SPECIAL FEATURE - AGGREGATE CRUSHING & SCREENING

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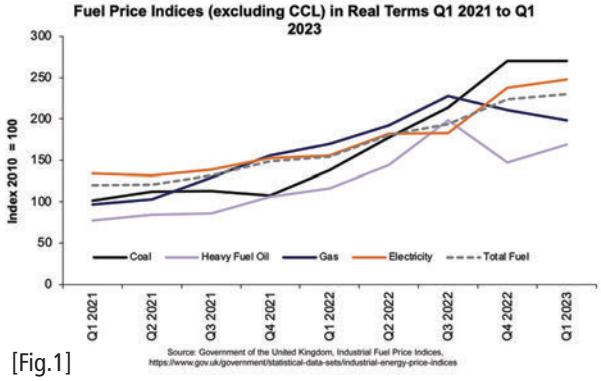
Global efforts to improve efficiencies in recycling

Whilst ambitions for a circular economy continue to gain momentum, uncertain market conditions make it increasingly difficult to turn a profit in the recycling business. So, squeezing maximum efficiency from recycling plant operations has become essential, writes Reiner Fertig of Martin Engineering.

Prices of recycled commodities like metal scrap, plastics, aggregates, paper and cardboard and have dropped significantly, yet the cost of processing recyclables has remained steady or risen due to higher energy and labor costs. Energy costs for industries across all sectors have more than doubled, almost everywhere in the world. [Fig.1]



[Fig.1]

In fact, for companies specializing in sustainable materials management, the cost of recycling equipment, manpower and energy required to process materials has risen substantially whilst markets have remained subdued and prices stagnant at best.

The impact on the bottom line is exacerbated by the kinds of challenges faced by recyclers that rarely impact producers of primary materials – recycled feedstocks can be notoriously inconsistent, frequently contaminated with unwanted objects and non-recyclables.

They are often sticky and laden with moisture, and can contain abrasive, corrosive substances, all of which give rise to an assortment of production challenges that few other sectors face to the same extent.

The material characteristics of waste feedstocks often mean that they can quickly clog up processing equipment such as conveyor belts, transfer chutes, bins and hoppers, and cause excessive wear and tear on machinery, leading to unplanned, costly shutdowns.

Worse still, despite the overwhelming risks, it's not uncommon for workers to be sent into hazardous situations to manually clear spillages, blockages and build-ups in order to get plants back up and running quickly. Without the right risk assessments to ensure that the hazards associated with energy isolation, working at height and confined space access are addressed, the consequences can be fatal.

From a safety standpoint alone, ensuring recycling plants run smoothly is critical, let alone the benefits in terms of productivity and profitability.

Metal recycling is key to a circular economy, but processing has to stack up economically as well as environmentally

Beating a battering from batteries in Mexico

One example that Martin Engineering was involved with was in Mexico, at Enertec at a plant dedicated to the recycling of vehicle batteries. The machinery grinds down and separates the plastics from the lead in spent batteries and the materials are reprocessed and used to manufacture new batteries.

However, their main conveyor belt suffered from continual impact damage and misalignment as a result of heavy batteries dropping onto it. Smaller batteries (such as motorcycle batteries) tended to rebound out of the loading chute because the conveyor belt lacked an effective support system.

Enertec's conveyor belt suffered from impact damage and misalignment.

Some of the batteries ran down the back of the chute, which caused damage to the conveyor belt and also to the tail pulley. And others fell down the sides, getting stuck between the chute and the conveyor and accumulating over time. In addition to this problem, the lack of proper support meant that significant vibration was being transmitted to the nearby weighbridge.

All these issues were causing repeated drops in productivity and an increase in unplanned maintenance to allow corrective actions to be taken – this was mainly carried out during unscheduled shutdowns when it was necessary to manually clear the chute and surrounds, as well as replace and repair damaged conveyor components. Besides the loss of production time this was also expensive and labor intensive, not to mention the additional risks of clearing the blockages by hand.

Following examination from technicians at Martin Engineering, the solution came with the installation of an Impact Cradle positioned under the belt conveyor loading zone beneath the chute. The Impact Cradle absorbs the force of falling objects and materials to prevent damage to the belt and surrounding structure. It eliminates any belt sag and is designed to minimise any bounce-back from the initial impact with the belt.

Martin's Impact Cradle absorbs the force of falling materials and objects to prevent damage to the belt and structure and eliminates any belt sag.

Like many of Martin's installations the cradle was custom-manufactured to meet Enertec specific requirements – in this case that meant it had to be made from stainless steel to resist attack from the corrosive acids in the electrolyte solution of the batteries they recycle. Following installation, the problems of misalignment and impact damage were corrected and Enertec recorded fewer production problems and lower maintenance costs.

Stemming the spillage from steel slag in Germany

Another example comes from the steel industry in Germany, where residues from the blast-furnace are transformed into a cement substitute known as GGBS (ground granulated blast-furnace slag). This happens at steel plants the world over.

In this case the producer was experiencing extreme carryback on a main material transport belt, which was causing excessive build-up beneath the conveyor and significant damage to the superstructure and conveyor system. An existing belt cleaner made from a horizontal strip of metal plate tilted slightly to face the discharge chute did not adequately remove dust and fines from the cracks and divots in the belt.

Carryback on the return side of the belt caused fugitive dust to travel away from the operation area and crested poor air quality throughout the plant. Spillage along the belt path also built up around the mainframe and increased operational costs for cleaning. The arrangement was impacting productivity and increasing maintenance costs. It also had the additional disadvantage of damaging the belt and catching on mechanical splices, causing costly premature belt replacement and running the risk of a catastrophic breakdown.

The existing metal blade delivered poor cleaning performance, while damaging the belt and splice. Copyright © 2023 Martin Engineering

Martin blades' patented design creates a tight seal, flows easily over splices and maintains cleaning performance through all stages of blade life
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After a thorough inspection that included Martin's unique Walk the Belt™ assessment, Martin Engineering representatives determined that a QC1™ Cleaner HD STS was the right solution to clear the belt of adhered carryback. Using the patented Martin® Spring Tensioner HD STS with a polyurethane blade formed in the "CARP" (Constant Angle Radial Pressure) design, the blade creates a tight seal on the belt, runs easily over mechanical splices and maintains cleaning performance through all stages of blade life. Mounted on a sturdy stainless steel mandrel, the blade cartridge is serviced without confined space entry with a simple one-pin operation, making replacement a safe and simple procedure.

The result was improved belt cleaning efficiency and reduced airborne dust. Operators observed that considerably more material was discharging directly into the chute as intended, with significantly less carryback than they had ever experienced. Due to the reduction of fine material being held in cracks and divots on the return side of the belt, there was less dust that could become airborne, leading to an immediate improvement in plant air quality.

Spillage along the belt path was also significantly reduced, leading to fewer workers taking a fraction of the time to clean along the belt path, improving safety and reducing the cost of maintenance and cleanup. Furthermore, there's been far less wear and tear on the conveyor belt and its operational life is reportedly double what the operator was achieving previously. Needless to say, the rest of the plant was converted to efficient belt cleaners from Martin Engineering.

Sense and sustainability

These examples highlight specific problems that were discovered along the entire length of processing lines as a result of Martin's Walk the Belt™ approach to problem solving. This ensures that root causes are understood and fixed, rather than simply addressing a symptom at one point caused by a deeper problem elsewhere in the system. That approach also identifies buildups and blockages inside silos and hoppers where Martin vibrators or even air cannons may be needed to dislodge material and keep the process flowing.

Given that no two plants are the same, and each different type of feedstock for recycling presents unique challenges, a tailored review under the guidance of material handling specialists is always the best starting point. That means examining every single loading point, discharge point, transfer point and storage vessel to ensure each is fit for purpose and is functioning optimally, as well as how it fits with the remainder of the equipment in the process, assessing how the entire end-to-end sequence is working.

Hard-pressed operations teams are focused on keeping their plants running and overcoming the challenges as they arise – and that's often as a result of badly designed or badly upgraded, mismatched processing machinery. It's understandable that they don't often have the time or the expertise to look at the bigger picture to identify the reasons why problems are arising.

That's where specialists such as the team at Martin Engineering come in, to deliver maximum processing efficiency – especially critical when margins are squeezed. For materials recycling to make as much economic sense as it makes environmental sense, achieving smooth and efficient end-to-end processing has to be the goal.

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