

# Business Guide Hydrogen Technology

Embracing technology Embracing ambition



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# 2. Preface



Tinne Van der Straeten Federal Minister of Energy

Belgium has experienced severe flooding the summer of 2021. In spite of the many signs of climate change and the warnings given by scientists, this disaster has surprised many people in our country. It is a harsh reminder that the consequences of climate change are real and can also occur in our cities and our countryside.

This reminder invites us to redouble our efforts in the fight against climate change. It is not too late but we have no time to waste. This fight needs ambitious goals and strong actions, a strategy to guide our acts and cooperation to make them happen.

The objective is clear: achieve climate neutrality by 2050 and base our energy supply on renewable energy sources. The European objectives, in which Belgium is involved, aim among other things to reduce the Union's CO2 emissions by 55% by 2030. This deadline is an intermediate step that forces us to take ambitious actions now.

Within this framework, our energy strategy focuses on strong energy efficiency measures and the exploitation of the renewable energy sources available to us, while respecting the environment and the citizens. This means electrifying many uses and powering them with renewable electricity, for example from our North Sea wind farms. The federal government has decided to triple the capacity in the Belgian North Sea and planning to build the Triton link to the offshore wind farms in Denmark. Other energy carriers such as renewable hydrogen and its derivatives are also necessary when they present technical, financial and/or energy efficiency advantages.

The federal hydrogen strategy is in line with this. In addition to being a lever against climate change, it aims to make this sector an engine of economic growth and job creation. Published at the end of October 2021, it is based on four pillars designed to position our country as a 'Hydrogen Valley': (1) positioning Belgium as an import and transit hub in Europe for renewable molecules, (2) becoming a leader in hydrogen technologies, (3) establishing a robust hydrogen market, and (4) investing in cooperation, which is essential to achieve these objectives.

A strong hydrogen industry is central to the implementation of this plan. First of all, to support the development of infrastructures and services on our territory. At the same time, to set up a complete supply chain for these molecules through international partnerships. In 2021, the Federal Government has initiated a cooperation with Oman and Namibia in this perspective and wants to continue to position its companies and its know-how on the global hydrogen scene.

The energy transition offers new perspectives in terms of economy and innovation. Let's take advantage of it to transition our economy towards sustainable and future-oriented activities. What's good for the climate, is good for the economy and for the society as a whole.

# 3. Introduction



Bart Steukers CEO Agoria

The amount of low-carbon hydrogen that is needed to decarbonize hard-to-abate sectors like steel, chemicals, refining or heavy-duty transport is huge, but the potential to produce hydrogen from renewable electricity in Belgium is limited. It will therefore be necessary to rely for a large part on the import of green hydrogen. Every international agreement to import green hydrogen should be seen as an opportunity to export our Belgian hydrogen technology.

In addition to Belgium's central location in Europe, its well-developed natural gas network and the strong presence of sectors that need hydrogen to decarbonize, Belgium's greatest asset today is the **presence of numerous technology companies with a unique expertise in the field of hydrogen**.

From hydrogen production via electrolysis, to end-use applications like buses and trucks or large combustion engines for ships and trains, to solutions to safely transport and store hydrogen, Belgium is home to many solutions providers that will play a key role in the developing hydrogen economy. Also when it comes to the materials that are needed in fuel cells and electrolysers, a strong value chain is present with important suppliers of membranes, catalysts or bipolar metal plates.

We welcome therefore the various efforts of the different governments in Belgium to support the development of the local hydrogen ecosystem through the national Recovery & Resilience Facility and the participation in the Important Projects of Common European Interest (IPCEI) on Hydrogen. We applaud the strong commitments to support the development of hydrogen technology, the launch of pilot projects and the investments in the development of hydrogen & CO2 infrastructure. This infrastructure will connect the main industrial clusters and serve as a backbone for the decarbonization of sectors like steel, chemicals and refining. In February 2022, the federal government also approved the establishment of a research center for hydrogen technology, the "Hydrogen Test Facility". With the strong commitments from the federal and regional governments, Belgium is very well positioned to play a central role in the developing European and international hydrogen economy.

Despite all of our expertise, the renewable energy potential in Belgium is limited and many of our technology suppliers are faced with a small "home market". Agoria believes that every international agreement to import green hydrogen should be seen as an opportunity to export our Belgian hydrogen technology. We therefore welcome the publication of the federal hydrogen strategy and the initiatives to prepare for the large-scale import of green hydrogen through recent cooperation agreements with e.g. Oman and Namibia, both countries with a vast renewable energy potential. Through developing strong partnerships and co-investing in green hydrogen projects abroad, we can gain better control of the low-carbon energy supply that is needed to fuel the decarbonization of our industry. This is not only good for the climate, but also for our own economic growth and employment.

# Hydrogen production

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# JOHN COCKERILL

Leader in the energy transition

John Cockerill Hydrogen offers efficient and reliable solutions for the production and distribution of green hydrogen. We meet the needs of major players in the industry, mobility and energy sectors.

#### **References:**

- HaYrport <sup>®</sup>: 350/700 bars refueling station at Liège Airport
- 'Liquid Sunshine': 10MW H2 plant for PV powered methanol
- 25MW project for the semiconductor industry
- More than 300 references for electricity generation power plants

# Use case:

With stacks of 5MW, John Cockerill electrolyzers are particularly well suited for large scale applications and renewable energy applications. Until now, more than 28 references of these stacks have either been commissioned or are under manufacturing. This represents 140MW and more than 112,000 tons of CO2 emission saved annually.

# CONTACT

### Raphaël Tilot

Executive Vice President Renewables & Hydrogen

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# **CUMMINS**

Cummins is a leading supplier of PEM and alkaline electrolyzers for on-site renewable hydrogen production, fueling stations and MW-scale Power-to-X solutions. Through the acquisition of Hydrogenics in 2019, Cummins has a long history of building top-performance hydrogen generators for customers all over the world. In January 2020, Cummins has successfully commissioned a 20MW PEM electrolyzer in Bécancour, Quebec, making it the largest in operation in the world. Cummins has a major manufacturing facility for both PEM and alkaline electrolyzers in Oevel, Belgium.

# CONTACT

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# Main Recent Power-to-X References:

Country	Project	Size (MW)	Contract Year	
Austria	Confidential	10	2020	
Spain	TMB Ibedrola	2,5	2020	
Spain	Enagas Mallorca	2,5	2020	
USA	Douglas County 5		2020	
Poland	Zepak	5	2020	
Germany	Green Hydroegn Esslingen	1	2020	
Canada	Air Liquide Becancour	20	2019	
Germany	HRS Giessen	3	2019	
Germany	HRS Wuppertal	2,5	2019	
New Zeeland	Halcyon Power	1,5	2019	
Belgium	HRS CMB Antwerp	1	2019	



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# **SIEMENS ENERGY**

#### We energize society

As a competent partner, consultant, and innovator with deep expertise in the field of energy, we build and shape the hydrogen economy from the very beginning. We develop and integrate technologies to cover the entire end-to-end value chain – from wind parks through power transmission, large-scale industrialization of water electrolysis, as well as compression, transport, storage, e-fuel production and hydrogen-based power and heat generation.

# CONTACT

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References:	Description
H2FUTURE, Austria	Hydrogen for steel making process. Link
Haru Oni Project, Chile	Power-to-methanol (and to other e-fuels). Link
Power-to-Methane Project, Switzerland	Methane out of green hydrogen will be fed into the local gas network
H2Wind Project	Offshore green hydrogen production. Bringing H2 to shore instead of electricity. <u>Link</u>
Stadtwerke Leipzig district heating power plant on H2, Germany	Long-term goal is to operate the gas turbines with 100 percent hydrogen. Link







# **EXION HYDROGEN**

Exion Hydrogen is a new and fast growing company with the mission to engineer and manufacture state-of-the-art medium and large scale water electrolysers.

Exion Hydrogen is focusing on the most advanced technologies in both alkaline and PEM electrolysis and has R&D facilities in Belgium and manufacturing premises in Poland.

# **References:**

- Industry small/medium scale H2 users
- Industry large scale green H2 replacing grey H2
- Energy H2 as RE-Storage medium
- Energy Electrolysis as grid balance tool
- Mobility Road / Water / Rail / Air

# CONTACT

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# Timeline

2021 : Company registration

- 2022 : Setup of manufacturing plant
- 2023 : Commercial launch of turnkey electrolyser products MW scale
- 2024 : Multi MW product development







# **ABB MOTION**

We keep the world turning, while saving energy every day

Electrolysis requires direct current supply which can be delivered by means of our DCS880 rectifiers. We offer makers and producers of hydrogen a complete package: From high voltage to the DC drives, to the electrolyser stacks: in every crucial part of the operation, we offer turn-key packages with premium efficiency and support.

#### CONTACT

Rudy Genijn Product manager +32 496 57 54 21 rudy.genijn@be.abb.com www.abb.com

# **References:**

We work closely with electrolyzer manufactures to design and manufacture the best rectifiers for every stack size and multiple configurations. Power range from 100MW to 450MW.

# About the DCS880 rectifiers

- DCS880 is used as AC to DC power converter, suitable for Alkaline, PEM, and Solid oxide electrolyzers in hydrogen production.
- Modular design allows scaling in current and voltage. Currents from 100 A up to 5200 A single module; > 20 kA as a system. Voltage up to 1500 VDC.
- Our containerized solutions can be placed at an industrial sites to perform the electrolysis on premises.







# **ALPHA INNOVATIONS SA**

Innovative solutions to fulfill your power and monitoring needs.

AC/DC & DC/DC power conversion (<100kW): Of-the-shelf and dedicated solutions, from design to mass-production. Power management, control and monitoring software on multiple hardware platforms: "any device" handling, strongly agile and customizable.

#### **References:**

SME specialized in hydrogen energy storage systems for houses and commercial buildings

#### Use cases:

Dedicated DC/DC power conversion solution: designed to meet specific requirements of the manufacturer (design, prototyping, mass-production).

Modular power management (site control & monitoring): User friendly and stackable software & hardware enabling full system agility through simple configuration.

# CONTACT

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# JEMA

#### High Performance Power Systems

JEMA is supplying high performance systems aiming at powering electrolyzers, hydrogen fuel cells or other types of systems involved in the hydrogen production. The wide possibilities in terms of power, voltage and current together with the high efficiency of our power systems enable us to provide dedicated solutions. JEMA is also supplying solutions for energy storage (industrial battery systems), microgrid management and other highly demanding applications.

#### CONTACT

Nicolas BRONCHART CEO +32 10 45 43 33 Nicolas.bronchart@jema.be www.jema.be

#### **References:**

- High power converters
- Very fast and precise control system
- Network connection quality (control of the harmonics, flickering,...)
- Industrial battery converters
- Highly dependable systems

#### Use cases:

JEMA is designing, manufacturing, testing, installing and servicing specific designs to adjust to demanding customer's requirements.

Several multi-MW conversion systems have been installed and are running in industrial environments, with customer specific and precise control systems, and high availability and uptime.





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# VAN HOOL



# **VAN HOOL**

Elegance and efficiency in public transport

Van Hool has been building public transport hydrogen buses for for the American market since 2005 and for the European market since 2007. We now have Van Hool hydrogen buses operating in almost every country in Western Europe and North America, and the interest in hydrogen zero emission public transport rises exponentially in our neighbouring countries.

#### **References:**

- Mechelen, Antwerp (Belgium)
- Pau, Versailles, Rouen, Belfort (France)
- Köln, Wuppertal, Frankfurt (Germany)
- Rimini (Italy)
- Rotterdam, Groningen (The Netherlands)
- Oslo (Norway)
- Aberdeen, London (United Kingdom)
- Aalborg (Denmark)
- San Francisco, Connecticut, San Diego (USA)

# Use case :

#### Public Transport

Van Hool, recently, delivered a hydrogen bus (model A330FC) to STIB-MIVB in Brussels. STIB-MIVB (the public transport company responsible for bus, metro and tram transport in Brussels) wants to test the vehicle over a two year period on as many bus lines as possible, so they can thoroughly analyse its performance in different weather conditions (summer/winter) and various topographies on the Brussels network. Van Hool has been building hydrogen buses for the North American market since 2005, and for the European market since 2007. Van Hool has so far produced 162 hydrogen buses for North America (21) and Europe (141). Thanks to the hybrid power source, the bus, with a tank capacity of 38,2 kg of hydrogen, will be able to carry out a full day's schedule of potentially 350 km.

#### **Business Guide Hydrogen** End Use: Transport/Power/Industry

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# CONTACT

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# VDL

# Strength through Cooperation

VDL has an extensive knowledge and experience in the field of ZE services. As one of the European Pioneers VDL realized the first introduction of large scale deployment of ZE bus fleets in Europe, VDL became frontrunner in New Energy Systems for stationary and maritime applications. With the experience of VDL Enabling Transport Solutions on battery and hydrogen mobility the last 20 years, and VDL Energy Systems, on Power Generation and Energy Storage already several decades, the goal of VDL is to become leader in the field of Green Energy for both stationary and mobility applications.

# CONTACT

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# **References:**

- H2Watt.eu
- H2Haul.eu
- Stahhs.eu
- NWEurope.eu
- Giantleap.eu

#### Use cases:

- Delivery of H2 gensets and Battery Storage
- Delivery of Hydrogen Busses
- Delivery of Industrial Heat Pumps
- Delivery of Industrial Compressors



# ΤΟΥΟΤΑ



# **TOYOTA MOTOR EUROPE (TME)**

Fuel cell technology for clean energy transition

Hydrogen is key to reach carbon neutrality and Toyota has been investing in fuel cell technology since 1992.

The **MIRAI**, the 1st mass-produced fuel cell electric vehicle, was introduced globally in 2014 which allowed to progressively expand this proven technology in many other applications like buses, trains, generators, boats and so on. Our goal is to expand fuel cell beyond cars in order to support wider hydrogen ecosystems with partners.

In 2020, TME established a dedicated Fuel Cell Business group to accelerate our vision towards a hydrogen society.

#### **References:**

- EODev hydrogen solutions:
  <u>EODev (eo-dev.com);</u>
  <u>TME & EODev</u>
- CaetanoBus Fuel Cell buses: <u>H2.City Gold | CaetanoBus;</u> <u>Co-branding</u>
- FCH2Rail train project (funded by EU's FCH 2 JU):
   FCH2RAIL DLR Transport;
   FC delivered to FCH2Rail
- Maritime: <u>Corvus Energy and</u> <u>Toyota to develop FC</u>

Ist public hydrogen station in Belgium: <u>1st Belgium HRS</u>

# Projects:

- Air Liquide launched the first public hydrogen station in Belgium on TME's R&D premises.
- In 2021, the assembly of the 1st generation Toyota Fuel Cell Modules started in Belgium. In 2022, we started the assembly of the 2nd generation Fuel Cell Modules.

# CONTACT

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Technical Head of Powertrain

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Links:

Toyota 2nd generation fuel cell modules European production

FC tech shines sustainable light on the Eiffel Tower







# **ANGLO BELGIAN CORPORATION (ABC)**

# We power your future

ABC develops and manufactures reliable and innovative medium-speed combustion engines for the energy and transport industry – propulsion engines, generating sets for marine & land applications, engines for locomotive traction applications. Its modern engine range is future-fuel ready. Together with CMB (BeHydro) it brings hydrogen combustion engines to the market for heavy-duty industrial applications.

# CONTACT

Jean-Christophe Van Acker Sales Manager +32 9 267 00 00 info@abc-engines.com www.abc-engines.com

# **References:**

- 'Hydrotug' tugboat for port of Antwerp: 4 MWe dual-fuel hydrogen engines for heavy-duty marine environment
- 1 MWe dual-fuel hydrogen
  6-cylinder containerized genset
- 1 MWe 100% hydrogen 6-cylinder containerized genset

# Use cases:

- Propulsion engines
- Marine auxiliary gensets
- Land-based power generation
- Locomotive traction
- Heavy-duty industrial applications



# **BEH,YDRO**



# **BEHYDRO**

We bring hydrogen to the industry

BeHydro is developing hydrogen engines and storage solutions for marine, railway and power applications. BeHydro is a joint venture between CMB and ANGLO BELGIAN CORPORATION and is unique because of its high level of commitment to R&D in the field of hydrogen. The hydrogen combustion engines developed at BeHydro are already commercially available in the power range 1 MW to 2,7 MW with a lifespan of 150.000 running hours.

# CONTACT

Roy Campe CTO CMB.TECH +32 3 247 59 11 info@abc-engines.com info@cmb.be www.behydro.be

# **References:**

- 'Hydrotug' tugboat for port of Antwerp: 4 MWe dual-fuel hydrogen engines for heavy-duty marine environment
- 1 MWe dual-fuel hydrogen 6-cylinder containerized genset
- 1 MWe 100% hydrogen 6-cylinder containerized genset

- Propulsion engines
- Marine auxiliary gensets
- Land-based power generation
- Locomotive traction
- Heavy-duty industrial applications





# MAXON INTERNATIONAL (HONEYWELL THERMAL SOLUTIONS)

We provide industrial burner systems, burner management systems and fuel delivery equipment that is capable to fire 100% H2 or a mixture of H2 with commercial gases, in all thermal processing equipment from low to high temperature in steel, aluminium, paper, textile, printing, glass, automotive, petrochemical, building material, food, waste incineration, etc.

#### Use cases:

- Blending (mixing) systems
- Burner control panels
- Burner management systems
- CFD analysis
- Combustion chambers
- Flame monitoring systems desig¬ned for multi-flame supervision
- Fuel/air adaptive control systems

- Fuel train supplies
- Functional safety analysis
- Gas sensors
- Piping
- Services
- Software services providing asset management, historian, diag-nostics and analytics via mobile and enterprise platforms.

# CONTACT

# **Bart Geyskens**

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#### ZIERO

Your one-stop shop for hydrogen solutions

Ziero is a company with more than 23 years of experience in hydrogen and alternative fuels. Customers can contact us for consultancy, engineering, R&D and hydrogen products.

When it comes to consultancy and engineering, these activities focus on "power to gas" projects (= production of green hydrogen), proof of concept designs & calculations.

Regarding products Ziero supplies both its own hydrogen products designed in-house as well as "one off concepts" on customer demand. Our focus is on hydrogen internal combustion engines. One of the most recent developments is a hydrogen generator of 45kva & 65kva. Both running on 100% hydrogen with zero emission.

In the generator market Ziero has partnered up with a generator OEM as well with the rental market.

Our main activities are in the fields of: Consultancy, Engineering, Calculations, R&D, Design, Development, retrofit & software

#### Use case:

- VW Caddy on hydrogen
- Still forklift for Colruyt together with Waterstofnet
- Hydrogen Hybrid unit for forklifts
- Hydrogen Power Generator
- Power 2 Gas consultancy & projects

# CONTACT

Thomas Houben Managing Director +32 473 83 13 36 thomas@ziero.eu www.ziero.eu

#### **References:**

- e-powerAtlas CopcoBREG
- Thomas More University



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# Storage & Transmission

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# Hydrogen H<sub>2</sub>

H<sub>2</sub>

o emission



# **ATLAS COPCO**

# Hydrogen Compression Solutions

As a global, industrial company, Atlas Copco Group counts almost 40,000 employees and has customers in more than 180 countries. Atlas Copco Compressor Technique has been in the hydrogen market for several decades. Our industrialized hydrogen products now play a key role in the energy transition.

We are offering the most reliable and energy-efficient solutions for different markets, including Power to Gas, Mobility, Hydrogen Transportation & Industrial applications of green and blue hydrogen, to secure our customers' present and future success.

# Our offerings include:

- Oil-Free Reciprocating piston compressor with a pressure range of up to 100 bar and volume up to 14.000 Nm3/hr. (HX-HN series)
- Oil-lubricated hydrogen trunk piston compressor with a pressure range up to 350 bar and volume up to 500 Nm3/h (CU-series)
- High-pressure Oil-Free Hydraulic Hydrogen compressor with a pressure range up to 1000 bar and volume up to 500Nm3/hr.

Country	Size	Inlet Pressure	Discharge Pressure	Year	Scope	Туре
Spain	600 Nm3/hr.	20 Bar	500 Bar	2021	6 X Three stage twin compressors housed in a 2 X 40 feet container	Plug & Play Mobility
Italy	200 Nm3/hr.	15 Bar	500 Bar	2021	1 X Three stage twin compressor housed in a 1 X 10 feet Concrete container	Plug & Play Mobility
Denmark	90 Nm3/hr	30 Bar	300 Bar	2021	1 X Three stage twin compressor housed in a 1 X 10 feet container	Plug & Play Mobility
Australia	90 Nm3/hr	35 Bar	385 Bar	2021	1 X Three stage twin compressor housed in a 1 X 10 feet container with 0 $-$ 100% turn down	Plug & Play off grid storage
United Kingdom	1200 Nm3/hr	35 Bar	385 Bar	2021	1X Two stage + 1 X Mono stage duplex units in series mounted inside a 40 feet container	Plug & Play for aviation application
	800 Nm3/hr	35 Bar	450 Bar	2021	1X Two stage Twin + 1 X Mono stage Twin units in series supplied with Control Pannel	Only Compressor + Control

**References:** 

Note : Plug and Play solution includes compressors mounted in a container with closed loop cooling system assembled and tested in factory. Only utility needed from customer is Power Supply.





# **ENGICON (GELDHOF)**

#### Integrated steel solutions

Geldof is a leading supplier with global references for storage tank projects for oil, petrochemicals and biochemicals, and other bulk liquids. The storage tank solutions range from the delivery of individual storage tanks to the erection of large and fully equipped storage tank terminals. Geldof is also a leading company in the engineering and fabrication of pressure vessels. We have established a proud track record of successful realisations for the world's leading principals and contractors servicing the global oil & gas, petrochemical and bulk chemical industries.

# CONTACT

Pieter Van Acker Chief Commercial Officer +32 475 781105 pieter.van.acker@geldof.com www.geldof.com

# **References:**

Geldof is a leading company in the engineering and fabrication of pressure vessels. We have also established a proud track record of success among the worlds' leading operators of tank terminals, with numerous references in refineries and chemical companies as well as in various other industries. Each vessel or storage tank (project) is individually conceived, built and delivered to optimally meet the application's requirements, the project's challenges and our customer's expectations

# Use case:

One of Geldof's specialty solutions is the realisation of cold, refrigerated and cryogenic gas storage projects (hydrogen, ammonia, butane, ethane, ethylene, propane, propylene, LNG). All over Europe, Geldof has built several liquefied gas vessels, storage tanks and tank terminals with a volume of up to 150000m<sup>3</sup>, from an individual tank to a turnkey tank terminal





# **PLASTIC OMNIUM**

#### A major global player in hydrogen mobility

Plastic Omnium is confident that hydrogen will play a major role in the clean mobility of the future. Leading the way in this technology, the Group has invested over €250 million since 2015 to increase the expertise across the entire hydrogen value chain. With R&D centers in Europe and China, targeted acquisitions as EKPO and our Open Innovation ecosystem, Plastic Omnium's Hydrogen Revolution is well under way.

#### **References:**

- Hyundai Motor Company
- Daimler AG
- VDL
- EVOBUS
- Alstom

# Use case:

Development and production of state-of-the-art on-board storage systems for gazeous hydrogen at 350 and 700 bar, including applications for passenger cars, light commercial vehicles, buses, trucks and trains. Scope of delivery from single prototype tanks for demonstartor projects to high- volume production, anticipating the deployment of fuel cell electric vehicles (FCEV's).

# CONTACT

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# **AMS ROBOMOULD**

AMS is the global technology provider for the manufacturing of the hydrogen liner type IV products for busses, trucks, trains, off-road equipment ...

And this in various materials based upon PE, PA or multilayer technology. On top of this, AMS can offer you a completely automated solution for the full manufacturing process of your hydrogen tanks.

# **References:**

- More than 8 global Tier 1 companies are relying today on AMS to support them in the setup of the manufacturing of their liner and future production facilities
- All these references are under NDA agreements

#### Use cases:

Liners from length 680mm until 4250mm and diameters from 1000 to 400mm are made with our AMS Robomould® Process Technology.

# CONTACT

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# **COM&SENS BV**

## Adding value by sensing

Frontrunners in fiber optic sensing technologies, provider of digital manufacturing and structural health monitoring solutions for composite pressure vessels "COPV" for hydrogen storage. We develop technologies to optimize composites pressure vessels production costs and time-to-market. We enable safe, connected and intelligent composite pressure vessels, increasing confidence in hydrogen storage usage.

# CONTACT

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# **References:**

- Plastic Omnium
- Optimum CPV
- Toyota

#### Use cases:

# Benefits for COPV Producers :

- Lower safety factors & control material optimization
- Digitize & monitor process parameters
- Link process parameters & product quality
- Data driven tool for design updates

# Benefits for H2 storage owners/ operators/users :

- Proactive failure alerts & vessel health monitoring
- Digital twin tool for fleet monitoring
- Predictive maintenance & continuous certification
- Lifetime prediction & usage performance monitoring









# **DELTA APPLICATION TECHNICS**

# We improve your efficiency

Based on our experience in dosing and application, handling and quality control, we offer solutions and services for the production of low- and high-pressure vessels.

#### **References:**

- Resin dosing systems
- Dispensing solutions
- Handling & conveying systems
- Quality control solutions

## Use case:

Production of low- and high-pressure vessels.

# CONTACT

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# SANHA



# SANHA FITTINGS

# Manufacturer of piping systems

SANHA, has been specialising in manufacturing piping systems for more than 50 years. As we are strongly committed to environmental friendliness, we have put our focus on the use of piping systems for hydrogen applications for several years now. Our SANHA Press Gas copper press piping system is already certified by KIWA for admixtures up to and including 100% hydrogen gas. We also have stainless steel press fittings in our range that are approved for hydrogen applications.

#### **References:**

Kiwa Declaration of performance to AR 214 for series 10.000 and 11.000:
 "Fitness for admixtures up to and including 100% hydrogen gas"; 2019

# Use case:

- Tested in labos of gas distributors
- Industrial references where H2 is used for incinerators
- Multiple pilot projects of hydrogen houses
- Active participation in standardization groups

# CONTACT

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# **THE SNIFFERS**

Safe, Compliant and Efficient Operations Realizing your Environmental and Sustainability Ambition

The Sniffers supports its clients with detecting hydrogen leaks both above ground and underground. We perform LDAR campaigns to detect and quantify hydrogen leaks in installations with a variety of best available techniques. To detect hydrogen leaks on underground pipelines, our technicians perform leak detection on foot.

#### **References:**

- Air Liquide
- Total Refinery Antwerp
- Exxon Mobile
- Air Products

#### Use cases:

- LDAR
- Pipeline Leak Detection
- Hydrogen Emission
  Quantification

# CONTACT

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# Materials & components

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# Advanced Alkaline Stack using ZIRFON UTP 220 separator membranes



Image courtesy: ISPT Hydrohub GW Scale Electrolyser Project

# AGFA-GEVAERT

# Membranes at the heart of efficiency

Agfa's high performance ZIRFON UTP 220 membrane has excellent durability and its low resistivity allows for the highest yield of hydrogen production. With this membrane, Agfa is setting yet another standard for advanced alkaline electrolysis. A recent study by the Fraunhofer Institute using Agfa's ZIRFON separator membranes confirms that the alkaline electrolysis technology is the most cost efficient hydrogen production system to date. The company is currently negotiating supply agreements for its membranes within the framework of several large green hydrogen projects.

# CONTACT

# Nick Valckx

Business Manager H2 Membranes

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#### **References:**



# Performance:





# BEKAERT

Committed to create green and sustainable solutions

Bekaert is a global leader in steel-based reinforcement applications such as automotive tires and concrete reinforcement. We have now committed to create solutions (steel and non-steel) for the green energy transition. Our involvement goes from green energy production in floating solar/wind (steel/synthetic/hybrid mooring lines), to green hydrogen production (Ti and Ni fiber-based solutions for electrolysers), to reinforcement solutions for flexible hydrogen transmission pipes and hoses, to hydrogen combus-

# CONTACT

# **Chris Dhulst**

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tion systems. In all of these sectors, we proudly innovate with scale-up in our mind from the start, benefiting from our global research network and manufacturing footprint in 120 countries.

# **References:**

- Multiple strategic & development partnerships with floating offshore developers
- 20+ years track record metal fiber porous transfer layers (PTL) for water electrolysis and CO2 conversion (316L, Ti, Ni, Cu)
- Hyve cost efficient green H2 at GW scale
- Eco2Fuel Electrochemical CO2 conversion into green molecules at industrial scale
- Waterstofwijk Hoogeveen : High performance (low NOx) domestic H2 boilers

# Use cases:

- Mooring solutions for offshore platforms (PV, Wind, Electrolysis)
- Porous Transfer Layers (PTL) for PEM/ALK/AEM electrolysers
- Porous Transfer Layers (PTL) for green molecules production
- Reinforcement solutions for H2 transmission and distribution lines (flexible pipes, H2 hoses)
- H2-ready burners for domestic heating

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# borit



#### **BORIT NV**

We deliver components for Fuel Cells and Electrolyzers

By developing a leading and efficient production infrastructure of thin metal bipolar plate assemblies and by providing excellence in metal forming, cutting, welding, coating and sealing, we contribute to the Clean Energy Economy

#### **References:**

https://www.borit.be/offerings/fuel-cell-electrolyzers https://www.borit.be/capabilities/value-chain

### Use case:

Borit supports customers from the early design phase over prototyping to series production. For this we use different technologies and capabilities throughout the production ramp-up in order to offer the optimal balance between development flexibility, cost and time-to-market. Borit's array of technologies allows us to support fast product development cycles combined with unique cost advantages.

# CONTACT

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# BOSAL

Contributing to a cleaner world by consistently innovating in mobility and energy Bosal offers customized design, prototyping, validation testing & serial production, for several applications:

- Hot BoP components for Solid Oxide Electrolysers (SOEC) and Fuel Cells (SOFC) for residential, commercial & industrial use
- Aftertreatment systems for internal combustion engines running on e-Fuels or hydrogen.
- Range Extender Technology for BEV
- Ammonia Cracking Technology for Alkaline Fuel Cells (AFC)
- Heat Recuperators for Gas Turbines

#### **References:**

- Electrolysers SOEC: Haldor Topsoe and Sunfire
- Residential SOFC: Hexis
- Commercial SOFC: BOSCH
- Mobile Range Extender: Weichai Power (SOFC) and Ford (Turbine)
- Industrial Gas Turbines: Ansaldo Energia

# CONTACT

#### Werner Boeykens

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# Use case:

Field tests with BOSCH for an SOFC distributed power unit (off grid) targeted at the worldwide market for Data Centers. Integrated BOSAL Design where we supply the HotBox with a multi heat exchanger assembly. Operating T° 750°C and efficiency > 60%. Fuel versatile.







# **IEMANTS (SMULDERS)**

#### Passionate about steel

lemants, subsidiary of Smulders, can participate in the engineering, production, assembly and mounting on the green- or brownfield for general steel constructions. We work on individual volumes of 500 to more than 10,000t for each project. Eventually, the financing in the Capex period is possible as well.

# CONTACT

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#### **References:**

- Esso
- BASF
- Covestro
- Nippon Shokubai
- JBF Global

#### Use case

As an esteemed supplier to the offshore wind industry, Smulders provides transition pieces and jackets for windmills as well as offshore high-voltage substations.

We're also involved in floating wind and in that way, there is an opportunity to prepare an installation of an elektrolyser on board of these constructions.







# **MOCKEL SA**

More than parts! Your partner for complex needs...

All of our employees are specialists in the manufacture of high precision mechanical parts. The company has the state of the art machinery, the technical know-how and the necessary experience to handle all aspects of production from start to finish.

# **References:**

# Anleg GmbH

## Use case:

gas handling unit (GHU) for a system, preferably hydrogen gas at up to 500 bar, particularly up to 700 bar (in this case) a pressure regulating device.

# CONTACT

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# NITTO

# Innovation for customers

Originated in Japan more than 100 years ago, Nitto has become one of the leading global chemical companies specialised in advance polymer materials. Today the Nitto Group consists out of 92 companies, 30.000 employees with a revenue of 7B US\$. Nitto's product portfolio consists out of 13.000 products which find their way in more than 70 B2B markets.

Nitto EMEA NV, located in Belgium, is the regional headquarters for the Nitto Group in the EMEA region which defines the strategic direction for the Nitto companies in the EMEA region.

# **Applications:**

Nitto is committed to the green energy transition hence we developed solutions to support applications in the growing hydrogen market. These product solutions consist out of fuel cell gasket seals (MEA subgasket, bi-polar plate gaskets), MEA processing materials and hydrogen/ammonia detection products.

# **References:**

- MEA ; subgasket sealing, speciality films for DTM process (Direct Transfer Method aka catalyst coating onto membrane)
- FC stack ; bipolar plates gasket sealings
- General H2 applications; DX-series (H2- and Ammonia detection tapes)



# CONTACT

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# umicore



# UMICORE

Umicore is a global materials technology and recycling group. It focuses on application areas where its expertise in materials science, chemistry and metallurgy makes a real difference. Its activities are organised in three business groups: Catalysis, Energy & Surface Technologies and Recycling. Each business group is divided into market-focused business units offering materials and solutions that are at the cutting edge of new technological developments and essential to everyday life. Umicore generates the majority of its revenues and dedicates most of its R&D efforts to clean mobility materials and recycling. CONTACT Dr Fabrice Stassin Government Affairs Umicore +32 2 227 71 53 fabrice.stassin@umicore.com https://fcs.umicore.com/

#### **References:**

- Qualified supplier of more than 10 OEMs across regions (car and truck OEMs as well as stack producers and system manufacturers)
- Considered benchmark catalyst materials by leading fuel cell companies
- Umicore is supplier and co-developer of PEM fuel cell catalysts with Hyundai Motor Company since September 2009, providing the high performance and durability catalyst requirements

# **Applications:**

Umicore's PEM catalysts are developed to provide the automotive industry with high performance fuel cells and to enable green hydrogen production through electrolysis.

With 30 years' experience of manufacturing PEM catalysts, Umicore has proven know-how in catalyst development, scale up and industrial scale production, as demonstrated by Umicore solutions already on the road in vehicles. As well as being key components of commercial stack platforms available on the market today, our PEM catalysts are benchmark materials at leading Fuel Cell companies. Umicore's PEM catalysts are also ideally suited for electrolyzer applications.

At Umicore's recycling facilities, the critical metals (PGMs) contained in electrocatalysts can be recovered and re-injected into the hydrogen economy.



# Research, development & engineering services









# VON KARMAN INSTITUTE FOR FLUID DYNAMICS

The von Karman Institute for Fluid Dynamics (VKI) performs experimental testing and numerical simulation on fluid dynamics phenomena with gaseous or liquid hydrogen, during transportation and distribution in a piping network or in a propellant management system, during storage in a fuel tank for mobility appications or for long term energy storage, or during combustion in an aeronautical or maritime propulsion system.

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#### **References:**

- European Space Agency (EUR)
- Ariane Group (FR)
- Safran AeroBooster (FR)
- Fluxys (BE)
- Boom Supersonic

#### Use case:

- Research on liquid hydrogen behaviour in the propellant management system for rocket launchers (sloshing, cavitation, chill down, boil-off, hammering...)
- Hydrogen combustion in aerospace applications (hypersonic propulsion, satellite thrusters...).
- Energy storage with densified cryogenic e-fuels (e.g. hydrogen, methane, LNG).







#### **SIRRIS**

#### Together we turn innovation into success

How to make your product, factory and business futureproof? The 150 experts of Sirris, the collective centre of the technology industry, help each year about 1,300 companies to make the right technological choices and to realise their innovation projects successfully in different sectors including the energy transition and the hydrogen economy.

Sirris is the collective centre for and by the technological industry. We offer Belgian companies three key assets to help them remain innovative: years of experience and comprehensive expertise in a wide range of industries; high-tech testing infrastructure spread across the country; and an extensive network of partners. This way we help large and smaller players in Belgian industry make the right technological choices and achieve sustainable economic growth.

# CONTACT

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#### **References:**

- EU H2020 THOR Project Thermoplastic Hydrogen tanks Optimised and Recyclable
- Climatic testing of power and hydrogen generation solutions (power convertors, transformers,...)
- Advanced manufacturing support
- R&D projects on using SLM technology for electrolysis

#### Use case:

- Climatic testing of large multi-MW integrated systems in harsh environments
- Precision manufacturing laser texturing
- Additive manufacturing of complex parts in different materials
- Simulation of structural behavior of high pressure composite vessels
- Material testing

# .AGORIA



# OCAS

Contract research and development on metallurgy, metal processing, surface engineering, testing and characterisation of materials and components.

OCAS accelerates the R&D processes of its customers through a specialised multi-disciplinary approach combined with innovative testing methodologies.

# CONTACT

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#### **References:**

- Material risk assessment
- Material screening and selection
- Repurposing of assets
- Acceptance testing of components
- Leak performance of connections
- Failure analysis / RCA

## Use cases:

- We support customers on their R&D needs to either investigate material compatibility or test component safe operation in specific conditions.
- We help identifying possible risks or proof exploitation is safe under given circumstances.
- We have been working closely together with inspection bodies to ensure validation of the material program and acceptance of the results.







# **METALOGIC**

METALogic wants to be the partner of its customers for all material related problems. We accompany our customers in all the decisive stages of an installation's lifetime to prolong its safe service life.

# **References:**

- Material selection
- Failure analysis
- Corrosion study & risk assessment
- Electrochemical research

#### Use case:

- Damage mechanism studies for hydrogenation and dehydrogenation units in the pharmaceutical and chemical process industry.
- Electrochemical research
- Failure analysis and material selection for a supplier of PEM and alkaline electrolyzers.

# CONTACT

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# **BREUER TECHNICAL DEVELOPMENT (BTD)**

BTD is an ISO-certified service provider in the IC engine development sector for more than 20 years. To meet the requirements of the EU and therefore the transport industry, BTD is a reliable partner in R&D of CO2-neutral drive systems (H2 and E-Fuels).

Our main activities are in the fields of:

Well-known companies in the

 Design, development, mechanical construction and measuring on test benches of engines or subsystems

# **References:**

automotive sector

Projects:

- BTD is a part of the European C2FUEL project (E-Fuels)
- BTD is active in IPCEI Hydrogen.

# CONTACT

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# **DSI-DELTA SERVICES INDUTRIELS**

#### Tools to Speed-up Your R&D

DSi is a Belgium-based company that develops innovative measurement techniques to evaluate engines, fuels and lubricants with a focus on zero and low-carbon products.

#### **References:**

- TotalEnergies
- AVL

## Use case:

- Assessment of Internal Combustion Engine fueled by H2 or e-Fuels to measure the wear (and corrosion), oil emissions, oil dilution and additives depletion,
- Validation of engines, components and lubricants at an early stage, saving effort, development time and costs later on,
- Study and integration of fuel cells / H2 ICE in demonstrators (vehicle, stationary application, power generating devices, zero-carbon storage device),
- Benchmarking of stationary fuel cells and H2 ICE generators,
- Design and Manufacturing of fluids conditioners, compliance study of machinery and test rig to upgrade to H2,
- Engine test cells and H2 ready lab with restricted access and engineering support.

# CONTACT

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Agoria is paving the way for all technology-inspired companies in Belgium that strive for progress in the world through the development or application of innovations and together represent more than 310,000 employees. The organization brings together nearly 2,000 technology companies, 70% of which are SMEs. In its offices in Brussels, Antwerp, Ghent, Liège and Charleroi, Agoria has around 200 employees. Agoria's services and positions cover HR and training, market development, regulation, digitization, infrastructure, manufacturing, climate, the environment and energy. Their aim is to connect all those who are inspired by technology and innovation, to boost the success of companies and to shape a sustainable future.

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Embracing technology Embracing ambition

