





**Heaps of plastic, mountains of sludge and coarse impurities such as metal were a considerable cost factor for disposal, until recently. Now some paper mills are using their rejects and residual materials as potential recyclables for energy production. The Palm paper mill has built a facility using state-of-the-art technology at its Würth location in Germany.**



Paper machines and stock preparations are subject to a constant optimization process. Over the last few years, energy production and the peripheral processes such as disposal of rejects and residual materials have gained considerable significance. “Paper manufacturers still have a remarkable potential in the recycling of residual materials for reducing costs and increasing the profitability of their production,” says Lucas Menke, Manager at Voith Paper Environmental Solutions (VPES).

Residual materials and rejects can no longer be conveniently and easily disposed of, as was still the case only a few years ago. But due to the increased use of recovered paper, their portion is increasing. In Europe, for example, the paper industry used around 53.3 million tons of recovered paper for paper production in 2007. By comparison, consumption of recovered paper was around 50 million tons in China and 30 million tons in the USA. Worldwide, around 208 tons of recovered paper were consumed; that corresponds to a utilization rate of 53%.

The high utilization of recovered paper and thus higher portion of residual materials lead to increasing disposal and landfill costs. Stricter waste management laws in many countries further tighten the situation. “With a system for processing residual materials, paper manufacturers can not only save these disposal costs but also obtain energy at the same time and thus noticeably lower their energy costs,” explains Dr. Andreas Haas, Director of the Planning



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Dr. Andreas Haas, Director of the Planning Department at the Palm paper mill.



Residual materials and rejects		
Rejects (high-calorific, easily combustible waste)	tails/pulper rejects	consist mainly of film and are connected with iron wires due to the process design
	rejects/coarse rejects	sorting residues, e.g., wrong insertions in recovered paper collections, CDs, film packages, high fuel value
Residual materials (low-calorific waste)	deinking sludge	sludge that arises from the separation of fibers and printing inks, low fuel value
	mixed sludge	sludge that accumulates from the process stages of cleaning, sorting and deinking, low fuel value
	bio-sludge	sludge that accumulates from the aerobic stages of the biological clarification plant, low fuel value

Rejects and residual materials are differentiated according to fuel value and physical composition (size, dry content). This classification then also defines the sequence of pretreatment.

Department at the Palm paper mill. Palm, the German paper mill, reacted to the challenges by building the most modern system for recycling residual materials in the world. We took a closer look at how the system functions and its advantages.

**Multi-location concept**

Annually, the Palm paper mill produces altogether 600,000 tons of newsprint

and energy concept. The core of the new system is a gas and steam facility running on natural gas that has been in operation at the Wörth location since 2008. It is supplemented by a residual material boiler that burns nearly all residual materials from the three production locations. So far, the facility is unique worldwide and the most modern of its kind. Eltmann and Aalen, the headquarters of the group, deliver their residual materials to Wörth.

of companies has made itself widely independent of external disposal companies.

The foundation of the new system was a thorough investigation of the accumulating reject and residual material flows from all three mills, looking at their quality, degree of contamination, foreign matter, degree of dewatering and absolute quantity.

*“In 2005, we disposed of all rejects and residual materials via third-party companies, which cost several million euros annually.”*

Dr. Andreas Haas, Director of the Planning Department, Palm paper mill

in Aalen and Eltmann and 890,000 tons of corrugated cardboard base paper in Aalen and Wörth – all from 100% recovered paper. The company has found a solution for the accumulating waste and included its three German locations in a comprehensive waste

“In 2005, we still disposed of all rejects and residual materials with costs to third-party companies, which cost several million euros annually,” says Dr. Andreas Haas. Today, the waste produces energy, and within three years the group

Wörth is the largest location with an annual production of 650,000 tons of paper. Since Wörth thus has the highest energy consumption of the three locations, Palm installed the new power plant technology there.

**Energy from residual materials**

With the gas and steam facility and the residual material boiler, steam and energy can be produced from the combustion of rejects and residual materials.

the goal of the integrated paper mill,” explains Lucas Menke. That means striving for a raw material and energy cycle in paper production that is as closed as possible. In Palm’s case that means all residual materials

rejects, tails and heavy parts are sorted out in the stock preparation and wastewater treatment area of the paper mill. Metal, iron and aluminum remain at the location for scrapping. However, the combustible residual materials start their journey to Wörth:

*“With our system, we are pursuing the goal of an integrated paper mill.”*

Lucas Menke, Manager at Voith Paper Environmental Solutions

Meri, a Voith Paper company, supported Papierfabrik Palm in planning the new facilities, utilizing its expertise in process technology and mechanical engineering for the residual materials treatment that was required in this project. “With our system, we are pursuing

are sorted and used for energy production.

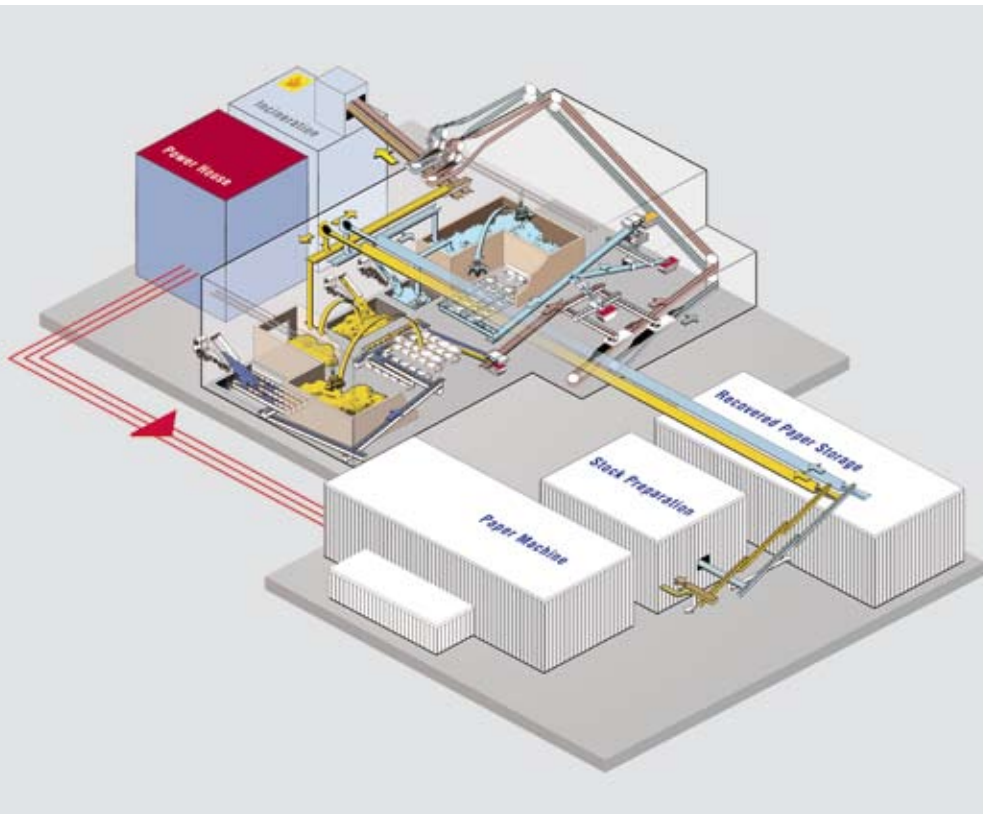
**The journey of the residual materials**

We accompany the residual materials from Aalen, and sludge, getter,

large claws, buckets or conveyor belts put them in transport containers that are loaded on trucks. Then it’s off to Wörth. Soon, they will be transported by rail with a newly developed special transport container system. Once they arrive there, the individual fractions are tipped into various pits called residual material pits.

First, a modern shredding facility in Wörth shreds tails, coarse rejects and fractions from the dissolution directly in the stock preparation. Ferrous metals are separated from the material flows with the aid of a magnetic separator.

The accumulating fiber residues, fillers and sludge from wastewater treatment are dewatered for the highest dry content. Two systems running in parallel then convey the fractions with high fuel value (dissolution rejects) and mixed sludge and fiber sludge with low fuel value over about 200 meters of carrier air conveyors to the residual material storage or to the power plant. If one conveyor fails, the other is available. The conveyed residual materials can either be directly burned without interim storage or



*Preparation of the various rejects and residual materials (left) for combustion is today an important part of a modern integrated paper mill and contributes substantially to profitability.*



*Shredding and metal separation is the precondition for combustion of the high-calorific rejects.*



*An intelligent self-propelled crane system takes fuel out of storage and feeds the secondary treatment stages, mixing and feeding systems.*



*A closed pouch belt conveyor also allows fuel transport on complicated stretches.*

temporarily stored in the residual material storage. The amount of residual materials that come from Aalen and Eltmann varies due to production and logistics of the plants.

“We designed the storage concept in such a way that larger amounts of residual materials can be stored in order to have a suitably good supply of fuel,” explains Dr. Haas.

### **The mix is what does it**

An intelligent crane system can remove partial amounts from the high-calorific fuel (rejects) and low-calorific fuel (mixed sludge) stored in the residual material storage and feed the secondary systems.

The secondary system for sludge allows mixing and homogenizing of the low-calorific fraction from which, in addition, metallic impurities are separated. The secondary system for rejects has several process steps: first magnetic separation, shredding, second magnetic separation, separation of non-ferrous metals, e.g., aluminum and extremely small iron particles. Depending on the requirements of the power plant, the two fuels can be mixed so that the fuel value required by the power plant is obtained. The mechanical engineering solutions delivered by Meri and described above also allow adaption to fluctuations in the quality of individual fuels to meet the power plant’s requirements. For the first time, a pouch belt conveyor system was used for conveying this fuel material.

**Main suppliers**

**Residual material preparation, storage and feeding system:**  
Voith Paper Environmental Solutions

**Power plant:**  
Austrian Energy & Environment

**Power plant planning & engineering:**  
EPROPlan Stuttgart



Dr. Wolfgang Palm, owner and Executive Director of the Palm paper mill (left), enthusiastically cuts the special gift from Meri at the official opening ceremony in Wörth at the end of April 2009. He is assisted by Dr. Andreas Haas, Director of the Planning Department at Palm (right).

With the new materials handling equipment, it is possible to implement challenging routes (inclines, corners) with a closed system – a big advantage.

“The system is sophisticated,” reports Dr. Haas. “If the desired fuel mixture ratio cannot be kept within the defined limits even just for two minutes – for example, due to obstruction or material change – the fuel is automatically transported back

into the residual material storage and remixed there.” EDP ensures that both types of material, the low-calorific sludge and the high-calorific rejects, are uniformly broken down.

**Boiler with optimum efficiency**

Now the new system has been running for a few months, Dr. Andreas Haas sums it up: “With the residual material boiler and the gas and steam facility, we produce our energy completely by

ourselves and avoid expensive disposal.” Did the investment pay off? “Definitely,” says Dr. Haas. “We would immediately install the system again just like this. The waste and energy system absolutely pays off.”

**Contact**



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Dr. Andreas Haas

**Possible savings in waste disposal costs in Europe**

**Recovered paper use:** 53,3 Mio t/year  
**Rejects and residual materials that are created:** 2,9 Mio t/year \*

**Possible savings in waste treatment:** 139 Mio euro/year \*\*

\* In the board and packaging area, between 3 and 8% residual materials are created. For calculation purposes 5.5% was assumed.

\*\* The price fluctuates between 30 and 65 euros. For calculation purposes, waste disposal costs of 48 euros per ton were assumed.

**Note:** This can only be implemented in about 1/3 of the systems, generally with several interconnected plants.