Case story
Dow, the Netherlands

A collaboration for performance and sustainability

Energy savings, reduced emissions, higher product yield, improved reliability, lower CAPEX, and longer service intervals are just a few examples of the many benefits the close collaboration between chemical producer Dow and Alfa Laval has resulted in. What started as a frame agreement for procurement has, over the years, evolved into a cooperation focusing on optimizing the plants and processes at Dow.

And the results have been astonishing.

100018551-EN 2408

An evolving collaboration

The cooperation between Dow and Alfa Laval started in 1999, with standardizing the scope of supply, the hardware and the documentation, which made the purchasing process significantly quicker and more cost-effective.

In 2008, the Alfa Laval sales team in the Netherlands approached the global thermal experts at Dow and proposed a deeper collaboration aimed at creating a structured process for working with process optimization through improved energy efficiency.

Ron Faber, sales manager at Alfa Laval Benelux recalls:

"We wanted to establish a closer relationship to be able to fully leverage the benefits with plate heat exchanger technology. So, together with Dow we initiated a technology conversion project where we together with the engineers from Dow actively seek out positions where replacing existing heat exchangers with plate heat exchangers leads to significant improvements. This can for example be higher energy recovery, emissions reductions, capacity increases, reduced maintenance, or higher reliability," says Ron Faber.

"Working with Alfa Laval's team of professional and knowledgeable people has given us opportunities to improve Dow's competitive edge. Our collaboration gives Dow cost advantages and a lot of sustainability benefits, such as energy savings and lower emissions."

Mee Geok Liau
Sourcing Manager, Dow

An award-winning upgrade

The technology conversion project is great success. Every year, a number of heat exchanger positions at different sites around the world have been analysed and upgraded, producing substantial positive effects from both a sustainability and a profitability perspective.

One of the upgrades at Dow's site in Terneuzen, the Netherlands, even won an internal award as one of the best energy efficiency and waste reduction projects in the entire company that year. The position in question was a heat recovery position in an ethylene oxide plant.

By replacing the existing shell-and-tube solution with two Alfa Laval Compabloc heat exchangers, several improvements were achieved:

- Substantial energy savings
- Reduced emissions
- Reduced makeup water for the cooling tower
- Improved product yield
- Less byproduct formation and lower waste disposal costs
- Mitigation of severe fouling problems
- Increased uptime

Replacing an existing shell-and-tube system in a heat recovery duty with two Compabloc plate heat exchangers resulted in substantial energy savings and reduced CO_2 emissions.

Reduced scope 3 emissions

The collaboration has also put a spotlight on the possibilities to reduce scope 3 emissions. Replacing shell-and-tubes with plate heat exchangers is a straightforward way to increase heat recovery and reduce energy consumption, which has a direct effect on scope 1 emissions. But an additional, and often overlooked, benefit is that plate heat exchangers also produce significantly less scope 3 emissions than shell-and-tubes.

Scope 3 emissions are indirect emissions in a company's value chain, e.g. the total emissions from producing a heat exchanger. Scope 3 emissions accounts for 70% of Dow's total greenhouse gas emissions and is a key focus area in the company's sustainability work.

The smaller size of a plate heat exchanger means less steel is required resulting in approximately 50% lower scope 3 emissions. In the example in the image, one Compabloc replaces three shell-and-tubes, requiring less steel for both the actual heat exchanger and the support structure.

There are three primary reasons for the lower emissions:

- A plate heat exchanger is significantly smaller than a corresponding shell-and-tube heat exchanger, meaning significantly less steel is required to produce the unit.
- Using more compact heat exchangers means smaller support structures, made from less steel and concrete, will suffice.
- Future scope 3 emissions are also reduced since higher grade materials are often selected for plate heat exchangers, thereby increasing their lifetime.
- A plate heat exchanger requires smaller and fewer spare parts since they are more compact and can be maintained in a way that minimizes the need for replacements.

An estimate based on an existing shell-and-tube installation at the Dow site shows that selecting a plate heat exchanger instead would reduce scope 3 emissions by roughly 50%. This calculation only takes the emissions associated with the steel in the heat exchanger and the support structures into account.

Going from units to plants

Thanks to the good results, the collaboration between Dow and Alfa Laval has continued to develop. Ron Faber explains the scope is steadily expanding.

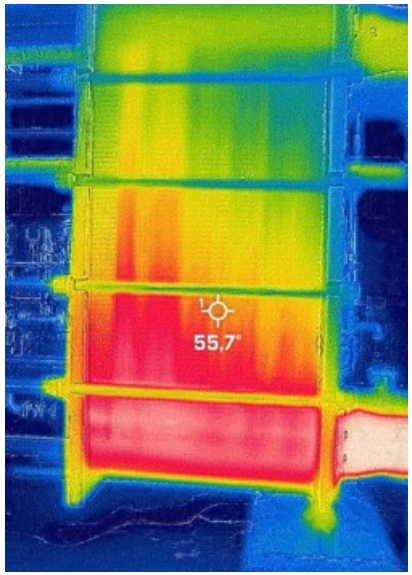
"So far we have focused on individual positions, trying to increase the plants' energy efficiency one heat exchanger at the time. But now, we are starting to look at larger sections, or even complete plants with dozens of heat exchangers. For example, we have recently started a project where we will investigate the possibilities in the entire polyurethane plant in the Terneuzen site," Ron Faber says.

Together with the engineers from Dow, the team from Alfa Laval Benelux will analyse all the heat exchanger positions in the plant and see where switching to plate heat exchangers is most beneficial in terms of sustainability, OPEX, CAPEX, operational reliability, production capacity, yield, etc.

"Replacing two shell-and-tube heat exchangers with two Compablocs resulted in reduced energy consumption and CO_2 emissions, lower equipment costs, shorter delivery time, a smaller installation footprint, and decreased scope 3 emissions. The Dow team was also amazed by the project's short payback time."

Sjaco Kloos
Process Engineer Manager, Dow

"This is a great example of the benefits of a close collaboration. A strong mutual trust means we can have a completely transparent dialogue and work closely together towards our common goal: to make Dow's processes as efficient as possible. We can see that this way of working really makes a difference," says Ron Faber.



Thermal imaging was one of the techniques used during the evaluation of eight of the Alfa Laval heat exchangers at the polyurethane plant in the Terneuzen site. The uneven heat distribution is a clear indication of fouling and that cleaning is required.

Service

The collaboration between Dow and Alfa Laval has also expanded into the service field. In 2023 an initial study was conducted in the polyurethane plant in the Terneuzen site in order to investigate the possible benefits of a more structured approach to maintenance and service.

Remco Harmse is Service Sales Manager at Alfa Laval Benelux and oversaw the study from Alfa Laval's side.

"Together with the engineers from Dow, we first made an audit of all the 38 Alfa Laval heat exchangers installed in the plant and selected eight of them for a more detailed study. This included a physical inspection of the units and a comparison of the current process parameters with the original design specs," Remco Harmse explains.

The investigation showed that the operating conditions had changed for most of the heat exchangers over the years, meaning they were no longer optimized for their duties. In many cases this caused excessive fouling due to lower flow rates, an issue that was resolved by reoptimizing the heat exchangers for the new operating conditions.

"Expanding beyond just hardware to include services has been commercially beneficial, resulting in greater operational reliability, lower energy consumption, and reduced emissions."

Mee Geok Liau
Sourcing Manager, Dow

Another important finding was a problem in the control software for the pumps that was causing negative pressure spikes. These spikes were impossible to detect in the normal control system and caused the heat transfer plates to crack. The problem was found in several of the positions in the plant, but fortunately it was easily fixed by correcting the pump software.

"The service study generated a higher degree of awareness among Dow's engineers of the benefits of regular maintenance. They learned that fairly simple measures such as cleaning and audits can have a major positive impact on the performance of the heat exchangers, leading to reductions in both energy consumption and CO_2 emissions. But the biggest advantages come from working with planning and maintenance predictions for the entire plant, resulting in longer production runs between maintenance stops, and lower costs for spare parts," Remco Harmse says.

A partnership with a holistic approach

Ron Faber explains that all the positive effects in the optimization projects all fall back to one common factor: the close collaboration between Dow and Alfa Laval.

"The key to the success is the strong network and the connections between the companies. Thanks to our close collaboration, we can be more transparent and share information in a way we can't do in a competitive setting. We have a completely open dialogue where all types of questions can be asked. This means we can leverage the knowledge from both companies to find the best solutions and optimize the processes to the fullest. That is the core of why our cooperation is so successful," Ron Faber concludes.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com