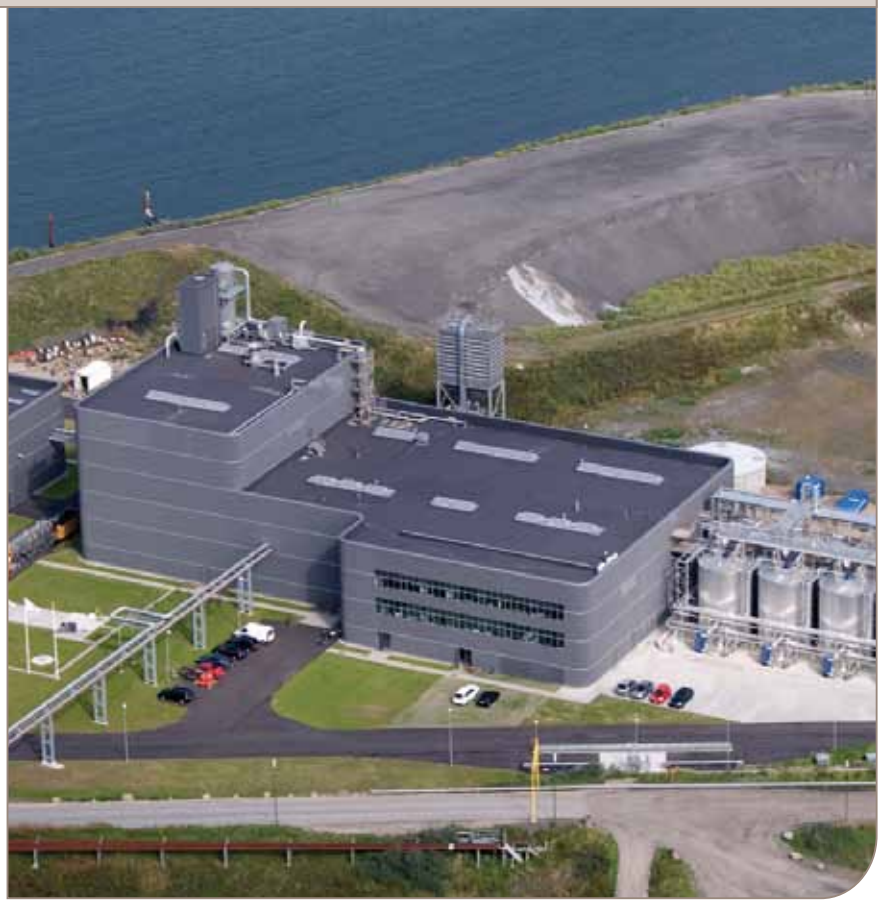
Powering new innovations in ethanol production

Inbicon 2nd generation ethanol plant in Kalundborg, Denmark **Case story**

"Alfa Laval's expertise was key in finding the right solution to our cooling needs and their spiral heat exchangers are extremely reliable. Everything runs without any problems since the start." says Carsten Skjodt, Project Manager Inbicon

Alfa Laval used their spiral heat exchangers – and their expertise – to add an innovative twist to Inbicon's 2nd generation ethanol production, helping create a revolutionary new process that will be licensed worldwide.



Producing tomorrow's biomass fuel in Kalundborg

Creating profitable, renewable fuels

Born out of a collaboration between Elsam and DONG Energy, Inbicon has a long history of innovation in sustainability. Their aims are far-reaching: to solve the global energy problem by converting crop residues into genuinely clean and profitable renewable fuels. At their award-winning biomass refinery in Kalundborg, Denmark, they have designed a patented technology for production of clean fuel, 'the new ethanol'.

This innovative process uses soft biomass residues to produce three revenue-generating products, ethanol, biofuel for use in power plants, and molasses-based animal feeds, reducing costs and CO_2 emissions in the process.

With the partnership and expertise of Alfa Laval, Inbicon has created, redesigned and tested a process that has the potential to revolutionize ethanol production worldwide.

However there was a weak link in the process which Alfa Laval was able to fix. Heat exchangers at the heart of the process became clogged by the viscous and fibrous media which caused expensive unscheduled downtime. "Alfa Laval supplies resilient equipment that can always be relied upon. Their vast knowledge means they understand the process inside out and contribute to innovative new concepts in development", says Jesper Bang Anderssen, Marketing Manager at Inbicon.

Producing biofuels while reducing carbon emissions

Inbicon's challenge was to develop a profit-generating process for clean biofuel production made from soft biomass residues.

The problem they faced was that the existing process was inefficient and costly. One major sticking point was the highly fibrous raw materials, which quickly clogged the normal heat transfer equipment.

In the process, straw is first ground and treated with steam to liquefy the hemicelluloses and make the cellulose accessible for enzymes. The hemicellulose sugars are separated from the cellulose fibres and enzymes are added to start pre-hydrolysis. During pre-hydrolysis the long cellulose fibres are cut into shorter sugar polymers. After pre-hydrolysis the slurry is cooled down for subsequent fermentation.

After fermentation, ethanol is distilled and lignin that is present in the residue is separated, dried and used as a solid fuel.

The one-channel design of the spiral heat exchanger makes it self-cleaning

Self cleaning spiral heat exchangers were the answer

Two spiral heat exchangers in parallel are positioned right after pre-hydrolysis, where slurry is cooled down before being fed to fermentation. These spirals are specially designed for the slurry they are handling.

The one-channel design of the spiral heat exchanger makes it self-cleaning, cutting maintenance time and costs, energy consumption and heat loss. They also eliminated unscheduled downtime due to equipment blockages. This is particularly important in a development unit since process conditions may vary much more than in a commercial plant.

Carsten Skjodt was particularly happy about the self-cleaning properties of Alfa Laval's heat exchangers, "The self-cleaning spiral design eliminates blockages. Without that process, it would be very difficult to cool the product efficiently".

Supplying 100% of its own steam and electricity

The Biomass Refinery at Kalundborg produces enough thermal and electrical energy to supply 100% of its own steam and electricity.

Alfa Laval's expertise was key in finding the right solution to our cooling needs.

A spiral heat exchanger is circular with two concentric spiral channels, one for each fluid. The curving channels provide extremely efficient heat transfer.

Fast facts:

Company challenge

- To create a clean 2nd generation ethanol production process that was energy efficient and that lowered costs of production and energy consumption
- Reduce high levels of waste, heat loss and blockage-related downtime
- Improve carbon footprint
- Remove corrosion problems in the heat exchanger

Solution

Replace inefficient heat exchangers with Alfa Laval compact spiral heat exchangers.

Results

Alfa Laval helped Inbicon create a patentable process for ethanol production by supplying spiral heat exchangers that resulted in:

- No costly, unscheduled downtime
- Three revenue-generating products: ethanol, lignin biofuel for power plants and animal feed
- Continuous, reliable operations

Innovation, collaboration and combined expertise have created a revolutionary new technology that has the power to change renewable fuel production forever and reduce greenhouse gases worldwide.

Why choose Alfa Laval spiral heat exchanger?

- Unique spiral shape has the ability to handle two highly fouling fluids simultaneously
- Significantly higher heat transfer efficiency.
- Self-cleaning design reduces fouling and energy costs
- Easy access cuts costly maintenance downtime
- Fully drainable units for easy maintenance
- Flexible design, fully engineered to adapt to every customer's needs
- 40 years' experience in manufacture and process design makes us an expert innovation partner for your unique process.

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.