Case Study: Nedstack and Meeting a Niche Demand

Nedstack
PEM FUEL CELLS

Nedstack is one of Europe's largest manufacturers of PEM fuel cells and was established in 1998 as a spinoff of AkzoNobel – a major paints and coatings company and a global producer of speciality chemicals. Based in Arnhem, the Netherlands, Nedstack is now a privately owned and independent company. The majority of Nedstack's business comes from the selling of stacks to system integrators, but the company has recently entered the chlor-alkali industry under its own name in a series of collaborations.

The Plant

LOCATION:
Solvay Chlorine Plant, Lillo, Belgium

SPECIFICATION:
12 fuel cell modules
12,600 cells in 168 stacks
1 MW power output
1 MW by-product heat output

BENEFIT:
Allows Solvay to self-generate 20% of its electricity consumption and valorise its hydrogen waste stream.

Decision to enter the chlor-alkali market

Nedstack finds itself in a unique position: a wholly independent fuel cell stack manufacturer, but with some grounding in the process industries from its development as a spinoff of AkzoNobel. The chlor-alkali industry produces chlorine and caustic soda through the electrolysis of brine with hydrogen gas produced as a by-product. Nedstack saw an opportunity for the large-scale utilisation of the by-product hydrogen to produce electricity and heat on site with customers that already deal with hydrogen on a day-to-day basis.

In 2007 Nedstack installed a 70 kW PEMFC at an AkzoNobel chlor-alkali plant in Delfzijl to test the versatility of its stacks and the viability of fuel cell solutions at chlor-alkali plants. The results were promising – the system has now surpassed 24,000 hours of operation – so Nedstack decided that it would scale up the system and aim to produce a 1 MW unit. Chemical group Solvay approached Nedstack, and together with the WaterstofNet funded the development of a 1 MW system for installation at Solvay's Lillo chlorine plant, close to Antwerp.

RCS and system design

Nedstack has had its stack designs with 10 to 75 individual cells CE marked since November 2008. The stacks were assessed by Kiwa Gastec and fulfilled the requirements of standard EN 62282 (2004) Fuel cell technologies – Part 2: Fuel Cell Modules with Amendment A1 (2007) and are in conformance with the European Directive 2006/95/EC: Low Voltage Directive. Its 1 MW plant is composed of 168 individual stacks, all CE marked, so when it came to CE marking the plant as a whole the task was greatly simplified. MTSA Technopower, a specialist machine manufacturer assembled and CE marked the plant as a whole.

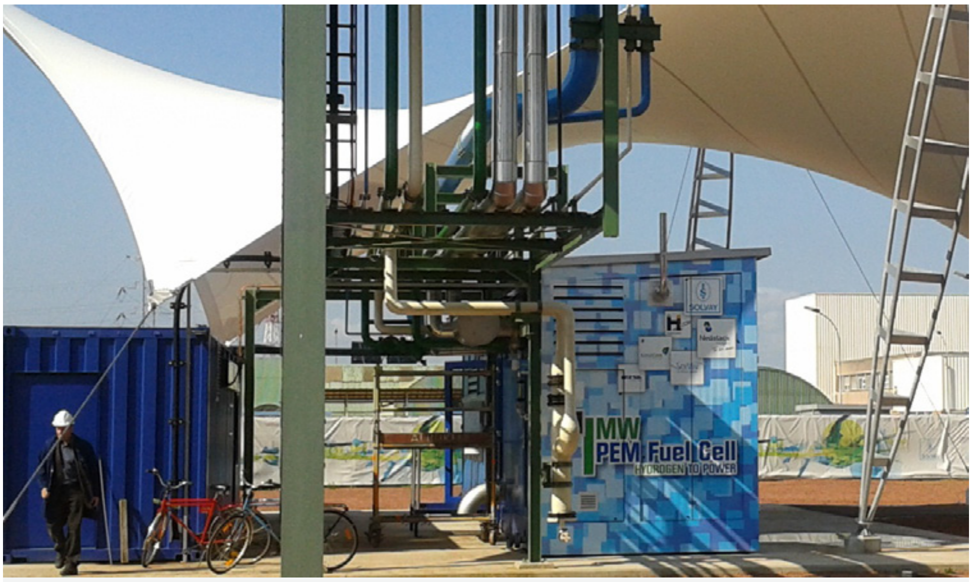
Nedstack performed a HAZOP study on its plant design in collaboration with Solvay and MTSA. HAZOP, or hazard and operability study, is a structured and systematic qualitative technique for system examination and risk management – often used as a technique for identifying potential hazards in a system by a team of at least five people, the leader of which has previous HAZOP experience but was not involved in the design of the system. Although HAZOP studies can be expensive, they can ease the certification of a system and it was an important step for Nedstack. The company also followed basic good engineering practices through the use of proper ventilation and hydrogen sensors.

Key Points

Installing the system

The fuel cell system was installed in two large shipping containers at the Solvay site. With regard to location and safety distances, these were defined primarily by Solvay's engineers but in collaboration with Nedstack, who had experience from its smaller plant for Akzo. Nedstack was keen to stress that it had consciously entered a market where the customers were already adept at dealing with hydrogen at an industrial level.

By working closely with the customer from the beginning of the process, the customer's needs could continuously be taken into account in the design and installation of the plant, reducing difficulties in the installation process. The biggest surprise of the entire process for Nedstack came after installation when the unit was first put into operation. Solvay's hydrogen pipeline had not been properly cleaned and residues contaminated several components in the plant. Nedstack subsequently installed filters to prevent any reoccurrences.



The installed system at Solvay's Lillo plant

Replicating efforts

With the experience of the initial Akzo installation and this subsequent 1 MW upscaled installation, Nedstack is confident the engineering approach can simply be duplicated for future installations. Solvay's installation was more modular than most would be as the company wanted to closely analyse individual cell and stack performance. These two factors mean that a future plant would be cheaper to manufacture. Nedstack is aiming to reduce plant cost through design simplification to a price that would allow for a payback time of less than five years, something the company sees as critical to widespread adoption.

Close customer interaction

The company took the time to work closely with its customer from the very beginning of the process. This guaranteed that the product would meet the customer's requirements exactly. Although such close working relationships will not be possible for all fuel cell manufacturers, the mantra of valuing customer involvement is worth adopting.

Unique niche and experienced partners

Nedstack found a novel route to market by entering an area where the customer base is experienced in handling hydrogen. A significant barrier to adoption in other applications is the training of customers and the overcoming of the perceived dangers in using hydrogen; Nedstack chose MTSA to certify the plant as it had previous experience with hydrogen. By choosing a unique niche Nedstack gains a competitive first mover advantage; Nedstack has experience in this niche, but it should be kept in mind that when entering an unknown niche there can be little support and such first moves are often calculated risks.

Thorough testing at every stage

In an area where capital costs of products are still high it is wise to try to minimise the number of potential mistakes or setbacks in the process. Testing a pilot plant, performing a HAZOP study and using hydrogen-experienced certifiers ensures quality, though as Nedstack learnt, testing of the entire application on site is still necessary – including any components or interfaces from other bodies, such as hydrogen feed pipes.