

Methodology

England household waste arisings

The 2017-18 waste arisings are based on the mass statistics published by Defra, categorised into various waste types (ie plastic, textile, WEEE, food, paper & card, glass, metals, organic waste and 'other') and destinations (sent for dry recycling, sent for organic recycling, and residual).¹

Residual waste treatment was determined based on data available for both household and non-household waste.² By scaling this data accordingly, the proportions of the residual household waste entering each process can be estimated as 21.8 per cent to landfill and 71.9 per cent incineration.

The final recycling rate we report is based on combining Defra's waste arisings data with further compositional analysis of the residual waste stream. This was used to determine the quantities of potentially recoverable, recyclable or reusable materials in residual waste. Of these, an estimated 13.5 per cent are plastic, 3.7 per cent textile and 1.2 per cent WEEE.³

For plastics, for instance, we find that 22 per cent of household plastics are recycled, which is lower than the recycling rate reported for the UK (around 33 per cent for all plastics, including commercial and industrial plastics, and 46.2 per cent for packaging).⁴ We have separated out household plastic waste (including non-packaging applications) in this analysis, which changes the recycling rate. What's more, 'recycling and recovery' are frequently reported as a single category for plastics recycling, which can result in even higher estimates of the proportion recycled, and we have used the compositional analysis to focus on recycling only.

	Kt per year				
	Collected for Recycling	Landfill	Thermal EfW	Other	Total
Plastics	467	361	1,193	105	2,126
Textile	114	98	325	29	566
WEEE	576	32	104	9	721
Other	8,798	2,179	7,203	632	18,812
Total	9955	2670	8825	775	22225

High impact materials analysis

Analysis of the three high impact material streams is based on projections of household waste arisings across England in 2030. These are calculated by scaling the estimated household waste arising for 2017-18 (as outlined above) by the estimated population increase in 2030. Assuming that the amount of waste per capita remains constant under the 'business as usual' scenario, this results in an increase in household waste arising for each of the three materials of seven per cent.

Plastics

Waste arisings compared to current reprocessing infrastructure

	Waste arisings (Mt / year)			Reprocessing infrastructure (Mt / year)		
	Reduced/ avoided waste	Collected for recycling	Other treatment	Existing	Including planned (only 47% dedicated to household)	Including planned (all dedicated to household)
Plastics						
Business as usual	0	0.5	1.78	0.24	0.33	0.44
High recycling	0	1.6	0.68	0.24	0.33	0.44
Transformation	1.14	0.8	0.34	0.24	0.33	0.44

WRAP reports reprocessing capacity for plastics to be 0.6Mt per year across the UK. Scaling this for England, reprocessing capacity is estimated to be 0.5Mt per year. The share of capacity dedicated to treatment of household waste was estimated based on the share of consumer and non-consumer plastics recovered in 2017, ie 47 per cent, as reported in Plasticflow 2025.⁵ This yields a final reprocessing capacity for household plastics of 0.24Mt per year.

Furthermore, since 2019, additional infrastructure for plastic packaging recycling has been announced. This amounts to 250kt for the UK, equivalent to 208kt when scaled for England. In this analysis, we have estimated the additional capacity needed based on three options: none of the planned infrastructure comes online, only about half of it is dedicated to household plastic waste (as estimated for existing plastic reprocessing infrastructure), all of it is dedicated to household waste. See next section for estimates of additional infrastructure needed.⁶

Assumptions on material fate for the high recycling and transformation scenarios are:

- **High recycling:** 70 per cent of plastic is recycled, in line with the UK Plastics Pact's target for 2025 (assuming that it applies to all plastics waste from households)⁷
- **Transformation:** we assume a 50 per cent reduction in plastic entering the household waste stream, reflecting the groundswell of opinion driven by concerns about marine pollution that single use plastics should be banned.⁸ In line with existing targets, we assume 70 per cent of the remaining plastic waste from households is recycled.

Facilities for recycling in the 'high recycling' and 'transformation' scenarios

Requirements for additional recycling infrastructure are calculated assuming that the existing infrastructure capacity is suitable for processing plastics collected for recycling under all scenarios and based on infrastructure capacity available as of 2017-18, and with additional planned infrastructure (of which either half or all additional capacity is dedicated to household plastic waste). This leaves between 1,156 and 1,364kt, and 352 and 560kt of plastics collected each year under the 'high recycling' and 'transformation' scenarios, respectively, requiring additional infrastructure (as summarised in the table below).

	Existing infrastructure only	Existing and planned (half for household)	Existing and planned (all household)
<u>Household plastic waste requiring additional infrastructure (kt/year)</u>			
High recycling	1,364	1,266	1,156
Transformation	560	462	352
<u>Additional closed loop recycling plants needed</u>			
High recycling	62	58	54
Transformation	31	26	21

The composition of the plastics collected for recycling is assumed to be that reported for consumer plastic packaging in 2017, although we assume that polystyrene is phased out and replaced with polypropylene.⁹ Reprocessing capacity for closed loop recycling is based on average plant size for existing plants (which ranges from 12,000 to 40,000 tonnes per year depending on the polymer type). We also assume that innovation in recycling processes enables closed loop recycling of LDPE and other smaller volume polymers. The resulting numbers of new plants required range between 54 and 62 closed loop recycling plants for the ‘high recycling’ scenario, and between 21 and 31, and ‘transformation’ scenarios, depending on whether planned infrastructure comes online and the share of it that is dedicated to household plastic waste.¹⁰

Textiles

Waste arisings compared to current reprocessing infrastructure

Textiles	Waste arisings (kt / year)			Current infrastructure (kt / year)
	Reduced/ avoided waste	Collected for recycling	Other treatment	
BAU	0	120	486	50
High recycling	0	390	216	50
Transformation	303	197	106	Not fit for purpose

Information on textile recycling capacity is limited. The *Textiles Market Report* suggests that nine per cent of total arisings are recycled, ie 50 ktpa for England, suggesting that infrastructure capacity is of a similar magnitude.¹¹

Note that our analysis focuses on textiles entering the household waste system. Therefore, we have not considered the reuse of textiles that do not enter the collection system. It’s worth pointing out that reuse largely happens informally and through charity shops, with a large share being exported.

Assumptions on material fate for the high recycling and transformation scenario are:

- **High recycling:** we assume recycling of textiles is in line with general municipal waste recycling targets of 65 per cent, assuming this target is brought forward to 2030.¹²

- **Transformation:** per capita textiles entering the household waste system drop by 50 per cent, assuming the UK per person consumption aligns with that of best performing European countries.¹³ Sixty five per cent of textile households waste is recycled at specialist recycling facilities.

Facilities for recycling in 'high recycling' and 'transformation' scenarios

Requirements for additional recycling infrastructure are calculated assuming that: the existing infrastructure capacity (50kt per year) will continue to be in use under the high recycling scenario; that the remaining textiles collected for recycling are largely downcycled, and only a third are processed through more innovative closed loop recycling processes. In the case of the 'transformation' scenario, all textiles collected for recycling are assumed to be processed through innovative closed loop recycling infrastructure.

The capacity for reprocessing plants is based on average plant size for similar existing plants, though in the case of closed loop recycling infrastructure there are currently very few examples available. Plant capacity size ranges from 13,000 tonnes per year for specialist closed loop recycling, to 25,000 tonnes per year for generalist textile recycling (downcycling). Total numbers of plants required under each scenario are summarised below.

	Infrastructure needed for 'high recycling' (2030)	Infrastructure needed for 'transformation' (2030)
Closed loop recycling	9	15
Generalist recycling (downcycling)	8	-

Electronics

Waste arisings compared to current reprocessing infrastructure

	Waste arisings for 2030 (kt / year)			Current infrastructure (kt / year)
	Reduced/ avoided waste	Collected for recycling	Other treatment	
WEEE				
BAU	0	620	155	680
High recycling	0	830	143.7	680
Transformation	487	417	70	Not fit for purpose

Existing WEEE reprocessing infrastructure was estimated based on figures reported by the Waste Electrical and Electronic Equipment Collection Guide, which reported that, in 2015, 0.68Mt of WEEE was "documented and controlled within the regulatory system", suggesting reprocessing capacity of a similar magnitude.¹⁴

Note that our analysis focuses on waste electronics entering the household waste system. Therefore, we have not considered the reuse of electronics that do not enter the collection system (estimated to be about ten per cent).¹⁵ As with textiles, the reuse of electronics often happens through informal channels.

Assumptions on material fate for the high recycling and transformation scenario are:

- **High recycling:** we assume that WEEE collection targets (based on fractions of items placed on the market) reach 85 per cent, all of which is recycled domestically, partly through specialist recycling infrastructure (as detailed below).¹⁶
- **Transformation:** better product design to enable longer life and repair, and improved systems for reuse and remanufacturing are assumed to lead to a drop in household WEEE of 50 per cent. Of the WEEE from households, 85 per cent is recycled at specialist recycling facilities.

Facilities for recycling in the ‘high recycling’ and ‘transformation’ scenarios

Our analysis of facilities required for recycling of WEEE are based on the estimated composition of the WEEE collected for recycling. The composition is based on the Defra targets for 2019 (as reported in the table below), assuming that the share of each WEEE category remains the same in 2030, and is scaled to the total amount collected for recycling under the high recycling and transformation scenario (shown in the table above).¹⁷

Composition of collected WEEE	DEFRA 2019 Targets (tonnes per year)	Share of WEEE collected for recycling
Large household appliances	188,232	34%
Small household appliances	56,693	10%
IT and telecoms equipment	49,334	9%
Consumer equipment	38,055	7%
Lighting equipment	0	0%
Electrical and electronic tools	25,513	5%
Toys leisure and sports	3,095	1%
Medical devices	26	0%
Monitoring and control instruments	202	0%
Automatic dispensers	1	0%
Display equipment	48,708	9%
Cooling appliances containing refrigerants	135,415	25%
Gas discharge lamps and LED light sources	5,168	1%
Photovoltaic panels	87	0%
Total	550,577	100%

For the ‘high recycling’ scenario, the actual amount of WEEE needing additional infrastructure is calculated by subtracting the available infrastructure capacity from the total tonnes collected, which leaves 150 tonnes a year needing additional infrastructure. For the ‘transformation’ scenario, all WEEE collected for recycling is assumed to require processing with new specialist recycling infrastructure, which would require either investment in new plants or repurposing of existing facilities.

The number of specialist recycling facilities are estimated based on the final tonnes of WEEE for each main category, based on the average capacity of existing plants that perform similar processes (though for some types of appliances there is limited information available). These range between 5,000 and 50,000 tonnes per year depending on the type of electronic item or appliance. In the ‘high recycling’ scenario, these are only assumed to be available for small household appliances, IT and display equipment, while generalist recycling with a good sorting capacity for reuse are assumed to

handle the remaining WEEE. In the ‘transformation’ scenario, we assume that innovation enables deployment of specialist plants for all types of WEEE.

	Additional infrastructure needed for ‘high recycling’ (2030)	Additional infrastructure needed for ‘transformation’ (2030)
Specialist recycling	4	17
Generalist recycling	2	-

Endnotes

¹ Defra, 11 December 2018, *Local authority collected waste statistics – England*

² Defra, 11 December 2018, *Statistics on waste managed by local authorities in England in 2017/18*

³ Defra, 2011, Detailed compositional assessment for municipal residual waste and recycling streams in England - WR1002. Available at:

<http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17303> accessed June 2019.

⁴ WRAP and Valpak, 2016, *Spatial flow analysis* and Defra, 11 December 2018 op cit

⁵ WRAP, 2018, *PlasticFlow 2025*, figure ES6

⁶ WRAP, 2019, *Plastics: market situation report 2019*

⁷ WRAP (nd), *Together we can – the UK Plastics Pact*, available at: <http://www.wrap.org.uk/content/the-uk-plastics-pact> accessed July 2019

⁸ Zero Waste Europe, September 2017, *Seizing the opportunity: using plastic only where it makes sense*, available at: <https://www.zerowasteurope.eu/wp-content/uploads/2017/09/ZWE-Plastics-Reduction-Paper-FINAL.pdf> accessed July 2019.

⁹ WRAP, 2018, op cit, figure ES2

¹⁰ WRAP, 2019, op cit

¹¹ WRAP, 2016, *Textiles market situation report*

¹² *Environmental impact of the textile and clothing industry*, 2019, European Parliamentary Research Service Available at: [http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI\(2019\)633143_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI(2019)633143_EN.pdf) accessed July 2019

¹³ Environmental Audit Committee, 19 February 2019, *Fixing fashion: clothing consumption and sustainability*; while per person consumption in the UK equals 26.7kg per person, it is only 14kg in the Netherlands and 12.6kg in Sweden.

¹⁴ WRAP, 2018, *Waste electrical and electronic equipment collection guide*

¹⁵ WRAP, 2017, *Switched on to value: powering business change*

¹⁶ L Pegg, 26 September 2019, ‘WEEE Regs review expected imminently’, *Letsrecycle*

¹⁷ *Letsrecycle*, 28 March 2019, ‘Challenging 2019 WEEE targets confirmed’