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VOITH

High performance, low energy
Perlen PM 7

“From the very outset we have made a giant leap forward with the PM 7’s running time efficiency. And even more crucially: From the beginning, we produced good to very good marketable quality.”

Jörg Michel, member of the executive board of Perlen Papier AG, responsible for production and technology.

1 Perlen Papier AG’s new PM 7.

2 Jörg Michel and Johannes Rimpf (right, Voith Paper Project Manager), following the successful start-up.

First IEM starts up at Perlen Papier

Economical, environmentally friendly and regionally adapted: These are the key features that distinguish a Voith Integrated EcoMill (IEM). The IEM concept was implemented at Perlen Papier AG with the construction of the PM 7, resulting in consumption of resources for newsprint well below the average. From the outset, the new machine used 5 % less electrical energy per metric ton of paper than the PM 5, which had undergone multiple upgrades and has since been shut down. This not only protects the environment but also pays off economically for the Swiss paper manufacturer.

From the very beginning, the PM 7 looked set to be a record breaker. For Voith, this is proof that the IEM is a trailblazing concept. In its capacity as a complete system provider, Voith supplied wastewater treatment, stock preparation, paper machine, winder, roll transport and roll wrapping systems, as well as the entire automation system. As part of its Process Line Package, Voith was also responsible for delivery, overall assembly, start-up and optimization of the entire production line. Conservation of resources was at the heart of the overall concept. Developed in close collaboration with Perlen Papier AG, all processes are coordinated with one another in a holistic approach.

In direct comparison to the now defunct PM 5, which had been upgraded continuously to keep pace with current technology, the PM 7 was already consuming 5 % less electrical energy per metric ton of paper produced right after start-up. The PM 7 is also an improvement over the PM 5 in terms of thermal energy. According to Jörg Michel, this is due to processes perfectly tuned to one another from dewatering (DuoFormer) and the press section (DuoCentri NipcoFlex with three nips and a fourth press) to the dryer section, where a total of thirty-one drying cylinders are installed in six dryer groups. The goal is to achieve an energy requirement that is lower by about 10 %. In addition, the additive costs for binding agents, starch, talcum and dyes on the PM 7 have been cut in half, primarily because of the modern press section.

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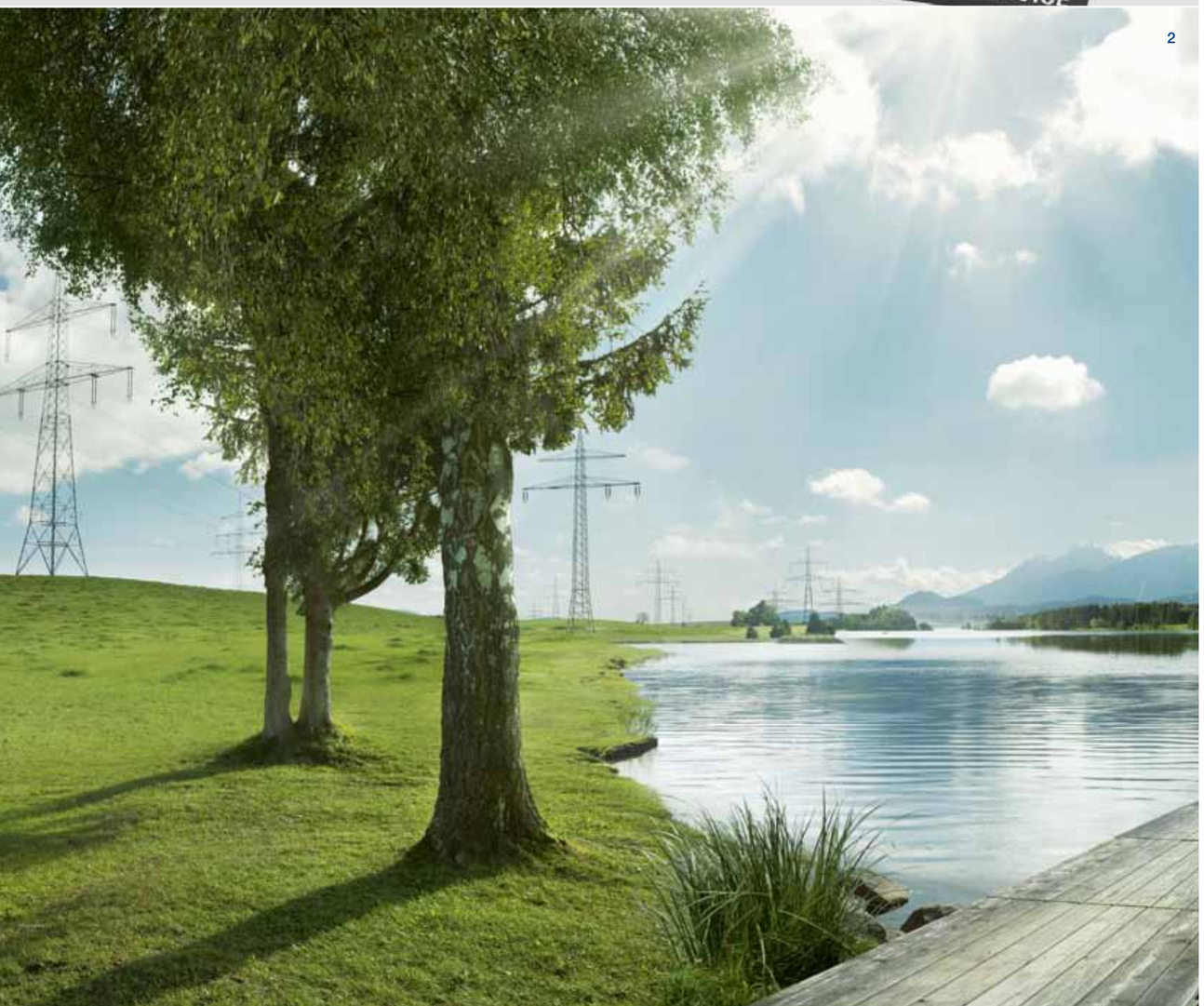

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1 Complete process integration brings economic benefits.

2 The Integrated EcoMill conserves resources.

Economical, environmentally friendly, regionally adapted: The Integrated EcoMill

Voith's Integrated EcoMill (IEM) impresses on several counts: It uses fewer resources while at the same time reducing investment and operating costs. This is made possible by completely integrated sub-processes – both inside and outside the paper mill. Raw material, energy and water use is thus optimized, resulting in tangible economic benefits. This makes the IEM an ecologically and economically attractive proposition, offering a sustainable alternative to conventional paper mills.

With its concept for the completely integrated paper mill, Voith is addressing the scarcity and high cost of resources as well as the increasing cost pressures in paper manufacturing. A key benefit of the IEM is that it takes into account the different location-specific factors and conditions to which the mill concept will be customized.

As early as the planning stage for an IEM, the fiber, energy and water circulation systems and specific location factors are considered before being incorporated into the overall concept. The resulting tailor-made solutions not only reduce the consumption of resources, they also minimize the IEM's investment costs and ongoing operating costs in the long term.

The IEM concept can be implemented intelligently in both new plants and rebuilds. With its IEM, Voith Paper has succeeded in combining various disciplines and bringing them together in an integrated approach.

1, 2 Lower energy consumption thanks to the new LowEnergyFlotation (LEF) in Perlen.

3 Recycling of recovered paper is an important topic at Perlen Papier.

Energy-efficient recovered paper recycling

Recycling of recovered paper is an important topic at Perlen Papier. Voith expanded the existing ALPA 1 recovered paper recycling plant by adding the ALPA 2 to its overall concept.

The integrated processes in the plant not only led to an increase in yield in the stock preparation unit but also allow Perlen Papier to save 7 GWh of energy annually as a result. The latest flotation technology, LowEnergyFlotation (LEF), plays a significant role in this process. This was the first time that Voith had equipped a new system with this technology – and with a sensational result: Printing inks are removed efficiently, while energy use for this process at Perlen Papier is reduced by more than 30 %.

The recovered paper used comes mostly from household collections in Germany and Switzerland. The bundles of recovered paper from Switzerland generally come tied up with various cords. Not only does the ALPA 2 remove the ties from the recovered paper, it also de-wires bales weighing several tons in a fully automatic process and then sends the loose paper to the TwinDrum pulping system. The approximately 1 500 t/day capacity TwinDrum continuously feeds both stock preparation lines. Its innovative pulping concept combines a gentle slushing of the fibers with a reduced requirement for additives. At a pulping consistency of 25 – 28 %, outstanding ink removal is achieved, among other benefits, due to the integrated displacer located in the pulping section of the TwinDrum.

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1 New HiClean cleaners in the approach flow system allow higher stock consistencies with no loss of efficiency.

2 TwinDrum pulping reduces additive consumption at Perlen Papier.

3 Accuracy is crucial.

Cost-efficient stock preparation: higher performance, lower energy use

At Perlen Papier, recovered paper recycling plays a crucial role in achieving positive results for consumption of energy and resources. Using new technologies such as LowEnergyFlotation (LEF) or the TwinDrum pulping system, for example, cuts energy consumption for flotation by 33 % and reduces the number of chemical additives needed for the pulping process.

The volume of recovered paper used on the PM 7 in Perlen is between 80 % and 85 %. This is why even at the initial planning stage for the new production line, a high-capacity recovered paper treatment system was of key significance. The outcome, in the form of the ALPA 2 recovered paper recycling facility, represents an integrated concept for stock preparation. It includes the automatic de-wiring of the recovered paper bales, pulping in the TwinDrum system, HC stock cleaning with the HIPRO protector system, screening using MultiSorters and C-bar screen baskets, LowEnergyFlotation (LEF), thickening with Thune bagless disc filters and screw presses, and dispersion with HC bleaching and waste water treatment.

Thanks to the integration of new processes, the ALPA 2 works much more efficiently than the existing ALPA 1. A good example of this is the flotation stage of the deinking facility where technology, fluid dynamics and the mechanical system are tailored perfectly to one another, and as a result, have enabled energy consumption to be reduced by 33 % from the very outset. The significance of this saving is all the more evident considering that the pre- and post-flotation processes are among the most energy-intensive steps and together account for around 20 % of the electrical energy requirement in a stock preparation unit for manufacturing newsprint.

The key to this success is LEF: Primarily as the result of systematic refinement of the fluid dynamics, it was possible to reduce energy consumption in the flotation stage at Perlen by currently 33 % without exhausting the full potential of the LEF. For Perlen Papier, the operating costs of the 700 t/day system have therefore already been lowered significantly. Especially important: There is no change in the quality of the flotation result when using LowEnergyFlotation.

Due to improved flow dynamics, LEF reduces energy consumption on all levels of the flotation, e.g., in transporting the deinking suspension, feeding air into the system, separating air bubbles and skimming off and conveying the flotation foam. Moreover, the PM 7's recovered paper recycling unit is the first completely new system to use the LEF.

At the start of the stock preparation process, a TwinDrum pulping system guarantees a high fiber yield. With a pulping capacity of around 1 500 t/day, it feeds both of Perlen Papier's recovered paper processing lines. The TwinDrum system mixes the recovered paper with water and additives and then gently pulps it at a stock consistency of 25-28 % before the reject is segregated. The system comprises a pulper drum and a screening drum. Compared with conventional single-stage drum pulping solutions, chemical additive use is cut by 15 % and specific energy by around 20 %.

Tailored to location and customer requirements

From the infancy stage and going forward, the Perlen PM 7 was designed to not only meet customers' quality expectations but also make use of prevailing conditions and be capable of being embedded into the existing infrastructure. In addition, the integration of all essential processes reduced consumption of resources to a minimum.

IEM at Perlen Papier, nestled into the idyllic Swiss landscape.

Perlen in Switzerland

Perlen PM 7 – an Integrated EcoMill in figures

*All results per metric ton

September 2010
Start-up

360 000 t/year
Production capacity

40 – 52 g/m²
Basis weight

10 450 mm
Wire width

2 000 m/min
Design speed

1 900 m/min
Maximum production speed

1 662 m/min
Start-up speed (world record)

30 %
lower fresh water consumption in the entire paper mill

Compared with the PM 5, optimized to its maximum and now out of service:

5 %
lower electrical energy use*

10 %
lower thermal energy use*

50 %
fewer additive costs*

The whole is greater than the sum of all parts

The decisive parameters were defined and established as early as the preliminary project phase. Printing tests and surveys completed by Perlen Papier's customers provided an accurate overview of the quality requirements to be met by the new paper machine. High consistency, optimum running characteristics and paper printability proved to be the main concerns.

Before drawing up the first layout for the new PM 7, the project team determined its ideal location on the company's premises. Effective use was made of the hillside location, and the machine hall was built so that one side now has ground-level access to the PM floor and the other side has access to the machine pit. The dimensions of the building housing the PM 7 were also reworked, enabling 35 000 cubic meters of gross floor area to be saved. Costs were reduced by keeping the building as small as possible.

In addition, the machine width and speed were adapted to customer requirements and the anticipated need for electricity, steam, water and chemicals determined. Subsequently, the project team put together the ideal combination of corresponding system components and carried out initial efficiency calculations.

According to Jörg Michel, member of the executive board of Perlen Papier AG, the configuration of the press section and the winder with its center winding principle, were the key factors in improving the quality of the paper. "Our customers carried out several test runs and always judged the paper quality positively," says Michel, who is responsible for production and technology. In addition, Voith incorporated a special solution into its concept for the roll wrapping system. As a result, rolls intended for Swiss customers no longer have the extra covers fixed at the roll ends in a separate process step. This saves packaging material and time, providing both an ecological and economical benefit.

After an exemplary start-up, the Perlen PM 7 began production in September 2010, and has since been running to everyone's complete satisfaction. In close collaboration, Perlen Papier and Voith Paper implemented a system that adheres to the strictest environmental criteria, works cost efficiently and – with typical Swiss perfection – produces paper at the highest quality level.

VariTop winder
The rolls from the PM 7 are reeled up and slit on two state-of-the-art VariTop winder units with a design speed of 2 500 m/min. Depending on customer requirements, roll widths of 1.5 to 3.6 m and roll weights of up to 10 t are possible. The outstanding winding quality guarantees a smooth roll run, even on advanced printing machines operating at high speeds.

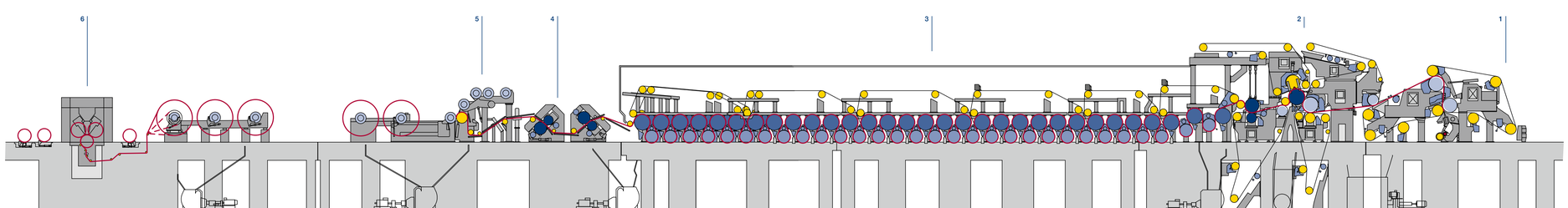
Sirius reel
Using Sirius reeling technology, the paper is reeled up in a careful and controlled manner to a roll diameter of more than 4 m. The reel master rolls are more than 9.6 m wide and weigh more than 100 t. On reaching the desired roll circumference, the EcoChange reel change system transfers the paper automatically and with minimal waste to the next available reel.

EcoSoft Delta calender
Even if the paper web leaves the press section with a uniform surface quality, the two EcoSoft calenders provide the option of additional surface smoothing if required by the customer. This ensures that both sides of the web can be printed simultaneously, without any detectable difference between first form and perfecting printing, even in the case of sophisticated color photo reproduction.

TopDuoRun dryer section
Thirty-one drying cylinders ensure optimum runnability over the six TopDuoRun groups. The specific steam consumption could be reduced by using a thermo-compressor in the first drying group.

DuoFormer TQv and DuoCentri NipcoFlex press
The latest generation TQv former, with its proven alternating arrangement of dewatering elements, produces an extremely symmetrical sheet formation. The sheet is compressed and the water removed from the paper mechanically in the downstream DuoCentri NipcoFlex press. The NipcoFlex shoe press achieves dry contents in excess of 50 %. In combination with the EcoSoft calender, the separate fourth press helps achieve an excellent surface quality and homogeneous surface condition on both sides of the paper.

Voith Advanced Wet End Process
As the link between stock preparation and headbox, the Advanced Wet End Process has a major influence on production stability and paper quality. The ComMix component achieves stable mixing of the stock in the HC stock range and simultaneous reduction of vat volumes. The new two-stage HydroMix concept for mixing the HC stock in the white water enables uniform stock consistency and therefore a consistently good basis weight profile in the paper machine. The newly developed cleaners exhibit outstanding cleaning efficiency even in the case of high stock consistency. This allowed the cleaning system to be substantially smaller and energy consumption could be reduced.



1 DuoFormer TQv with MasterJet headbox
2 DuoCentri NipcoFlex with 4. press
3 TopDuoRun dryer section
4 EcoSoft Delta calender
5 Sirius reel
6 VariTop winder

1 The Voith LSC scanner checks paper quality.

2 Constant monitoring from the control room.

3 Field instruments at work.

Automation package for the entire production line

For its new PM 7, Perlen Papier opted for a fully integrated automation package, covering the complete production line from recovered paper treatment to wrapped roll. Voith was entirely responsible for all planning, components and sub-systems.

The resulting automation concept has been customized exactly to the needs of Perlen Papier. In addition to machine controls, a quality control system and process control technology, it includes all field instruments used in the process, i.e., valves, fittings and various sensors such as pressure, flow or consistency transmitters. Voith also undertook delivery and was responsible for all electrical installations (power feed, medium voltage, motors, frequency converters etc.). An important criterion in selecting components was to achieve the best possible energy efficiency class.

From basic engineering to plant optimization, Perlen Papier received all deliveries from a single source. Voith decided on the components used in consultation with its in-house mechanical engineers, process technologists and clothing experts. This meant that the paper manufacturer benefited from fast, uncomplicated delivery and avoided any nasty surprises in the coordination of this very wide range of products.

The automation package comprises three product groups: CD and MD control including the necessary components, several information systems plus the scanners and sensors. Products with proven track records were used in all sectors. This includes the sophisticated CD profile control technology, which Voith equips with its own actuators, measuring instruments, spray nozzles and steam boxes.

The use of statistical process and quality control technologies (SPC & SQC) achieves outstanding 2 sigma values with correspondingly good profiles. The OnQ ModuleJet actuators, installed for example in the headbox at Perlen, make a significant contribution. Using a precise linear movement and a specially developed valve, they meter the inflow of dilution water exactly and guarantee good, uniform basis weight cross profiles. At the same time, less waste is produced. The actuator system also comes with a number of diagnostic options such as trend display, trend correlation and calculation of shrinkage curves. Combined with the MD profile control system for measuring and adjusting basis weight, moisture, thickness and color of the paper, this ensures that paper parameters such as the basis weight of the high-quality newsprint always remain consistent.

As a result, the paper machine reached the targeted speed and paper quality just a few hours after start-up. By signing a comprehensive service agreement, Perlen ensures that production will continue to run smoothly. Under the terms of the agreement, Voith will, for example, perform remote maintenance on the automation systems for the PM 4 and PM 7, as well as the winders and roll wrapping system of the PM 7. The overall concept provides for Voith personnel to log into the system at Perlen if necessary, check the status, eliminate malfunctions, and carry out improvements. Perlen Papier's maintenance crew can reach Voith around the clock for fast and expert help if needed.

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1 High performance fabrics.
2 SkyLine doctor blades.
3 Roll, roll cover and doctor blade.

Ideal dewatering through use of synergies

With a start-up speed of 1 662 m/min, the PM 7 recorded the fastest ever start-up of a paper machine. A key factor in this was the perfect matching of clothing and roll covers in wire, press and dryer sections. The dewatering capacity in particular benefits from the interplay between the various components.

The interaction of the fabrics was thoroughly tested in the Voith Paper Technology Center (PTC) at Heidenheim prior to use at Perlen. The mixture of materials to be used in Perlen was replicated for extensive testing in the PTC. This optimal coordination ensured that the first paper produced immediately after start-up in September 2010 was of marketable quality and met the customers' quality specifications. But even more importantly: Perlen Papier specified the Voith clothing and roll covers used as the quality standard for its machine and ordered additional Voith fabrics after start-up.

Voith supplied the roll covers and fabrics for all sections of the PM 7. In the forming section, the H-series PrintForm fabrics met all quality expectations with respect to the wire-related parameters immediately after start-up. In addition, the high dry content downstream of the high vacuum suction boxes and the excellent running properties of the wires contributed to the record breaking start-up speed of 1 662 m/min. The fact that the surface of the roll covers used (BlackStone S and WebMax) is still clean after a long period in service is testimony to their performance.

The heart of the PM 7's press section is a DuoCentri NipcoFlex press. It is used particularly when there are stringent quality requirements. Felts from the PrintFlex range ensure ideal dewatering in all four presses. In combination with the SolarFlow cover used on the suction press roll and featuring a large open area, flow resistance is reduced and high nip dewatering is achieved directly after start-up. The resulting high dry content is a precondition for good runnability. TerraSpeed coating on the center roll and 4th press roll results in reduced draw through the press, while high nip dewatering enables a reduced use of the uhle box. This decreases drive energy, thus resulting in cost savings.

However, it is not just the components of the press section that are perfectly matched to one another. In the dryer section, a special Cera coating on the cylinders and guide roll surface prevents deposits from forming in the relevant locations. The PrintTech dryer fabrics used are adapted to the web stabilizing systems, allowing fast and reliable threading through the dryer section. In the finishing process, an EcoSoft Delta calender with 2x2 rolls ensures perfect calendering. The NeoSilk S covers used are highly wear resistant and durable. In addition, they have an outstanding surface quality, making them the ideal pressure module for newsprint and enhanced newsprint.

Within the scope of a Total Roll Management program, Voith is responsible in the future for complete roll service on the PM 7. The exclusive three-year agreement goes far beyond the usual replacement of parts. Voith will also supply all roll-related products from one source and will undertake ongoing optimization of the entire roll system with respect to function and performance. In addition, Voith will provide advice to the Perlen paper mill on servicing activities carried out by Perlen itself. Technical improvements are expected to increase running times step by step, while maintaining the technical availability of the system. The aim is to reduce the annual costs for roll servicing by 20 % within three years.

1 Roll transport to warehouse.

2 Mobile-mounted winding head of ClassicPlus roll wrapping machine.

3 Outer cover robot at work.

ClassicPlus provides maximum flexibility

Integrated processes tailored to one another and technical innovations help make the Perlen PM 7 the showcase for an Integrated EcoMill. One of the highlights is the newly developed ClassicPlus roll wrapping system, which ensures maximum flexibility in roll packaging thanks to its modular concept.

The ClassicPlus roll wrapping system works on the principle of parallel packing with a waterproof kraft paper. This is done by wrapping parallel layers around the roll, using a mobile winding head several times depending on roll width. In Perlen, the system works with a standard packing paper width of 950 mm, which can be handled by the mobile winding head. The layers are glued together to seal them against one another. The ClassicPlus is currently designed for a capacity of 70 rolls per hour from the PM 7. In the future, the system will also pack the rolls from Perlen PM 4. The modular concept of the ClassicPlus makes this possible, as it allows wrapping machine capacity in Perlen to be increased to 130 rolls per hour by means of additional components.

In the ClassicPlus system, the rolls are wrapped sandwich-style in packing paper (kraft paper-polyethylene-kraft paper). Compared with the conventional packing principle of fixed unwinders, parallel packing with a mobile unwinder offers maximum flexibility with respect to the range of roll widths possible. At Perlen, this can range from 440 to 3 000 mm. Another advantage of the ClassicPlus is that it requires only about 50 % of the installation space of the traditional packing system, e.g., with four fixed unwinders.

The system is fully automatic and uses industrial robots to place the internal and external covers and for applying shipping labels. Corrugated board and/or PE-coated kraft paper are used for the roll end covers, protecting the rolls against both mechanical damage and ingress of moisture. Only one operator is necessary to operate the wrapping machine. A special sensor with a defined notification system assists the operator in monitoring the machine and the quality of packing.

The ClassicPlus wrapping system caters to full packing (roll circumference and ends) for international shipping and edge-aligned circumference packing for customers in Switzerland. This allows savings in packing material, an economic and ecological advantage for Perlen Papier.

1 45 m diameter settling basin with 6 400 m³ effective volume.

2 Innovative high-performance carrier material in the MBB reactors.

3 Retention system for MBBR carrier material.

30 % less fresh water

It was possible to lower consumption of fresh water in the entire paper mill by one-third. The key to this is consistent water management covering all areas from recovered paper preparation through the two paper machines (the existing PM 4 and the new PM 7) to the wastewater treatment system.

The wastewater purification system includes water loop cleaning and reject treatment, processes for which Voith developed and implemented a new machine and process technology concept. This involved doubling the capacity of the wastewater treatment facility during paper mill operation to 1 000 m³/h wastewater and 50 t/day COD load. Two moving bed biological reactors (MBBR) are used as high-load biological filters, along with two downstream, cascaded low-load biological filters and three final settling tanks. These facilities ensure that biologically purified water can be discharged into the Reuss River, which is abundant in fish and has its source in the Saint-Gotthard Massif mountain range. This allows the company to meet the stringent ecological standards of Swiss environmental authorities.

Together with the respective first chambers of the low-load biological filters, the two MBBRs are key components of the aerobic wastewater purification system, because the carriers contained in the reactors act as a growth surface for the activated sludge. In Perlen, a new kind of carrier material was used, which has up to six times greater active surface area than conventional carrier material.

In addition, these new high-performance carriers allowed capacity of the existing low-load biological filters to be increased significantly. This meant that to double the degradation rate all that was needed was to build an additional MBBR. The existing high-load reactor and the two low-load biological filters were converted and fitted with a new ventilation system. Because of the rebuild, the hydraulic load could be increased to around 1 000 m³/h.

Perlen Papier gets its fresh water from its own well, which also supplies the village of Perlen with drinking water. This means that during further processing of the water there has to be a strict separation of drinking water and industrial water. Perlen Papier uses around 50 % of the fresh water for cooling purposes and discharges it back into the natural cycle in an uncontaminated condition.