Legislation in the European Union and the impact on existing plant

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Current EU legislation

- EU member countries must comply with United Nation protocols, European Commission directives and other international protocols
- Individual member states may set their own additional national legislation
- Main European Commission directive for 2012 onwards is:
  
  the Industrial Emissions Directive
All coal-fired units must:

• have efficient particulate controls
• Have flue gas desulphurisation or equivalent technology
  
  (<150-400 SO$_2$ mg/m$^3$ or >92% SO$_2$ removal)
• have NOx emissions below 150-300mg/m$^3$

Plants which cannot meet these limits must:

• work under a trading bubble or
• follow limited operation until 2023 and close

significant investment in retrofitting control technologies
Control technologies are effective

**SO$_2$ emissions from electricity generation in the EU**

- Reduction due to efficiency improvements
- Reduction due to increased share of nuclear and renewable energy
- Reduction due to fossil fuel switching
- Reduction due to flue gas desulphurisation and the use of low sulphur fuels
Control technologies are effective

**NOx emission reductions from electricity generation in the EU**

- Reduction due to efficiency improvements
- Reduction due to increased share of nuclear and renewable energy
- Reduction due to fossil fuel switching
- Reduction due to combustion modification and flue gas treatment
The Cost of Retrofits

- **FGD**: flue gas desulfurization (scrubber – Wet or Dry)
- **FF**: fabric filter
- **SCR**: selective catalytic reduction
- **SNCR**: selective non-catalytic reduction
- **DSI**: dry sorbent injection
- **ACI**: activated carbon injection
Retrofitting takes time

Source: The Brattle Group, 2012
Retrofitting in the USA

New “Mercury and Air Toxics Standard” (MATS) in the USA means that most plants are investing in significant retrofit of control technologies.
## 2012 power plant retrofits worldwide

<table>
<thead>
<tr>
<th>Equipment type</th>
<th>Installation date</th>
<th>Value ($billion)</th>
<th>Average Value ($million)</th>
<th>Number of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>New ESP</td>
<td>2014</td>
<td>4.9</td>
<td>40</td>
<td>122</td>
</tr>
<tr>
<td>ESP upgrades</td>
<td>2013</td>
<td>1.4</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Fabric filters</td>
<td>2014</td>
<td>0.9</td>
<td>40</td>
<td>22</td>
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<td>Bag replacement</td>
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<td>500</td>
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<tr>
<td>FGD upgrade</td>
<td>2014</td>
<td>1.2</td>
<td>20</td>
<td>60</td>
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<tr>
<td>New FGD</td>
<td>2015</td>
<td>7.8</td>
<td>60</td>
<td>130</td>
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<tr>
<td>Catalyst</td>
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<td>1.5</td>
<td>2</td>
<td>750</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>2012</strong></td>
<td><strong>21.9</strong></td>
<td><strong>222.4</strong></td>
<td><strong>1,754</strong></td>
</tr>
</tbody>
</table>

*Environews 2012*
Many commercial companies provide flue gas controls such as FGD:

- Alstom
- BHEL
- Formosa
- Fuji
- Hitachi
- Hyundai
- Shanghai

- B&W
- BWE
- Rafako
- GE
- Wuhan
- IHI
- Siemens

- Babcock Power
- Conoco
- Foster Wheeler
- Harbin
- Babcock Hitachi
- MHI
- PJSC EM Alliance
New mercury legislation

- Reduction requirements in Canada are challenging – some fuel switching and coal plant closures as well as investment in control systems

- Reduction requirements in the USA under the Mercury and Air Toxics Standard are challenging – some coal closures and significant expenditure on control technologies

- UNEP (United Nations Environment Programme) global legally binding instrument on mercury
• The new IED only requires annual monitoring for mercury

• The IED requires the use of BAT - best available technology

• Current BAT for particulates, SO\textsubscript{2} and NO\textsubscript{x} may reduce Hg by “co-benefit” effects (up to 70- 80%)

• It is unclear whether this will be enough to control mercury in the EU to potential new UNEP (United Nations Environment Programme) requirements
Economic mercury control - demonstrations in Russia

Centrifugal Wet Scrubbers
• Typical performance
  − 92 to 95% PM removal
  − 20 to 25% total mercury removal

Hydro seal
Pump
Spray water
Reagent tank
Vent tube
Wet centrifugal scrubber
Simple Modifications

Reagent tank

Pump

Spray water
Improved Mercury Removal

![Graph showing the relationship between NaClO concentration and mercury capture efficiency. The graph indicates that mercury capture efficiency increases with higher NaClO concentrations, with different lines representing different mercury species (Hg(0), Hg(II), Hg(Total)).]
Conclusions

- The EU has updated legislation for coal-fired units
- The new legislation (IED) will effectively require DeNOx and FGD on all plants
- Those that cannot comply must close by 2023
- Mercury legislation will come next
- Many plants in the EU are too old to merit investment in control technologies - coal capacity will be reduced significantly in many countries in the EU in the short-term future
- Investment is needed in efficient and clean new build plants as well as retrofitting to older units
Thank you for listening

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