

PETROCHEMICALS

Recycle revolution

A paradigm shift is underway in the plastics industry, due to the impact of plastic waste in our oceans and environment. The shift to a circular economy will also have a marked impact on the oil and gas sector, explains Paul Hodges MEI, Chairman of the petrochemical consultancy International eChem.

Plastics producers now find themselves pressured by consumers, legislators and brand owners to refocus on the sustainability agenda. Only a few months ago in Vienna, at the ICIS World Polyolefins Conference, Europe's second largest polyolefin producer, Borealis, announced its vision 'to establish plastic waste as just another standard feedstock' for the industry.

This paradigm shift will have a critical impact on future demand for oil and gas. In the short-term, it will reduce demand growth. In the medium to longer-term, waste plastic could become an important feedstock in its own right, thereby reducing demand for virgin feedstocks. Oil and gas companies, as well as OPEC and the International Energy Agency (IEA), therefore need to revisit their future demand scenarios.

Polyethylene (PE) is the largest volume plastic, with 92mn tonnes produced in 2017, and it highlights how the sustainability issue has moved to the top of the industry's agenda. Already 12 major brands, including Coca Cola, Unilever, Nestlé, Wal-Mart and Pepsi – responsible for more than 6mn t/y of plastic packaging – are committed to working towards using '100% reusable, recyclable or compostable packaging by 2025'. We can be sure their numbers will grow over the next few years.

PE's problem is that more than 50% of its demand goes into single use packaging. Following the publication of a report from the World Economic Forum on the New Plastics Economy initiative in

2016¹, and Sir David Attenborough's *Blue Planet 2* series for the BBC, it is clear this application is under major threat.

The New Plastics Economy initiative involves leading participants from across the global plastic packaging value chain. Its report warned that on current trends, the oceans would contain more plastics than fish (by weight) by 2050 – a clearly unacceptable outcome. Already, it has helped lead the European Union to develop an EU 'Strategy for Plastics in the Circular Economy'² which aims to 'transform the way plastics and plastics products are designed, produced, used and recycled'. The EU Strategy's goal is for all plastics packaging to be recyclable by 2030. It also highlights the need for specific measures, possibly a legislative instrument, to reduce the impact of single-use plastics, particularly in our seas and oceans.

The issue is not that PE and other plastics, such as polypropylene, can't be recycled. It is simply that the recycling industry has failed to understand the true value of waste plastic as a resource. For example, industry association Plastics Europe estimates that Europe produced 60mn tonnes of plastics in 2016, but recycled just 5.3mn tonnes of plastic post-consumer waste within the EU. This highlights the challenge – and the opportunity – for plastics producers.

In the past, they have seen access to competitive sources of feedstock as being a choice between oil and gas – principally between naphtha in Europe, Asia and Latin America, and ethane in North America and the Middle East. But now, recycled plastic is set to be the growth feedstock for the future. The Recycling Technologies company, for example, has developed a modular machine based on pyrolysis technology that chemically recycles unsorted, post-consumer plastics into cracker feedstocks, with the aim of installing a minimum of 10mn t/y capacity within 10 years.

Winners and losers

Paradigm shifts generally produce winners and losers. In this case, the winners will be those plastics producers who adapt to the new opportunity created by the need to produce recycled plastic. This will clearly require investment in recycling facilities, but the sums involved are small compared to the cost of building new olefin crackers or refinery capacity. And in many countries, producers can even expect to be paid to take the recycled plastic as a feedstock, when the alternative is the cost of sending it to landfill.

The losers will be existing feedstock suppliers. Many oil majors have assumed that rising demand for petrochemicals will help to compensate for demand lost to electrification in the transport sector. Similarly, OPEC's recent *World Oil Outlook 2040* saw petrochemicals as providing 'significant growth' for the future. The IEA will also need to revisit its assumptions about future demand growth as the impact of the new paradigm becomes more apparent.

Different geographies will move at different speeds with the switch to recycling. But it is already clear that consumers in emerging economies have exactly the same priorities as those in the west. Indonesia, for example, recently had to use its army to unblock rivers in Bandung, as these had become completely blocked with plastic waste. China is similarly engaged in a 'war on pollution', which is seen by President Xi Jinping as one of his 'three tough battles' to secure China's goal of 'becoming a moderately prosperous society' by 2020.

As National Geographic has reported (July 2017), the world has produced around 8.3bn tonnes of plastic over the past 60 years and only 9% has been recycled. This is a shocking waste of a valuable resource. The paradigm shift now underway is well overdue. ●

References

1. <http://newplasticseconomy.org>
2. http://ec.europa.eu/environment/circular-economy/index_en.htm

PLASTICS

Circular approach to tackling waste

Application of circular economy principles could transform the future of plastics and dramatically reduce negative impacts in terms of ocean pollution and the like, reports *Brian Davis*. But what will this mean in terms of traditional feedstocks?

Moves towards a more sustainable world will entail significant decoupling from current consumption of finite resources (such as hydrocarbons) and demands designing waste out of the system. The transition to renewable sources is based on building a 'circular economy model' which covers economic, natural and social capital.

According to the Ellen MacArthur Foundation, the circular economy model is based on three principles – design-out waste and pollution; keep products and materials in use; and regenerate natural systems (ie soil). The foundation co-authored with the World Economic Forum the *New Plastics Economy Report*, which clearly supports European Commission initiatives designed to encourage a more circular economy, demanding new technologies in terms of material design, reprocessing and renewable sourcing (see also p18).

In May 2018, the UK Department for Business, Energy and Industrial Strategy (BEIS) announced a new global research and innovation hub to tackle the urgent issue of plastic waste in our seas, using more sustainable alternatives. The UK, India, Canada and other Commonwealth nations have signed up to be part of the new Marine Plastics Research and Innovation Framework. The UK government is contributing £25mn to the hub, with financial support by Unilever, Waitrose and others, and professional input by the British Plastics Federation, the Ellen MacArthur Foundation and Mott MacDonald.

Leading plastics producers, like Borealis, have expressed full support of the European Commission in its call for action to accelerate the journey towards a 'circular plastics economy', but are also aware of the challenges ahead.

Markku Korvenranta, Executive Vice President Base Chemicals of Borealis, told *Petroleum Review*: 'Our vision is indeed that plastic waste becomes the feedstock to

manufacture our future products. We're certainly not there yet and we are convinced that this will be a transition which we want to drive. During this transition, we will gradually replace virgin [plastic] in selected applications while remaining compliant with existing chemical, safety and sector regulations (eg REACH, EFSA etc) and meeting the expectations of the individual value chains.'

'To enhance the existing recycling value, more and better collection and sorting will be required. Design guidelines and protocols for recycling need to be better implemented and significant innovation efforts need to be made. Areas of innovation include chemical recycling, physical/solvent-based recycling and purification technologies. These novel recycling technologies could one day become game-changers, but at the moment they are still far from being scalable and mature.'

Considering the future of plastics' feedstock, Korvenranta also had some important things to say. 'On a more general note, our approach to using plastic waste as an alternative feedstock is the same as our approach to biofuels. We will need to be convinced that using any alternative feedstock would result in an overall better sustainability performance and would actually reduce externalities to the environment, while guaranteeing safety to consumers in comparison to fossil fuel. Mechanical and chemicals recycling together with biomass, renewable energy, electrification and energy saving initiatives will gradually reduce the need for oil-based feedstocks in the plastics industry. The oil industry with its processing, logistics and innovation capabilities, can play an important role in enabling the shift.'

The argument is taken up by Daniele Ferrari, Chief Executive Officer of Versalis, an Eni company, in response to the question: 'How will plastics companies respond to the circular economy, and does this mean less dependence on oil/gas as a feedstock?' He also believes it is a

chance for the industry to brush up its image.

'The circular economy and related plastics strategy may represent a political and regulatory challenge for the chemical business. From the Versalis point of view, it is an important opportunity to improve competitiveness by pursuing resource efficiency and by developing innovative solutions capable of responding to new market trends. At the same time, it is a chance to restore the industry's image in terms of sustainability.'

'Versalis' commitment to the "circular economy" is an ambitious plan driven by innovation to transform our business model and to define new sustainable solutions that can actually help overcome global issues, including marine litter.'

'Our approach takes into account the entire product lifecycle, and becomes effective through specific projects related to product innovation and eco-design, feedstock diversification and polymer recycling. These projects rely on in-house research and on partnerships with other players along the value chain. Regarding feedstock diversification, it is fundamental to assess the product impacts by considering the alternative raw materials' environmental, social and economic impacts from a lifecycle perspective. We think that diversification needs to be synergistic with traditional feedstock, in order to obtain the best performances with a lower environmental impact.'

To sum up, 'Versalis is working on chemistry from renewables, with the aim to increase resource efficiency and feedstock availability, and to expand the portfolio with products of higher added value. We are also investigating the use of feedstocks obtained from secondary raw materials. Finally, we are committed to promote and develop new and improved recycling technologies (chemical, physical and mechanical), also involving processors, recyclers, associations and technology partners.' ●

Photo: mtm Plastics