

Briefing: Regional waste infrastructure planning – a possible approach

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Since the 1990s waste strategies have often been predicated on the assumption that ‘we have a problem – where can we get rid of it and what technology is likely to offer the line of least resistance?’ In effect, waste is a reactive issue. This paper suggests an alternative approach in a regional or sub-regional context based on establishing a consensus of probability around known economic, technological and socio-political interactions in the 5–10 year horizon for markets in waste disposal, resources (such as recyclate, electricity, heat, transport fuels or soils) coupled to regionally specific extant or predicted ‘sinks’ or markets for different materials in these applications.

1. INTRODUCTION

Moving from ‘end’ to ‘front of pipe’ thinking, of particular importance is the presumption that the energy, agricultural and waste resource markets are subject to distinct, often unconnected, supply and demand influences on costs and prices, yet the movement of resources between them is inextricably intertwined by the reality that they all ‘modify’ carbon in different ways to achieve an economic return on investment from different market participants. As such they will increasingly cross-compete for that carbon feedstock in ways which, to individual operators in each market, will appear erratic, illogical and unpredictable, due to their lack of knowledge of these underlying price determinants outside their own ‘chimney’ of knowledge.

Those interactions will accelerate due (mainly) to

- (a) probable underlying significant real price increases in the price of carbon as a fossil resource
- (b) nationally driven taxation and/or traded pollution permit regimes applied to carbon and resources to improve resource efficiency
- (c) continued escalation in the landfill tax that will render obsolete the technology which currently acts as the major carbon reprocessor in the UK.

A five stage approach is detailed below to create a probability map of strategic preferences based on known sets of assumptions regarding those financial, technological, spatial planning trends and constraints in a particular regional context.

The objective of this approach is thus to define a more credible and understandable framework on which to base political, commercial and ethical decisions.

2. STAGE 1: MAPPING TONNAGE AND FINANCIALS OF ‘SCRAP’ CARBON

2.1. Determine trends

Map, define and reference all known and predicted trends in flows of ‘scrap’ carbon into the system from the following sources

- (a) municipal controlled waste
- (b) commercial and industrial waste
- (c) sewage and organic effluents
- (d) agricultural arisings of biomass
- (e) forestry residues

whether these materials are left in situ or otherwise disposed of.

This ‘biomass resource’ can then be analysed or credibly extrapolated utilising identified factual or academic assessments by sector arising (e.g. C and I), area, calorific value, mass or other relevant parameters.

2.2. Convert data to financial equivalence

Translate the above inputs of scrap carbon data into ‘financial equivalence’ utilising current and predicted values per t for 2008 and (say) 2012, 2015, and 2020. This will produce a market value map by type of scrap carbon and the parameters selected in stage 1.

2.3. Analyse output markets

Undertake a similar exercise but this time looking at the output markets for fossil and renewable carbon based on current and predicted patterns. Broad category definitions for this would cover

- (a) material as recyclate (UK or exported)
- (b) energy as heat, light, road fuels, electricity, gas
- (c) soils as compost by market (e.g. on farm, horticulture, flood defence, engineering)
- (d) landfill disposal
- (e) other (are there any?).

This analysis needs to identify significant current sinks for these materials on a geographic basis, possibly expressing this as

mass using some form of conversion factor agreed academically (such as Mt of oil equivalent).

3. STAGE 2: MAPPING AND MATCHING VIRGIN CARBON MARKET TONNAGES AND VALUES

Stage 1 data can be replicated against 'virgin' carbon to produce an economic market map of (financial) values for required carbon demand sinks/users. As a consequence there will become apparent an understanding of carbon scale relativity in terms of tonnage, calorific equivalence and volume.

This will then identify where technological shifts may be required to connect spatially the existing site 'sinks' to exploit available carbon from an adjacent 'scrap' source not currently utilised. New investment could provide an economic return in response to changing upward costs of existing carbon feedstocks to substitute cheaper sources from waste.

In the energy context such mapping would need to take account of additional investment to remove known blockages in the existing infrastructure (e.g. in the centralised grid distribution network of wires or pipes where bottlenecks are predicted due to population demographic changes or localised increases in energy intensity).

The economic analysis will start with revenue/cost comparisons, but consideration of investment decisions will need to model tradeoffs in terms of investment cost per unit of avoided carbon/MWh output/GJ saved or similar measures. This involves moving to the next level of detail in terms of defining specific sites where 'carbon processing' is occurring and evaluating them in a spatial modelling exercise to reduce overall carbon footprint matching supply and demand.

Thus this stage will map all locations with an energy/carbon load of (say) 1 MW–8500 MWh to 10 MW/85 000 MWh equivalent and would cover food preparation plants, hospitals, airports, freezer and chilled stores, food, regional distribution centres, transport complexes, schools, public administration blocks, cement plants, power stations, gas distribution sites, prisons, rail yards and docks, and identified locations of proposed low energy housing sites capable of being connected on a local grid network from new.

The above then need to be assessed in terms of suitability based on available space, connectivity to the relevant energy grid, motorways, rail and/or navigable waterways, brownfield status, adjacency of housing and other parameters identified by the group.

4. STAGE 3

This requires the assessment of the narrowed-down list of sites deemed suitable on current or forecast economic, spatial and social grounds. These shortlisted locations should thus represent the best possible (i.e. least risk) means to establish integrated carbon resource reprocessing activities. Ideally such locations would be co-located with existing or proposed electrical, gas, heat or road fuel using sites insofar as the cost of new pipes or cables usually exceeds £1 million/km.

Additionally they should have sufficient extra space for aerobic composting, recycling and recycle material reprocessing

activities colocated (to permit the movement of materials between different exit routes on a weekly, seasonal or structural basis as market conditions move). Such sites may be owned by single investors, energy supply companies or multiple independent participants acting as shared tenants.

Electricity and combined heat and power (CHP) are presumed to be the strongest economic driver considering

- (a) predicted increases in UK population
- (b) rising coal and oil prices due to far eastern and global demand
- (c) imminent (by 2015) withdrawal of 33% UK electrical supply capacity due to nuclear and coal obsolescence
- (d) international agreements on sourcing renewable fuels
- (e) commercial drivers from the carbon reduction commitment¹
- (f) targets on local authorities for reducing carbon footprints
- (g) supply security issues if the UK becomes 80% dependent on imported gas
- (h) a UK four-day gas reservoir compared to 8 weeks in many other EU states.

Such CHP locations are thus most likely to present economically attractive investment routes to the private sector and will become the highest probability 'anchor' sites for waste carbon management. Bear in mind, however, that across the UK the available energy from waste from municipal, commercial and industrial sources is unlikely to produce more than 6 or 7 GW of electricity (8% UK current baseload demand) or 15 GW electricity plus heat (based on estimates by the Institution of Civil Engineers). This is after withdrawal of economically viable routing of other biomass to composting or recycling due to reasons of end market value or location.

5. STAGE 4

Once the market-driven probability profile is established (stage 2) it should then be easier to define the reverse logistics infrastructure in terms of intermediate feedstock processing centres (materials recovery facilities (MRFs)/RDF preparation/transfer stations, etc.). Stage 2 sites would ideally incorporate these activities for their immediate area anyway.

Beyond that, it will be possible to back-cast into decisions on how to collect material at source and re-engineer the vehicle fleet. Common sense suggests that separation at source is likely to be more economic on the basis that it is cheaper to blend or integrate separated material for a variable series of exit routes than it is to separate collected mixed materials to a required specification of moisture, calorific value, chlorine contents or cleanliness.

A further implication of such a process is that the heavy duty compaction vehicles currently back-designed from mixed disposal to landfill to optimise route efficiency and distance travelled per t disposed will be less in demand. Separated collection systems will favour palletised, modular handling as typified by the same trends that occurred in the food industry in the 1970s when the switchover from direct deliveries to RDC load assembly centres occurred. Logistically the resources sector will replicate that process: but in reverse.

6. STAGE 5: SOCIO-POLITICAL EXPLANATION AND IMPLEMENTATION

Once this analysis is completed a regional or sub-regional

grouping should be in a position to make recommendations to political bodies based on sound science, in terms of carbon impact and internal economics (and the risk assessment of how these might move in the coming decade).

Thereafter those suggestions need to be compared with the opportunities/threats in relation to employment, job creation, fuel poverty strategies and the whole debate around public acceptance.

There are two significant corollaries to this process.

- (a) First, that no explicit decision is needed on the type(s) of technology to be employed (whether in the biochemical, physicochemical or thermochemical stages). That is an issue for each individual developer of each scheme at the secondary planning stage.
- (b) Second, if this process works it will create an inward investment stream into waste carbon management based on market conditions. This will be extremely favourable by 2012 with landfill gate fees for scrap carbon resources at £80 or more, and energy/recyclate material prices at new probable

highs due to their high embedded fossil carbon content. For the UK as a whole this is estimated at around £16 billion. The message for local authorities, who have yet to decide whether to fund their own investment in these facilities is: why bother? The preconditions for the private sector to accept that risk on their own balance sheets are becoming more real by the week.

As the capacity of such plants extends beyond available supply of scrap carbon, waste disposal gate fees will begin to weaken and fall much as they did as German incineration capacity outstripped the supply of waste in the years from 2000. This will make 30 year contracts with retail price index indexation look increasingly foolhardy, particularly if the process technology and/or the backup logistics supply infrastructure is also carbon intensive relative to other options which might come from the iteration outlined in this note.

REFERENCE

1. See <http://www.defra.gov.uk/environment/climatechange/uk/business/crc/index.htm> for further details (accessed 28/11/2008).

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