SECONDARY HEAT

JOINING DOTS TO CREATE A CIRCLE

A STORY FROM
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ANDRITZ
ENGINEERED SUCCESS

JOINING DOTS TO CREATE A CIRCLE

RECOVERING AND REUSING SECONDARY HEAT ACROSS PULP MILL ISLANDS

When looking at circularity and sustainability at a pulp mill, it's easy to just focus on individual process islands, for example, cooking, evaporation or drying in order to improve environmental performance. However, when zooming out and looking at the whole picture, there are huge opportunities for linking islands and recovering and reusing secondary heat.

ANDRITZ is firmly committed to helping customers reach their sustainability goals as they seek ways to reduce carbon footprint and minimize raw material use. The fiberline and drying islands at pulp mills have enormous potential to reuse each other's secondary heat by installing technology to capture and transport the excess heat and use it in other process areas, thus lowering the carbon footprint as well as making major savings in energy and raw water usage.

WORKING ACROSS BORDERS TO OBTAIN ADDED BENEFITS

"When dealing with secondary heat utilization in pulp mills, the focus up until now has been very much on the individual islands, for instance, cooking, evaporation or drying," says Jussi Piira, ANDRITZ Director, Sustainable Solutions. "However, at ANDRITZ we have been stepping back and taking a more holistic view and working on solutions that cross the borders of the process islands and identifying any secondary heat that can be utilized in another process on another island."

"This has been quite difficult to explain to customers in the past as they tend to be focused on one area in particular," adds Paavo Tolonen, ANDRITZ Vice President, Global Product Group Manager, Cooking. "So, it's when we zoom out and take a wider look at the mill, a bigger picture emerges of where secondary heat opportunities can be identified across the process islands."

Basically, the idea is that relatively small-sized equipment is installed around the mill's "receiving" process islands that can convert secondary heat to generate clean steam for the process without having to use valuable boiler generated steam. This heat is pumped to the process island from the heat exhaust of the "supplying" process island – the one generating secondary heat.

Several benefits are obtained from this heat recovery, including savings in energy, recovery of clean condensates, optimized water, and secondary condensate utilization. Secondary heat can also be recovered from effluent and other sources.

As well as environmental benefits, there are also financial rewards. "The cost benefits come when we return the primary condensate to the boiler house and we don't need to create boiler water from raw water," says Aki Muhli, ANDRITZ Technology Manager, Cooking. "In this way we save energy, raw water and demineralization costs, which can add up to substantial amounts of retained revenue.

"Furthermore, the maximum utilization of raw water is becoming increasingly important as we have seen with record high temperatures and drought being experienced across Europe and other parts of the globe recently."

MINIMIZED ENVIRONMENTAL IMPACT - MAXIMUM SAFETY

ANDRITZ has developed several solutions to utilize secondary heat across fiberlines at pulp mills by closing loops across the following processes.

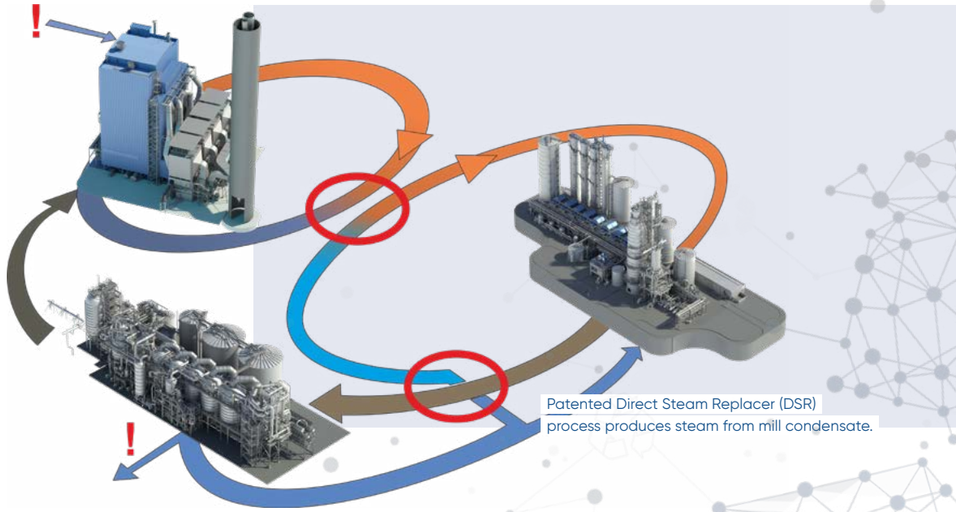
DIRECT STEAM REPLACER

The direct steam replacer enables reduced boiler and raw water usage. In this case, clean low-pressure steam is generated from condensate. The heat resource is low pressure steam from the boiler. Benefits of a Direct Steam Replacer: reduced boiler water consumption, less boiler water to be heated, increased clean condensate recovery and less condensate to wastewater handling.

Highlights:

- Clean condensate from fresh steam is returned to the boiler water.
- Secondary condensates or other suitable clean water streams are used as a steam source for direct steam applications.

Patented Direct Steam Replacer (DSR) process produces steam from mill condensate.



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VAPOR REBOILER

Clean condensate is converted to fresh steam using the flash stream as a heat source. Benefits of a Vapor Reboiler in continuous cooking: Improved health and safety, decreased evaporation load, and high turpentine recovery. Benefits of a Vapor Reboiler in batch cooking: reduced consumption due to secondary heat recovery, improved yield, reduced shive amount due to steaming, and higher turpentine yield.

Highlights:

- Health and safety is one of the major benefits with the utilization of the Vapor Reboiler as it reduces or eliminates sulfuric compounds, turpentine and tall oil process based risk when collecting gases from the chip bin.
- Flash steam condenses inside the tubes.
- Falling film of condensate keeps heat transfer surfaces clean from fibers.
- Clean steam generated from secondary condensate is removed through a central pipe upwards.

Vapor reboiler converts clean condensate to fresh steam. The heat resource is flash steam.

DIGESTER EVAPORATOR

Steam to the digester is generated from black liquor using MP steam as a heat source.

Benefits of a Digester Evaporator in continuous cooking: Higher black liquor dry solids content to evaporation, smaller heating surface and steam consumption in the evaporation plant, and increased return rate for primary condensate.

Benefits of a Digester Evaporator in batch cooking: Energy savings from reduced steam consumption, increases dry solid content in the black liquor and decreased evaporation load.

Highlights:

- Evaporation of water from weak black liquor from digester upper extraction to be used in digester top for heating.
- Medium pressure secondary vapor from DEvap to digester top replaces direct steam injection to the digester top.
- High dry solids liquor from DEvap increases overall dry solids and decrease black liquor to evaporation.

REACHING SUSTAINABILITY GOALS

Maximizing secondary heat usage at pulp mills is now well within reach of all pulp mills and ANDRITZ customers are already seeing rewards with the various technologies being installed around the world. Whether a greenfield development, or an existing mill, the utilization of secondary heat at pulp mills represents an excellent opportunity to further circularize production across the mill, at the same time as make major financial savings.

Piira concludes, "As environmental regulations get tighter, and pulp producers focus on their sustainability goals, it makes perfect sense to utilize every possible area around the mill where reuse of resources is possible.

"Secondary heat utilization is an excellent solution for our customers to assist them as they aim to reach their sustainably goals at the same time as making major financial savings on energy, water, and raw material usage."Vapor reboiler converts clean condensate to fresh steam. The heat resource is flash steam.

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IMPROVED ENERGY BALANCE WITH SECONDARY HEAT IN PULP DRYING

There is a lot of R&D development going on at ANDRITZ as it seeks to reuse secondary heat from mill processes also in the drying line at pulp mills – and excellent results are already being obtained.

Ola Larsson, Director, Technology and R&D, Drying, ANDRITZ, says "This is an area where we have a lot of development going on right now, looking at all possibilities of where secondary, low value heat can be reused. We already have an impressive example at a mill in Sweden where we are saving up to 30% of fresh steam in the drying process by using secondary heat obtained from the boiler stack."

The ANDRITZ Steam Saving System in this case is taking energy from the stack, producing hot water and releasing the pressure of the water as low-pressure steam, which is then fed to the dryer. The recovered energy is supplying some 20-30% of a pulp dryers need.

"This is a classic case of circularity at pulp mills as we recover energy, and in a long run, save fresh water," continues Larsson. "Both resources are under the spotlight as mills try to reduce costs and improve on raw material and energy usage."

ANDRITZ is also working on recovering energy from the drying process, which will again be utilized elsewhere in pulp mill processes.

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RECOVERING AND REUSING SECONDARY HEAT IN ACTION

INSTALLATION OF A DIGESTER EVAPORATOR (DEVAP) AT HEINZEL PÖLS, AUSTRIA

Heinzel Pöls was looking to make improvements to solve a bottleneck in its evaporation plant in order to increase pulp capacity. The mill is one of the largest producers of elemental chlorine-free (ECF) bleached softwood sulphate pulp in Central and Eastern Europe.

After close collaboration with ANDRITZ experts, the mill made the decision to install the world's first DEvap digester evaporator at an existing mill, retrofitting the new concept during a project that took place in 2021. The first greenfield installation took place at Metsä Fibre's Äänekoski bioproduct mill in Finland.

The DEvap concept has been designed by ANDRITZ to save energy and water use in several areas of the pulping process, as well as the possibility of increasing capacity in the evaporation plant. The concept works by replacing medium pressure steam (MPS) used in the digester top with secondary vapor evaporated from the discharged black liquor. In the DEvap evaporator unit, MPS is used as an energy source. The heat of the condensation of the fresh MPS is used to generate secondary vapor from the black liquor.

"We were convinced by the concept of the DEvap system right from the beginning simply because it's such a good idea," says Siegfried Gruber, Head of Project Engineering, Heinzel Pöls. "The system has now been retrofitted onto our digester at the mill, which is nearly 40 years old, and has made a big difference in terms of higher capacity from the evaporation plant as well as greatly improving energy and water efficiency at the mill."

In terms of benefits, the DEvap system enables higher black liquor dry solids and lower black liquor flow going for evaporation, which leads to reduced steam consumption in the evaporation plant and lower boiler water consumption. In the DEvap pre-evaporation of the black liquor takes place, so less evaporation needs to be done in the actual evaporation plant, thus resulting in the saving of steam consumption. This also means less capacity is used in the evaporation plant.

"The big benefit to us is that we save the whole middle pressure steam condensate, which is about 40 tonnes per hour," says Gruber. "Before the installation of the DEvap system the steam went direct to the digester. Now we heat indirectly so we get back the whole condensate and save a lot of water; before the installation we were taking 40 tonnes per hour or more of water from the river, and then we had to make it ready to produce condensate and steam out of it by heating it up from 12 °C. Also, the condensate is very hot, around 160 °C, which we then put back into the recovery boiler system, so we also save a lot of energy there.

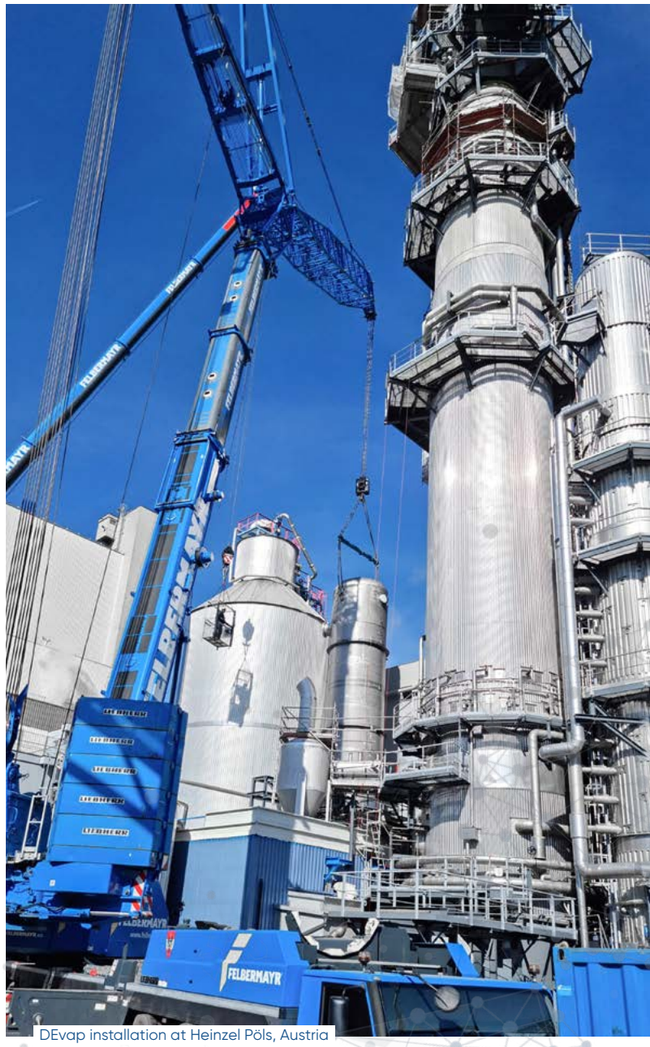
"One of the most important benefits of the installation was that it solved one of the biggest bottlenecks in the mill in the evaporation plant. Now this is resolved, and we have a surplus capacity in the plant of 7-8%."

Robert Zaiser, Pulp Mill Manager, Heinzel Pöls, agrees, "From the production side we are very happy with the DEvap system, despite being a little skeptical to begin with. We need to run the digester at this mill with a very high load, and we cannot have any negative influences or disturbances to the operation. However, we have had only minor problems with the operation since the installation, and our fiberline operators are really satisfied with how it performs.

"There is also an added, hidden benefit we have noticed; since the installation of the system, we immediately saw a 5% decrease in bleaching chemical usage, which was a very pleasant surprise."

The project to increase capacity at the mill was carried out over the space of a year, which included the installation of the DEVap system from ANDRITZ. Gruber concludes, "Solving the bottleneck in the evaporation plant allows us to quickly increase capacity. We are now running at a capacity of 460,000 t/y with 470,000 t/y possible in the near future.

"We have seldom had a project at this mill which has ended up with so many advantages and benefits as we have seen with the installation of the DEvap system."



DEvap installation at Heinzel Pöls, Austria

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