Recycled Flue Gas Properties – An Utility View

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Outline

• Indicators of Successful Plant Operation
• Indicators for Oxyfuel Technology
• Flue Gas Recycle Options
• Limits of Recycled Flue Gas Properties
• Conclusions
Indicators of Successful Plant Operation

Overall goal: Return of investment for the company

Power generation goal: Safe, reliable and efficient generation at minimum cost

Safety: Safety First, Healthy conditions for employees, Environmental impact

Availability and Operability: Low commercial risks, high availability, Flexible operation

Efficiency: High plant efficiency, Responsible resource usage

Cost: Economic beneficial, Business case
Indicators for Oxyfuel Technology

• **Safety/Environment:**
  - Likely lower environmental impact
  - Higher CO2, NOX, SOX… concentrations → Risks for employees
  - Other safety challenges e.g. new equipment, O2/CO2 storage…

• **Availability and Operability:**
  - New Technology → Higher commercial risks than conventional generation
  - Concerns regarding availability → Vendor guarantees?
  - Less plant flexibility, Air firing capability (?) → Higher commercial risks
Indicators for on Oxyfuel Technology II

- **Efficiency:**
  - *Efficiency drop* due to Carbon Capture → More usage of fossil resources

- **Cost**
  - Higher *cost* than conventional power plants
  - Uncertainties in regulation (CO2 storage)
  - Low prices at carbon emission trading scheme

→ Oxyfuel as a business case uncertain

→ Oxyfuel is more risky than conventional generation
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Recycle Options – Two Cases

Hot flue gas recycle

Cold flue gas recycle
Hot Flue Gas Recycle

- Mill outlet temperature 100…160 °C
- No high load air operation due to FGD and SCR capacity limits
- Recycled Flue Gas Properties
  - High SOX concentration
    → SOX level (boiler vendor maximums) 3000 ppm (?)
    → Above H2SO4 dew point
  - Higher water concentration
  - Smaller FGD unit
    → **Higher efficiency** (compared to cold flue gas recycle), but **more risks:**
      - Some concerns remain regarding boiler materials
      - Capacity limits in air firing
Cold Flue Gas Recycle

- Mill outlet temperature $< 100 \, ^\circ\text{C}$
- Probably retains higher load air operation capability
- Recycled Flue Gas Properties
  - SOX concentration
    - SOX level $\sim 40…80 \, \text{ppm}$
  - No dew point concerns due to reheat after FGD
  - Larger FGD unit needed

$\Rightarrow$ **Lower efficiency** (compared to hot flue gas recycle), but **less risks:**
  - No boiler materials issues expected
  - Lower pollutant concentration in flue gas recycle
Conclusions

- Oxyfuel is more risky than conventional generation
- Flue gas recycling makes plant operation more complicated than in conventional plants
- Recycled flue gas properties determined by optimizing plant efficiency against operational risks
- Boundary conditions define flue gas recycle option
  - **Hot flue gas recycle** appears more beneficial for Oxyfuel only plant where gas conditions allow this configuration
  - **Cold recycle** allows a higher load in air mode and less acidic gases, but reduce efficiency
Thank you for your attention.
Vielen Dank für Ihre Aufmerksamkeit.
Спасибо за внимание.

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