Using Plasma Ignitors to Reduce or Eliminate Fuel Oil Consumption for Low Load Flame Stabilization and Cold Start Capabilities

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AGENDA

- Plasma Technology
- AC Plasma Technology
- Drivers
- Installation
- AC Plasma in Operation
- Technology Application
- Safety
- Benefits
- Summary
PLASMA TECHNOLOGY

- Microwave induced plasma (up to 6 kWe)
- DC plasma (up to 300 kWe)
- AC plasma (up to 150 kWe)
WHAT IS AC PLASMA TECHNOLOGY?
DRIVERS

• Changing Market:
  – Renewables: increased penetration & intermittent generation
  – High cost of auxiliary fuels

• Changing Operation:
  – Load following
  – Cycling operation
  – Single or double shifting
  – Seasonal variation

• Cyclic Operation leads to:
  – Higher O&M cost with increased off-design
INSTALLATION EXAMPLE

- Großkraftwerk Mannheim (GKM)
  Mannheim, Germany 480 MWe
  - System performance
  - Operations
  - System control
  - Maintainability
AC PLASMA IN OPERATION
AC PLASMA IN OPERATION

- Coal feeder-3 start 11.5 t/h (25% feeder load)
- After 85 s. since start 11.5 t/h (25% feeder load)
- After 100 s. since start 11.5 t/h (25% feeder load)
- Two Mills in operation M3-18 t/h (40% feeder load)

www.african-utility-week.com

www.powergenafrica.com
APPLICATION

The following Applications hold for Bituminous and Sub-Bituminous Coal:

- Cold Start Up
- Low Load Flame Stability
SAFETY

- Text covering Plasma Ignitors is now included in the appendix of NFPA 85 2019

- NFPA will not classify Plasma Ignitors as Class 3 special
  - Class 3 special are not intended for solid fuels
  - Covers light off of oil and gas fuels only
BENEFITS

Plant Justification

ROI Elements
• Cost for oil support, 8 hours/day = 2.33 MUSD/Yr
• Costs for coal, 20% MCR vs 35% MCR = 5.10 MUSD/Yr
• Total saving = 7.43 MUSD/Yr

Operating costs
• Cost to operate Plasma Ignitors = 0.16 MUSD/Yr

Assumptions
1. 600 MW unit, 4 corners
2. Coal costs, $2.70/MMBtu
3. 35% MCR
4. Oil costs = $2.00/Gal
5. Cost of Power = $0.05/Kwhr
## BENEFITS

OPEX savings for AC PIT system compared to DC systems:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cost to operate AC system (per year, 4 plasma lances)</th>
<th>Cost to operate DC system (per year, 4 plasma lances)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lance cooling air (fan power)</td>
<td>---</td>
<td>$1,000</td>
</tr>
<tr>
<td>Cooling water (make-up)</td>
<td>---</td>
<td>$10,000</td>
</tr>
<tr>
<td>System efficiency (90% vs 75%)</td>
<td>$68,000</td>
<td>$82,000</td>
</tr>
<tr>
<td>Electrode life, labor savings</td>
<td>$11,000</td>
<td>$65,000</td>
</tr>
<tr>
<td>Electrode costs, material</td>
<td>$12,000</td>
<td>$41,000</td>
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<tr>
<td>Total</td>
<td>$91,000</td>
<td>$199,000</td>
</tr>
</tbody>
</table>
SUMMARY

• Suitable solution for flexible operation of plant

• Plasma Ignitors offer an economical alternative for costly support fuels- up to 80% or more oil consumption reduction

• Plasma ignitors have demonstrated safe, stable operation at 25% feeder speed

• Attractive Return On Investment (ROI) proposition with guarantees