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Moving towards Zero Waste in a UK Local Authority Area: Challenges to the Introduction of Separate Food Waste Collections

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***Abstract*—**EU and UK Government targets for minimising and recycling household waste has led the responsible authorities to research the alternatives to landfill. In the work reported here the local waste collection authority (Charnwood Borough Council) has adopted the aspirational strategy of becoming a "Zero Waste Borough" to lead the drive for public participation. The work concludes that the separate collection of food waste would be needed to meet the two regulatory standards on recycling and biologically active wastes.

An analysis of a neighbouring Authority (Newcastle-Under-Lyne Borough Council (NBC), a similar sized local authority that has a successful weekly food waste collection service was undertaken. Results indicate that the main challenges for Charnwood Borough Council would be gaining householder co-operation, the extra costs of collection and organising alternative treatment. The analysis also demonstrated that there was potential offset value via anaerobic digestion for CBC to overcome these difficulties and improve its recycling performance.

***Keywords*—**England, Food Waste Collections, Household Waste, Local Authority.

I. Introduction

AS awareness of the climate and demographic risks to the natural environment has increased more sustainable waste management practices have been sought. These are usually divided into techniques to reduce, reuse and recycle household waste in preference to either landfill disposal or in the UK incineration. This has led Local Authorities (LAs) to adopt strategies and operational practices to introduce source separation of household waste collections. Traditional weekly collections of household waste for landfill disposal have changed to several collection rounds for different materials; sometimes on different timescales. The most commonly adopted practice is alternate weekly collection of dry recyclables (paper, cardboard, plastic and glass) reseparated at a central facility and residual waste [1].

This has achieved an English national average recycling rate of 43.3% [2], below the 50% required by the Regulations. In particular, food and garden waste need special attention in order to meet phased targets in the EU (Landfill Directive 1999/31/EC) [3] for reducing landfill disposal of biodegradable municipal waste [4]. Thus the UK Government Waste Strategy for England, 2007 [5] (Review of Waste Policy, 2011 [6]) and the Waste Prevention Programme for England (2013) [7] identify food waste as the priority for meeting these targets. The Roadmap to a Resource-Efficient Europe [8] also highlights the food sector as a critical area for action. These policy statements have led to a number of UK-based initiatives focused on food waste. These include the introduction of Landfill Tax (£80 per tonne from April 2014); and WRAP (Waste & Resource Action Programme) initiatives such as the 'Courtauld Commitment' (a voluntary agreement to improve resource efficiency and reduce waste within the UK grocery sector), and 'Love Food, Hate Waste' (food waste reduction educational and behaviour change campaign).

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II. Food Waste Predicaments

Around 30-50% of all food produced is never eaten [9] and this is from production, retail handling and household waste. One third of the waste is reported to be domestic [10].

Household Food Waste is defined as unconsumed food and waste generated during the preparation of meals, it does not include packaging materials [11]. A number of LAs have already introduced separate food waste collections using a separate container at the kerbside for treatment and recovery of by-products. The strong link between sustainability indicators and transport however has led the larger authorities to undertake reviews of the alternatives.

III. Waste Composition Analysis

The main waste categories present in residual waste are kitchen/food waste, around 31% by weight, and paper/cardboard around 16-18% by weight [12]. Waste composition analysis of household waste from eight Scottish LAs found 18% of household waste is food waste [13]. However, this increased to 31% of residual household waste (estimated to be approx 3.2 kg/household per week) following removal of the standard dry recyclable materials. There was no seasonal variation detectable in the amount of food waste present.

Other waste composition studies carried out by Burnley [14] found combined garden and food waste to be between 35% and 38% of household waste, whilst Demirbas [15] reported a total organic fraction between 18% and 21%. This figure was much lower than other studies and was accounted for by seasonal reductions in garden waste. The high

proportion of food waste present in household waste suggests separate collection and bio-treatment of this waste fraction would assist in meeting weight based targets and reduce biodegradable waste sent to landfill [16].

IV. Treatment Process for Organic Household Waste

Biodegradable municipal waste as defined by the Landfill Directive as food and garden waste. These waste materials can be collected separately, or together which then determines the treatment procedure. Food waste containing cooked or raw meat or fish is covered by the Animal By-Products Regulations, 2005 (ABPR) [17], which controls the treatment conditions and uses of the composted material produced. The ABPR includes inspection of facilities and monitoring of products for pathogens by the State Veterinary Service. If garden and food waste are collected in the same container, or vehicle, the organic waste must be processed in compliance with ABPR.

Food waste is quickly biodegraded and has historically been anaerobically digested via landfills for its biogas. Anaerobic digestion in bioreactors is therefore an attractive substitute treatment option [18] to recover this renewable energy. This would require source separation of the two organic streams allowing garden waste that does not contain animal residues to be composted using simple open windrows. Processing food waste in enclosed reactors is more expensive than composting garden waste alone, ranging from £26 to £104 per combined tonne compared to £20 to £36 per tonne for garden waste alone [19].

V. Current Household Waste Management Practices in the UK

LAs have a key role in supporting sustainable development through their range of public activities, for example planning, education and waste management [20]. Many have chosen therefore to introduce separate collections of garden and food wastes for bio-treatment or a mixed organic waste (Table I).

TABLE I
Percentage of Local Authorities Collecting Food Waste (WRAP, 2012)

	Percentage of Local Authorities collecting food waste*			
	Separate food waste collections	Collect food waste mixed in garden waste	Combination of both separate food waste only and a mixed food & garden waste collections	None
England	29%	22%	2%	47%
Wales	95%	0%	5%	0%
Scotland	34%	22%	6%	38%
Northern Ireland	4%	58%	8%	31%
UK	32%	23%	3%	42%

*This information represents WRAP's best understanding of kerbside food collection schemes in operation by local authorities in the UK in 2012. In any authority the scheme may not be available to every household. Where LAs collect only fruit and vegetables with garden waste this does not count as a food or mixed organic waste collection.

An annual "league table" of individual LAs recycling performance, including dry recyclable materials and organic wastes for bio-treatment is issued annually by the UK Government Dept for Environment, Food & Rural Affairs (Defra), (Table II).

TABLE II
Top 20 Performing Recycling & Composting Las 2012/13[21]

Local Authority	Percentage of household waste sent for reuse, recycling and composting
South Oxfordshire District Council	65%
Vale of White Horse District Council	65%
Surrey Heath Borough Council	64%
Three Rivers District Council	62%
Stockport MBC	61%
Calderdale MBC	61%
Stratford-on-Avon District Council	60%
West Oxfordshire District Council	60%
Rutland County Council	60%
Oxfordshire County Council	60%

All the 2012/13 top 10 performing recycling councils operate some form of segregated food waste collection for householders. CBC currently offers no collection service for food waste, other than landfill disposal with residual waste.

CBC recycled and composted 49% of household waste it collected in 2012/13 which placed CBC 84th out of 433 LAs in recycling performance in England.

VI. Methodology

This paper reports a case study comparison between two neighboring LAs Charnwood Borough Council (CBC) & Newcastle under Lyme Borough Council (NBC). The two have similar demography and size and have been classified as comparable by the Chartered Institute of Public Finance and Accountancy (CIPFA). This model was developed to aid local authorities carry out comparative and benchmarking exercises based on a wide range of performance indicators. These include socio-economic as well as the statistics on wastes. It is used by Central government and Audit Commission to compare LAs performance.

NBC provides weekly food waste collection to all householders. Thus a comparison would show the improvement on the recycling performance of CBC by processing of food waste.

Research was also undertaken to establish the amount of support there was from CBC householders for food waste collections. This included thirteen quarterly telephone surveys carried out since January 2010. Participants are chosen to achieve a demographic and geographic representation of the

Borough. The number of responses is set at 10 per 10,000 population per annum. Respondents were asked "How likely would you be to participate in a food waste collection service?" using a Likert scale, where 1 = not at all likely and 4 = very likely. They were also asked why they would, or would not participate in separate food waste collections.

Two focus groups formed to assist the development of a Zero Waste Strategy were used to assess support for food waste collections. One focus group consisted of political representatives of the Council; the other focus group consisted of residents from the Borough, using a similar sampling procedure to the telephone surveys to achieve a demographic and geographic representation of the Borough. Using a scoring matrix the focus groups were asked to priorities a selection of policy and operational measures, including separate food waste collections, that could be introduced to improve the performance of the household waste and recycling collections. Analysis was carried out to rank the options for both focus groups and also to combine the results from the two groups to produce an overall ranking.

Additionally, a six week public consultation exercise on the Zero Waste Strategy during October and November 2012 used a questionnaire that offered the opportunity to provide free-text comments on waste and recycling operations of CBC, or related subjects. The consultation was promoted through a series of public meetings, leaflets, posters, text alerts and the LAs Twitter account and a dedicated webpage on CBC website.

VII. Results

A. Telephone Survey of Residents

Results from the thirteen quarterly telephone surveys carried out show that show 60% of respondents are likely or very likely to use a food waste collection (Fig. 1).

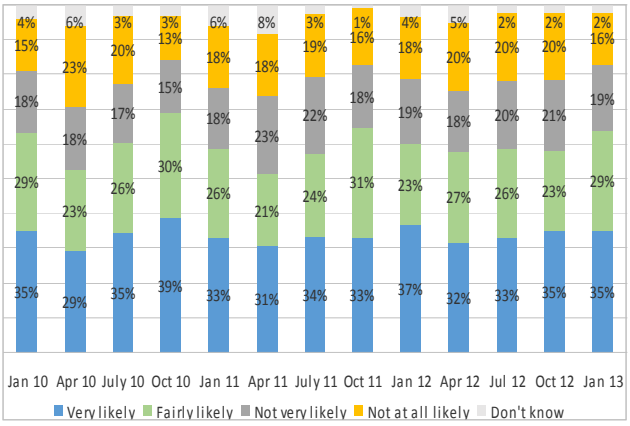

Fig. 1 CBC householders' likeliness to use a separate food waste collection

The second question asked why they would or would not participate in food waste collections. Results gave the following reasons for participating:

- It is a good service to offer;
- Better than putting food waste in with residual waste; and
- Better than going to landfill and good for the environment.

Reasons for being unlikely to participate included:

- Residents already disposing of food waste themselves;
- Not having a lot of food waste;
- Too much hassle;
- Unhygienic and attracts pests;
- And not wanting another container

B. Zero Waste Strategy (ZWS) Focus Groups and Public Consultation

Two facilitated focus groups were conducted: with local politicians; and with residents to identify the most important waste service and policy issues and whether the participants would support the introduction of food waste collections. The results from the focus groups had varying levels of support for the introduction of separate food waste collection. The resident's focus group expressed a higher level of support than the politician's focus group. The degree of success would depend on the system of collection. The two existing possibilities for food waste were:

- Additional mechanical recovery from the residual waste stream, if the potential yield was high enough to justify the additional resources involved.
- The technically easier collection and treatment by separate food waste collection for anaerobic digestion or composting.

This was incorporated into the ZWS draft, for public consultation via a questionnaire available on the LAs website, in paper form at roadshows and events. The public consultation suggested how food waste collections would assist the LA in its aspirational aim to be a Zero Waste Borough and gauged the level of public support. This consultation had 300 responses, with 1% of participants saying they would not support the separate collection of food waste, which is better than the random telephone survey as was anticipated.

C. Comparing CBC & NBC Organic Waste & Recycling

CBC is in Leicestershire (East Midlands) and NBC Staffordshire (West Midlands). Both are mainly rural with two large urban centres (NBC Kidsgrove and Newcastle, CBC Loughborough and Shepshed) both also have Universities and transient student populations (NBC Keele University, CBC Loughborough University). CBC has 67,000 households and NBC 52,000.

Historically, NBC had a low recycling rate for the separate treatment of dry recycling and organic waste (Fig. 2) and was in the lower quartile of the recycling performance table [22], [23].

Recycling performance improved following the simplification of collection system to the common alternate weekly scheme in 2009/10. Recycling has now increased to 50.3% in 2012/2013 (Fig. 2). NBC is now 57th highest performer nationally (50.3% for 2012-13) (Table III) compared to Charnwood which is 84th out of 433 LAs

nationally, with a recycling rate of 49% for 2012-13.

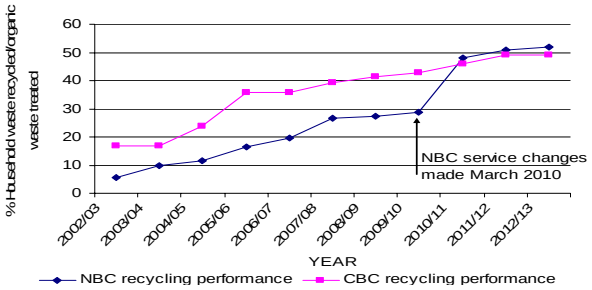

Fig. 2 CBC & NBC recycling performance (since 2002) source Waste Data Flow

TABLE III
COMPARING HOUSEHOLD WASTE PERFORMANCE (2012/13)

	CBC	NBC
Recycling rate 2012-13	49%	50.3%
Position nationally for recycling performance	84th	57th
Waste collected kg/hh	429kg	422kg

Both LAs currently operate identical waste management schemes except that CBC charges for garden waste and NBC also collects food waste (Table IV) [24].

TABLE IV
COMPARING CBC'S AND NBC'S HOUSEHOLD WASTE COLLECTIONS (FEB2014)

	Recycling collections	Garden waste collection	Residual waste collections	Food waste collections
CBC	Fortnightly collections paper, cardboard, glass bottles and jars, metal and aluminium cans, plastics, batteries & textiles	Fortnightly charged for service in CBC 31,371 households Feb 2014 (47% coverage)	Fortnightly collection	No separate food waste collection
NBC	Fortnightly collections paper, cardboard, glass bottles and jars, metal and aluminium cans, plastics, batteries & textiles	Fortnightly free of charge collection to all households	Fortnightly collection	Weekly food waste collections since 2010 to all households

NBC has collected food waste weekly from all households since the changes noted in 2009/2010. The total weight of food waste collected annually and the average amounts per household are shown in Table V.

TABLE V
WEIGHT OF FOOD WASTE COLLECTED SEPARATELY FROM HOUSEHOLDS IN NBC 2010 TO 2013 [21]

Year	2010/11	2011/12	2012/13
Total weight of food waste collected (tonnes)	3573.26 Tonnes	3244.88 Tonnes	2709.26 Tonnes
Average weight per household/per year (Kg)	67.9 Kg	61.7 Kg	51.5 Kg
Average weight per household/per month (Kg)	5.6 Kg	5.1 Kg	4.3 Kg

NBC's food waste figures show a range between 51.5 Kg /household/year (2012/2013) and 67.9 kg/household /year (Fig. 3).

NBC's food waste collections have recovered declining amounts of food waste each year the service has been operated (Table VI). This decline has been replicated to show how much food waste CBC could potentially recover (Table VII).

TABLE VI
POTENTIAL YIELD OF FOOD WASTE FROM CBC HOUSEHOLDS IF REPLICATING THE COLLECTIONS OPERATED BY NBC

	Year 1	Year 2	Year 3
Average weight per household / per year (Kg)	67.9 Kg	61.7 Kg	51.5 Kg
Possible yield per year (Tonnes) from 67,000 households	4549.3	4133.9	3450.5

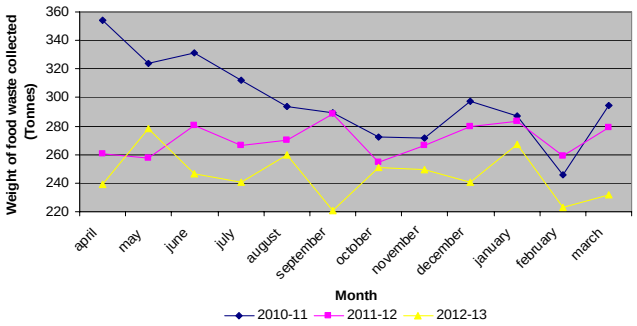

Fig. 3 NBC food waste collected 2010-2013

If CBC were to introduce a similar scheme achieving the average NBC figures this could add 4000 tonnes per year or up to 7% to the total recycled materials (Table VII). It could also via anaerobic digestion provide renewable energy.

TABLE VII
POTENTIAL RECOVERY OF FOOD WASTE IN CBC AND IMPACT ON RECYCLING RATE

	Year 1	Year 2	Year 3
Residual household waste collected in 2012/13 (tonnes)*	29848	29848	29848
Recycling and bio treatment collected in 2012/13 (tonnes)*	28676	28676	28676
Potential recovery of food waste (tonnes) – if replicating Kg per household recovered by NBC** x 67000 households	4549.3	4133.9	3450.5
Amended residual waste figure assuming recovery of food waste and no increase from 2012/13 figure (tonnes)	25298.7	25714.1	26397.5
Amended recycling and composting waste figure assuming recovery of food waste (tonnes)	33225.3	32809.9	32126.5
Potential recycling rate (% of household waste collected that is recycled or bio-treated) assuming replicating recovery of food waste Kg per household as recovered by NBC. (Assuming residual waste and recycled waste remain at 2012/13 figures other than the amendment for food waste).	56.8%	56%	54.9%

* actual figures for 2012/13 from Waste Data Flow

** assuming collect 67.9Kg per household in year 1, 61.7Kg in year 2 and 51.5Kg in year 3.

VIII. DISCUSSION

National plans have previously been effective to increase recycling rates, especially through the transposition of EU Directives and policy such as Landfill Tax and Household Waste Recycling Act 2003 [25]. Some UK policies have now

been devolved.

The devolved Governments in Scotland and Wales require LAs to introduce separate food waste collections (70% of households in Scotland must have a food waste collection by 2016) [26]. This differs in England, legislation has not been introduced and funding opportunities are not available to LAs; therefore further separate collections are difficult to justify financially in many areas, including CBC.

Both CBC and NBC have future plans to further reduce waste with CBC adopting a Zero Waste Strategy [27] and NBC a part of the Staffordshire Joint Municipal Waste Management Strategy [28] which includes aspirations to reach Zero Waste to landfill.

The findings of this research show that both garden and food waste have a high impact with food waste making up as much as 30% of current residual household waste, confirming previous work [13], [29], [30]. Separate collection of food waste will ultimately be needed by CBC if it is to reach the targets set in the ZWS. This is in contrast to some other materials suitable for recycling such as bulky waste and textiles which would offer lower potential benefits from segregation.

The results also show the amount of food waste collected by NBC has been reduced each year. This may be due to less food being wasted by householders or more self-composting. Participation monitoring and a communications campaign would be needed to clarify why the amount of food waste being collected from households has reduced and whether this would affect CBC introducing food waste collection. Access to suitable collection equipment and local treatment facilities also need to be investigated before implementation.

IX. Conclusions

CBC has ambitious plans to reduce the amount of household waste sent for landfill disposal, referred to as the Zero Waste Strategy for Charnwood Borough, 2012-2024 [25]. With high proportion of food waste in the remaining residual waste, introducing a separate weekly food waste collection operated in a similar way to a neighboring authority (NBC) would achieve the current targets for recycling and landfill disposal.

The separate food waste collections operated by NBC avoids landfill disposal for some biodegradable material and using anaerobic digestion produces a compost like material and generates electricity.

Some more work is needed to adapt food waste collection to the local CBC conditions. The separate collection of organic materials for bio-treatment for example was shown to be dependent on facilities available and the reasons for a decline in the amounts of food waste collected in the case study over the three year period examined was not resolved.

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