

An integrated network on thermal biomass conversion for power, heat and transport fuels

# ThermalNet Final Report

Work Package: 2D

WP Title: Fouling, corrosion, erosion

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## Technical report

A summary of the state of the art on biomass ash characteristics and impacts on thermal processes, viz:

- The characteristics of the inorganic components of biomass materials and their behaviour in combustion, gasification and pyrolysis processes,
- The formation of biomass ash fouling deposits on gas-side surfaces in thermal processing and associated equipment,
- The gas-side corrosion of high temperature components of thermal processing plants,
- The erosive characteristics of biomass materials and their ashes and the impact on thermal processing plants.

# WP 2D

# Work Programme

- The preparation of the technical review document.
- The organisation and hosting, in co-operation with IEA Bioenergy Task 32, of a Thermalnet Workshop on Biomass Ash Issues in Glasgow in September 2006.
- Participation in Thermalnet Workshops and meetings organised by others.

# WP 2D

# State of the Art

- The ash contents of biomass materials vary from <1% to values in excess of 20%, and the ash chemistry varies widely.
- Many of the process and other problems encountered on industrial scale biomass thermal processing plants are ash-related.
- The potential for the formation of troublesome ash deposits on gas-side surfaces is significant, depending on the ash chemistry and the process conditions.
- The potential for the accelerated metal wastage of plant components due to gas-side corrosion and, to a lesser extent, erosion is a key risk area.
- A number of the key environmental issues associated with the operation of biomass thermal processes are ash-related.

The deliverable technical report presents a description of the key issues under the following subject headings:

- Introduction to biomass and biomass characteristics
- Biomass ash characteristics and characterisation techniques
- The behaviour of biomass ash at elevated temperatures in combustion systems
- The formation and nature of ash deposits in biomass combustors and boilers.
- The environmental impacts of biomass ash in combustion systems
- The impact of biomass ash on corrosion and erosion processes in combustors and boilers
- Biomass ash utilisation and disposal
- Biomass ash behaviour in gasification systems
- Biomass ash behaviour in pyrolysis systems

# WP 2D

# Deliverables

- The State of the Art Technical Report (80 pages) on biomass ash characteristics and behaviour in thermal processes.
- The Final Report from WP2D (20 page summary report)
- The proceedings of the Workshop on Biomass Ash Issues.
- Contributions to Thermalnet Workshops held under other Work Packages, at the Heidelberg, Lille, Salzburg and Vicenza meetings.

## WP 2D

## Conclusions

- Many of the problems associated with the design and operation of biomass thermal process plants and plants co-firing biomass with fossil fuels are ash-related.
- The key ash-related issues are associated with ash deposit formation on gas-side surfaces, corrosion under ash deposits and the ash-related environmental issues.
- Ash-related issues are regarded as one of the more important risk areas, due to the lack of detailed understanding of biomass ash characteristics and behaviour.
- There is a requirement for further research in a number of subject areas.

# WP 2D

# Recommendations

## Further research topics:

- Sustainable biomass sources and fuel pre-treatment requirements,
- Innovative thermal processes and energy recovery systems,
- Ash deposition and related problems associated with biomass co-firing with coal at elevated levels,
- High temperature corrosion of boiler tubes at elevated temperatures with oxyfuel firing and advanced biomass co-firing,
- The control of NOx emissions from biomass co-firing and the impact on SCR catalysts,
- The control of particulate emissions from domestic and small commercial biomass combustion plants,
- The fouling of syngas coolers and gas clean-up systems in biomass gasification plants,
- The impacts of biomass ash and other inorganic components on pyrolysis processes.