“The Future Development of Municipal Waste”

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SYNOPSIS

For most of us with our noses up against the day-to-day tribulations and trials of the conventionally understood waste industry, it is sometimes difficult to stand back and see the context of our actions in the great march of progress. The purpose of this paper is to present some ideas on how a readjustment of our focal length to achieve a greater breadth of vision might impact on the pace of change and, thereby, the economic and operational scale of the waste industry. Although the UK is a perceived and actual laggard in a European and developed world context, it possesses a number of unique opportunities to progress at a dramatic pace. Such success is not guaranteed until identified blockages are overcome. **This paper is designed to outline the relativities of those blockages in government, technology, information systems and public perception.**

The interaction between industrial/commercial and domestic waste arisings are explored against the EU driven framework of targets, economic instruments and Tradable Permit regimes. The relatively small geographic scale of the UK, coupled to the high per capita level of arisings, creates particular opportunities to exploit the interactions between waste, agriculture and energy requirements in coming decades. The efficient **realisation of those synergies is necessarily underpinned by the need to create an effective online infrastructure of data capture** for resource flows and the successes/difficulties of implementation of data capture systems is explored – as is their significance to achieving an effective step change in resource efficiency within the economy overall.

The closing proposition is that developed economies have evolved over the last 200 years on the basis of developing extremely refined manufacturing, logistics, marketing and retail operations to deliver wealth into economies around the world but probably have less than 30 years to replicate those systems at the back-end of the global economy. That process has been benchmarked by financial systems which have either under priced the environment or exploited it for free. Those developed economies now have less than 3 decades to price in more expensive so called “externalities” in ways which bring minimum disruption to employment and inflationary pressures. This transition process in a condensed timeframe will not be easy and the waste industry has a key role to play in introducing technologies, finance and managerial skills to deliver substantive improvements in performance.

Time is short and international knowledge exchange on how process blockages can be overcome will form an essential part of this major shift in handling end use resources – in short – it is the industrial revolution which will characterise the 21st century.

Keywords: resources, resource efficiency, economics, taxes, financial instruments, mass balances, Producer Responsibility, holistic, macro-systems

THE UNDERLYING FUNDAMENTALS

Stripped down to the essentials, a strategic assessment of waste issues – globally and in the UK – must involve an understanding of the **interplay between impacts arising from the post use management of scrap resources and the solutions available to be applied.** Each of the headings on this impacts/solutions matrix can be broken down from the general to the specific by considering, for instance, the key issues for organic/inorganic materials and then, progressively, down to finer levels of detail of specific products or materials. At a macro level, however, the framework of this paper sits within a presumption that impacts from waste activities arise in terms of pollution, solid, gaseous and aquatic. These parameters reflect the wider approaches to sustainability issues which embrace the physical, natural, human (economic) and natural environment. Correspondingly, the solutions which our industry applies to abate those impacts are economic, technical or persuasive (communication).

The second major background factor lies in the overall scale of the process. Much work has been undertaken in Europe and elsewhere considering resource flows at macro level in developed economies. After an initial period in the 80s and 90s when such work was questioned, it is now coming back into fashion – even in some cases as a more realistic basis of assessment than more narrowly focused lifecycle assessment (LCA) systems[1]. In the UK, the Department of the Environment, Food & Rural Affairs has engaged the Wuppertal Institute to corroborate the relativities between UK and other developed western European countries analysed. The author has also undertaken some crude mass balance comparators. For a population of around 60 million, around 600 million tonnes of raw material stock were being consumed in the UK each year to supply around 60 million tonnes of finished consumer capital and consumption goods for private personal use (excluding housing and social capital). The Wuppertal work suggested a much higher figure, slightly in excess of one billion tonnes (excluding water) based on the embedded resource inputs in complex finished goods imported (particularly electronic, electrical, automotive and similar imports) where resource consumption had occurred elsewhere in the global economy.

In consequence there is now growing realisation that this ratio of inputs to outputs in excess of 10:1 has to operate within the basic laws of thermodynamics. In effect **the developed economies of the world are involved in running a pollution economy** at a rate at which spaceship earth is failing to neutralise pollution and waste in solid, gaseous or aquatic form at anything like the rate that it is being produced. A detailed explanation of how that process is operating in the UK can be obtained from "Great Britain plc" produced by Biffa in 1997 and available from http://www.biffa.co.uk/publications/gbplc.html.

THE EMERGENT TRANSITION FORCES

Against such a background there are grounds for optimism. Whilst we have discharged millions of years of carbon accumulation within the earth's crust back into the atmosphere in the space of 200 years, we have managed to move from outright scepticism to guarded acceptance in less than 6, that global warming has to be confronted and the necessary

[1] Biffa (1997) Great Britain plc: The Environmental Balance Sheet, ISBN 09523922-16

technological kick-in is occurring. Quite where those pressures for change will come from will influence the pace and direction of the waste industry in different countries in coming decades. In essence they will – broadly – originate from either the corporate, governmental or NGO pressure points or – the biggest pressure point of all – fundamental environmental disasters which will accelerate all 3 elements. **Those pressure points will in turn have to operate within the context of free market systems.**

It is unlikely that there will be a return to centralised state collectivist approaches and it is up to the waste industry to decide whether it wishes to be an agency for change in this process (by encouraging that market transition) or seeking to resist it. Broadly – in the UK – the position is currently one of resistance from within the waste industry and from our customers but the position is changing fast. The EU has been a significant force in governmental pressures for change which have translated themselves to the UK government. Had the UK not been a member of the European Union, it is questionable whether the current range of statutes in force would be in place.

In the corporate sector, major blue chips are beginning to realise the marketing opportunities inherent in adopting a high profile Corporate Social Responsibility (CSR) agenda – of which waste policy forms a part – but it is still early days. As with much in business, timing is of the essence. **Nevertheless, it can be salutary to consider waste as a threat to such businesses and brands** in the same way that nutrition issues have impacted on global fast food brands or Fair Trade, timber certification standards and marine stewardship strategies have impacted on producers and retailers in other sectors. The thrust of European strategies can best be considered in the context of the earlier resource flow "pipe".

In essence these comprise kick-starting by the use of financial, budgetary and regulatory instruments applied in relation to inputs of resources (virgin input taxes), the resource conversion process (regulation) or end of pipe taxes (on landfill disposal, discharges direct to air or aquatic environments, etc), Overall the general system is also developing within an umbrella framework conditioned by Tradable Permits (q.v.).

What varies between European states – but almost certainly will be a subject for increasing integration to avoid accusations of transfrontier unlevel playing fields – **is the balance between regulation and taxes and the use of "sticks" versus "carrots"**. In the UK that balance is as yet far from stabilised – indeed the extent to which improved resource efficiency should be left to the devices of the free market in a Friedmanite/Chicago school approach (which leans to Tradable Permits and intra-company competition where polluters reward the virtuous) is still undecided in comparison with those who prefer more classic socialist subsidy driven instruments which provide artificial rewards to change behaviour. **Also in the UK that process is made additionally complex because "Environment" is not the recognised preserve of a single selected ministry** and the reality is that the ministries of local government (ODPM), environment (DEFRA), industry (DTI), regulator (Environment Agency) and Treasury all compete to claim precedence in implementing or managing different elements of these fiscal, budgetary and operational mechanisms for change. **Increasingly the shortcomings of this lack of coordination will have to be recognised** and there is likely to be a review of international best practice exemplars to find a way through the resultant fog. The author's personal perspective is that the optimal combination will involve a narrowly focused enforcement regime under a single point regulator, a "standards and quality control agency" which will define engineering standards, compliance targets, timetables, reporting standards, etc with implementation targets in the

hands of Department for Trade & Industry (for matters relating to Producer Responsibility, industrial and commercial waste) and local government ministries for matters pertaining to household education and waste.

INTERNALISATION OF EXTERNALITIES – THE PRIVATE SECTOR AND INDUSTRY

The UK economy has evolved since the early 1800s into a series of discrete industry groupings focused around the inward supply of specific goods and services (cars, clothing, furniture, food, etc).

It is thus logical to assume that **the most efficient mechanism for managing those products when they become scrap is likely to best revolve around those inward supply chains** given their predisposition to knowledge and expertise coupled to the opportunities for economies of scale in end life management systems. This concept of "Producer Responsibility" is backed by recent government pronouncements and is fast gaining ground within the EU as a logical and effective mechanism for a particular range of products. Indeed, in the UK, there are now emergent dates for the implementation of these concepts which will impact on around 15 million tonnes of physical consumer goods moving through the household, industrial and commercial dustbin economy. Inevitably, such a process is not exactly welcome to a number of supply chains and no matter how diverse their products or interests, **the process of acceptance can be both slow and fairly negative.** In the UK this is certainly the case – in part because changes driven by the need for improved resource efficiency and reduced environmental impacts are perceived as very real threats to bottom line performance. Nevertheless, change is occurring and the leading edge blue chip companies lead the charge in recognising that improved environmental standards can create significant opportunities for market share gain and brand positioning. It is indeed from the lessons of substantive reductions in brand value which have occurred in fast foods, retailing and other sectors (as a result of cavalier approaches to emergent scientific evidence or public opinion) that **the major brands are now rethinking their approach to the environment.** This is especially so given that brands are now unsupported by vertically integrated manufacturing processes – **supply chains have been delegated out to hundreds or thousands of suppliers who operate in geographically remote points of production and sub assembly in places where NGOs and activists are increasingly searching for evidence of environmental or social exploitation.** As governments seek to introduce the regulations, each industry sector is characterised by hard-nosed bargaining with each side seeking to maximise its winnings on each of its cards in the pack between industry and government.

There is also a growing sophistication and understanding of the parallel financial and resource flow economies. This underpins a trend to greater numeric understanding of the physical flow of resources in specific regions, industry sectors and material areas as the realisation emerges that without data the competitive impact of fiscal and budgetary instruments (whether through Tradable Permits or subsidies) can be assessed in terms of their scale or impact. And the choice of those multifarious instruments is indeed wide. So too is the likely balance sheet and profit/loss impact of such instruments if they are introduced without due regard to the relationship between the cost of end life product neutralisation and the ex-works gross domestic product (GDP) of the product in question. In some cases these can be as high as 100% (fluorescent and mercuric lighting devices) where products are both light and possess significant potential to pollute through use of heavy metals, etc or relatively insignificant (pharmaceuticals, eg) where the sector is characterised by significant turnover, low weight and low environmental impact waste product streams.

PUBLIC SECTOR ISSUES

Household arisings of solid waste from domestic sources in the UK amount to a mere 8% of the overall total yet they represent a politically sensitive tip of the larger iceberg. It is also the sector which is least sensitive to pricing signals in the market as a result of a split between contracting authority for collection and disposal between local government (units of 100,000 populations or less) and area government (populations of around one million). As a result, **policy instruments tend to focus on subsidies** amounting to around £600m per annum **intermingled with a heavy reliance on targets** to drive recycling rates up and organic inputs to landfill down. As a consequence of target setting, Tradable Permits are likely to result – and are viewed with trepidation by the majority of Public Officials.

Additionally, **the driver of direct charging on households is viewed with huge trepidation by local and central politicians**. This timorousness is difficult to appreciate when a typical UK householder pays (directly and indirectly) around £4,000 per annum for local government, out of which waste accounts for £50 per annum (1.2%). Historically, government at national level – or rather civil service departments involved with waste – have been obsessed with domestic waste arisings only. The reality is that from a waste sector point of view, point of origin will become increasing irrelevant. **Economies of scale and the need for high utilisation of expensive intermediate handling facilities will drive integration between household, commercial and industrial arisings.** Such trends in the UK will be dependent on the pace at which appropriate end life processing technologies are selected and achieve planning approval at local level. Much is dependent, of course, on output composition and the preponderance of landfill. The combination of regulations, directives and financial instruments is about to bring about the biggest shift in UK waste handling systems seen since the Environmental Protection Act 1990. The nub of the challenge is that **we have between 10 and 15 years to shift from end life processing systems based on landfill storage for geological time periods** (which are neutralised over 30 years) **to shift to physical, mechanical and chemical treatment systems which neutralise it in anything from 30 hours to, at most, 30 days**. Such a shift will occur for around 50 million – 60 million tonnes of material – the rate depending on the pace at which the landfill exit gate closes as fewer and fewer replacement sites are consented. Yet there remains a fundamental communication problem, coupled to political indecision which threatens to drive up the building pressures on available exit routes. The UK private waste sector refuses to invest in newer, more sustainable technologies because the economic signals which could provide a reward for the incremental cost of the latter (around £30-£40 per tonne compared to landfill) simply are not forthcoming. There is insufficient understanding on the justification for that cost increase – which approximates to around £10 per tonne due to added labour costs (caused by throughput productivity per capita falling from 100,000 tonnes per annum in a landfill to 3,000 tonnes in the more sophisticated technologies), £10 per tonne for incremental capital costs/interest charges and £10 for higher maintenance charges.

Even if the economic signals were right – and there is little evidence that they will be until 2010 on current predictions – the waste industry and their customers are equally divided on whether to adopt a “one size fits all” approach or whether to “mix and match” by adopting a spread of biological, physical, thermal technologies in a particular region. The complexity and detailed mathematics of this process are evaluated in “Future Perfect” available on www.biffa.co.uk.

THE RESOURCE ECONOMY

Against this confused and uncertain backdrop a more macro approach to an understanding of the resource economy is likely to prove fruitful on the basis that the level of the debate thus far has tended to the micro and narrow. In overall terms the waste management industry in many parts of the world is an end pipe manager of scrap raw materials (organic and inorganic). The inorganic fraction is sizeable in volume terms (75% of the 440 million tonnes produced in the UK) but it is the organic fraction in which governments are most interested – in terms of global warming potential, degradability, reusability and resource intensive in terms of their original production. In managing that carbon, the waste industry can shift it from inside the ground (landfill) to 3 fundamental alternatives:

(i) Soil manufacture (on the ground)
(ii) Energy (substituting for non-renewable energy carbon inputs)
(iii) Recycling (substituting for non-renewable carbon process inputs)

The factors used in selecting appropriate options at local level are based on quite simple indicators of negative and positive value. But all is not quite so straightforward – each of the 4 runners in the race has fundamentally different economic odds attached to it – in terms of logistics costs, operating costs, payments for net outputs, receipts from Tradable Permits, capital intensity and technical risk. **It is the complexity and dynamic of the interaction of these forces over time which will provide the greatest challenge and excitement for waste sector practitioners in coming decades** – certainly in the UK. The technology options are vast and the levels of sophistication will move the waste industry from a bucket and spade industry to one requiring substantial investment in terms of process technologies – be they thermal, mechanical or biological. In the UK that challenge is not insignificant – if 250 of the 360 wide licence landfill sites currently accepting high carbon content material shut over the next 20 years (and they are closing at the rate of around 25-30 per annum) they will need to be replaced by around 2,500-3,000 smaller facilities. The major proviso lies in whether the public will accept single hit – probably thermal – process plants handling 500,000 tonnes per annum plus, per site. 3,000 continuous operation chemical, biological or thermal process plans will require manning levels totalling between 30,000 and 40,000 new, more highly qualified employees, **doubling current manning levels in the UK waste industry.** The interaction between this industrial revolution in waste and the ability of the education system to provide for this demand is questionable – **as is the ability of the road transport infrastructure to accept significantly more, long distance haulage of waste materials entering the recycling chain.**

THE INDUSTRIAL DIMENSION

For industrial and commercial producers, the reaction will probably lie in encouraging sector collectivisation to maximise tonnage/kilometre ratios for retrieved materials and maximise bargaining strength. Those factors will also be accelerated by targets for Producer Responsibility. **Strangely – in the early stages – such "clubs" are crystallising across industry sectors on the basis that major brands which compete head to head in the inbound (retail) market find it strange or uncomfortable to cooperate in the outbound (waste) economy.** This has certainly been the case in the early stages of automotive and electrical/electronic Producer Responsibility. There is also a recognition of strange vertical and horizontal integration as we enter the new waste economy as embedded carbon in completely different waste materials is recognised as

energy, soil substitute, reusable raw material input stream. **This produces interesting cross sectoral alliances** such as in tyres and cement or glass and aggregates, etc. **Waste companies have a key brokerage role in accelerating such strategic alliances** on the basis that day to day commercial pressures within sectoral boundaries encourage a "stick to the knitting" approach.

THE MASS BALANCE APPROACH

It was for this reason that we decided to commit funding to the development of a wider understanding of material flows in the economy. The opportunity was presented by the UK Landfill Tax Credit Scheme regulations in 1997 and – although these were amended in March 2003 – over 5 years it was possible to commit around £8m of funding to the creation of a range of resource flow studies in the economy. Many of these have yet to appear – out of a total of around 50 which have been funded, 15 have been produced as of August 2003. That money has been spent in the following broad dimensions:

- Regional studies
- Industry sector studies
- Material stream studies
- Integrated database management development in the public sector on waste
- Integrated database management systems for industrial and commercial compliance schemes associated with Producer Responsibility.

Examples of completed publications reflecting these areas of focus are:

- Island State, a holiday island off the south coast of the UK with a population fluctuating between 90,000 and 140,000
- City Limits, for the 8 million population of Greater London
- Societal flows, in the UK
- The agricultural sector
- The tyres sector
- Carbon in the UK economy
- The foundry industry
- Thermal technologies

The objective of all these studies – which are undertaken by prestigious universities with core specialisms in the selected area of interest working with appropriate trade associations or public bodies – is to accelerate internal understanding in the selected area of study with regard to the scale and significance of the non-financial resource flow system under their control. The industrial revolution since 1800 has inevitably led to the development of sophisticated value chains as measured by units of currency. These financial valuations are inappropriate, however, wherever environmental goods are supplied on a subsidised basis to a specific generation – the weaknesses inherent in this are now becoming readily apparent as those subsidies to one generation pile up as costs to those which follow (whether in terms of medical, engineering, social or biodiversity impacts) for subsequent generations. The intention is, therefore, to close the resource flow loop, raise resource efficiency and reduce those net externality inputs which currently represent major dysfunctionalities in our so called developed economies. In the UK – as I have outlined – obstacles to progress need to be tackled in 3 distinct phases with kick-start initiatives from government (step 1) driving revised pricing signals into industrial and commercial supply chains via Producer Responsibility (step 2) finally resulting in transitional process technologies which re-secure segregated materials for reuse as

substitutes for non-renewables at the start of subsequent consumption processes (step 3). It sounds simple, but **achieving significant orders of magnitude of resource consumption reductions represent the greatest challenge to the global economy in the 21st century.** A far broader outline of how the specifics of that process might work more smoothly in the UK is provided in Future Perfect but the scale and breadth of that challenge cannot be underestimated. On the upside, **global waste industries across the planet have a substantive opportunity to become active catalysts in this process** – indeed they are probably in pole position if companies, academics, regulators and legislators familiar with waste seize the opportunity before them on a cooperative basis. **These key trends in society will not abate – they will grow and intensify** and if we fail to address them in the context of resource efficiency then we will have failed untold millions of people in future generations. **Now is the time – now is the moment!**

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