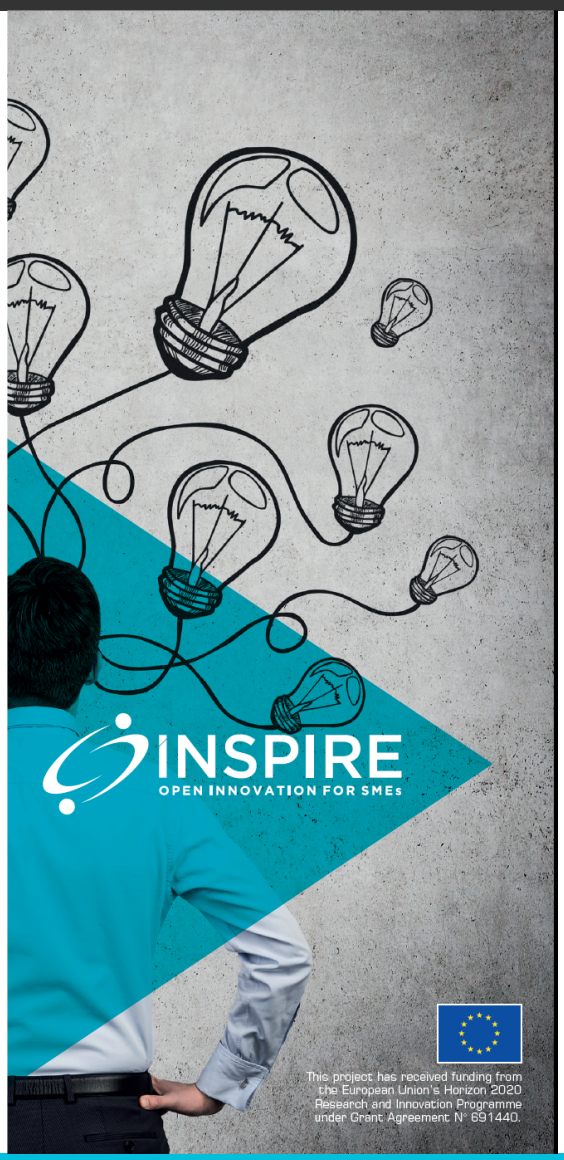

HELBIO

Greece, www.helbio.com

A Greek SME enters into a collaboration with two large corporations in two different energy-dependent sectors in order to develop further its proprietary technologies and open up new routes to market

Executive Summary

HELBIO develops and markets hydrogen production systems, primarily from renewable sources, either for industrial use or integrated with fuel cells for Combined Heat and Power (CHP) production. The multi-fuel systems are designed and manufactured for operation with both liquid and gaseous fuels, and HELBIO has established a leading position worldwide in hydrogen production from bio fuels.

HELBIO is a key partner in a collaborative project that aims to create the foundations for commercializing an automotive-derivative fuel cell system in the 50 to 100 kW range, for combined heat and power (CHP) applications in commercial and industrial buildings. Based on a fuel cell stack similar to the one used in automobiles, HELBIO designs and builds the fuel processor of the power system, based on proprietary technologies, and will integrate it with a pressure swing adsorption system so as to produce pure hydrogen.

CASE N°: SE51

SECTOR: RENEWABLE ENERGY

TECH INTENSITY: HIGH-TECH

LIFE CYCLE STAGE: ESTABLISHED

INNOVATION VECTORS: PRODUCT

OI PARTNERS: PSR, LARGE CORPORATION, OTHER SME

KEYWORDS: Hydrogen production systems, manufacturing, energy, CHP

Helbio
Hydrogen & Energy Systems

BACKGROUND

HELBIO S.A. was established in 2001 as a spin-off company of the Heterogeneous Catalysis Laboratory of the Department of Chemical Engineering, University of Patras, with the purpose of promoting hydrogen production technologies from renewable raw materials and power generation using fuel cells. The company was initially funded by the Greek Ministry of Development under the PRAXE B programme for matching capital and venture capital, with stakeholders the Emporiki Venture Capital, the University and the researchers. Today HELBIO is a subsidiary of the Metacon group. The Metacon Group is built around the invention and development by HELBIO of hydrogen production by catalytic, flameless steam reforming of world leading performance. HELBIO has delivered more than 20 complete energy systems of which four were developed before 2005 with the unique reformer technology.

Metacon was founded in 2007 by the serial entrepreneur Kurt Dahlberg. The genuine R&D competence of HELBIO and the industry knowledge of Metacon have contributed to building a strong team. Metacon AB owns 53% of HELBIO and Professor Verykios is one of the major shareholders of Metacon AB. HELBIO develops, manufactures and commercializes:

- fuel-processing systems operating on fossil fuels, such as natural gas and Liquefied Petroleum Gas (LPG), as well as renewable biofuels, such as ethanol and biogas;
- power or heat and power (CHP) systems based on fuel cells, for out-of-grid applications, auxiliary power production, back-up systems, etc.
- hydrogen production units for industrial applications to replace existing hydrogen transport and storage facilities which are costly and hazardous.

The company has established collaborations with major Greek research organizations (e.g. University of Patras, Foundation for Research and Technology – Hellas) and other European organizations (research centres, industry, institutional actors), participates in national and European research, development and demonstration projects and has an extensive international network of partners, collaborators and clients.

HELBIO has produced a steady stream of innovations and technological improvements in the areas of catalyst development, advanced reactor design and development and hydrogen purification technologies, etc. The company has developed a number of prototype products which utilize the most technologically advanced fuel processor and it has established a leading position worldwide in hydrogen production. Its technology is based on proprietary and patented reactor-catalyst configurations for reformation processes. The reactor configurations utilize the concept of HIWAR (Heat Integrated Wall Reactor) which offers very rapid heat exchange characteristics, resulting in very efficient and highly compact systems.

HELBIO focuses on the standardization and commercialization of two main products:

1. Small scale (5kW) APU (on-board auxiliary power units) or CHP (combined heat and power) systems operating with NG (natural gas), propane/LPG (liquid petroleum gas) or biogas (consisting of a fuel processor, fuel cell stack and power electronics). The target markets for the above product are the following: i) telecommunication towers, ii) on and off-grid households and other buildings, iii) yachts and sailing boats, iv) trucks and v) small-size farms with small-scale biogas production.
2. Industrial hydrogen generators (20-300 Nm3/h) operating with NG (natural gas), propane/LPG (liquid petroleum gas) or biogas (consisting of a fuel processor and Pressure Swing Adsorption system).

The target markets for the above products are hydrogen refuelling stations and industries using pure hydrogen for their processes, e.g. oil and margarine industries, production of industrial gases.

HELBIO S.A. was recently awarded a Phase 2 project under the Horizon 2020 SME Instrument, aiming to commercialize and launch a 5kW Combined Heat and Power (CHP) production system operating with intermediate hydrogen production (steam fuel reforming) and fuel cells (Prometheus-5). Currently, the market for remote or back-up power generation is served by diesel or gasoline generators which rely on mature and relatively low-cost technology. However, they offer about half of the electrical efficiency compared with the proposed system and present other drawbacks, such as high operational and maintenance costs, high pollution emissions, vibration, noise, etc.

The commercialization of HELBIO's system will result in power generators which have twice the electrical efficiency of conventional ones, leading to proportionally reduced fuel consumption and proportionally reduced GHG (greenhouse gas) emissions. In terms of developing the market, this project offers an important vehicle for

standardizing the manufacturing process for industrial mass production, scaling up and entering into strategic collaborations with FC (fuel cell) manufacturers, partners and vendors. As a result HELBIO will be able to address a larger market and provide mass-produced products via its Prometheus-5 commercialization plans. It is intended to use alternative fuels like propane, LPG, NG and especially biogas as a source of renewable energy.

INNOVATION CHALLENGE & MARKET OPPORTUNITIES

HELBIO's reactor was put on the market in 2005 and its functionality has been proven in various industrial applications with different customers. Unlike its competitors, HELBIO's reformer can convert many different types of fuel such as biogas, natural gas, methanol and ethanol without any loss of efficiency and without any need for a large-scale production facility. HELBIO's patented reformer offers higher efficiency (more than 5% higher efficiency compared with competing reformer technologies) and a smaller carbon footprint than its competitors and is considered a world leader within biogas to hydrogen reforming. HELBIO's reformer makes it possible to use locally available waste and fuels and convert them to hydrogen, electricity and heating in a small-scale plant and in a much more efficient process compared to other solutions in the market.

The reactor configurations utilize the concept of HIWAR which offers very rapid heat exchange characteristics, resulting in very efficient and highly compact systems. The main fields of application of the reformer are: hydrogen refuelling stations; the steel, electronics and glass industries; oils and fat hydrogenation. HELBIO's main advantages are:

- lower cost of hydrogen production
- lower maintenance costs and enhanced durability of materials
- multi fuel capability
- no (or reduced) emissions (no SOx, very low NOx)
- improved safety (no flame)

A consortium of European automotive and stationary fuel cell developers consisting of two large companies (GE, Alstom), HELBIO and three Research and Technology Organizations (University of Split, University of Tuscia and a Norwegian RTO called SINTEF) responded to an FCH JU (Fuel Cells and Hydrogen Joint Undertaking) call aiming to develop, manufacture and validate a new generation of fuel cell systems with properties that significantly improve competitiveness and more specifically develop, build and validate a 50kW PEM (Proton exchange membrane) CHP system running on natural gas.

The mass production of fuel cells will be a strong factor in reducing high production costs. In this respect, pooling the resources of two non-competing sectors (the automotive sector, represented by Daimler, and that of stationary power generation, represented by Alstom Power) will bring benefits to both by increasing production volumes and ultimately reducing costs to make fuel cells competitive.

OPEN INNOVATION TRAJECTORY

Concept development

The overall aim of the project is to create the foundations for commercializing an automotive-derivative fuel cell system in the 50 to 100 kW range, for combined heat and power (CHP) applications in commercial and industrial buildings. More specifically, the project has the following objectives:

- develop system components allowing reduced costs, increased durability and efficiency;
- build and validate a 50 kW PEM prototype CHP system;
- create the required value chain from automotive manufacturers to stationary energy end-users.

The initial approach was to use well-known technologies for setting a «baseline» demo for further improvement. As a consequence, the project partners were able to identify a PEM fuel cell-based CHP concept to address the stationary power market, primarily for commercial and industrial buildings requiring an installed capacity from about 50 kW to several hundreds of kW. The overall system will be demonstrated and further validated to increase the technology readiness level, while in addition innovative solutions will be demonstrated to continue to improve performance and reduce costs and complexity.

The project consortium includes partners from the full value chain, ranging from automotive manufacturers to stationary energy end-users of the fuel cell CHP system who are expected to

enhance significantly the route to market for the system/technology.

The development process, IPR and competition strategy

HELBIO has designed and is currently building the fuel processor based on its proprietary technologies and intends to integrate it with a PSA so as to produce pure hydrogen. Daimler delivers fuel cell stacks which are identical to those used in the Mercedes fuel cell cars. Alstom Power is responsible for the integration of the entire energy system and the planned large-scale international commercialization of the system. The first demonstration plant is being set up entirely by HELBIO and installed in Rugby, UK (to be commissioned in June 2017). The HELBIO hydrogen generator is currently produced in a collaborative manufacturing facility in Thessaloniki.

HELBIO utilizes its proprietary technologies, while the related co-development activities, as well as the demonstration activities and knowledge management procedures, are covered by the project Grant Agreement clauses of the H2020 - Fuel Cells and Hydrogen Joint Undertaking call.

The company's competition strategy is to take advantage of its unique selling proposition (USP), i.e. the technology of the H2 generator which can reduce the overall size of the unit by up to 40 times. The interviewee indicated that competition is very limited with only two identified competitors (1 Dutch company and 1 German company of a similar size to HELBIO).

Commercialization and follow-up

Following the successful installation of the first industrial hydrogen generation units, HELBIO will be able to capitalize on the results of the project in hydrogen refuelling stations (relevant technology, application and PSA) in different markets. The very high requirements of hydrogen purity are of course identical in both applications, since the fuel cell stacks will be used in the stationary energy facilities and in the Mercedes fuel cell electric cars.

The company has scaled up manufacturing to a level that covers current demand and that expected in the near future through its trusted collaborative manufacturing facility in Thessaloniki. It also plans to identify both manufacturing partners and vendors for the commercialization of the product in Europe, the USA, Japan, India, Brazil and China in order to reach much greater volumes of production and sales.

This collaborative project is ground-breaking as it combines Daimler's technology and hydrogen fuel cell cars which are already in small-series production with the advantages of the stationary plant for cogeneration (simultaneous production of electricity and heat) for use in industrial, commercial and residential buildings, which is expected to provide significant cost savings.

HELBIO had to hire more engineers to keep up with the development needs of the project. Apart from the complementary technologies needed to produce this novel CHP system, the collaboration with major industrial players, such as ALSTOM and Daimler, is a key element of HELBIO's marketing strategy. These companies offer much needed market reach as well as already established distribution channels that facilitate the commercialization of HELBIO's technology.

BUSINESS IMPACT

HELBIO has utilized its proprietary technology in order to develop together with major industrial players an innovative product that can disrupt the CHP market. During this process they have developed technical know-how that might be useful to them in the future. They have also learnt to identify the complementary commercial and technical skills they need when they form a consortium that will facilitate a route to market for their technologies. The CHP unit presents a significant opportunity for HELBIO to utilize its IP and bring a major innovation to market.

LESSONS LEARNED

This case shows that even large multinational companies with a significant amount of resources at hand have much to gain by employing the technical know-how of SMEs in order to develop an innovative product. It also shows the challenges that an SME can face when it collaborates with companies of a significantly larger size, while also demonstrating the benefits that an SME can derive from such a collaboration.

Main lessons learned:

1. Strategic collaboration among key players, which reflects the full value chain of the fuel cell CHP system, is crucial not only for the overall system demonstration and further validation to increase the technology readiness level, but also to enhance significantly the route to market for the system/technology.
2. Apart from the need for a clear agreement, it is important to build trust because in the event of a conflict a small company will find it difficult to protect itself against a large multinational because of the high cost of legal action.