

Case Study

Star quality

Substantial investment pays off at a pioneering recycling facility in the West Midlands.



Greenstar's MRF at Aldridge is one of Europe's most advanced

Greenstar's Materials Recovery Facility (MRF) at Aldridge, just north of Birmingham, is one of Europe's largest – and most advanced. Substantial investment in automation and continual improvement enables the plant to produce top quality material outputs from recyclables supplied in both co-mingled and source-segregated streams.

Commissioned in May 2008 at a cost of £7 million by waste management firm Greenstar Environmental, the Aldridge MRF is housed in a 13,000 m² former steelworks building. The facility runs 24 hours a day, seven days a week, and with a licensed annual throughput capacity of 300,000 tonnes it is among the largest in Europe. The MRF was installed and equipped by Dutch engineering company Bollegraaf and boasts automated and manual sorting processes designed to handle recyclates which have been partially separated at the kerbside or are fully co-mingled. Aldridge also accepts glass in the co-mingled input stream while producing paper of a quality marketable to leading paper mills both in the UK and abroad.

Aldridge MRF – key facts

- Operator: Greenstar Environmental Ltd
- Commissioned: 2008
- Capacity: 300,000 tonnes per annum
- Tonnage processed: 220,000 tonnes (2008)
- Recovery rate: 95% (2008)
- Employees: 120
- Inputs: Co-mingled and kerbside-sorted municipal recyclates from a 50 mile radius; an increasing volume of commercial recyclates
- Outputs: Paper (News and PAMs grade and a soft mixed paper grade), cardboard, rigid and flexible plastic (PET clear and jazz, HDPE natural and jazz, PVC), glass, aluminium cans, steel cans, hardmix and beverage cartons (e.g. Tetra-Pak products)
- Not accepted: Organic waste, hazardous waste, textiles, general kerbside waste



Final quality control on plastics outputs at the Aldridge MRF



News and PAMs grade paper output at the Aldridge MRF

“For us, this flexibility is important,” explains Mick Davis, Greenstar’s Director for Processing. “We accept all the common dry household recyclates – regardless of how local authorities choose to collect them. This gives us the widest possible customer base. Right now, Aldridge is taking material from 15 different councils, as well as from commercial and industrial customers.”

Maximising automation

Automation is a hallmark of the Aldridge MRF. Equipment for sorting, cleaning, processing and loading is deployed across two floors. Any manual picking is reserved for quality control, either in removing unwanted material from the input stream in a pre-sort or for cleaning up final outputs.

By weight, paper accounts for around half of the recyclates processed at the site, so taking centre stage is a series of starscreens capable of processing up to 35 tonnes of material per hour. Each screen recovers progressively smaller sizes of paper, from cardboard, through News and PAMs, to mixed paper. Mr Davis explains the decision to install starscreens at Aldridge: “Although other automated systems such as near infrared (NIR) optical sorters like the ones we use for plastic can do the job, starscreens are better at handling the sheer volume of paper we receive. They can also cope with damp or overlapping material which causes problems for NIR sorters.” Greenstar’s staff visually check the quality of recovered paper every 30 minutes: whole batches may be rejected and passed back through the process to be re-sorted.

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Group Engineering Manager
Neil Arlett

Material not removed by the starscreens is passed onto the container line where a twin-shaft glass-breaker smashes up bottles and jars and sieves out all the glass – which is approximately a third by weight of Aldridge’s inputs. Fines such as bottle tops and pieces of shredded paper are removed here too, while metal and plastic containers continue on the line. An overband magnet and eddy current separator then remove steel and aluminium cans, respectively; metal accounts for 5% of the material handled at the MRF.

Plastic, representing some 7% of the MRF’s feedstock, is the last major material stream recovered at Aldridge. The job is done by an array of NIR optical sorters which identify and segregate the plastic into five polymer grades: clear and ‘jazz’ (i.e. coloured) PET, natural and jazz HDPE, and mixed plastic. When justified by the market, polypropylene (PP) and polyvinyl chloride (PVC) can also be recovered. Each optical sorter costs around £250,000 and can process around 6 tonnes of feedstock per hour.

Continuous improvement

Greenstar cannot be said to be sitting back on their laurels. “We’re always asking ourselves ‘What can we do better? How can we evolve?’,” says Group Engineering Manager Neil Arlett. “We’re constantly questioning the process – and continue to work closely with Bollegraaf to get the best out of Aldridge. The fine-tuning of the plant is an iterative process.”



One of five starscreens processing co-mingled recyclates at Greenstar’s Aldridge MRF

At a plant the size of Aldridge even modest efficiency improvements result in considerable financial benefits. Every additional percentage of the input stream which can be diverted from landfill reduces disposal costs and boosts materials sales. This dual benefit enables Greenstar to enjoy relatively short payback periods on investments at the MRF while remaining competitive on gate fees.

In February 2009, Greenstar invested in a £250,000 glass-cleaning plant at the Aldridge site to improve the quality of its cullet. The new equipment can process between 10 and 15 tonnes of cullet per hour and material recovered at the glass-breaker is now fed into a new trommel screen; fragments less than 12mm in diameter are sieved out as an aggregate substitute. A cyclone air classifier cleans up the 12mm plus fraction, about 75% of Aldridge's recovered glass, by blowing off shredded paper, bottle tops, and glass dust. These fines are supplied to cement kilns as a fuel, while the 'polished' glass is sent to reprocessors for other applications.

Following advice from Bollegraaf, Greenstar has also improved the efficacy of its starscreens. "We now adjust the starscreens far more frequently to deal with the continually varying mix of input materials," says Mr Arlett. "As the composition of recyclates changes, we speed up or slow down the spin rate of our stars. We also alter the slope of the screen decks." (See background box.) Since this new maintenance regime was introduced, far less hand-sorting is needed to maintain the quality of Aldridge's paper.

Chinese approval

"The quality of the materials we produce is key," stresses Mr Davis. "Even during the December 2008 slump in demand for recyclates, reprocessors continued buying our outputs because of their high quality." Not only has the volume of paper supplied to UK reprocessors, such as Severnside, remained stable, but the Aldridge plant recently became one of only two in the country awarded accreditation by the China Certification & Inspection (Group) Co. Ltd (CCIC) – China's recycling quality inspection agency. This verifies that Aldridge's paper, cardboard, plastic and metal outputs are of a sufficiently high quality to be exported direct to Chinese reprocessors and manufacturers without the need for third parties. Building on the success of Aldridge, Greenstar is now investing in a new MRF in London.



Monitoring segregation performance at the Aldridge MRF

Background: Getting the best out of starscreens

Starscreens are now widely adopted across the recycling industry. Many designs exist, but all employ the same principle. Each starscreen consists of steel shafts to which stars – spinning at up to 2,500 revolutions per minute – are fitted. The screen itself is inclined at between 38° and 45° to the conveyor belt. Large two-dimensional objects such as cardboard, newspapers and magazines are gripped and carried up the slope, while three-dimensional objects like plastic bottles, metal cans and glass roll out onto a separate belt. Fines fall through the bottom of the screen.

The spacing between the stars determines the diameter of material extracted, while adjustments to the stars' spin-speed and the angle of the screen fine tune the sorting process. As is commonly true for sorting processes, a trade-off exists between sorting speed and accuracy. Slowing the stars improves the removal of unwanted materials from the paper line but reduces sorting capacity. Similarly, a steep screen shakes out more contaminants and affords several opportunities to sort as materials may fall back down the slope, but again the processing rate is reduced as the paper must work harder to move up the slope.

Bollegraaf's UK Service Manager, Harald van der Hoeven, uses a rule of thumb for testing the performance of a starscreen: "When set up correctly, the output should require only 0.8 pickers per tonne per hour for final cleaning up by hand. In other words, a starscreen processing ten tonnes of recyclates per hour should need only eight people."

Stars range from 165 to 600mm in diameter depending on the material to be sorted, and at Aldridge are made from polyurethane. This rubber-like material grips paper well and also bends slightly to resist damage, but also means the stars need regular replacement.

Schematic of the Aldridge MRF



Abbreviations

- CCIC: China Certification & Inspection (Group) Co. Ltd
- HDPE: High Density Polyethylene
- LDPE: Low Density Polyethylene
- MRF: Materials Recovery Facility
- News and PAMs: Newsprint, Periodicals and Magazines
- NIR: Near Infrared
- PET: Polyethylene Terephthalate
- PP: Polypropylene
- PVC: Polyvinyl Chloride

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