Biomass Co-Firing
Ferrybridge “C” Power Station

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19th Annual Meeting And Meetings Of The
Combustion, Coal Characterisation And Coal
Conversion Divisions.
Nottingham University 10 April 2008
Scottish and Southern Energy

- UK’s largest non-nuclear generator
- Over 10,000MW of generation capacity including share of joint ventures
- 46.6TWh generated
- 1,518MW of renewable energy generation
- 568MW hydro and wind generation capacity qualifying for ROCs
Renewable Obligation

- Designed to increase amount of renewable generation
- Firing Renewable fuels to satisfy the Government’s Renewable Obligation
- Identify fuels that will burn well and are economically and environmentally sustainable
Co Firing of Biomass

• First Commercial co firing of biomass in a UK Coal Station, Started Sep 2002
• 920 Kt Biomass burnt (Mar 08)
• Principal Fuels: Olive Pellets, Palm Kernels
# Biomass Characteristics

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Cv GJ/Tonne</th>
<th>Volatile Matter</th>
<th>Ash</th>
<th>Moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive Pellets</td>
<td>16 - 17</td>
<td>66%</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Palm Kernels</td>
<td>16.5-17.5</td>
<td>67%</td>
<td>4%</td>
<td>9%</td>
</tr>
<tr>
<td>Wood</td>
<td>16.5 – 17.5</td>
<td>74%</td>
<td>0.5%</td>
<td>7%</td>
</tr>
<tr>
<td>Coal</td>
<td>24-25</td>
<td>28-32%</td>
<td>10%</td>
<td>10 – 12%</td>
</tr>
</tbody>
</table>
Olive Cake

- Olive Cake
- Dried filter cake from Olive Oil Production
- Relatively cheap, Freely available.
- Difficult to mill due to fibrous nature of stones
- High Cl⁻ from Brine Washing
Fuels – Olive Pellets

• Consists of the pulp from Olive Oil Production
• No Stones
• No Cl⁻ problems
• More expensive than cake but easier to mill
Palm Kernel Expellers

- By Product of Palm Oil manufacture
- Best quality fuel for co firing
- Dust more of an issue
- Environmental Issues with destruction of rain forests
Wood

- Require dried wood – Green wood too wet
- Wood Pellets widely available in Scandinavian domestic market
- Relatively expensive
- Fibrous – Unsuitable for high dosing Co-milling
Co Milling

- Biomass delivered to plant by road
- Stored in purpose built facility - Rain, Odour & Dust
- Loaded onto coal conveyor from dedicated feeder
- Dust controlled by cyclovent facility
- Rotting Biomass and vermin control
Co Milling Issues

- Load degradation – Particularly at high dosing levels > 5% w/w
- Measurement of dosing rate achieved through control scheme
- Extra cleaning
- No effects seen on pressure parts – low dosing rates dilute K levels
Milling Equipment

- Babcock 10E Ball Mills
- Mills fill up, and have to be backed off
- Mill Motors have failed due to high running currents with higher biomass %
New Biomass Facility

- New dedicated facility for firing neat biomass
- New reception and material handling facilities
Material Handling
Dedicated Burners

- Sub Stoichiometric combustion in first stage of burner
- Gasses burn in furnace chamber
- Burning White Wood
- Requires clean fuel – not resilient to contamination