An Introduction to the Biomass and Fossil Fuel Research Alliance (BF2RA) and Overview of Project Portfolio

Greg Kelsall, BF2RA Chairman

Coal Research Forum:
Presentation of a selection of projects funded through the BF2RA Research Programme

University of Nottingham, 15 October 2013
BF2RA – What is it?

- BF2RA was formed in late 2009. It is a not for profit company that is limited by guarantee
- Membership is open to both the private and public sector
- Members currently include those from the electricity supply industry, equipment manufacture, fuel user and research sectors
- The objectives of BF2RA are to promote research into issues related to biomass and fossil fuels
- BF2RA also organises the annual Coal Science Lecture
Comprises 7 “world class” energy, equipment supplier and coal utilisation companies

** Drax confirmed as a new member for 2014
The annual membership subscription for 2014 is as shown below. This subscription may be varied in subsequent years subject to the agreement of the Membership of BF2RA

- Tier 1 (Fuel / major equipment suppliers/ power generators) £25,000
- Tier 2 (Users, consultants) £12,500
- Tier 3 (R&D/ government organisations) £18,000
BF2RA Funding Model/Open Call Process

- Typically up to £40k per successful project with balance funding coming from academic institution, other third party and/or UK Research Council

- Typically fund 3-4 year PhD projects but can be shorter duration RA projects in well justified cases

Process flowsheet

1. Prepare Open Call Topics
2. Request 2-page outline proposal
3. Rank proposals and meet/discuss to make selection
4. Invite 6-page final proposal
5. Rank proposals and meet/discuss to make final selection
6. Appoint Industrial Supervisor
7. Interview and select student

Total time for process ~ 9 months
Priority Research Themes

Priority research themes for the 2012 Open Call for Proposals were as follows:

- Utilisation of fossil fuel and biomass
- Materials development
- Advanced cycles for fossil fuel/biomass utilisation and issues relating to performance
- Control of emissions and products arising from fossil fuel and biomass utilisation

Updating these ready for new 2014 Call for Proposals. 4-5 new projects expected to be awarded for Oct 2014 start

- Topic for Session 3 Panel discussion this afternoon
BF2RA’s project portfolio

Eleven research projects are currently underway:

- Dynamic modelling and simulation of supercritical coal-fired power plant with CO2 capture ability - University of Hull
- Intelligent flame detection incorporating burner condition monitoring and on-line fuel tracking – University of Kent
- Impact of biomass torrefaction on combustion behaviour in co-firing – University of Nottingham
- Avoiding sintering of coal-fired shallow fluidised beds – University of Nottingham
- Milling and conveyance of biomass – University of Nottingham
- A new classification system for biomass and waste materials – University of Nottingham
- Modelling of power plant alloys – University of Nottingham
- Development of a novel feeding system for use with high pressure combustion and gasification systems – University of Sheffield
- Low Temperature Ignition of Biomass – University of Leeds
- Novel Coatings for Biomass Firing – University of Cranfield
- Coated Ferritic Alloys – University of Nottingham

☑ Included in agenda
Impact of Biomass Torrefaction on Combustion Properties in Co-firing

**Researcher:** Umair Hussain (main supervisor - Prof Colin Snape)

**Aim:** Investigate key fundamental issues associated with the development of torrefaction technology to help promote the more widespread use in the UK

**Scope:**
- Source fuels/ generation of torrefied samples
- Proximate/ultimate analysis using TGA and EA
- Determination of calorific value
- Scanning Electron Microscopy (SEM) to study visual changes

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**Project Time Line**
Avoiding the sintering of coal-fired shallow fluidised beds

**Researcher:** Daniel Afilaka (main supervisor - Dr Hao Liu)

**Aim:**
Investigate the causes of fluidised bed sintering in biomass co-fire and define safe operating modes to avoid sintering.
Utilisation of Fossil Fuels and Biomass – Fuel Preparation & Transportation

*Researcher:* Orla Williams (main supervisor - Dr Carol Eastwick)

*Aim:*

To rank and classify grinding, erosion and abrasion behaviour of biomass types to different mills.
Development of Novel Feeder for Pressurised Systems

**Researcher:** James Craven

**Aim:** develop a novel/ reliable feeder to continuously feed solid fuel into high pressure environments to enhance the commercial viability of high pressure gasifiers/ combustors

**Modified Lock-Hopper System as design basis:**
- Uses water as an incompressible fluid
- No use of inert gas for pressurising
- No syngas dilution with inert gas
- Mode 1: No net change in operating pressure- theoretical energy saving compared to a conventional lock hopper of 89% at 50 bar
- Mode 2: No waste of product syngas- theoretical energy saving compared to a conventional lock hopper of 81% at 50 bar
Development of Novel Coatings to Resist Fireside Corrosion in Biomass-Fired Power Plants

*Researcher:* Dominika Orlicka (main supervisor - Dr Nigel Simms)

**Aim:**

- To develop the best coating composition resistant to fireside corrosion in biomass-fired power plants using a multi-target magnetron sputtering system
- To expose the best coating composition in a specially constructed furnace to simulate the chloride-induced corrosion conditions
- To understand the influence of elements: Co, Cr, Al, Ni, Fe on the coatings properties and their role in chloride-based corrosion
- To deposit the best coating composition onto the heat exchanger tubes to identify their thermal stability and confirm the corrosion resistance
- To evaluate the alternative methods of applying the best coating compositions to boiler tubes
Integrity of Coated Ferritic Alloys under High Temperature Creep and Fatigue

*Researcher:* Thomas Hoey (main supervisor - Dr Wei Sun)

*Aim:*

Investigate the mechanical and chemical integrity of coated samples subjected to high temperature exposure and steady / cyclic mechanical loadings

Specific Objectives:

• Gain a better understanding of presently developed coatings and the associated key failure mechanisms

• Rank the potential coatings based on testing results

• Provision of generic understanding of factors limiting coating service life

Typical MCrAlY coating
BF2RA’s project portfolio- new projects

Three research projects selected for 2013 starts:-

13. Biomass Exacerbated Cyclic Oxidation of Steels in Steam (BECOSS)- University of Birmingham
14. Biomass cofiring with low volatile matter coals– University of Nottingham
15. Modelling milling of biomass – University of Nottingham
BF2RA website

Members’ Area – contents list

Published Documents

- BF2RA Project Meetings Schedule
- Grant Summary Information
- Minutes of BF2RA Members’ Meetings
- BF2RA Progress Review (Technical Officer’s Report to BF2RA Members)
- Project Documentation
- Call and Proposals Information
- Efficient Fossil Energy Technologies (EFET) EngD Centre
BF2RA website – example of detailed content

www.bf2ra.org/members/membersarea/projectdocumentation/..

Grant 04 - Nottingham University - Avoiding Sintering of Coal-fired Shallow Fluidised Beds

Grant 04 EngD Annual Report August 2013
Grant 04 Meeting Minutes July 2013
Grant 04 Presentation July 2013
Grant 04 3rd Progress Report June 2013
Grant 04 Meeting Minutes January 2013
Grant 04 Presentation January 2013
Grant 04 2nd Progress Report December 2012
Grant 04 1st Progress Report June 2012
Grant 04 Progress Meeting Minutes June 2012
Grant 04 Presentation June 2012
Grant 04 kick-off meeting 8 Nov 2011
Grant 04 EngD Project Plan Nov 2011
Grant 04 Daniel Afilaka Presentation 8 Nov 2011
Grant 04 Project Proposal
BF2RA Value to Members

• World class research with good funding leverage
  – 2.5m€ equivalent programme (at full economic cost) in 2013 increasing to 3m€ in 2014

• Full access to 6 monthly progress reports and final reports via ‘member only’ area of BF2RA web-site

• Full access to attend any project progress meeting

• Provide Industrial Supervisor for project of particular interest

• Shape the scope of the open call and detail of invited projects

• Member of the BF2RA ‘Club’
  – Better understanding of supplier/customer research interests
  – Collective view often better than the individual company view

• Select speaker for annual Coal Science Lecture (London)
  – Primarily funded with BCURA grant + sponsorships
For further information about BF2RA please:-

- visit: - [www bf2ra.org](http://www.bf2ra.org)

or

- email: - [technical@bf2ra.org](mailto:technical@bf2ra.org)

Thank you