ASHTRANS EUROPE 2014

STEAG Power Minerals and ZAG International, a World UK Perspective and New Trends

Peter Brennan
1. **Current Trends in Coal-Fired Power Generation in the UK:**
   - Biomass.
   - Gas Prices.
   - Environmental Regulations (SO2; NOx).
   - Fly Ash Quality.
   - Fly Ash Storage.

2. **New Coal-Fired Power Plants in Mainland Europe.**

3. **Options for Improving Fly Ash Supply in the UK:**
   - Storage.
   - Beneficiation.
   - Drying.
   - Imports.

4. **Logistics.**

5. **Summary and Conclusions.**
Drax Power Station

Six 660MW generating units.

Ash production from one generating unit:

EN450 Fly Ash - 200,000 tonnes per year.

Bottom Ash - 40,000 tonnes per year.

Total Ash production at full operation with six coal-fired generating units:

EN450 Fly Ash - 1,200,000 tonnes per year.

Bottom Ash - 240,000 tonnes per year.
Drax Power Station

One coal-fired generating unit converted to biomass in June 2013.

Second coal-fired generating unit converted to biomass in April 2014.

Third coal-fired generating unit converted to biomass in March 2015.

Option to convert a fourth coal-fired generating unit to biomass in 2015/2016.
Drax Power Station

Impact on EN450 Fly Ash and Bottom Ash production:

Three generating units converted:

Loss of 600,000 tonnes of EN450 Fly Ash per year.

Loss of 120,000 tonnes of Bottom Ash per year.

Four generating units converted:

Loss of 800,000 tonnes of EN450 Fly Ash per year.

Loss of 160,000 tonnes of Bottom Ash per year.
The Impact of Biomass in the UK

New Build Biomass Stations:

- In addition to coal-fired power stations converting to biomass in the UK there are a significant number of new biomass power stations:
  - Total generating capacity of new-build biomass power stations – 1,100MW
  - Estimated generating capacity of planned biomass power stations – 3,200MW

Wilton 10 Biomass Power Station, Teesside
Generating Capacity: 35MW
London 23 June 2014

UK spot power prices on the base and peak reached a new four year low on Monday, the weakest since April 6, 2010 when the contracts were assessed at GBP34.50/MWh and GBP38.50/MWh respectively …..

The historically low gas prices mean that profits from gas-fired generation have increased, allowing a greater proportion of gas plant use compared to coal-fired generation ….. as gas prices continue to fall the more efficient gas plants are able to compete with older, less-efficient coal-generation …..
In the UK combustion plants are regulated under a number of mechanisms including the Large Combustion Plant Directive and the Pollution, Prevention and Control Regulations which will transfer to the Industrial Emissions Directive in 2016.

<table>
<thead>
<tr>
<th></th>
<th>EXISTING</th>
<th>NEW (i.e. POST 2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{SO}_2$</td>
<td>400 ppm</td>
<td>200 ppm</td>
</tr>
<tr>
<td>$\text{NOx}$</td>
<td>500 ppm</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Particulates (Dust)</td>
<td>50 ppm</td>
<td>30 ppm</td>
</tr>
</tbody>
</table>

- A significant number of UK coal-fired generating units do not have FGD fitted.
- Only one UK coal-fired power plant currently has NOx abatement equipment fitted (SNCR).
• In the UK only two power stations produce EN450 quality fly ash on a consistent basis. Most power stations produce fly ash with an LOI level higher than 7%.

• Fly ash beneficiation processes have been installed at a number of power plants to reduce LOI levels below 7%:
  
  o STI units at West Burton, Longannet and Aberthaw Power Station.
  
  o Steag units at Rugeley Power Station.

• Fly Ash quality could decline further into the future as the operating regime of coal-fired power stations increasingly switches from baseload to two-shifting.
External silo plants in Germany:

- **Ottmarsheim**: 7,700 tonnes
- **Nürnberg**: 2,500 tonnes
- **Bachmann**: 16,000 tonnes
- **Werne**: 4,000 tonnes
- **Neumarkt**: 40,000 tonnes
- **Neubeckum**: 23,000 tonnes

Others:

- **Flat store Baums**: 18,000 tonnes
- **Redrying plant**: 100,000 tonnes

**Total**: > 200,000 tonnes

Storage capacity is also available internally at the power station.
# New Coal Fired Power Plants in Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of plant</th>
<th>Company</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Hamburg-Moorburg</td>
<td>Vattenfall</td>
<td>COD 2013/14</td>
</tr>
<tr>
<td>Germany</td>
<td>Walsum 10</td>
<td>STEAG</td>
<td>COD 2013 (in operation)</td>
</tr>
<tr>
<td>Germany</td>
<td>Westfalen</td>
<td>RWE</td>
<td>COD 2014 (1 unit in operation)</td>
</tr>
<tr>
<td>Germany</td>
<td>Lünen</td>
<td>Trianel</td>
<td>COD 2013 (in operation)</td>
</tr>
<tr>
<td>Germany</td>
<td>Wilhemshaven</td>
<td>GDF Suez</td>
<td>COD 2013 (in operation)</td>
</tr>
<tr>
<td>Germany</td>
<td>Karlsruhe</td>
<td>EnBW</td>
<td>COD 2013</td>
</tr>
<tr>
<td>Germany</td>
<td>Mannheim</td>
<td>EnBW</td>
<td>COD 2014</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Eemshaven</td>
<td>RWE</td>
<td>COD 2014</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Maasvlakte 3</td>
<td>E.on Benelux</td>
<td>COD 2013 (in operation)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Maasvlakte</td>
<td>GDF Suez</td>
<td>COD 2013</td>
</tr>
<tr>
<td>Spain</td>
<td>As Pontes</td>
<td>Endesa</td>
<td>COD 2013 (in operation)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Sostanj (Unit 6)</td>
<td>TE Sostanj</td>
<td>COD 2017</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Ledvice 4</td>
<td>CEZ EP</td>
<td>COD 2014</td>
</tr>
</tbody>
</table>
There are a number of factors which are likely to lead to a decline in Fly Ash production in the UK in the coming years. Although significant volumes of Fly Ash will still be produced in the UK it is necessary to consider the possibility that Fly Ash can be produced in the wrong place, at the wrong time, or be of inadequate quality for use in cement and concrete.

In order to address these issues a strategy should be considered for the UK which includes the following key elements:

- Access to a number or sources of Fly Ash.
- Development of imports of Fly Ash.
- Consideration of investment in ash beneficiation technology in strategic locations.
- Accessing stockpiled fly ash deposits where these meet the technical requirements of the end user.
- Investment in silo plants and terminals.
- Establishment of innovative and effective logistics solutions.
Quality improvement

Ash beneficiation at Rugeley Power Station

• Only facility of its kind worldwide.

• Product: Fly Ash according to EN 450 Cat B Cat S.

• Capacity: 10,000 tonnes per year per processing unit.

• Capacity can easily be scaled up by means of installing further processing units.
Ash beneficiation at Rugeley Power Station

- Seven processing units currently in operation.

- Annual production of EN450 Cat B Cat S Fly Ash is approximately 70,000 tonnes.

- Residue levels in the range of 10% to 25% depending on feed ash.
Quality improvement

Ash beneficiation

• Further processing plants planned for other UK power stations.

• The design concept shown here has an annual production capacity of 60,000 tonnes.
Redrying plant in Lünen, Germany

- Winter production transported to site for storage in conditioned form. Dried during the summer months.
- Product: Fly Ash according to EN 450.
- Capacity: 100,000 tonnes.
- Permit according to the waste legislation, certified recycling plant.

- In the UK a drying plant could be sited within an existing Fly Ash stockpile area containing EN450 quality material.

Production vs. Demand

![Production vs. Demand chart](image-url)
Import of Fly Ash to the UK: Logistics

- Fly ash logistics are critical when considering imports of Fly Ash.
- Optimal logistical conditions increase security of utilisation and supply.
- Biggest cost impact for the price of Fly Ash.
- Major impacts on the logistic costs:
  - storage capacity (silos, flat stores etc.)
  - capability of load and discharge facilities
  - availability, flexibility und reliability of carriers i.e. road, rail and waterways
  - supply chain (number of necessary transhipments, two way transports etc.)
  - environmental regulations, legal restrictions

Optimal logistical infrastructure secures a high level of security at reasonable costs.
Summary and Conclusions

A number of factors are combining to create a problem with current and future EN450 Fly Ash supplies in the UK. These are mainly associated with market conditions in the electricity generation sector and increasingly stringent environmental regulation.

There should be enough Fly Ash to serve the UK market in the future. However the Fly Ash is likely to be:
- in the wrong place.
- at the wrong time.
- of the wrong quality.

Consequently in order to provide a long-term reliable supply in the UK it will be necessary to:
- have access to sources of Fly Ash outside of the UK.
- have extensive storage facilities.
- process poor quality ash to EN450 standard.
- establish economical and effective logistics solutions.