Sustainable meri Environmental Solutions

Residual Treatment

For Recycled Paper Mills

Competence Book – Efficiency

Reject & Sludge Treatment
Rope & Trash Handling
Conveying, Transportation & Storage
Waste To Energy (W2E) Solutions
Recycling

Basics Residual Treatment & Handling

Economical Importance

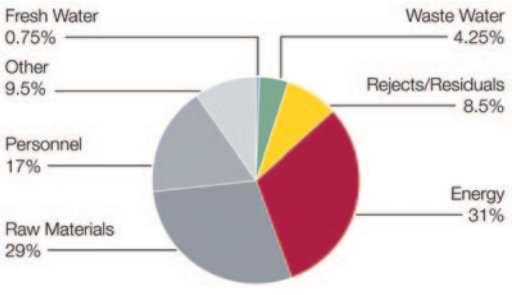
The Yield of Paper Mills using Recycled Paper as a raw material is, approximately between 90% (Board) and 70% (Tissue), depending on the Paper Grade being produced. Consequently, many tons of different types of Residuals are left over from the Production Process. Internal Residual Treatment and Handling, as well as Disposal, Reuse or Incineration have significant Economic Importance today. In Central Europe, the cost can range up to 5-9% of the product production cost. Successful solutions must be elaborated individually for each Paper Mill and depend on Internal Factors (e.g. Process, Layout, Operational Logistics) and External Factors (e.g., Transport Cost, Disposal Fees, Reuse or Incineration Values).

Example 1200 t/day Board Mill

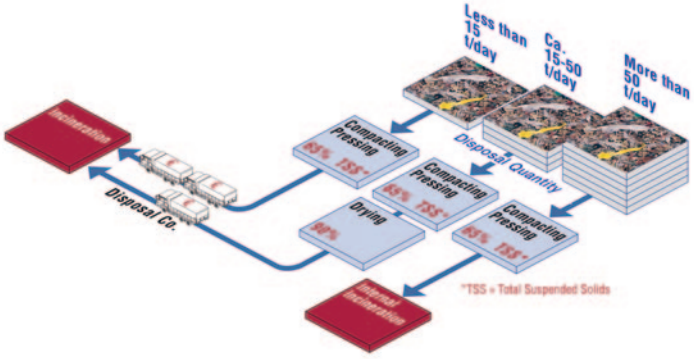
			TSS % /dryness	MT /day	MT /year	Cost /year	Cost /year
Production	**1200 BDMT/day**						
Yield 89%		**Reject Rate 5.0%**	65%	103.7	36301	60	2,178,047
WP to Pulper	1,348 BDMT/day	**Sludge Rate 5.4%**	55%	132.4	46333	40	1,853,320
Residuals	148 BDMT/day	**Trash Rate 0.6%**	60%	13.5	4719	75	353,933
Operating Days	350	**Residuals 11.0%**		249.6	87353		4,385,299

Steps to Successful “Residual Solutions”

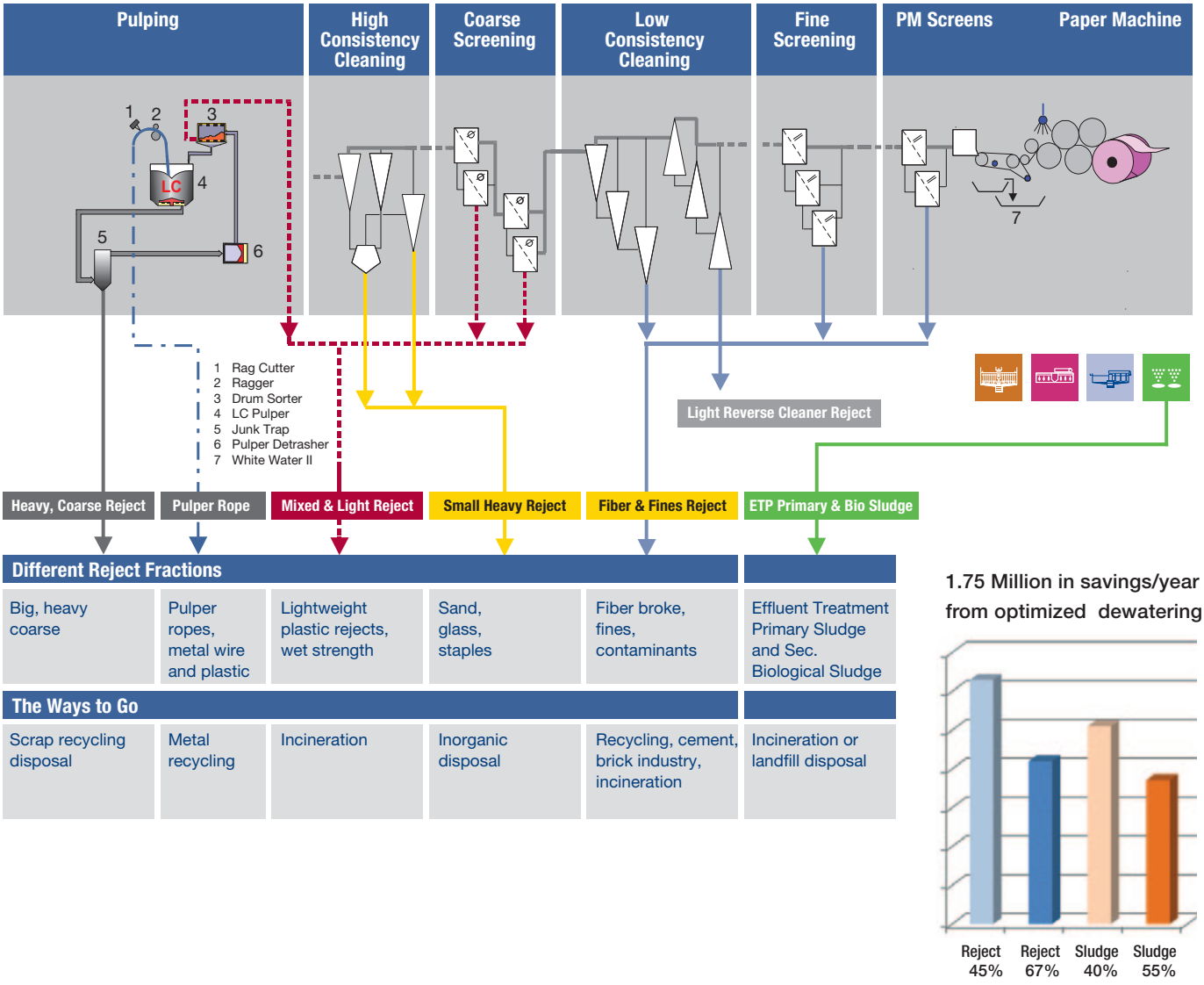
- Elaboration of a production related Residual Balance, which considers different streams of Pulper Coarse Trash, Pulper Ropes, Light Weight Pulper Plastic Rejects, Small Heavy Inorganic Rejects, Fibrous Rejects, Primary Effluent- and /or Biological-Sludge.
- Classification and Quantification of Residuals Streams by Characteristics considering ways of Disposal, Reuse or Incineration (i.e. as high / low caloric heating value, inorganic and organic disposal, metals, recyclable or non recyclable).
- Investigation of different ways for Residual Transport, Disposal, Reuse and/or Incineration and comparison of different Residual Cost Models based on the Residual Balance.
- Evaluation of different Residual Logistic Concepts, ways of internal transportation, storage and truck loading, or in the case of incineration internal transportation and storage of “Residuals as Fuel.”
- Elaboration of optimized Layouts for Reject- and Sludge-Treatment / Handling which allows operational bypass of e.g. shredding and pressing equipment to simplify maintenance and ware part replacement
- Selection of Concepts with highest possible dewatering (but economical) in case of Disposal and for Incineration (Waste to Energy – W2E).



Example of the cost distribution in a typical northern European Paper Mill using Recovered Paper as Raw Material.



Alternative Reject Logistics for disposal or incineration, depending on amount of Rejects.



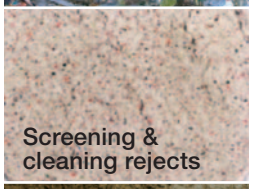
1.75 Million in savings/year from optimized dewatering

Characteristics of Residuals and Processing

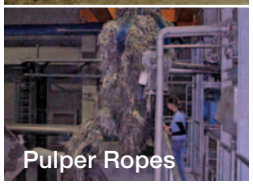
Besides the Quantity (t/h) and Sequence (continuous or discontinuous) with which Residual Streams get discharged from the Main Process the following characteristics are important:

- Size and appearance of Pulping Rejects might require special conveying, Bulk and Metal
- Separation and/or multiple stages of Shredding.
- In case of Incineration, the Heating Value of Residuals is essential to allow controlled efficient burning. Typically, a Low and High Heating Value fraction are prepared to allow accurate mixing before feeding the Boiler.
- Plastic Rejects (Pulping & Hole Screening) need to be dewatered (by pressing) to the highest possible dryness for best secondary use in Incineration and to achieve lowest disposal fees.
- Fibrous Rejects and Sludge need adequate Conditioning (w. Polymer) and Pre-Dewatering before being dewatered in a high performance Screw Press.
- Pulper Ropes need dedicated handling and require a very special Pre-Shredding technology followed by Fine Shredding and Metal Separation.
- Transportation and Storage Solutions, which allow the bypass of Single Process Steps/Equipment, are essential to secure stable and continuous operation, especially when Residuals are used as fuel for incineration.

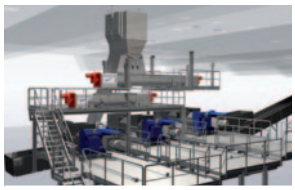

Pulping rejects


Screening & cleaning rejects

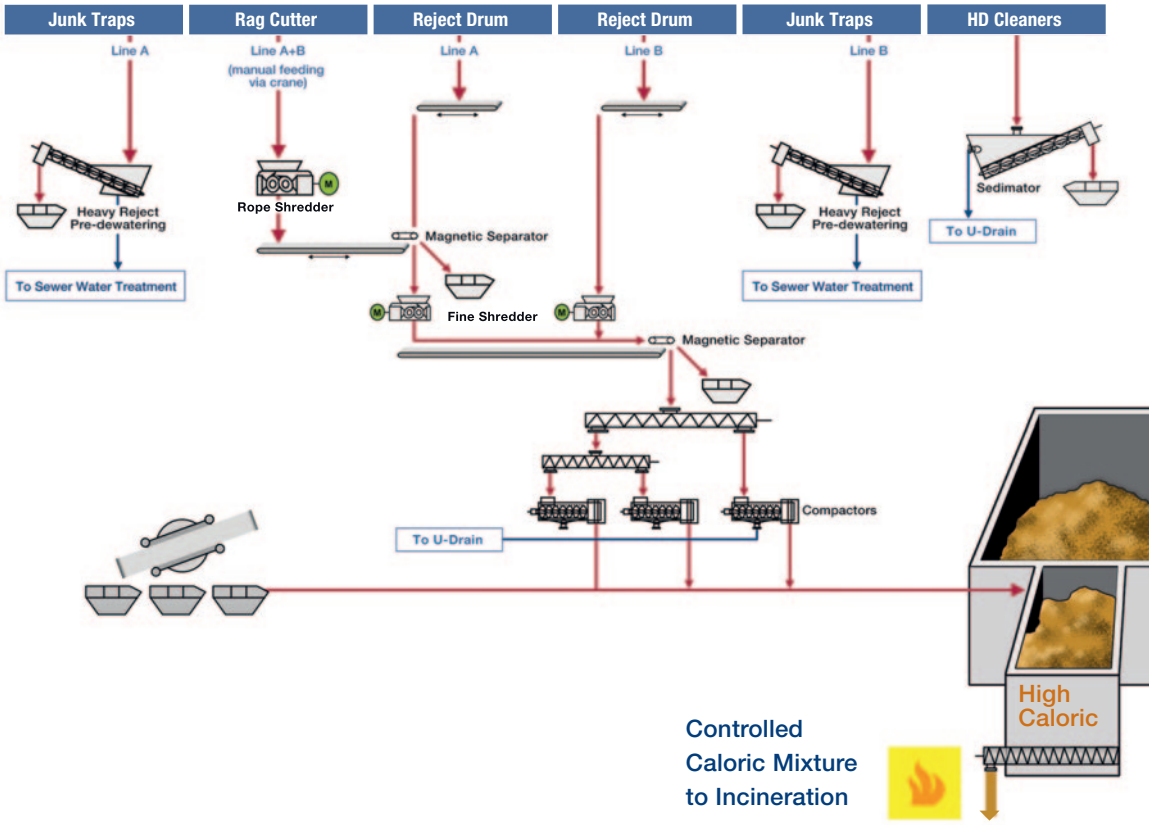

ETP sludge from primary/biological

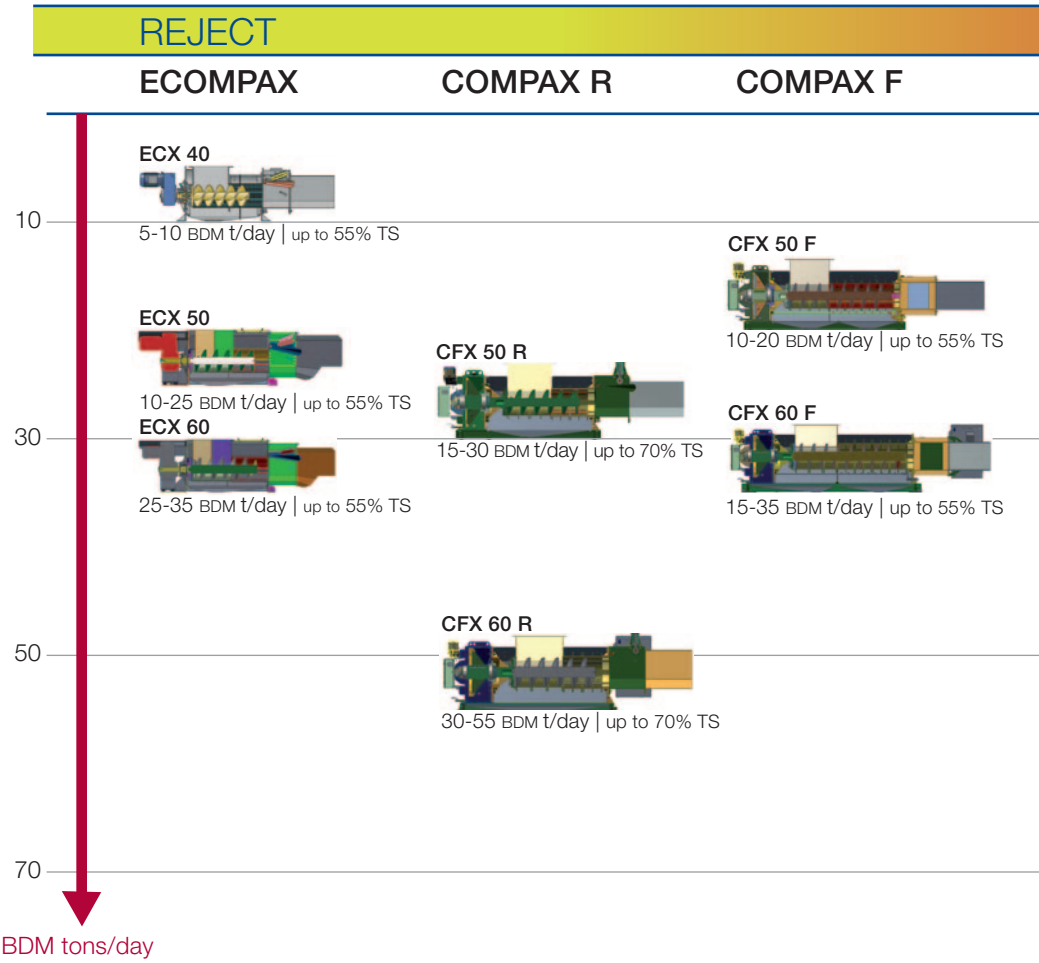

Pulper Ropes

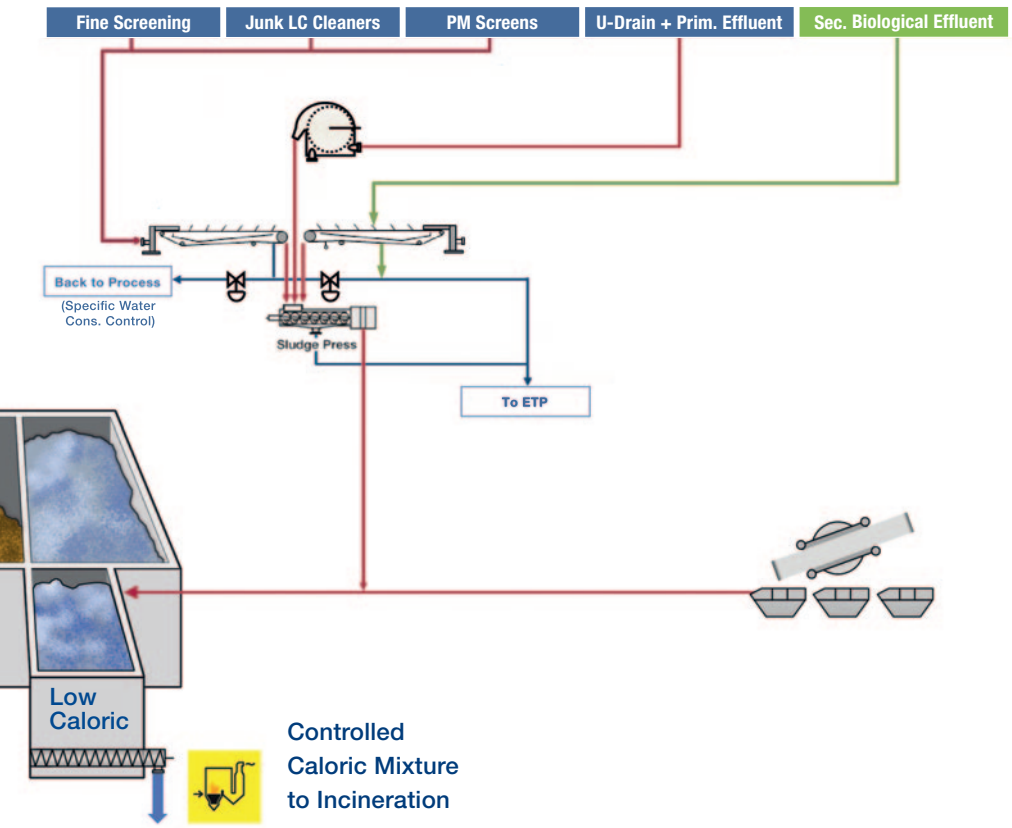
Residual Handling Systems



For the dewatering of coarse pulper rejects different versions of the SCREENEX are available. To remove small heavy residuals such as glass, sand, staples and stones the SEDIMATOR is used. The SEDIPHANT allows the 3-phase separation of light and heavy residuals and a real pre-clarification of water.







SLUDGE

MINIPRESS

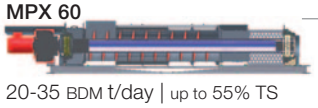
MPX 40

10-12 BDM t/day | up to 55% TS

MPX 50

12-20 BDM t/day | up to 55% TS

MPX 60



20-35 BDM t/day | up to 55% TS

RSP Residual Sludge Press

RSP 65

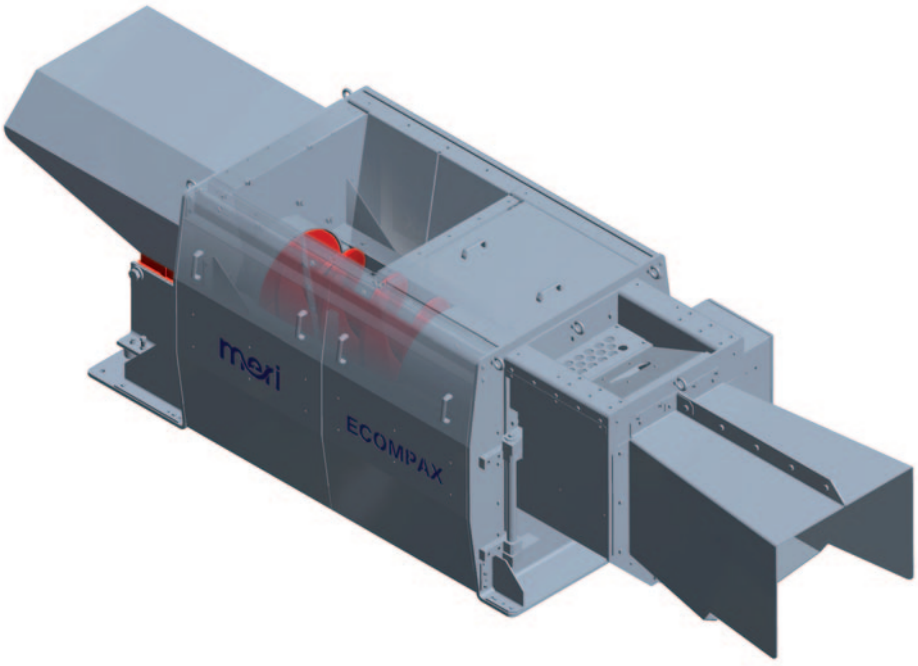
30-50 BDM t/day | up to 60% TS

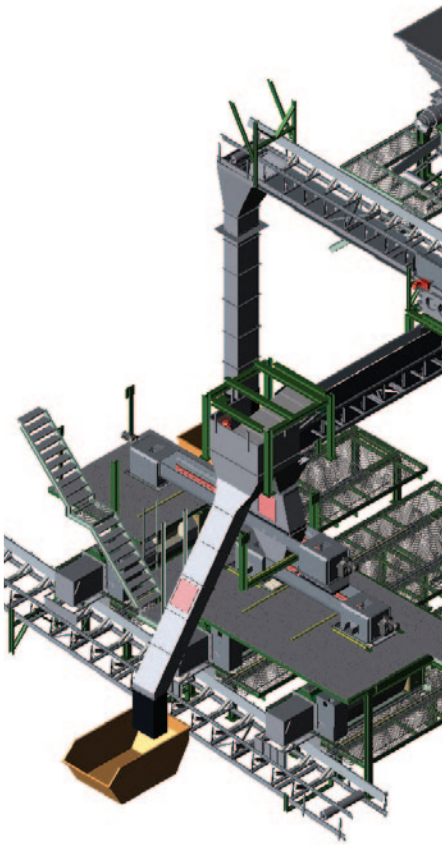
RSP 80

50-70 BDM t/day | up to 60% TS

All throughput (BDMt/day) and final dryness (%TS) values listed depend on: the application, residual solids type to be processed, if pre-dewatered, the chemicals used for conditioning and the chemicals used for sludge dewatering.

Reject Dewatering





ECOMPAX ECX Series – Description, Features, Models

The ECOMPAX ECX Screw Compactor series is designed for the dewatering of Plastic Residuals i.e. Pulper- and Hole Screening-Rejects and is the basic version of the market-leading COMPAX Series.

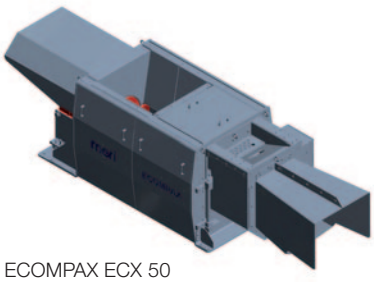
The ECOMPAX is the efficient dewatering and pressing solution for small and medium quantities from 10 up to 35 BDMT/day which achieves a dryness up to 55 % BD (*).

The ECOMPAX has a hollow shaft mounted gear motor, which is held in a self-aligning roller bearing. The twin flight screw is flange connected to the drive shaft.

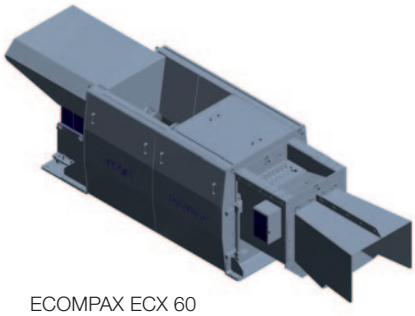
The counter pressure is generated by a press-flap, which can be actuated by either an air pillow for the ECX-Air or hydraulic cylinder for the ECX-Hydraulic.

Depending on the version, different ranges of power are installed on the ECX. The ECOMPAX must be installed fixed to concrete foundations.

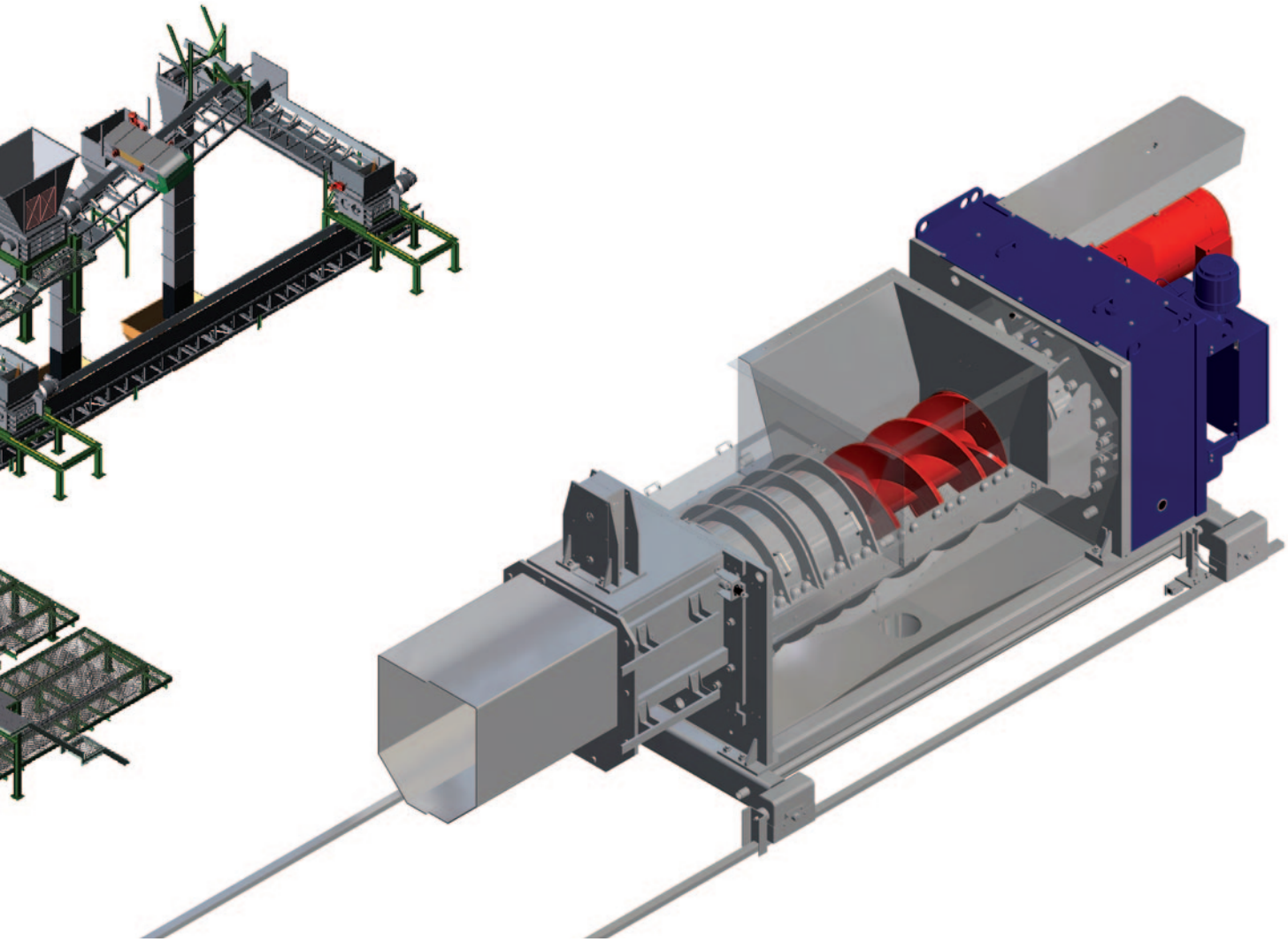
*) All given values for ECX or CFX are subject to specific application, and type of solid and content of fibers.



ECOMPAX ECX 50



ECOMPAX ECX 60



COMPAX CFX R Series – Description, Features, Models

For many years, the COMPAX CFX screw compactors have been the leading equipment for the dewatering of Plastic Residuals i.e. Pulper- and Hole Screening-Rejects – as proven by hundreds of installations.
Its ultimate performance provides a dryness of up to 70% BD and throughput from 25 – 60 BDMT/day (*).

It features a welded gear box with "Triple Bearing Assembly" – 2 radial and 1 axial bearing and a Flanged Twin Flight Screw which operates against hydraulically actuated counter pressure flap.
The COMPAX CFX series design allows fast and efficient maintenance for spare parts exchange, shorter downtime and low cost.

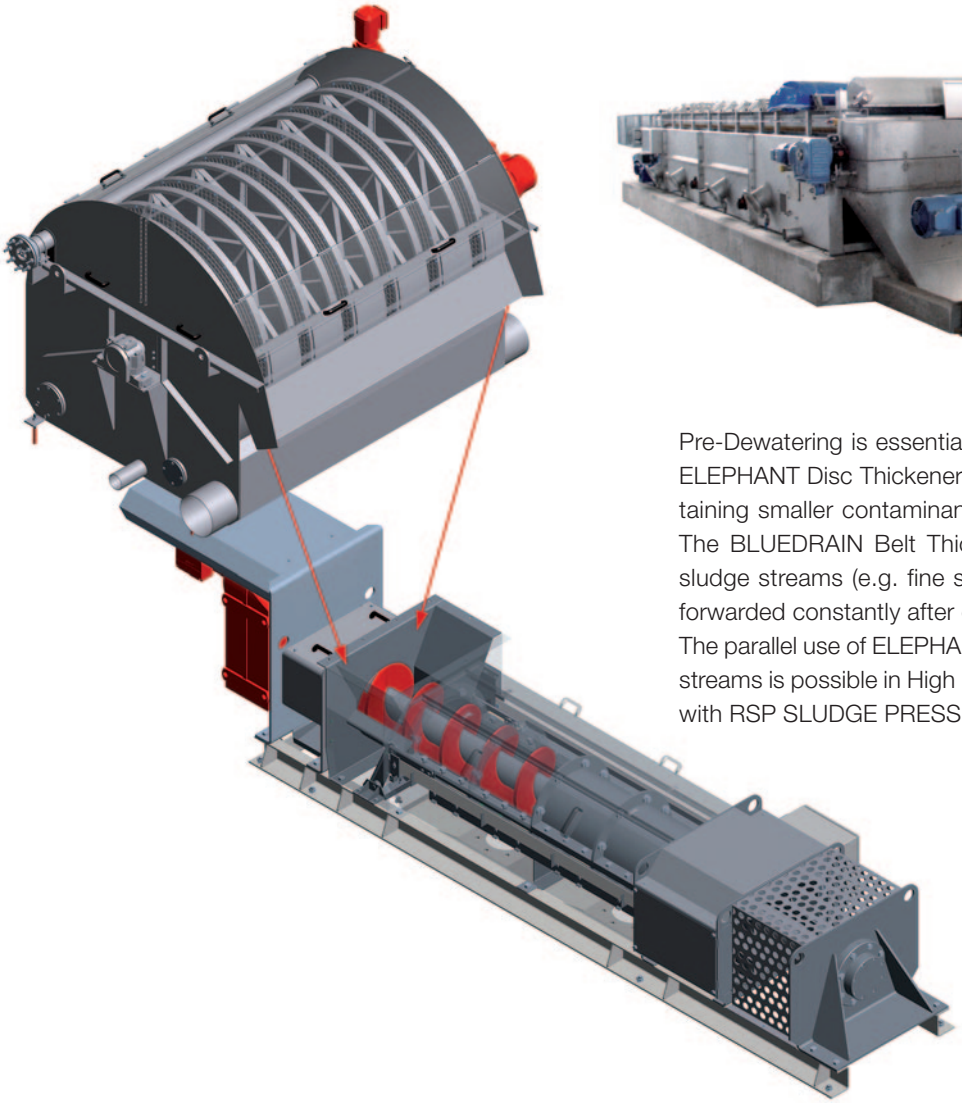
The latest generation of the DYNAMIC COMPACT CONTROL is the most advanced compacting control system, which secures:

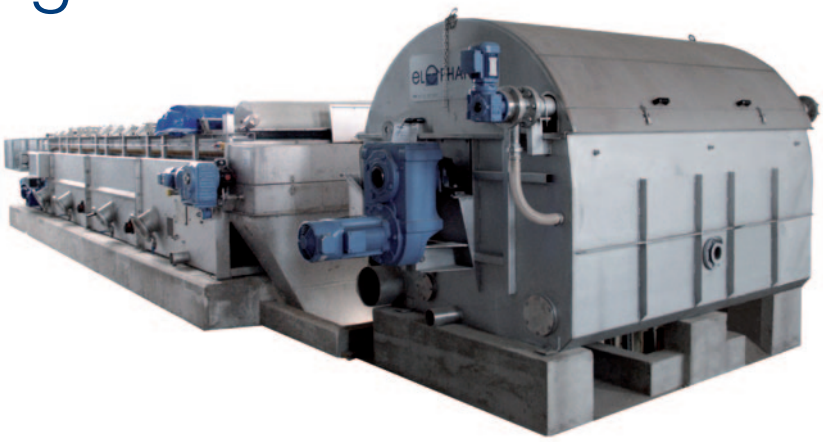
- Best operational performance
- Performance & wear monitoring
- Long term data logging
- Easy configuration & setting
- In-place safety instructions & manual
- 2 camera video supervision

Features	ECOMPAX ECX	COMPAX CFX
Final dryness	up to 55% dryness BD (*)	up to 70% dryness BD (*)
Frame structure	fix-mounted on concrete foundation	frame on wheels – slide in/slide out for bypass
Drive	gear motor on hollow shaft	welded gear box with Auto Lubrication, gear motor
Bearing	self-aligning roller bearing pivoting screw	"Triple Bearing Assembly" full suspended screw
Screw	flanged twin flight screw	flanged twin flight screw
Pressure flap	Air actuated flap option hydraulic flap 65 bar	hydraulic actuated flap 130 bar

DYNAMIC COMPACT CONTROL is the most advanced control system for CFX and ECX Compactors. It allows monitoring, parameter setting, video surveillance, safety and maintenance guidance and can be interfaced via PROFI- or CAN BUS to DCS and SCADA systems.

Sludge Dewatering



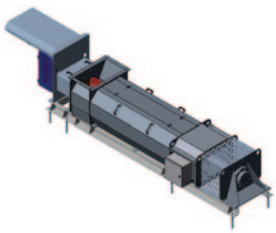


Pre-Dewatering is essential for high performance installations. The ELEPHANT Disc Thickener is suitable for “dirty” solids stream containing smaller contaminants with variation in flow and solid load. The BLUEDRAIN Belt Thickener allows high flow-rates of “thin” sludge streams (e.g. fine screening, cleaning, DIP) which can be forwarded constantly after chemical conditioning.
The parallel use of ELEPHANT and BLUEDRAIN for different residual streams is possible in High Performance Installations in combination with RSP SLUDGE PRESS.

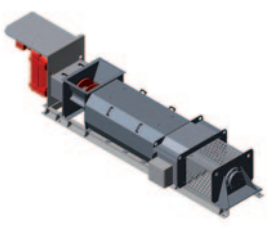
MINIPRESS MPX With or Without ELEPHANT THICKENER for Pre-Dewatering

The MINIPRESS MPX screw press is a cost efficient solution to dewater Residual Solids, Sludge and Fibrous Rejects i.e. from Fine Screening, Cleaning, Water Treatment or Effluent Treatment.
The MPX Series are designed for small and medium solids amounts (5-30 BDMt/day), for central or decentral Dewatering. The MPX can reach final dryness up to 55% TS depending on the type of solids, if Pre-dewatering and Chemical Conditioning is used. The MINI-PRESS MPX is available in different lengths with 3 (MPX-X03) or 4 screen segments (MPX-Z04), depending on solid-characteristics.
For some applications, MPX operation without Pre-dewatering is possible. In this case the long MINIPRESS (MPX-Z04) with special screen design is the choice.
For Pre-Dewatering the ELEPHANT Disc Thickener can be used, which secures best performance.

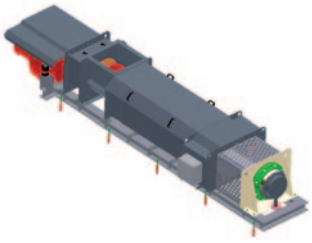
The ELEPHANT Disc Thickener is designed to pre-thicken residual solids and rejects which can contain even smaller contaminants (limited size). The easy operation with different materials, changing flow and solid feed quantities as well as the safe and reliable operation under all process conditions have made the ELEPHANT thickener successful in hundreds of installations.



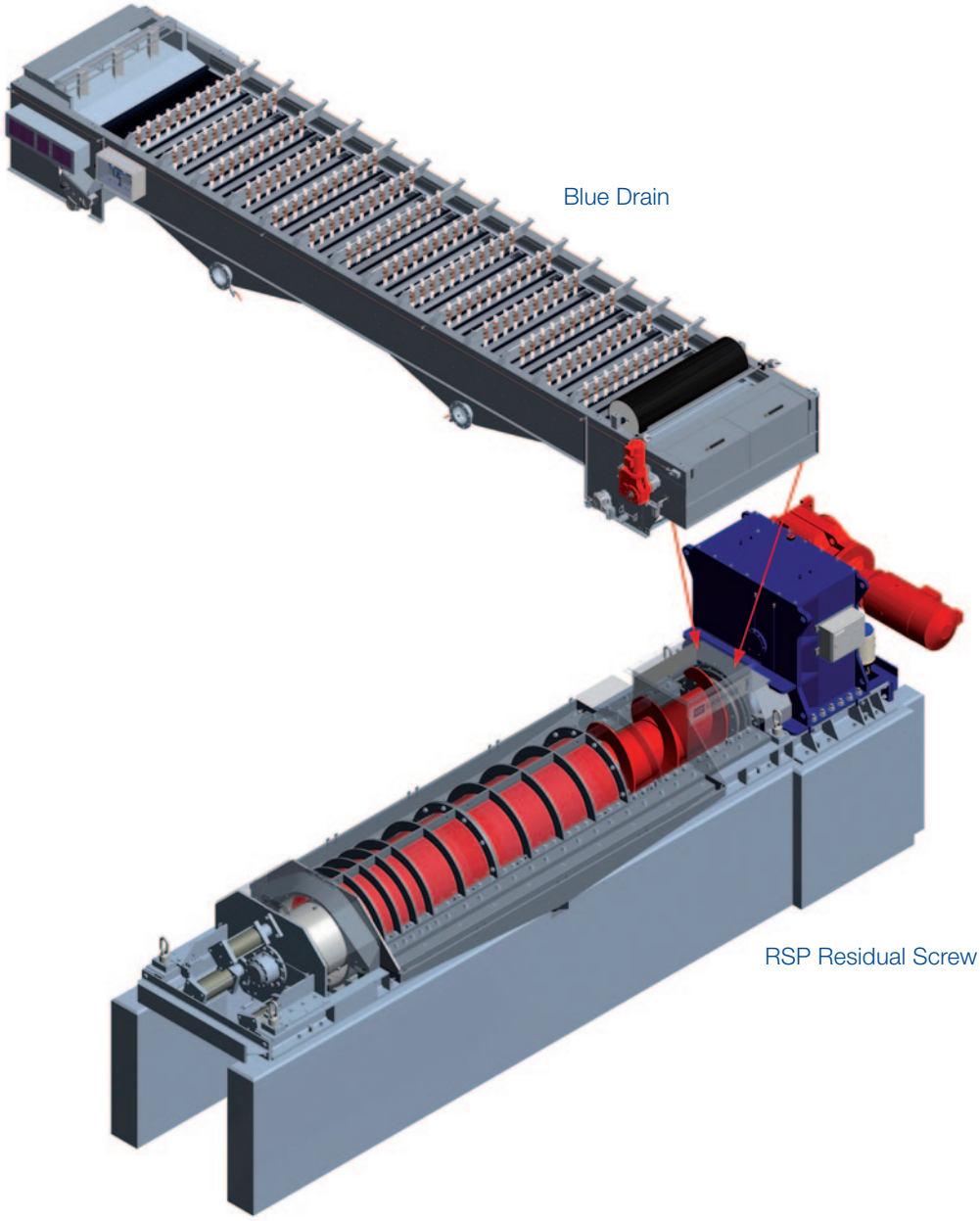
MINIPRESS MPX 40



MINIPRESS MPX 50



MINIPRESS MPX 60



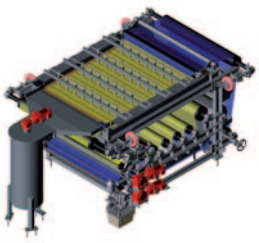
RSP SLUDGE PRESS With BLUEDRAIN for Pre-Dewatering

The RSP Sludge Press is specifically designed for pressing high amounts of pre-dewatered Residuals (e.g. fibrous rejects, DIP, ETP and Bio sludge).
The capacity for the RSP series ranges from 15-100 BDMt/day (*) depending on type of solids (ash/fiber ratio). Final dryness up to 60-65% TS (*) can be achieved.

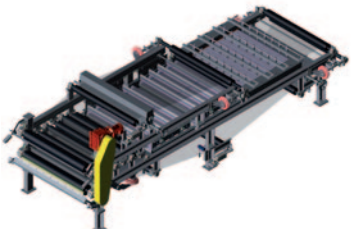
The RSP Sludge Press Design features:

- 2 side flanged press screw for easy exchange and adaptation
- External screen segment and internal shaft dewatering for highest dryness
- Counter pressure ring pneumatically actuated and torque controlled
- Welded triple reducer gearbox for ultra-low RPM (wear) with axial bearing
- Wear segments on press screw
- Design allows easy maintenance

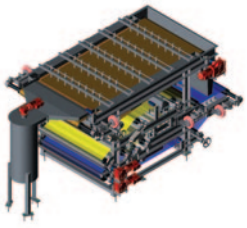
The BLUE-BELT-PRESS series is comprised of different types of belt presses to dewater amounts from 5-35 BDMt/day (*).
Depending on the type of solids, different dewatering Modules such as, Gravity Dewatering-, Wedge-, S Roll- and Press Nip are combined in the respective BLUE-PRESS type to achieve best dewatering results for process-, primary ETP-, or secondary Bio-Sludge.



BLUEPRESS



BLUEPRESS Double



BLUEPRESS Triple

*All throughput (BDMt/day) and final dryness (%TS) values listed depend on: application, residual solids type to be processed, if pre-dewatered, chemicals for conditioning used for sludge dewatering.

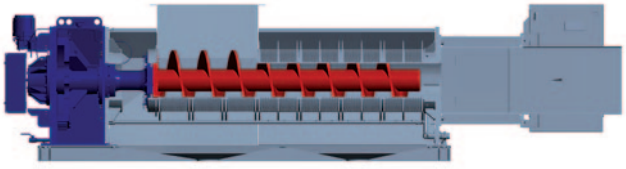
Hybrid Dewatering

Combined Dewatering of Plastic and Fibrous Residuals

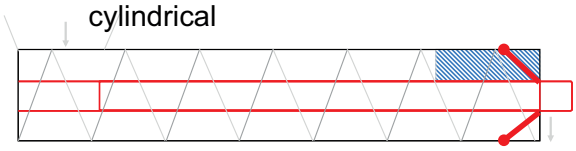
Residual treatment has today different requirements:
In the case of disposal or secondary use (Incineration, W2E) separation of plastic and fibrous residuals is required. Respective low- and high-caloric fraction streams need to be treated separately.
If plastic and fibrous residuals can be combined together, HYBRID DEWATERING is an alternative. This means that plastics and fibrous materials are dewatered in the same press.

HYBRID DEWATERING Equipment

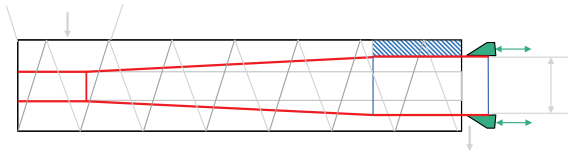
The COMPAX CFX-Fiber series is designed to dewater fibrous rejects in combination with plastic rejects (e.g. hole screen reject).
The single flight screw with cylindrical shaft pressing against a hydraulically actuated Twin Flap allows the combined dewatering.
The CFX-F features a welded gear box with “Triple Bearing Assembly” – 2 radial and 1 axial bearing on the shaft to which the screw is flanged.
The wide open “free flow” outlet without counter bearing allows the discharge of bigger fiber-plastic agglomerates without operational problems.
The COMPAX CFX-Fiber operates at half the rotation speed compared to the COMPAX CFX-Reject series to allow optimized dewatering of fibrous materials.



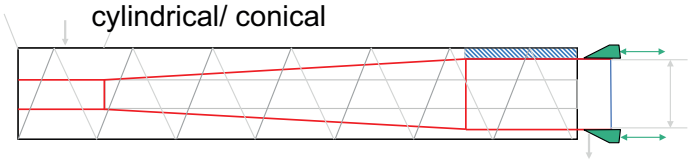
COMPAX CFX



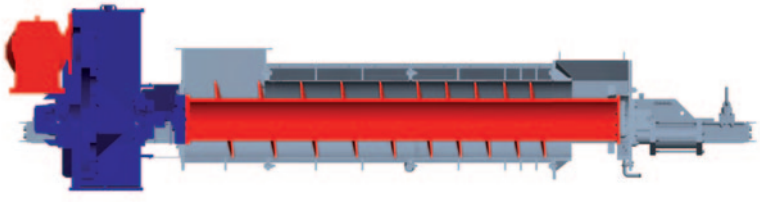
Small Plastic, Fibers



Fibrous Reject



Sludge, Fines, High Ash



RSP Short

RSP Long

The RSP RESIDUAL PRESS

The RSP RESIDUAL PRESS uses a flanged press screw, which is bearing-supported on both sides. The modular design allows the RSP to be equipped with different press screws. Depending on the residuals to be thickened, the RSP screw geometry can be adapted accordingly.

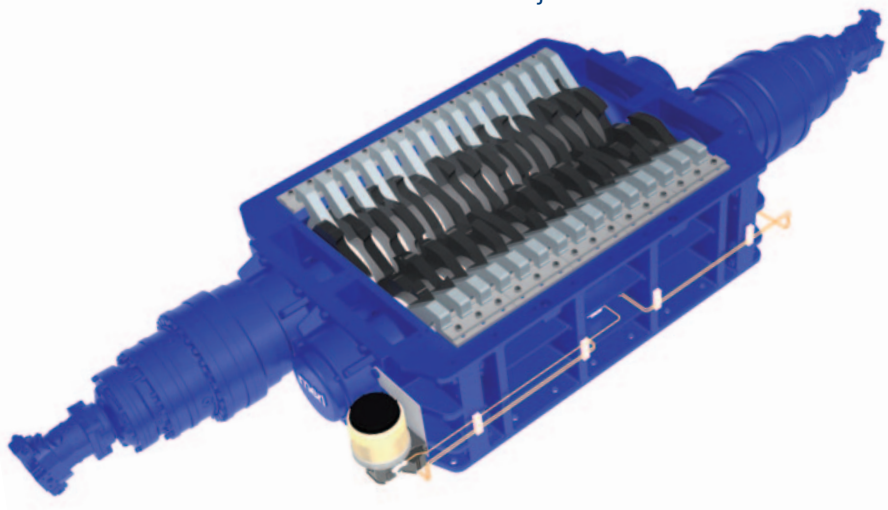
Sludge with a high content of fines and fillers requires less screw flight height and a more progressive cone geometry than fibrous material (see graphic).
If plastic rejects are mixed (e.g. hole screens) a total cylindrical screw shaft will be mounted in the RSP.

> Cylindrical-Press Screw for the dewatering of plastic rejects combined with fibrous residuals and sludge.
Since plastic rejects dewater faster, less screen elements are necessary. Therefore the screw can be shorter. The counter pressure ring is pushed by hydraulic cylinders.

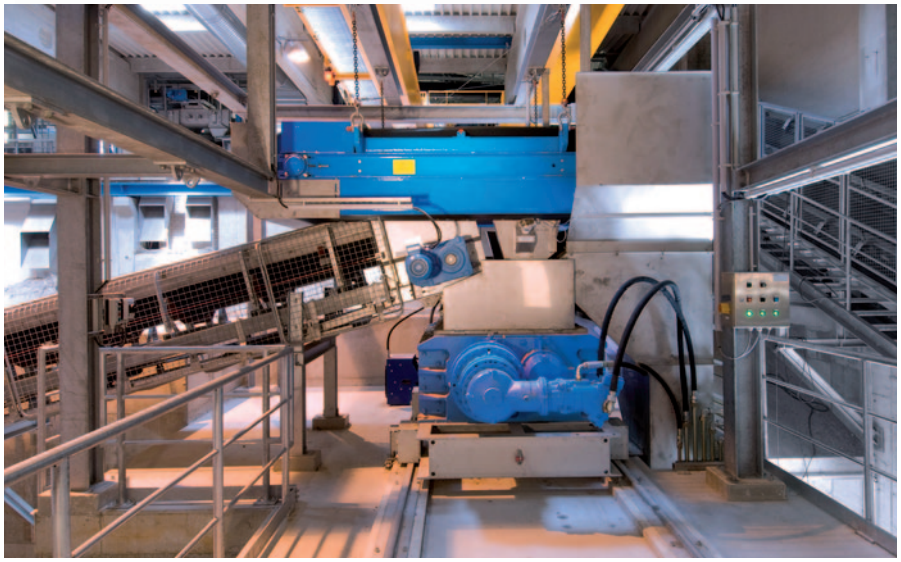
> Conical-Press Screw for dewatering of fibrous residual sludge – only.
Fibrous residual sludge needs more dewatering time and thus more screen surface. Therefore the RSP screw is longer. The counter pressure is generated by air actuated conical ring to control final dryness.

Shredding

LION SHREDDER – the Best for Reject



The LICO LION Shredder Control is an advanced “extremely fast” control system which directly interacts with the hydraulic or electrical drives – to secure advanced shredding-/cutting-logics. The LICO-Operating terminal allows monitoring, parameter setting, video surveillance, safety and maintenance guidance and can be interfaced via PROFI- or CAN BUS to DCS and SCADA systems.

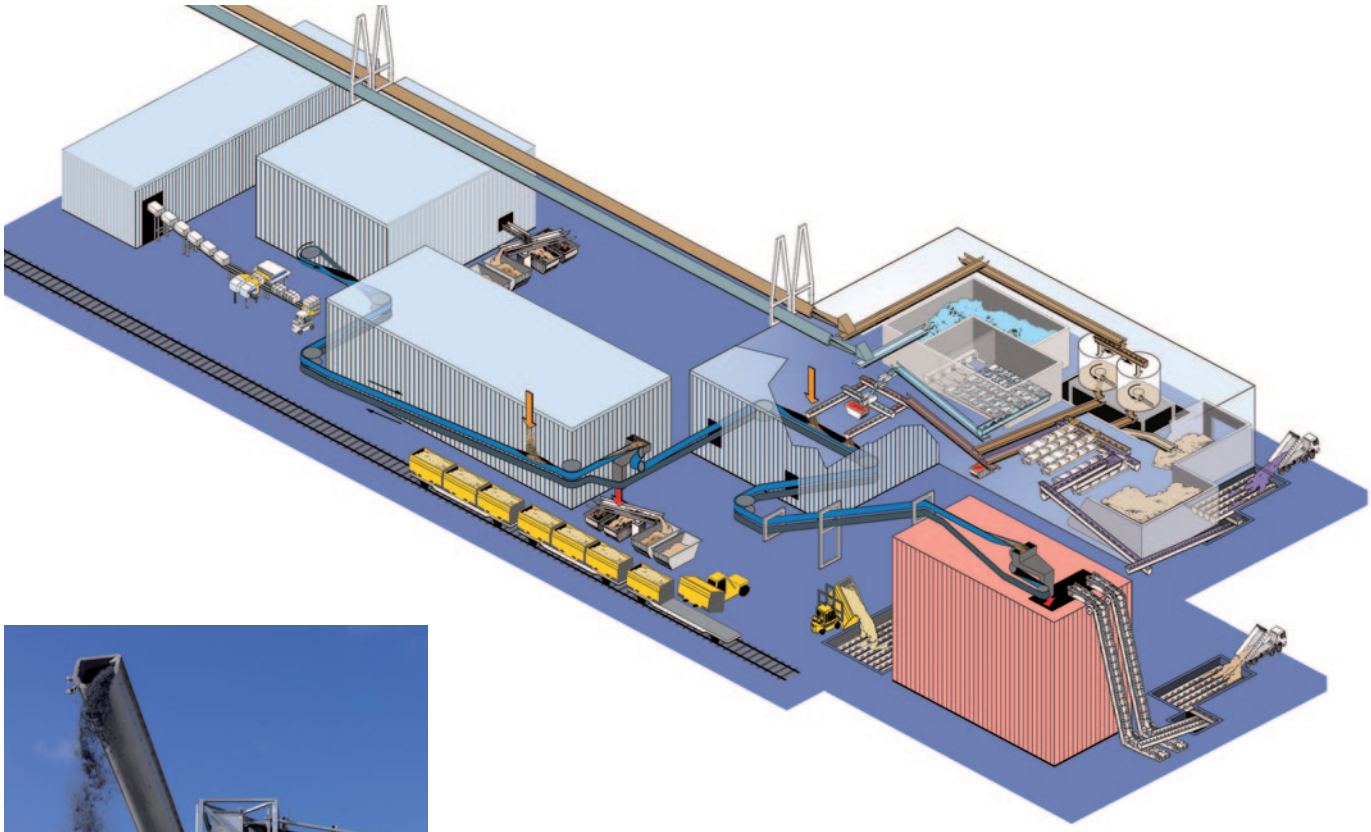


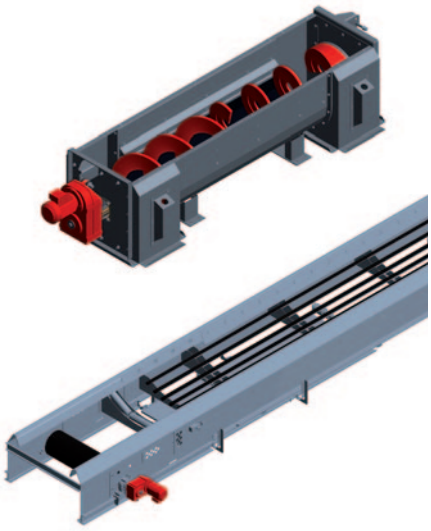
The Shredding of **Paper Industry REJECT** requires best Shredding Technology to secure continuous operation, lowest maintenance time and lowest wear cost. The LION SHREDDER has proven in many REJECT installations to be the market leading equipment:

LION key factors for REJECT Application Success:

- 2 Shaft Shredder with counter rotating shafts at slow rpm
- 2 independent hydraulic or electric drives depending on the application and material to be shredded.
- New intelligent LICO LION Control allows best adaption to reject material, perfect operation with auto feeding and reversing functions even for steel wire containing ropes.
- Special hot drop forged knives secure up to 8000 hours of lifetime, depending on application, for lowest operational cost
- High performance hydraulic unit directly controlled by LICO
- Automatic grease lubrication system, no oil in shredder
- Maintenance friendly design, secures fast service time

Transportation & Storage for Residuals





RESIDUAL LOGISTICS – Internal Transportation & Storage

Residuals as Pulper-, Fibrous Reject, Sludge etc. typically appear at different process steps in different locations of the plant. Subsequently, residuals must be conveyed to the Reject- or Sludge-Treatment equipment. After treatment, (e.g. separation, dewatering/pressing, shredding etc.) the Residual Fractions must be transported to a “Central Logistic Point” in the plant to be further stored or loaded for transport to disposal.

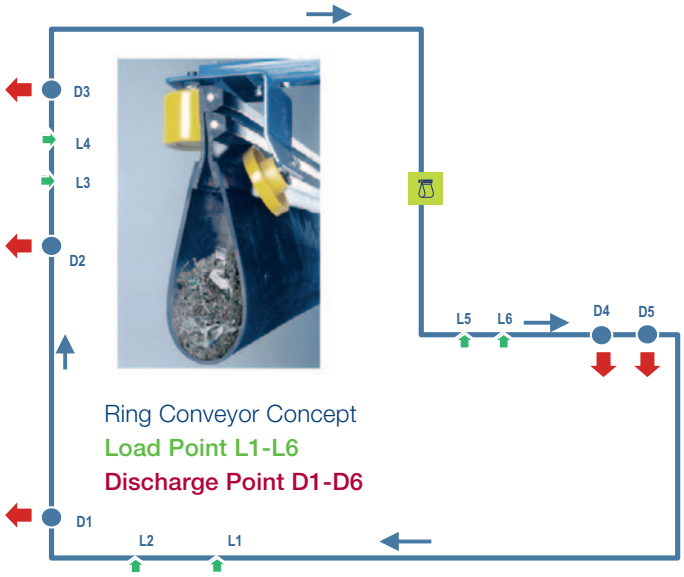
We can offer the complete customized solution for your plant out of one hand, with special equipment specifically designed for Paper Industry – Residual-, Reject- and Sludge-Transport and Storage:

- Special belt conveyors designed for transport of plastic rejects, which secure clean operation and lowest maintenance
- Screw conveyors for plastic rejects or fibrous sludge
- Distribution spirals or distribution belt conveyors to divide residual streams to multiple equipment
- Container stations to automatically fill containers or trucks (rotating or lateral version)
- Bunker filling conveyors which secure best bunker filling and most efficient foot print use
- Silos for storage of fibrous sludge residuals
- High capacity walking floors for storage with automatic filling and discharge
- Special long distance conveying systems, such as the MPC (see next page)
- Intelligent conveying systems with multiple load and discharge points
- Vertical conveying system to fill silos or power plants
- Complete Layouts for mill-wide transportation and storage with automated control for truck and train loading stations
- Automated truck and train loading stations

MERI POCKET CONVEYORS – MPC

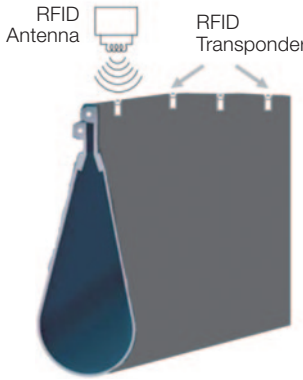
The smartest solution for intelligent transport: Multiple materials from different locations to different destinations, on complex long distance routing

The MERI POCKET CONVEYOR – MPC is the most advanced Material and Residual Transport System available today. The MPC is an enclosed conveyor supported by roller pairs, which guide the profile-embedded steel cables on the belt-rims of the folded conveyor.

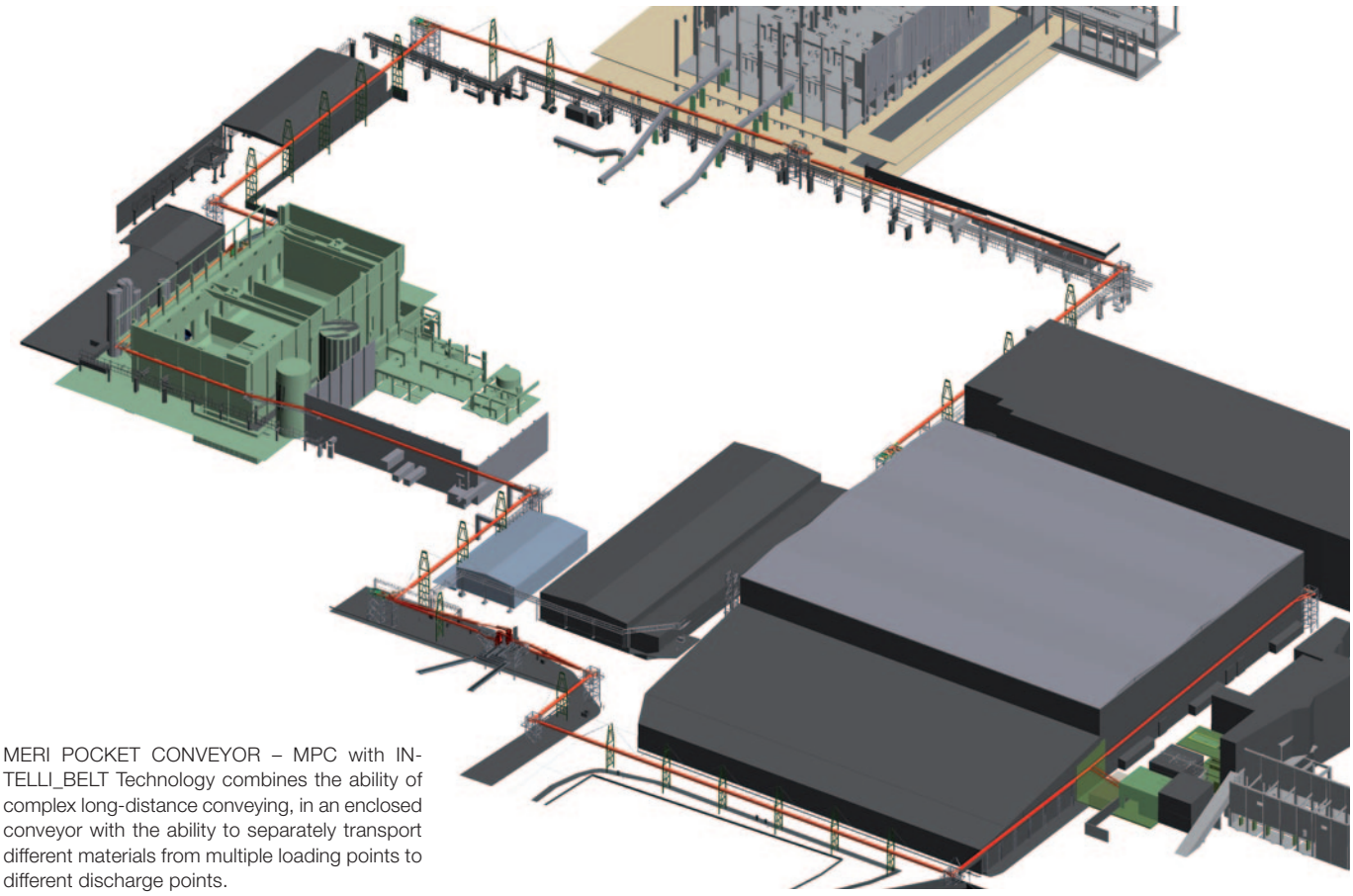


The MERI POCKET CONVEYOR – MPC has the following features:

- MPC belt is closed over the whole transport distance
- Multiple MPC loading- and discharge-points possible
- MPC operate at Inclinations up to 30°
- Curved routing and run around corners without transfer points
- Horizontal and vertical “Banana routing”
- Long distance routing along walls or with “Golden Gate”-supports in covered tunnels or framed gangway elements

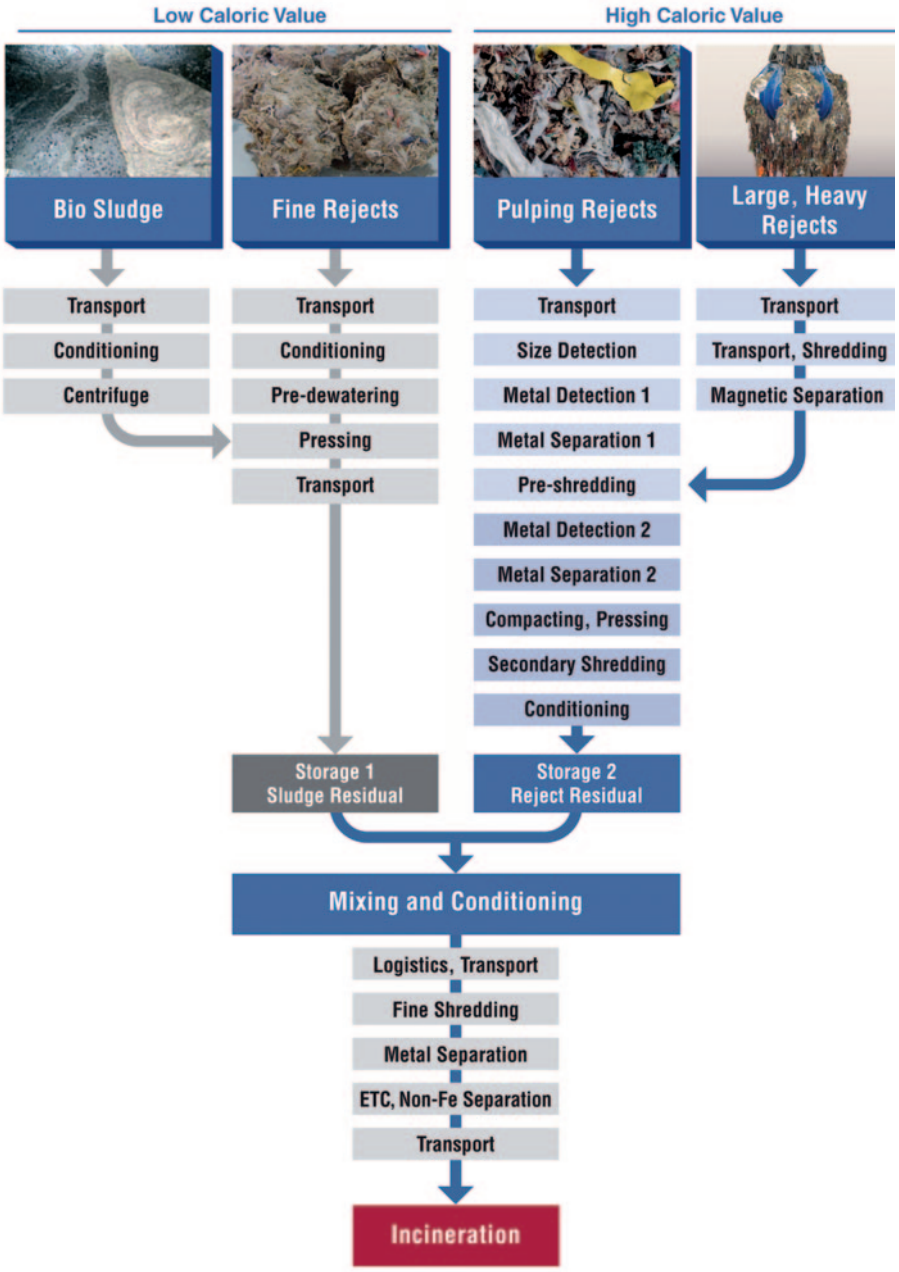


Meri Pocket Conveyor MPC with Transponder



MERI POCKET CONVEYOR – MPC with INTELLI_BELT Technology combines the ability of complex long-distance conveying, in an enclosed conveyor with the ability to separately transport different materials from multiple loading points to different discharge points.

Waste to Energy (W2E)



To secure successful boiler operation adequate fuel preparation as well as a properly sized fuel storage capacity is essential.

Fuel Logistics and Fuel Storage capacity must consider paper production “off times”, which require sufficient fuel reserve to continue the running of the Boiler until the Rejects and Residuals are available as fuel again.

On the other hand when the Boiler is under Maintenance / Revision the Fuel Storage capacity must be large enough to hold Reject & Residuals generated when Paper Production continues running.

A further option is to use External Sources for RDF (Recycle Derived Fuel) which then needs to be incorporated in the Residual Logistics.

MERI has the experience to engineer and design the right Fuel Logistic and Fuel Storage Concept for your Production Plant.

Waste To Energy (W2E) for Rejects and Residuals

Waste To Energy means to use the secondary value of Reject and Residuals for incineration. In this way the Recycled Paper Industry can significantly lower Energy and Disposal Cost.

Depending on the type of Incineration plant, the preparation of Rejects and Residuals as Fuel, requires several process steps. Fluidized Bed Incineration as “State of the Art” requires advanced preparation compared to simpler Grid Incineration.
Plastic Rejects are used to prepare high caloric fuel fraction; fibrous residuals and sludge are considered as low caloric fuel fraction. To secure efficient operation of the Fluidized Bed Incineration the 2 fuel fractions are mixed proportionally to reach a required fuel heating value for the Boiler.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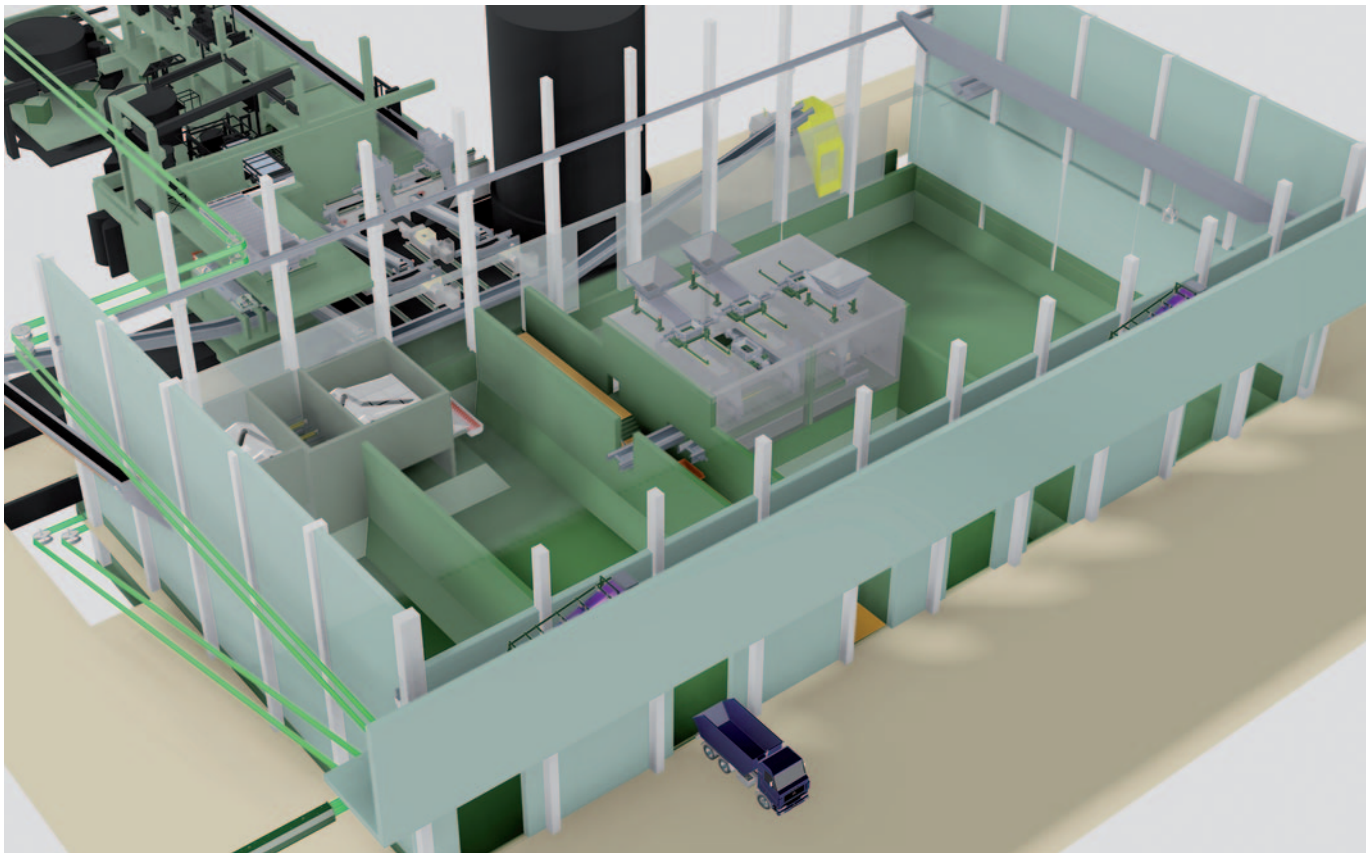

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