"Measuring recycling on the basis of monetary value"

PROF. DR. P.C. REM,
CHAIRHOLDER RESOURCES
& RECYCLING

95

THEME: RAW MATERIALS

PST PLANT INSTRUMENTAL IN ACHIEVING RECYCLING TARGETS

IS THERE LIFE AFTER STEEL?

NUMBER 8 - AUTUMN 2015 ARN

‘More than 80 percent of glass packaging is reused in new bottles and jars’

Municipalities are invited to participate voluntarily. Practice has shown that municipalities that operate a sound waste policy and separate more, enjoy lower costs and as a result lower waste collection charges; a clear and immediate result. “The municipalities themselves have also demonstrated their ambition by joining the Ministry in developing a vision on waste, that goes hand in hand with an equally ambitious implementation programme. That programme can count on broad support among the municipalities”, explained I&M.

Dual profit

One of the key principles behind the VANG project is that better separation must not result in higher waste collection charges for the population. The ‘polluter pays’ principle is fully enforced. For municipalities this is an essential trigger for achieving the ambitions set by I&M. At the same time, more and more waste substances are becoming worth money. For municipalities, that fact represents a dual profit; both financial and environmental. In addition to the cost aspect, the partners also face the challenge of taking up their own social responsibility. Experience from practice has shown the Ministry that better waste separation often also leads to more employment opportunities and local opportunities for innovation.

Encouraging the right behaviour

Naturally, achieving the VANG targets depends on the cooperation of individual citizens. The next obvious question is how cooperative are they? Are citizens in fact sufficiently willing to consistently separate waste and reduce their domestic waste flows, and what encouragement is available to them to make them take part? According to the Ministry, the separation of paper and glass has become fully accepted; if the process is made easy enough, it is self-evident for people to join in. Waste separation needs to offer households an advantage, for example in the form of lower waste collection charges. It is all about empowerment and encouraging the right behaviour. There is of course a difference if people live in a block of flats in a city, in a rural area or in low-rise accommodation. Part of the VANG programme is to organise pilot projects to investigate the circumstances in which people do separate their waste correctly, for example in high-rise accommodation.

‘A sound waste policy leads to lower costs and lower waste collection charges’

Chain approach

Separating waste is one thing, but even waste separation will not necessarily lead to less waste at the end of the chain. What can the Ministry do about that situation? How can Central government and municipalities ensure less waste per citizen? The policy at I&M is primarily aimed at preventing waste, for example by working together with the packaging industry to examine the amount of packaging produced. According to the Ministry, the knowledge and commitment of every link in the chain will be needed, including individual citizens and municipal authorities. In relation to all chains where their intervention is meaningful, municipalities and Central government will take the initiative of investigating how best to deal with raw materials throughout the chain. It starts at the front end of the chain with sustainable products. But at the end of the chain, consumers have a role to play too. “Not thoughtlessly disposing of items, or purchasing items that are thrown away soon afterwards can make a huge contribution to preventing the creation of waste,” argued the Ministry.

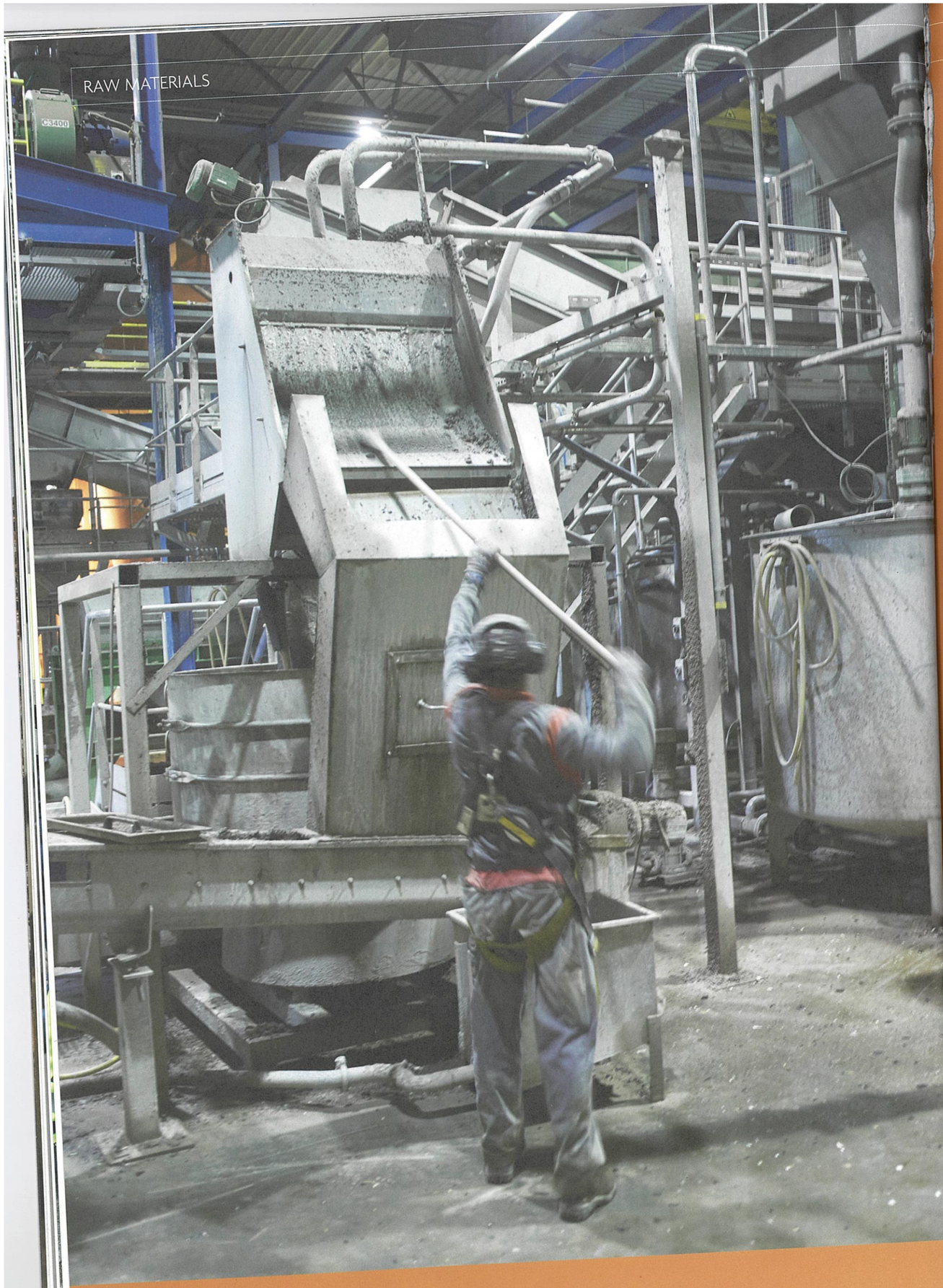
Improved use of raw materials

Over the coming period, the greatest challenges lie in tackling the chains. Within its VANG programme, the Ministry is therefore encouraging cooperation between the chain parties. A chain is currently being established, for example, for nappies and incontinence products. In other chains, such as soft drink cartons, plastics and textiles, it is hoped that cooperation will lead to better use of raw materials, in the future. At the end of the day, VANG aims to smooth the path for better made products, which can subsequently be better used, and at the end of the cycle better separated and collected, in such a way that the raw materials are recovered. ◂

PST PLANT: THE UNMISSABLE LINK

95

CASE STUDY: RAW MATERIALS



Since 1 January 2015, every member state of the European Union has been obliged to recycle 95% of the weight of an end-of-life car. At least 85% of materials must be recycled, while the balance up to at least 95% can be achieved with recovery, for example by energy recovery from incineration. The Netherlands already met these requirements in 2013 and 2014 and will probably do so again in 2015. Thanks to the PST plant in Tiel.

Text **Yvonne van der Heijden** Infographic **Michel Giezen** Photography **Maarten Corbijn**

"Without the post-separation of shredder waste at the PST plant, the Netherlands would not comply with the European obligations for car recycling," says Hans van de Greef, the director of ARN Recycling. "The reason for this is that roughly 20% of an end-of-life car's weight remains as shredder waste after it has been dismantled and shredded. It is impossible to comply with the requirement to recycle 85% of an end-of-life car if that waste is incinerated or landfilled."

Van de Greef points out that the official figures for ARN's recycling performance in 2013 and 2014 showed that post-separation was essential to increase the recycling percentage. "In 2014 the total recycling rate was 86.1%, with an additional 9.9% recovery. The PST plant accounted for 2.1% of the recycling of materials and 4.4% of the energy recovery. The year before, ARN reported a total of 86.0% recycling and 9.9% recovery, including 1.7% recycling and 4.3% energy recovery by the PST plant."

The secret

The secret of the PST plant lies in its advanced and complex separation installation. Van de Greef: "With mechanical separation, there are a great many steps involved in recovering raw materials from shredder waste that comes mainly from cars. Those steps include sieving, which involves separating materials on the basis of particle size and separating materials in air or liquid on the basis of density and magnetism. This leaves end fractions, such as plastics, fibres, minerals and metals, including copper, aluminium and iron."

The aim of the PST plant is to process at least 40,000 tons of shredder waste a year. "That is the total annual volume of shredder waste ▸

That the statutory target was achieved two years ago is partly due to a LIFE+ subsidy of one million euro that ARN received from the EU in 2011

from end-of-life cars in the Netherlands. In 2014, we recycled 40% of the shredder waste supplied to us. Before the PST plant went into operation, that waste would have been incinerated or landfilled."

LIFE+ subsidy

That the statutory target was achieved two years ago is partly due to a LIFE+ subsidy of one million euro that ARN received from the EU in 2011. "The LIFE+ subsidy enabled us to scale up the PST plant from the test phase to a fully operational facility," says Van de Greef.
ARN used the subsidy to gradually implement technical improvements in all of the processes in the PST plant. The modifications included changes in the feed system, the installation of a different type of pump and the use of alternative, more durable materials.
"The improvements have increased the efficiency of the production line. With more stable production, we can process a larger volume of shredder waste, and therefore produce more useful end products, each year," says Van de Greef. "Expansions of the separating line have also significantly improved the separation of materials, which results in purer end products with a higher quality and greater value."

Overcoming obstacles

Van de Greef and his team had to overcome quite a few obstacles during the construction and commissioning of the PST plant, ranging from finding a stable volume to feed into the production line to separating copper wires from the plastic fraction. The greatest challenge, says Van de Greef, was that the team had to design, build and commission an entirely new production line for the large-scale processing of car shredder waste from 11 different locations.

"There are other companies in Europe, mainly shredder companies, that have invested in the development of technologies to recover valuable materials from shredder waste. Their systems use elements from our production line, but the production line as a whole, built with the specific aim of meeting the 95% recycling target, is unique," explains Van de Greef.

Furthermore, the people who would have to operate the machines had no experience in the recycling industry. "It has been a steep learning curve for everyone concerned in the last few years. Getting the production line up and running was a question of trial and error. You have to remember that 170 different units are operating simultaneously in the plant and they all have to be synchronised."

Major advances thanks to LIFE+ subsidy

ARN has made major progress in optimising the processing line, partly thanks to the LIFE+ subsidy. "A tremendous amount of time has been devoted to finding the correct settings for all of the units to ensure that the entire production process runs smoothly," says Van de Greef. "A complicating factor is that the composition of the material streams delivered to us by the 11 shredder companies is always different. The LIFE+ subsidy has played a crucial role in enabling us to stabilise production."

The improvements that were made have had a positive environmental impact. Primarily, according to Van de Greef, because they have increased the efficiency of the production line. "With more stable production, we can process a larger volume of shredder waste each year. That yields more useful end products and simultaneously reduces ▸

LIFE+ en ARN

LIFE+ is a European Union programme that provides subsidies for the development and implementation of projects to support the EU's nature conservation and environmental policies. LIFE+ has three pillars: nature and biodiversity, information and communication, and environment policy and governance. ARN's LIFE+ project to improve the recycling performance in relation to end-of-life cars in the Netherlands falls under the heading of environment policy and governance, because it is designed to help the Dutch government to meet its EU obligations for car recycling.

A visit to the PST plant?

ARN is proud of its PST plant. We organise guided tours of the production line for the processing of shredder waste all year round. If you would like to visit the PST plant in Tiel, you can request further information and apply for a visit at info@arn.nl.

R&D: **Continuous guarantee** of sufficient recycling

"Research & Development is very important for the PST plant. Our intention is to ensure that we constantly achieve sufficient recycling. We also endeavour to save costs and increase revenues. R&D is also essential to optimise the production line."

"A good example is the heavy plastics fractions, which contained a great many copper wires. We conducted research for a year to discover a method of separating the metals. That involves analysing which machines are suitable and investigating whether there are potential customers for your end products. In June 2015, we finally installed additional machines to recover copper, aluminium and stainless steel. This was a major investment, but we are now producing a very good copper fraction that goes directly to a copper foundry. As a result, the revenues from the heavy plastic fraction have increased by tens of euro per ton, thus proving that R&D pays for itself."

"Another thing we do is search for possibilities for recycling the end fractions that still follow the thermal route, such as the intermediate fraction of plastics that goes to blast furnaces in Germany as a substitute for coke and oil. Our research led to the purchase and installation of three new machines to recover wood and rubber from the floating and intermediate fractions of plastics. Consequently, we produce 40% more, cleaner plastic that can be re-used as a raw material in the plastics industry. This fraction now has a positive end value. One of ARN's priorities in the area of R&D is to further improve the separation of plastics."

"We are currently looking for alternative high-grade applications for a mineral fraction that is currently used as a filler for road building in France. We are investigating whether smelting it into basalt to produce building materials is an option. It might also be possible to crush the glass from another mineral fraction to produce rock wool or bricks. We have not yet completed that research. Finally, R&D plays a key role in the Advanced Recycling Solutions fibre project."

Allard Verburg
Manager Business Development ARN Recycling

Advanced Recycling Solutions (ARS)

"Advanced Recycling Solutions (ARS) is a project designed to find ways of increasing the recycling and reducing the incineration of materials from the PST plant. We are mainly investigating processing methods that can convert the fibre fraction into re-usable materials. Every year, 10,000 tons of fibres are recovered in Tiel from textile products in car interiors, such as seats, ceilings and dashboards."

"We are searching for a feasible solution in a network of companies and experts from the PST plant and elsewhere. We already know what techniques can be used to compact the fibres into pellets (similar to dog feed), which can then be sold to an end user."

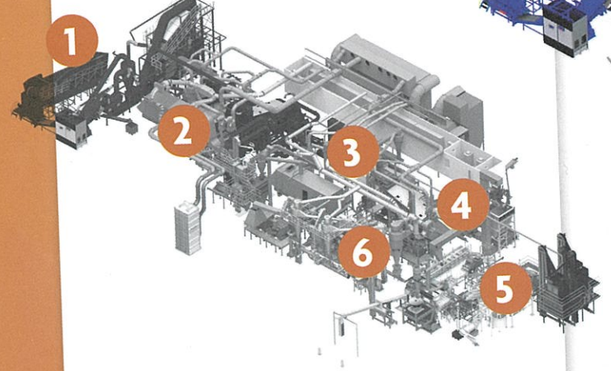
"The technical challenge ARN faces is to produce the purest possible fibre, with the wood and copper residues that disrupt the process removed as far as possible. And to find a solution for the moisture-content of fibres, which varies so greatly with the seasons. The moisture content is 2% to 3% in the summer and 12% to 15% in the winter."

"We have made so much progress that we are now looking for customers. ARS pellets could be used in a number of moulding processes, such as die casting, hot pressing and extrusion, a method in which a flexible material is forced through a matrix. The composition of the pellets depends on the wishes and specifications of the customer. We limit ourselves to four or five recipes, each of which gives the material its own specific properties in terms of aspects such as strength or flexibility."

"Our materials can be used as a partial substitute for wood in certain products, for example for fencing poles around a field. With further development, it should in future be possible to reuse ARS pellets in the automotive industry, in which case the life cycle of fibres will be closed."

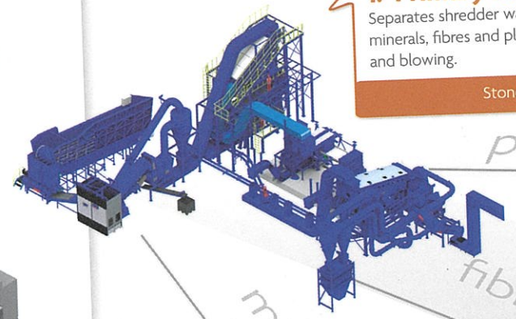
Wim Spierings
Project Manager, Advanced Recycling Solutions (ARS)

PST plant



At the PST plant in Tiel, the raw materials present in shredder waste are separated out. The result is 4 different fractions, for which the various machines in the plant have each been painted in their own colour, broadly along the following lines: metals (red), plastics (green), fibres (orange) and minerals (yellow).

En route through the plant, the material passes through no less than 170 different machines in which the waste is sieved and centrifuged, ground using hammers, and separated using a sink-float mechanism, until they are pulverised into the finest possible homogeneous particles.



1. Primary separation

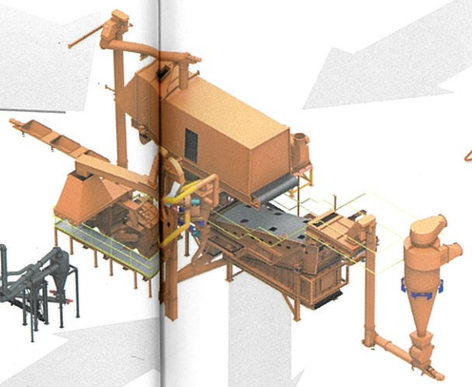
Separates shredder waste into three main flows: minerals, fibres and plastics, by sieving, grinding and blowing.

Stone • Rubber

plastics

fibres

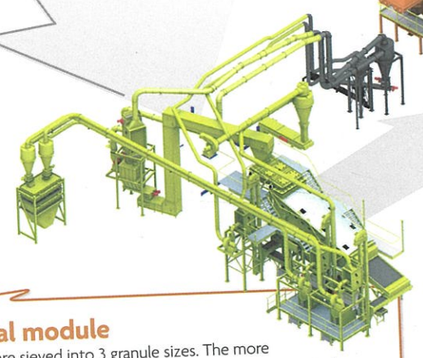
minerals



2. Fibre module

The supply of fibres comes from the primary module, but fibre residue is also supplied from the yellow and green modules. The copper wires are removed from the fibres using a percussion crusher.

Fibres

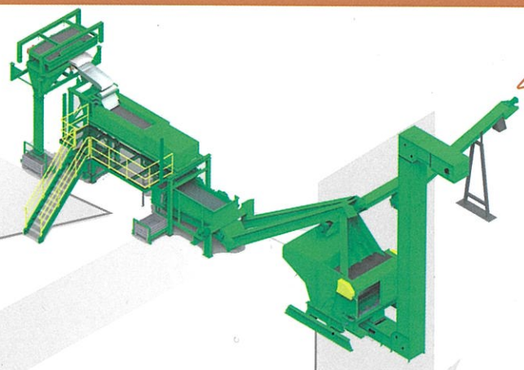


3. Mineral module

The minerals are sieved into 3 granule sizes. The more even the material size the easier it is to separate out unwanted fibres and other contaminants. The 3 output flows serve as raw material for applications in road building.

Minerals

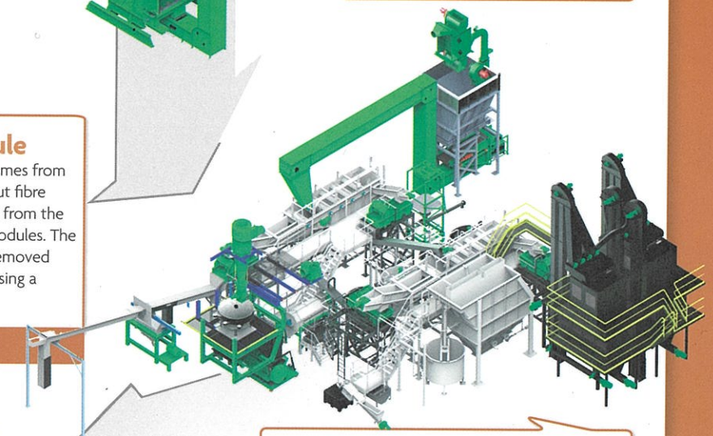
The plastics contain numerous contaminants such as wood and rubber, but this flow also contains large amounts of aluminium, iron and copper.



4. Plastic pre-separation module

Using a magnet, an Eddy Current and a special sieve, aluminium, iron and rubber are separated before the material is ground into the most evenly-sized particles possible

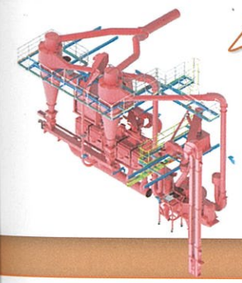
Rubber • Aluminium



5. Plastic module

The ground plastic is passed through a sink-float separator, which separates the plastic types from one another in 2 baths, according to their specific gravity. The output is three plastic flows: PP&PE, a blast furnace fraction and a heavy fraction that contains large amounts of copper.

Plastic PP&PE • Plastic blast furnace fraction



6. Metal module

The heavy plastic fraction and the copper wires from the fibre module are passed through a new module to remove the copper and aluminium. This is achieved using a percussion crusher that beats the copper wires into tiny balls, at which point they can be separated out on an air table.

Copper • Aluminium • Plastic

History of the PST plant

2005

On 25 October 2005, it is announced that the PST plant will be built to mark ARN's 10th anniversary.

2004

It is decided that the PST plant has to be built in anticipation of the 95% recycling obligation from 2015.

2006

Tiel is chosen as the site of the plant because of its location: in the centre of the Netherlands, on an easily accessible business park and on major routes to potential customers in Germany.

2008

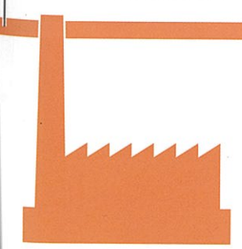
The ground-breaking ceremony is held on 10 July 2008.

2010

The PST plant is completed The construction of the PST installation commence in April 2010. The first machines, hammer mills, are delivered on 8 September 2010.

2011

The PST plant is officially opened by State Secretary for Infrastructure and the Environment Joop Atsma on 28 April 2011. A LIFE+ subsidy is awarded in September 2011, for the period up to 1 September 2015. The PST installation goes into operation and production commences in November 2011.



2012

9,000 tons of shredder waste are processed.

2013

In March 2013, the input of shredder waste is adjusted in order to stabilise the production line. This plays an important role in the further growth of production capacity. From 1 May 2013, the production line starts operating around the clock, five days a week. 25,000 tons of shredder waste are processed in 2013. ARN complies with the 95% recycling target.

2014

The installation for the separation of rubber and wood is installed in September 2014. 36,000 tons of shredder waste are processed in 2014. ARN meets the 95% recycling target.

2015

The installation for recovering metal is installed in June 2015. The aim is to process 42,500 tons of shredder waste in 2015. ARN will probably meet the 95% recycling target in 2015.