Case Study — Developing an Industrial Waste EfW Project

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1. Market Context

- The need for EfW facilities in the UK:
  - waste management companies need an alternative to landfill; and
  - power producers need an alternative to fossil fuel.
- But:
  - waste management companies are often nervous of EfW: power generation is not their core business; and
  - power producers are often nervous of EfW: handling waste is not their core business.
- Moreover:
  - large companies have little appetite for what is for them a small project; and
  - small companies generally have insufficient resource to develop and finance what is for them a large project.
- But some companies have had the vision to overcome the obstacles:
  - they will benefit as a result; and
  - they demonstrate that such projects are possible for such companies.
- And their EfW projects aren't an incentive for them or others to move down the waste hierarchy: they are the opposite.

2. Economic Case

- Revenue from gate fees: landfill costs are high and are expected to increase —
  - but a non-WID plant (i.e. one that can only process WID-exempt biomass wastes like forestry residue and sawmill offcuts) cannot benefit from gate fees;
  - for the purposes of illustration, a gate fee of £50 per tonne will yield a revenue of £500,000 per year per 10,000 t/a plant capacity.
- Revenue from power: power prices are high and are expected to increase — potentially they comprise:
  - 'brown power' value, including embedded benefits and Triad benefits — for the purposes of illustration, a purchase price of £68/MWh will yield £480,000 per year per 10,000 t/a plant capacity; and
  - renewable energy benefits including Renewable Obligation Certificates (ROCs), Climate Change Levy Exemption Certificates (LECs), and Renewable Energy Guarantees of Origin (REGOs) — for the purposes of illustration, a value of £75/MWh based on a 'ROC Banding' of 1.5 will yield £520,000 per year per 10,000 t/a plant capacity.
- Operating and maintenance costs, for the purposes of illustration say £500,000 per year per 10,000 t/a plant capacity, including:
  - staff costs — which depend heavily on whether existing staff are available to cover some tasks;

  - utilities costs, e.g. water, support fuel, boiler feedwater treatment chemicals, gas cleaning reagents, fly ash disposal, wastewater disposal;
  - maintenance and repair costs, including infrequent major overhauls — which depend heavily on the quality of the plant operation and maintenance regime; and
  - miscellaneous costs, e.g. land rent, council tax, insurance, outsourced security services, telecoms, grid use charge, outsourced laboratory analyses, annual EA subsistence fees, annual Ofgem fees, staff training, administration.
- The capex that a net revenue of £1 million per 10,000 t/a of plant capacity will support depends on, among other things:
  - the financing arrangements; and
  - economies of scale.
- One uncertainty is the EU ETS liability, if any, because we cannot answer the questions:
  - Will the plant have a liability under EU ETS? — in principle, all power generation facilities with a rated thermal capacity of 20 MW or more are required to hold an EU ETS emissions permit. There is an exemption for municipal waste to energy plants: what about other EfW plants?
  - How many free EUAs will the plant receive? — under EU ETS Phase 2 this depends on the number of free EUAs remaining in the industry sector category of the 'New Entrant Reserve'. Under EU ETS Phase 3, EUAs will be auctioned, but at what price?
  - What proportion of energy input will come from fossil sources? — any plastic in the fuel will give rise to CO_2 emissions that must be supported by EUAs or the buyout price. But what fraction of each type of plastic will there be, and what CO_2 emissions will the different plastics be considered to emit?
  - What will be the cost of meeting our EU ETS liability? — any fossil-sourced CO_2 emissions will have to be supported by submitting purchased EUAs, the cost of which depends on the market price which, in turn, depends on the balance between the national permitted emissions and the actual national CO_2 emissions, and the value of Joint Implementation ERUs and Clean Development Mechanism CERs.
  - What will the administrative costs be, e.g. for accreditation, verification and validation?
- Risks, e.g.:
  - technology risks, e.g. whether the plant will process the intended waste, or whether more waste preparation is required than anticipated;
  - contractor risks, e.g. whether the plant will start up on schedule, or whether the contractor will go into liquidation;
  - operating risks, e.g. whether the plant throughput will be achieved, or whether the O&M costs are higher than anticipated; and
  - financial risks, e.g. whether the gate fees are lower than anticipated, or whether loan interest rates will rise.

3. Project Options

- Plant design fundamentals:
  - fuel — which will affect whether or not ROCs will be gained;
  - plant capacity — which need not be based on the amount of waste currently available in-house;
  - technology — which will affect the plant efficiency, eligibility for ROCs, and the ability to gain planning permission.

- Issues affecting permitting, e.g.:
  - separating the site between an existing Materials Recovery Facility and a proposed Energy Recovery Facility – to avoid having to re-permit an existing facility;
  - the height of the chimney – planners prefer chimneys low; the EA prefers chimneys high;
  - whether to submit applications for the planning permit and environmental permit simultaneously, or one after the other – simultaneous submission increases the chances of gaining planning permission, but also increases at-risk expenditure.
- Contractor selection issues:
  - whether to select the main contractor before or after the planning application – doing so beforehand means you have better information for the planning process but effectively prevents seeking competitive bids;
  - whether to nominate a main contractor as a partner or seek competitive bids – a nominated contractor will work with you to develop the project but potentially can take advantage of the lack of competition;
  - whether to seek one turnkey contractor or let smaller contracts – the banks may insist on one contract, but smaller ones will reduce capital cost.
- Project financing issues:
  - whether to seek capital grants or not – doing so will delay the project;
  - whether to seek an equity partner – doing so will dilute your control of the business, but without one you may not have the equity to raise the necessary debt;
  - when to seek an equity partner – the later you leave it, the better value you gain, but the greater your speculative risk;
  - whether to take a corporate financing or project financing route – project financing protects your existing business but prevents you using assets as security to support the loans;
  - whether to enter into a long-term waste supply contract and power purchase contract or not – doing so reduces risk, but also reduces the opportunity to gain from upward market movements.

4. Technology Utilised

- The degree of waste pre-treatment:
  - remember the waste hierarchy – the aim should be to remove everything that can be reused or recycled;
  - decide whether you wish to depend on gaining ROCs – if so, you must ensure the waste is more than 90% biomass by energy content (unless you are using an 'advanced conversion technology');
- The choice between combustion, gasification and pyrolysis; and
  - bear in mind the plant is designed on a thermal capacity not mass throughput or power output;
  - the design of the secondary combustion chamber can be critical for gaining an environmental permit.
- Energy recovery – the boiler design must:
  - minimise heat transfer surface fouling;
  - not have a steam temperature above 400°C or else corrosion will be severe.

- Gas cleaning – 'Best Available Technique' requires such measures as:
  - flue gas recirculation for NO_X control; and
  - activated carbon injection for dioxin and heavy metal control.
- Power generation – consider the relative merits of:
  - steam Rankine cycle vs Organic Rankine Cycle;
  - single-stage and multi-stage steam turbines;
  - reaction vs impulse steam turbines.
- Condenser – consider the relative merits of:
  - air cooled condensers – which minimise water consumption;
  - water-cooled condensers – which cost less, require a smaller footprint, and increase plant efficiency.
- Combined Heat and Power (CHP) – this is considered 'best available technique', but:
  - can you can sell the heat (as hot air, hot water or steam)? and
  - if you do supply heat, you will probably reduce power output (and probably still not achieve 'Good Quality CHP').

5. Project Development

- Speculative costs incurred – can be minimised by small steps and frequent reviews, but this will increase overall cost and time.
- Project programme – depends entirely on the developer's speed of decision-making!
- Project steps (generally in this order):
  - prefeasibility study – turns a concept into a project;
  - feasibility study – optimises the project concept and determines its viability;
  - grid connection study – can take forever but grid connection costs must be determined;
  - public consultation is a statutory obligation – an exhibition prevents opponents hijacking a public meeting;
  - preparation of an Environmental Impact Assessment, an Environmental Statement, a planning application and Environmental Permit (formerly IPPC) application, with the necessary site surveys;
  - arranging project financing – some would do this sooner, but it's difficult to get financial institutions to take the project seriously at an earlier stage.

6. Project Programme for Enviropower Ltd, Lancing, West Sussex

- Concept to Financial Close (FC – is it a coincidence that the initials also stand for Father Christmas?) – March 2004 to December 2006:
  - planning determination – January 2006 to May 2006 (with subsequent variations);
  - IPPC permit determination – February 2006 to October 2006 (with subsequent variations).
- Financial Close to completion (handover):
  - construction – January 2007 to August 2008;
  - commissioning – September 2008 to November 2008.