

Polymer recycling comes of age

Petrochemical companies, packagers and brand owners can now boost their circular economy performance by chemically recycling waste plastic diverted from landfill

WILL BEACHAM BARCELONA

A UK-based start-up is close to commercialising a facility which takes municipal plastic waste and chemically recycles it into the petrochemical feedstock naphtha plus other oils and waxes. The group is looking for chemical industry partners to invest in the company and its technology.

Recycling Technologies is constructing a £5m, 1 tonne/hour unit which will be installed at a waste facility near Perth, Scotland, by the end of 2018.

The company aims to expand production of the units – known as the RT7000 – rapidly and is currently signing terms for a new location in Swindon, southwest England, which will have capacity to manufacture up to 200 machines/year. As economies of scale increase, the cost/unit should decline.

Recycling Technologies' claims to offer a solution to companies across the entire polymer value chain which want to engage with the circular economy and improve environmental performance and recycling rates. Small, modular units are placed next to municipal waste plants where plastic which cannot be recycled mechanically is recovered and recycled. The resulting feedstock, known as *Plaxx*, can be configured as naphtha, industrial wax or heavy fuel oil.

Company strategy is to initially build, own and operate at least 12 machines in the UK and northern Europe. This will allow it to gain operational and maintenance experience and make design enhancements. Revenue will be generated from the plastic waste gate fee paid by the waste companies together with *Plaxx* sales.

As the technology matures, Recycling Technologies will start selling the machines worldwide with recurring revenues generated

through the supply of spares and a remote monitoring service.

If the company reaches full capacity it will produce and sell 200 machines annually, each able to handle 7,000 tonnes of plastic waste. This will add 1.4m tonnes of recycling capacity every year. Each tonne of plastic waste is converted into 750kg of *Plaxx*, giving each plant 5,250 tonnes/year capacity.

If successful over the next 10 years, the company plans to build capacity to recycle 10m tonnes of plastic each year, quadrupling current EU plastic recycling capacity. The capacity will provide the plastics sector with 7m tonnes/year of *Plaxx*, replacing fossil-fuel based raw materials.

The chemical recycling technology was developed at Warwick University in 2010.

According to sales and marketing director, Adrian Haworth, a great response from industry to the technology drove the decision to commercialise. With venture capital investment a 1kg/hour pilot plant was built which ran for a year. Then at the end of 2013 more capital was raised to build a beta unit of 100kg/hour. The local council in Swindon, UK, offered space in a large shed next to their recycling facility.

At present this machine is operating to showcase the technology while the design is finalised

ADRIAN HAWORTH
Sales and marketing director,
Recycling Technologies

"We are looking for additional equity participation of chemical businesses who could add technical and industry knowledge to allow rapid expansion"



Polymers can now be chemically recycled from municipal waste

for the first 1 tonne/hour plant which will be shipped to Perth, Scotland. This is being financed through a £1m grant from the Scottish government plus £4m from venture capitalists.

The idea is to have smaller, modular plants which you can take to the waste plastic rather than vice versa because the cost of transporting waste plastic is prohibitive.

Haworth says: "It became very apparent that there was a lot of plastic – feedstock was never going to be an issue. We aim to recycle residual plastic that can't be mechanically recycled economically – this is the majority of waste plastic."

Following modifications, the Swindon unit was restarted in April with a plan to run it for 24 hours, five days a week. It will run intermittently to allow for testing by potential commercial partners such as Tetrapak and other packagers who want to show their material can be recycled.

ELLEN MACARTHUR LINKS

The company has collaborated with the Ellen MacArthur Foundation, an influential think-tank which campaigns for circular economy.

Recycling Technologies proposed that recycling rates for plastics could rise from the 10% mechanical recycling figure quoted by Ellen MacArthur to 90% if mechanical and chemical recycling run alongside each other.

According to Haworth: "The first unit is around £5m but we'd hope that price would come down once we're mass manufacturing. Even with that investment payback will take less than three years."

The plants initially produced a very heavy, low sulphur crude oil suitable for fuel oils. But after talking to wax manufacturers plus Borealis, SABIC and others about naphtha, a wider range of products will be marketed. "The chemical people are telling us they can take all of the oil, not just the naphtha. There is a very strong appetite to investigate the use of chemically-recycled product. The wax cut is already sold whilst C6-C35 cuts would be blended into petrochemical feedstock," says Haworth.

There have been discussions with a number of major companies who have signalled that there is an appetite in the chemical sector to move into recycling.

On 21 May the company revealed it has signed a £50m offtake deal with trading group InterChem to sell the polymer proportion of *Plaxx* from all 12 RT7000s over the next five years. InterChem also paid £1m for a 4% stake in the company. Recycling Technologies inked a £15m agreement with wax manufacturer Kerax which will buy all the wax portion of *Plaxx* over the same time period.

Haworth says Recycling Technologies is interested in partnering with more chemical companies, having just raised £3.7m through its own investors. "Separately, we are looking for additional equity participation of chemical businesses who could add technical and industry knowledge to allow rapid expansion. We are now looking for another £10m and have appointed [merchant bank] Turquoise International to start talking to the venture capital guys. We'd like to understand from the petrochemical majors at what stage might they take part."

He says early-stage discussions are currently taking place about selling a stake in the company to a chemical partner.

85% ENERGY-EFFICIENT

The process is 85% energy efficient and 75% mass efficient giving 5,200 tonnes of *Plaxx* from 7,000 tonnes of plastic waste. The process uses 15% of the energy in the waste plastic as the energy source for thermal cracking.

Around 3% of the throughput emerges as hazardous waste in the form of a tar plus the attrition of the ceramic thermal medium used

KEY FACTS

- First £5m unit by end 2018 near Perth, Scotland
- Chemically recycle municipal plastic waste
- Produce naphtha, wax or other cuts
- 12 units to be located in UK and Northern Europe
- Each has 5,250 tonnes/year production capacity
- Offtake deals totalling £65m signed in May 2018
- Long-term plan for 200 units annually

» in the machine. While the material is currently dumped in landfill, research is underway into minimising halogenated material in the waste.

There is no shortage of future locations for RT7000 machines. With around 40 sites currently under discussion Haworth says the company has stopped acquiring sales leads for sites at present while it processes the current list. For 10 of these sites, heads of terms discussions are taking place. All the wax has been pre-sold for the first five years and a sign should be signed “imminently” for all liquid *Plaxx* products for the same period.

The wax sales contract covers the volume produced by the 12 Recycling Technologies’ build, own and operate sites. The plan is for three units in Scotland, four in England and five under discussion near Rotterdam. After that units will be sold.

They are designed at one tonne/hour because that is the maximum size you can get in a 20ft container. Also a town of 150,000 people will generally have its own recycling facility which could produce enough waste plastic for one machine of this capacity.

“We are convinced that by then there will be a big market for recycled oil products. Our trading partners will have the first opportunity to buy from these plants. How the *Plaxx* is used depends on demand – in the Phillipines we expect it to go for marine fuel but in Europe it is destined for petrochemicals.”

Haworth says he sees the units just as a tool in the box of the recycling facility. Sites are being chosen which are already permitted and have space so the rollout can be very quick indeed. For the first 12 units Recycling Technologies will lease land with the waste facility owners paying a gateway fee for the waste plastic they supply. However, the company plans to charge less than the waste facilities currently pay for landfill or incineration.



Recycling rates for plastics could rise from the 10% Ellen MacArthur figure to 90%

The *Plaxx* will then be produced and marketed by Recycling Technologies at this stage in the development cycle. Most recycling sites have sorting equipment which has never been used because there is currently no home for residual plastic without chemical recycling. In Germany, France and Denmark (and in Scotland when the project starts) plastic waste will be collected separately. The plastic will then go off to a plastics recycling facility rather than being contaminated with other waste.

The recycling facilities will then sort out the plastic of value such as polypropylene (PP), polyethylene (PE) and polyethylene terephthalate (PET) for mechanical recycling. The rest of it is destined for the RT7000 chemical recycling facility.

Haworth says the group has spoken to some of the chemical players about them

building a big site to take a much larger volume of regional plastic. But the cost of transporting the plastic long distances is high so it does not make sense. “The distributed model is the way to go – the waxes can often be used locally so it doesn’t all have to be aggregated into a big refinery.”

Chemical companies do not currently own distributed assets and they do not normally handle waste. “So we are in discovery mode to find out where this is going. It may be that the waste companies are more natural partners.” But, he says, right now there is huge interest from the petrochemical sector rather than the waste companies, adding: “Packaging people throughout the value chains are interested: supermarkets, fillers, packaging manufacturers, the branders. They all have this problem of recycling plastic so they are the ones who really want this to succeed.” ■

CHEMICAL INDUSTRY VIEWPOINT: PAUL HODGES

Q: Why would it be attractive for petrochemical companies to invest in Recycling Technologies or buy an RT7000? It does not fit the conventional business model for a petchem company.

A: “Consumer pressure has already led 12 major brand owners including Unilever, Nestle, Coca Cola and Pepsi to commit to a vision of only using “100% reusable, recyclable or compostable packaging by 2025”. Polymer producers therefore risk losing some of their key customers if they can not provide packaging that meets these criteria. Their problem is

not that PE and PP and other plastics cannot be recycled, but that the recycling industry has not kept up with the market need. So it makes sense for companies to consider moving into the recycling space themselves via an investment in order to maintain their market position.

Q: The machines follow a distributed rather than centralised production method. Is it feasible for chemical companies to locate small-scale plastic production facilities next to an RT7000? Would require use of non-conventional production technologies

for continuous, rather than batch production?

A: “This would certainly be an option for the future, and could be very profitable. In the short-term, however, the business model is to retrofit to the current manufacturing process. The Recycling Technologies innovation is to take the solution to the problem by operating an RT7000 on the waste site. Its output can then be used as a cracker feedstock into existing petchem plants, or as wax.

Q: How close are you to signing deals with chemical companies?

A: “We are seeing an encouraging amount of interest from companies around the world. Many have already visited the site to see the beta unit, and we are now starting discussions over investment terms. In May we signed deals with InterChem and Kerax to take all *Plaxx* output from the planned demo units for the next five years [see main article].” ■



Paul Hodges is a non-executive director at Recycling Technologies as well as chairman of consultancy International eChem