Material FlowHow

METAL 2023

Predicting the future

Forward-thinking solutions with Pesmel's digital twin technology

Supply chain ecosystems

Managing and optimizing complex supply chains

Rack-supported building

Storage and building from one supplier

PESMEL

Contents

Material FlowHow is Pesmel's customer magazine

Publisher: Pesmel Oy
Editor-in-chief: Sanna Leikas
Editorial Board: Ilkka Hiirsalmi, Sanna Leikas and Michael Sandelson
Contributors: Nick Barlow, Petri Laine, Tony Leikas and Juha Suksi
Layout: Brandkind
Printing: Grano
Printed on: MultiArt Silk 130/250 g/m^2
Publishing year: 2023

Flexible supply chain,
enhanced customer service

Supply chain management is a trend, which mills are using in their search for competitiveness, applying various supply chain models to provide better customer service. Today's suppliers need to be able to rapidly adjust to changing demands to serve their end customers reliably.

Flexible and agile technologies are needed to manage growing production volumes, tightening delivery schedules, and more complex deliveries. Automated intelligent storages are becoming a vital part of the supply chain due to their capabilities. Fully integrated storages bring the flexibility that the supply chain needs, helping mills to have fast and accurate customer service in a changing environment.

Companies that have taken the leap into modern technologies in terms of their supply chain are reporting astonishing results. Pesmel's tailormade high-bay storage solutions, proprietary Warehouse Management System (WMS), and digital twin offering increase efficiency and overall supply chain effectiveness.

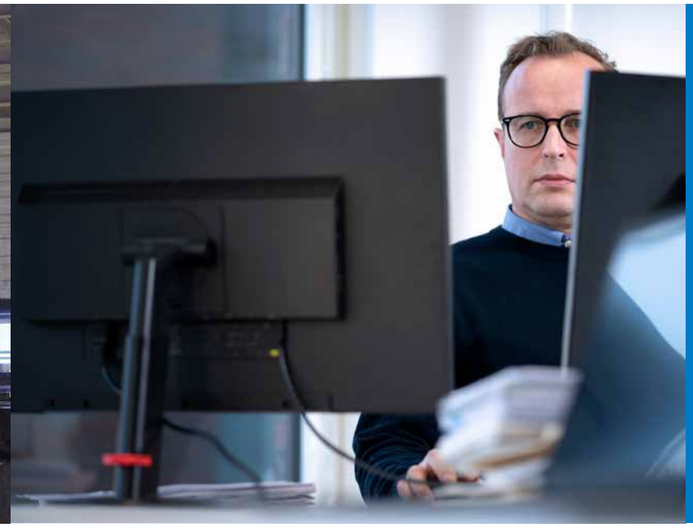
The entire logistics ecosystem is made up of connected elements that influence efficiency, and ultimately customer satisfaction. Information sharing means connectivity along the entire supply chain. In intelligent storages, the WMS is connected to production systems and continues all the way to end-user systems. A business can update production plans to calculate inventories and stock levels, while shipping and delivery data can be shared with other, open-interfaced systems at truck or train loading and dispatch. Turnaround times are reduced, transportation improved, and different production demands met.

Pesmel's long-term vision includes effective use of artificial intelligence, cloud technology, and the digital ecosystem, from warehouse commissioning to end-of-lifecycle operation, opening the way for better customer service, improved market share, and overall enhanced logistics management.

You are welcome to contact us to hear more about the topics covered in the articles and other content.

With best regards,

Juha Suksi
Vice President, Metals



Pesmel's WMS makes monitoring and running several complex systems at the same time possible.

The future of supply chain ecosystems

Pesmel's services and solutions do not exist in a vacuum but as one part of a complex supply chain leading from manufacturer to end consumer. Making sure that these solutions can integrate efficiently and easily into that chain helps everyone run their businesses smoothly.

Pesmel is well-known for cutting-edge material flow solutions. The warehouse management system (WMS), digital twin offering, and high-bay storage solutions are designed to make the production and transportation of material goods inside and from mills and other factories simple and effective.

Flexible and agile supply chain management

Depending on the business and its requirements, mill operators and their end customers may employ various kinds of supply chain models, such as on-demand, agile, made-to-stock, and so on. These models are potentially made up of dozens of steps, from sourcing raw material to delivery of the final product to the end customer. With years of experience, Pesmel understands how material flow solutions affect the supply chain. Often, they are the key elements in ensuring efficient business operations and satisfied end customers.

Achieving customer satisfaction is therefore complex. When talking about the supply chain, there may be several parts to it that combine to provide all the goods and products required for a successful business. Understanding how to manage all of them and accommodating different supply chain models requires flexible and agile technologies. That's why, for example, Pesmel's high-bay warehousing solution is so advantageous, delivering high performance in any-sized facility.

Think of a logistics ecosystem with connected elements that influence efficiency and overall competitiveness.

When systems like flow control solutions are implemented, they need to be connected to production systems, end-user systems, and everything in between. A solution that is built to properly serve logistics increases overall supply chain effectiveness, saving turnaround times, improving transportation, and adapting to different production demands. And that same solution can be used to implement different supply chain models.

End customers frequently rely on suppliers who can rapidly adjust to changing demands, which may alter on a daily basis. It is useful to think of a logistics ecosystem with connected elements that influence efficiency and thereby overall competitiveness. In fact, we see this in everyday life with the explosion of e-commerce. In common with internet retailers, mill owners also need to ensure purchases are delivered promptly and in good condition. Delayed deliveries or inefficient handling reduce customer satisfaction and make it less likely that they will give more business to the vendor.

Digital connectivity and information sharing

The connectivity of Pesmel supply chain solutions is enabled through information sharing. While the physical technology of high-bay warehousing moves products quickly, the material flow WMS is connected to all the supply chain phases, including the end customer. A business that shares a vendor management model with their suppliers can update potential production plans to the system that can be used to calculate inventories, stock levels, and so on. The overall awareness that this connectivity offers brings obvious advantages to information sharing and production and supply modelling.

All of this means that the benefits of Pesmel's offering are not limited to the production phase. Even when trucks are loaded and dispatched from a mill, shipping and delivery information is immediately shared with other, open-interfaced systems. In this sense, the material flow concept helps customers differentiate themselves from their competitors. By managing the information flow throughout the supply chain, and adapting to constantly changing demands, the WMS makes monitoring and running several complex systems at the same time possible. Implementing automated warehousing solutions improves any supply chain, allowing producers to better serve their customers.

Embracing digitalization and new technologies in the supply chain ecosystem opens the way to better customer service and improved market share.

It is well known that technology allows responsiveness. Embracing new technologies can solve problems before they even exist through the power of simulation. Pesmel's digital twin service is an example of how digitalization makes the planning, commissioning, and running of modern mills faster, easier, and more efficient. The digital twin is built-in to the WMS environment, constantly collecting information from the supply chain and production plans. Simulating the mill's operation days or weeks in advance, the twin allows the mill to decide on the efficacy of current and projected production, storage, and shipments, and how to fine-tune them to help meet the demands of the agile supply chain model.

Integrating the digital twin into the WMS makes it easy to serve customers in the long-term. Embracing digitalization and new technologies in the supply chain ecosystem opens the way to better customer service and increased market share through improved access to information, better planning possibilities, and overall enhanced logistics management. Pesmel, the leading provider of automated material flow solutions, is constantly developing advanced solutions to ensure customers can look to the future of their business with confidence.

Contact person
Tony Leikas, CEO
tony.leikas@pesmel.com

High-bay storage racking

Cooperation and experience lead to a successful project

Top-notch high-bay storage racking solutions require diverse expertise and experience. Different areas include industry-specific high-bay warehousing and building technology, norms, regulations, and project management. Pesmel has worked with high-bay warehouses for decades and understands the importance of risk management to ensure that their solutions conform to customer requirements in a safe and proper manner. Close, open cooperation with the customer is critical when planning and building these types of projects.

Pesmel provides two types of storage racking solutions: freestanding, and a rack-supported building. Their first variant is a common way of building a high-bay storage, where the racking and building are separate units. Here, the customer provides the building, and the supplier provides the high-bay storage. Freestanding racking can be placed inside either an existing or a new building.

In rack-supported building high-bay storage and external cladding are integrated.

The rack-supported building is a construction where the high-bay storage racking and external cladding are integrated. This is advantageous for the customer, as they get the entire solution – the warehouse and the building – from one supplier. The customer does not have to deal with multiple subcontractors, as is common with the construction industry, during the design and installation phases. With a rack-supported building solution, the requirements for the warehouse, racking, and building are handled as one entity from the beginning.

"This solution is a special, highly engineered construction with an optimizable structure that is scaled to match and that can save our customers time from a logistics point-of-view. It's also cost-effective, as the solution is a building and integrated storage in one," comments **Arto Rokkanen,** Structural Engineer at Pesmel. "We blueprint it to both local and our own standards. The solutions are based on many years' experience and are designed to support large loads caused by the movement of equipment and products."

Partnership from the start

Close cooperation and clear communication between Pesmel and the customer are vital building blocks from day one. They form the basis of successful planning and execution and consider both the end-customer's preferences and the supplier's recommendations. The multi-phase project starts quite literally from the ground up. The foundation slab forms the base of the entire rack-supported building. "The foundations are a critical point when it comes to the foundation bolts' tolerances," **Henri Vesala,** Pesmel's Director of Warehouse Rack & Building Technology, comments. "We also need to consider loads, dimension requirements, tolerances, and site location."

The rack-supported building works as part of an in-mill logistics system and must be precision-engineered. Thorough pre-calculations and pre-design work are done at the start of any project to optimize the solution. Arto explains that a structural analysis and 3D modelling are carried out. Each one is adapted to fit customer needs. The pre-design phase needs to be carried out very early on to allow time to produce all the necessary reports and calculations.

Close cooperation with customer is critical during project planning and execution.

"In the pre-design phase, we have to choose which profile we're using and how to produce it," he says. "These are affected by the choice of supplier and metal – albeit cold rolled, hot rolled, or tailor-made sections."

In-house engineering expertise

Vital design considerations are temperature variations of as much as 55 degrees Celsius, seismic factors, snow, wind, and ductility – a material's ability to have its shape changed without losing strength or its load resistance. These must also conform to each country's standards. The loadings report is the main document that governs the racking design. It also contains information about local features provided by the customer.

"Different sections of steel in different areas of the construction are needed. The material such as the beams must neither bend nor break, and the structure needs to tolerate the energy to avoid collapse," explains Arto.

The racking's wide bracing system bears lateral loads such as wind load and seismic forces efficiently. Compression and tension forces on the columns are smaller, as are the effects on the foundations. In a longitudinal direction, the gable structures are bracing the building and, for example, the seismic effects can cause a tension reaction between 200 and 400 tons in a 30 to 40-meter-high construction."

Bracing arrangement principles, 2D views, as well as a conceptual 3D model are included at the start of the project, along with concept-level section drawings and a preliminary framing plan. These are used as a basis for further discussion between the customer and Pesmel.

Pesmel has its own, unique racking concepts developed over the years.

The racking is designed in blocks to enable smooth assembly. Considerations such as channel profiles, clearances including those needed for stacker crane operation, alignment requirements, sprinkler pipes, and ICT cables are all part of the design phase.

Safety issues are one of the most important factors considered when it comes to rack design. "We take work and maintenance safety considerations into account such as lifelines for 30 meters, joints that have access when hanging 40 meters above ground level, tolerances, displacements, and spaces between components," says Henri. "We also try to assemble everything at ground level to minimize working at height."

A smooth construction process needs coordination

The high-bay warehouse project requires careful planning and good project management skills from the supplier. There can be 5,000 tons of structure, 150,000 construction pieces including the bracings and profiles, and up to 1.5 million bolts – each of which is installed properly. Erection times depend on the storage type and size. The entire process takes from seven months upwards, but, as "time is money" these days, assembly times are kept as short as possible.

"This means that all the construction phases need to be carried out in parallel," Henri explains. "We also need to take account of transport logistics and space at the mill site. A 5,000-ton project needs some 250 truckloads of 20 to 30 tons each, excluding the roof and wall claddings. All the material needs to be stored nearby on one layer. This needs roughly the same amount of area as the building itself."

Pesmel has their own process for managing elements of the construction phase, which is split into stages. The team has their own responsibilities, which Henri oversees and manages. The customer also plays an important role when it comes to their own knowledge and scope.

"The customer's scope usually includes foundation design and its execution," he says, "and an important thing to understand is our structures' tolerances and the forces that they emit. The importance of customer-side knowledge is even more crucial if their scope in the project is greater."

Solutions designed to last

Customers can be sure that every detail of the solution that Pesmel delivers has been thought through. Choosing one supplier for everything benefits customers in many ways. "We have our own, unique racking concepts that have been developed over the course of several years. This means that we know the process inside out – from design to completion," says Henri.

"There are no headaches for the customer, it's scaled to match, and manufactured with the right tolerances. Our proprietary in-house expertise and experience enables us to both provide customers with the right solutions and solve issues together with them during erection."

"Our solutions are designed to last for 50 years. There are maintenance programs when it comes to bolts, painting, and bolt and weld checks. Building regulations normally stipulate that these programs must be part of every facility, and how often they should be conducted," Arto explains. "We carry out the structural calculations and analysis, make a risk analysis, and check for any imperfections to see that all the requirements will be satisfied."

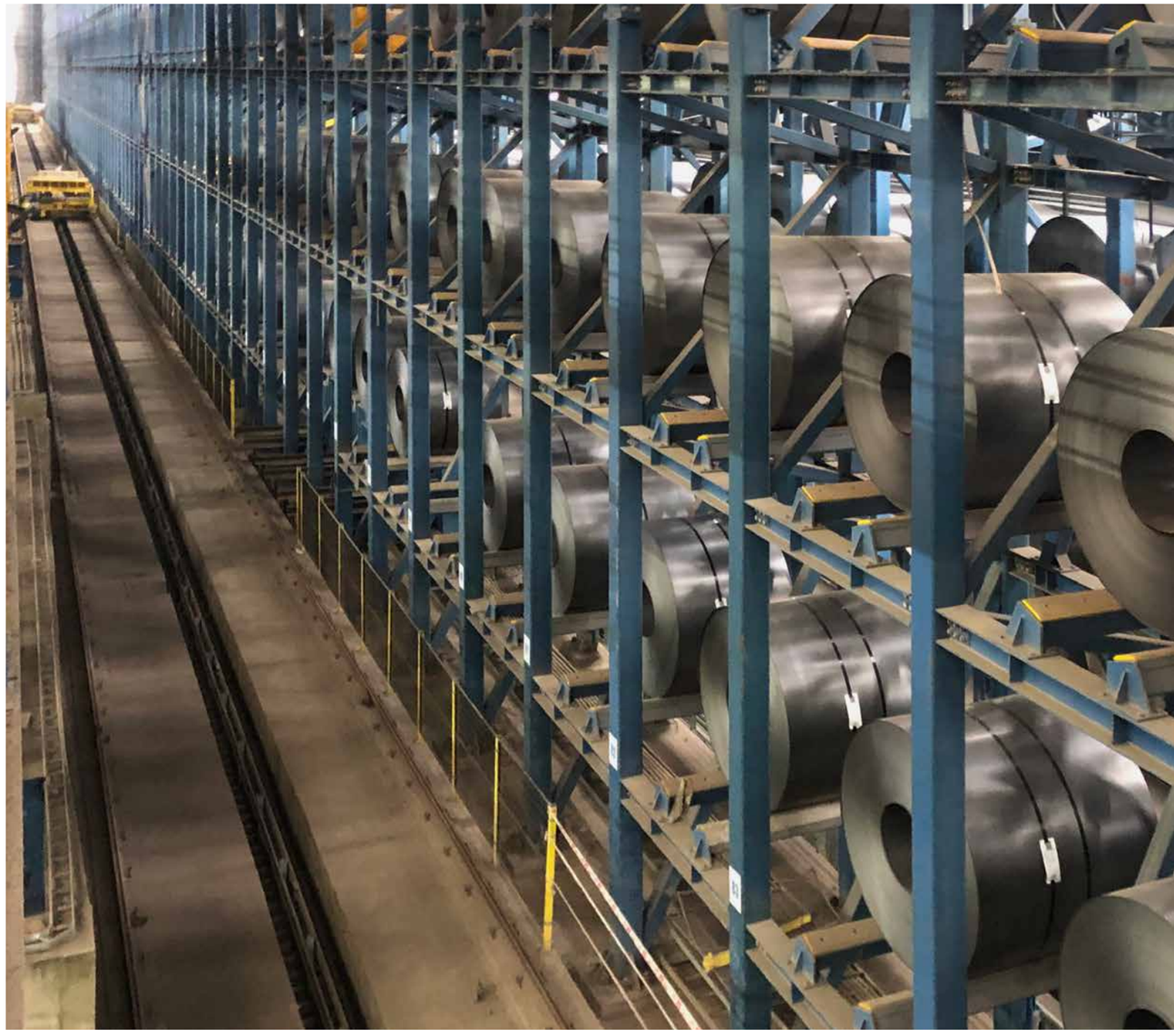
Contact person
Henri Vesala, Director of Warehouse Rack & Building Technology
+358 40 822 7525
henri.vesala@pesmel.com

Comprehensive fire safety

Pesmel's high-bay warehouses are well-prepared when it comes to fire safety. Both the free-standing and rack-supported buildings have built-in sprinkler systems in each storage channel with smoke and heat detectors. The fire extinguishing equipment types depend on what is being stored – whether it is pulp and paper, metal coils, or tires.

"Each country has its own codes and slightly different regulations when it comes to structural fire safety, but we maintain a constant focus on fire safety system development. We can make calculations about fires so that they won't affect the structure. We use simulations for functional fire design," comments Arto.

"We also perform the safety resistance capacity calculations ourselves, which depend on the products and local standards. For example, each state in the U.S. has different regulations and the local fire marshal is responsible for accepting our solution. We take a 3D model with us when we visit them prior to handover," Henri concludes.



Integrated material flow by Pesmel and Danieli for flat products.

As strong and durable as steel

Finnish and Italian flexibility and innovation remain key factors behind the Danieli-Pesmel strategic alliance to give customers a one-stop shop.

Danieli and Pesmel team; Tony Leikas, CEO of Pesmel and Stefano Giacomelli, Executive Vice President of Danieli in front and Ilkka Hiirsalmi, CMO of Pesmel, Juha Suksi, GM Metals of Pesmel and Lorenzo Bacchetti, Senior Manager, Cranes Automation and Automatic Yards of Danieli in the back.

The mutual partnership was forged just one-and-a-half years ago, merging Danieli's knowledge of metals processes with Pesmel's material flow know-how. The aim is to develop and supply tailored, seamlessly integrated material flow solutions at steel and aluminum mills.

These involve production, processing, and handling flat and long products such as wire rod bundles, merchant bars, plates, and coils – whether hot-rolled, cold-rolled, or coated.

Both companies pioneer solutions and technologies for logistics, material handling, and warehousing to increase plant efficiency and capacity utilization. Danieli delivers process lines and also specializes in EOT cranes. Pesmel's strengths lie in logistics and automated storage and retrieval systems ASRS for products including wire rods and cold-rolled steel, integrating automated material-handling systems into the production process.

Merging knowledge brings innovative benefits

"Both companies are key manufacturers and have a very strong, innovative soul," remarks **Lorenzo Bacchetti,** Senior Manager, Cranes Automation and Automatic Yards at Danieli.

The alliance also merges know-how. Benefits for the customers include fast feeding to production lines thanks to an intermediate automated high-bay storage serving all process lines. Full automation with real-time tracking of products assures high capacity and throughput per hour, as well as enhanced delivery accuracy.

"To our customers this co-operation means that we can integrate the mill to a level where it runs as a one complete unit," says **Tony Leikas** CEO Pesmel. Integrated and automated material flow means that bottlenecks are eliminated.

Pesmel's high-bay storage solution cuts down the amount of floor space needed for storing products in comparison to traditional warehouses, and no separate storages are required after the process lines.

Production can be adjusted thanks to reduced dependency on EOT cranes, which are used just for loading vehicles. Pesmel's automated high-bay storage can pick and prepare loads in 20 minutes, speeding up logistics and reducing operator costs by up to 80 percent.

"Safety is key too. Injuries and fatalities occur mainly in warehousing and logistics. In my opinion, the main benefit to our customers is that all logistics and activities – especially lifting of loads – will be done without people nearby," explains **Stefano Giacomelli,** Executive Vice President of Danieli.

"These factors give Danieli and Pesmel advantages over the competition and bring their customers favorable total cost of ownership", concludes Tony Leikas.

Good cooperation and a one-stop shop

"Both companies saw an opportunity and started working on that," Giacomelli comments about the alliance.

Vice-President, Metals at Pesmel, **Juha Suksi,** remarks that "the cooperation has gone well, especially after last year's training of Danieli staff by Pesmel. This made it possible to spread the Pesmel-Danieli cooperation more widely within both organizations, which we're very pleased about."

"We can deliver the entire package as one. We also gain global market penetration thanks to sales representation and a worldwide supply chain, not to mention regional customer support. This is becoming increasingly critical and key in acquiring new contracts," says Danieli's Lorenzo Bacchetti.

Juha Suksi notes that market and customer reactions have been mainly positive to the joint co-operation. Stefano Giacomelli at Danieli concurs. "We can say that they have reacted with interest, because they understand that the solution portfolio has been enlarged. They can also benefit from new trends like the one that flow how technology brings and zero damage to final products."

"There are also energy savings, footprint reductions for greenfield plants, as well as better use of existing space to enhance existing plant performance without needing additional space," he adds.

Existing deliveries, a decade of cooperation

Danieli and Pesmel already supply common deliveries to Danieli Group subsidiary Acciaierie Bertoli Safau S.p.A (ABS) in Italy and an US steel products manufacturer.

ABS trusted Pesmel's experience as a supplier of demanding high-bay storages. The simulation Pesmel provided during the initial phases helped them understand their concept before the system was manufactured and implemented.

One of the winning issues for the US customer was in-mill integration. "With them, it was being able to adapt process lines to the logistics systems seamlessly for the customer, and vice versa," says Lorenzo Bacchetti.

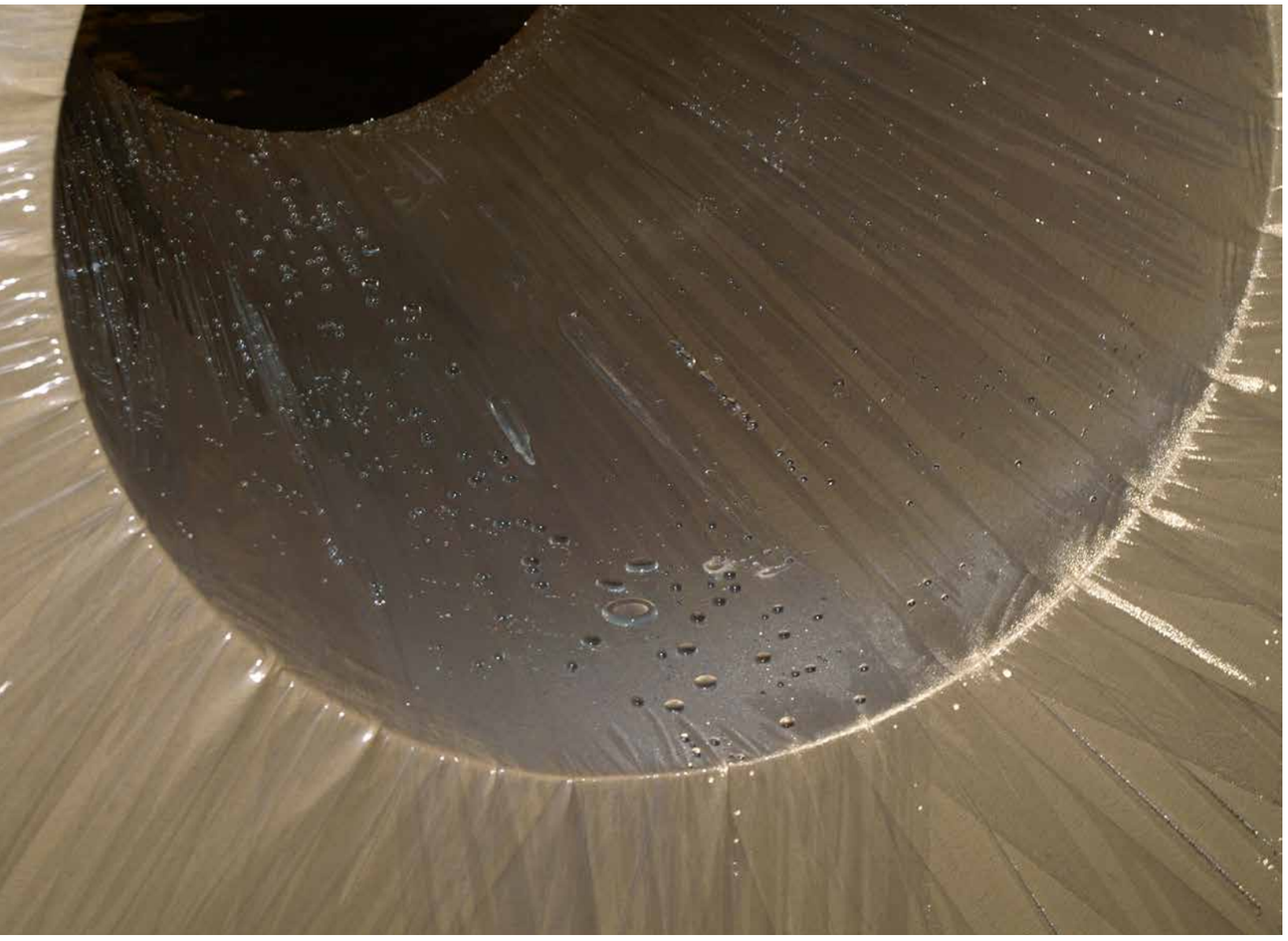
For Pesmel, it was a 10-year co-operation that won them the contract. The customer made decisions quickly once they had a suitable project because they trusted Pesmel, both technically and concept-wise.

Automated high-bay storage for wire rod coils in ABS plant, Italy.

"Getting another project for the same customer helped us since it was with the same technical concept. Co-operation with Danieli helped us to find solutions for interfaces with their process lines, which the customer also respected," Juha Suksi explains.

"There are plans for future expansion of the Danieli-Pesmel alliance with products such as plates, bars, spooled coils, billets, or round blooms, but firstly it's about natural evolution of this partnership when it comes to cold rolled and wire rod products," says Danieli's Lorenzo Bacchetti.

"We have a lot of ideas, teams, and people, which in the end are key for both companies to reach our targets," he concludes.



Cost savings with high quality packing

Quality steel is well worth protecting with the best packing to keep its product properties unchanged from mill to customer. An automated packing solution can achieve this in a cost-effective way.

Steel coils that have sustained damage due to inferior packing or rough handling are bad for business and cause their producers to lose money.

Keeping product quality uniform from the production line to the end user represents a considerable challenge, but this can be overcome with the right kind of solutions.

Coils are vulnerable to two kinds of damage. These are moisture and dust, and mechanical impacts. Moisture is particularly harmful, as it causes rust. Coils experience internal moisture while cooling after production processes. They are also exposed to humidity and dust due to climate and weather conditions during transportation, for example.

Mechanical damages happen during handling, storing, and transportation. Proper packing, and particularly moisture protection, are key elements for preserving excellent product quality.

The right packing level is selected according to transport method and distance as well as how long, and where, the product will be stored. Coils delivered within the same territory do not necessarily require the same level of careful protection as those that are sent overseas.

Ultimate protection with automated packing

Pesmel has developed a range of packing technologies that are unparalleled in their ability to keep metal coils both watertight and rust-free. The company's automated packing lines are designed to provide leading protection for customers' end products, as well as being highly competitive in terms of total cost of ownership.

Moisture protection is carried out using through-eye wrapping (TEW) technology, providing the best possible moisture protection. TEW machines stretch PE film through the coil eye and form an airtight seal. This drastically reduces the amount of air trapped inside packaging, limiting the potential for condensation.

An additional layer of crepe paper can be applied under the PE film. This low-cost paper is excellent for absorbing moisture residue inside the coil.

This duo of protective measures prevents water droplets from entering the package, whilst locking residual humidity away from the metal in the packaging interior. The airtight package means that storage time can be beyond 24 months.

The scale and type of handling, storing, and especially transportation determine the level of mechanical protection. The automatically applied mechanical protection consists of metal and plastic outer and inner body wrapping, headers, and edge protectors. A second layer of mechanical protection can be applied to products with long delivery distances or significant storage periods.

Pesmel's packing systems use materials that match today's environmental, recycling, material, and energy saving requirements. Packaging can be done using non-toxic, 100 percent reusable materials.

Automation is the key to cost savings

Packaging materials, labour costs, maintenance, and designated packing space all contribute to the operational costs associated with packaging.

Automation using quality machines makes for more effective coil packing in many ways, boosting capacity and generating significant material savings.

With traditional packing, the annual cost of packing materials can easily be higher than the investment in an automated packing line. Automated packing can reduce packing material costs by 30 percent. The packing materials are automatically cut on-site according to coil size, enabling optimal use of materials without waste. Consequently, only a small space is needed for storing the packing materials.

Automated packing significantly increases the output volume. In manual packing, several operators pack average six coils in an hour. The automated packing line makes over 20 packages in an hour and requires just one supervisor.

The fully automated packing solutions are operator-safe, and safety areas for workers are clearly marked. The packing quality is stable, and the risk of human error is reduced.

Pesmel has delivered its coil packing to several customers over the years. Here are short introductions about four customers with different packing machine variations.

Durable moisture protection for stainless steel coils

Pesmel has a long and successful shared history with Finnish company Outokumpu, not only with packing lines, but ASRS (Automated Strorage and Retrieval System) solutions as well. Over the years, Pesmel has delivered several coil packing lines to different Outokumpu mills. The company was also strongly involved in developing the very first TEW machine together with Pesmel at the beginning of 21st Century.

Outokumpu's Tornio mill in Finland has several automatic Pesmel coil packing lines. Part of Outokumpu Tornio's coil production is delivered to the company's service centers abroad, so the coils are wrapped with crepe paper and PE film using through-eye wrapping technology to protect them against moisture during transportation. The TEW packing system is equipped with a 12-place automated film roll changing magazine, which ensures uninterrupted packing for eight hours.

The outer edges of the coils are protected with simultaneously fed edge protections under the PE film to minimize product damages. The packing lines also include a labelling robot which affixes product labels automatically.

No materials are wasted with a machine using TEW technology as the packing material usage is automatically optimized according to coil size. The result is a precise and reliable package that will effectively protect the coil from dirt and moisture.

A totally new approach to coil packing

For Sweden-based SSAB, it was about total airtightness, zero moisture inside the packaging, as well as accurate and robust edge protection for their coils. Rust, returns, and material wastage had all been significant issues associated with the previous packing line.

SSAB invested in four fully automated Pesmel coil packing lines in 2007. The goals set for SSAB's packing development included cost-effective production and cost reductions by protecting the products from damage in handling and during transportation between SSAB and customer facilities.

SSAB also wanted to to cut costs by reducing the number of packing material types, changing to better packing materials, and standardizing coil packing codes. The packing lines were designed to use recyclable packing materials and minimize amount of packing waste in order to emphasize SSAB's environmental policy.

The packing lines in Borlänge were mostly manual, and the new automated lines brought a totally new approach to packing. They consist of of through-eye wrapping (TEW) technology with crepe paper and PE film, body wrapping with plastic film, and edge protection with strapping. The TEW technology provides airtight and watertight packin which protects the coils from external moisture and humidity. The crepe paper inside the plastic film absorbs the moisture inside the coil.

Equally important as protection against moisture is mechanical covering, especially when coils are exported abroad. All the packing materials are automatically fed and cut to length to optimize material usage and bringsignificant savings in material costs.

Appropriate protection applied to coils ensures uniform quality and appearance, so the coils will reach the end customer in perfect condition.

Tailor-made packing solution

In 2011, major aluminum manufacturer Chalco in China wanted an automatic, high-capacity packing line that could pack 20 coils per hour. It was clear from the beginning that Chalco would benefit from utilising automated TEW technology.

Besides leaving the eye accessible for handling, Pesmel was the only operator able to deliver a TEW solution for aluminium coils wrapped on 400 mm corrugated cores as opposed to the larger 610 mm and 700 mm eyes used with other metal coil types.

Chalco also required excellent moisture protection. Each packaged coil had to remain airtight and watertight after staying outside for two days during the rainy season.

Pesmel was able to deliver a packing line that met all of Chalco's requirements after working with them to create a tailormade solution. The solution has a TEW system with PE film, inner edge protections, and plastic body wrapping with strapping. Packing materials are automatically optimised for different coil sizes. The investment paid for itself within three years.

State-of-the-art automation in coil packing

To complement three automated ASRS storages with logistics, Tata Steel in India ordered two coil-packing lines from Pesmel in 2019. These packing lines can handle steel coils with a width of between 800 mm and 1,900 mm, an outer diameter of 800 mm to 2,200 mm, and weights of up to 45 metric tons. The lines are fully automatic without any manual phases packing heavy-duty packages for long distance transportation.

The packing lines feature an automated TEW packaging system that wraps crepe or VCI (volatile corrosion inhibitor) paper and PE film around the coils to protect them against unwanted moisture, dust, oxygen, and eliminate the risk of rust.

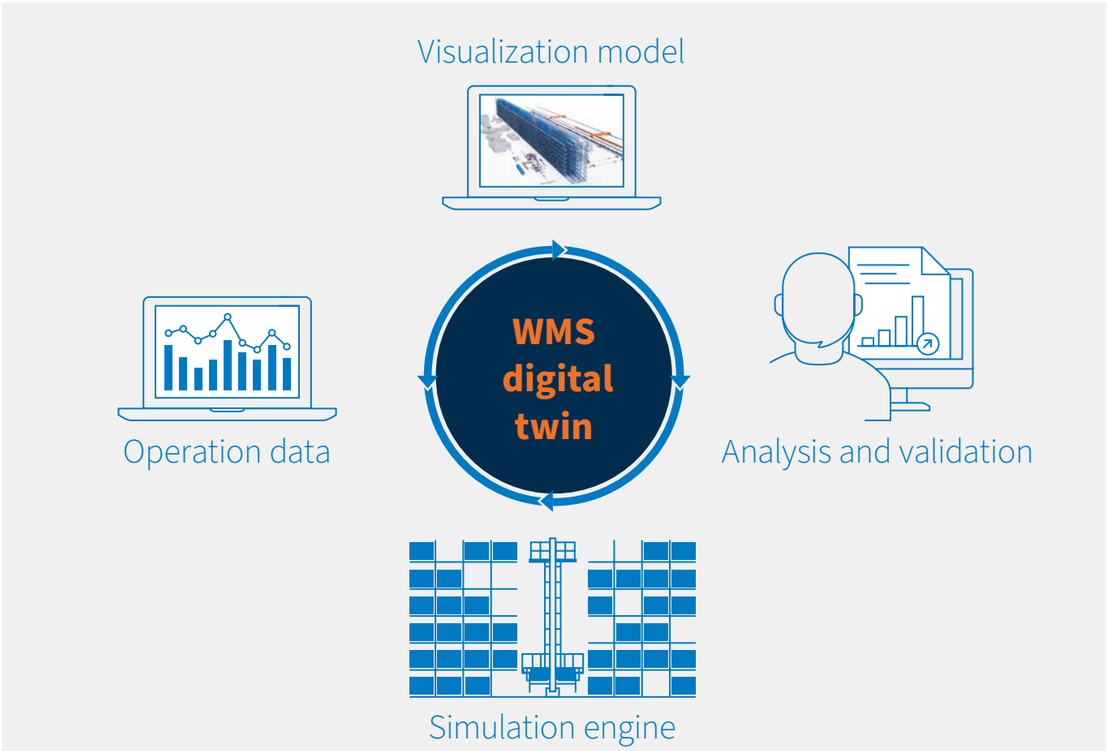
With TEW packing, the packaging materials are fed automatically based on coil dimensions and packing code. A 12-spool carousel magazine for packing materials and an automatic 12-roll spool changing system enable long periods of operation without having to replenish material during wrapping. This means there is no need for additional downtime.

Solutions include seven robots with six to seven axes operating and managing the entire packing operation, configuring it as a state-of-the-art automatic packing line. Automated inner diameter (ID) and outer diameter (OD) body wrapping, side disc, ID, and OD corner protection machines feed the correct amount of packaging material to the coil, providing essential mechanical protection. Systems for strapping, labelling, and label reading are also part of the delivery.

Automation with on-site preparation of packing materials enables optimal usage of materials according to coil size and packing philosophy, providing significant material cost savings in.

When a project involves significant CAPEX, time really is of the essence. Integrating digital twin technology into the customers' warehouse management system from the beginning drastically reduces start-up costs and time, as well as improves efficiency throughout the system's lifecycle.

Digital twin and virtual warehouse commissioning



Simulation from the start

"When a customer has a case involving complex material flows from production to dispatching, simulation is the first thing we do," says **Tony Leikas,** CEO of Pesmel. Available data ranging from inputs to shipping and dispatching is fed into the Pesmel digitwin environment from the very start of a project. Analysis of the data lets the software illustrate an optimized physical form for the customer's warehouse.

"The simulation is performed before any construction is carried out, right at the beginning of a warehousing project," **Tuomas Vuorenmaa,** Pesmel ICT Engineering Manager, continues. "Based on the analysis, the warehouse management system WMS takes on a physical form such as the warehouse's cranes, racking and conveyors that the customer can actually see. But the simulation gives information on the entire process."

When the commissioning phase begins the WMS environment has already been represented virtually by the digital twin. One result of this is that the facility has in effect been operational before it has even been built. When manufacturing is up and running, the WMS is ready for production optimization.

"Code is already written and fully functional when start-up begins."

"The software is ready to handle complex material flows as soon as operational use begins," says Vuorenmaa, "so the start-up time is very short, especially compared to earlier times when code would still have to be written at this point for the WMS. Now it's already written and fully functional when start-up begins."

Optimization without interruption

The fact that start-up time and costs are vastly reduced is extremely helpful. After the facility is operational the virtual environment persists, where testing and optimization can be safely performed without interruption to production.

"We don't have to wait. Ten days can be simulated in a few hours."

"When the virtual model is complete then we can be confident that we know how the actual system will perform. If the software works, the material flow will also work. We don't have to wait for the physical warehouse to be full to understand how the process will work, for example. We can run the model beforehand at a much higher speed than in real life. Ten days can be simulated in a few hours," Vuorenmaa explains.

A digital twin project offers many possibilities for both Pesmel and the customer. Data allows a level of business model experimentation and optimization that is unique for each project.

"Imagine a customer who plans to develop the supply chain," says Tony Leikas, "who might want to check how their own logistics behave and interact with external logistics, and how their production can be supported. With complex material flows involving thousands of stock keeping units, trucks coming and going and so on, it's too complex. Traditionally, there have been separate simulation models for different phases, but now we handle all of it in the WMS."

Upgrade the old, develop the new

The WMS and simulation software are a package that can equally be applied to old as well as newly constructed warehouses. Especially with warehouses that already have Pesmel material flow technology installed, it is relatively simple to optimize and develop the existing resources.

This is also a reflection of the fact that there are always certain elements of the WMS that are tailored to the customer, such as specific machinery, flow management, and desired analytics. "There is the software, and then there are our people who apply it to a specific project," remarks Vuorenmaa. "The software is fully developed and ready to be applied to a project, it's only some company-specific variables that Pesmel employees need to take into account."

Pesmel's digital twin environment makes implementing large warehouse projects much faster and more reliable. Whereas in traditional material flow plans it can take months after start-up to optimize everything, with the digitwin the optimization is performed during the implementation phase.

"We had one project where we ran simulation for some months before start-up. Now, six months after operations began, we have not found very much we can further optimize," Leikas says. "This means our simulation procedure is perfect and shows how far we have come in helping our customers manage large, complex flows and enjoy a fluent, reduced commissioning process. When we had a separate simulation and WMS there were always some hiccups, but now we create dependable, consistent material flows for our partners."

"We have a long-term vision that includes artificial intelligence, cloud technology, and the digital ecosystem."

A long-term digital vision

In the future, the digital twin model will demonstrate even more possibilities to access and make the most out of data. Pesmel are developing a circular data model whereby information obtained from different facilities can be collated, analyzed, and optimized.

"We can only imagine where the digital twin technology will be in the years to come," remarks Leikas. "We have a long-term vision that includes effective use of artificial intelligence, cloud technology, and the digital ecosystem."

"Our aim is that the digital twin will be present at the beginning of the warehouse commissioning process and at the end of its lifecycle some 50 years later. And all that data that we have collected in those years can be used to improve future operations," he concludes.

Contact person
Tuomas Vuorenmaa, Manager, ICT Engineering
+358 20 7009 735
tuomas.vuorenmaa@pesmel.com

Towards carbon-neutral warehousing

With over 40 years of experience, Pesmel is well-known for its innovative material flow solutions. The company's practical and pragmatic approach to its products is also useful in pursuing a zero-carbon policy, explains **Tony Leikas**, Pesmel CEO.

Compensation cannot last forever

"We have noticed that many companies use a compensation approach when planning their sustainability agendas," Leikas notes, "and say that their operations are carbon neutral. But in the long run we can't compensate forever. It is better to lower the starting point. We prefer a practical approach based on our wide company knowledge."

Pesmel provides tailor-made solutions to our customers in internal and shipping logistics. "The most effective thing we can do is to make sure that our own solutions are as sustainable as possible. Then we also help our customers improve their sustainability."

"Energy efficiency is only one part of the overall picture."

A focus on environmental issues is not a new thing for Pesmel. Related work started some 15 years ago in improving energy efficiency through technology such as regenerative drives and optimized control systems. "Better structuring of the systems and equipment has led to increased development in energy efficiency measures. But energy efficiency is only one part of the overall picture," Leikas points out.

Understanding the whole picture

To get an idea of the overall possibilities, Pesmel have analyzed the typical emissions and resources required to build and optimize the in-mill logistics of a mid-sized CRM (Cold Rolling Mill) complex producing 1,000,000 metric tons annually using Pesmel solutions. Through this analysis, the company has been able to calculate the climate impacts of an automated ASRS throughout its lifecycle, from construction to recycling. The research found that the total lifecycle climate impact of the manufacture, use, and disposal of the evaluated system is equivalent to approximately 16,600 tonnes of CO_2 emissions. Most of the emissions occur as a result of the racking manufacture and the in-use energy consumption.

Compensating for such a facility operating a Pesmel automated solution would require planting 10 hectares of forest. "It's not so much for a big mill, especially considering a 40-year operating cycle," Leikas says, "and a warehouse that uses traditional technology like forklift trucks would require 5 to 10 times more compensation."

Sustainable benefits through automation

In fact, Pesmel's automated high-bay warehousing solutions are one of the main reasons the operating carbon footprint is so low. "Our automated systems are powered by electricity that can be obtained from renewable sources. Creating sustainable energy sources like installing solar panels on a roof, or identifying certified energy providers, can significantly increase energy efficiency and sustainability. These are low-hanging fruit that can be identified to benefit our customers."

Future improvements on the way

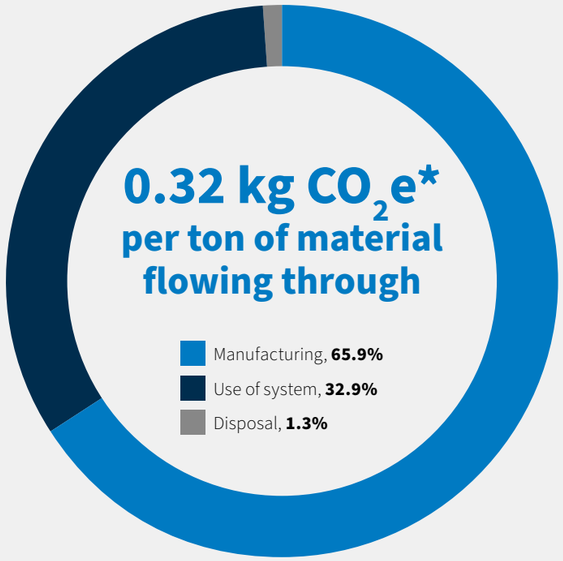
While progress has been made on improving sustainable operations, more can always be done. "Our aim is to improve carbon neutrality in two ways. Firstly, we will continue to increase the amount of steel that is recycled. Secondly, when purchasing steel, we will ensure as far as possible it is carbon neutral."

These measures have a surprisingly powerful effect, says Leikas. "Whereas, as we have mentioned, compensating for the typical Pesmel solution requires planting ten hectares of forest, when we have implemented these measures the required compensation will be only one or two hectares."

"Creating sustainable energy sources benefits our customers."

Ultimately, every business needs to do its best to improve sustainability within their own and their customers' areas of operation. "We can identify the best possibilities for energy sourcing and usage," Leikas concludes, "and I believe there will be big steps in the next few years through better energy efficiency, recyclability, optimization, and the use of renewable energy."

The biggest factors affecting carbon neutrality in automatic storage are the steel used for construction and the electricity required to operate. By increasing the recycling rate of steel, or by buying carbon neutral steel, and using sustainably certified electricity, the carbon footprint can be reduced by 90 percent of the current level.



Current storage carbon footprint over a 40-year lifecycle from manufacturing to demolition

Key figures for the evaluated system:

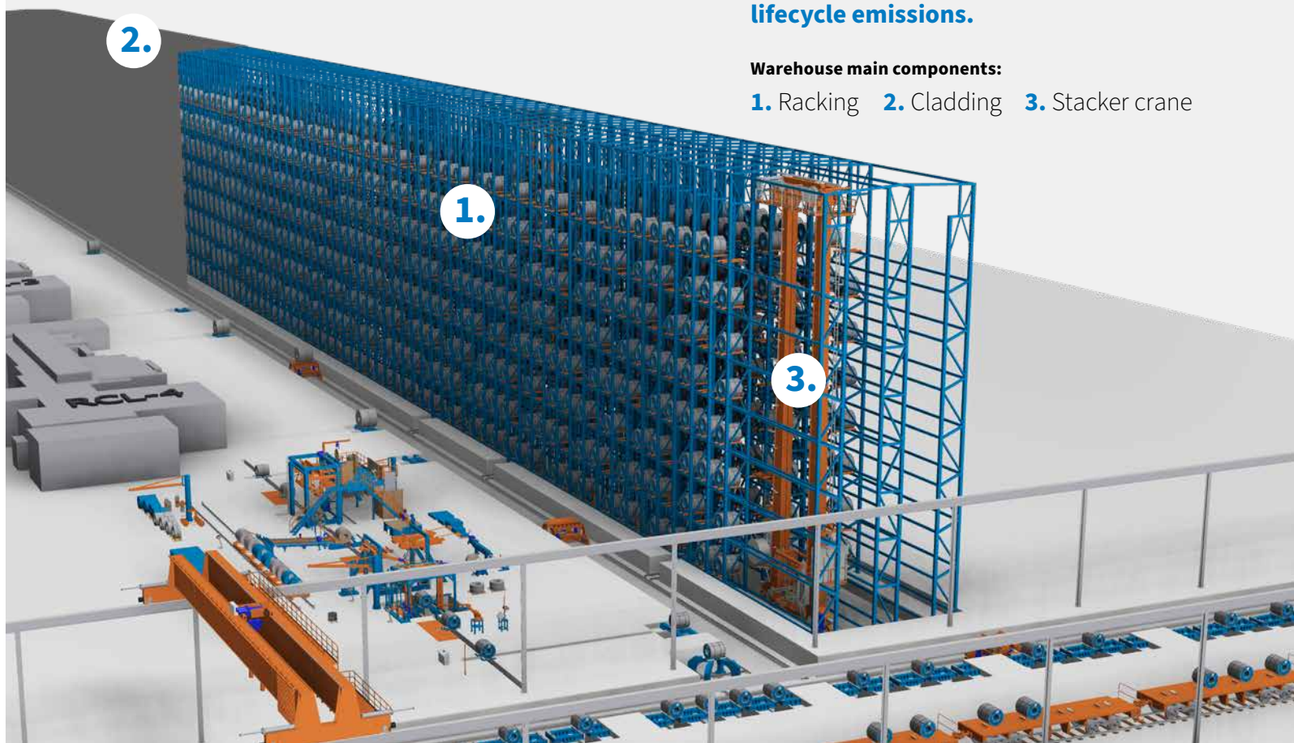
- Storage capacity 66,000 metric tons
- Storage output 1,000,000 metric tons per annum
- Two stacker cranes

* Carbon dioxide equivalent

High-bay warehouse components made mainly of steel are fully recyclable and reusable, offer an opportunity to greatly reduce CO_2 lifecycle emissions.

Warehouse main components:

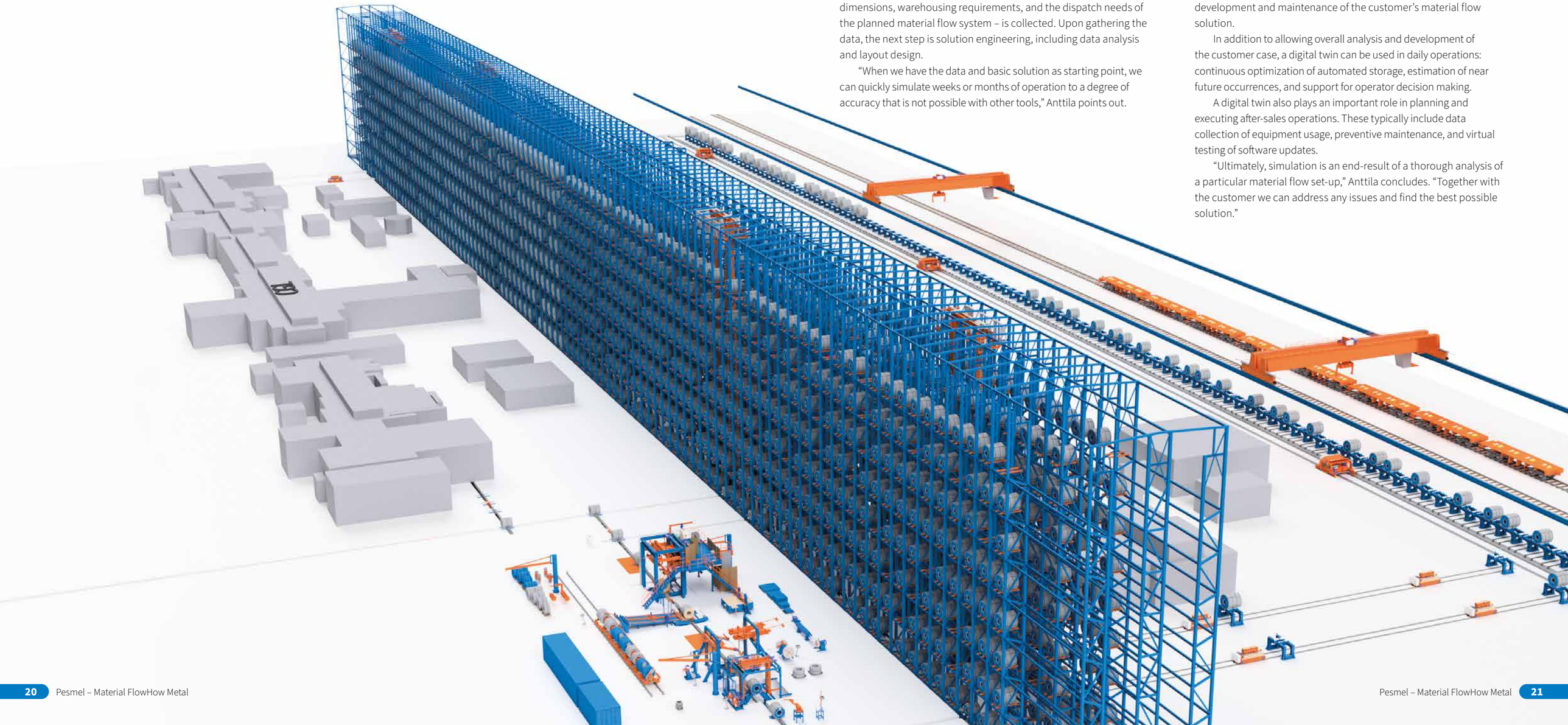
1. Racking **2.** Cladding **3.** Stacker crane



The Pesmel simulation process

Increasing the credibility and validation of flow solutions

Pesmel uses simulation to ensure efficient and accurate design of complex material flow solutions at their customers' mills, says **Eero Anttila,** Manager, Material flow integration.



Customizing solutions successfully through simulation

The needs of every customer are different. Offering bespoke, customizable solutions to improve material flow is one of Pesmel's clear strengths. But identifying and addressing the specific requirements of a given project require a lot of planning and cooperation.

To bring to life the vision shared between the customer and Pesmel, simulation is used in the early engineering phase to accurately analyze material flow in a given location.

Understanding the process and optimizing the solution

"The simulation is not a separate product," explains Eero Anttila, "but an integral part of our offering. We use it with our customers to design, develop, optimize, and validate our logistics systems."

For the customer, simulation makes it easy to visualize the solution and approve it prior to making further investments. For Pesmel, the data gathered provides greater understanding of the customer's process and integration needs and allows solution optimization.

To begin a simulation process, customer data – such as product dimensions, warehousing requirements, and the dispatch needs of the planned material flow system – is collected. Upon gathering the data, the next step is solution engineering, including data analysis and layout design.

"When we have the data and basic solution as starting point, we can quickly simulate weeks or months of operation to a degree of accuracy that is not possible with other tools," Anttila points out.

Three steps of simulation provide comprehensive material flow integration

There are three main phases of simulation. Upon gathering and analyzing customer data, Pesmel will identify the actual functionality and capacity requirements of the system. In the second phase, the capacity simulation provides a visual presentation and validation of the tailored solution. Finally, the simulation facilitates the design and workshop testing of the warehouse management system (WMS), the heart of the material flow solution.

"Through the simulation process we can offer comprehensive insights into material flow requirements and potential solutions, prior to the start of engineering or other commitments," says Anttila. "Ultimately, we provide them with skill and experience for devising a well-structured and integrated material flow solution."

Digital twins through the simulation process

A digital twin is a virtual representation that serves as the digital counterpart of a physical process. At Pesmel, it is used in the development and maintenance of the customer's material flow solution.

In addition to allowing overall analysis and development of the customer case, a digital twin can be used in daily operations: continuous optimization of automated storage, estimation of near future occurrences, and support for operator decision making.

A digital twin also plays an important role in planning and executing after-sales operations. These typically include data collection of equipment usage, preventive maintenance, and virtual testing of software updates.

"Ultimately, simulation is an end-result of a thorough analysis of a particular material flow set-up," Anttila concludes. "Together with the customer we can address any issues and find the best possible solution."

Contact us

If you would like to know more about the topics covered in this issue or have any other enquiries, our experts would be more than happy to help. We would love to hear from you.

Head Office

Pesmel Oy
P.O. Box 14 (Päntäneentie 3)
61801 Kauhajoki, Finland
Tel. +358 20 7009 600
pesmel@pesmel.com

Sales

Juha Suksi
VP, Metals
Tel. +358 207 009 624
juha.suksi@pesmel.com

Service

Petteri Laamanen
Account Manager
Tel. +358 20 7009 720
petteri.laamanen@pesmel.com

Regional

Central Europe
Krzysztof Kwaśniewski
Tel. +48 660 990 258
krzysztof.kwasniewski@pesmel.com

China
Jeany Liu
Tel. +86-1300 616 1741
jeany.liu@pesmel.com

Denmark, Norway, Sweden
Robert Clayhills
Tel. +46 70 483 5567
robert.clayhills@nipman.com

India
Jagannathan Rajagopalan
Tel. +91 93 2284 9709
jagannathan.rajagopalan@pesmel.com

Japan
Achim Wagner
Tel. +81 72 241 3821
a_wagner@horitomi.co.jp

South America
Thomas Valentin
Tel. +55 11 97200 1973
valentin(at)valentinconsultoria.com.br

South Korea
Dae-Yu (David) Kim
Tel. +82 (0)31 492 1691
dykim3e(at)hanmail.net

Spain
Erik Pekkola
Tel. +358 50 324 6179
erik.pekkola(at)pesmel.com

Taiwan
Harry Lehto
Tel. +886 905 339 337
harry.lehto@pesmel.com /
taiwan@pesmel.com

Thailand
Vorarat Kulchotirat
Tel. +66 984 437 404
vorarat.kulchotirat@fersmek.com

Turkey
Ayse Sarigul
Tel. +90 212 212 9650
alpmak(at)alpmak.com.tr

USA, Canada
Rajagopalan Jagannathan
Tel. +1 972 491 7171 / +1 972 977 0518
jagannathan.rajagopalan(at)pesmel.com

Customer-reported results from Material Flow How® vs. traditional solutions:

15%
increase in sales due to shorter delivery times

7 day
reduction in invoicing times with integrated software

30%
savings in packing materials

65%
space savings compared to traditional storage

0
lost orders, shipment/ handling errors

10%
increase in mill efficiency

pesmel.com
Visit our website to find out more about Pesmel's unique Material Flow How® concept for the metal industry, and the technologies and processes behind it.

PESMEL

The Material Flow How® company