ENEL experience on Refused Derived Fuel co-combustion in a coal fired Power Plant

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Agenda

• Enel Organization
• DEBCO Project and Enel involvement
• RDF co-combustion in Fusina Power Plant
• Conclusions
Demonstration of large scale Biomass Co-firing and supply chain Integration (DEBCO) Project

• Collaborative project included in the Seventh Framework Programme under Grant Agreement n° TREN/FP7EN/218968 “DEBCO”;
• 17 partners from 8 different European countries;
• The aim has been to demonstrate and assess, on a long term basis, advanced and innovative co-firing technologies capable of achieving biomass shares up to thermal inputs of 50% or more, including research activities and large-scale demonstrations;
• Duration: 60 months starting from 01/01/2008 to 31/12/2012.

www.debco.eu
DEBCO Partnership

- 4 energy providers;
- 3 engineering and manufacture companies;
- 6 R&D institutions;
- 4 Small Medium Enterprises

**Partners:**
1. Enel Engineering and Innovation (coordinator)
2. Electrabel
3. PPC
4. Tractebel
5. Matuz
6. University of Stuttgart (IFK)
7. Laborelec
8. RSE
9. ECN
10. CERTH
11. Agriconsulting
12. VGB PowerTech
13. IFRF
14. Doosan Babcock
15. Alstom Power
16. Wroclaw University of Technology
17. PCC Rokita

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Fusina Power Plant

FS 3 & 4 (320 Mwe)

FS 1 & 2 (160 Mwe)

RDF building

"Andrea Palladio" Power Station - Fusina
**Fusina Power Plant**

- Integrated supply chain example in the Fusina area
  - ~ 40Kt/year of coal saved.
  - ~55 Kt/year of CO₂ avoided

<table>
<thead>
<tr>
<th>Load</th>
<th>320 MWe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burner</td>
<td>LowNox concentric firing system</td>
</tr>
<tr>
<td>Primary fuel</td>
<td>Coal</td>
</tr>
<tr>
<td>Secondary fuel</td>
<td>Refuse-derived fuel (RDF)</td>
</tr>
<tr>
<td>% Secondar fuel</td>
<td>2.5-5</td>
</tr>
<tr>
<td>RDF injection</td>
<td>RDF mixing with coal after coal mills. Injection through coal nozzles.</td>
</tr>
<tr>
<td>Air Pollution control devices (APCD)</td>
<td>DeNOX SCR reactor Electrostatic precipitator (ESP) DeSulphurization system (DES0x)</td>
</tr>
<tr>
<td>RDF consumption</td>
<td>70.000 t/y (authorized)</td>
</tr>
</tbody>
</table>
RDF co-firing at Fusina PP

Start RDF co-firing

Max RDF authorized: 35,000 t/year
Max RDF authorized for one Unit: 9 t/h

Doubling of RDF quantity

RDF co-fired at Fusina PP in the period 2005-2012

Year | RDF co-fired at Fusina PP (ton/year)
--- | ---
2005 | 18,400
2006 | 27,000
2007 | 32,000
2008 | 22,000
2009 | 55,000
2010 | Lack of energy demand 46,000
2011 | 56,000
2012 | 58,000

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**Key points**

- Reliability of dedicated fuel handling and grinding systems
  - Safety
- Sustainability and Reliability supply chain
- Boiler performance
- Air Pollution Control Devices performance
- Ash quality and utilisation

**RDF co-firing**
**Fusina Sustainability and Reliability supply chain**

Key words: quality and integration

- RDF co-fired at Fusina is produced by Ecoprogetto, the local public utility charged in municipal waste management and disposal in the Venice area.
- RDF production plant is able to manage up to 200,000 t/year of MSW.

**Diagram:**

1. **Municipal solid Waste (MSW)**
2. Grinding
3. Dry bio-stabilization in biocells
4. Inerts materials
5. Separation
6. RDF Pellettised
7. RDF on trucks
8. Dry bio-stabilization in biocells
9. Ferrous metals
10. NO Ferrous metals

**Notes:**

- INTEGRATED POLE OF FUSINA
- RDF meets the requirements for “normal quality”
Handling, Milling, Safety issues

- Storage sylos
- Ferrous and non ferrous separation units
- RDF reception area
- Storage sylos
- Milling system (Hammer)
- Pneumatic conveyor Unit 4
- Pneumatic conveyor Unit 3
- RDF Injection line

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Boilers performance

RDF co-firing up to 5\%_{th} didn’t highlight significative impacts on the boilers

Temperature fields

RDF Injection

Corrosion test in collaboration with RSE

Fouling

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PC/RDF co-firing up to 5% RDF thermal input resulted not to affect the macro-pollutant and micro-pollutant emissions of the PC power plant in line with the limits of D.Lgs. 133/05

Catalyst deactivation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>New one</th>
<th>Cat. 3500h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidation</td>
<td>56-65%</td>
<td>56-71%</td>
</tr>
<tr>
<td>NOx (%)</td>
<td></td>
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</tbody>
</table>

**Ashes resistivity**

Ashes produced from RDF co-firing up to 5%th, can be assimilated to coal ones in the use as concrete addition

**Acid gas**

- 90% SO$_2$ reduction
- Dioxine continuous sampling system and analysis by third laboratory

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Conclusions

• Enel is successfully carrying out co-firing experience at Fusina power plant.

• Coal/RDF co-firing at percentages of 5% has been demonstrated to be feasible at industrial level, reducing CO\textsuperscript{2} emissions by the utilization of existing capital equipment, with reasonable costs and fairly short project times for plant conversion.

• Coal/RDF co-firing up to 10% of thermal input will be sustainable with a low impact on combustion and emission systems.

• Coal/RDF co-firing at percentages of 5%th at Fusina has highlighted emission levels in line with the limits of D.Lgs. 133/05.
Tank you for your attention