

ENERGY  
FOCUS



## Multi-fuel = multi-savings at Maxau

A unique hybrid-design CFB boiler in Germany burns biomass, mill sludges, coal, and refuse-derived fuels – giving the mill tremendous flexibility in selecting the lowest cost fuel to power its groundwood mill and paper machines. AE&E delivered this unique boiler.

Stora Enso's Maxau mill, on the Rhein River near Karlsruhe in southwest Germany, produces SCA and SCB publication papers. The two machines, with design capacity of 540,000 t/a, and the groundwood mill are the highest energy consumers in Maxau's process. As Joachim Grünewald, Mill Director, explains, "Energy prices in Germany are the third highest in Europe. Without self-generated power, making paper here does not make economic sense."

But in 2007, the team at Maxau saw clouds forming on the energy horizon. According to Jürgen Glowatzki, Maxau's Project Manager, "We had a 95 bar steam network

with three old turbines, two gas boilers, a gas turbine with heat recovery, and a bark boiler. The emissions of the gas turbine and bark boiler were not going to meet new regulations slated for 2012, so we needed a solution. Plus, we were 97% dependent on natural gas."

The recommendation from their engineering consultant was to build a multi-fuel boiler big enough to cover normal steam demand and run the gas boiler in parallel during the winter months. As the turbines were old, it was also recommended to install a new backpressure turbine with extraction (41 MW) to feed the low-pressure system.

*"Energy costs are very high here. Without self-generated power, making paper here does not make economic sense."*

Joachim Grünewald,  
Mill Director

### Multi-fuel logic

The decision to go with multi-fuel was an important one. "Our sister mill in Belgium runs a boiler with 100% refuse-derived fuels (RDF), basically sorted household waste," Glowatzki says. "This is a cheap fuel source and helps reduce the load on landfills, but it would not be acceptable to the local community because of their fear of possible air pollution. Still, we felt that some percentage of the fuel could be RDF."

Other readily available fuels were purchased biomass, mill bark, paper-derived fuels (mill sludges), demolition wood from construction sites, and of course coal and

natural gas. Being able to select and blend these fuel sources would give the mill flexibility it never had before.

"The business reason for the investment was to realize significant savings on the energy side," Grünewald explains. "If we can't run the power plant efficiently, we have to shut down paper production as well."

### A challenging order

After Board approval of the 120 MEUR project, the Maxau team had technical discussions with three potential suppliers, including ANDRITZ. "Our desire was for a turnkey delivery," Glowatzki says. "The other suppliers could not accommodate our needs. ANDRITZ Energy & Environment was the most flexible and seemed to have a unique technical solution."

In November 2007, ANDRITZ and Stora Enso Maxau signed a contract for delivery of a PowerFluid boiler, internal fuel handling system, flue gas treatment (dry absorption within a fabric filter), ash handling system, feed water system, and auxiliaries.

### Unique technical solution

Given the parameters of 55 kg/s of live steam at 520° C and 95 bar with high chlorine content in the RDF, Maxau and ANDRITZ knew it was going to be a real challenge.



*"This was a hybrid boiler design never tried before. But, I was convinced that we could do it with ANDRITZ and have a good project together."*

Jürgen Glowatzki,  
Maxau Project Manager



Readily available fuels are biomass, mill sludges, refuse-derived fuels, coal, and natural gas. Being able to select and blend these fuels gives the Maxau mill tremendous flexibility. ▾



The PowerFluid HC is a hybrid design that burns both clean and dirty fuels at a lower investment cost. Shown next to the steam drum are Glowatzki (left) and Heinrich Kreuziger, ANDRITZ Warranty Engineer for the Maxau project. ▶



The “unique technical solution” Glowatzki refers to is a “hybrid” PowerFluid boiler. Unlike a stationary fluidized bed boiler, the bed material in a circulating fluidized bed (CFB) boiler flows with the flue gas through the furnace. The bed material is separated by a cyclone and returned to the lower furnace. CFB is the best technology for reaching complete combustion of various low-grade fuel combinations and minimizing emissions.

But there are several types of CFB. ANDRITZ had two designs: PowerFluid CC for clean conventional fuels (coal, biomass, etc.) and PowerFluid RC for dirty residue fuels. Because of the RC’s configuration with an integral bed material heat exchanger, tail-end pass, and separate economizer, it is more expensive.

Maxau asked ANDRITZ for a third alternative – a boiler that could burn both clean and dirty fuels at a lower investment cost. The result of this challenge is the PowerFluid HC design – incorporating components from the CC and the RC.

“The fact that it was a hybrid design never tried before, and such a large size (200 t/h) might be perceived as a risk,” Glowatzki admits, “but ANDRITZ was so competent, I was convinced that we could do it and have a good project together.”



▲ The PowerFluid HC boiler has four feed lines to proportion fuels based on market price and availability. Natural gas is only used for start-up via the burners shown here. Emissions are well within targets.

**Throttling back on gas**

“Our starting point before the project was about 97% natural gas and 3% bark,” Glowatzki explains. “We couldn’t continue this way with gas prices continually rising.” Maxau set three design points for the boiler: one at 100% coal, one at 100% biomass, and a third at what they thought would be the most likely scenario (34% biomass, 42% coal, 10% RDF, and 14% sludge).

“Right now, we can buy plenty of biomass, so we are running the boiler at about 70% biomass and the rest RDF and sludge,” Glowatzki says. “Since we don’t have to purchase much coal or natural gas, we are saving big money – about three million euro a month at the present time.”

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Grünewald is quick to point out, “This is a long-term investment. Today, we are generating power at a lower cost than planned, but we know that fuel availability and pricing will swing. It is very difficult to predict the future. At least the multi-fuel boiler gives us flexibility and options.”

**Converting challenges to opportunities**

The PowerFluid boiler started up in March 2010. “The start-up was good, with excellent cooperation,” Glowatzki says. “We were able to load the boiler faster than we anticipated utilizing the steam.”

However, there was a slight disruption during the project. As Glowatzki recalls, “In the middle of the engineering, our management decided to shut down PM 7. With the machine going down, we would have up to 70 t/h extra steam in the system. We converted this problem into an opportunity by rebuilding two old turbines with condensing tails to use the extra steam to make electricity.”

With all this, Stora Enso Maxau covers about 40% of its electricity demand. “After we complete modifications to the turbines, this will increase to 50% self-generated,” Glowatzki says. “Every MW of self-gen-

erated power is about 40% cheaper than purchased power.”

**“Never walk alone”**

“The project here at Maxau was my first big involvement with ANDRITZ,” says Grünewald. “I have to say that the ANDRITZ team was very professional. During the erection time, we faced some scheduling difficulties not related to ANDRITZ. Still, we had clear and good communications with the project team, and it went well during the entire project.”

The true test of cooperation is when there is a problem. “During the start-up we encountered some problems with the feeding of the biomass and refractory damage at different places inside the boiler,” Grünewald continues. “There is a song that comes to mind, ‘You never walk alone.’ We never felt alone during the project. My impression is that they solve the problem first and talk about the costs later in a fair manner.”

**Performance-to-date**

“Our fuels are not very easy to burn – a mixture of coal, biomass (not just clean biomass), RDF, and sludge from our water treatment and deinking,” Glowatzki says. “The boiler is very flexible. We have four feed lines and can proportion them based on fuel availability. The PowerFluid boiler handles this perfectly with emissions well within targets.”

Grünewald agrees. “We are happy with the boiler’s performance,” he says. “Our op-

ANDRITZ also provided the ash handling system as part of its turnkey delivery. Ash is transported to nearby companies and is used in the manufacture of bricks. ▶



erators are still optimizing the boiler. The biomass we get from our own process (spruce bark) is wet and stringy. It has the potential to give us problems, although the boiler seems to tolerate its 50% moisture content. The same with our sludge, which we burn at 50% dryness content.”

The ash from the boiler is transported to nearby companies manufacturing bricks. “We have to keep our RDF fuel quality at the right level, so as not to pollute the ash to the point where the brick companies won’t take it,” Grünewald says.

“The project was conducted with excellent spirit and cooperation,” Glowatzki says, “and the follow-up support has also been very good. To date, this is the only hybrid PowerFluid in the world, but I would think this design has a lot of potential in the pulp and paper industry. It certainly works for us.”

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