British Plastics Federation
Plastics Recyclers Group

“The role of plastics in the EFW and advanced conversation technologies market place”

Presented by Paul Danks 23.6.11
Agenda

• Introduction to myself and Orchid
• Orchid Process
• Fuel output from Orchid process
• Background information on UK and European waste and fuel specifications
• Various outlets/technology options
• Outlet technology
• Current fuel specifications for various technology options
• Gate fees for fuels
• Benefits/issues of plastic as an energy in feedstock
• What the future hold for plastics in fuels?
Introduction to myself & Orchid

• I’ve been working in the Waste management, treatment, fuel production and power generation industry for the past 20 years

• Worked for two of the major Waste Management/treatment companies in the UK

• Over the past 10 years I’ve been specialising in alternative bio-fuel/RDF technologies and alternative power generation technologies i.e. Gasification and pyrolysis

• Project development of EFW facilities from alternative fuels utilising alternative technologies

• Sourcing outlet markets for recycables and alternative fuel/RDF ‘s and alternative raw materials into the marketplace
Introduction to myself & Orchid

• Orchid is part of the Orchid Bio-energy Group

• Our investors are ArcLight (US based investment fund in wind, solar, petro-chem, alternative fuels)

• The Orchid process was chosen as part of the DEFRA new technologies programme

• Its purpose was to process MSW and prove the process could recover various size fibre fuels and blend them to various specifications for an outlet market

• Following the successful 12 month programme the facility went Commercial April 2009

• Programme is to build a facility at Shotton for 160K p.a. plus Bexley 160k p.a. over the next 2 years

• Continuous R&D including Orchid fuel to liquid (successful trials conducted)
Orchid Process
Fuel Output from Orchid Process

The Orchid process manufactures 3 output fuels.

- 6mm biomass rich fuel which comprises 85% by weight and CV biomass content (meets ROC criteria) ideal for biomass WID complaint boiler (approx 20% of input feed)

- 6-16 mm floc which comprises approx 70% biomass remainder 30% is made up of light plastics and textiles ideal for Cement industry, gasification, pyrolysis and liquid fuel (approx 40% of input feed)

- 16-30 mm floc which comprises approx 50% biomass remainder 50% is made up of light plastics and textiles ideal for Cement industry, gasification, pyrolysis and liquid fuel (approx 40% of input feed)
Fuel Outlets/Technology Options

- Cement industry (KILN) UK – only available on large volume contracts – fuel specification
difficult to meet – Technology proven been operationally for numerous years

- Cement industry (KILN) overseas - only available on large volume contracts – fuel specification
difficult to meet – Technology proven been operationally for numerous years

- Combined Heat & Power (CHP) UK/Overseas – Available for biomass rich fuel in UK, overseas
  facilities will take more varied feedstock – need to be WID compliant to maximise fuel input

- Gasification – technology only proven via limited suppliers – lack of operational facilities in the UK
  – proving difficult to financial close projects in the UK

- Pyrolysis – technology not fully proven at commercial scale – lack of operational facilities in the
  UK and Europe – proving difficult to financial close projects in the UK
Fuel Outlets/Technology Options

• Energy from Waste facilities (UK) and (Overseas) Technology proven been operationally for numerous years – UK facilities are prominently for PFI contracts with no capacity for commercial waste suppliers – Overseas facilities currently have tonnage shortfall, targeting the UK marketplace for materials

• Biomass Boilers - technology proven for biomass only – requires upgrade of emission control to take more varied feedstock ie RDF

• Plastics to liquid fuel – technology not proven at commercial scale – various scale trials conducted proving difficult to financial close projects
Outlet Technologies
<table>
<thead>
<tr>
<th>Technology and Offtake</th>
<th>Fuel size</th>
<th>CV</th>
<th>Moisture content</th>
<th>Fuel presentation</th>
<th>Exclusions in fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement industry (KILN) UK</td>
<td>Particle &lt; 30 mm</td>
<td>&gt;17 mj/kg net</td>
<td>&lt;15%</td>
<td>Floc</td>
<td>Chlorine below 0.6%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Cement industry (KILN) UK</td>
<td>Particle &lt; 20 mm</td>
<td>&gt;18 mj/kg</td>
<td>&lt;17%</td>
<td>Floc</td>
<td>Chlorine below 0.6% low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Cement Industry (KILN) UK</td>
<td>Particle &lt; 30 mm</td>
<td>&gt;17 mj/kg net</td>
<td>&lt;15%</td>
<td>Floc</td>
<td>Chlorine below 0.4 % low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Overseas RDF marketplace</td>
<td>Particle &lt; 35 mm</td>
<td>&gt;15 mj/kg</td>
<td>&lt;17%</td>
<td>Baled and wrapped</td>
<td>Chlorine below 0.6%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Cement industry overseas (KILN)</td>
<td>Particle &lt; 35 mm</td>
<td>&gt;16 mj/kg net</td>
<td>&lt;15%</td>
<td>Baled and wrapped</td>
<td>Chlorine below 0.6%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>CHP Overseas</td>
<td>Particle &lt; 35 mm</td>
<td>15-17 mj/kg</td>
<td>&lt;10%</td>
<td>Baled &amp; wrapped plus pellets</td>
<td>Chlorine below 0.6%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Gasification</td>
<td>Particle &lt; 20 mm</td>
<td>&gt;16 mj/kg net</td>
<td>&lt;15%</td>
<td>Briquettes 65-75 mm</td>
<td>Chlorine below 0.6%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Gasification</td>
<td>Particle &lt; 100 mm</td>
<td>&gt;8 mj/kg</td>
<td>&lt;55%</td>
<td>Shredded</td>
<td>Chlorine below 2%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Pyrolysis</td>
<td>Particle &lt; 20 mm</td>
<td>&gt; 18 mj/kg</td>
<td>&lt;10%</td>
<td>Shredded</td>
<td>Chlorine below 2%, low metal content thresholds and no large metal or glass</td>
</tr>
<tr>
<td>Large EFW overseas/UK</td>
<td>Particle &lt;400 mm</td>
<td>8.5-11 mj/kg</td>
<td>&gt;25%</td>
<td>Loose, baled and wrapped</td>
<td>No exclusions</td>
</tr>
</tbody>
</table>
### Gate fee for fuels

- **Cement industry UK** - £45-60 per tonne (collected) limited capacity in UK marketplace

- **Cement industry Overseas** - £35-55 per tonne (collected) capacity available

- **RDF overseas** - £50-60 per tonne (delivered) capacity available, large interest in attracting material from the UK

- **Gasification UK** - £30-50 per tonne (collected) limited capacity

- **Biomass UK** - £10-20 per tonne (collected) limited capacity, becoming more readily available

- **EFW UK** - £80-120 per tonne (delivered) very limited capacity

- **EFW Overseas** - £65-80 per tonne (delivered) huge shortfall currently, attracting material from UK market
Benefits/Issues of plastic as energy in feedstock

- Plastic is a fantastic material to boost the energy value of all alternative fuels with average CV of 30-40 mj/kg

- The plastic content by weight in MSW – Dense plastics 6-15%, Plastic film 6-10%

- The plastic content by weight in C&I – Dense plastics 15-20%, Plastic film 10-15%

- Plastics in gasification and pyrolysis technologies produce reduced dioxins and furans due to the combustion temperature of the vessel typically between 800-1000 degrees – emission clear up equipment capex is reduced and the output gas is cleaner and stable to run an engine or generate steam to run a turbine for electricity generation

- Plastics in EFW however produce dioxins and furans, this is due to combustion temperature of 1200-1400 degrees the temperature where dioxins and furans form. Reason for
Benefits/Issues of plastic as energy in feedstock

- Dependent upon the technology / outlet further preparation maybe required to meet the fuel specification of the outlet market:
  - size reduction
  - further blending
  - change of out loading method
  - change of transport method to remove material from site

- If the above is required additional cost will be incurred to meet fuel specifications

- Liquid fuel technology requires a plastic rich infeed material
What does the future hold for plastic in fuels?

• Over the next couple of years plastics are going to play an important role as an important ingredient to alternative fuels and alternative technologies.

• The UK infrastructure being developed over the next 5 years will release capacity to the plastics industry an outlet away from Landfill and reduce costs.

• The European infrastructure requires material from the UK marketplace to address the shortfall plus facilities currently being commissioned.

• Whilst additional operating cost may be incurred to meet specification the gate fee will become more competitive due to the new infrastructure requiring material to operate.

• An exciting opportunity for the plastics industry to contribute and added ingredient to the increasing demand for alternative fuels.
Many Thanks for your time

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