BPP Consulting Client Advice Note to Essex County Council

Client Brief

Provide indicative advice whether a CHP facility would be viable at 200,000tpa or would over-capacity provide other benefits (e.g. produce more heat and steam to sustain a 'de-ink' paper pulp plant as proposed by the permitted facility) If so what benefits might such a plant offer in that location

Key questions:

Viability at 200,000tpa

The main issues that would affect viability are assumed to be the revenue (waste management and energy production/sales) against costs (construction & operation). There may also be risk factor of security of supply of material if the capacity is at the upper end of forecast needs.

When referring to the CHP plant it is taken to be an Energy from Waste plant, i.e. a waste combustion plant producing electricity supplied to the grid with a heat off-take enabled. This should ensure the plant is compliant with the R1 formula to qualify as a waste recovery plant under the Waste Framework Directive. It should also be noted that extracting steam from the turbine for heat supply purposes does reduce the overall electricity generation potential. It is reported that extracting 5MW of heat will typically reduce the electricity generated by circa 1MW. Therefore, the proceeds of heat sales must offset that loss in revenue as well as cover the cost of any infrastructure such as pipework needed to facilitate distribution of the heat to the user.

A number of EfW facilities of c200kte capacity have been built in the UK although:

1. most if not all of these have been built either on the back of local authority contracts which provide a guaranteed income for the life of the plant, or funded through PFI/PP, significantly reducing risk; and
2. few are operating as CHP plants.

The only merchant EfW plant we are aware of that was built without a contract is the Lakeside facility at Colnbrook (450,000 tpa). This was an early entrant in the landfill diversion market which secured long term local authority supply contracts enabling authorities to avoid having to construct their own. This operates as an EfW plant supplying electricity but not heat.

The only merchant CHP plant we are aware of is the Sustainable Energy Plant (550,000tpa) at Kemsley paper mill in Kent is currently being built. This plant is to supply heat and power to the adjoining existing mill, helping to reduce operating costs and replacing an onsite gas-fired power station. It is to sell the surplus power to the grid. This plant is perhaps the closest comparator with the proposed Rivenhall plant, also being designed to take SRF and RDF rather than raw mixed residual waste. However, it is to supply heat and power to an existing anchor load rather than a prospective anchor load as is proposed in Rivenhall.

It is generally accepted that provision of capitcal intensive plants like EfW plants is subject to economies of scale. That means because the capital costs associated are to a degree fixed, the greater the throughput of the plant, the lower the per tonne gate fee (as the more the costs are spread across the tonnes accepted). This is illustrated in Figure 1 below based on data from early 2000. This graph shows the technology costs per tonne for differing EfW plant scales. It appears from this that a plant of 200ktpa would be sub-optimal in terms of potential economies to be gained and that it is only above 400ktpa tonnage capacity, the cost benefits of increasing facility scale begin to reduce (as the curve flattens out).

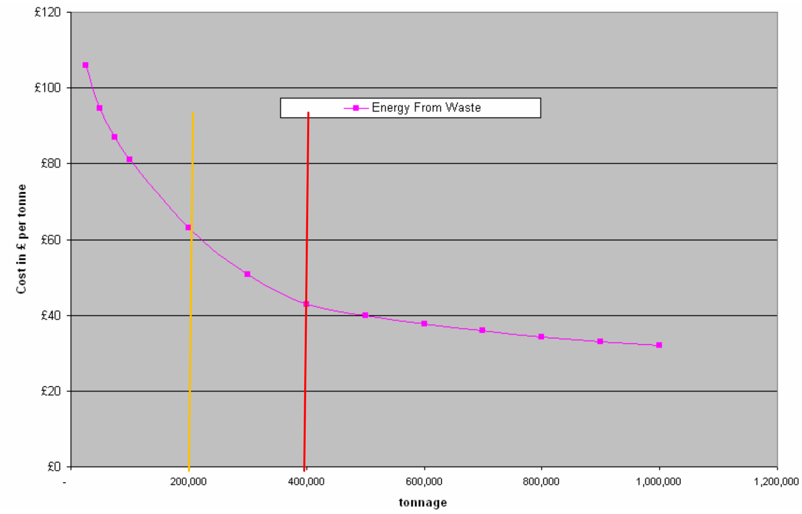

Figure 1: EfW Technology Gate Fees vs Capacity

Source: Defra Study[1]

Figure 2 below displays the size distribution of the operational UK EfW plant fleet.

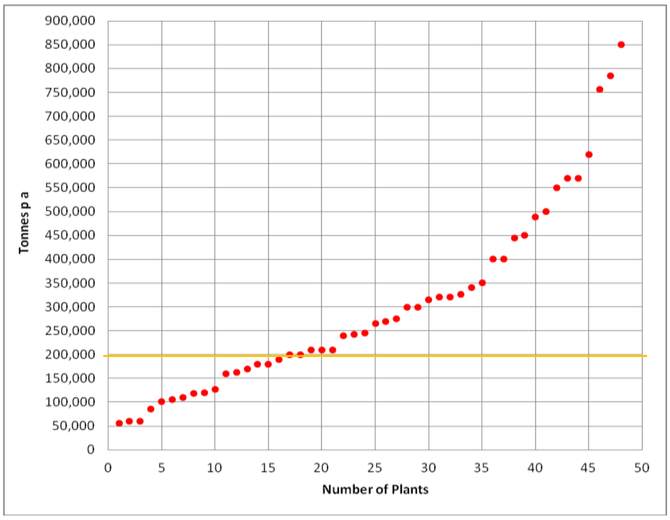

Figure 2: UK Operational EfW Plant Throughput

Source: Various

This demonstrates that a plant of c200ktpa would by no means be exceptionally small, with 20 of the 48 plants being at or below that throughput. When compared with Figure 1 this suggests that a significant number of plants have been built at a sub-optimal size. This can largely be explained by the fact that many of the plants have sized according to predicted arisings within a specific area to service local authority contracts.

[1] Economies of Scale - Waste Management Optimisation Study for Defra April 2007

Possible Benefits of 'over capacity'

Rivenhall is relatively exceptional within the UK EfW plant population as the EfW plant is proposed as a component of much larger integrated facility with an apparent synergy/co-dependence between them both in terms of, fuel supply to the EfW/CHP plant and energy demand from the other facilities to be met by the EfW/CHP plant. As an integrated facility with integral CHP it offers the opportunity for both an immediate solution to management of the residues of the other components and a more efficient utilisation of energy produced from the combustion of waste (both these residues and other imported) in the EfW plant. This in turn should bring CO_2 savings given that the heat would displace other energy sources likely to be fossil fuel fuelled.

Fuel Supply

It could be assumed that the sizing of the plant reflects the assessment of the plant's potential to attract sufficient waste fuel (supply/availability of SRF and other fuels such as RDF) at an attractive gate fee. The gate fee must cover the repayment of borrowed capital (cap ex) and operating costs, offset against the revenue gained from heat and power sales.[2] The potential for off-take of heat to supply co-located facilities is considered to be secondary as it may be varied according to need with more heat being used to raise steam for power generation instead.

However, the throughput of the consented facility (Feb 2016) is substantially greater than originally consented – 595kte vs 360kte:

- Original permission for CHP 360kte – material sourced from including from outputs of the onsite MBT plant (109.5kte), rejects from the onsite MRF (10kte) and residues from Basildon WMF/(Courtauld Road MBT plant) (87.5kte), plus process sludge from de-inking plant(165kte). Total fuel/residual from these sources therefore 372kte.
- Revised facility (Condition 2 variation 2014, permitted 2016) for CHP 595kte with capacities reduced for MBT, AD and the de-inking plant (MDIP) and slightly increased MRF.

It is reasonable to expect that the reduction in-capacity of the MBT (-80kte) and MDIP (-190kte) components will also reduce the residues available for combustion in a commensurate way. In fact, it is noted that the residues from the de-inking & paper pulp (MDIP) facility (clays) are now proposed for export and not fuel, and so a loss of 165kte fuel from this source may be assumed.

[2] The latest WRAP Gate Fee Survey 2017 indicates that Operators consider that non-contracted EfW gate fees are likely to rise in the south east due to increased RDF export prices due to the falling value of sterling (£); and the shortage of landfill capacity at least until additional EfW capacity becomes operational.

Energy Demand

The MDIP is identified as an 'energy hungry' facility. The permit refusal document (Appx 18) refers to steam export of 35MW/285,250MWh and it is assumed this is predominantly demand from the MDIP since co-location is presented as enabling this need to be met by energy supplied by the EfW plant in the form of heat, steam and power[3]. Delivery of the CHP capability of the EfW plant appears to be dependent on construction of the MDIP.

The increase in throughput of the EfW plant and reduction in capacity of most other components does suggest that their inter-relationship is not rigid in terms of fuel supply and energy demand. That is to say if one component changes, it would not necessarily affect the fundamental viability of delivery of the other. For example, while the EfW capacity has increased, the MDIP capacity has decreased and it is not clear how that might impact the energy demand and viability of the heat supply arrangement between the plants.

There is no scenario in the documentation of a 200kte plant supplying sufficient heat to the MDIP. However, as described above, the MDIP capacity has now been reduced (presumably with lower heat requirement) while the EfW plant capacity has increased (presumably with potential for increased heat generation) suggesting there is no clear link between the scaling of these components. However a note of clarification produced by Fichtner dated 06/03/18 actually tells us that, although the throughput has increased, the thermal capacity of the plant has decreased by 10%. This is attributed to the lower predicted calorific value of the fuel to be burnt.

<u>Benefits of plant in location</u>

- Co-location benefits were thoroughly explored in consideration of the application.
- Co-location of the EfW plant with the other waste management uses proposed would provide clear benefits, through reducing numbers of vehicle movements associated with management of input materials and associated residues (one delivery location for multiple treatment, minimising need for onward transport of residues), co-location of processing/treatment on site would provide some security of supply for fuel for the EfW plant. Development on a single site would be more efficient use of land and contain the extent of potential environmental and amenity impacts within a single location.
- Other benefits in terms of EfW plant specifically would clearly be the ability to meet some or all of the energy (heat and power) needs of the other facilities (reference is made to 'half of the energy being used on site'[4]) with associated CO2 saving benefits (WRATE is referred to in documentation[5] that demonstrates savings) while still exporting electricity to the grid.
- It is not clear how the proposed benefits of co-location can be guaranteed to be delivered in the event that the EfW plant is built and then provision of the other facilities is subsequently determined not to be viable.

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[3] ES Appx 1
[4] Para 5.11 Appeal Report / Appx 4
[5] Para 6.98 Para 13.17/18 Appeal Report / Appx 4