UK Energy from Waste Statistics – 2017

June 2018

INTRODUCTION

Tolvik's fourth annual report on the UK Energy from Waste ("EfW") sector builds on our previous reports and brings together data from a range of sources into a single document. Over time, in reviewing the available data (largely sourced from Annual Performance Reports ("APR") prepared by operators in accordance with permit requirements) it has become clear that, despite the increased use of standard forms, there remains some inconsistency in the way in which data is reported. We hope that with time this report will become a consistent and reliable source of data on the sector, and to help achieve this objective it is our intention over the next 12 months to work closely with operators to see how the consistency of data can be improved.

The sector has grown rapidly in recent years and given the changes in the EfW "mix", data variability means that some caution is needed in drawing year to year conclusions. However, for the first time our analysis is starting to suggest that plant optimisation may be making a real difference to performance.

As before, the focus of this report is upon EfW facilities generating energy from the combustion of Residual Waste during 2017. Residual Waste is defined as non-hazardous, solid, combustible mixed waste which remains after recycling activities. This definition is a little broader than that for Municipal Waste but primarily includes wastes falling within European Waste Catalogue ("EWC") 19 12 10, 19 12 12 and 20 03 01. The report continues to exclude EfW facilities in Jersey and the Isle of Man, cement kilns and facilities solely processing Waste Wood or other biomass wastes. It also adjusts for very modest tonnages of clinical waste reported by two EfWs.

Where we have used commercially sensitive information in the preparation of the report we have aggregated the data so as to maintain confidentiality.

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Front Cover Image: Severnside EfW, fully operational in 2017   Courtesy: Suez

1. MARKET OVERVIEW

The EfWs falling within the scope of this report are detailed in Appendix 1.

As at December 2017 there were 40 fully operational EfWs in the UK, with a further two EfWs accepting waste in 2017 as part of hot commissioning, resulting in a total Headline Capacity of 12.26 Mtpa. There was a further 3.64 Mtpa of EfW capacity in construction. This figure is marginally lower than 2016 due to both the exclusion of Avonmouth ACT (which ceased operations in 2016) and the fact that only one EfW commenced construction during 2017 (Viridor Avonmouth EfW).

Mtpa	Fully Operational	In Commissioning	Total Headline Capacity	In Construction	Total
2014	6.77	1.65	8.42	N/A	N/A
2015	8.87	1.21	10.08	4.16	14.24
2016	10.48	1.28	11.76	4.16	15.92
2017	**11.85**	**0.41**	**12.26**	3.64	**15.90**

Figure 1: Headline Capacity (as at December 2017) Source: Tolvik analysis

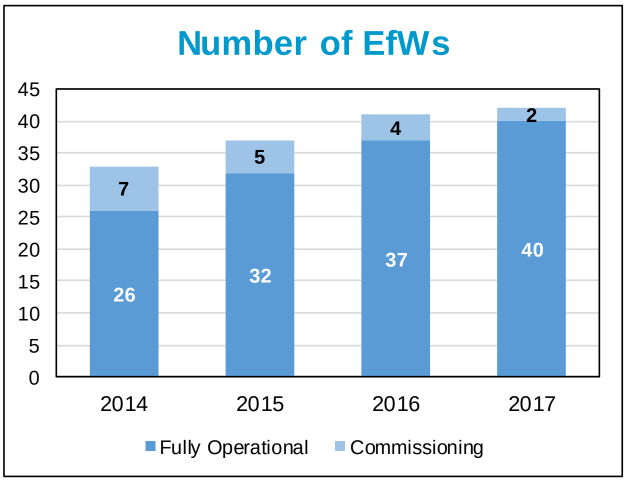


Figure 2: Number of EfW Facilities

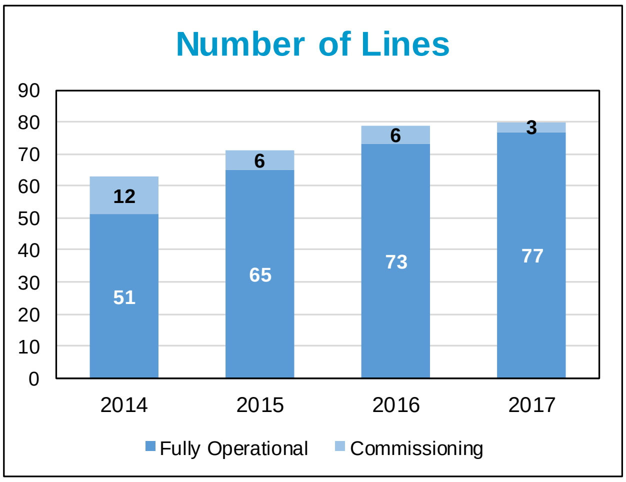


Figure 3: Number of Lines at EfW Facilities

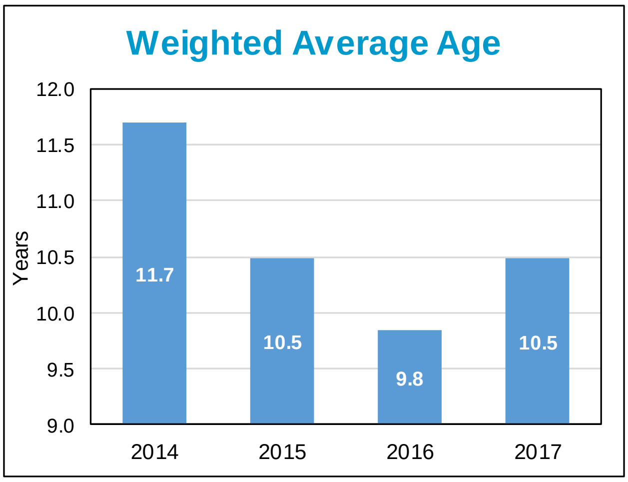


Figure 4: Weighted Average Age by Capacity (as at December 2017) Source: Tolvik analysis

Figure 4 shows the average age of UK EfWs as measured by the capacity weighted age of each line.

Four EfWs which were operational in 2017 were originally built before 1980. One, Edmonton, is to be rebuilt in the next few years.

2017 saw an increase in this average for the first time, reflecting the slowdown in new EfW capacity becoming operational during the year.

2. WASTE INPUTS

In 2017 a total of 10.89 Mt of Residual Waste was processed in UK EfWs, an increase of 7.7% on 2016. This is a relatively slower rise than the 8.8% compound average growth rate seen since 2009.

These inputs were the equivalent, for EfWs operational throughout the year, to 90.8% of the total Headline Capacity – similar to previous years.

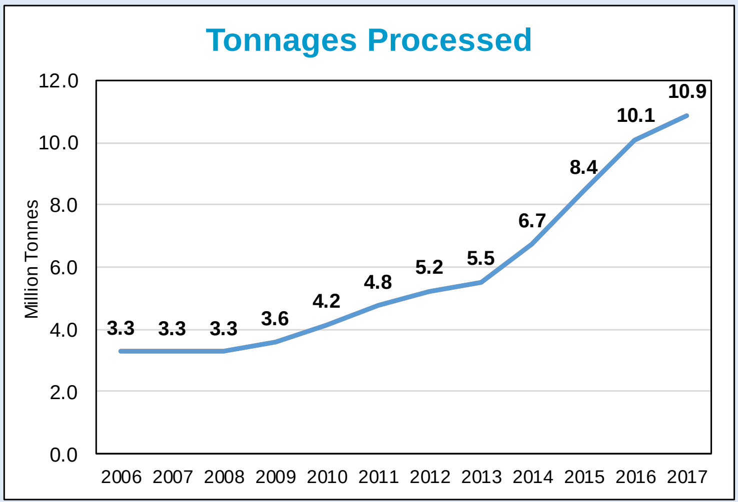


Figure 5: Total Tonnage of waste accepted at EfWs in 2006-2017
Source: APR (1)

Mt	Input Tonnage	Inputs as % of Headline Capacity
2014	6.72	88.2%
2015	8.45	89.0%
2016	10.10	91.0%
2017	**10.89**	**90.8%**

Figure 6: Annual EfW Inputs
Source: APR

The Role of EfW in the UK Residual Waste Market

In 2017 it is estimated that Residual Waste inputs to EfWs in the UK represented 39.1% (2016: 35.4%) of the overall UK Residual Waste market.

In 2018 it is expected that for the first time the tonnage of Residual Waste sent to EfW in the UK will exceed the tonnage sent to landfill.

RDF Exports are expected to remain flat or marginally decline in 2018.

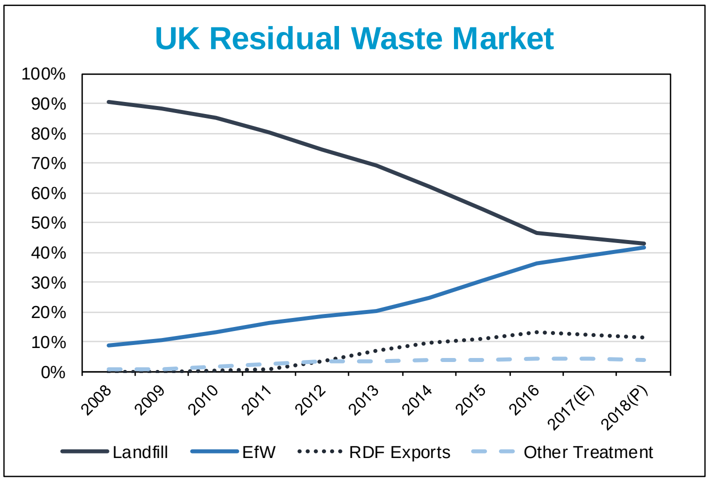


Figure 7: Development of the UK Residual Waste Treatment; 2017 Estimate and 2018 Provisional Source: Tolvik analysis

EfW Inputs by Waste Source and Type

Based on a detailed review of Wastedataflow[2] for 2016/17, it is estimated that 83.2% of all EfW inputs were derived from Residual Local Authority Collected Waste ("LACW") and the rest from Commercial and Industrial ("C&I") Waste.

The continued (albeit modest) increase in C&I Waste inputs reflects the development of "merchant" EfW capacity in the UK.

Waste Source	LACW	C&I Waste
2014/15	85.4%	14.6%
2015/16	85.1%	14.9%
2016/17	83.2%	16.8%

Figure 8: Inputs by Waste Source   Source: Wastedataflow

Net Calorific Value of Residual Waste

There is only limited reporting of Net Calorific Value ("NCV") in APR, but under confidentiality Tolvik has operator NCV data for 2016-17 for a number of additional EfWs. It is generally accepted that the NCV of Residual LACW, comprising as it does mainly of Household Waste, is lower than that for Residual C&I Waste.

Figure 9 excludes facilities designed to solely process RDF and, by plotting the "best fit" for the 19 EfWs for which we have data suggests that in 2017 the average NCV for Residual LACW was 8.9MJ/Kg and for Residual C&I Waste was 11.0MJ/Kg. As the graph shows, there is a very wide range of results and the best fit is therefore sensitive to data changes, and this is an area which we would like to explore further.

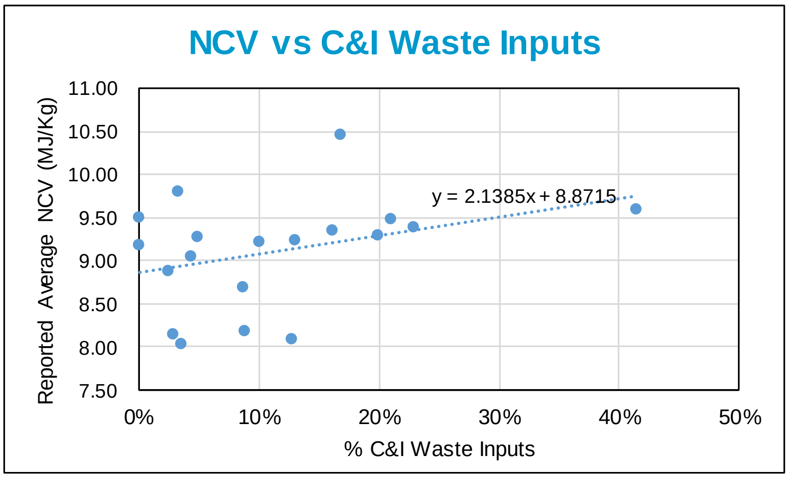


Figure 9: Inputs by NCV   Source: Tolvik analysis

Operator Market Shares

In 2017 Veolia and Viridor had the greatest market share by operator based on input tonnages.

Operator	Input (kt)	Share
Veolia	2,343	21.5%
Viridor	2,180	20.0%
Suez	1,924	17.7%
FCC	1,292	11.9%
Council	911	8.4%
Cory	746	6.9%
MFE	632	5.8%
MES	391	3.6%
Other	465	4.3%
Total	**10,883**	**100%**

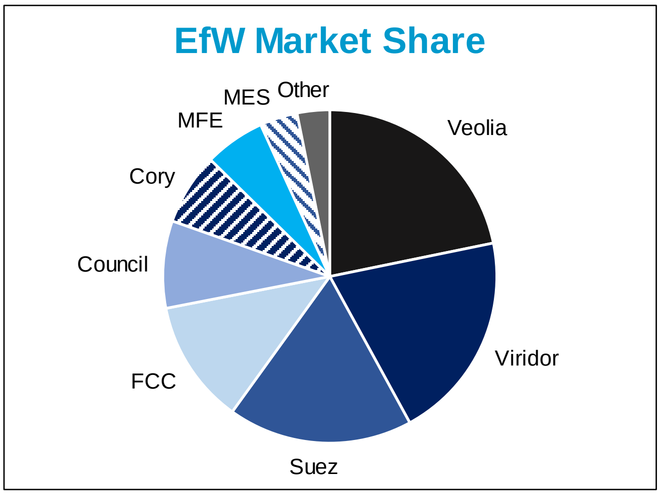


Figure 10: 2017 Share of Input Tonnage (includes Joint Ventures)   Source: Tolvik analysis

3. ENERGY

The total power exported by EfWs in the UK in 2017 was 6,187GWh – approximately 1.9% of total UK generation in 2017 and a 19% increase on 2016. The average power generated per tonne of input rose to its highest ever level of 575kWh/t, as several large EfWs which experienced turbine issues in 2016 came back into full operation.

	Est. Gross Power Generation GWh$_e$	Net Power Export GWh$_e$	Parasitic Load (excl. power import)	Parasitic Load (incl. power import)	Average Net kWh/tonne input	Net Heat Export GWh$_{th}$
2014	3,936	3,368	14.4%	N/A	468	N/A
2015	5,460	4,636	15.1%	N/A	549	554
2016	6,120	5,214	14.8%	15.3%	516	730
2017	**7,146**	**6,187**	**13.4%**	**14.2%**	**575**	**865**

Figure 11: 2017 Power Generation   Source: Tolvik analysis

Changes in the fleet mix and the full operation of those EfWs which experienced turbine issues resulted in the average parasitic load (for those reporting) falling in 2017 to 13.4%; after including imported energy in the calculation of parasitic load where available, the average parasitic load increased by 0.8%.

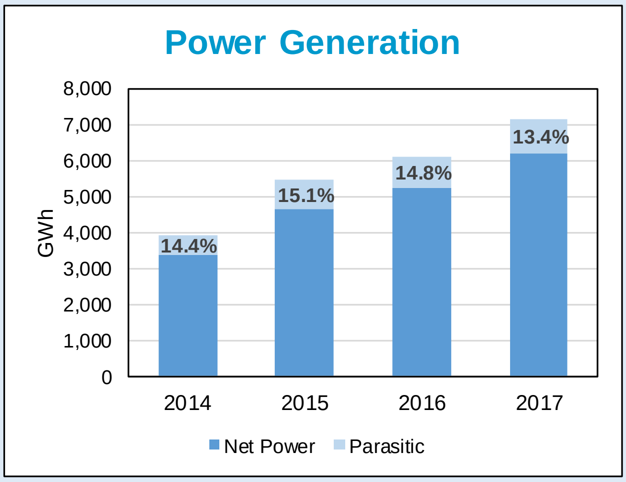


Figure 12: Power Generation from EfW

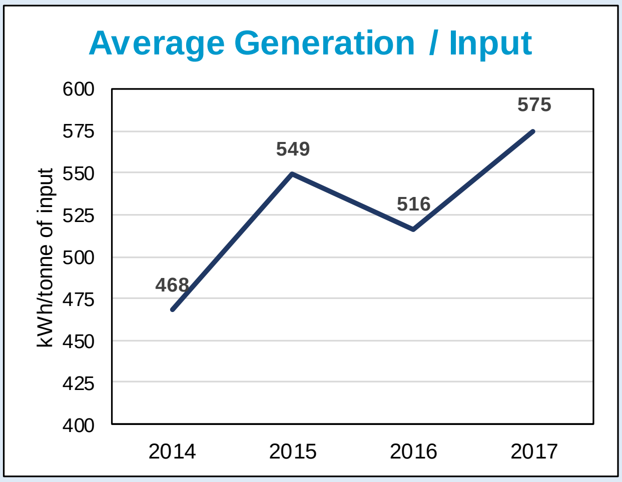


Figure 13: Average Power Generation per tonne of input

Power: Benchmarking

For each EfW, for which data was reported, Figures 14 and 15 show the distribution of the average net power exported per tonne of input and the average parasitic power load for the year.

With an average 575kWh/t generated per tonne of waste input in 2017 (2016: 516kWh/t), across all EfWs the output range was from 325kWh/t to 920kWh/t. Ferrybridge FM1 delivered the highest figure which in part reflects its feedstock (solely RDF with a higher NCV) and the fact that it does not export heat.

In 2017 parasitic loads at EfWs ranged between 8.4% (Ferrybridge FM1) and 34.1% (Lancing which includes power used in fuel preparation) with an average of 13.4%.

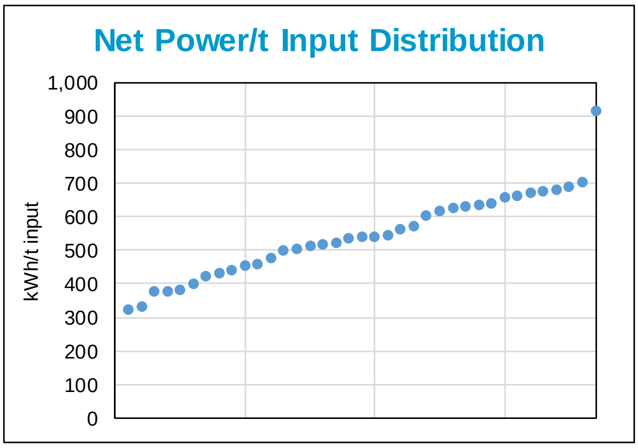


Figure 14: 2017 Net Power Exported per tonne of Input
Source: Tolvik analysis

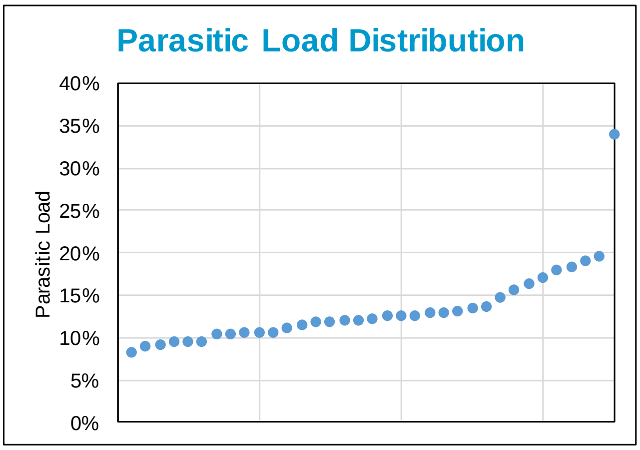


Figure 15: 2017 Parasitic Load Distribution
Source: Tolvik analysis

Beneficial Heat Use

In 2017 eight EfWs in the UK exported heat for beneficial use alongside power with an estimated total export of 865GWh$_{th}$. (2016: 730GWh$_{th}$). Across all EfWs this is the equivalent of 75kWh$_{th}$/tonne of inputs (2016: 75kWh$_{th}$/tonne).

EfW	2017 Est. Export GWh$_{th}$	Heat/Steam Offtake
Runcorn	405	Steam supply to Ineos
Eastcroft	224	To Enviroenergy for electricity and hot water
Sheffield	96	To district heating operated by Veolia
Devonport	54	To adjacent naval dock yard
Gremista	40 (est)	To district heating on the Shetland Islands
SELCHP	37	To district heating operated by Veolia
Coventry	5	To district heating operated by Engie
NewLincs	3	To industry (produced 17 GWh$_{th}$ but limited demand)
Total	**865**	

Figure 16: EfWs Exporting Heat in 2017 Source: APR

Efficiency and R1

As at December 2016 the number of EfWs accredited as R1 (“Recovery”) operations rather than as disposal facilities was 22. More recent data is not available.

4. OPERATIONS

In 2017 average EfW availability, based on average operational hours for each EfW, fell to 88.6%, in part due to a major fire at Bolton in September 2017 (without which the figure would have been 89.6%). Average IBA and APC outputs, expressed as a percentage of inputs, were largely unchanged.

	Availability - Hours	% of Input Tonnage		
		Incinerator Bottom Ash ("IBA")	Air Pollution Control Residues ("APCr")	Metals Recovery (where separate recovery reported)
2014	89.0%	20.3%	3.5%	1.9%
2015	88.3%	20.4%	3.5%	1.9%
2016	90.2%	20.2%	3.5%	1.9%
2017	**88.6%**	**20.6%**	**3.4%**	**1.7%**

Table 17: Average Operational Data Source: APR

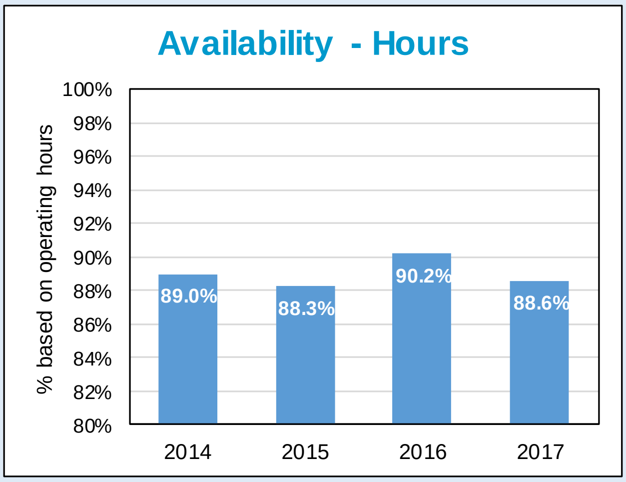


Figure 18: Average EfW Availability - Hours

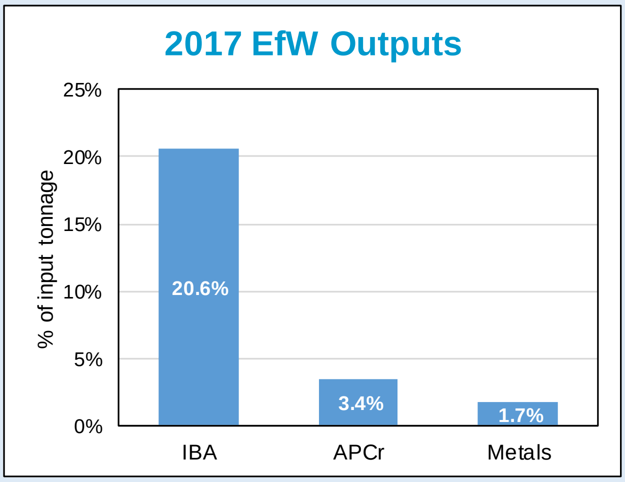


Figure 19: Average 2017 EfW Outputs

Availability

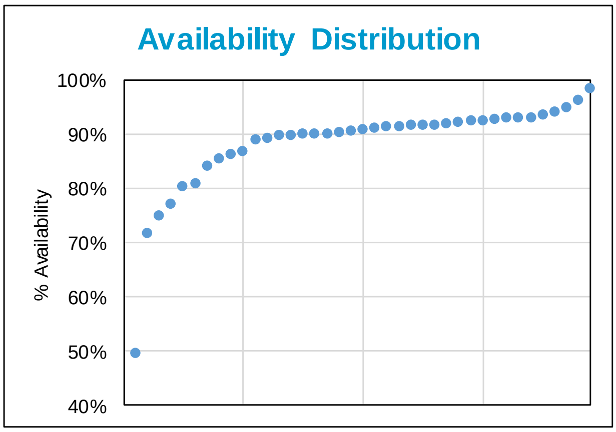


Figure 20: 2017 Availability Distribution Source: Tolvik analysis

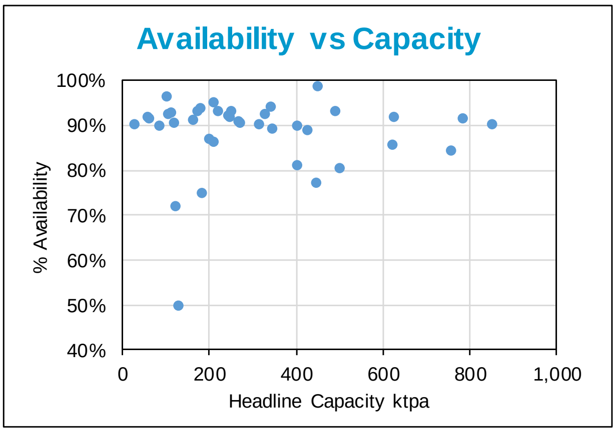


Figure 21: 2017 Availability vs EfW Headline Capacity Source: Tolvik analysis

Operator	Average Availability
Veolia	93.4%
MFE	91.9%
Cory	91.7%
Other	91.5%
MES	89.9%
Suez	86.4%
Viridor *	86.1%
FCC	85.0%
Council	84.7%
Average	**88.6%**

Figure 22: 2017 Average Availability by Operator

Five of the six EfWs with the highest reported availabilities were operated by Veolia and it is little surprise to see that in 2017 their average availability, at 93.4% (2016: 94.3%) was the highest of all EfW operators.

Lakeside EfW had the highest of 98.8% in 2017.

Viridor's * average as reported in Figure 22 was adversely impacted by Bolton, excluding Bolton Viridor's average would have been 92.1% (2016: 88.8%).

All others EfWs had an availability in excess of 72%.

Outputs

Incinerator Bottom Ash

In 2017 IBA accounted on average for 20.6% (2016: 20.2%) of all waste inputs. In total, the tonnage of IBA generated was 2.2Mt.

IBA outputs expressed as a percentage of waste inputs generally fell within the 14% - 25% range, with Allington, as a fluidised bed facility, once again reporting the lowest percentage. Almost all IBA is now recycled rather than landfilled.

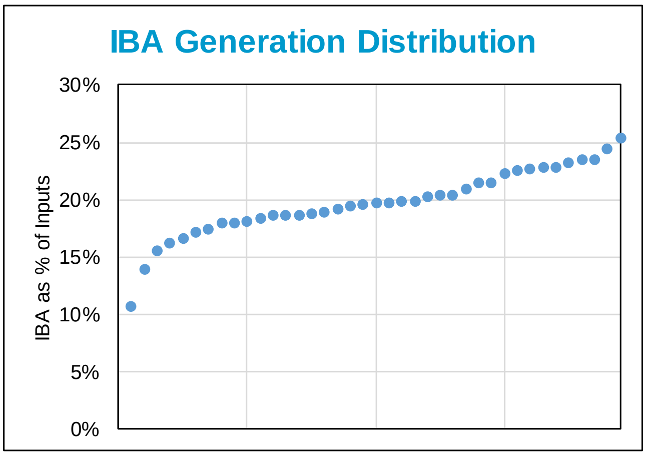


Figure 23: 2017 Distribution of IBA Generation (as % of inputs)
Source: Tolvik analysis

Air Pollution Control Residues

In 2017, APCr generation was 3.4% of waste inputs (2016: 3.5%).

The total generation of APCr in 2017 was reported to be 360kt, an increase of circa 4% on 2016. Allington, as a large fluidised bed EfW once again produced the greatest portion of APCr as a percentage of inputs.

In 2016 it was estimated that around 26% of APCr was recycled. Figures for 2017 are not currently available.

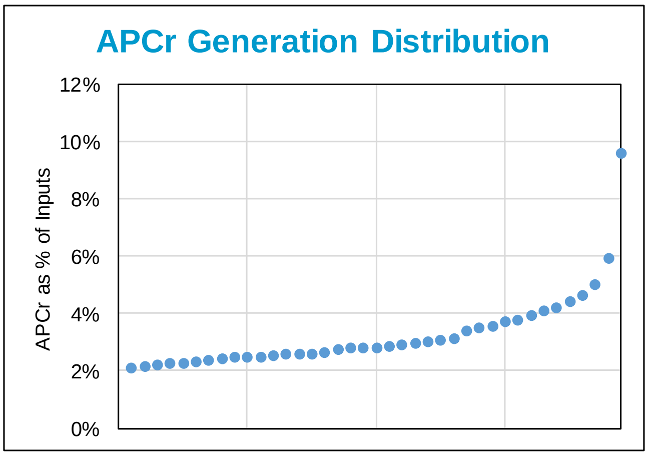


Figure 24: 2017 Distribution of APCr Generation (as % of inputs)
Source: Tolvik analysis

Consumable Use

There has been a significant increase this year in the availability of data relating to the use of consumables specifically water, lime (or other alkaline reagents), urea and carbon included in the APR. Generally, this data is calibrated to "Specific Usage" – i.e. usage per tonne of input and this is the approach taken in this report.

Consumable	Unit	Year	Low	Median	High
Total Water Usage (both potable and non-potable)	m^3/ tonne input	2016	0.05	0.29	2.24
		2017	**0.03**	**0.24**	**2.66**
Activated carbon or coke	kg/ tonne of input	2016	0.03	0.30	1.79
		2017	**0.06**	**0.25**	**1.20**
(Hydrated) lime or sodium bicarbonate		2016	3.92	9.87	30.91
		2017	**1.87**	**9.74**	**31.88**
Urea		2016	0.04	1.83	3.39
		2017	**0.62**	**2.36**	**4.40**

Figure 25: Specific Consumable Usage (where reported) Source: APR

As can be seen from Figure 26 there is a significant range in consumable consumption between various EfWs.

With the exception of Urea, the median consumable use in 2017 was slightly below that seen in 2016.

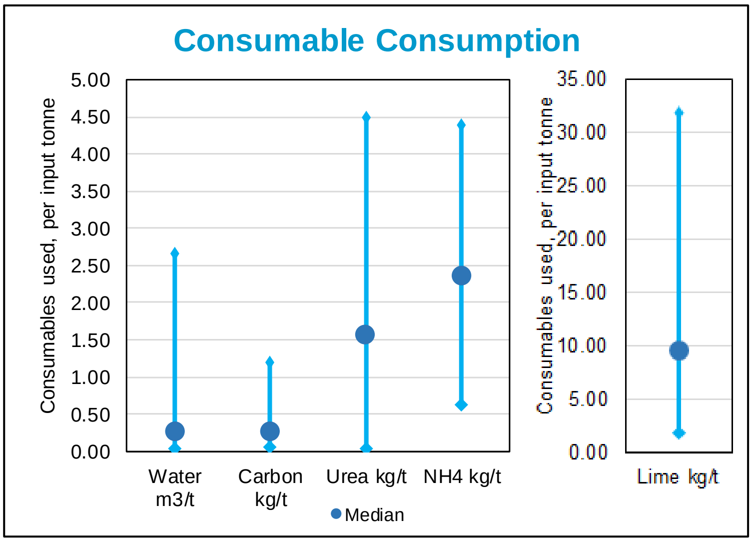


Figure 26: Average Specific Consumable Usage (where reported) Source: APR

Operational Risk Assessment ("OPRA") Scores

All permitted facilities have an OPRA score or equivalent provided by the relevant regulatory authority. A score of A represents the "best" assessment. Using the latest available data for 2016, there are signs of a steady improvement in OPRA scores over the last couple of years with no EfWs rated category E in 2016.

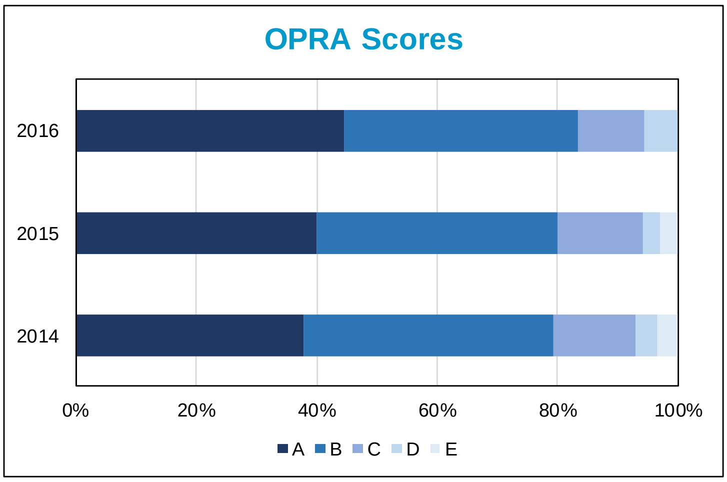


Figure 27: OPRA Scores by Facility Source: EA, NRW, SEPA [(1)]

5. GATE FEES

In this report we have sought to improve gate fee data and provide improved granularity from previous years to differentiate different sources, the types of Residual Waste and contract durations. In 2017 median EfW gate fees ranged from £56 to £91/t and generally EfW gate fees in 2017 were higher than in 2016. The rise reflects the impact of indexation provisions in longer term contracts and the increasing cost of alternatives – both in RDF export (primarily driven by strengthening European EfW markets) and landfill (where in some areas the reduced number of landfills has led to a decline in competition and higher gate fees).

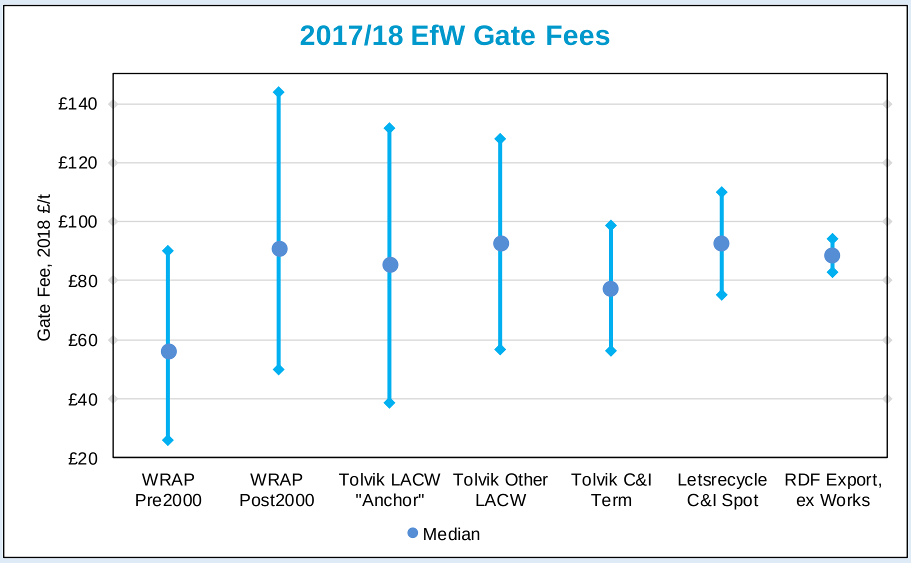


Figure 28: 2017/18 EfW Gate Fees Sources: WRAP [3], Letsrecycle.com [4] and Tolvik analysis

Local Authority Collected Waste (“LACW”) Gate Fees

The “*WRAP Gate Fee Report*”[3] focusses largely on LACW gate fees and the findings in their 2017 report were broadly similar to previous years. For the first time we have undertaken our own analysis of LACW “Anchor” contracts (i.e. contracts which specifically relate to the construction of an EfW in response to a long-term Residual LACW contract) and other short to medium term Residual LACW contracts. As Figure 29 shows, the analysis is broadly consistent to WRAP’s findings, recognising that individual gate fees will be influenced by a range of factors, including EfW capacity, contract term and the assumed proportion of merchant capacity.

Description	Gate Fee (per tonne)			
	Low	High	Median	Weighted Average
WRAP – all EfWs	*£26*	*£144*	*£83*	*n/a*
WRAP Pre 2000	*£26*	*£90*	*£56*	*n/a*
WRAP Post 2000	*£50*	*£144*	*£91*	*n/a*
Tolvik LACW “Anchor” Contracts	£39	£132	£85	£88
Tolvik Other LACW Contracted	£57	£128	£92	£83

Figure 29: Local Authority EfW Gate Fees Source: WRAP Gate Fees Report 2017 and Tolvik analysis

C&I Waste Contracted Gate Fees

The C&I Waste gate fee data in Figure 30 has been compiled from a number of projects.

The “term” gate fee data is based on contracts of minimum 5 years (more typically 10 years+), with a credit worthy waste supplier and often has a deferred commencement date (i.e. the contract term only starts once a new EfW is operational). Such gate fees have continued to rise over the last 12 months, with an increase in the median of around £5/t, continuing the trend seen in 2016.

Letsrecycle.com(4) reports short term C&I Waste gate fees (i.e. contracts typically of less than 3 years duration) ranging in 2017 from £75/t to £105/t. This is broadly consistent with Tolvik’s own data for contracts of 1-3 years duration which show a median for 2017 of **£89/t.** These figures exclude pure “spot” transactions (i.e. pay on gate) where, in some geographies, gate fees are understood to have been in excess of £110/t.

Description	Year	Gate Fee (per tonne)		
		Low	Median	High
Tolvik C&I Term (>5 years)	2015	£52	£65	£78
	2016	£55	£72	£88
	2017	**£56**	**£77**	**£98**
Tolvik C&I Short Term (1-3 years)	2016	£75	£85	£90
	2017	**£75**	**£89**	**£95**
Letsrecycle C&I Short Term (<3 years)	*2016*	*£70*	*£88*	*£105*
	2017	***£75***	***£89***	***£105***

Figure 30: Contracted C&I Waste EfW Gate Fees Source: Tolvik analysis and Letsrecycle.com

RDF Export

Offtake	Year	Gate Fee (per tonne)		
		Low	Median	High
Letsrecycle RDF Export (“ex-works” – i.e. collected from point of production)	*2015*	*£65*	*£80*	*£95*
	2016	*£75*	*£85*	*£97*
	2017	***£80***	***£86***	***£94***

Figure 31: Ex-works RDF export costs Source: Letsrecycle.com

As Figure 32 shows, the floor ex-works RDF prices have continued to rise modestly with the influence of strengthening European waste markets driving up European EfW gate fees and hence export costs.

Since the Brexit vote there has been greater stability in the market, and this is expected to continue with year-on-year UK export tonnages currently plateauing at around the 3.5Mt export level.

The latest data from Letsrecycle.com relating to April 2018 points to a range of £83/t - £94/t; although in our view most recent transactions are now above £90/t.

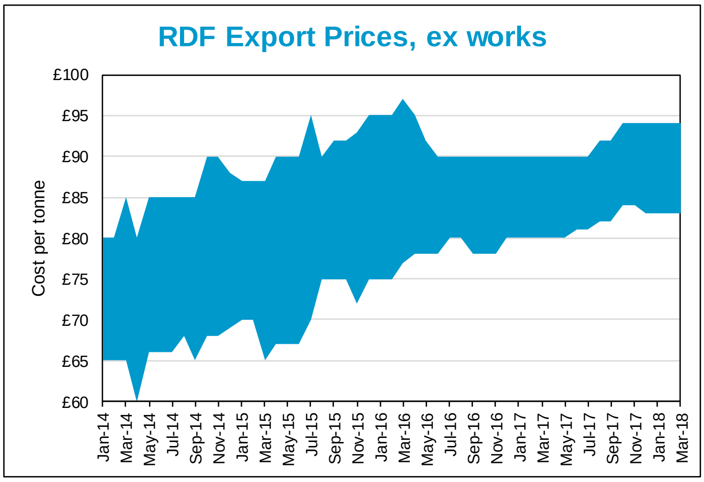


Figure 32: Ex works RDF Export Prices Source: Letsrecycle.com

6. MARKET DEVELOPMENTS

Based on EfWs which were operational or in construction as at December 2017, Section 1 identifies a Headline Capacity of 15.90Mt. Headline Capacity is not suitable for projecting future EfW demand in any analysis of the UK Residual Waste market; this is more appropriately measured by the "Operational Capacity". It is estimated (based solely upon the EfWs in Figures 35 and 36), that by 2020 the UK Operational Capacity will be **14.8Mt.** Based on the status of various projects in Figure 37, which are currently in the most advanced stages of development, this is projected to rise to at least **15.7Mt** by 2022.

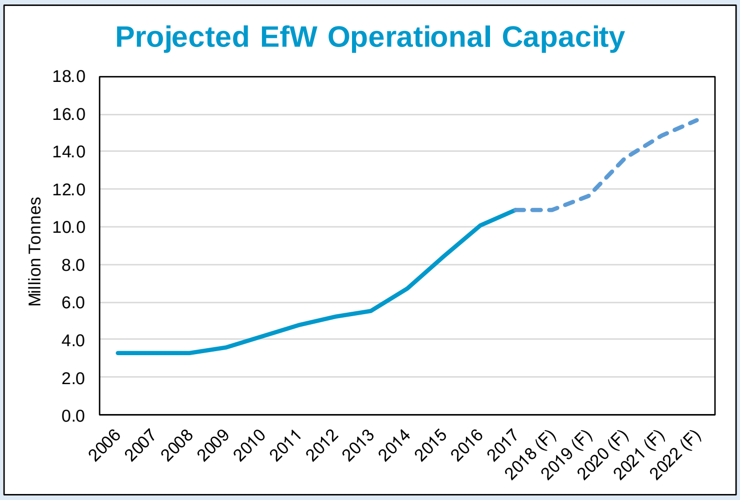


Figure 33: Projected UK EfW Inputs Source: Tolvik analysis

Figure 33 assumes:

- 900ktpa of additional EfW Capacity commences construction in 2018/19 and no existing EfWs are decommissioned;
- An assumed Operational Capacity based on average inputs over 5 years (or shorter period for newer EfWs); and for EfWs in construction it is estimated to be 95% of the Headline Capacity.

Additional EfW Capacity

The actual Operational Capacity beyond 2020 will be dependent upon the development of additional EfWs. Recent trends suggest that the EfWs most likely to be developed will either be smaller Advanced Conversion Technology ("ACT") facilities, benefitting either from subsidy support or enhanced energy revenues via private wire/heat arrangements, or larger scale EfWs based on conventional moving grate technologies.

In September 2017 the results of the latest Contract for Difference ("CfD") round was announced. This exhausted the current CfD budget allowance for subsidy support to ACT projects starting in 2021/22 – further projects seeking support will need to wait for the next bidding round which will be no sooner than 2019.

The CfD strike prices awarded to the successful projects were lower than the previous auction. The continued increase in economic efficiency of offshore wind (against which ACT projects must bid) suggests strike prices will continue to decline. There is then the potential that successful ACT projects secure a level of support which is insufficient for them to be commercially viable. We therefore expect only a small portion of the very significant number of consented ACT facilities in the UK to be actually financed and built.

As reported last year, the strengthening Residual Waste market (both in terms of tonnages and gate fees) and the successful financing of key projects means that interest in developing larger scale EfW facilities continues. Figure 37 in Appendix 1, identifies those EfW projects of which we are aware with an anticipated capacity of greater than 300ktpa and for which active development was reported during the last 12 months. Self-evidently it is very unlikely that all of these facilities will be constructed.

7. TOLVIK OBSERVATIONS

Our detailed analysis of the various waste markets over recent years has identified some emerging themes that we think are likely to become a feature of the UK EfW sector as we move towards 2020.

- Due to the inevitable challenges around commissioning and early operations, particularly for new technologies and less experienced operators, a number of EfWs currently in construction (identified in Figure 36) are likely to initially **operate below their projected Operational Capacity**.
- On the other hand, as recent EfW builds emerge from their warranty periods, continuous **optimisation initiatives** are expected increase waste throughputs and power export efficiencies – particularly for larger EfWs. These include increased availability from less frequent and shorter outages (as operators become familiar with wear rates and specific “hot spots”) and additional investment (e.g. enhanced anti-corrosion measures) where operators have real data against which to benchmark the investment. This would echo the experience in the Netherlands where, with modest incremental investment alongside active optimisation, EfW capacity has effectively risen by around 5% over the last 5 years without any actual new EfW processing lines being constructed.
- The optimisation process will include an **increased focus on managing NCV** of waste feedstocks as operators seek to maximise gate fee revenue within the scope of firing diagrams, specific plant dynamics and fuel supply chains. Contract terms will increasingly become more sophisticated in managing NCV of inputs, recognising the challenges of measuring and assessing NCV at an EfW which accepts Residual Waste from a number of suppliers.
- For the most modern mid to larger EfW’s (300ktpa+), **existing consents** (both planning and permits) **will continue to be revised upwards** by operators in response to these optimisation measures as they seek to ensure sufficient operational “headroom”. The effects of such changes will be of an order of magnitude to at least offset declining Operational Capacity at other EfWs – resulting from technical challenges or ageing plant. Operators will need to carefully consider the **appropriate public engagement** if trust in and the reputation of the sector is to be maintained.
- With **diminishing EfW construction capacity**, we expect EfW construction and commissioning periods to lengthen. The high European element common to most EfW technologies may result in further pressure from Brexit related factors (exchange rate, skilled personnel) whilst other major UK infrastructure projects of national significance could start to pull on the UK’s limited skilled resources.
- As set out in the recently released “*Waste Exports: Brexit Briefing Note*”, **Brexit**, and the yet to be determined transition period and customs arrangements, could significantly impact flows and economics of RDF exports. The real effect of this is likely to vary depending on the positioning of exporters/operators.
- The **search for heat offtakes** to assist the EfW decarbonisation agenda is expected to gather pace, but this is a complex area, not ideally suited to the more rural EfWs. We expect industrial heat solutions to be more deliverable in the near term, but district heating schemes will take longer, requiring strong leadership by ambitious local authorities, with some form of capital support.
- Driven by recent Government interest in single use waste plastics, we would expect that **incineration tax** will increasingly become a subject of debate. The sector will need to consider carefully its response given the potential for unintended consequences. For example, if an incineration tax is not appropriately calibrated then landfill could become cheaper than EfW (in conflict with the waste hierarchy) and/or such a tax could make export a more attractive option than treatment at a UK EfW.
- With limited other investment opportunities, there is **increased competition and liquidity in the finance markets** which is bringing down the cost of capital. This is creating increased opportunities both for the financing of additional EfWs and the refinancing of existing assets/operators.

APPENDIX 1: ENERGY FROM WASTE FACILITIES INCLUDED IN THE REPORT

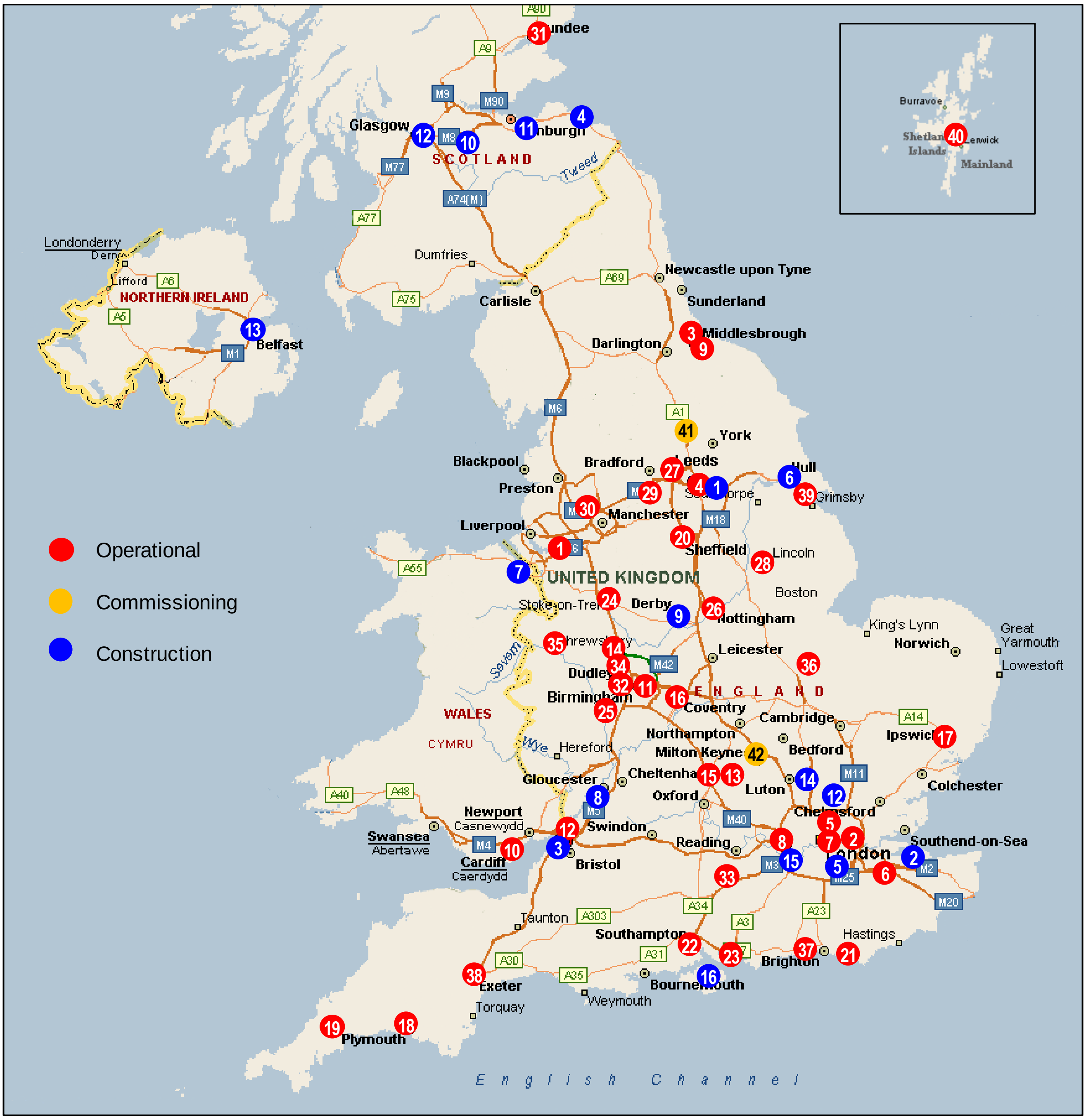


Figure 34: Location of EfW facilities. For further details on the EfWs shown see Figure 35 and Figure 36.

Operational EfWs

	Permitted Name	Known As	Location	Operator	Headline Capacity (Ktpa)	2016 Input (Ktpa)	2017 Input (Ktpa)
1	Runcorn EfW Facility	Runcorn	Halton	Viridor	850	868	891
2	Riverside Resource Recovery Facility	Riverside	Bexley	Cory	785	753	746
3	Tees Valley - EfW Facility	Tees Valley	Stockon-on-Tees	Suez	756	610	563
4	Ferrybridge Multifuel 1	Ferrybridge FM1	Wakefield	MFE	625	573	632
5	EcoPark Energy Centre	Edmonton	Enfield	Council	620	548	511
6	Allington Waste Management Facility	Allington	Kent	FCC	500	513	484
7	SELCHP ERF	SELCHP	Lewisham	Veolia	488	448	446
8	Lakeside EfW	Lakeside	Slough	Lakeside (1)	450	436	456
9	Wilton 11 EfW	Wilton 11	Middlesborough	Suez	444	148	393
10	Cardiff Energy Recovery Facility	Trident Park	Cardiff	Viridor	425	352	363
11	Tyseley ERF	Tyseley	Birmingham	Veolia	400	351	341
12	Severnside Energy Recovery Centre	Severnside	S.Gloucestershire	Suez	400	132	323
13	Greatmoor EfW	Greatmoor	Buckinghamshire	FCC	345	267	291
14	Staffordshire ERF	Four Ashes	Staffordshire	Veolia	340	340	338
15	Ardley EfW Facility	Ardley	Oxfordshire	Viridor	326	304	286
16	CSWDC Waste to Energy Plant	Coventry	Coventry	Council	315	283	293
17	SUEZ Suffolk - EfW Facility	Great Blakenham	Suffolk	Suez	269	267	262
18	Devonport EfW CHP Facility	Devonport	Plymouth	MVV	265	247	251
19	Cornwall Energy Recovery Centre	Cornwall	Cornwall	Suez	249	68	250 (2)
20	Sheffield ERF	Sheffield	Sheffield	Veolia	245	235	230
21	Newhaven ERF	Newhaven	East Sussex	Veolia	242	233	223
22	Integra South West ERF	Marchwood	Southampton	Veolia	220	204	202
23	Integra South East ERF	Portsmouth	Portsmouth	Veolia	210	204	202
24	Stoke EfW Facility	Hanford	Stoke-on-Trent	MES	210	182	184
25	EnviRecover EfW Facility	Hartlebury	Worcestershire	Severn (3)	200	36	197
26	Eastcroft EfW Facility	Eastcroft	Nottingham City	FCC	180	170	151
27	Leeds Recycling and ERF	Leeds	Leeds	Veolia	180	166	172
28	Lincolnshire EfW Facility	North Hykeham	Lincolnshire	FCC	170	164	169
29	Kirkless EfW Facility	Kirklees	Huddersfield	Suez	160	128	132
30	Bolton ERF	Bolton	Gtr Manchester	Viridor	127	86	49 (4)
31	Baldovie Waste To Energy Plant	Baldovie	Dundee	Council	120	85	84
32	Wolverhampton EfW Facility	Wolverhampton	Wolverhampton	MES	118	111	112
33	Integra North ERF	Chineham	Hampshire	Veolia	110	98	93
34	Dudley EfW Facility	Dudley	Dudley	MES	105	93	95
35	Battlefield EfW Facility	Battlefield	Shropshire	Veolia	102	94	97
36	Peterborough EfW Facility	Peterborough	Peterborough	Viridor	85	83	79
37	Enviropower Ltd, Lancing	Lancing	West Sussex	Enviropower	75	59	33
38	Exeter ERF	Exeter	Devon	Viridor	60	53	56
39	Integrated Waste Management Facility	NewLincs	NE Lincolnshire	Tiru	56	55	54
40	Energy Recovery Plant	Gremista	Shetland Islands	Council	26	23	23
41	Allerton Waste Recovery Park	Allerton Park	North Yorkshire	Amey	320	-	101
42	Milton Keynes Waste Recovery Park	Milton Keynes ACT	Milton Keynes	Amey	90	-	25 (5)
			Avonmouth ACT ceased ops 2016			*32*	
			Totals		**12,263**	**10,070**	**10,883**

Figure 35: Operational EfWs in 2017   Source: APR

Please note: those highlighted blue were operational for part of the year.

(1) Viridor / Grundon Joint Venture
(2) Estimated, based on March – December 2017 data
(3) FCC / Urbaser Joint Venture
(4) Major Fire, September 2017
(5) Estimated figure as actual data not available

EfWs In Construction

	Permitted Name	Known As	Location	Developer	Headline Capacity (Ktpa)
1	Ferrybridge Multifuel 2	Ferrybridge FM2	Wakefield	WTI/SSE	570
2	Kemsley Park EfW	Kemsley	Kent	WTI	550
3	Severn Road Resource Recovery Centre	Avonmouth	Bristol	Viridor	350
4	Dunbar Energy Recovery Facility	Dunbar	East Lothian	Viridor	300
5	Beddington Energy Recovery Facility	Beddington Lane	Croydon	Viridor	275
6	Hull Energy Works	Energy Works	Hull	Spencer	227
7	Parc Adfer	Parc Adfer	Deeside	WTI	200
8	Javelin Park ERF	Javelin Park	Gloucestershire	Urbaser/Balfour	190
9	Sinfin Integrated Waste Treatment Centre	Sinfin Road ACT	Derby	Renewi	180
10	Levenseat Renewable Energy	Levenseat ACT	West Lothian	Levenseat	180
11	Millerhill Recycling and Energy Recovery Centre	Millerhill	Edinburgh	FCC	163
12	Glasgow Resource and Renewable Energy Centre	Polmadie ACT	Glasgow	Viridor	150
13	Full Circle Generation EfW	Bombardier ACT	Belfast	Full Circle	120
14	Hoddesdon EfW Plant	Hoddesdon ACT	Hertfordshire	AssetGen	90
15	Charlton Lane Eco Park	Eco Park ACT	Surrey	Suez	60
16	Isle of Wight Waste Recovery Park	Isle of Wight	Newport	Amey	30
				Total	**3,635**

Figure 36: EfWs In Construction in 2017 Source: Tolvik analysis

EfWs of >300ktpa Capacity in Active Development

	Facility	Location	Developer	Headline Capacity (Ktpa)	Status
1	Edmonton	Enfield	NLWA	700	Permit issued. Construction to start 2019
2	Riverside EP	Bexley	Cory	650	Application to be submitted to PI in Q4 2018
3	Lostock	Cheshire West	CIP	600	Consented
4	Rivenhall	Essex	Gent Fairhead	595	CfD. Planning application outstanding to increase stack height. Permit issued
5	Rookery South	C Bedfordshire	Veolia/Covanta	585	Permit issued. Judicial Review
6	North Beck	NE Lincs	North Beck	500	Planning application submitted Jan-18
7	Kelvin	Sandwell	Verus Energy	395	Planning application submitted Oct-17
8	Protos	Cheshire West	Biffa/Covanta	350	Consented
9	Newhurst	Leicestershire	Biffa/Covanta	350	Consented
10	Billingham	Stockton	Teeseco	c.350	Planning consent amended from biomass to RDF
11	Rye House	Hertfordshire	Veolia	320	Planning approved by Herts CC but called in by Secretary of State. For Herts LACW
12	Multifuel	Slough	SSE	300	SSE announced "intention to develop" May-18
13	Fryers Road	Walsll	BH Energy Gap	300	CfD. Co-operation announcement Jun-17

Figure 37: Non-exhaustive list of EfWs >300ktpa in Active Development Source: Tolvik analysis

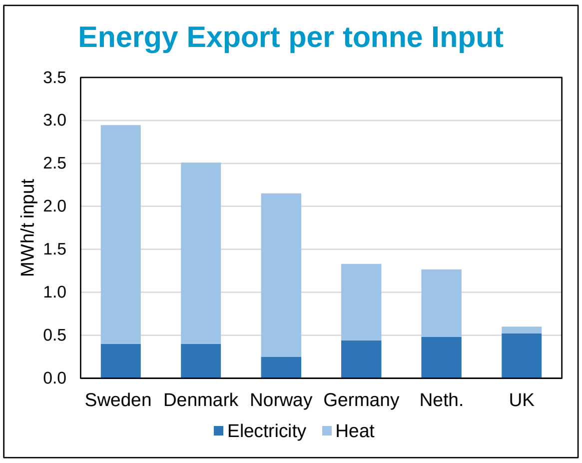
APPENDIX 2: INTERNATIONAL BENCHMARKS

As in previous years, this report has pulled together the latest available published EfW data from other northern European countries for the purposes of a comparison with the UK EfW market. There will be differences in the categorisation of EfW facilities and in the calculation/measurement methodologies applied, but it is hoped that the data provides a useful high-level overview of some key operational metrics.

Country	Data Year	Reported Inputs (Mt)	Associated Capacity (Mt)	Inputs as % of Headline Capacity		
				Latest Data	Prior Year	Change
Sweden (5)	2016	6.00	6.51	92.2%	92.0%	0.2%
Denmark (6)	2015	3.58	3.79	94.5%	91.7%	2.8%
Germany (7)	2016	23.64	24.38	97.0%	94.4%	2.6%
Netherlands (8)	2016	7.80	8.01	97.3%	94.5%	2.2%
UK	**2017**	**10.89**	**12.00**	**90.8%**	**91.0%**	**(0.2)%**

Figure 38: Reported EfW data used for benchmarking *Sources: As per Appendix 3 (5-8)*

As Figure 39 shows, whilst in the UK EfWs are largely focussed on electricity export, in most other European markets energy is exported through a mix of power, hot water and steam.



Country	Electricity (MWh/t)	Heat (MWh/t)	Total (MWh/t)
Sweden	0.36	2.65	3.02
Denmark	0.40	2.19	2.59
Germany	0.34	0.89	1.24
Netherlands	0.48	0.75	1.23
UK	**0.58**	**0.08**	**0.65**

Figure 39: European Benchmarks – Energy Export

The UK's figures for ash and metal outputs are broadly in line with the rest of Europe.

Country	IBA	APCr	Metals
Sweden	16.3%	4.6%	
Denmark	17.0%	3.0%	
Germany	24.0%	4.2%	2.4%
Netherlands	24.5%	2.4%	1.8%
UK	**20.6%**	**3.4%**	**1.7%**

Figure 40: European Benchmarks – Ash and Metal Outputs

APPENDIX 3: DATA SOURCES

(1): Annual Performance Report either provided by operators or released under the Freedom of Information Act.

EA: Contains public sector information licensed under the Open Government Licence v3.0.

NRW: Contains Natural Resources Wales information © Natural Resources Wales and database right.

SEPA: Contains SEPA data © Scottish Environmental Protection Agency.

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(2): http://www.wastedataflow.org/ Q100 for four quarters Apr 2016 – Mar 2017

(3): http://www.wrap.org.uk/gatefees2017

(4): http://www.letsrecycle.com/prices/efw-landfill-rdf-2/efw-landfill-rdf-2017-gate-fees/

(5) Sweden - Avfall Sverige: Svensk Avfallshantering 2017

(6) Denmark - BEATE Benchmarking af affaldssektoren 2016 (data fra 2015) Forbrænding

(7) Germany - ITAD: Jahresbericht 2015/16

(8) Netherlands - Afvalverwerking in Nederlands, gegevens 2016

APPENDIX 4: GLOSSARY

ACT	Advanced Conversion Technology (i.e. gasification/pyrolysis)
APCr	Air Pollution Control residues
APR	Annual Performance Reports
C&I	Commercial and Industrial Waste
CfD	Contract for Difference
EA	Environment Agency
EfW	Energy from Waste
EWC	European Waste Catalogue
Headline Capacity	The maximum annual throughput contained within the Environmental Permit except where an operator has publicly reported an alternative figure.
IBA	Incinerator Bottom Ash
Kt (pa)	'000s tonnes (per annum)
LACW	Local Authority Collected Waste
Mt (pa)	Million tonnes (per annum)
NIEA	Northern Ireland Environment Agency
NCV	Non Calorific Value
NRW	Natural Resources Wales
OPRA	Operational Risk Assessment
RDF	Refuse Derived Fuel
Residual Waste	Solid, non-hazardous, combustible waste which remains after recycling either treated (in the form of an RDF or SRF) or untreated (as "black bag" waste).
SEPA	Scottish Environmental Protection Agency

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