DEBCO
Demonstration of Large Scale Biomass Co-Firing and Supply Chain

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 Agenda

- DEBCO description and main Objectives
- Demonstration power plants
- Experimental facilities

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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;
• Budget: **6.941.512 € (4.166.823 € UE contribution)**;
• Duration: 60 months starting from 01/01/2008.
Partnership

- 4 energy providers;
- 3 engineering and manufacture companies;
- 6 R&D institutions;
- 4 SMEs.

**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. Wrocław University of Technology
17. PCC Rokita

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Main Issues and Objectives

- Reliability of dedicated fuel handling and grinding systems
- Safety
- Sustainability and Reliability supply chain
- Boiler performance
- APCD performance
- Ash quality and utilisation

• Large-scale demonstration activities of advanced and innovative co-firing technologies (3 PP Roodhenuize, Fusina, Kardia);
• Evaluation of local and international fuel supply possibilities;
• Engineering activities to retrofit and optimise the tested technologies;
• Assessment of co-firing impact on boiler performances, generated power, plant efficiency and air pollution control device performance;
• Evaluation of possibilities to use and valorise the co-firing residuals;
• Exploitation of all project results through Techno-Economic Analysis of the 3 demonstrated sites;
• R&D activities to investigate standard and advanced co-firing technologies, assess the biomass productivity and the socio-economic impact of biomass co-firing.
Activity structure

Project Coordinator: ENEL
WP leaders:
WP0: ENEL;
WP1: IFK;
WP2: Electrabel;
WP3: CERTH;
WP4: ENEL;
WP5: IFK;
WP6: ECN;
WP7: VGB;
WP8: IFRF.

WP 0: Management & Decision Support

DEMONSTRATION

- **Laborelec-Rodhenuize** (285MWe): 25% biomass, 50% by 2008 100% by 2011
- **Enel –Fusina** (320MWe): increasing from 2.5% to 5%th RDF (bio fraction >60%) by 2008
- **PPC-Kardia** (300MWe): 5-10%th biomass with large bio-fraction. Trials from 2009

WP 2: Engeneering Retrofits & Optimisation

WP 1: Investigation into standard & advanced steam parameters.
- Co-firing up to 100 % biomass share.
- Fuel production and marketing.
- Socio-economic impact of co-firing biomass.

WP 2:

WP 3: Fuel Supply Local:
- energy crops
- agricultural residue
- solid recovered fuels
International:
- wood

WP 4: Assessment of boiler performance, availability, & impact

WP 5: Assessment of air pollution control devices

WP 6: Utilisation of Residues

WP 7: Exploitation

WP 8: Dissemination

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• Demonstration of large-scale biomass 285 Mwe (wood pellet) co-firing at increasing share 25% and 50% (Advance Green);
• Demonstration of 100% biomass (wood pellet) combustion 180 MW (Max Green);
• Define long supply chain sustainability criteria and verification procedure
• Engineering studies on handling, milling and feeding biomass, flue gas cleaning devices, process control and safety issues.
• Modeling activities, long and short term monitoring, techno economic assessment on boiler performances, air pollution and ash formation has been performed;
• Two Joint Measurements Campaigns have performed
  – 50% biomass in 2009
  – 100% biomass in 2012
Fusina Power Plant
Enel (Italy) – 320 MWe Steam Generator

- RDF co-fired at 2.5% thermal input from 2004 to 2009, 5% since 2009;
- Integrated supply chain example
- Modeling activities, long and short term monitoring, techno economic assessment to evaluate coal/RDF co-firing impact on boiler performances, UBC, slagging, fouling, corrosion, air pollution and ash formation in different operational configurations;
- One Joint Measurements Campaign in 2011.

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Kardia Power Plant
PPC (Greece) – 300 MWe Steam Generator

- Investigate the possibilities of co-firing locally grown biomass (e.g. Cardoon) with local Lignite at 10% of thermal input;

- Modeling activities, long and short term monitoring, techno economic assessment to evaluate impact on boiler performances, UBC, slagging, fouling, corrosion, air pollution and ash behaviour.

- One Joint Measurements Campaign in 2010.

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Brzeg Dolny  CHP-Power Plant  
PCC Rokita SA (Poland) – 22 MWe PC Steam Generator

• Co-firing tests with 10% and 36% share of wooden and seed rape biomass with various combinations of biomass/PC blends.
• Coal/glycerol co-firing with and without urea addition - ~ 40% by mass using special burners located close to two corners.
• Tests performed at 80% nominal load.
• Evaluation of co-firing impact on boiler performance, emissions, fouling and slagging.
Dorog Power Plant
DOROG-ESZTERGOM REGION EROMUPPC (Hungary) (40MWe)

- 100 % biomass input tested with saw-dust, sunflower hull and pellet.
- 75 % biomass input tested with wood-chips.
- Evaluation of co-firing impact on boiler performance, emissions, fouling and slagging.
Meliti Power Plant
PPC (Greece) – 1 Unit of 330 MWe

- Designed for xylite / lignite mixture, currently operating with a wide fuel mixture
- Supply chain options investigation
- Specifications for biomass feeding system and co-milling tests with wood and maize residues pellets.
- CFD modeling of boiler under co-firing operation.
- Short term milling tests at 20% biomass thermal share

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R&D activities performed on pilot scale facilities

IFK pilot scale facility

Wroclaw University furnace test facility

ECN Lab-scale Combustion Simulator

RSE corrosion test rig

Legend
1 Devolatilisation zone
II Combustion zone
1 Solid fuel feed
2 Multi-stage flat flame gas burner
3 Inner burner
4 Outer burner
5 Shield gas ring
6 Reactor tube
7 Optical access
8 Over-fire Air (OFA) facility

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Results

- The DEBCO project gave the opportunity to acquire a considerable expertise and know-how for future co-firing projects, e.g. the retrofit of existing plants and the realisation of green-field advanced plants;
- The results of the DEBCO project will play an outstanding role in supporting the current efforts of several European countries to increase the electricity portion generated by renewable resources;
- The practical experience and the technical know-how strengthened with the activities relevant to the DEBCO project are documented in:
  - 71 private documents (51 deliverables, 5 technical reports, 15 meeting reports);
  - 48 publications (19 conference papers);
  - 4 techno-economic analysis reports on demonstration sites;
  - A Guidebook going to be issued in early 2013.
THANKS FOR YOUR ATTENTION