and is member of the High Level Group to advice to the EC commissioner of transport on future mobility issues (like fuels).

projects:

- Zwiindrecht Apartments, the Netherlands: Hydrogen, supplying apartments with heat and electricity.
- BP Singapore: Hydrogen fuelling station for hydrogen fuel cell cars in Singapore.
- EPA/DaimlerChrysler/UPS Fuel Cell Vehicle Initiative, Michigan, USA: Hydrogen fuel station to power UPS vehicles.
- Howaldtswerke-Deutsche Werft AG (HDW), Germany: Supply of transportable hydrogen fuelling station and two dispensers for fuel cell powered submarines.
- See www.airproducts.com/H2energy for more information.



organisation: **Akzo Nobel Base Chemicals BV**

address: Stationsplein 4
postal code: 3818 LE
town: Amersfoort
website: www.basechemicals.com

contact person: Rindert van Zinderen Bakker
telephone: +31 33 467 6713
fax: +31 33 467 6157
e-mail: rindert.vanzinderenbakker@akzonobel.com

products: Akzo Nobel Base Chemicals' products are applied in a wide range of production processes in the chemical and processing industry. Akzo Nobel Base Chemicals supplies the following products: caustic soda, chlorine, di-methyl-ether, iron and aluminium salts, hydrochloric acid, sodium hypochlorite and sodium sulphate. Hydrogen is produced in our electrolysis processes and its current main application is as (substitute) fuel. Akzo Nobel Base Chemicals has started a research and development project that will lead to a sustainable application of hydrogen.

organisation: Akzo Nobel Base Chemicals is an important supplier of chlor-alkali products, with production facilities in the Netherlands (Delfzijl, Hengelo and Rotterdam), Sweden (Bohus and Skoghall) and in Germany (Bitterfeld and Ibbenbüren). Akzo Nobel Base Chemicals is your preferred partner in a sustainable chlor-alkali business and water treatment chemicals. We have achieved this position by providing solutions and services via long-term agreements. We strive for excellence in the areas such as health, safety and the environment.

projects: Akzo Nobel Base Chemicals is involved in a project whereby hydrogen is used in fuel cells to generate electricity. In collaboration with Nedstack, a research project has now been defined that will eventually lead to the construction of a fuel cell plant. This will allow Akzo Nobel Base Chemicals to produce renewable energy.



organisation: **Altran Technologies Netherlands BV**

address: De Fruittuinen 30

postal code: 2132 NZ

town: Hoofddorp

website: www.altran.net

contact person: Skill Center Sustainability & Hydrogen

telephone: +31 23 569 4090

fax: +31 23 569 4099

e-mail: Sustainability@Altran-Tech.nl

- products:*
- Altran Technologies Netherlands BV consists of various departments, all with their own specialisations (skill centres). The Sustainability and Hydrogen Skill Centre focuses on a project-based approach to all subjects relating to the implementation of renewable energy.
 - The Sustainability and Hydrogen Skill Centre specialises in system design, safety, project management, feasibility studies, audits, interim management and consultancy relating to renewable energy and hydrogen.

organisation: Altran Technologies Netherlands BV is a leading technology consultancy that provides its clients with sustainable innovative solutions.

Altran Technologies is a committed partner that works closely together with its clients in joint, multidisciplinary project teams. The pragmatic and results-oriented approach is highly valued by clients. The company offers a unique combination of extensive cutting-edge technology expertise with a strong business approach. As part of a global knowledge network of over 18000 experts, Altran Technologies has built up an extensive track record in the renewable energy, (micro) electronics, manufacturing and logistics, robotics, telecommunications, the petrochemical industry, and railway safety-critical systems.

networks: The Altran Group consists of a worldwide network of around 200 subsidiaries, e.g. Arthur D. Little.

- projects:*
- Autonomous Sustainable Island (Vlieland)
 - Hydrogen Vision
 - Autonomous Sustainable Restaurant
 - Inventory of Alternative Transport Fuels

Projects within the transition path New Gas, Support for Transition Coalitions (OTC):

- Dispersal of energy supply in a free energy market
- ORDE Neeltje Jans (sustainable energy project)
- ORDE in a sustainable suburb
- Sustainable grid balancing
- Feasibility of natural gas/ hydrogen for transportation

miscellaneous: Altran Foundation for Innovation. The 2006 theme is Technological Innovation and Energy. www.altran-foundation.org/sustainability@altran-tech.nl



organisation: **Arnhemse Waterstof Netwerk /
Arnhem Hydrogen Network**

address: Eusebiusbuitensingel 49 / PO Box 99
postal code: 6800 AB
town: Arnhem
website: -

contact person: M.J. de Kroon
telephone: +31 26 377 5145
fax: +31 26 377 3450
e-mail: H2@arnhem.nl

products: The Arnhem Hydrogen Network aims to make local hydrogen and fuel cell applications both visible and publicly accessible. The programme for the next few years covers projects focusing on demonstration, feasibility research and business-cluster development. The town of Arnhem and the Arnhem Hydrogen Network offer an environment that is well suited to manufacturing and demonstrating hydrogen and fuel cell applications.

organisation: The network is formed around three main groups that can speed up the development and demonstration of hydrogen and fuel cell applications:

1. the hydrogen and fuel cell industry
2. customers and public authorities
3. knowledge institutes and advisors

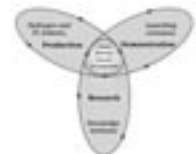
The Arnhem local authority hosts the network, supports projects and is prepared to act as one of the initiating customers. The network welcomes all organisations that want to share our experience and resources in Arnhem-related projects.

networks: Via participants affiliated with:

- Dutch Hydrogen and Fuel cell Association
- World Fuel Cell Council
- EU Hydrogen-business development platform
- Hydrogen Network Enterprise

projects:

- Feasibility study into using hydrogen in Arnhem's suburbs.
- Pre-study into using hydrogen and fuel cells in Arnhem's public transport system.
- Pre-study into clean hydrogen production.
- Pre-study into the location of the public hydrogen refuelling station in Arnhem.
- Preparatory phase of the Hydrogen Network Enterprise.



organisation: **Ballast Nedam International
Product Management (BN IPM)**

address: Nijverheidstraat 12
postal code: 4143 HM
town: Leerdam
website: www.ballast-nedam.com

contact person: H.G. van Uitert / A. le Febre
telephone: +31 345 639 250
fax: +31 345 639 207
e-mail: h.van.uitert@ballast-nedam.com / b.lefebvre@ballast-nedam.com

- products:*
- Design and Build: coordinates all product-based activities, e.g. development, planning, permits and licences, purchase of materials, realisation and after sales service.
 - Installation Technology: own installation group specialised in installing the most popular products and is holder of the necessary product certificates.
 - Environment Technology: environmental specialists who are responsible for preparing and implementing environmental projects.
 - Facility Management: monitors and organises all maintenance and service activities.
 - Alternative Fuels: this group is responsible for developing and constructing alternative fuel systems for LNG, CNG, and hydrogen.

organisation: Ballast Nedam International Product Management (BN IPM) is part of the Ballast Nedam corporation, which is a leading construction company that includes all relevant disciplines and can thus participate in all phases of the project. BN IPM is an independent subsidiary of Ballast Nedam, but has access to the experience gained in the rest of the company. BN IPM is located in Leerdam, but has offices throughout Europe and the Far East. The company's core activities include product management, project development, new construction and facility management of refuelling stations, environment-related projects and alternative fuel installations. BN IPM participates in the discussion concerning development and implementation of refuelling stations for the future, and the application of alternative fuelling techniques. BN IPM is ISO 9001-2000 certified and has an international VCA certificate (a safety certificate for construction companies).

networks: ENGVA

projects: ESKAN: Carclean, mini-refuelling station for hydrogen.
Cute/Usher, tendering phase in collaboration with Van de Borre/ Stuart.
ECN, tender for building and maintaining
fuel cell test laboratories.
Development of Duogen concept.

organisation: **Blomenco B.V.**

address: Achtermonde 31
postal code: 4156 AD
town: Rumpt
website: www.planetcapital.nl
www.hydrogenllc.com

contact person: Mr Leo Blomen
telephone: +31 345 683 993
fax: +31 345 681 379
e-mail: e-mail: blomenco@euronet.nl

products: Management, financing, consultancy, entrepreneurship.
organisation: Management and financing of enterprises that focus on sustainable energy, general energy technology, water and environmental technology, telecommunications and other innovations. Since 2005 Blomenco is partner in Planet Capital management B.V., a venture firm investing in and managing sustainable energy technology ventures. Blomenco is also under contract to act as Chief Executive Officer of the management team of the USA-based public company HydroGen LLC / HydroGen Corporation [HYDG on Nasdaq OTC], with air-cooled phosphoric acid fuel cell technology for industrial and utility applications in the multi-MW range.

networks: Social Venture Network

projects:

- Hydrogen technology related projects have included market introduction of complete fuel cell power plants.
- Hydrogen plant technology.
- Steam reformer development.
- Energy economics of sustainable energy and water technologies.
- Offshore carbon dioxide removal.
- System design and integration of fuel cell- gas turbine combination systems.
- Management and sale of fuel cell intellectual property and sustainable energy companies.
- Board memberships in energy, water and environmental companies worldwide.



organisation: **BOVAG**

address: Kosterijland 15

postal code: 3981 AJ

town: Bunnik

website: www.bovag.nl

contact person: Mr Erik de Vries

telephone: +31 30 659 5403

fax: +31 30 656 7835

e-mail: bbt@bovag.nl

products: BOVAG is a trade association whose members include nearly 11,000 companies operating in the field of fuel, transport, vehicles, etc. The association's Fuel Station Department represents the interests of almost 1,800 filling stations in the Netherlands, and is the largest association for refuelling stations. The organisation's main activities include lobbying, contract negotiations, research, operating a call centre for members, and gathering/distributing useful information for entrepreneurs.

organisation: Association with 11,000 members and 11 departments. Each department focuses on a specific sector, and has its own board, which consists mostly of independent retailers.

networks: VNO

projects: Organisation of a Fuel Congress, November 2005



organisation: **BTG (Biomass Technology Group BV)**

address: Pantheon 12
postal code: 7521 PR
town: Enschede
website: www.btgworld.com

contact person: dr. ir. L. van de Beld
telephone: +31 53 486 2288
fax: +31 53 486 1180
e-mail: vandebeld@btgworld.com

products

- Biomass Technology Group (BTG) provides services for generating energy and biofuels from biomass.
- The consultancy section provides advice, carries out studies and develops projects. Specific expertise includes biomass import, logistics and obtaining permits.
- The research section provides contract studies and develops technologies. BTG also acts as engineering contractor and has its own research laboratory.
- Specific expertise and test facilities are available for biomass pyrolysis, bio-oil applications, gasification of wet mass in supercritical water, and tar removal.
- In collaboration with subsidiary Bioheat International BV, BTG is also working on JI/CDM (Joint Implementation / Clean Development Mechanism) projects.

organisation: Over the past 25 year BTG has specialised in biomass conversion systems for the production of high-value fuels and energy. BTG's mission is the worldwide development and implementation of bioenergy systems. BTG Central Europe, BTG Estland and Bioheat International are all subsidiaries of the BTG group.

networks: IEA Hydrogen - Annex 16B
NWO-ACTS - Sustainable Hydrogen

projects: Superhydrogen, Winegas: Production of renewable hydrogen via gasification of wet biomass in supercritical water.
Renewable hydrogen: inventory of hydrogen production processes.



organisation: ***CEA (communication and advice on energy and the environment)***

address: Westblaak 226
postal code: 3012 KP
town: Rotterdam
website: www.cea.nl

contact person: Hugo Burger
telephone: +31 10 280 5670
fax: +31 10 280 5654
e-mail: hburger@cea.nl

products: CEA has set up the Wabest platform, together with Air Products, Remeha, Nefit, Pipelife, Leeuwarden, Utrecht and Arnhem local authorities, plus CEA, Gastec and Kipperman. This is a platform within which industry and governments work together on stationary hydrogen applications in towns and cities. Wabest works:

- With a vision for the shorter and longer term – no ‘one hit wonders’,
- Using integral system analysis – hydrogen plays a full role in the total system,
- from paper to hardware – including liquid and gaseous hydrogen, and modified heating boilers, Wabest has good contacts with manufacturers of reformers and fuel cells,
- with one eye on the social/community circumstances.

For governments, Wabest forms the bridge leading to new policies. Wabest implements policy analyses and communicates with the various internal and external stakeholders. Support therefore forms the key to success.

organisation: Various companies and governments work within Wabest on new initiatives concerning the use of hydrogen for stationary applications in the built environment. Further to the first feasibility study, Wabest is now looking for specific projects. Applicants can make use of the SenterNovem’s Unique Opportunities Scheme.

projects: Inventory of attitudes within the Fire Departments and insurance sector with regard to hydrogen.

Energy transition process Wabest (using hydrogen in towns).



organisation: **CEPAration BV**

address: Lage Dijk 29 B
postal code: 5705 BX
town: Helmond
website: www.ceparation.com

contact person: Dr Rinse A. Terpstra
telephone: +31 492 565 330
fax: +31 492 590 010
e-mail: terpstra@ceparation.com

products: Ceramic membranes for gas separation;

- a) High-flux, high-temperature, Knudsen selectivity: status = available
- b) Medium-flux, high-temperature, high selectivity: status = development

organisation: CEPAration BV is a Dutch company that develops, manufactures and sells proprietary ceramic hollow-fibre membranes and modules for liquid-separation and gas-separation applications.

The company's head office, production and development facilities are located in Helmond, near Eindhoven. The sales and application departments are located in Leeuwarden, Friesland.

networks: None (yet)

projects: None (yet)

CEPA*ration*

organisation: **Corus**

address: Wenckebachstraat 1

postal code: 1951 JZ

town: Velsen-Noord

website: www.corusgroup.com

contact person: Ir. J.F.C.-J.M. Reijerse

telephone: +31 251 499 716

fax: +31 251 470 344

e-mail: joost.reijerse@corusgroup.com

products: Corus manufactures and supplies steel and aluminium products for various applications such as construction and engineering, the automotive industry, transport, and the packaging sector.

Corus' relationship to hydrogen: Corus develops metal separator plates for the polymer electrolyte membrane fuel cell.

organisation: The Corus Group plc has a turnover of 11.5 billion euro. Corus has 21 business units and the head office is located in London. The group has production facilities in 17 countries and sales offices in 41 countries.

Corus Research, Development and Technology is the central laboratory for the group, with around 900 employees in the UK and the Netherlands (IJmuiden).

networks: Collaboration with ECN with regard to fuel cells.

projects: Senter project EDI03076 with ECN to develop a fuel cell stack containing metal separator plates.



organisation: **Deerns Consulting Engineers BV /
Deerns raadgevende ingenieurs BV**

address: Fleminglaan 10
postal code: 2280 CE
town: Rijswijk
website: www.deerns.nl

contact person: Jan Grift
telephone: +31 70 395 7612
fax: +31 70 395 7621
e-mail: j.grift@deerns.nl

products:

- Research and development
- Observations
- Applications
- Services

Deerns is one of the Netherlands' leading advisors and designers of technical facilities in the built environment. The advisory services provided by Deerns cover all disciplines with regard to built environment installations. Our mechanical engineers, electrotechnical and energy-technical expertise forms the basis of these services. We also have in-depth specialist knowledge of a great many sub-aspects. We can often answer very specific questions from our clients by using our knowledge of these sub-aspects, thus creating a building that best matches the client's requirements.

organisation: Deerns helps to create a comfortable, sage and sustainable climate in which to live and work. We develop the complete technical infrastructure, from initial concept up to detailed design and management of the implementation. Our input ranges from energy studies, developing an optimum indoor climate and lighting concept, to effective security plans, an uninterrupted energy supply, a well-functioning data communication system, plus management and maintenance. The results are often innovative, always thorough and well thought out, and certainly based on the foundations of sustainability and cost efficiency. Architects, project developers, real-estate investors, government bodies, construction and project management companies and organisations in the construction industry, are all valued clients.

networks: Dutch Hydrogen and Fuel cell Association.

projects:

- market inventory of fuel cells.
- fuel cell demonstration Dillenhof Klazienaveen.

organisation: ***Delft University of Technology,
Applied Sciences, Dept R3***

address: Mekelweg 15
postal code: 2629 JB
town: Delft
website: <http://nm.iri.tudelft.nl> (being revised)

contact person: F.M. Mulder
telephone: +31 15 278 4870
fax: +31 15 278 8303
e-mail: f.m.mulder@tnw.tudelft.nl

products:

- Research on fundamental aspects of energy storage and conversion materials.
- Hydrogen storage materials.
- Fuel cell electrolytes.

organisation: Delft University of Technology
Faculty of Applied Sciences
Department R3, section Fundamental Aspects of Materials and Energy

networks: Various national and international collaborations with other institutes and universities.

projects:

- Catalysed light metal hybrids.
- Nano-structured carbons, metal organic frameworks.
- Intermediate temperature fuel cell electrolytes.

organisation: **Delft University of Technology -
Delft Institute for Sustainable Energy (DISE)**

address: Julianalaan 136
postal code: 2628 BL
town: Delft
website: www.energy.tudelft.nl

contact person: Prof. Dr. J. Schoonman
telephone: +31 15 278 2647
fax: +31 15 278 8047
e-mail: j.schoonman@tnw.tudelft.nl

products: Renewable energy sources, such as sunlight, wind, and biomass will play an increasingly important role in the future. A large part of the required technology still needs to be developed. Delft University of Technology provides an important contribution to these developments through scientific research on new materials and devices for converting and storing renewable energy. An important part of these research activities focus on sustainable hydrogen. Current efforts include the development of new photocatalysts for sunlight-induced splitting of water into hydrogen and oxygen. Another example is the recent discovery of gas hydrates for the safe storage of hydrogen.

organisation: Delft University of Technology (TU Delft) is a centre for scientific and technological research and education. Its mission is to contribute to a safe, healthy, comfortable, and sustainable society. TU Delft currently employs around 6,000 personnel, half of which are scientific staff. The university includes around 13,000 students; around 10% of which come from abroad. Most of the university's research efforts on the production, storage and utilisation of sustainable energy (e.g. solar cells, wind turbines, biomass, hydrogen production and storage, lithium-ion batteries, etc.) are integrated within the Delft Institute for Sustainable Energy (DISE).

networks:

- The Dutch Platform for Advanced Catalytic Technologies for Sustainability (ACTS)
- Annex 20 Programme 'Hydrogen from water photolysis', International Energy Agency/ Hydrogen implementing agreement (IEA/HIA)

projects: ACTS



organisation: **DeMaCo Holland BV**

address: Oester 2
postal code: 1723 ZG
town: Noord-Scharwoude
website: www.DeMaCo.nl

contact person: Marco Versterre
telephone: +31 226 332 136
fax: +31 226 332 112
e-mail: mv@DeMaCo.nl

products:

- Integrated cryogenic-related projects.
- Cryogenic transfer lines.
- Cryogenic valves.
- Phase separators.
- Valve boxes.
- Storage tanks.
- Liquefaction equipment.
- Liquid hydrogen applications for industry, aerospace and research laboratories.

organisation: DeMaCo Holland focuses on integrated cryogenic-related projects. DeMaCo Holland has its own highly specialised engineering department (20 engineers) and is active throughout the industry, aerospace and research laboratories: in fact anywhere that liquid gas solutions are required.

With over 20 years experience in cryogenics DeMaCo is active on a worldwide basis. Most manufacturing is done in-house (total 90 employees). Most projects are installed by special installation teams from DeMaCo. The ISO2000 procedures that DeMaCo has incorporated ensure that products are supplied with the quality determined at the beginning of the project and at the time they are required. The DemaCo engineering team has experience with applications starting from 1.8 Kelvin.

projects:

- Iwatani hydrogen plant Kansai 2005.
- Hydrogen piping and storage at diverse applications.
- Aerospace (snecma/airliquide rocket engine testing centre, DLR/Messer rocket engine testing centre, ISRO/Inox (launch pad), LPC/Linde (rocket engine testing centre)).



organisation: **DSM Solutech BV**

address: Eisterweg 4
postal code: 6422 PN
town: Heerlen
website: www.solupor.com and www.dsm.com

contact person: G.H.M. Calis
telephone: +31 46 476 1546
fax: +31 46 476 1396
e-mail: gijs.calis@dsm.com

products: DSM Solutech manufactures microporous polymer foils under the Solupor product name. These (U)HMWPE foils have a high porosity, are extremely strong, and can be very thin. They are mainly used for supercapacitors, lithium batteries and polymer fuel cells (PEMFC). Solupor is used in PEMFCs as a basic for a composite membrane. This membrane is therefore thinner and stronger than counterparts that only consist of ionomer. DSM also sells a Solupor composite membrane.

organisation: DSM Solutech BV was first established in 1993, with headquarters in Heerlen. It is a 100% subsidiary of the DSM Group, and is part of the Venturing and Business Development Business Group.

networks: DPI
NWO
KNCV

projects: Various projects with leading institutes and companies concerning PEMFCs, for developing composite membranes with better electrochemical performance and better mechanical characteristics than unstrengthened ionomer membranes. Development of other Solupor applications with respect to PEMFC technology.



organisation: ***Dutch Biological Hydrogen Foundation
(DBHF)***

address: Wageningen University, Proceskunde Dept., Bomenweg 2
postal code: 6703 HD
town: Wageningen
website: www.biohydrogen.nl

contact person: J.H. Reith (secretariat)
telephone: +31 224 564 371
fax: +31 224 568 487
e-mail: reith@ecn.nl

products: The activities of the Dutch Biological Hydrogen Foundation comprise:

- co-organisation of workshops and conferences
- promotion of knowledge exchange, research and development through the Netherlands Biohydrogen Network
- participation in the IEA Hydrogen Programme
- provision of grants for conference participation by young researchers
- publications
- participation in the Internet platform www.biohydrogen.nl.

organisation: The Dutch Biological Hydrogen Foundation was founded in 2001. Its objectives are to promote research and development, national/international cooperation and knowledge exchange with regard to biological hydrogen production.

projects: The foundation co-organised the international conference 'BioHydrogen 2002', held 21-24 April 2002, in Ede, under the auspices of the IEA (International Energy Agency) and the EU 'COST' programme (Cooperation in the field of Scientific and Technical research). This conference was sponsored by Novem, ECN, and Samsung.

Publications: 'Bio-methane and Bio-hydrogen: status and perspectives of biological methane and hydrogen production'. Edited by J.H. Reith, R.H. Wijffels and H. Barten. 2003. ISBN 90-9017165-7. This publication can be downloaded (in pdf format) from the website: www.biohydrogen.nl.

organisation: **Duurzaamheidscentrum Lauwersoog /
Sustainability Centre Lauwersoog**

address: Zuiderparklaan 4
postal code: 9951 TL
town: Winsum
website: www.duurzaamheidscentrum.nl

contact person: Tineke van der Schoor
e-mail: duurzaamheidscentrum@hotmail.com

products:

- Development of (regional) visions on, and creating public acceptance of, new and renewable energy technologies such as hydrogen.
- Creating coalitions and platforms to develop new ways of using hydrogen.

organisation: Sustainability Centre Lauwersoog is located in the north of the Netherlands, and provides information to the general public regarding energy, water and nature. The necessary transition to a sustainable energy system forms the backbone of our work on new energy techniques. Educating the general public, demonstrating new techniques and developing 'experiences' are among our most important activities.

networks: Energy Valley

projects: The Sustainability Centre is still in the start-up phase. The first specific activity is a collaborative project known as Sustainable Wad Fleet.

organisation: ***DWA installation and energy advice***

address: Duitslandweg 4

postal code: 2411 NT

town: Bodegraven

website: www.dwa.nl

contact person: ing. R.C.A. Schilt

telephone: +31 172 635 336

fax: +31 172 635 301

e-mail: schilt@dwa.nl

- products:*
- Research
 - Energy Consultancy
 - Building Physics
 - Installation Consultancy
 - Industrial Installation Consultancy
 - Management and Maintenance
 - Monitoring
 - Financial and Subsidy Consultancy
 - Control Consultancy
 - Management Consultancy
 - Knowledge Transmission
 - Secondment

organisation: DWA is an independent consultancy company (a member of ONRI, the Dutch Association of Consulting Engineers), which specialises in providing consultative services regarding technical installations and energy systems. Interesting consultative service products have been created through the company's own research efforts, e.g. integrated energy systems and specialist software for calculating energy flows. See our website for more information.

networks: ONRI (Dutch Assoc. of Consulting Engineers)
OVEA (Order of Energy Advisors)
TVVL (Dutch Society for Building Services)
AEC
Ibipza

projects: Inventory of fuel cells
Fuel cell demonstration project in the Palace quarter, Den Bosch



organisation: **ECM Technologies**

address: Castorweg 56
postal code: 8938 BE
town: Leeuwarden
website: www.electrochemicalmachining.com

contact person: Hans-Henk Wolters
telephone: +31 6 223 79750
fax: +31 184 711 5507
e-mail: wolters@electrochemicalmachining.com

products: Electrochemical machining (ECM) is an interesting technique for manufacturing the stacks in fuel cells. During ECM the metal produces hydrogen gas as a waste product.

This could be used as an energy carrier at some point in the future.

organisation: ECM Technologies specialises in ECM research and consultancy. ECM is a metal machining technique that is well known for its high quality, accuracy and fast machining speed. Several developments over the last 30 years have resulted in a new generation ECM technique being developed. It is expected that this technology will become a fully competitive operational machining technique within a few years.

projects: ECM Technologies are currently implementing a market study into the feasibility of manufacturing reactor plates through ECM techniques. The company has therefore contacted worldwide organisations that are working towards alternative fuel techniques.

miscellaneous: Production of reactor plates for fuel cells.



organisation: **ECO Ceramics BV**

address: Staalstraat 10
postal code: 1951 JP
town: Velsen Noord
website: www.ecoceramics.nl

contact person: Herman Goverse
telephone: +31 251 229 212
fax: +31 251 229 615
e-mail: info@ecoceramics.nl

products:

- Flat-flame ceramic foam burners (capacities from 100-2000 kW/m²). The burners are suitable for most gases and enriching methane with 70% hydrogen.
- Design and manufacture of burner systems up to 1000 kW, mainly for drying processes; designed and built in accordance with CE regulations.
- Ceramic micro-filtration membranes
- Design and manufacture of Cross-Flow Membrane Filtration installations.

organisation: ECO Ceramics BV is an independent small to medium-sized company that develops and manufactures porous ceramic products based on various technology licences. Ceramic membranes have been produced at the location in Velsen Noord since 1990. The company has been manufacturing and developing ceramic foam burners for various domestic heating appliances, as well as industrial heating and drying processes, since 1996.

projects: ECO Ceramics BV is a partner in the EET hydrogen development project 'Greening of Gas' (VG2).



organisation: **Ecofys**

address: Kanaalweg 16-G
postal code: 3526 KL
town: Utrecht
website: www.ecofys.nl
www.ecofys.com

contact person: dr ir Robert van den Hoed
telephone: + 31 30 280 8479
fax: + 31 30 280 8301
e-mail: r.vandehoed@ecofys.nl

products: products: Ecofys specialises in developing integrated sustainable energy solutions. Ecofys consults a broad scope of industries, local governments and the building sector concerning their energy strategies. With extensive knowledge over the full range of sustainable energy technologies, and a strong network of technology suppliers as well as market parties, Ecofys provides services concerning:

- Techno-economic feasibility studies
- Business development for hydrogen technology suppliers
- Financing schemes including regional, national and European subsidy opportunities
- Implementation of policy analysis at regional, national and European levels
- System development of hydrogen-based fuel cell systems

organisation: Ecofys is a prominent consultancy in the field of sustainable energy, energy conservation and climate change, which currently has more than 180 employees in seven countries, including the Netherlands, Germany, UK, Belgium, Spain, Poland and Italy. The company develops integrated sustainable energy solutions for a broad spectrum of clients in industry, local governments and the building sector. Ecofys is part of the E-concern group (www.e-concern.com), which also consists of Evelop (project development), Ecostream (system supply) and Ecoventures (venture capital). E-concern's mission statement is: 'A sustainable energy supply for everyone'.
projects: Several techno-economic, feasibility, and demonstration studies, including micro CHP, stationary fuel cells, fuel cell boats, transportation, and hydrogen infrastructure development.

ECOFYS

organisation: **Energieonderzoek Centrum Nederland
(ECN)**

address: Westerduinweg 3
postal code: 1755 LE
town: Petten
website: www.ecn.nl

contact person: Mr Frank de Bruijn
telephone: + 31 224 564 089
fax: + 31 224 568 489
e-mail: debruijn@ecn.nl

products:

- High-temperature fuel cells (SOFC)
- Low-temperature fuel cells (PEMFC)
- Hydrogen production (reforming, electrolysis)
- System integration for mobile and stationary applications
- Conceptual studies for hydrogen infrastructures
- CO₂ capture
- Electricity storage
- Technical roadmaps

organisation: ECN is an independent research institute that specialises in R&D of technologies required in the transition towards a sustainable energy management. ECN's 'Hydrogen and CO₂ capture' unit carries out the hydrogen, fuel cells and CO₂ capture programme. This unit includes around 60 personnel who work on long-term projects for governments and large companies, plus medium-term and short-term projects for large and small companies. The unit is an active partner in many EOS, IS and EU projects.

networks:

- IEA Advanced Fuel Cells
- IEA Hydrogen
- Locogen
- Fuel Cell Europe
- SOFCnet
- FCtestnet
- CO₂-net
- Cogen Europe
- MicroCHEAP
- Dutch Hydrogen and Fuel cell Association
- Electrochemical Society

projects:

ECN is involved in many European and national projects.

On SOFC development, ECN participates in the following projects under the EU's 6th Framework Programme (FP6):

- REALSOFC: R&D on cost-effective, durable SOFC components
- BIOCELLUS and GREEN FUEL CELL: SOFC on gasified biomass
- SOFC 600 (ECN is coordinator): SOFC cell development for operation at 600°C.
- FLAME SOFC: SOFC system development for micro-CHP applications
- 5th Framework Programme projects, in their final stage or just completed
- CORE-SOFC: R&D on durable SOFC cells and stack components

With respect to PEMFCs, ECN participates in the following FP6 projects:

- AUTOBRANE: R&D on cells suitable for operation above 100°C, for automotive applications
- HYTRAN: system development for automotive applications (FIAT PANDA 4x4)
- FP5 projects, in their final stage or just completed
- 50 PEM HEAP: cell, stack and system development for stationary CHP and UPS systems up to 50 kW
- FRESCO: development fuel cell stack and system for a fuel cell scooter

National projects, in cooperation with Nedstack and HyGear:

- HotPems: R&D on PEMFC above 100°C for CHP applications
- DuoGen: R&D on natural gas-fed hydrogen production units combined with a PEMFC system for fuelling stations

With respect to hydrogen production, ECN participates in the following FP6 projects:

- CELINA: hydrogen production from kerosene for aeronautic applications
- FP5 projects, in their final stage or just completed
- Profuel: hydrogen production from petrol for automotive applications
- BioFEAT: hydrogen production from biodiesel for automotive applications
- Bio-H2: hydrogen production from bioethanol for automotive applications
- Mirthe: hydrogen production from methanol for portable applications
- DESIRE: hydrogen production from marine diesel for ships

With respect to a hydrogen society, ECN participates in the following FP6 projects:

- HYSOCIETY, HYROADS, HYWAYS, focusing on road-mapping for European countries, socioeconomic aspects of hydrogen introduction
- NATURALHY: mixing hydrogen in a natural gas infrastructure



organisation: **Energy +i.d.**

address: Boslaan 7 / PO Box 2058

postal code: 9301 KH

town: Roden

website: www.eplus-id.nl

contact person: Renee Janssen - van Rosmalen

telephone: +31 50 501 3242 / +31 6 558 02 321

fax: +31 50 501 5950

e-mail: renee-energyplus@gmx.net

products:

- Strategy and feasibility studies on energy and environmental topics;
- Development of sustainable system concepts and products.

organisation: Consultancy bureau, associated with Beci.

networks:

- Dutch Hydrogen Association
- ENGVA (European association for natural gas vehicles)

projects: Several strategy and feasibility studies:

- Coordination of a SenterNovem project: Greening of gas
- Participation in project team Costa Due van Provincie Groningen (feasibility of biomass in the north of the Netherlands).
- Strategic studies for the scientific Institute of the Dutch Christian Democratic Party.

organisation: **ENGVA (European Natural Gas Vehicle Association)**

address: Kruisweg 813 A
postal code: 2132 NG
town: Hoofddorp
website: www.engva.org

contact person: Jeffrey Seisler
telephone: +31 23 554 3050
fax: +31 23 557 9065
e-mail: info@engva.nl

products:

- ENGVA aims to create an economically attractive market for NGVs in Europe and lobbies with governments, policy makers at European, national and local levels in order to achieve this. The association provides its members with information and communication, and keeps them informed of new technical developments.
- ENGVA also sponsors training, symposia and conferences on various related subjects.

organisation: ENGVA was established in January 1994 by a core group of 63 members from 17 countries. These included natural gas utilities, NGV equipment and vehicle manufacturers, as well as environmental organisations and individuals. Its membership currently includes over 275 companies and individuals from 45 countries.

ENGVA's mission is to develop a sustainable and profitable market for NGVs throughout Europe by creating a favourable political and economic environment that encourages the development of NGV technology as well as a European fuelling infrastructure.

ENGVA encourages the direct use of natural gas to hydrogen. The long-term objective is to have engines running on hydrogen.

networks: IANGV (International Assoc. for Natural Gas Vehicles)
UITP (International Union of Public Transport)



organisation: **Ernst & Young Grants and Incentives**

address: Boompjes 258

postal code: 3011 XZ

town: Rotterdam

website: www.ey.nl

contact person: drs. P. Schipper

telephone: +31 10 406 8804

fax: +31 10 406 8680

e-mail: grantsandincentives@nl.ey.com

products:

- Inventory of all grant opportunities at local, national, European and international levels
- Preparation and filing of applications
- Project management
- Advisory services
- Appeals

organisation: Ernst & Young's Global Incentives Advisor, a global team of dedicated local professionals (more than 500 professionals across five continents), is uniquely positioned to identify and secure optimum benefits for our client's projects. The Dutch team of Global Incentives Advisor, Ernst & Young Grants and Incentives consists of 90 specialists located in seven towns in the Netherlands, therefore securing knowledge of and experience in European as well as Dutch and local grants and incentives. The Expert Group Energy & Environment consists of (technical) grant specialists, strongly focusing on energy efficiency and sustainable development.

miscellaneous: Subsidy provision, in the broadest sense of the term.

organisation: **Europe's Energy Point**

address: Kerklaan 9
postal code: 7211 BJ
town: Eefde
website: www.energy-point.com

contact person: Mr Hans Hof
telephone: +31 575 513 553 / +31 6 535 84 265
fax: +31 575 513 593
e-mail: hans.hof@energy-point.com

products: Europe's Energy Point is boosting higher quality systems for the greater European Union by:

- Stimulating fuel saving.
- Improving energy efficiency.
- Improving the operation of energy systems.
- Encouraging the use of renewable energy.
- Introducing innovations.

organisation: Europe's Energy Point is a dynamic consultancy company that:

- Provides high-quality energy and environment consultancy.
- Supplies top-quality products.
- Has an independent position in the market.
- Focuses on innovative applications.

networks:

- Arnhem Hydrogen Network
- European Hydrogen and Fuel Cell Platform
- COGEN Europe
- Euroheat and Power

projects:

- Hydrogen project for 'de Stoere Houtman' in Arnhem.
- Presentations and knowledge transfer of hydrogen technology.
- Theme-days on hydrogen knowledge.
- Hydrogen project in Spain.
- Learning materials on hydrogen knowledge for secondary schools.
- Entrepreneur's initiatives.
- Sustainable energy projects.

**EUROPE'S
ENERGY
POINT** 

organisation: **EXENDIS**

address: Keesomstraat 4

postal code: 6716 AB

town: Ede

website: www.exendis.com

contact person: Evert Raaijen

telephone: +31 318 676 151

fax: +31 318 624 615

e-mail: e.raaijen@exendis.com

- products:*
- Battery chargers for disabled (and less-abled) personal transport
 - Automotive power conversion and battery management products
 - Frequency converters and power conversion products for railway applications
 - Shore-power inverters for luxury yachts
 - Military power supplies and battery chargers
 - Solar energy inverters
 - Fuel cell inverters

organisation: The dedicated systems, products and services that Exendis produces are supplied, for example, to convert energy to a reliable and sustainable energy supply. EXENDIS is listed on the Amsterdam stock exchange and has enterprises in the Netherlands and Hungary.

Energy Systems Mobility supplies an extensive range of battery charging systems for transport applications, control and supervising systems.

Energy Systems Infrastructure supplies energy supply systems for industrial, railway, marine, defence and special applications. Energy Systems for Renewable Energy supplies inverters for the renewable energy sector.

networks: EMVT association

IOP EMVT

Contact with ECN, NEDSTACK, Gasunie, Nefit and HyGear

projects: Several cogeneration projects:

- HOTPEMS
- SBIR (funded by the Dutch Ministry of Economic Affairs)



organisation: **Formula Zero B.V.**

address: Keizersgracht 6 sous

postal code: 1015 CN

town: Amsterdam

website: www.formulazero.nl

contact person: Godert van Hardenbroek

telephone: +31 20-622 6327

e-mail: g.v.hardenbroek@formulazero.nl

- products:*
- Formula Zero is developing the world's fastest hydrogen go-kart using fuel cells (0-100 km/h in 5.6 sec). A new zero-emission racing class (FORMULA ZERO) will be set up for this type of vehicle.
 - Organisations can become associated with this new phenomenon, by sponsoring these remarkable zero-emission races.

organisation: Formula Zero BV is a privately owned company, founded by Eelco Rietveld and Godert Van Hardenbroek. The company's mission is to promote well to wheel zero-emission technologies by racing with fuel-cell-powered cars.

projects: 'Realisation Hydrogen go-kart' (this project was partly financed by a subsidy from the UKR). This is a collaborative project with TNO Automotive and Bradford Instruments. Objectives include: building a hydrogen go-kart using fuel cells and achieving world-record acceleration for fuel cell vehicles with this go-kart.

FORMULA**ZERO**[®]

organisation: **Gasunie Engineering & Technology (GET)**

address: Energieweg 17
postal code: 9743 AN
town: Groningen
website: www.getgasunie.nl

contact person: H. Levinsky/O. Florisson
telephone: +31 50 521 2677/2651
fax: +31 50 521 1946
e-mail: h.b.levinsky@gasunie.nl / o.florisson@gasunie.nl

products: Research, development, innovation, analysis, measurements, testing, calibration, studies, audits, engineering, consultancy, and training with regard to the transport and use of natural gas and gaseous energy carriers.

organisation: Gasunie Engineering & Technology (GET) is a knowledge and consultancy centre of excellence on premium gas technology. GET originated from the merger between Gasunie Engineering and Gasunie Research. N.V. Nederlandse Gasunie, one of Europe's largest gas companies, founded both divisions in the 1960s. Gasunie operates a gas transport network with a total length of approximately 12,000 kilometres.

networks:

- Hydrogen working group (part of the Energy Transition, a project of the Ministry of Economic Affairs)

projects:

- VU project v.d. Kerkhof
- EET project 'Vergroening van Gas' (greening gas)
- IP project 'Preparing for the hydrogen economy by using the existing natural gas system as a catalyst (NATUALLY)' (subsidised by the European Commission)

organisation: **Green Vision**

address: Westervoortsedijk 73

postal code: 6827 AV

town: Arnhem

contact person: Marinus van Driel

telephone: +31 645 212 054

fax: +31 263 629 323

e-mail: marinus.van.driel@green-vision.nl

products: Research and development for new energy solutions such as reformers for biomass, hydrogen storage systems, system integration etc.

organisation: Green Vision focuses on R&D for renewable energy solutions.

projects: BWP-2 (hydrogen from biomass)

Scarlet (supercritical water gasification)

organisation: ***GTC Almere Pressurecontrols***

address: Joop Geesinkweg 999, Amstel Business Park

postal code: 1096 AZ

town: Amsterdam

website: www.pressurecontrols.com

contact person: Peter van der Lichte

telephone: +31 36 536 9243

fax: +31 36 536 9242

e-mail: info@pressurecontrols.com

- products:*
- Pressure, flow and temperature components and systems.
 - Pressure regulators.
 - Sensors (pressure, flow, temperature).
 - Valves.
 - Fittings etc.
 - Test systems for hydrogen components.
 - Components and systems with a higher leakage rate.

organisation: The company supplies components and systems according to CE, PED and ATEX, including testing and certification. These include design, engineering, sales, assembling, testing and maintenance.

The company works together with a range of international suppliers, which provide feedback on their experience and additional possibilities.

networks: ENGVA-ISPE

projects: Supplying design and engineering skills from various national projects.



organisation: **HAN University Arnhem**
(Mobility Technology Research)

address: Beverweerdlaan 3
postal code: 6825 AE
town: Arnhem
website: www.mobtech.nl

contact person: Mr J.C.N. Bosma
telephone: +31 26 3 65 83 11
fax: +31 26 3 65 81 26
e-mail: hans.bosma@han.nl

products:

- Advice and research on topics concerning hydrogen as an energy carrier.
- Demonstration of new hydrogen applications.
- Development of hardware concepts concerning hydrogen.
- Knowledge transfer.

organisation: The Department of Mobility Technology Research is part of HAN University (known by its Dutch initials, HAN). The department's independent position, with respect to the faculties of HAN University, makes it uniquely placed to enable both the business and governmental organisations to utilise the expertise within the university's various faculties.

The Department of Mobility Technology Research undertakes research, studies and consultative activities in the field of traffic and transport.

There is a special focus on the following topics:

- I. Clean mobility and the environment.
- II. Intelligent traffic and transport (man-vehicle-environment).

The department's hydrogen activities are part of the first topic. Apart from hydrogen applications in transportation, other hydrogen applications are also of interest.

networks:

- Arnhem Hydrogen Network
- Hydrogen and Fuel Cell Technology Platform (IG Education and Training)

projects:

- Clean Car; using blends of natural gas / hydrogen in ICE's, both in stationary applications and in vehicles
- RAAK Technical expert centre for hydrogen; programme with projects along the total hydrogen chain

organisation: **Homeowners Association
'De Stoere Houtman'**

address: De Houtmanstraat 18
postal code: 6826 PJ
town: Arnhem
website: www.destoerehoutman.nl

contact person: Jaap Huurman
telephone: +31 26 362 9962
e-mail: nulmat@bos.nl

products: De Stoere Houtman has initiated a feasibility-study to clarify whether or not hydrogen can be used as an energy carrier at neighbourhood level. This feasibility study also includes a further investigation into using a combination of sustainable energy (such as wind, sun and biomass) rather than fossil fuels. The ultimate goal for the residents is to reduce their overall utility bills by applying sustainable forms of energy. The study recommends cost-saving energy facilities for the residents combined with the cleanest possible way of generating power (measured as a reduction in CO₂ emissions), including the (im)possibilities of using hydrogen in a residential area.

organisation: 'De Stoere Houtman' (which means 'the strong woodman') is an association of private homeowners (138 houses) in and around De Houtmanstraat in the post-war neighbourhood of Presik-haaf in Arnhem, the Netherlands. The homeowners started organising themselves into a structured group when the local authority (in 2001) announced plans to buy these houses, demolish them and replace them with new homes. Because the owners submitted innovative ideas concerning the renovation of these houses and their surroundings, in 2002 they received financial support from the Dutch Ministry of Spatial Planning, Housing and the Environment. This grant allows the homeowners to develop more innovative ideas, one of these being energy management, including the use of hydrogen.

networks: Initiative Group on Financing and Business Development in the European Hydrogen and Fuel Cell Technology Platform

projects: Arnhem Hydrogen Network

notes: Any community organisation that is interested in using hydrogen in their homes is very welcome to join the Worldwide Network of HyCommunities. We can only advise (future) hydrogen consumers to organise themselves and get in touch with us!



organisation: **Hydrogen Network Enterprise (H2NE)**

address: Westervoortsedijk73

postal code: 6827 AV

town: Arnhem

website: www.H2NE.nl

contact person: ir. E.A.M. de Nie

telephone: +31 481 377 258

fax: +31 481 350 449

e-mail: e.denie@h2ne.nl

- products:*
- H2NE focuses on achieving an innovative industrial estate consisting of around 15 companies specialising in the manufacture of hydrogen equipment and application of hydrogen systems.
 - This involves creating a favourable business climate for companies wanting to set up a hydrogen business, i.e. technology transfer, combined marketing, the presence of hydrogen-qualified personnel and specialised facilitating services.

organisation: H2NE is still in the initial stages and is a European-supported development project, in which the Industrial Cluster is gaining both form and financing. As the participating companies join the group, the synergy between them will be supported by a communal company known as the Hydrogen Facilitator.

H2NE

organisation: **HyGear**

address: Westervoortsedijk 73

postal code: 6827 AV

town: Arnhem

website: www.hygear.nl

contact person: Jacques Smolenaars

telephone: +31 26 366 3238

fax: +31 26 362 9323

e-mail: jacques.smolenaars@hygear.nl

products:

- Hydrogen production units.
- Reformers for fuel cells.
- Laboratory equipment for testing fuel cells, reformers and other hydrogen equipment.

organisation: HyGear is a small to medium-sized company based in Arnhem. The company develops and manufactures hydrogen production units for various purposes, e.g. on-site hydrogen production for industrial applications, on-site hydrogen production for refuelling stations and reformers for fuel cells.

networks: The European Hydrogen and Fuel Cell Technology Platform.
Fuel Cell Europe.

projects:

- Research and development of a hydrogen production unit and a fuel cell system for cogeneration coupling in non-residential buildings (Senter EDI).
- HyWays (EU 6th Framework Programme, under the Roadmap Towards a Hydrogen Economy).
- Practical experiment to supply hydrogen via a small-scale fuel processor (Senter Energy Conservation Programme).
- Hotpems - development of high temperature fuel cell system technology.
- Nemesis - development of hydrogen generation technology from diesel and gasoline.

organisation: ***Informatiecentrum Duurzame Energie
Technieken/Information centre for
sustainable energy techniques (Idet)***

address: Van Voordenpark 6k
postal code: 5301 KP
town: Zaltbommel
website: www.idet.nl

contact person: Mr Martin Kleintunte
telephone: +31 418 577 030
fax: +31 418 510 179
e-mail: martin@idet.nl

products:

- Information centre concerning sustainable and renewable energy for buildings.
- Development of new energy concepts for buildings and houses: workshops, monitoring, and demonstration of new techniques.
- Presenting new developments that are currently in the demonstration phase, and that can be widely used in the market.

organisation: Idet is an information centre for sustainable and renewable energy technologies (formerly known as Foundation "Dubotechniek"). The centre's exposition room is used to demonstrate new developments in sustainable and renewable energy technologies relating to buildings. Advisory services on new building development are provided to architects, local authorities etc. Idet is able to monitor web-based services.

networks:

- Advanced networking for sustainable fragmentation.
- Fuel cell standards.

projects: Testing the Vaillant central-heating fuel cell.

organisation: ***Innovation Support & partners***

address: Pascalstraat 12

postal code: 2811 EL

town: Reeuwijk

contact person: Drs. Pieter H. van Dijkum

telephone: +31 182 393 854

fax: +31 182 393 061

e-mail: van.dijkum.fceu@planet.nl

- products:*
- Editor-in-chief of the 'Fuel Cell Europe' quarterly magazine entitled 'Fuel Cell Europe Impulse'.
 - Consultancy and project acquisition, plus management regarding (hydrogen and) fuel cells.
 - Consultancy regarding European product legislation and maintenance.
 - Monitoring of energy projects supported by the European Commission.

organisation: Partnership of two senior advisors with an extensive network of specialists both inside and outside the Netherlands.

networks: Fuel Cell Europe
Fuel Cell Test Net

projects: Various projects regarding hydrogen and fuel cells in mobile applications and as APU (auxiliary power unit).

organisation: ***Institute for Energy, Directorate-General Joint Research Centre, EU***

address: Westerduinweg 3
postal code: 1755 ZG
town: Petten
website: <http://ie.jrc.cec.eu.int>

contact person: Mr Marc Steen
telephone: +31 224 565 271
fax: +31 224 565 630
e-mail: marc.steen@cec.eu.int

products: The Institute for Energy under the Joint Research Centre of the European Commission performs research into various applications of hydrogen and fuel cells. The research activities, partly performed in collaboration with other industrial and research partners, focus on assessing hydrogen storage, hydrogen sensors and fuel cells in terms of efficiency, safety and emissions. The results of this research are used as input for policy making at European level.

organisation: The Institute for Energy (IE) is part of the European Commission's Directorate General Joint Research Centre (JRC). Its mission is to provide scientific and technical support for the conception, development, implementation and monitoring of community policies related to energy. Special emphasis is given to the security of energy supply and sustainable and safe energy production. IE supports EU actions by implementing specific research programmes in the fields of clean and sustainable energy spanning both nuclear and non-nuclear domains. Activities in the non-nuclear area encompass energy recovery from waste and biomass, harmonisation and validation of safety and performance assessment of fuel cells and hydrogen storage technologies, as well as the operation of a scientific reference system on cleaner energy technologies.

networks:

- European Hydrogen and Fuel Cell Technology Platform
- International Partnership for the Hydrogen Economy
- International Energy Agency - Hydrogen Implementing Agreement
- International Energy Agency - Fuel Cell Implementing Agreement
- Hysafe Network of Excellence

projects:

- Research activities with direct funding from the European Framework Programme for Research and Technological Development.
- Research activities in collaboration with partners within the framework of the European Research Arena (NoE Hysafe, IP Storhy, IP NessHy, RTN FCTESTNET, STREP FCTESQA, IP Roads2HyCom, IP Dynamis, SSA Harmony, STREP HyApproval, STREP CELINA).



organisation: ***Integral***

address: Badhuisweg 3

postal code: 1031 CM

town: Amsterdam

website: www.integral.nl

contact person: Hauke Sie

telephone: +31 20 630 4333

fax: +31 20 630 4344

e-mail: h.sie@integral.nl

products: Knowledge management

organisation: As an information architect, the company offers practical solutions to questions concerning information and knowledge, including those relating to a hydrogen economy.

projects:

- Several own initiatives, including a website: www.waterstof.nl, which aims to facilitate and encourage a hydrogen economy.
- Production of materials relating to hydrogen.
- Development of informational and course-related material.

organisation: ***Inventech Benelux B.V.***

address: Mechelaarstraat 17

postal code: 4903 RE

town: Oosterhout

website: www.inventech.nl

contact person: John Heidenreich

telephone: +31 162 472 478

fax: +31 162 421 944

e-mail: heidenreich@inventech.nl

- products:*
- Gas analysis equipment (O₂, H₂, N₂, etc.)
 - Moisture analysers
 - Oxygen analysers (from ppt to % levels)
 - Chilled mirror and dew-point analysers
 - Density analysers of gases and liquids
 - Online viscosity analysis
 - Online water in oil analysers
 - Alarm monitoring + data acquisition
 - Flow meters (turbine and ultrasound)
 - Level meters
 - Gas and liquid filters
 - Dust emission analysers
 - Hydrogen leak detection equipment
- services:*
- Repairs
 - Maintenance contracts
 - Calibrations

organisation: Inventech Benelux is a professional supplier of a wide range of advanced test and measurement equipment. The main activities, including the service, support and sale of analytical instruments, are aimed at industrial production processes and laboratories for quality control and R&D. Customers in the Benelux countries are primarily in the process industry, power plants, pharmaceutical and food industry, petrochemical industry, laboratories, and research institutes.

organisation: ***IWO, Instituut voor Wetenschap en
Ontwikkeling (Institute for Science and
Development)***

address: Zweerslaan 46
postal code: 6711 GG
town: Ede
website: www.iwo.nl

contact person: R. Hunik
telephone: +31 26 334 1555/+31 318 693 630
fax: +31 318 693 631
e-mail: r.hunik@iwo.nl/info@iwo.nl

products:

- Innovation consultancy, courses and workshops.
- Technical consultancy and management of projects concerning sustainable technology, risk analysis and material science.
- Coaching of management and policy planning at not-for-profit organisations.
- Sociological and educational projects.
- Transfer and exchange of science, technology and culture through courses, workshops, performances and conferences.

organisation: IWO was founded in 1994 and specialises in education, coaching, consultancy and publications by implementing and/or coordinating science and development projects as well as supporting such activities. IWO aims to utilise scientific progress for constructive developments of both communities and individuals. Working in international partnerships is deliberately promoted. IWO operates through projects that are often run with temporary co-workers or via partnerships.

networks: AVERE (A European network of industrial manufacturers and suppliers of electric vehicles)

projects:

- Normalisation
- SOFC implementation
- Hunik: SOFC - CO₂ storage patent

miscellaneous: regulations, standardisation, normalisation



organisation: **KEMA**

address: Utrechtseweg 310

postal code: 6828 AR

town: Arnhem

website: www.kema.com

contact person: Ms Sandra Heus

telephone: +31 26 356 6267

fax: +31 26 351 3683

e-mail: sandra.heus@kema.com

products: KEMA is a respected advisory and testing organisation (Netherlands KEMA-approval and many other quality marks). Consultants provide technical solutions, strategic advice and insight into the financial consequences of all kinds of energy-related questions. KEMA provides a unique combination of expertise regarding the management of energy utilities and technical skills.

organisation: KEMA gives consumers more trust in the performance of products, processes and equipment for the production, distribution and use of electricity. How will the demand for power develop over the next few years? Do components or household appliances meet these criteria? Responding to these types of questions is KEMA's core business.

Internationalisation and liberalisation are closely associated with increased pressure to operate energy networks as efficiently as possible, without compromising reliability. This means improved efficiency and an investment policy that takes account of operational, tactical and strategic aspects. As an energy consultant and specialist in hallmarks and certification, KEMA is closely involved in these processes. As independent consultant, KEMA supports both suppliers and users of electricity and other forms of energy.

- networks:*
- Standards commission 310 197 'Hydrogen and fuel cells'.
 - EMVT (the association of electromagnetic power techniques).
 - NWO programme AIRE (accelerated implementation of renewables).
 - EU Network of Excellence DG_lab (a network of DER laboratories and pre-standardisation).
 - Ministry of Economic Affairs transition path for 'new gas'.



projects:

- Monitoring of a 100 kW SOFC (solid oxide fuel cell) in Arnhem.
- Study into usage aspects of hydrogen in fuel cells.
- Feasibility study of SOFCs in combination with fuel cells.
- Fuel cells in the glass horticulture sector: status and opportunities.
- Feasibility fuel-cell-based cogeneration plant for light crops in the glass horticulture sector: case studies for MCFC and SOFC-GT.
- Traffic and transport in the 21st century: a study into future prospects for electric vehicles.
- Development and implementation of a dynamic process simulator for a fuel-cell-based cogeneration plant (type ADIR-MCFC: advanced direct internal reforming molten carbonate fuel cell).
- Development and implementation of a dynamic process simulator for an 'external reforming molten carbonate fuel cell'.
- Study into the hydrogen use in gas turbines.
- System integration study: hydrogen, fuel cells and HVDC (high voltage direct current).

miscellaneous:

- System integration.
- Integrating hydrogen into the national electricity grid.



organisation: **Kiwa Gastec Certification**

address: Wilmersdorf 50

postal code: 7327 AC

town: Apeldoorn

website: www.kiwa.nl

contact person: Falco Thuis

telephone: +31 55 539 3240

fax: +31 55 539 3676

e-mail: falco.thuis@kiwa.nl

products: Kiwa Gastec Certification is an independent company specialising in testing and certification of gas-related products, including gas appliances, measurement equipment, plus installation and distribution materials. Gastec tests and certifies fuel cells and other hydrogen products, partly as a result of the active role that the company plays in developing international regulations for these products. The company also evaluates the safety of hydrogen installations.

organisation: Kiwa Gastec Certification is an independent international certification centre for gas products. The company is part of Kiwa NV in Nieuwegein, and has around 100 staff. Kiwa Gastec Certification is accredited by the Dutch Council for Accreditation and is Notified Body for European guidelines (CE marking). Testing is carried out in the company's own laboratories but can also be implemented at the manufacturer's facilities.

networks: International Standardization Organisation (ISO)

International Electro technical Commission (IEC)

International Gas Union (IGU)

projects: Testing and certifying hydrogen components and products (e.g. fuel cells), plus evaluating the safety of hydrogen installations.

organisation: **Kiwa Gastec Technology**

address: Wilmersdorf 50, PO Box 137

postal code: 7327 AC

town: Apeldoorn

website: www.kiwa.nl

contact person: Mr E.A. Polman

telephone: +31 55 539 3386

fax: +31 55 539 3335

e-mail: erik.polman@kiwa.nl

products: Technological development, including components, end products, systems, software and services to facilitate the use of natural gas and other gases for gas producers, gas utilities, network companies, OEMs and end-users.

The main focus is on renewable energy, the energy trade and gas supply infrastructure, certification of companies and products, plus engineer training.

organisation: Kiwa Gastec Technology is internationally renowned in energy-related technologies, and focuses on R&D, consultancy, engineering and training. The company's product range can be used throughout the energy supply chain, from well head to burner tip. Kiwa Gastec Technology, which joined the Kiwa Group on 1 January 2005, has around 40 highly qualified and experienced staff in Apeldoorn, the Netherlands. Kiwa Gastec Technology provides solutions for industries that are involved in the energy supply chain.

networks: GERG

NGV Holland

projects:

- IEA Greenhouse Gas Group: Reduction of CO₂ emissions by adding hydrogen to natural gas (2003)
- Using hydrogen in the current gas grid:
 1. Domestic appliances: heating boilers and cooking devices (completed in 1999)
 2. Distribution, grid capacity, leaks and gas mixing
- Development of auxiliary equipment for fuel cells (for fuel cell manufacturers)
- Development of safety systems for hydrogen vehicles (for car manufacturers)
- Sensitivity of gas engines to varying fuel compositions (hydrogen/natural gas)

organisation: **Laboratory for High Temperature Gas Kinetics, Groningen University**

address: Nijenborgh 4
postal code: 9747 AG
town: Groningen
website: www.flame.fmns.rug.nl

contact person: prof. dr. H.B. Levinsky
telephone: +31 50 521 2677
fax: +31 50 521 1946
e-mail: h.b.levinsky@gasunie.nl

products: Insight into the technical consequences of introducing hydrogen into the energy infrastructure, obtained through research into the combustion properties of hydrogen and hydrogen/natural gas mixtures.

organisation: The research activities at the Laboratory for High Temperature Gas Kinetics (Combustion Science and Engineering Unit) of the University of Groningen are aimed at understanding the elementary physical and chemical processes responsible for the behaviour of high-temperature combustion systems. The group is currently studying flame structure, in relation to flame stability and pollutant formation (NO_x), and ignition phenomena. To do so, the group develops and applies a wide range of advanced laser-diagnostic measurement techniques, and utilises analytical and numerical models to interpret the results. The group also analyses the technical consequences of policy choices (such as adding hydrogen to natural gas).

networks: Member of the NATURALHY Programme
The Combustion Institute
NWO-ACTS 'Sustainable Hydrogen'

projects:

- EET project: 'Vergroening van Gas' (greening gas)
- NWO project on the effects of adding hydrogen to hydrocarbon fuels on the chemistry of pollutant precursors



organisation: **Linde Gas / Hoek Loos**

address: Havenstraat 1
postal code: 3115 HC
town: Schiedam
website: www.hoekloos.nl

contact person: Hendrik de Wit
telephone: +31 10 246 1353
fax: +31 10 246 1377
e-mail: hendrik.de.wit@hoekloos.nl

products:

- gaseous and liquid hydrogen
- hydrogen production units based on steam reforming
- electrolysis and partial oxidation
- 'Over The Fence' supply via pipeline
- filling stations (world market leader)
- hydrogen storage and consultancy.

organisation: Hoek Loos manufactures and sells industrial and medical gases, and is part of the global Linde company. Hydrogen plays a strategic role within the group. Linde therefore supplies a broad product range covering the production, distribution, storage and trans-shipment of hydrogen.

networks: EC Hydrogen and Technology Platform
HYPNET
HyWays

projects: Energy Transition in the Netherlands
CUTE project (hydrogen buses) in Amsterdam, Porto, Barcelona and Perth.
Various refuelling stations worldwide, including the most well-known, in Berlin, Tokyo and Beijing. Supplier of liquid hydrogen for the GM Marathon, and various projects within the framework of the Energy Transition network.

organisation: **MAGNETO special anodes BV**

address: Calandstraat 109

postal code: 3125 BA

town: Schiedam

website: www.magneto.nl

contact person: P.J.F.M. Hack

telephone: +31 10 262 0788

fax: +31 10 262 0201

e-mail: info@magneto.nl

products:

- Titanium anodes with electro-catalytic coatings using platinum, iridium and ruthenium.
- Nickel, tantalum, and niobium electrodes.
- Development and production of electro-catalysts.

organisation: MAGNETO is the original inventor and manufacturer of titanium anodes with proprietary electro-catalytic coatings.

The company supplies anodes and electrochemical cells to the international electrochemical industry. All products are custom-built per client or designed for a specific technical market segment. The company invests a significant part of its turnover in R&D into new anode concepts and applications.

networks: FME-CWM employers association

WETSUS research institute in Leeuwarden

Mini Waste UK

projects:

- Producing electrodes for water electrolysis.
- Research into biofuel cells and biological hydrogen production, together with organisations such as TNO and WETSUS.



organisation: **MAN Truck & Bus b.v.**

address: Stuartweg 2
postal code: 4131 NJ
town: Vianen
website: www.man-mn.nl

contact person: Mr Meindert Snoek
telephone: +31 347 363 200
fax: +31 347 363 210
e-mail: meindert.snoek@man-trucks.nl

products: trucks, buses and coaches

organisation: MAN Truck & Bus b.v. is the Dutch importer of MAN corporate vehicles and buses. The company is part of the MAN Nederland group, and is a subsidiary of Pon Holdings, the Netherlands' largest company in the automotive sector. MAN corporate vehicles and buses are manufactured by MAN Nutzfahrzeuge AG in countries such as Germany and Austria.

MAN Nutzfahrzeuge AG: The MAN manufacturer of corporate vehicles and buses has its headquarters in Munich, and produces trucks for road transport, builds special vehicles for the armed forces and fire departments, and complete buses for both public transport companies and coach operators.

networks: NVG

projects: MAN Nutzfahrzeuge AG participates in the European CUTE (Clean Urban Transport for Europe) project. The company supplies buses with various alternative drive systems, with LPG engines, CNG engines, H₂ engines and, in the future this list will also include fuel cells.



organisation: **Mesos Management BV**

address: Dijnseburgerlaan 7

postal code: 3705 LP

town: Zeist

website: www.mesosgroep.nl

contact person: P.M. Oskam

telephone: +31 30 693 6070

fax: +31 30 693 6071

e-mail: p.oskam@mesosgroep.nl

products:

- Trade management
- collaborative industrial agreements
- chain management and innovative projects.

organisation: Mesos Management BV focuses on managing and administering trade and professional organisations. The company also develops and implements projects and schemes in various sectors, e.g. the retail trade, construction sector and industry. Mesos Management BV is proactive and result-oriented, and takes account of the development phase of collaborative agreements. The company provides professional support, both in the 'fuzzy' pioneering phase as well as the bureaucratic management phase of a project.



organisation: ***NBT (New Business and Technology)***

address: Willem Klooslaan 17

postal code: 1422 JV

town: Uithoorn

contact person: ir. G.K. Troost

telephone: +31 297 563 919

e-mail: gktroost@euronet.nl

products:

- Consultancy and services relating to new business and market research for SMEs and research institutes.

Specialist areas include:

- Energy technology
- Nuclear Fusion (ITER)

organisation: New Business and Technology

Market research

Pre-feasibility assessment

Proposal development

networks: TNO

Consultation group for energy aspects

KIVI (Dutch Inst. of Engineers)

SenterNovem (EMVT, electromagnetic power technique)

projects: BrandstofCel Nederland BV

Reformer developments

Barendrecht Commission

miscellaneous: Project development

Safety studies

KIVI symposium on Hydrogen Versus Other Alternatives (2006)

organisation: **Netherlands Biohydrogen Network /
Nederlandse Contactgroep Biologische
Waterstofproductie**

address: c/o J.H. Reith, ECN Biomass Unit, Westerduinweg 3
postal code: 1755 LE
town: Petten
website: www.biohydrogen.nl

contact person: J.H. Reith (secretariat)
telephone: +31 224 564 371
fax: +31 224 568 487
e-mail: reith@ecn.nl

- products:*
- Biological hydrogen production using micro-organisms or enzymes can make a substantial contribution to a renewable energy economy.
 - Biohydrogen can be produced by fermenting wet biomass and residues, and by making use of photobiological processes based on sunlight.
 - The Netherlands is one of the leading countries in fundamental research aimed at a combination of a fermentation and photobiological process. In the shorter term, bioprocesses are being developed for combined production of hydrogen and methane.
 - Knowledge of the structure and mechanism of natural hydrogen enzymes provides opportunities to develop efficient, low-cost catalysts for hydrogen/electricity interconversion and industrial production processes.

organisation: The Netherlands Biohydrogen Network consists of researchers affiliated with Wageningen University, Delft Technical University, Agrotechnology and Food Innovations BV, TNO, KUN, RUG and ECN.

This network focuses on:

- national/international knowledge exchange and cooperation (e.g. IEA Hydrogen Programme)
- clustering expertise and R&D activities
- creating development projects in cooperation with governments and industry
- providing expertise and solutions to questions from the field.

The Network provides an overview of ongoing projects, publications (available in pdf format), links, news items and other information on the website: www.biohydrogen.nl.



- networks:* IEA Hydrogen Programme, Annexe Biohydrogen and EU networks
- projects:* Workshop for Biological Hydrogen Production, 4 October 2001, Utrecht.
Report: ECN-C--02-085.
Status and prospects for biological hydrogen and methane production – an inventory of R&D and expertise among Dutch knowledge institutions, 2003.
Report: ECN-C--03-021.
Reports and other publications are available from www.biohydrogen.nl

organisation: ***Nederlandse Waterstof en Brandstofcel
Vereniging / Dutch Hydrogen and Fuel cell
Association***

address: Secretariat, Pottenbakkersdonk 511
postal code: 7326 PG
town: Apeldoorn
website: www.waterstofvereniging.nl

contact person: mevr. J. Wensing
telephone: +31 6 514 52034
fax: +31 55 534 7778
e-mail: info@waterstofvereniging.nl

products:

- The Dutch Hydrogen and Fuel cell Association brings together the industrial sector, knowledge institutes and universities/colleges.
- The association encourages collaboration to increase synergy, supports the creation of standards, clusters general information on hydrogen as an energy carrier, acts as information centre for the general public, and is constantly working to ensure that hydrogen reflects a positive image.

organisation: The Dutch Hydrogen and Fuel cell Association is the main network organisation in the Netherlands for hydrogen as an energy carrier, and is open to all relevant companies, institutions and government departments.

networks: European Hydrogen Association



organisation: **NedStack Fuel Cell Technology BV /
NedStack Fuel Cell Components BV**

address: Westervoortsedijk 73,
postal code: 6827 AV
town: Arnhem
website: www.nedstack.com

contact person: I. Ariaans-van Silfhout
telephone: +31 26 366 4278
fax: +31 26 366 5129
e-mail: info@nedstack.com

products:

- NedStack Fuel Cell Technology BV develops and manufactures multi-purpose PEM (Proton Exchange Membrane) and DM (Direct Methanol) fuel cell stacks, with a power range from 100 Watt up to 25 kWe. The PEM fuel cell stacks operate on pure oxygen, pure hydrogen or reformat.
- NedStack Fuel Cell Components BV develops and manufactures components for the production of PEM FC and DFC stacks, such as Membrane Electrode Assemblies (MEAs) and bipolar cell plates.

organisation: NedStack Holding BV is a privately owned holding company containing two 100% subsidiaries, i.e. NedStack Fuel Cell Technology BV and NedStack Fuel Cell Components BV. The organisation was founded in 1998 as a continuation of AkzoNobel's fuel cell activities. In total there are around 32 staff working at NedStack. NedStack uses internally developed and patented technology in its products. The group is based in Arnhem.

networks: World Fuel Cell Council, Fuel Cells Europe, IEA (International Energy Agency), Netherlands Hydrogen Association, WETSUS, FC TESTNET.

projects:

- EETK99036 - Micro cogeneration plant based on Solid Polymer Fuel Cell technology.
- EETK20104 - PEM fuel cell system for city buses.
- EDI02123 - cogeneration plant for non-residential buildings.
- EDI03156 - PEM Powerplant, 50 MW fuel-cell-based energy power plant.
- EC FP-5 - Optimerecell; development of high-power fuel cells for car manufacturers.
- EC FP-5 - Reversible fuel cell development.
- Transition Coalition – Fuel cell ferry for Amsterdam Transport Company.



organisation: ***NEN (Dutch Standardization Institute)***

address: Vlinderweg 6

postal code: 2623 AX

town: Delft

website: www.nen.nl

contact person: ir. Harold J. M. B. Pauwels

telephone: +31 15 269 0326

fax: +31 15 269 0207

e-mail: energy@nen.nl

products:

- The Dutch Standardization Institute is the knowledge and information centre for national, European and worldwide standards.
- All current standards, including advice regarding hydrogen, fuel cells, other energy carriers and their applications can be obtained from NEN.

organisation: NEN is the leading Dutch knowledge network in the world of standards and regulations. The users of these standards must be able to consult NEN at any time and from any location. NEN tries to provide information to its clients as quickly as possible, using the latest techniques. The company organises training courses and other events to promote the practical application of these standards.

networks: NEN is the only national standards institute in the Netherlands, and is a member of the European (CEN, CENELEC, and ETSI) and worldwide (ISO, IEC and ITU) standards networks.

projects:

- International ISO and IEC standards regarding hydrogen, fuel cells, electric vehicles etc.
- NATURALHY project, an EU 6th Framework Programme, to study the conditions under which hydrogen can be added to the natural gas network. This study, with its budget of 17 million euro, includes 39 participants, e.g. Gasunie, TNO, ECN and Shell Hydrogen.



organisation: **Nexus Global B.V.**

address: Nijverheidstraat 12

postal code: 4143 HM

town: Leerdam

website: www.nexusglobal.nl

contact person: Mr Leo Disse

telephone: +31 345 639 250

fax: +31 345 639 207

e-mail: leo.disse@nexusglobal.nl

products: Nexus Global specialises in turnkey engineering and installation of energy systems, particularly in hydrogen technology. Products include:

- Hydrogen fuelling installations.
- Energy systems for houses and apartments.
- Energy systems for non-residential buildings (offices, hospitals).
- Energy systems for greenhouses.
- Laboratory installations.
- Feasibility and system studies.

organisation: Nexus Global is a joint-venture between HyGear and Ballast-Nedam IPM. As a result the in-house knowledge of hydrogen technology (HyGear) plus engineering, project management and implementation (Ballast-Nedam IPM) is combined under one roof and thus guarantees the high quality of our products.

projects:

- Eskan: Carclean, mini refuelling station for hydrogen.
- System engineering for the Duogen project.
- Several desk studies for energy systems.

organisation: **NovioConsult Van Spaendonck BV**

address: Mariënborg 67
postal code: 6511 PS
town: Nijmegen
website: www.novioconsult.nl

contact person: ir. ing. C. Geuzendam
telephone: +31 24 381 3333
fax: +31 24 324 1971
e-mail: c.geuzendam@novioconsult.nl

products: NovioConsult Van Spaendonck is one of the leading Dutch companies that specialises in consultancy and organising multi-stakeholder and multi-objective transition processes. Projects involve the initiation, process-architecture and development of innovation networks to meet policy and business goals. The company's innovation services provide short but effective interventions and the development of strategic programmes including management information.

A summary of our innovation products:

- Policy programming, coaching and inspiring evaluations.
- Creativity stimulating techniques.
- Architecture of transition processes and system innovations.
- Multi-stakeholder analyses and implementation of innovation networks.
- Reversed project and product development (starting with the consumer).
- Organising knowledge development and exchange.
- Developing business and innovation roadmaps.

organisation: NovioConsult Van Spaendonck is a consultancy that is based in Nijmegen and was founded in 1983. Using the company motto as a basis ('policy for citizens, companies and government') our consultants give professional advice regarding administrative, organisational and policy-making matters in the physical and social arena: urban and rural development and planning, environment and water, energy, public housing, nature and landscape, economy and infrastructure. The specialised staff, currently comprising 23 persons, strives to provide first-class services to our customers: e.g. municipal, regional, provincial and central authorities, business and industry, umbrella organisations etc.



networks: Habiforum

Nederlandse Vereniging van Milieukundigen

projects:

- Conferentie Zeeland Waterstofland (hydrogen conference in Zeeland province).
- Pilot N470, a springboard for sustainable building in civil engineering projects and infrastructure: learning evaluation (2005, 2006 and 2008) from the sustainable building pilot to sustainability mobility on the provincial road N470.
- Evaluation of the organisation and innovation strategy of 'Roads to the future', commissioned by the Ministry of Transport, Public Works and Water Management.
- Knowledge network and promotion of energy storage in the province of Brabant.
- Roadmap 'Energy Innovations' for the province of Zeeland.

organisation: **NV Nedap**

address: Parallelweg 2K (or PO Box 101)

postal code: 7141 DC

town: Groenlo

website: www.nedap.com

contact person: C. Carli

telephone: +31 544 471 861

fax: +31 544 466 008

e-mail: chris.carli@nedap.com

products: 'Atrium 5000 Fuel Cell Inverter'

The 'Atrium 5000 Fuel Cell' is a modular bi-directional Grid Tie Fuel Cell Inverter, which consists of a DC/AC Basic Module capable of supplying continuous 5kW Pure Sine Wave at 230VAC. A DC/DC Fuel Cell Module converts Fuel Cell Stack DC output to the correct input DC voltage of the DC/AC Module.

Battery and/or Super Capacitor: energy and electrical storage is achieved via the Storage Module.

UPS (Uninterruptable Power Supply). A UPS capability is achieved with the aforementioned modules. Communication is CAN based.

organisation: Nedap is characterised by a development- and entrepreneurship-oriented open, innovative and creative culture. The company focuses on: developing and supplying innovative and sustainable solutions in the fields of security and electronic control units as well as automation, management and information for organisations. Nedap concentrates on market segments where its technological know-how and knowledge of the customer's business process can create added value for the customer. These markets segments are approached through the company's own sales channels as well as through third parties. The company is organised into market groups.

networks: UL 2264



organisation: ***Plug Power Holland BV***

address: Wilmersdorf 50
postal code: 7327 AC
town: Apeldoorn
website: www.plugpower.com

contact person: Bas Dorsman
telephone: +31 55 538 1000
fax: +31 55 538 1099
e-mail: apeldoorn@plugpower.com

products: GenCore® is a fuel cell system for electricity backup applications, which is fuelled by hydrogen and produces up to 5 kWe. As soon as the primary electricity supply stops the GenCore takes over and power is returned immediately. GenCore is designed to be used in telecom and utility applications and is certified to all necessary standards including CE, NEBS and CSA.

organisation: Plug Power Inc. was established in 1997 in Latham, New York. Plug Power Holland BV opened its doors in Apeldoorn in 2000, as the company's Dutch subsidiary, which now serves as the Company's European, Middle Eastern and African operation. Plug Power Inc. is an established leader in the deployment of clean, reliable, on-site energy products. More than 550 Plug Power fuel cell systems have been delivered to customers worldwide in commercial, public sector, telecommunications, utility and uninterruptible power supply markets.

networks:

- Fuel Cell Europe
- World Fuel Cell Council
- US Fuel Cell Council

organisation: **Prins Autogassystemen b.v.**

address: De Run 5408

postal code: 5504 DE

town: Veldhoven

website: www.prins-lpg.com

contact person: Mr R.J.A. Konings (Roger)

telephone: +31 40 254 7700

fax: +31 40 254 9749

e-mail: rja.konings@prins-lpg.com

products: LPG/CNG/Hydrogen Injectors:

Working temperature -30°C to +120°C, operational pressure 392kPa or less, linear from 2.5ms, range of injectors 32cc/stroke to 110cc/stroke (at 24ms and 255kPa) or less.

organisation: Prins Autogassystemen B.V. develops en manufactures alternative fuel systems for mainly light-duty Otto engines. The company's core business is still the manufacture of LPG systems, though CNG systems are increasing nowadays.

CNG is often described as the next step to H₂. These systems contain injectors used for vapour injection (developed in collaboration with Keihin Corporation) in LPG/CNG and H₂ applications.

projects: projects: confidential

miscellaneous: from the first of March 2006 our new address is:

Jan Hilgersweg 22

5657 ES Eindhoven



organisation: **Procede Group BV**

address: PO Box 328
postal code: 7500 AH
town: Enschede
website: www.procede.nl

contact person: ir. S. van Loo
telephone: +31 53 489 4355
fax: +31 53 489 5399
e-mail: sjaak.vanloo@procede.nl

products: Procede products include:

- Design, development, simulation and optimisation of processes
- Trouble-shooting and consultancy
- Product development
- Cost evaluations (and cost reductions)
- Environmental and energy auditing
- Research management and training of process engineers
- On-site services including secondment of highly trained personnel

organisation: Procede supplies financially attractive process technology solutions. The company's activities focus on increasing the efficiency of processes and reducing costs. Procede is a partner to both multinationals and SMEs, primarily in the chemical, textile, oil, gas, and food industries.

Procede couples this expertise with excellent experimental facilities. Its staff are competent process engineers with a wide range of theoretical and practical experience. Procede has laboratories, skilled technicians and a well-appointed workshop, plus excellent computer facilities and access to an inexhaustible number of scientific references and online documents.

projects:

- Producing hydrogen from biomass
- Storing hydrogen in alternative reagents

organisation: **Proton Ventures BV**

address: Krammer 33
postal code: 3232 HE
town: Brielle
website: www.protonventures.com

contact person: ir. J.P. Vrijenhoef
telephone: +31 181 242 143
fax: +31 181 479 143
e-mail: hans.vrijenhoef@protonventures.com

products:

- Development of climate-neutral hydrogen in Rozenburg (Rotterdam Europoort), producing hydrogen from fossil fuels and reusing CO₂ usefully for downstream production of urea, melamine, enhanced oil and gas recovery.
- Import into the Benelux area of electrolyzers for small applications (1-100 Nm³/hr H₂ (99.9% pure) and/or 0.5 to 50 NM³/hr O₂ (99.9% pure) at pressures of up to 25 barg.
- The company also assists with requests for subsidies, and provides financial advice with regard to business plans, process engineering and the outsourcing of management tasks.

organisation: Proton Ventures BV is a project developer providing chemical solutions, mainly in the Rijnmond region. The name Proton is derived from the Dutch 'experimental garden' for technological developments, whereby the management invests in (new) chemical activities at its Micro Chemical BV location in Rozenburg. Co-siting and innovation are keywords. Proton Ventures primarily focuses on developing hydrogen technology, but also looks for new developments in sustainable business activities based on their Waste2products[®] concept.
If you are interested in participation or collaboration, please contact Leon Lampers or Hans Vrijenhoef.



organisation: **Royal Haskoning**

address: Hoofdweg 490
postal code: 3067 GK
town: Rotterdam
website: www.royalhaskoning.com

contact person: Mr Niels Lanser
telephone: +31 10 286 5697
fax: +31 10 456 2312
e-mail: n.lanser@royalhaskoning.com

products: Royal Haskoning has developed the following activities/products with respect to hydrogen technology:

- Based on the specifications and behaviour of hydrogen systems, Royal Haskoning is able to engineer, integrate and demonstrate hydrogen systems/equipment in new or existing systems. The scope of activities includes feasibility studies, system design and modelling, demonstration, system engineering and full-scale application.
- Based on current knowledge of the hydrogen chain and extensive experience of the way in which hydrogen systems impact society, the company implements policy studies concerning the impact of a hydrogen economy on a national, European and global scale.

organisation: Royal Haskoning is an independent consultancy that operates on a worldwide basis. The various disciplines are clustered into nine divisions, i.e. Spatial Development, Infrastructure & Transport, Architecture & Building, Mechanical & Electrical Services, Environment, Water, Coastal & Rivers, Maritime and Royal Haskoning Asia. Various hydrogen technology activities have been developed under the direction of the Environment Division. These projects mainly focus on engineering, demonstrating and implementing hydrogen systems. Royal Haskoning also carries out policy studies with respect to hydrogen technology. The strong synergy between the various divisions during projects enables Royal Haskoning to cover the entire range of subjects relevant to the development of a hydrogen economy.

projects:

- Various feasibility studies, e.g. implementing fuel cell systems at hospitals, airports and data centres.
- Various policy studies.



organisation: **Sensistor-Technologies**

address: Nieuwstraat 135
postal code: 3311 XR
town: Dordrecht
website: www.sensistor.com

contact person: Kasper P.M. Pols
telephone: +31 78 614 3732
fax: +31 78 614 3726
e-mail: kasper.pols@sensistor.de

products: Hydrogen leak detection systems. The Sensistor H₂ leak detection systems allow leaks (from 0.5 to 2000 ppm) to be identified and quantified. These leakage detection systems are fitted with a unique selective H₂ sensor, thus providing fast, accurate and sustainable measurements, without air needing to be added. Example applications include: the hydrogen industry; pipelines/valves; the car manufacturing industry; chemical plants; and all other situations where leakage tests are required.

These H₂ leak detectors are available in a wide range of models, e.g. built into other equipment, portable or as laboratory models.

organisation: Sensistor was established in 1981 by a team of scientists working at the Linköping University and Chalmers University of Technology. The company aims to find applications and markets for inventions concerning hydrogen sensors.

Today Sensistor works from six locations worldwide, and focuses on developing, manufacturing and selling leak detection systems based on the 'hydrogen method'.

networks: German Hydrogen Association
Dutch Hydrogen Association
German Association for Non-Destructive Testing
Experts Committee for Leak Testing (DGZFP)
European Hygienic Engineering & Design Group
Hydrogen Forum Sweden
Swedish National Testing and Research Institute
American Society for Non-Destructive Testing



organisation: **SenterNovem**

address: Catharijnesingel 59

postal code: 3511 GG

town: Utrecht

website: www.SenterNovem.nl

contact person: ing. M. Kolkman / ir. F. Denys

telephone: +31 30 239 3789 / +31 70 373 5928

fax: +31 30 231 6491 / +31 70 373 51 00

e-mail: M.Kolkman@SenterNovem.nl / F.Denys@SenterNovem.nl

- products:*
- SenterNovem implements government policy for various governmental bodies, including the Ministry of Economic Affairs, the Ministry of VROM (Spatial Planning, Housing and the Environment), the Ministry of Transport, Public Works and Water Management, lower governmental bodies and the European Union.
 - SenterNovem provides a wide range of services, including subsidies, policy advice, process supervision, knowledge exchange, information dissemination and assistance in finding partners for innovative, energy, environment and climate-related projects. Hydrogen projects can make use of various subsidy opportunities within a variety of programmes.

organisation: SenterNovem is an agency under the Ministry of Economic Affairs, with offices in Sittard, The Hague, Zwolle and Utrecht. The organisation focuses on three main subjects, i.e.: innovation, energy and climate, plus living and working environment. SenterNovem therefore contributes to a strong position for Dutch industry and to a more sustainable society that cares for people and the environment.

networks: Executive Committee of the IEA Implementing Agreement on Hydrogen Production and Utilisation.

IEA Hydrogen Coordination Group.

Mirror-group of the EU Hydrogen and Fuel Cells Technology Platform.

projects: Financing of various hydrogen and fuel cell projects via several programmes.

miscellaneous: Encouraging both national and international networks.

**SenterNovem**

organisation: **SenterNovem/EG-Liaison (EGL)**

address: Juliana van Stolberglaan 3

postal code: 2509 AC

town: Den Haag

website: www.egl.nl

contact person: dr. Richard van der Walle

telephone: +31 70 373 5250

fax: +31 70 373 5650

e-mail: r.van.der.walle@egl.nl

products: SenterNovem's EG-Liaison group supplies independent project advice on the EU's 6th Framework Programme (FP6) and provides news and developments to help shape the new EU Framework Programme (FP7). EG-Liaison also offers specific training courses for organisations, e.g. on submitting project proposals, or on the project management of large international projects. EG-Liaison can also help you to find the right project partners in Europe.

The 'Sustainable Energy Systems' section of FP6 contains a number of opportunities for hydrogen projects, at both research and demonstration levels. EG-Liaison can provide assistance (free of charge) in defining these types of projects.

organisation: SenterNovem/EG-Liaison supports companies, universities and research institutions that are interested in obtaining European R&D funding. The aim is to increase Dutch participation in European R&D programmes and to strengthen European cooperation with regard to innovation projects. There is an extensive network of scientific/energy officers at the European Commission.

projects: The organisation has been closely involved in the establishment of several projects that were initiated by Dutch partners. Examples include:

- NATURALHY, to study the addition of hydrogen to the natural gas network (Integrated Project, led by the Gasunie).
- HYVOLUTION, regarding the development of a blueprint for an industrial bioprocess for hydrogen production from locally produced biomass (an integrated project, coordinated by A&F BV).

EG-LIAISON

organisation: **Shell Hydrogen B.V.**

address: Carel van Bylandtlaan 23

postal code: 2596 HR

town: The Hague

website: www.shell.com/hydrogen

contact person: de heer Chris de Koning / mevrouw Gin Ong

telephone: +31 70 377 3074 / 3079

fax: +31 70 377 3130

e-mail: chris.dekoning@shell.com / gin.ong@shell.com

organisation: For complete information on the organisation, visit the Shell Hydrogen website.

networks: European Hydrogen & Fuel Cell Platform

European Hydrogen Association

National Hydrogen Association (US)

FreedomCar/Fuel initiative

HyNet

projects: CUTE

ECTOS

Hydrogen refuelling stations in Tokyo, Iceland, Washington DC, Luxemburg,
Amsterdam



organisation: **Siemens Nederland N.V.**

address: Prinses Beatrixlaan 800

postal code: 2595 BN

town: Den Haag

website: www.siemens.nl

contact person: drs. ing. Remko Knol

telephone: +31 70 333 3252

fax: +31 70 333 3225

e-mail: remko.knol@siemens.com

- products:*
- Siemens Nederland works together with the fuel cell department under the Power Generation Division (located in Pittsburgh, USA) on the market introduction of solid oxide fuel cells (SOFC).
The company is therefore looking for pilot project applications in the Netherlands (a 100 kWe natural-gas-fired cogeneration plant). The Netherlands includes ideal locations for a combined coupling of both electricity and natural gas with a heating (or cooling) demand.
 - Siemens PEM is also developing and manufacturing fuel cells that can be used in 120 kWe units to drive submarines.

organisation: Siemens provides integral solutions for industry, the government and the consumer, through focusing on:

- Energy
- Mobility
- Living and working

With regard to energy, Siemens provides integral solutions for the gradual transition from a traditional energy supply to a sustainable energy supply. In this respect, fuel cells form an important element for the future.

projects: Various projects with SOFC and PEM-FC

In the Netherlands:

100 kWe SOFC field test in Westervoort (1999)



organisation: **SPARQLE International**

address: Hasebroekstraat 1

postal code: 7552 VX

town: Hengelo

website: www.sparqle.com

contact person: J.M.L. Penninger

telephone: +31 74 291 6621

fax: +31 74 250 5285

e-mail: penninger@sparqle.com

products: Experimental research services.

organisation: SPARQLE International specialises in:

- Experimental research of high-pressure technology.
- Producing sustainable energy carriers (e.g. hydrogen and other fuel gases) from wet biomass.

networks: KNCV (Dutch Chemical Association)

AIChE (American Inst. Of Chemical Engineers)

ACS (American Chemical Society)

projects:

- Supercritical water reforming/gasification.
- EU Exploratory Research Award Stage 1 EU Proposal no. JO/ST/3042 (1998).
- EET Kiem Project 'Hydrogen and other fuel gases from aqueous biomass by supercritical water gasification', project no. 98114 (1999-2000).
- EU Craft Project 'Hydrogen-rich gas from supercritical water gasification of wine grape residues and greenhouse residual biomass (Winegas)', EC contract number ENK5-CT-2001-330010 (2001-2004).
- EU Project 'Biomass and waste conversion in supercritical water for the production of renewable hydrogen (SuperHydrogen)', EC contract number ENK6-CT2001-00555 (2001-2005).
- EET (Economy and Ecology Technology) Project entitled 'Hydrogen and other fuel gases from supercritical water by thermal treatment with biomass (SCARLET)', project no EETK02007 (2004-2007).
- Senter project 'Developing a supercritical diesel reformer in a hybrid fuel cell system (SuperDiesel)', project no. EDI03054 (2003-2006).
- EET Project 'Biological hydrogen production (BWP II)', project no. EETK03028 (2003-2007).

SPQL

organisation: **Stork Product Engineering B.V.**

address: Czaar Peterstraat 229

postal code: 1018 PL

town: Amsterdam

website: www.stork.com/spe

contact person: De heer F. Eckhard

telephone: +31 20 556 3488

fax: +31 20 556 3563

e-mail: fir.eckhard@stork.com

- products:*
- Innovative product development.
 - Engineering and realisation of complex systems for space, aerospace, power production, storage and transition.
 - Studies and concept definition, e.g. wind turbines, hydrogen production and fuel cell applications.
 - Extensive analysis capabilities.

organisation: Stork Product Engineering is a subsidiary of the Stork corporation and specialises in technical product development. The company is a reliable and practical partner in technical progress by developing and engineering products for complex systems. The innovative developments and successful technology spin-off range from ignition systems for rocket engines, supersonic gas separation, biological life support and reaction wheels for satellites.

Stork Product Engineering has created a unique cluster of knowledge, expertise and experience with regard to materials, mechanisms and mechanical structures, tribology, thermodynamics, control and measurement, and combustion technology. Stork can therefore turn innovative ideas into new technologies.

New concepts have recently been developed for sustainable energy generation based on fuel cell technology, thermo-electric conversion and power management systems. These new concepts contribute by improving the efficiency of gas-fired turbines and boilers when generating electricity, and form a sustainable alternative to batteries.

projects: Fuel Cell Netherlands

Feasibility studies into hydrogen storage for buses

Diesel reforming (dynamic conversion in hydrogen)

Biological hydrogen production

Innovative hydrogen and fuel cell applications

miscellaneous: Feasibility studies

Prototype and system development, including testing and certification.

STORK[®]
knows-how

organisation: ***Susebeek Technical Consultants (STC)***

address: Rembrandtlaan 112

postal code: 7242 DE

town: Lochem

website: www.susebeektc.com

contact person: ing J.A. Susebeek

telephone: + 31 573 255 407

fax: + 31 573 255 505

e-mail: j.susebeek@wxs.nl

products:

- Energy-saving studies and programmes for industry and small/medium-sized enterprises (SMEs).
- Environmental studies for industry and SMEs, and wastewater treatment plants.
- Project management for industrial projects.
- Cost engineering and database services according to DACE (Dutch association of cost engineers) standards.

organisation: 'Every healthy eco-system is characterised by it's desired outward stream'. It is important that every business incorporates responsible energy and environmental management in relation to a good cost-control system. Since 1995 STC has been assisting businesses and establishments to fulfill the demands of their direct and indirect surroundings.

STC's technical and financial advice concerning complex energy and environmental questions are identified by clearness and immediate suitability. This also applies to the investment selections, feasibility studies and audits.

In addition to implementing its own research, STC also keeps in contact with research and training organisations, and with centres focusing on the transfer of technical know-how. STC operates in an international arena and is familiar with the various subsidy schemes, and has experience with various EU R&D programmes.

networks:

- EU- HFP- BD group
- Twente University
- Kivi/ Niria
- USA/ NL Trade directory
- NAP/DACE (The Process Industry Competence Network)
- Dutch Hydrogen and Fuel cell Association
- Arnhem Hydrogen Network

projects:

- Sustainable energy sources and hydrogen in a housing area
- Sustainable energy sources and hydrogen in a rural area



organisation: **Technical University Eindhoven**

address: Den Dolech 2

postal code: 5612 AZ

town: Eindhoven

website: www.tue.nl

contact person: Peter H.L. Notten

telephone: +31 40 247 3082

fax: +31 40 247 5054

e-mail: P.H.L.Notten@tue.nl

products: The university has over 20 years of scientific experience in the field of hydrogen storage materials. This includes storage via the gas phase as well as electrochemical storage. This combination has resulted in a significant contribution to the development of the Nickel-MetalHydride battery, which is now used by everyone, for applications ranging from portable electronics to hybrid cars. These activities take place in close collaboration with Philips Research Laboratory.

organisation: Eindhoven Technical University focuses on fundamental/strategic technological research that is relevant for both industrial or other applications. This contributes to a stronger competitive position for the industrial sector, and to resolving social problems. The university aims to play a leading role in a limited number of research fields, thus increasing its capacity to attract top (foreign) researchers and Masters students, as well as international research funds.

networks: Electrochemical Society
International Society of Electrochemistry

projects: EET 'High energy density materials'
ACTS

organisation: **Thomassen Compression Systems BV**

address: Havelandseweg 8A

postal code: 6991 GS

town: Rheden

website: www.thomassen.com

contact person: Hans Kervers

telephone: +31 26 497 5327

fax: +31 26 497 5201

e-mail: hk@thomassen.com

- products:*
- Reciprocating compressors for special gases including hydrogen.
 - Discharge pressure up to 600 bar
 - Power 100 – 16,250 kW
 - Custom-designed centrifugal compressor performance components.

organisation: Thomassen Compression Systems (TCS) has an established reputation for providing tailor-made compression solutions to the oil, gas, chemical and refining industries. The detailed knowledge of field processes and compressor-related systems enables TCS to design, manufacture, install and service all types of compression systems.

networks: API

projects: Various projects for compressing hydrogen gas.

organisation: **TNO (Netherlands Organisation
for Applied Scientific Research)**

address: Schoemakerstraat 97
postal code: 2628 VK
town: Delft
website: www.tno.nl

contact person: ir. Nico Versloot
telephone: +31 15 284 3465
fax: +31 15 284 3954
e-mail: nico.versloot@tno.nl

products:

- Hydrogen production techniques.
- Underground hydrogen storage.
- Practical applications and safety in the built environment.
- Knowledge of materials concerning hybrid and ceramic nanoporous materials.
- Designing and optimising hydrogen compression installations (flow dynamics).
- Interaction between hydrogen and metals at conditions prevalent during production, storage, transport and applications.
- Development of proton-conducting membranes for applications in PEM fuel cells.
- Engine concepts, development of fuel systems and engine management software for using alternative and renewable fuels in vehicles.
- Strategic hydrogen study.
- Hydrogen safety from production to application.
- Consultancy on fire and explosion safety.
- Hydrogen gas generator for use in fuel cell systems.

organisation: TNO is a knowledge and expertise centre for industry, governmental bodies and social organisations, with over 5400 staff who develop and apply knowledge on a daily basis. Developing and applying innovative knowledge: that's what TNO is all about.

TNO is multifaceted and focuses on five core areas:

- TNO Quality of Life.
- TNO Defence, Security and Safety.
- TNO Science and Industry.
- TNO Built Environment and Geosciences.
- TNO Information and Communication Technology.



TNO has built up a wide range of high-grade knowledge in all these core areas. In order to ensure optimum application of this knowledge, TNO employees work closely together within these core areas. This also applies to hydrogen, where TNO tackles a wide range of problems and offers integrated solutions to resolve them. TNO has a broad portfolio of hydrogen activities and is among the European leaders in several areas.

networks:

- European Pressure Equipment Research Council (EPERC).
- Knowledge centre ISAPP.
- Netherlands Contact Group for Biological Hydrogen Production.
- EU Hydrogen and Fuel Cell Platform.
- European network for geo-energy (ENeRG).
- Fuel Cell Testnet.
- EU Network of Excellence HySafe.

projects:

- International Energy Agency (Hydrogen Implementing Agreement).
- System studies into possible future scenarios of new gas infrastructure.
- Converting hydrogen use into practical applications in the built environment.
- EU NaturalHy: research into the possibilities of adding hydrogen to natural gas.
- Developing a capillary fuel cell.
- Flexible Fuel Vehicle: using various mixtures of hydrogen/natural gas in vehicles.
- Supercritical gasification of horticultural refuse to produce hydrogen and CO₂ fertilisation.
- Superdiesel: hydrogen production for fuel cells based on marine diesel.
- Biological hydrogen production.
- HySafe: safety of hydrogen as an energy carrier.
- Innovative chemical hydride for efficient hydrogen storage.

miscellaneous:

Safety aspects



organisation: **Twente University**
department of communication science

address: Campus of Twente University
postal code: 7500 AE
town: Enschede
website: www.utwente.nl

contact person: dr. J.M. Gutteling
telephone: +31 53 489 3290
fax: +31 53 489 4259
e-mail: j.m.gutteling@utwente.nl

products: Research into public acceptance of (new) technologies, and communications with stakeholders concerning these new technologies.

organisation: Twente University is an entrepreneurial research university. Established in 1961, it provides university education and research into various sciences, from management and applied physics to biomedical technology.

Twente University aims to provide top-level research that can contribute to social and technological innovation, i.e. increasing knowledge, where the borders between various specialisations are less clear-cut, and where traditional differentiations between fundamental and applied research are no longer relevant.

Technical subjects are given first priority for research programmes: nano-technology, process technology and mechanics, telematics and information/communication technologies, plus biomedical technologies. In the social sciences the priority lies with governance studies and research into the behavioural sciences. Research is carried out by multidisciplinary teams consisting of (social) psychologists, health specialists, sociologists, linguists and doctors.

networks: Society for Risk Analysis
International Communication Association

projects: A paper has been written within the framework of the Novem/NECST (neutral energy carriers) programme, concerning the general acceptance of hydrogen.



organisation: **Utrecht University**
Innovative Studies

address: Heidelberglaan 2
postal code: 3584 CS
town: Utrecht
website: www.nwi.uu.nl/research/research_main.php?personal_id=137

contact person: dr. M. Hekkert
telephone: +31 30 253 6112
fax: +31 30 253 2746
e-mail: m.hekkert@geog.uu.nl

products: Research into the successful development and application of hydrogen as a fuel.
organisation: Utrecht University.
Copernicus Institute for Sustainable Development and Innovation.
Section for Innovative Studies.

projects:

- Research into hydrogen R&D performance in Germany.
- Research into stakeholder preferences concerning the transition to alternative motor fuels.
- Well to wheel analysis of natural-gas-based fuels (including hydrogen).
- Transition to CO₂ storage and hydrogen use.
- Wind energy at sea and hydrogen as storage medium.
- Analysis of (Dutch) stakeholder network with regard to hydrogen.



Universiteit Utrecht



organisation: **VHK (Van Holsteijn & Kemna BV)**

address: Delftech Park, Electronicaweg 14
postal code: 2628 XG
town: Delft
website: www.vhk.nl

contact person: ir. R. C.A. van Holsteijn
telephone: + 31 15 275 5755
fax: + 31 15 275 5788
e-mail: r.van.holsteijn@vhk.nl

products: VHK BV is a research, design and engineering company, with a unique experience and track-record in the field of mass-produced energy using consumer durables. The company has initiated several successful product innovations in the field off energy conservation and has more than 20 years of experience in the field of:

- Application development of new technologies
- Concept design
- Prototyping and testing
- Design and engineering
- Prototype series
- Production development
- Policy support research (for European Commission and Energy Agencies in EU Member states)

organisation: The company's head office is situated in the Science Park Delft, in the vicinity of the Technical University of Delft; VHK has a branch office in Brussels to facilitate projects that are undertaken for the European Commission. The company was established in 1984 and specialises in research and development of mass-produced energy using consumer durables. The company counts many national and international industrial clients. Research projects for policy support are carried out for the European Commission (Energy Labelling, Eco Design) but also for Energy Agencies and local governments. With regard to the application of hydrogen and fuel cells, VHK has undertaken several studies for both industrial clients and governments. The company sees many future opportunities for using hydrogen and fuel cells in the built environment sector.

projects:

- Study into possibilities for micro-cogeneration in the built environment
- Concept development of micro-cogeneration based on the PEM fuel cell
- Quality standards for CHP



van holsteijn en kemna
research - design - engineering

organisation: **VVM (Vereniging van Milieuprofessionals /
Assoc. of Environmental Professionals)**

address: Josquin des Prézstraat 1

postal code: 5216 GR

town: Den Bosch

website: www.vvm.info

contact person: Monique Bollen

telephone: +31 30 272 4212

fax: +31 73 621 6985

e-mail: m.bollen@vvm.info

- products:*
- VVM acts as a knowledge platform and fulfils a network function for all environmental professions in the Netherlands. Members discuss the latest environmental issues during their weekly meetings. VVM also publishes a specialised environmental magazine entitled ArenA.
 - VVM's energy section has responded quickly to the current aspects of energy and the environment, by organising a number of meetings based on these subjects. The most important objective is to encourage people to form an opinion and to offer opportunities for information exchange.
 - The energy section also organises an annual energy debate.

organisation: VVM is closely involved in the current social questions that border its working area, and plays an active role in the themes that will be central to the environmental discussion over the next few years. The organisation has over 100 members who actively guide the various sections. Around 30 activities are organised each year, e.g. study days, congresses, training courses and excursions. As well as broadening knowledge, these activities also offer opportunities for discussion and informal contacts.

VVM provides a 'home' for over 2000 integrated or mono-disciplinary professionals who wish to share their specific experience on the practice of their profession. Anyone who is working (or training) professionally in the environmental arena can join VVM. Within VVM the energy section is one of the most active.



organisation: **Wageningen University**
(Environmental Technology Section)

address: Bomenweg 2
postal code: 6703 HD
town: Wageningen
website: www.milieutechnologie.wur.nl

contact person: Bert Hamelers
telephone: +31 317 483 447
fax: +31 317 482 108
e-mail: Bert.Hamelers@wur.nl

products: Wageningen University (Environmental Technology Section) develops new biotechnological processes for producing electricity and fuels from residual biomass products. This type of biomass is created through food production and processing. Using this type of biomass increases the economic feasibility and social acceptance. The department studies innovative biotechnological process for producing hydrogen and electricity using 'anodophilic' organisms.

organisation: The Environmental Technology Section is part of Wageningen University and offers an education and research programme focusing on sustainable solutions to worldwide environmental problems. The approach consists of combining various disciplines in order to achieve innovation. Relevant disciplines include biotechnology, microbiology, organic chemistry, physical chemistry, chemical technology etc. research is divided into four groups: anorganic bioconversions, bioenergy, water technology, plus soil and sediment treatment. The bioenergy group focuses on bioconversions of organic residual substances into CO₂-neutral fuels and electricity.

networks: Contact Group for Biological H₂ production

projects: Producing hydrogen using biocatalytic electrolysis (Wageningen University)



organisation: **Wageningen University**
Agrotechnology & Food Innovations

address: Bornsesteeg 59
postal code: 6708 PD
town: Wageningen
website: www.biohydrogen.nl

contact person: Dr. ir. P.A.M. Claassen
telephone: +31 317 475 325
fax: +31 317 475 347
e-mail: pieternel.claassen@wur.nl

products:

- Agrotechnology & Food Innovations (A&F) has extensive experience throughout the entire chain, from agricultural raw materials (biomass) to energy carriers such as hydrogen.
- A&F has been coordinating a wide range of national and international 'biohydrogen' projects since 1999. The objective is to develop a two-stage bioprocess to produce hydrogen from energy crops such as miscanthus, and from organic residues such as steamed potato peelings and paper sludge), or even household waste.
- The A&F Business Unit Bio-based Products addresses the pre-treatment of biomass to form fermentable feedstock and the fermentation of this feedstock to form hydrogen. This bioconversion is based on efficient fermentation by bacteria at 70-80°C under anaerobic conditions, thus producing hydrogen from organic processes.

organisation: A brief overview of A&F
From 'land to mouth' and everything in between: greenhouses, stables, agricultural production, design and production, transport and retail activities. A&F covers the entire production chain. We work with consumer-based product designs, new logistic concepts, environmentally friendly production, new production technologies and efficient processing, in order to achieve better or new products, both for food and non-food applications. We achieve all this based on scientific insight and technological know-how: from food technology, industrial biotechnologies, chemical and process technologies, to consumer testing and ICT models for logistics and cattle breeding systems. Together with our clients, we achieve specific, innovative chain-wide solutions.

- A&F is split into four business units:
- Agrisystems & Environment

- Quality in Chains
 - Bio-based Products
 - Food Quality
 - A&F has an annual turnover of around € 35 million and a staff of approximately 400. A&F is part of Wageningen University.
- networks:*
- The Netherlands Biohydrogen Network
 - IEA Hydrogen Programme, Task 21 'Biohydrogen'
- projects:*
- EET project 'Biological Hydrogen Production' (BWP II), Sept. 2003 - July 2006.
 - EET project BWP I, Sept. 2000 – Sept. 2003.
 - EU FP5 project 'BioHydrogen', Jan. 2000 – Jan. 2003.
 - EET Kiem project 'Biological Hydrogen Production, Nov. 1998 – Nov. 1999.
 - EU FP6 IP 'Hyvolution', January 2006-January 2011

organisation: **Westfalen Gassen Nederland BV**

address: Rigistraat 20
postal code: 7418 EW
town: Deventer
website: www.westfalengassen.nl

contact person: Mr Jan Bron
telephone: +31 570 505 960
fax: +31 570 505 972
e-mail: j.bron@westfalengassen.nl

products:

- Industrial gases in cylinders, mobile and stationary tanks for: the metal industry, food industry, healthcare sector, laboratories, and petrochemical industry.
- Welding and cutting equipment, such as: autogenous welding and cutting tools, electrical welding equipment, welding accessories, welding consumables.
- Ekonor Concept, consisting of: electrical power supply, orbital welding equipment, internal clamp, cooling system using liquid argon, and recording camera.
- Gas distribution systems, consisting of: pressure-reducing stations, piping, accessories, gas withdrawal unit.
- Various: Pelletisers for carbon dioxide snow, gas mixture equipment (up to five components), onsite systems for nitrogen and oxygen, oxygen concentrators.

organisation: Westfalen Gassen Nederland BV is based in Deventer. The company supplies industrial, medical and special gases made to order, and is also a well-known domestic supplier of propane and refrigerants. Over the past 16 years, the company has expanded from 6 to 40 employees. Various distributors throughout the country ensure that Westfalen products are supplied correctly and quickly. This is particularly important for the homecare market.

Westfalen Gassen Nederland BV has acquired a respectable market share that increases steadily every year. The main reasons for this success are the extensive delivery programme, which includes over 300 standard gases and mixtures, as well as the personal approach towards both existing and potential customers. Westfalen Gassen Nederland BV distinguishes itself by constant product improvement, product development and partnership. Finally, the service department is on standby 24 hours a day to provide support when an urgent response is needed.

networks:

- NNI (Dutch standards institute)
- VFIG (Association of Producers of Industrial Gases)
- EIGA (European Industrial Gases Association)
- VNCI (Association of Dutch Chemical Industry)

projects:

Not yet

Notes

Notes

Notes





The Hydrogen kart of Formula Zero appeals to everybody's imagination.





Ministry of Economic Affairs


SenterNovem