Particulate Control in the Power Industry

Niall Moroney
Emissions Control Engineer
Agenda

> Introduction to RWE

> Sources of Particulates and the Importance of Control

> Operational Case Study: Aberthaw Power Station
  
  – Approach to particulate control

  – Operational Challenges

> Future Challenges in Particulate Control for LCP

> Summary
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RWE Group – Key Facts and Figures

> RWE is one of Europe’s five leading electricity and gas companies

> RWE is active in the generation, trading, transmission and supply of electricity and gas

> RWE’s core markets are Germany, the UK, the Netherlands, Central and South Eastern Europe

> The RWE Group has over 70,000 employees supplying over 16 million customers with electricity and approximately 8 million customers with gas

> RWE is the number one power producer in Germany

> In 2011 RWE recorded over €51.6 billion in revenue
RWE – One of Europe’s five leading Electricity and Gas Companies

RWE Core Markets

Leading Positions in Core Markets

<table>
<thead>
<tr>
<th>Market</th>
<th>Electricity</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>No. 2</td>
<td>No. 3</td>
</tr>
<tr>
<td>UK</td>
<td>No. 4</td>
<td>No. 4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>No. 2</td>
<td>No. 1</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>No. 2 in Hungary</td>
<td>Leading position in Hungary</td>
</tr>
<tr>
<td></td>
<td>No. 3 in Slovakia</td>
<td>No. 2 in Slovakia</td>
</tr>
<tr>
<td></td>
<td>Presence in the Czech Republic</td>
<td>No. 1 in the Czech Republic</td>
</tr>
<tr>
<td></td>
<td>No. 6 in Poland</td>
<td></td>
</tr>
</tbody>
</table>

Total Europe: No. 3 (Electricity) | No. 6 (Gas)
RWE Generation UK Plant Portfolio

- Didcot B CCGT 1400MW
- Little Barford CCGT 700MW
- Great Yarmouth CCGT 420MW
- Pembroke CCGT 2000MW
- Tilbury Biomass 750MW
- Aberthaw Coal 1560MW
- Littlebrook Oil 1245MW
- Staythorpe CCGT 1600MW
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Sources of Particulates

> Typically Coal has ~15% ash - can be up to 50% - Even fuel oil has enough ash for 50mg/Nm$^3$

> Rust spalling - cold starts

> Incomplete combustion - CinA

> Alternative Fuels:-
  
  – Biomass

  – Ash re-firing
The Importance of Particulate Control

> Health Effects:
  
  – Asthma

  – Decreased lung function

> Visibility Impairment

> Environmental Damage

> Aesthetic damage
Required for a Permit to Operate

> LCPD specifies 48 hour and monthly ELVs of particulates from LCP

> Validated measurements are reported which are 30% below the CEM measurement

> Validation should not be relied on to achieve compliance

> Legislation also requires the use of BAT for control of particulates

> BAT is site specific determination
Dust Abatement Technologies

> Range of technologies:

> Cyclone separator

> ESP – wet, dry, hot or cold

> Bagfilters

> Scrubbers

> Bagfilters or ESP must suited for LCP
BAT Assessment for Particulate Control

Cleanliness of Flue Gas (inverse of dust burden) vs. Cost of installation

- Multicyclone
- Scrubber
- ESP
- Enhanced ESP
- Bag Filter
- Microporous Bag Filter
- FGD

RWE npower
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Case Study: - Aberthaw Power Station

> Located on the Bristol Channel near Cardiff Airport

> Fires low volatile semi-anthracite coal in a downshot boiler

> Three 520MWe direct cooled coal fired units

> Opt-in to the LCPD, seawater FGD fitted on all units
Particulate Control: A Three Phase Approach

Combustion Optimisation
> Minimise CinA – improves ESP efficiency
> Minimise excess air on the unit

ESP Removal
> Optimise removal efficiency
> Minimise duct inleakage

Seawater FGD
> Ensure efficient gas/liquid distribution
Combustion Optimisation

> Coals fired must be within a set specification

> Firing configuration a balance between NOx and dust/CO

> Dynamic classifiers installed on all units

> PF leg balancing
ESP Operation

> Sulphur trioxide and ammonia injected before the ESP
  - Low sulphur coals more problematic

> ESP has 3 passes each with 4 fields

> Transformer rectifier upgraded

> Air ingress assessments routinely performed on the units
FGD Operation

> Seawater FGD: 97% SO$_2$ Removal Efficiency
Operational Challenges

> Poor quality coal can cause combustion issues

> Plant faults:
  - Blocked burners, damper faults, fans
  - ESP failures
  - FGD issues – demister, operational issues

> Co-firing of biomass

> Management of ESP rapping
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Future Challenges for LCP

> Aging Plant – plant degradation and failures

> PM 10s and PM 2.5s becoming more of a concern

> Implementation of the IED introduces more stringent “backstop” ELVs:

<table>
<thead>
<tr>
<th>(mg/Nm³)</th>
<th>LCPD Opt-in</th>
<th>IED</th>
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<tbody>
<tr>
<td>Monthly</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>48hr</td>
<td>55 (97% compliance)</td>
<td>na</td>
</tr>
<tr>
<td>Daily</td>
<td>Na</td>
<td>22</td>
</tr>
<tr>
<td>Hourly</td>
<td>na</td>
<td>40 (95% compliance)</td>
</tr>
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> The BREF may impose yet tighter ELVs
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> RWE is one of Europe’s five leading electricity and gas companies

> Particulate Control is important for LCP to maintain a license to operate and for local health effects

> Aberthaw Power Station uses a combination of combustion, ESP and FGD optimisation to achieve dust emission compliance

> Future legislation will require LCP to comply with more stringent particulate ELVs
Any Questions?