

THE CO-UTILISATION OF WASTE BIOMASS WITH COAL THE APPLICATION OF CO-FIRING IN CHINESE POWER BOILERS



Co-firing Research Facilities at Tsinghua University

OBJECTIVES

The overall aim of the project is to facilitate the application of co-firing of waste biomass in China to help limit CO₂ emissions. This requires the following objectives to be met:

- To assess the potential environmental and other benefits to China of introducing co-firing of waste biomass in the coal-fired power generation sector.
- To investigate the behaviour of Chinese biomass in co-fired combustion and gasification systems, with reference to pollutants emissions, ash behaviour, fouling/corrosion, preparation requirements, firing methods and process monitoring needs.
- To determine the applicability of UK technology in the Chinese market, and the scope for joint R&D initiatives.
- To work with Chinese government departments and others to identify the preferred approach to the development of an enabling environment that will aid the introduction of co-

firing technologies in the most promising market sub-sectors.

SUMMARY

Within the UK and China, there is increasing interest in the co-utilisation of waste biomass as a fuel with coal for large-scale industrial applications to offset some of the increasing demand for coal and to reduce CO₂ emissions.

In the UK, the co-firing of a wide range of liquid and solid biomass materials, on a commercial basis, provides an effective and efficient approach to the generation of electricity from renewable sources. In China, biomass co-firing has yet to be established on a fully commercial basis in a significant way. The increased demand for power to support the growth in the Chinese economy is being met primarily through increased introduction of coal-fired power plant, adding to overall carbon dioxide levels. The major use of biomass in China continues to be as a fuel in domestic and small industrial applications.

Some innovative research and development to establish technologies for the utilisation of biomass, either directly or more recently in combination with coal has been initiated in China. This includes both gasification (small scale IGCC) and various combustion technologies.

In addition, there is an increased recognition that the rapid industrialisation of China is resulting in massive increases in both industrial and municipal solid wastes, of which there is a significant biomass element. There is a clear need to establish cost effective, environmentally sustainable approaches to maximising both resource recovery and energy recovery from these waste materials. The co-firing with coal of biomass fuels recovered from the residual wastes can represent a very attractive option, provided the key technical and engineering challenges with using such fuels are overcome;

this proposal addresses these challenges for the biomass available in China.

The project will undertake the following activities:

An assessment of biomass availability and opportunities for co-firing in China. Previous reviews of waste biomass and green MSW availability on a geographical basis within China, in terms of quantities, location, availability, etc. from all available sources will be updated. In conjunction with existing surveys of coal-fired power plants in China, these data will be used to identify and quantify the potential opportunities for introduction of biomass/MSW as a co-feedstock. In addition, this activity will determine the technical (and non-technical) barriers to the introduction of co-firing technology, with strong consideration of the impact of institutional and regulatory issues.

Studies into biomass collection, handling and processing. Economically viable ways of collecting, handling and processing the different forms of biomass available in China will be investigated. Local drying, shredding and possibly pelletising are expected to form a key approach to facilitate transportation, storage, handling and subsequent use. Testing is planned both in the UK and China.

An evaluation of biomass types and supporting characterisation trials. The chemical and physical properties of the available biomass types relevant to their use as a fuel will be reviewed. In particular, the following will be considered:

- Proximate analysis, Calorific Value, moisture content, ash content, etc as a function of drying requirements, ash handling and disposal
- Size and particle properties as a function of handling, feeding, milling, etc
- Ash contents and chemistries, S, Cl and trace species with reference to, fouling, slagging, and corrosion of superheaters and emissions

These assessments will be supported by combustion and gasification trials to assess the performance of industrially-relevant combinations of selected coals, biomasses and MSWs, with the choices being made to ensure representative samples applicable to the situation in the key areas of China (defined as the major centres of population and agricultural production) and the case studies defined below. These trials will be carried out using existing test facilities in the UK and China.

Case studies in different regions of China. A set of representative case studies that could form

the bases of demonstration projects for the co-firing concept will be established. These will be based on existing coal-fired power plants. Studies will be focused in different regions to take account of the varying forms of biomass available in each region and the market opportunities. For these studies, techno-economic assessments will also be carried to identify the priority coal technology – biomass combinations, including the impact of CDM benefits. In addition, this task will investigate the institutional and regulatory issues associated with possible demonstration projects and future industrial applications.

COST

The total cost of this project is £330,062, with the Department of Energy & Climate Change (DECC) contributing £269,741.

DURATION

30 months – May 2008 to October 2010.

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