Fidelity
White Paper

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Waste Side Story: The other side of consumption

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Executive summary

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Waste management is one of the most critical problems we face. Our consumer lifestyles create vast amounts of waste, and how we handle it determines our health and the impact we have on the climate. This waste mountain is only set to grow, especially as emerging markets develop a taste for Western consumerism. By 2050, the World Bank predicts that waste growth could be twice as fast as population growth[1] and, if not managed correctly, will have a devastating impact on our lives and the planet.

Fortunately, plenty of companies across the world are developing new techniques to turn our unwanted rubbish into a valuable commodity - from revolting yet efficient cockroach factories that morph food waste into cosmetics to the more urbane recycling of coffee pods into bicycles. In this paper, we examine how the industry is responding to forces such as the Chinese ban on waste imports and European regulation (page 4), and the multiple ways to invest across the value chain, from waste-to-energy plants to advanced recycling to disruptive collection and sorting technologies (page 6).

Societal and economic pressures are growing to make the most of our resources, as it becomes inescapable that we will have to treat waste in a way that reduces greenhouse emissions. We believe the waste sector offers an array of long-term secular growth opportunities, with limited cyclical volatility.

[1]Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development; Washington, DC: World Bank. © World Bank. License: CC BY 3.0 IGO

A brief history of waste: Urbanisation

Waste has long been part of human existence. Until the mid-20th century, however, residual waste mostly consisted of pottery and ash[2]; everything that was not reused was effectively compostable whether dumped, buried or burnt. After the second world war, more and more waste was created that nature could not break down, such as petrol-based plastics and synthetic hormones.

Burning rubbish also became more difficult as countries turned away from allowing domestic coal fires. In the UK, the government introduced the 1956 Clean Air Act, which prevented certain types of waste from being incinerated, meaning waste had to be buried on a large scale.

As the age of mass production got underway and disposable incomes increased, goods became cheaper and better packaged, and the "throw-away" society was born. Cities became the worst offenders in terms of generating waste as their populations grew. After a century of mass urbanisation across the globe, they now account for 75 per cent of natural resource consumption, 50 per cent of global waste production and 60-80 per cent of greenhouse gas emissions (GHG)[3].

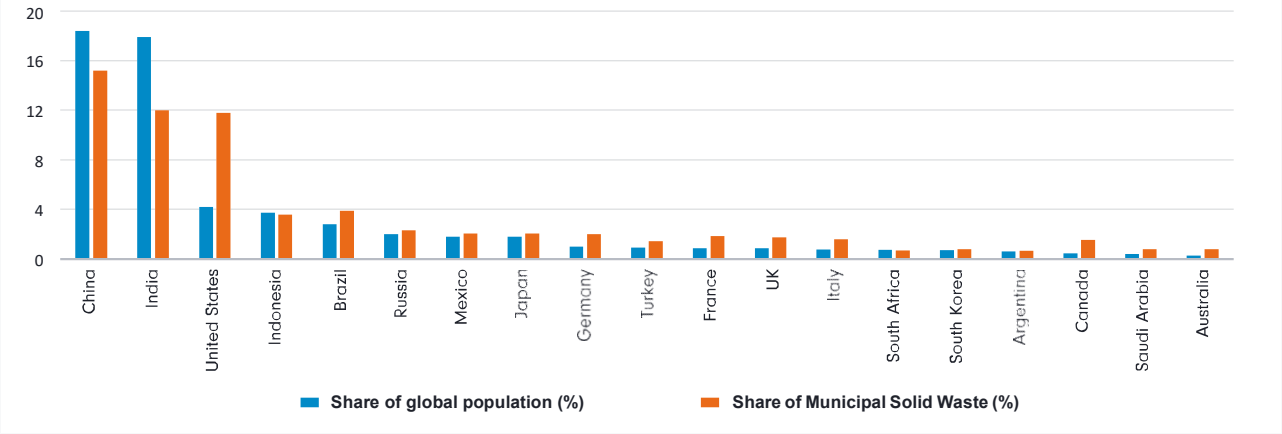
Populations in high income countries have largely urbanised already, so their waste production is growing by a lower percentage than in the past. Having created the problem in the first place, their wealth now enables them to be more conscious of their waste generation and for some even to adopt trends such as buying second hand clothes locally instead of relying on 'fast fashion' (i.e. cheap clothes made in low-income counties and transported long distances). The exception is the US, which is still the largest generator of waste per capita with the least recycling. But generally waste growth in lower income countries with an emerging middle class and greater urbanisation is growing more rapidly.[4]

Around 80 per cent of waste collected in emerging economies is disposed of in open air dumps and unregulated landfill sites, resulting in rising air, soil and groundwater pollution.[5] But all parts of the world are struggling to find alternatives to landfill, with some countries having more success than others.

After a century of mass urbanisation across the globe, cities now account for 75 per cent of natural resource consumption, 50 per cent of global waste production and 60-80 per cent of greenhouse gas emissions.

[2]Herbert, L. (2007). Chartered Institution of Waste Management: Centenary History of Waste and Waste Managers in London and South East England. [Online]. Ciwm.co.uk.
[3]Ellen MacArthur Foundation (2017). Cities in the Circular Economy. [Online] [Accessed 8 Mar. 2019].
[4]Verisk Maplecroft, 2019
[5]Suez (2017). Improving waste management in emerging economies makes a substantial contribution in the fight against climate change - SUEZ Group. [Online] [Accessed 8 Mar. 2019].

Chart 1: US generates most waste per capita



Source: Verisk Maplecroft 2019.

Major trends: Growth, onshoring, regulation and circularity

Waste sector outperforms rest of economy

The disposable culture of developed economies, which is swiftly spreading to developing nations, has driven growth in waste of all kinds. Beyond the obvious municipal waste, other complex materials need to be broken down, including electronic, chemical and nuclear waste, even space debris.[6] The World Bank estimates that by 2050 developed nations will produce 25 per cent more than today's levels, East Asia 50 per cent more, and South Asia twice as much.[7]

> The future of the waste sector lies ultimately in the move to a circular economy.

That's why households, companies and governments must find cost-effective yet environmentally-friendly solutions to manage this waste. Virgin material productivity (i.e. ensuring the initial extraction of raw materials is as efficient as possible) and waste reduction are vital[8], but the future of the waste sector lies ultimately in the move to a circular economy. A circular economy is one in which resources are made maximum use of before being recycled into other products or returned to nature, as opposed to a linear economy where raw materials are converted into products and then thrown away.[9] The waste management sector is expanding and innovating rapidly to meet these demands. In the UK, the waste sector has outperformed the rest of the economy in terms of gross value added for much of the last two decades and the trend looks set to continue (chart 2).

The Chinese Sword: Clamping down on waste imports

The second trend is the development of new destinations to deal with waste, particularly from developed markets. This began in 2018 after China closed its doors to waste imports due to growing environmental concerns. It banned 24 types of recyclables and solid waste (mainly considered to be contaminated) from being brought into the country. This legislative change, known as the Chinese Sword, sparked a global waste crisis because it cut off the main route of disposal. For 20 years, developed countries had exported over 70 per cent of their waste to China for treatment and recycling.[11]

Those countries now need other solutions. The cost of onshore recycling is higher in developed economies as they cannot rely on the low-cost labour of developing nations for manual sorting, so the most cost-effective solution remains to export it. The UK is now exporting waste to Malaysia where imports have tripled since the Chinese ban, although UK exports overall have fallen 17 per cent.[12] The US has significantly increased its exports of plastics to Thailand (400 per cent), Vietnam (105 per cent) and Malaysia (295 per cent).[13]

These south east Asian countries cannot absorb large amounts of waste indefinitely. Malaysia has already introduced a tax on plastic imports and tightened regulations, after local residents near plastic processing factories complained about air pollution. This and the fact that an estimated 111m tonnes of plastic waste from the US will not have a final destination by 2030 highlight the urgent need for a ramping up of local waste management in developed markets, shifting from offshore to onshore solutions.[14]

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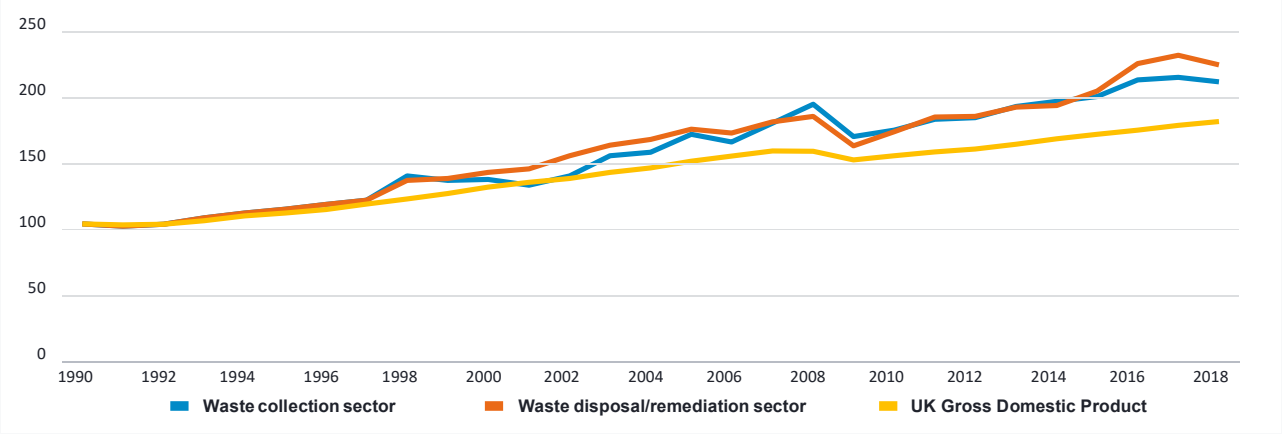
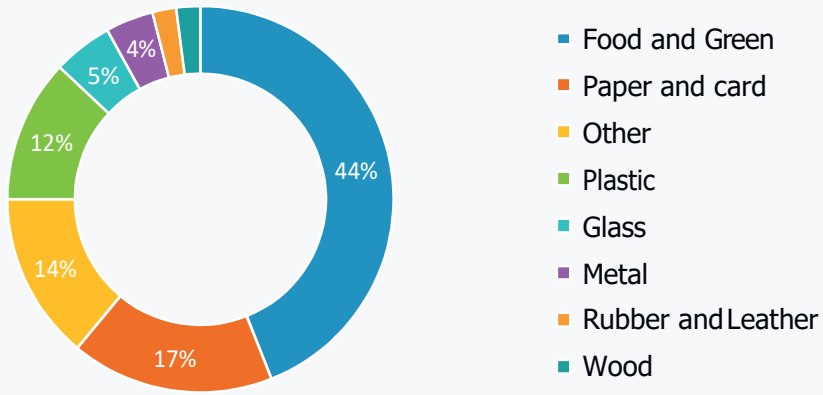
[6]Surrey University. 2018. Surreyacuk. [Online]. [1 April 2019].
[7]Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050. Urban Development; Washington, DC: World Bank. © World Bank. License: CC BY 3.0 IGO
[8]Business Green. (2019). OECD: Global resource use set to double by 2060. [Online] [Accessed 8 Mar. 2019].
[9]Ellen Macarthur Foundation.
[10]Ons.gov.uk. (2017). Non-financial business economy, UK: Sections A to S - Office for National Statistics. [Online] [Accessed 8 Mar. 2019].
[11]Hazra, S. 2019. Sustainable Plastics. London: Kepler Cheveraux.
[12]Powell, J. n.d. 2018 Recycling Market Update. Resource Recycling. [Online]. [Accessed 7 March 2019].
[13]Dhiraj, A. 2018. Study: The Top Importers (and Exporters) Of The World's Plastic Waste And China Won't Accept Plastic Trash Anymore. CEOWORLD magazine. [Online]. [Accessed 8 March 2019].
[14]Brooks, A., Wang, S. and Jambeck, J. (2019). The Chinese import ban and its impact on global plastic waste trade. [Online] [Accessed 19 Mar. 2019]. Science Advances.

Chart 2: The waste management sector has grown faster than the UK economy



Source: Bloomberg, Fidelity International, November 2019.[10] Chart is rebased to 100 in 1990.

Chart 3: Plastic is the most visible form of waste, but food and foliage account for the majority



Source: World Bank, 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development; Washington, DC

Regulation: Europe takes the lead

The third trend, not unrelated to the second, is an increase in regulation. Europe has taken the lead, especially in relation to plastics, and the message is spreading. Over 40 countries have now introduced plastic bag legislation or outright bans, and more are likely to follow.[15] Others are using subsidies or tax breaks to encourage recycling and energy from waste.

The European Union (EU) has also introduced measures designed to create a circular economy and keep emissions within target levels in the Paris Agreement. These measures (introduced in 2018) aim to recycle 70 per cent of municipal waste and 80 per cent of packaging waste (including all plastics) by 2030, as well as reduce environmental impact.[16] The EU Landfill Directive (adopted in 2001) requires reductions in landfill waste of 65 per cent and the recycling of 50 per cent of household waste by 2020. In 2014, the UK government estimated that £8bn[17] of investment was needed to meet these targets within six years - in an industry with an annual turnover of £9bn[17] - but progress is being made thanks in part to a landfill tax introduced in 1996 which increases every year.

As EMs continue to urbanise and develop, we expect these countries will legislate more, but it may take time. In some cases, such as the Philippines, nationally-imposed regulations have been hard for local governments to implement due to corruption and a lack of political will.[18] However, there are several examples of successful regulation in EMs. In India, the law now requires highways to incorporate re-used plastics in urban areas housing over 500m people, typically in the form of a polymer glue extracted from plastic waste that holds the tar together.[19] The country has over 100km of plastic roads, which have eased road traffic and reduced accidents.

China, meanwhile, alongside its Sword regulation, has introduced laws designed to tackle soil pollution. Almost a fifth of arable land in China has higher levels of pollution than the acceptable national standard.[20] Cleaning this up could become a growth area for the waste sector, as the area of arable land in the country is 27 times that of Japan which already has a decontamination value of 200-300bn yen ($1.8bn-2.7bn) per annum.[21]

Switching from a linear to circular economy

Much of the regulation and discussion around waste is feeding into the final trend: switching from a linear to a circular economy. This has been highlighted most visibly by the plastics debate, despite the material constituting only 12 per cent of waste produced globally.[22]

From 2017 to 2018, there was a 340 per cent year-on-year increase in the use of the phrase 'plastic waste' in earnings calls, demonstrating the influence of increased regulation and consumer concerns on companies.[23]

The shift to a circular economy faces some challenges, however. For example, private firms used to pay for the items they collected, but thanks to the China import ban, the price of recyclables has declined while processing costs have increased. Local governments may now have to pay private facilities to manage waste. Despite this apparent reversal, it still makes financial sense for governments to act responsibly. In 2016, McKinsey estimated that a tonne of dumped rubbish cost the taxpayer $375 in terms of disease and pollution, while proper waste disposal only cost $50-$100.[24]

Companies can help by innovating to reduce processing and collection costs, with facilities like reverse vending machines (where a customer is often paid for depositing waste like glass bottles), and investing more in local recycling facilities. Extended producer responsibility (EPR) may also be a viable option for governments seeking to increase circularity. EPR systems shift end-of-life responsibility back upstream to the manufacturers and can be mandatory, meaning these companies are more likely to engage with customers to offer collection and management services.[25]

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[15]EU Action Plan. European Commission. [Online]. [Accessed 8 March 2019]. [16]EU Action Plan. European Commission. [Online]. [Accessed 8 March 2019]. [17]UK Government. 2014. GOVUK. [Online]. [19 March 2019].
[17]Grant Thornton on UK waste turnover.
[18]South China Morning Post, October 2018.
[19]Subramanian, S. 2016. Plastic roads: India's radical plan to bury its garbage beneath the streets. The Guardian. [Online]. [Accessed 8 March 2019]. [20]Anon 2016. New 'Soil Ten Plan' To Safeguard China's Food Safety & Healthy Living Environment. China Water Risk. [Online]. [Accessed 8 March 2019]. [21]Zhu, Yan, He and Wang 2015. China's Environment. Goldman Sachs Equity Research.pp.1–67.
[22]Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050. Urban Development; Washington, DC: World Bank. © World Bank. License: CC BY 3.0 IGO.
[23]Lee, L. and Moscardi, M. 2019. ESG trends to watch in 2019. MSCI. [Online]. [Accessed 11 March 2019].
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[25]Miller, C. 2018. The "New" Economics of Recycling. Waste360. [Online]. [Accessed 8 March 2019].

Key sectors: Collection, recycling, energy and technology

Opportunities exist along the value chain

The waste management sector has developed a complex infrastructure, as each client may have different requirements. The amount they spend on waste depends on their effluents, volume, location, geography and local infrastructure. This provides opportunities for companies that can come up with mass and niche solutions across the value chain, as chart 4 shows. Other non-core areas include suppliers to waste servicing companies (e.g. machine construction, chemical producers). In our view, the main sources of revenue are: collection, recycling, energy generation and innovation.

Collection

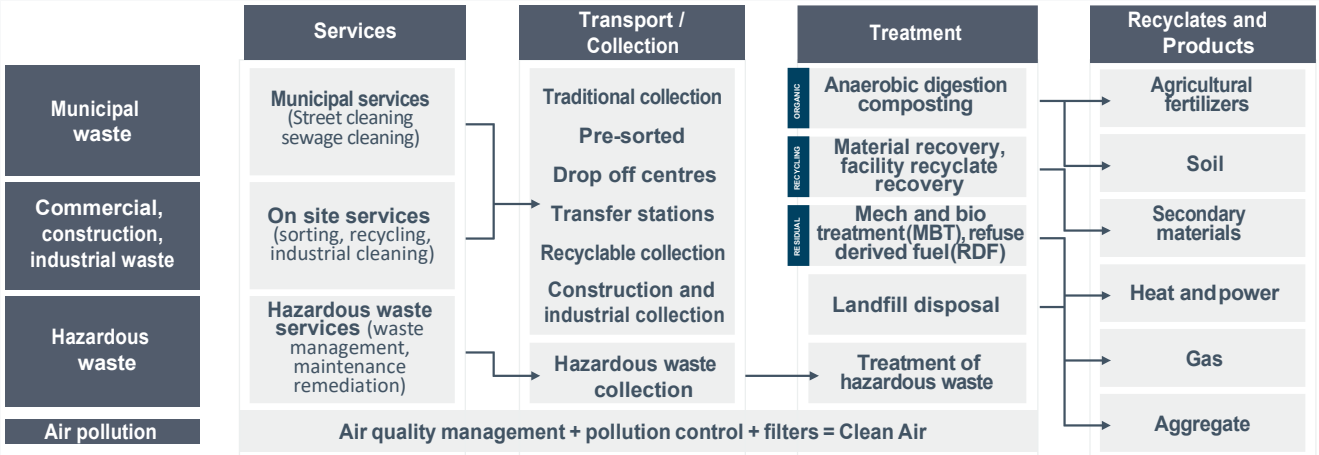
The form in which waste is collected depends on local regulation. In more developed countries, waste is typically pre-sorted before collection into waste (residual products), wet recyclables (organic matter and food) and dry recyclables (paper, plastic, cardboard, glass, cans). The value of collecting these products therefore depends on their residual value. Transporting waste also offers opportunities whether by road, rail or sea.[26]

Case study: TOMRA

TOMRA is a good example of a company taking advantage of the move to a circular economy. It has designed state-of-the-art collection and sorting systems that use sensors to optimize the recovery of resources and minimize waste in the recycling, food and mining sectors. It also provides reverse vending machines. TOMRA's systems collect and sort over 40 billion empty cans and bottles every year, providing retailers with an efficient way of recovering containers that can then be reused. For now though, we believe its growth prospects are fully priced in to its valuation.

[26] Eisted, R., Larsen, A. and Christensen, T. 2009. Collection, transfer and transport of waste: accounting of greenhouse gases and global warming contribution. Journal of Research in Crime and Delinquency. [Online]. [Accessed 11 March 2019].

Chart 4: Products from Waste



Source: Fidelity International, 2019.

Recycling: e-waste, food and plastics

Recycling offers multiple revenue streams as there are numerous points to add value during processing, not just at the point of effective re-sale. Moreover, once sorted, recycled products are cheaper and more efficient to produce than virgin materials.

The residual value of materials can be even higher when they can be transformed into a variety of products. For example, a company in China has found an innovative way to deal with food waste using cockroach factories. As the waste cannot be directly fed to pigs, to prevent the spread of devastating diseases like African swine fever, cockroaches are fed the scraps first and then become a source of livestock feed. At one factory, a billion cockroaches are fed 50 tonnes of kitchen waste a day. The insects are also considered a key ingredient in Chinese cosmetic products, such as face masks, and weight loss pills, as well as a medicine for ulcers and skin wounds. At the end of their natural life they are steam-cleaned, washed and dried before "being sent to a huge nutrient extraction tank."[27] The company is privately held, so not investable at present, but demonstrates the range of recycling possibilities in developing as well as developed markets that could list in the future.

Electronic waste is another interesting area, as old devices and their components are not widely recycled, but the estimated recoverable value is very high due to the concentration of metals and rare earths in each device. In comparison to the expensive extraction of virgin metals, recycled e-waste is a huge opportunity. In Europe, the overall aim is to collect and recycle 85 per cent of e-waste by 2020.[28]

Here we compare the energy of between recycling with that of virgin material extraction for different materials.

Recycling uses less energy than extracting virgin materials[29]

Material	% of reduction in energy use when recycling
Aluminium	95%
Copper	85%
Zinc	76%
Plastic	76%
Glass	21%[30]

Because recycled materials are cheaper to produce, they can be sold at lower prices than virgin materials. And the opportunity to get more from recycled material is significant. For example, currently 40-60 per cent of the total potential value is extracted from recycled plastic, but with the proper infrastructure, rates could increase substantially.[31] To do this, companies must increase scale and volume to drive profitability, even where there is a complex range of plastic products to recycle.

Case study: Befesa

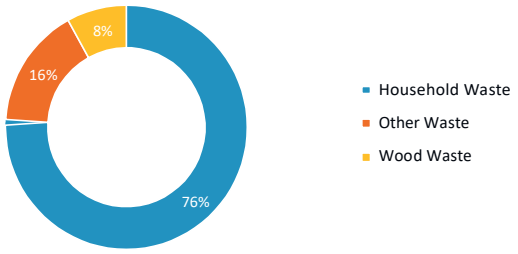
Befesa specialises in the recycling of steel dust, salt slags and aluminium residues, as well as related logistics and industrial services. The company is one of the leaders in Europe and Asia for hazardous waste recycling services to steel and aluminium plants. It is helped by structural drivers such as environmental legislation and taxes which support a switch from landfill to recycling. The need for steel dust recycling is rising because of increased demand for steel manufactured by the Electric Arc Furnace (EAF) process. Aluminium usage is also growing given its relatively light weight. The company should benefit from expansion in emerging markets.

[27]Reuters: https://www.reuters.com/article/us-china-cockroaches/bug-business-cockroaches-corralled-by-the-millions-in-china-to-crunch-waste-idUSKBN1O90PX.
[28]BBC, https://www.bbc.co.uk/news/world-europe-16633940; EU Action Plan. European Commission. [Online]. [Accessed 8 March 2019]. [29]ASM 2018. The World of Metal Recycling: The Facts. ASM Metal Recycling. [Online]. [Accessed 11 March 2019].
[30]Hutchinson, A. 2017. Is Recycling Worth It? PM Investigates its Economic and Environmental Impact. Popular Mechanics. [Online]. [Accessed 11 March 2019].
[31]Engel, Stuchtey and Vanthournout (2016). Managing waste in emerging markets. [Online] [Accessed 8 Mar. 2019]. McKinsey & Company.

Energy generation

Waste-to-energy plants are another growth area. They burn municipal solid waste (MSW) - everything from plastic to foliage to animal products - to generate electricity. The sector is estimated to be valued at $41bn by 2025.[32] The UK's waste-to-energy infrastructure, for example, has expanded from 29 facilities to 37, with capacity doubling from 4.9 million to 9.8 million tonnes per year from 2014 to 2016.[33] When properly managed, the process is not damaging to human health and generates relatively cheap energy. In our view, this subsector offers investors one of the most attractive opportunities in waste, with typically stable returns and fewer production risks than traditional energy sources.

Chart 5: Energy recovery sources



Environmental benefits

Waste-to-energy deployment also tends to reduce greenhouse gasses. The Environmental Protection Agency (EPA) has estimated that for each tonne of MSW sent to a waste-to-energy plant, one tonne of greenhouse gasses emissions is avoided[35]. In developed markets, there is already strict environmental regulation for waste-to-energy plants. This ensures they use devices such as filters, scrubbers and precipitators to minimise pollution. A significant proportion of the initial investment in these plants is dedicated to putting adequate systems in place to control toxic emissions. This means the risks of harmful environment impacts are heavily mitigated upfront.

Case study: Viridor and Biffa

Sir David Attenborough's "Blue Planet II" television documentary spurred the UK government to action. It now plans to recycle 65 per cent of municipal waste by 2035 and to make all plastics recyclable or decomposable by 2025. To take advantage of this opportunity in an under-supplied market, two companies - Viridor and Biffa - intend to build advanced plastic processing plants in the UK that purify waste directly into pellets ready for manufacture into new materials. The demand for these facilities is significant. Biffa estimates there is a shortage of nearly 6m tonnes per annum of waste treatment capacity to 2030; at least 20 new waste-to-energy plants may be needed to close this gap.[36]

[32] www.globenewswire.com: Channell, J. and Curmi, E. 2018. Sustainable Cities. Citi Global Perspectives and Solution.
[33] DEFRA 2019. UK Statistics on Waste. Department for Environment, Food and Rural Affairs. [Online]. [Accessed 11 March 2019].
[34] DEFRA 2019. UK Statistics on Waste. Department for Environment, Food and Rural Affairs. [Online]. [Accessed 11 March 2019].
[35] Kasper, M. 2013. Energy from Waste Can Help Curb Greenhouse Gas Emissions. Center for American Progress. [Online]. [Accessed 11 March 2019].
[36] DEFRA, Fidelity analyst calculations

Tech disruption: trucks, batteries and coffee pods

As developed markets manage more waste onshore, they will have to become more efficient at processing it. One way to do this is through investing in technology. For example, since the Chinese import ban, new entrants are disrupting the trading of recyclable material through online platforms, creating additional revenue streams for recycling firms.

Refuse truck technology and optimising the routes they take are helping to reduce emissions and increase energy efficiency. Robotic arms can reduce truck loading times. Automation can be used in conjunction with smart bins that know when they are full, guiding collection routes.

As more vehicles go electric, the associated increase in lithium ion batteries to power them will require more sophisticated systems to collect and recycle them, as they can pose a safety risk if not handled correctly. This niche recycling market is expected to post a 22.1 per cent CAGR to US$23.7bn by 2030.[37]

Other technologies are helping to reduce waste. Single-use coffee pods such as Nespresso now offer exchange services, using technology to automate ordering, delivery and collection. Recycled coffee pods are being melted down and turned into other products such as bicycles.[38]

Companies are also developing solutions for a closed loop business model, by designing goods which could be partially or fully re-used over time. Apple, for example, has designed a machine called Daisy which disassembles redundant iPhones in order to recycle components.[39] In the consumer world, Adidas has developed a new technology to create running shoes made from 100 per cent recycled plastic.[40] We also expect solutions to emerge from waste management companies working more closely with industrials, like the Tetra Pak/Veolia partnership.[41]

New entrants will disrupt the market as waste management accelerates

Waste levels are high and continue to rise, while regulation and the Chinese ban on imports are driving greater local processing of waste management. This presents significant opportunities in collection, recycling, energy and technology. The global waste market value in 2025 is expected to reach $485bn (CAGR of 6 per cent).[42]

We also expect waste management to accelerate as countries try to meet their Paris climate targets. Improved processing of waste has already achieved significant reductions in greenhouse gas emissions, thanks to better fleet efficiency, recycling, composting and anaerobic digestion, as well as regulation. From 2008 to 2015, UK emissions from waste roughly halved,[43] exceeding reductions in Germany (35 per cent), France (17 per cent) and the EU28 average (24 per cent). But there is more to do, as these countries remain the biggest carbon emitters in Europe.[45]

Waste levels are high and continue to rise. The global waste market value in 2025 is expected to reach $485bn (CAGR of 6 per cent).

The waste sector has traditionally depended on funding from municipal clients. But, as discarding excessive amounts of waste - especially plastic - becomes more socially and environmentally unacceptable and the opportunities for businesses become clearer, that is changing. We expect to see a growing number of new entrants disrupting the market and creating long-term value for investors.

[37] Israel, H. and Das, P. 2018. Transforming World - The Next 5 Years. Bank of America Merill Lynch Thematic Research.
[38] CNN.
[39] Apple Newsroom. (2019). Apple adds Earth Day donations to trade-in and recycling program. [Online]. [Accessed 30 Apr. 2019].
[40] Adidas (2019). [FUTURECRAFT.LOOP] - Long Documentary. YouTube. [Online]. [Accessed 30 Apr. 2019].
[41] Tetra Pak (2019). Tetra Pak and Veolia partner to get all beverage carton components recycled. [Online]. [Accessed 3 May 2019].
[42] Patil, A. & Kumari, P., 2019. Waste Management Market by Waste Type (Municipal and Industrial) and Service (Collection and Disposal): Global Opportunity Analysis and Industry Forecast, 2018 - 2025. Allied Market Research. [Accessed March 20, 2019]. Israel
[43] https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf
[44] EU data: https://www.eea.europa.eu/themes/climate/eu-greenhouse-gas-inventory/eu-greenhouse-gas-inventory-for
[45] EU data: https://www.eea.europa.eu/data-and-maps/data/esd-2

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