



evides
industriewater



Air Liquide/Pergen (Rotterdam)
*Demineralised water for the biggest refinery
of Europe at Shell Netherlands Refinery*

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History

At the site of Shell Netherlands Refinery, Evides has constructed a process water plant which produces demineralised (demiwater) for supply to the Cogen (Cogeneration) plant of Pergen. This Cogen produces steam for delivery to Shell (700 tonnes per hour) and generates electricity which is primarily supplied to Eneco (300 MW). Shell uses this steam in various production processes and to heat some buildings and certain storage tanks. The Pergen Cogen replaced Shell's 46 year-old Boilerhouse 4, which was still being fired with heavy oil residue. The gas-fired Pergen Cogen makes a considerable contribution to the sustainability of the largest refinery site in Europe: emissions of sulphur dioxide (-99%), nitrogen oxides (-66%) and fine particles (-90%) are reduced considerably.

The chemical and petrochemical industry consumes large quantities of utilities, including electricity and steam. The most important feedstock in the production of steam is demiwater. For high-yield Cogens like Pergen, supply quality is equally as important as reliability of supply: conductivity ($< 0,2 \mu\text{S}/\text{cm}$) and TOC content (Total Organic Carbon; < 200 ppb) are essential.

Pergen – a division of the world's largest producer of industrial gases, Air Liquide – is responsible for the design, construction and operation of Shell's latest Cogen. The demi-production plant (investment approximately 20 million euros) is part of the Cogen. Pergen wanted to tender the production and purchase of demiwater and sought a partner who was prepared to make the investment needed as well as to operate the demi-production plant. Evides Industriewater was selected to fulfil this role. A few factors helped to determine this choice: firstly, Evides Industriewater boasts a sizeable water sources portfolio in the Rotterdam harbour area which makes it possible to realise the supply of various water qualities, while at the same time offering sufficient back-up capacity. Secondly, Evides Industriewater has vast proven track record in the realisation of such products in the petrochemicals industry. According to the DBFO model, Evides is fully responsible for the project: from design to construction, and from financing to day-to-day operation. In the Rotterdam harbour area, Evides Industriewater employs the personnel qualified to operate such installations. Thirdly, Evides Industriewater offers proven experience in using ion-exchange technology for the production of demiwater that meets the required quality demand. Finally, Evides Industriewater was prepared to pre-finance the investment for such a project (contract duration: 15 years).





The demi-plant

All this results in well-managed feed water quality, reliability in design and operation and – finally – a guaranteed supply of demiwater around the clock.

In 2004, a start was made to the activities of Evides Industriewater, by undersigning a letter of intent, after which work could begin on the design. Evides developed the installation based on a DBFO contract. This means that Evides Industriewater has resumed full responsibility for the design, construction and financing of the project. After construction (February 2006 to end of 2007) the demi-plant was started-up and commissioned at the beginning of 2008.

With a total capacity of 1,055 m³ demiwater per hour, the plant is one of the largest of its kind in Europe. The plant is fed by so-called industry water which is supplied by Evides Industriewater. The Shell site at Pernis already is connected to the transport network of industry water. This water has a good, constant base quality (equivalent to drinking water). In addition, the redundancy of the piping transportation network adds to the reliability of supply. Because the water is of good and consistent quality, the size and number of treatment steps of the new demi-plant are relatively limited. This was beneficial for the proposed location because the plant needed to fit into a very compact building due to space limitations.

The demiwater process is based on ion-exchange (IX) because this demineralisation process results in a relatively high recovery, whereby savings are made as a result of the reduced use of feed water and reduction of quantities of waste water. Further, Evides Industriewater has a lot of experience in operating such installations very efficiently (including the Dow Chemical plants in Terneuzen and Stade/Hamburg).

The industry feed water flows through two pipes into two 10,000 m³ break tanks. It is then pumped from these tanks to the demi-plant, which consists of five IX lines. Each IX line consists of a cation filter with weak and strong acid resin, a CO₂ degassing tower, an anion filter with weak and strong base resin, followed by a mix-bed filter serving as a final polisher.

The plant has a high operating reliability: the contractually required daily supply capacity of demiwater can on average be supplied using four of the five IX lines. The fifth line thus merely acts as back-up, whereby the required redundancy is offered needed for correct operation. Further, the plant





Specifications

has three complete regeneration stations, each of which can simultaneously regenerate a cation and an anion filter. Despite the fact that the required chemicals are supplied to the installation via piping, the plant has its own chemical storage in order to allow autonomous operation for four days in case piped supply is interrupted.

The plant operates fully automatically without needing the continuous supervision of operators. An automated management system determines, on the basis of the feed water's conductivity and the throughput of the filters, the timing of the regeneration of the ion-exchange filters. This system also calculates the remaining run-time of the filters and determines which production lines must operate and when. Operators of Evides Industriewater remotely oversee the process and can, if necessary, take corrective action. All signals from the plant are also sent to the Pergen control room in order to enable the Cogen operators to have an insight into the process status and act in case of emergency.

If necessary, the demi-plant can be expanded in the future with a sixth IX line.

Kation filters

Number of units:	5
Max. number of units in operation:	4
Diameter:	3.500 mm
Capacity (instantaneous):	360 m ³ /h
Run time:	10 h

Anion filters

Number of units:	5
Max. number of units in operation:	4
Diameter:	3.600 mm
Capacity (instantaneous):	360 m ³ /h
Run time:	10 h

Mix-bed filters

Number of units:	5
Max. number of units in operation:	4
Diameter:	3.100 mm
Capacity (instantaneous):	360 m ³ /h
Run time:	480 h

Demiwater

Parameter	Value
Conductivity:	< 0,2 μS/cm
Silica:	< 0,02 mg/l
Total ferrous (Fe):	< 0,02 mg/l
Total copper (Cu):	< 0,003 mg/l
Sodium (Na):	< 0,01 mg/l
DOC:	< 900 μg/l



Result

Using a custom-designed and operated demi-plant, Evides Industriewater produces demineralised water for supply to Pergen. This secures an exceptionally reliable supply of demiwater to Pergen, which fully complies with safety, reliability and operating standards common to the petrochemical industry. Due to the high quality feed water, the reduced production of waste water contributes to the environmental benefits which accompany the Cogen's high yield characteristics. This is important to both Pergen as well as the consumer of steam, the Shell refinery.



Evides Industriewater: using the water chain for the industry

Evides Industriewater is a subsidiary of Evides NV which, as a supplier of drinking water in the provinces of Zeeland and Zuid-Holland in of the south-west of The Netherlands, is the second largest drinking water company in The Netherlands.

Evides Industriewater is the biggest supplier of water services to the industry in The Netherlands. Evides Industriewater is responsible for the production and supply of process water, demineralised and distilled water to the industry as well as irrigation water to the agro-business. Total production amounts to approximately 80 million m³ per year. In addition, Evides possesses and manages various industrial and domestic waste water treatment plants.

In the district of The Hague, Evides Industriewater is partner in a joint venture that is responsible for the erection and operation (DBFO = design, build, finance, operate) of the Harnaspolder sewerage water treatment plant representing 1.3 million population equivalents, and the renovation of the Houtrust sewerage water treatment plant. Evides Industriewater develops and constructs a waste water treatment plant in Delfzijl for the chemical industry in that area. Evides Industriewater also manages the waste water treatment plant at the international airport of Amsterdam (Schiphol) as well as the percolation water treatment plant of the landfill site in Vlissingen.

All of these plants have been erected by means of DBFO (Design, Build, Finance, Operate) schemes with Evides Industriewater being in control throughout all phases. Evides Industriewater uses state-of-the-art technologies (membranes, ion exchange) to convert various surface water qualities (sea water, brackish water, river water and drinking water) into process water, demi water and ultra-pure water. In full compliance with our commitment to reliability at the service of process and customer.

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Knowledge