Executive Summary

The baling line is one of the most important and most crucial production units in a pulp mill and its condition directly affects mill earnings. Production demands a safe, efficient baling line that is easy to maintain. Valmet’s RoboBaling technology provides these key criteria. Whether the market pulp comes from a conventional pulp drying line or flash drying line, the underlying technology is similar.

Handling incoming bales at paper, board and tissue mills is just as important as creating them. Safety is a key factor in pulper feed systems as mills replace older manual dewiring stations with modern automated equipment, thus avoiding wire-related and repetitive motion injuries for operators. In addition, capacity is increased and the incoming raw material stream is kept in pristine condition all the way to the pulper.

This white paper discusses the typical layouts of baling lines and pulper feed systems, with emphasis on safety, efficiency and ease of maintenance and a rundown of the main equipment components. In addition, key services such as baling line audits, maintenance and operations support agreements, virtual training simulators and remote access support are described. Finally, we demonstrate how the equipment and services come together to achieve superior results by reviewing baling line and pulper feed system case studies from around the world.
NOTE: Some of the graphics in this white paper are presented with QR codes. If you have a QR app on your smart phone, you may use it with the QR codes in this white paper to view video clips of the corresponding RoboBaling components in action. Alternatively, you may direct your internet browser to Valmet’s YouTube channel found at www.youtube.com/user/valmetglobal and view them there.

The bale handling line conveys, presses, wraps, binds, marks and stacks the bales coming from the cutter layboy or the flash dryer. After this the bale is ready for transport and marketing. Economical packing and protection of the shipping pulp product is best achieved by equipping a pulp drying line with Valmet’s RoboBaling™ technology. The RoboBaling technique results in improved precision, capacity and availability and also reduces power consumption, noise levels and maintenance.

Bale handling lines can be divided roughly into two different types: for wrapped 250 kg bales and for unwrapped 1000 kg bales, the latter being normally intended for the domestic market. The average nominal bailing line capacity today is 240 bales/hour, but each of Valmet’s machines can handle peak capacities of up to 300 bales/hour.

Highest possible safety standards with RoboSafety

Due to new and stricter safety regulations, many existing safety precautions and systems are fast becoming outdated. Valmet places great emphasis on safety and has therefore developed its own safety concept called RoboSafety, which fulfills the requirements of all currently applying EU safety standards. The system is modularized and can be adapted to local laws and regulations outside the EU. The safety system is a free standing unit consisting of all necessary safety functions. This enables production with the highest possible safety for operators, with zero lost time injuries as the goal.

The RoboSafety system is designed in accordance with the following directives and harmonized standards:

- EN ISO 12100-1 and -2 General principles for design
- EN ISO 13857 Safety distances, upper and lower limbs
- EN ISO 13849-1 Safety related parts of control systems
- EN 60204-1 Electrical equipment of machines
- EN ISO 13850 Emergency stop
- EN 349 Minimum gaps
- EN 1088 Interlocking devices
- EN ISO 14120 Guards

Safety zones

RoboSafety divides installations into safety zones (Figure 1, next page). If anyone enters a safety zone, all power sources are interrupted which ensures the highest possible safety level for all employees. The intelligent safety system makes it easy to return to production as soon as a problem has been corrected. RoboSafety is an option for customers desiring a ready-made solution that complies with existing local laws and regulations regarding employee safety.

According to Frank Swietlik, Valmet’s General Manager for Pulp Drying and Baling in North America, "We modify our system to focus on regional safety regulations, including local mill safety requirements. A recent delivery required multiple keys in a Fortress Lock situation because according to corporate safety
Published March 18, 2015

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guidelines each operator in the safety zone has to carry a key. This was easy to achieve with RoboSafety technology, providing a customized safety system that matched the customer’s needs.

How does RoboSafety function?
The safety system includes a monitoring unit, i.e. SafePLC or safety relay, that monitors all safety functions and turns off the power to the related machines when activated. Each safety PLC can handle up to two lines. Local safety cabinets consisting of contactors and remote I/O are placed along the line; each cabinet can handle up to three zones depending on maximum power used by the machines. All cabinets are connected with a bus. A master PLC handles the communication with superior systems, machine control systems and internal signal exchanges within the system. Safety system status can be fed to the existing control room for supervision of open doors or active safety functions, etc.

Supervised doors for entrance or light beam detectors are used to activate the system (Figure 2). Power and air supply to the machine is cut and the machine stops immediately when the RoboSafety system is activated. A blue lamp in the control panel is lit to indicate that the safety system has been triggered. When all doors are closed the safety system can be reset by pressing the blue lamp button. The power to the machine is then switched on and the machine can be operated from the control panel.

Figure 1. Example of a four zone RoboSafety system in a typical baling line

Figure 2. Doors are equipped with safety switches which are monitored by the RoboSafety system. The power to machines is switched off when a door is opened.
Doors are installed for easy access to operating and maintenance positions. Individual sections of the fence can be easily dismounted with a special tool if needed. Light beam sensors or scanners can be used to improve accessibility where a fence is considered to be too restricting. All safety systems data can be transferred to a superior system or control room for visualization. The implemented safety functions are described in a Safety Manual.

**Plug-and-play pre-tested modules save total installed costs**

RoboBaling technology utilizes bus technology, where all pieces of equipment are connected by means of a bus cable instead of massive field cabling from a central PLC to separate machine I/O. In addition to making installation and subsequent maintenance work easier, the bus technology also makes it quick and easy to pre-install or test mill installations.

According to Swietlik: "We put a lot of effort into making the system a plug-and-play system. It’s 100% tested in our shop. When it gets onsite you plug it in to power and bus and it just runs." The ready-to-use units are excellent for retrofitting into existing baling lines, as they enable short installation times and easy start up.

The installation time onsite is short because all baling line machines are constructed as complete ready-to-use units. The equipment is test-run at our workshop before delivery. The bale press is pre-tested several times by a special hydraulic operating test bale - after 1000 successfully pressed bales the machine is approved for delivery.

There is also a clear difference in total installed cost, as Swietlik confirms: "In-shop pre-testing of Valmet RoboBaling equipment reduces construction/installation cost by up to 70%. In a fairly representative recent North American delivery, the mill used multipliers of 1.25 for Valmet and 2.0 for our competitor in order to determine what the capital cost to purchase was as compared to total installed cost. This isn’t surprising as other baling and pulper feed equipment suppliers require much more field wiring and testing on site, resulting in a labor intensive startup.”

The automatic machines can be delivered in a number of designs and models customized for handling not only single bales, but also bale units of four to eight bales in different sizes and weights. All machines are easily adjustable for different bale sizes. A complete module system from Valmet makes it possible to build a customized line for meeting special requirements.

The other main feature of RoboBaling technology is the replacement of several hydraulic units and functions with electro-pneumatic actuators. In most cases this provides operational advantages because tuning differences relating to hydraulic oil temperatures are totally missing and the machine operates in the same way regardless of whether the machine has just started (cold) or has been running at a steady state.

**Controlling bale flow and quality**

The user is provided with a continuous flow of true and current information - a vital factor for achieving today’s high demands for logistic excellence. The intelligent control systems with user-friendly touch displays ensure that you can easily control, monitor and maintain the production line. For optimal
performance of the whole baling line, a PC-based bale control unit, BCU, works as a common master and monitors the overall functions between the various pieces of equipment.

A major benefit of RoboBaling technology is that all machines share the same sophisticated control system, regardless of mill or production. Consequently, learning to operate one machine type makes it easy to operate any other machine in the range.

The bale quality system, BQS, is a real-time tracking, identifying and reporting tool for pulp production and quality parameters. Instead of being a last in, first out system (based on production lots), BQS tracks each single bale, its location at any given moment, and where it is being guided.

**Human Machine Interface (HMI)**

Although each machine and conveyor is intended for automatic operation, it can also be operated manually from the user-friendly control desk, which features a graphical touch display and PLC control equipment for making easy adjustments and accessing diagnostic routines. Using the HMI (Figure 3) the operator can make all necessary adjustments and by using the "Auto Start" function, can restart the machine from any sequence in the work cycle.

The high capacity of RoboBaling lines is partly due to the built-in self-diagnosis system with auto start, which permits an alternative operation mode in case of disturbances. This means few shutdowns of short duration. Stefan Nordhälling, Senior Design Engineer for Valmet is responsible for the machines and explains that there are a number of built-in sensors sensing when the machine is in motion. If there is no indication of motion an alarm is shown on the display. It takes approximately 22 seconds to dewire a bale. One of the many advantages of the new dewiring line, which can be adapted to all bales on the market, is its "excellent dewiring efficiency", according to Nordhälling. "Thanks to a built-in metal detector, bales that cannot be properly dewired are collected with a reject conveyor," he explains.

All the control desks in the line are linked by a communication bus, which provides a highly effective communication network between all the line machines, making commissioning fast and easy, and ensuring smooth, coordinated bale handling. Efficient customer support is provided by Valmet's Remote Access System (RAS), which enables access to immediate expert help and software upgrades from one of Valmet's worldwide service support centers.

All RoboBaling equipment components have very good interactive event-message handling via the HMI. Through messages the operator will get alarms about low pressure, broken sensors, disconnected cables, etc.
Distributed intelligence with a Bale Quality System (BQS)

RoboBaling keeps the user in mind with a sophisticated control system to enhance logistics and quality management, the Bale Quality System (BQS). Distributed intelligence is the basis for the RoboBaling control system. A single bus cable, connecting all machines in the baling plant, provides fast and easy commissioning and ensures smooth bale handling.

The BQS can be added to the control system to enhance logistics and quality management. This key supervisory tool keeps track of production data and quality parameters from several baling lines (Figure 4). BQS is a unique system that tracks each individual bale, bale set and bale unit throughout the production line. The system uses absolute bale position tracking to ensure the exceptional reliability of key data. The BQS has the unique feature of instant detection and automatic self-adjustment when a bale is removed from, or added to, the baling line.

Single bale tracking
BQS tracks every single bale, its location at all times, and where it is being directed. This provides true bale tracking all the way to bale storage. The tracking data provides optimum traceability.

Automatic handling
An otherwise highly complex set of procedures is simplified by:
- automatic handling to group bales of same quality (grade) and properties (process order) into units and lots
- automatic control of lines according to process order in stock preparation (recipe handling)

Reliable information
The constant flow of true information in real time is established through unique trackable bale identities. Without BQS, products are only given numbers and therefore relevant product information such as air dry weight, grade and moisture is lacking for every single bale and unit produced.

Available data
BQS provides data for reporting of machine and conveyor availability and capacity. This is an important tool for bottleneck detection and general troubleshooting.

Rapid diagnostics
Machine alarms are sent from BQS to the Distributed Control System (DCS). This efficient detection of machine problems enables rapid corrective measures.

After start up, remote support is a possibility via connection with a Virtual Private Network (VPN), which links to Valmet’s global Remote Access Support (RAS) system.
Superior tracking and optimized line control

All RoboBaling machines and conveyors share the same sophisticated technology and are equipped with machine control desks that feature a graphic touch screen Human-Machine Interface (HMI). All the control panels in the line are linked by a shared network, which provides the efficient data flow and control network for BQS. Information from the line’s machines and conveyors is stored in the BQS database and is easily available for reporting and analysis.

At the cutter layboy or the slab press, BQS gives each bale a unique bale identity for tracking. Bale set identity is also established. All quality and profile data is subsequently linked to these identities. Bale scale readings are coordinated to provide accurate data on bale weight. Inkjet marking of the text layout for bale labeling is supervised, and BQS coordinates unit information and classification of the finished unit, and sends information to sales and warehouse systems. BQS amalgamates pulp quality data for each individual bale in a bale set and makes key quality data on bale tracking, bale weight, marking and unit formation readily available for analysis and interpretation by the mill’s information system.

Overview of a typical baling line

RoboBaling technology from Valmet represents the most sophisticated technology in the world for a baling line (Figure 5). Installation time is short as units are ready-to-use. A unique bale quality system follows each bale set, each individual bale and each bale unit through the production line. User-friendly touch-screen displays help operators easily control, monitor and maintain the line. If a need arises, a remote access support system provides immediate expert help without unnecessary delay.

A conventional pulp drying machine uses an airborne dryer to dry the sheet, then a cutter layboy to create stacks of sheets. Alternatively, a flash dried pulp line feeds individual fibers into a mold via screws, and presses them into a bale shape using a slab press. In both lines, the stack or bale is then conveyed to a press to push the air out and densify the stack so you’re not shipping air. At this point a 'bale' is created.
The bale is then covered with wrapper, either of the same pulp sheet but larger in size, or another wrapper of similar paper characteristics. The wrapper is folded around the bale and strapped using either wire or paper straps to secure it. The bale is then weighed and labeled. Labeling is best achieved via inkjet marking directly onto the wrapper rather than an adhesive label.

The pressed, wrapped, folded and strapped bale is then typically unitized into a stack of four to six bales high. Two stacks may be unitized together side-by-side if the pulp will be shipped over a long distance. (An existing industry standard is two stacks of four 250 kg bales strapped together, for example when shipping eucalyptus from Brazil or fiber from Southeast Asia.) A conveyor takes the unitized stacks to the warehouse where a forklift truck moves them into temporary storage, typically grouping the bales by grade, customer or production date - before moving them into outgoing transportation vehicles.

Now let's walk through a typical baling line and look at the separate components - from the press to the final shipping point. The equipment used in conventionally dried pulp, flash dried pulp and wet lap baling lines is quite similar. We'll start with the slab press, a special press used to create flash dried pulp bales…

**Slab Press**

Swietlik describes Valmet's slab press (Figure 6): "With flash drying of pulp, the process to create the initial pulp stack is different. Individual fibers are fed into a mold and pressed into a bale, using a slab press. The remaining equipment in the baling line is identical to that found in conventional airborne pulp drying lines."

Uniform bales and bale stack units, requiring as small volume as possible, are of great importance for cutting freight- and storing costs. Therefore, Valmet has particularly high demands on those parts which affect bale density and bale weight variations.

**Bale density**

High bale density is obtained by an efficient air removal system and by precise operator control over the number of slabs, the ram speeds, the holding time, the pressing force on each slab, and the final pressing force. The most favorable combination of these factors in relation to the required output and to the properties of the actual pulp can therefore be easily determined.

**Bale weight**

The bale weight deviation is minimal due to the unique screw feeding system and the fact that formation of a new bale does not start until a sufficient quantity of pulp for a full bale is stored in the chutes above the feed screws. This makes the bale weight independent of variation of the pulp flow from the dryer. Furthermore, the quantity of the pulp feed into the press mold is determined by the number of turns of the screws, which is very closely controlled by a pulse encoder. A pulp distributor, which with great accuracy distributes equal quantities of pulp to the chutes, insures a uniform bale shape.
Easy and efficient operation

The slab press combines the latest technology with extensive experience, to produce an easy to handle machine with increased capacity, greater bale weight accuracy and maximum availability.

Enhancements made to the slab press have lowered noise levels and reduced dust emission. Maintenance costs have been minimized and the superior control system ensures easy and efficient operation. In flash-drying plants, mostly CTMP, all over the world the Valmet slab press is the most frequently installed bale-forming machine.

Key benefits of slab press

- World-leading bale former in flash-drying plants
- Uniform bales and bale units with consistent bale weight and high bale density
- No dust problems

Bale scale

The bale scale can be set to desired upper and lower weight limits. If the weight is not in the permitted range, the scale gives the appropriate alarm. The bale scale conveyor can either be configured to give an alarm and continue production or the bale stops on the conveyor awaiting necessary weight adjustments before continuing production. Weight data received from the scale can be transferred to the bale handling line's computer-based system (BQS) for data storing and reporting.

RoboPress™ bale press

Located first in a conventional pulp drying baling line, and just after the slab press in a flash dried pulp baling line, the RoboPress (Figure 7), available in multiple configurations, presses the bales to a compact and easy to handle format. It features a compact design to reduce the building volume and is equipped with a fatigue-resistant frame for long service life. The patented closed-hydraulic system minimizes oil volume for an improved environment.

Figure 7. The RoboPress bale press gently presses the bale stack, removing air and densifying the bale for efficient shipping.
RoboPress PR-15 has the highest capacity of up to 300 bales/hour. In comparison with a conventional system, the patented closed hydraulic system ensures higher availability and a longer service life for the various hydraulic components. The closed hydraulic system requires only a small volume of oil (approx. 1000 liters) and eliminates the air filter clogging problem associated with conventional bales presses. The deaerator unit reduces oxidation of the oil by up to 30 times, maintaining the highest standard of oil cleanliness and therefore eliminating the need for oil changes.

The compact design provides valuable space-saving benefits in the production area. Press installation is made easy, as RoboPress does not require a press pit. Service and maintenance is also easy, as most service points can be accessed from floor level. The bale positioning system minimizes unnecessary stops due to wrong bale positioning or bales with an unsuitable geometric shape.

RoboPress PR-15 LC is a more cost efficient solution for lower production levels of up to 80 bales/hour, and is easily upgradable to the full PR-15 capacity level in the future by adding the necessary hydraulics. RoboPress PR-2 WL, also running up to 80 bales/hour, provides the more sensitive processing essential for wet lap bales that have weaker fiber bonds in the wet pulp.

**Key benefits of RoboPress bale press**
- No need for press pit
- Optimal frame design for infinite fatigue lifetime
- Patented hydraulic system minimizes oil volume
- Superior bale positioning system reduces unnecessary stops

**RoboApplyer™-sheet, bale wrapper using sheets**

After pressing the bales, they must be wrapped. The RoboApplyer-sheet (Figure 8) uses pulp or paper sheets for wrapping pulp bales. The wrappers are placed and folded with high precision, reflecting the high quality of your finished bales. The wrappers are separated and lifted from the stack by a reliable pneumatic system. The feeding system is designed for gentle handling of wrappers and can handle a wide range of wrapping sheet basis weights. Folding plates fold the upper and lower sheets tightly along the bale, starting with the bottom sheet.

**Key benefits of RoboApplyer-sheet bale wrapper**
- Easy, automatic high-speed sheet wrapping
- High flexibility to meet specific wrapping needs
- Controlled sheet separation and wrapper infeed
- Uniform appearance of bales provides good printability

*Figure 8. The RoboApplyer-sheet applies sheet-fed wrapping to the pressed bale, presenting a printable surface for the inkjet marker.*
RoboAppleyer™-roll, bale wrapper with roll feed

RoboAppleyer-roll (Figure 9) is a high-capacity wrapping machine that uses rolled paper to wrap pulp bales at a rate of up to 300 bales/hour. The machine offers smooth operation, high availability and an efficient wrapping technique that can reduce baling wire costs by up to 50%.

![Figure 9. The RoboAppleyer-roll applies roll fed wrapping to the pressed bale, with reduced wire costs.](image)

Variable frequency drives, which feed from a paper accumulator, ensure that paper feeding is very smooth. Threading the paper is easy, as a feeding plate with air nozzles automates the in-feed. And, there is no paper wrapping wastage, because the whole paper roll is utilized before the roll change.

RoboAppleyer-roll overlaps the ends of the wrapper underneath the bale, a technique that saves the cost of one or two baling wires. Using this machine can therefore save you 50% on baling wire costs.

According to Swietlik, the roll-based wrapping method is gaining popularity: "With a sheet-based wrapper, you must periodically stop the pulp drying machine and reconfigure the cutter layboy to a larger wrapper sized sheet, rather than continuing making a saleable product. The newer roll-based method allows the pulp drying line to run 100% making saleable and purchase bleached kraft paper wrapper in roll form that has similar characteristics and wraps in one continuous wrap around the bale. Thus there's increasing interest in roll-based wrapping, specifically the RoboAppleyer-roll."

Key benefits of RoboAppleyer-roll bale wrapper

- Smooth, cost-efficient operation
- Reduced wire costs
- Flexible to meet wrapping needs
- Good printability

RoboTyer™ and RoboHightyer™ for strapping bales

The RoboTyer (Figure 10, next page) automatically applies high-tensile steel wire around the pulp bales at preselected positions. Each wire is tied at the bottom of the bale by a double-twisted knot.

The RoboHightyer (Figure 10, next page) is a well-proven tying machine based on the RoboTyer design, designed to bind a single "big bale" with a weight of up to 1000 kg. These "big bales" normally consist of four bales stacked on top of the other and tied with two or three wires. They can be grouped together as batches of two or three for subsequent handling by a clamp truck. Depending on the transport system these big bales can also be tilted 90°.
All service points are located at floor level. The tying machine can be easily pulled out from the baling line using a pallet jack to simplify cleaning and service, or for replacement of wear parts. This low-weight unit can be easily replaced by an overhauled spare. A trained person can make the exchange in a few minutes.

Wire cage improves safety

The fully automatic tying machine in combination with the specially developed wire cage (Figure 10) ensures a safe and reliable system for bale wire application. The wire cage with wire stand, wire cone and other accessories form a complete wire unwinding system. All aspects of the wire cage and wire unwinding system are designed to ensure the highest level of safety. Wire threading when refilling wire is safe and simple, and is done at floor level. The wire cage is equipped with a close meshed net and the cage door is monitored by electrical safety switches. The cage is also equipped with wheels, making it easy to move and relocate for increased flexibility.

The wire feeding system in the RoboTyer, operated by an electric servo-motor, provides exact and gentle wire feeding. Parameters for acceleration, retardation, speed, wire tension and twisting can be adjusted from the HMI. Wires ranging from 1.8 to 3.0 mm in diameter are fed through a wire guide system into the tying machine via a foldable connector, which can be placed on the left, right or center of the cage, depending on the baling area layout.
Key benefits of RoboTyer and RoboHightyer bale strappers

- Servo-motors for exact and gentle wire feeding
- Wire feeding-, tension-, and twisting parameters easily adjustable from the HMI
- Safe and simple refill of wire
- Tying machine can be easily pulled out from the baling line for efficient cleaning and service
- Main parts inside easy-to-replace twisting unit
- All service points at floor level

**Figure 11. The inkjet marker enhances the quality and usability of bales by applying logos, trademarks and pulp bale production information.**

**Inkjet marker for labeling bales**

To keep track of the bales they are marked with an inkjet marker. The Valmet inkjet marker (Figure 11) applies high-quality printing to mark bales with company logos, pulp trademarks and other relevant information such as production data. The marker can be equipped with a bar-code system which in turn can be connected to a "read after write" laser scanner. Our fully automatic marker provides high quality printing. The markings remain clean, sharp and legible after long storage, and inks are resistant to rain, snow and sunlight.

The marker system consists of up to three marker units, each fitted with one or two individually controlled print heads. To adapt to various bale sizes and positions, the print heads are installed in pneumatic-loaded sliding plates. The weight and geometrical shape of the sliding plates are optimized to avoid vibration during marking.

The system has a separate control- and ink cabinet that supplies the ink. Using large ink containers reduces the number of ink fill-ups and reduces ink costs by allowing bulk purchases.

The printing control system has capacity to store pre-programmed printing tasks. It contains functions that simplify the application of special information to the wrapper. This flexibility enables customized printing to meet special requirements!

**Key benefits of inkjet marker**

- Permits marking on up to three sides of the bale
- Marking plates easily adaptable for different marking system suppliers
- Barcode printing option
- Marking plates aligned with bale for high quality printing
• Marking plates’ geometry and weight optimized for high quality printing
• Free standing control- and ink cabinet
• Marker can be connected to BQS (Bale Quality System) for individual marking of production data on the bales

RoboFolder™ folds wrapper on bales
The Robofolder (Figure 12) with its well proven design produces elegant bales. Precise folding is achieved by accurate positioning of the bales and optimized folding plate geometry.

The folding machine produces an elegant bale with a wrapper of pulp or roll paper. The design is optimized for infinite fatigue lifetime. All service points are located at floor level for efficient, service-friendly routines. High availability is well documented for this proven design, and as a result there are hundreds of satisfied Robofolder customers all over the world.

Key benefits of RoboFolder wrapper folder
• Optimized design for infinite fatigue lifetime
• Optimized folding plate geometry produces elegant bales
• Accurate positioning of bales
• All service points at floor level

RoboPalletizer™
The RoboPalletizer automatically provides pallets to the baling line. It is used in lines where one or more pulp bales are to be transported on pallets. Bale stacking on pallets is carried out by the subsequent stacking machine.

A stack of pallets is loaded by forklift onto the loading position of the RoboPalletizer. The operation is automatically stopped when pallets are refilled to the pallet magazine. The bottom pallet is then separated from the stack and discharged to the next conveyor.

Key benefits of RoboPalletizer
• Efficient palletizing routine with smooth pallet separation
• Maximum safety during operation
• Easy maintenance
• Automatic fork lift detection enables safe loading of pallets
RoboStacker™ stacks bales into multi-bale units

In the RoboStacker (Figure 13) the bales are gently and rapidly stacked before being strapped into multi-bale units of up to 1250 kg. It allows a preset number of bales (normally four) to be carefully lifted and stacked on top of each other. The bales are automatically adjusted, both sideways and lengthwise, in order to produce a straight stack for easy and economic transportation. RoboStacker is a high-capacity stacker that can process up to 300 bales/hour.

Two lifting units with several lifting forks, one on each side, move in under the bale stack to lift it. The bales are accurately and swiftly positioned under full control. The extended machine frame, which surrounds the bale stack, ensures that any falling bales cannot jeopardize the safety of personnel or damage nearby equipment.

Key benefits of RoboStacker bale stacker

- Highly efficient stacking solution
- Fast and gentle handling of bales by multiple lifting forks
- Automatic adjustment of bales to arrange a straight stack
- Bale stacks enclosed in a frame for increased safety

RoboStacktyer™ straps multi-bale units

The most common way to create a wire tied load unit is to use a RoboStacktyer (Figure 14). The RoboStacktyer consists of a press unit and tying unit, for highly efficient production of compact wire-tied and elegant looking bale units, typically consisting of four to eight bales, ready for shipping to the customer.

There is a Valmet RoboStacktyer available for all requirements - the machine is available in three different models to ensure compatibility with any plant layout or transport system. The integrated tying unit, based on the proven RoboTyer concept with servo drives, offers all the benefits of our RoboTyer single bale tying machine. The tying machine can be easily pulled out from the press unit to simplify cleaning and service.
Key benefits of RoboStacktyer multi-bale strapper

- Available in multiple designs for various layout requirements
- Pressing from all sides provides uniform bale unit shape
- Tying machine can be easily pulled out from the press unit for efficient cleaning and service
- Tying unit includes all of the benefits of a single bale tying machine
- Simple and safe wire handling
- Easy twisting unit replacement

Conveyor system

If RoboBaling machines are the bricks, the conveyors are the mortar holding the baling line together. Valmet’s baling conveyor systems are used in pulp producing lines for sheet dried or flash dried pulp and in pulp receiving lines for recipe handling, dewiring and pulper feeding.

The heavy-duty design of beams, chains, gear motors, etc. guarantees a long life and safe operation. There is a central drive for dual transport directions. Service and chain tensioning are easy. Gentle stop and start and optimized conveyor speed is made possible by variable frequency drives.

Conveyors in virgin pulp producing lines transport bales from the cutter layboy or slab press through the entire baling line to the pulp bale storage. The line typically includes:

- swing conveyors after the cutter layboy
- a scale conveyor before the bale press
- a movable conveyor to transport wrapping sheets to sheet applying machine

The standard for conveyors today is the chain conveyor, with slat conveyors used primarily in pulper feeding applications. Conveyors for single bales and wrapping sheet stacks normally have 1” chain pitch, whereas conveyors after the RoboStacktyer have 50 mm chain pitch to handle bale stacks. Conveyors in flash dried pulp producing lines are of standard type, but can be equipped with peripherals such as cover plates.

There are various types of conveyors, such as stationary, swing, movable and angle conveyors. The drive unit is mounted on the conveyor frame and needs no separate base plate. The spare part requirement is minimized by the modular construction of the conveyors: one and the same part can be used in several conveyors.

Key benefits of conveyor systems

- Available in multiple designs for custom-made logistic solutions
- Heavy-duty design
- Several chain strands for gentle handling of wet lap bales
- Central drive for dual transport directions
- Easy service and chain tensioning

Pulper feed system

What can Valmet’s pulper feed system add to your paper, board or tissue mill? The bale handling system is a fully automated dewiring system for baled pulp, but may be provided in a semi-automatic or manual
fashion. With a minimum of labor and maximum flow control, the system dewires and controls everything from the incoming unit to bales entering the continuous or batch pulper (Figure 15).

Valmet’s dewiring system is characterized by minimum effort and maximum process control. Each bale that comes into the dewiring plant is tracked and monitored using a master control system that provides information about how the bale should be handled along the line.

The bales are transported via the loading conveyor to the unit dewiring machine, the RoboStackcoiler, where the bale units are dewired and destacked into single bales to subsequently be further transported to intermediate storage or to be dewired. A single bale enters the RoboCoiler for dewiring. The bale is transported into position for the wire to be identified. The wires are cut off and rolled up into compact coils of wire, slightly larger than a ball of twine. These coils of wire are collected in a separate container next to the dewiring machine for recycling.

The dewired bale is then transported through a metal detector before continuing on its way to the pulper. If the metal detector detects residual wire or any other scrap metal, the bale is transported to the side to a manual dewiring station where the bale goes through a manual inspection and dewiring.

**High capacity and rate of dewiring**

A fully automated production line can provide several benefits for dewiring. High capacity and rate of dewiring in combination with a high level of safety and availability are characteristics of the units in the RoboBaling product series.
The dewiring machine for single bales can handle up to 160 bales/hour, which is a remarkable figure, implying an average of just over 22 seconds for the handling of a bale. This is quicker than manual dewiring and even quicker than other competing dewiring systems.

Follow-ups also show that the automated machines produce better results with regard to the quality of the completed task - Valmet’s RoboCoiler, for example, achieves a rate of dewiring of more than 99% if the bales that are processed are of good quality.

**A high level of safety and availability**

An automated line minimizes exposure to areas of risk and dangerous operations. The accidents and damage that can be caused by manual dewiring are completely eliminated. Physical contact with the machines or manual handling of the bales is only necessary during the repair of faults, service or, for example, during inspection of a rejected bale when the metal detector is set off. "Automated dewiring is becoming very important in North America due to safety. Many lost time injuries have occurred due to manual dewiring of bales. Also a large number of shoulder injuries due to repetitive pulling wire from bales and bale stacks," says Swietlik.

Control and electrification are also integrated in the machines with easily accessible service points which ensure that operation takes place in a controlled manner.

All units are operator-controlled via a user-friendly touch screen panel. The user interface is operator-friendly and instructive for fast and easy operations, enabling maximized production uptime. Ultimately, automated production also involves rational production. The low investment costs and increased uptime imply that the investment can be repaid in a short time.

A typical system will include a unit dewirer and destacker, a bale dewirer and a metal detector - all connected by a series of flat conveyors with an inclined conveyor at the pulper end.

**RoboStackcoiler™ for unstrapping and unstacking bale units**

RoboStackcoiler (Figure 16) offers a cost-efficient, fully automatic solution for dewiring and destacking pulp bale units down to single bales for pulp receiving lines at rates of up to 200 bales/hour. The machine

![Figure 16. RoboStackcoiler dewires and destacks bale units down to single bales, and is operated and monitored via a touch-screen with an easy-to-use graphic interface.](image)
handles all unit sizes on the market; different bale unit sizes can be pre-programmed into RoboStackcoiler and are then automatically identified and processed when fed into the machine. In a fully automatic line, bales are then transported directly to the RoboCoiler for automatic dewiring of individual bales.

**Safe wire handling**

Steel wire is used to keep pulp bales together during transportation to the paper, board or tissue mill. Steel wire is an indispensable part of the transport chain, but is often associated with problematic handling. The wire must be carefully removed from the pulp bale to avoid damage to machines caused by remnants and/or an inferior end product. Also, operators must wear personal protective equipment when manually dewiring to avoid injury.

With RoboBaling technology, wires cut from the bale units are automatically formed into compact, recyclable coils ([Figure 17](#)). With no long or loose wires, the coils are safe and easy to handle. RoboBaling technology not only reduces risks for operators, but also provides the smoothest, most efficient solution for handling cut wire. To ensure that all the wires will be completely cut off, the floating cutting unit is designed with an extra-large catching zone.

**Key benefits of RoboStackcoiler bale unit unstrapper and unstacker**

- Quick installation and start up
- Fully automatic
- Maximum flexibility
- Safe wire handling

**RoboDestacker™ for unstacking bale units**

In mills where manual dewiring is performed on incoming multi-bale units, RoboDestacker ([Figure 18](#)) is a fully automatic machine for efficient destacking of pulp bale units down to single bales. This high-capacity, 100% electric powered solution, available in stationary or movable versions, delivers destacking rates up to 285 bales/hour.

In a semi-automatic or automatic pulp receiving line, multi-bale units are automatically destacked...
down to single bales by RoboDestacker after manual unit dewiring. The machine can handle any bale quality and bale unit size. Different bale unit sizes can be pre-programmed into RoboDestacker and are then automatically identified and processed when fed into the machine.

RoboDestacker comes in two flavors - stationary and movable. The movable variant, which runs on rails, is used in automatic recipe handling applications.

RoboDestacker is service-friendly - every service point can be reached from floor level and key mechanisms such as the clamp unit and lifting arrangement are located under easily removable covers. The machine is powered by a 100% electric drive system, eliminating the need for pneumatic connections or an external hydraulic power unit. This factor keeps both initial investment costs and life cycle costs at low levels.

**Key benefits of RoboDestacker bale unit unstacker**

- High capacity
- 100% electric drive system
- Stationary or movable versions
- Easy to install, operate and service

**RoboCoiler™ unstraps single bales**

RoboCoiler is the highest capacity single bale dewiring solution (Figure 19), operating at up to 160 bales/hour. The machine operates safely and efficiently to remove any wire configuration, regardless of the numbers of wires, their location on the bale or the size of the bale. The cutting procedure produces minimal wrapper waste, and changing cutting tools and winding crowns is a quick, easy and inexpensive

*Figure 19. RoboCoiler rapidly and safely removes and coils the strapping wire from single bales.*
procedure. As with RoboStackcoiler, wires cut from the bales are automatically formed into compact, recyclable coils. Thus there are no long or loose wires which can cause serious injuries to the person handling the rest product.

The machine is also available in a lower cost version with lower capacity, featuring only a single cutting unit and wire coiling unit. If the capacity needs to be increased, it is easy to upgrade the machine to a full capacity version.

As is the case with many other RoboBaling components, the machine is delivered as a ready-to-use unit designed for fast installation and start up. In fact, it is possible to install RoboCoiler and put it into production in a single day.

**Key benefits of RoboCoiler bale unstrapper**

- Cuts all wire configurations
- Fastest dewiring solution
- Safe wire handling
- Quick installation and start up

**RoboWinder™ compacts steel wire**

The RoboWinder (Figure 20) is intended for compacting steel wire primarily taken from dewired pulp bales and units. It can also be used to compact steel wires from a tying machine test station. The machine is delivered as a ready to use unit equipped with a control panel, drive unit and pneumatic system.

The cut wire is manually loaded into the feed chute. A coiling screw equipped with spikes grips the loose wires and rotates to create a wire coil. A wire carrier pushes the wires against the coiling screw to make the coil more compact.

When the coil is ready the main hatch is opened and the coil is pushed out during reverse rotation of the coiling screw. The coil can easily be picked up e.g. by a fork-lift truck; the machine produces wire coils with a maximum width of 500 mm and maximum weight of 150 kg.

The coiling screw is operated by a safety grip switch, an enabling device that is linked to the machine’s internal monitoring system. This safety feature ensures maximum protection for the operator.

**Metal detector**

Nothing but pure pulp gets through the detector. The dewired bale passes through a metal detector before being fed into the bale pulper. If any metal is detected the bale is transported directly to the reject conveyor for manual inspection and dewiring.

The reject conveyor collects the bales refused by the metal detector. At regular intervals, the bales are dewired manually and then returned to the line.
Regardless of whether the bales are destined for a continuous pulper or a batch pulper (with unique recipes) the system ensures that the correct pulp grade is always delivered.

**Special purpose solutions**

All conveyors are available in a large number of variants (Figure 21) optimized to handle different capacities, pulp qualities, bale weights and bale dimensions. Valmet offers a wide range of special purpose solutions, including:

- **RoboTilter™**: a tilter module for bale stacks to be placed in a standard conveyor.
- **RoboAligner™**: an aligner module for single bales placed under a conveyor, can be equipped with bale lifting means.
- **Roller Way**: a roller method for rejection of single bales.
- **RoboFeeder™**: turns the bales to get the sheets standing. The standing sheets are then delivered a few at a time into the pulper. Can handle pulp bales weighing up to 300 kg.
- **Rotating unit**: tilts the bale 180 degrees in the transporting direction.
- Swinging, movable and pivoting conveyors
- Fixed conveyors equipped with load cells: weights single bales while on a conveyor.

![Figure 21. The movable conveyor moves bales and bale stacks horizontally between other conveyors (commonly used in a recipe handling situation). The Roller Way ejects reject bales from the chain conveyor.](image)

**Services**

Valmet has one of the widest offering of sustainable products and services in the fields of energy, pulp, fiber, paper, board, tissue and biotechnology. This ranges from traditional services such as spare parts and roll grinding, to process analysis services and complete outsourcing of mill functions. We are dedicated to offering flexible, tailor-made services that best meet our customers' needs.

Some of the key services provided for baling lines and pulper feed systems are described in the following sections of this white paper…
Baling line audit ensures maximum utilization of installed machinery

A professional audit from Valmet will ensure optimal use of the installed equipment and maximize efficiency while minimizing service costs. Valmet offers baling line audits in order to ensure maximum utilization of the installed machinery. Whether 5 or 50 years old, a Valmet machine should always run flawlessly.

Valmet offers baling line audits in three different sizes depending on individual mill needs (Figure 22). Reaching from machine program optimization to complete production line studies and planning of capacity increase, the audit ensures maximum customer satisfaction.

Our baling specialists will do an inspection of the mechanical components of the machine to find any malfunctioning parts or excessive wear. A study of the current machine program is done to evaluate:

- Program cycle waste time
- Program optimization possibilities
- Possible maintenance reducing program changes

A plan for spare part handling is made based on the mechanical inspection. This determines what parts to keep in stock and their intervals for change.

Our baling specialists will do an analysis of the future plans for the production line and a long term investment plan is created to reach the customers goals.

A plan for service stops and maintenance is determined together with mill personnel, based on the spare part recommendations and mechanical inspection. Service agreements are proposed from Valmet to further secure long term availability and maximize production line efficiency.

Valmet specialists evaluate the complete production line process and recommend investments and rebuilds to optimize logistics both in the production line and shipping.

The report is a documentation of the data extracted during the testing combined with Valmet’s years of experience and product knowledge. The report includes all measurements, analysis and conclusions from the separate parts depending on the depth of the audit.

All results are based on mill needs and recommended solutions are customized to fit the mill’s future plans and ensure maximized utilization of the installed machinery.

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Figure 22. Baling line audits can range from basic mechanical inspection up to comprehensive future planning.
Key benefits

- A professional audit from Valmet will ensure optimal use of the installed equipment and maximize efficiency while minimizing service costs.
- The audit report provides a detailed picture of needed investments for planning future growth and optimization.
- Through greater knowledge of machinery status, life cycle costs are kept to a minimum.

Agreements

Valmet offers service packages which provide a solution to reduce maintenance costs, increase equipment availability and maintain maximum process performance. Whether maintenance- or operations-based, the agreements target proper operation of all equipment and systems in the baling lines (equipment, electrical components and automation control). Our goal is to insure availability, reliability, quality and increase equipment lifetime.

The best Valmet expertise and local engineers together with customer staff, operating under an agreement, can conduct effective troubleshooting. Regular production and process analyses carried out by Valmet expertise result in optimized operations leading to lower production costs.

Remote Access Support (RAS)

Remote support is typically included with all new baling deliveries during the first year of operation. Basically, Valmet baling experts are available 24/7 to dial into the baling line process control system and troubleshoot problems. After the first year of packaged remote support an agreement may be created to continue the support.

In practice, this means that Valmet has VPN connection to a customer's advanced process control or baling systems, which are prepared for this kind of access. If needed, Valmet specialists are able to adjust operation parameters remotely or even make upgrades of software. Following are just a couple of hundreds of remote access support cases:

**RAS baling line example - April 22, 2011**

12:30: Production manager of BCTMP plant contacts Valmet because the mill is shut down due to a stop in the bale quality system.
13:00: Valmet engineer in Sundsvall, Sweden connects remotely to the baling systems at the mill.
14.30: System problem found and solved. BQS and mill back in full operation.

In the case above, the saved profit from pulp sales was 34 t/hour x 210 EUR/t = 7134 EUR/hour due to a faster startup. The support can also extend to the fiberline, as seen in the following example:

**RAS fiberline example - March 7, 2011**

09:00: Fiberline manager contacts Valmet. There is high chemical consumption in the fiberline, 55 kg/ton (ClO₂ as active chlorine).
13:00: Remote connection is made by a Valmet specialist. Customer is advised to tune the temperature parameter in the process control system.

By 8:00am on March 10th an average reduction of 3 kg/ton was seen. This correlated to a mill savings of 3 kg/t x 4800 t/d x 0.3 EUR/kg = 4300 EUR/day.
VirtualSite baling training simulator

The VirtualSite baling training simulator is an effective training tool for Valmet baling line operators. As part of Valmet’s integrated training package this highly realistic simulator plays a vital role in ensuring successful baling line startups and efficient long-term operation.

Well-trained operators run baling lines more efficiently and profitably, make fewer errors and respond more rapidly and effectively to unexpected situations. Using the VirtualSite baling training simulator before a baling line starts up gives operators the preparation and knowledge they need to manage baling machines and conveyors confidently and efficiently - knowledge that brings considerable benefits such as faster startup, optimized operation and maximized uptime (Figure 23).

The VirtualSite baling training simulator package consists of a simulator engine that generates bales and moves them downstream along the line, a graphical user interface, which provides an accurate line overview, and a control/configuration tool for operating individual machines. The simulator is designed to reflect reality as accurately as possible in terms of production and operability.

Using the VirtualSite baling simulator gives operators essential training on overall baling line operation, touch screens and alarms from machines and conveyors. It also provides valuable training on responding to production disturbances that can arise.

The simulator is configured according to the layout of your actual baling line(s) and includes all machines and conveyors, so the operator gets to know how your baling line conveyors and machines connect to each other. The PLCs on the conveyors and machines are simulated, providing a realistic flow of status data.

The operator can study individual bale movements along the line from an overview display via the graphical user interface and bring up human-machine interfaces (HMIs) for the control of each machine. An insight on specific machines is available from a range of short movies showing baling line machines in operation.

Many different alarms can be generated at random intervals on each machine, which trains the operator in how to handle alarms, correct faults, reset alarms and restart the baling line. Safety alarms can also be generated to stop several machines and conveyors. A question feature can be activated to test the operator’s knowledge of possible alarm causes.
The operator can open and use the same HMIs that are in the actual baling line to perform a range of tasks such as viewing signals, manually running conveyors and resetting alarms. The system also provides links to the Interactive Multimedia Training (IMT) manual for accessing further information on aspects such as local panels and alarms.

A combination of training simulator sessions, highly experienced classroom instructors, computer-based IMT and accurate operating instructions give operators the extensive and in-depth expertise they need, not only to manage lines effectively, but also to train other operators, providing smooth train-the-trainer continuity for the bailing line.

**Key benefits**
- Save time on operator training
- Faster line startup
- Efficient operation from the start
- Fewer operator errors
- Rapid and effective response to alarms
- Maximized uptime

**Case studies**

**Baling line at ENCE Navia optimizes production and improves safety**

After a successful three-day trial period, the Navia pulp mill (Figure 24) took possession of a new Valmet-supplied baling line on April 3, 2008, thus completing the first step of Grupo Empresarial ENCE’s millwide expansion project. The expansion project involved the rebuilding of almost every part of the pulp mill. The new baling line - which was installed in parallel with the existing baling line - was started up in advance to allow the project to focus on the rest of the mill.

All the machines in the baling line were installed during March, starting with the RoboPress bale press. The RoboApplyer wrapping machine located after the bale press uses paper as the wrapping material, which is standard in the ENCE Group. The RoboApplyer folds the ends of the wrapper underneath the bale so that they overlap, which saves the cost of one to two baling wires. Paper wrapping is also an advantage when printing bar-codes on the bales. The bales are tied by a RoboTyer machine, stacked by a RoboStacker, and pressed and tied into units by a RoboStacktyer unitizer.

*Figure 24. At the ENCE pulp mill in Navia, Spain (left), safety fences protect operators on the baling line (right).*
The baling line was tested for the existing low rate of production, but was adjusted for a higher rate of production later. Even though some additional adjustments were left for May, the baling line operators felt that the line was strong and user-friendly. The RoboBaling machines have power systems with servo motors and frequency-controlled electric motors that are of the same type as those used in robotics. They also include PLC control equipment and a touch-screen graphical display, which indicates the status of the machine. Touch panels are handy and easier to operate than the usual switches.

One thing that was left until after the mill took over the line was adjustment of the envelope folding. As the Navia mill’s paper wrapping has a lower basis weight than that of other mills, it was a bit tricky to get a nice envelope. But after some adjustments the bales look really good. The rate of bad-looking bales is 0.0-0.5, which is within the limit for the mill. To optimize baling line operation, some extra training was done in June, as there was limited time for classroom training during commissioning of the line.

Safety fences - Valmet sets the standard
The baling line is often regarded as a relatively safe area of the mill, but when vigilance lapses it can lead to an accident. A safety fence around Valmet’s baling lines helps protect operators (Figure 24, previous page). Certain machine adjustments can be made using a display located outside the fence, and the line must be stopped before anyone can gain access to the equipment itself.

The Stendal mill in Germany was the first to install a safety fence around its baling line. Since then the fence has become standard throughout Europe. The ENCE Navia installation was much appreciated by the operators. "Running the line is easier now," says César Morante, Project Manager for ENCE Navia. "We can avoid mistakes and disruptions, which makes the job safer for operators."

A reliable line with proven design
Even though safety is an important issue at the Navia mill, it was not the unique reason for choosing Valmet as the supplier. "One of the things we very much like about the new design is that the machines are compact units with controls and everything included in one package. Valmet has supplied a reliable line with a good mechanical and modular design. As the line needs to run constantly without stopping, it needs to be reliable. That was the most important thing for me," says Morante.

Baling line in Estonia boosts production
Estonian Cell, the only European pulp mill sourcing products solely from aspen, wanted to boost the capacity of its single baling line and improve availability in continuous shift production. Estonian Cell has become Europe's largest producer of aspen BCTMP (bleached chemithermomechanical pulp) since it opened in 2006. However, rapidly rising electricity costs and production bottlenecks adversely affected financial results. The company responded with a bold strategic investment plan. This included the slab press investment and a new, innovative anaerobic effluent treatment phase that will reduce the mill’s electricity consumption by providing biogas for use in production.

"One of the most important investments to improve the financial results was the contract with Valmet to expand the baling line in order to significantly increase production volumes and reduce costs," says Lauri Raid, Mill Manager, CTO and board member of Estonian Cell.
Increasing capacity and gaining savings

The pulp mill, located in Kunda, 110 kilometers east of Estonia’s capital, Tallinn, was originally designed to produce 140,000 tonnes of aspen BCTMP annually in an eco-friendly, sulfur-free process with chlorine-free bleaching.

"The investment in a new slab press became even more critical considering the losses the company was making," continued Lauri Raid. "So, increasing capacity and gaining the related cost savings was the top priority. We wanted to tackle availability issues and equipment-related breakdowns and reduce maintenance costs. We also had three other objectives: improve the appearance of our bale wrappers, go from double to single wiring on bales and offer customers a big bale option."

Multiple benefits from the new slab press

In 2012 Valmet got the go ahead to design, supply and erect a slab press (Figure 25) and partial baling line to produce over 500 air dried tonnes of aspen BCTMP per day. At the heart of the reconfigured line is Valmet’s slab press, type PFE, the latest version of the automatic bale-forming machine for flash dried pulp that has been supplied to over 70 pulp mills worldwide.

Lauri Raid (Figure 25) explains that the new solution has solved previous precompaction issues: "Uneven delivery of pulp to the slab press had been a major problem. If you start to compact the bale too early, all the other problems start from there. Valmet’s double screw solution provides better, more even delivery of pulp to the press and was the best design for achieving higher capacity."

New and old side by side

However, the challenge was not simply to replace the slab press. "We wanted to retain some of the machinery from the old line and incorporate new machines," comments Lauri Raid. "We also wanted the option to use both the old and new press to feed the same baling line - so the new press was to be installed alongside the old one."

One of the more unusual new line elements was a massive, upper pulp distribution screw for splitting pulp flow from the flash drier to the two presses. "Originally, we thought we would have to build a new cooling tower for the new press," explains Lauri Raid. "Valmet was the only supplier with experience of distribution screws and this solution has substantially reduced project costs."

The new slab press has been operating since July 2013. Although the old press currently stands idle, reincorporating it in production remains an option for the future.
From the new slab press, bales are fed via an L-shaped conveyor system to link up with the existing bale press. New and original machinery is interspersed throughout the line. Additions include Valmet's RoboApplier and RoboFolder (Figure 26) machines to provide efficient bale wrapper application and folding. Valmet's RoboHightyer increases bale options by producing "big bales" consisting of two non-wrapped standard bales for use in large industrial pulping applications.

**Targets achieved**
"All our targets are being achieved," says a satisfied Lauri Raid. "Our bale wrappers look smarter, using single bales wires has cut wire costs and means less dewiring for customers, and we can now offer the big bale option. It’s too early to assess maintenance costs, but it looks promising. Production stability is good and we have met our internal availability targets."

"Most importantly, our top priority has been achieved. Our target capacity has been easily reached. In fact, we recently beat our one-day capacity record by producing 557 tonnes and are well on course to meet our target of 165,000 tonnes for 2014," concludes Lauri Raid.

**North American pulper feed system emphasized safety**
A recent pulper feed system rebuild in the United States was solely undertaken to improve safety. The mill had suffered for years many lost time injuries due to manual dewiring of bales. There were also a large number of shoulder injuries due to repetitive pulling of wire from bales.

Mill personnel researched solutions and consulted with Valmet about safety-improving options. Based on their review of Valmet’s proposal, a rebuild capital expenditure project was presented to corporate and eventually approved. The basis for the project was 100% focused on safety and removing the shoulder injury incidents.

A RoboCoiler was installed as part of the rebuild, which made a huge improvement in dewiring-related injuries, as the process was automated and inside a safety fence. Since the rebuild, there have been no lost time injuries due to snapping wires or repetitive shoulder movement. Mill personnel are quite happy with the results.

**Maximizing operator safety and boosting productivity at InnovioPapers Nijmegen**
InnovioPapers focuses on sustainable paper solutions, producing 150,000 tons of substrates and related products per year for use in packaging and technical and specialty papers. Since 1993 the mill has operated a single paper machine, which has been continuously upgraded to offer extensive coating options as well as two supercalenders for finishing.
In 2010, the mill began to look at ways to enhance stock preparation for feeding the batch pulper. Each batch was made up of 10-14 bales, comprising up to four different pulp qualities and the only automatic element in the feeder system was bale destacking - dewiring of bale units and single bales was done manually. According to Rene Van Wieringen, Manager Business Development at InnovioPapers, "Previously we had two operators. One forklift operator organizing bales and one operator just removing wires. We had some safety incidents involving wires. So our aim for the stock preparation project was to improve both safety and productivity."

"We looked at all kinds of installations from different suppliers and made numerous reference visits," recalls Rene Van Wieringen. "What we soon realized was that the quality of the units and bales is very important for the overall efficiency of the installation." Having a long-term productive relationship with Valmet since 1998, the mill installed a Valmet fully automatic RoboBaling dewiring and recipe handling system in spring of 2012.

**Full automation of a complex system**

In the new solution, bale units are placed on a loading conveyor according to the quality called for by the system and indicated on the display above the conveyor. RoboStackcoiler then automatically removes unit wires and destacks the units. In the next stage, single bales are dewired by RoboCoiler. Bales then pass through a metal detector, and any rejected bales are sent to the reject bale dewiring conveyor for manual dewiring.

Dewired bales are stored on six storage conveyors - two lines each for the two most common qualities and one each for the remaining two. When one of the two pulper feeding conveyors is ready to receive a new batch of bales, the Valmet recipe control system sends the bales forward according to the active recipe. Throughout the process, the system tracks and continuously controls every bale in the system.

**Support was critical to project success**

Cas Bakker, Supervisor Materials Handling at InnovioPapers, adds: "We had a small team from Valmet on site here, sometimes for 24 hours a day, and it was very efficient. Cooperation with Valmet was very good. You always know who to talk to about any issues, so the installation went smoothly."

As part of the installation, InnovioPapers has access to Valmet's Remote Access Support. "It means that Valmet’s technicians can look into our system from Sweden, which is of great help if something happens and our technicians can’t solve the problem. We have used it a few times to solve problems and it has worked out well. It takes time for your own people to build up expertise and even then they can never get to the level of a specialist."

**Targets achieved**

In operation, the new system has achieved or exceeded expectations relating to efficiency, safety and flexibility. "The saving in man hours has been very significant and higher than we expected. We now have one operator, rather than two, for machine supervision and forklift operations. We calculated the potential savings very thoroughly from every possible angle, but were still surprised that there is less operator involvement than expected, around 0.7 of a full time position, so the operator actually has time for other duties." The savings in forklift truck hours alone has been about 50%, down from around 4,000 hours per year to 2,000.
"There has been a big improvement in safety. Areas around the machines are fenced off and emergency systems are fully integrated in the new control system. Automatic wire-cutting means wire-related incidents involving operators have been eliminated."

**Conclusion**

RoboBaling technology has been developed in line with customers’ needs for safe, reliable, cost-efficient operation along with high productivity, minimal servicing and smart self-diagnosis. Our machines are designed to deliver measurable results to fulfill a range of production-related improvement aims such as increasing precision and capacity, and reducing power consumption and maintenance.

RoboBaling machines are ready-to-use-units, designed for rapid installation and easy start up. As well as speeding up line commissioning. This makes the machines ideal for retrofitting into existing baling lines to meet your current or future upgrade needs.

Purchasing the entire baling or pulper feed system from Valmet makes sense. After commissioning, mills know that they have one discussion partner who will take care of all their questions and problem solving. Valmet’s service and sales personnel are available wherever in the world the customer is located.

*This white paper combines technical information obtained from Valmet personnel and published Valmet articles and papers.*

*Valmet provides competitive technologies and services to the pulp, energy and paper industries. Valmet’s pulp, paper and power professionals specialize in processes, machinery, equipment, services, paper machine clothing and filter fabrics. Our offering and experience cover the entire process life cycle including new production lines, rebuilds and services.*

*We are committed to moving our customers' performance forward.*