BERR | Department for Business Enterprise & Regulatory Reform

PROJECT PROFILE NO PP257

DEVELOPMENT OF UNDERGROUND COAL GASIFICATION FOR POWER GENERATION

THE APPLICATION OF ADVANCED GAS TURBINES FOR CLEAN POWER

Erzhuang UCG Station – Xinwen Mining, Laiwu, Henan Province, China (courtesy of Xinwen Mining)

OBJECTIVES

The overall aim of the project is to assess the potential technology needs for the introduction of industrial gas turbines and associated gas cleaning equipment for application in China using fuel gases from Underground Coal Gasification, Coke Ovens, Blast Furnaces and other sources. This requires the following objectives to be met:

- To identify and resolve the technical issues when using available fuel gases in gas turbines
- To review potential sites and assess the associated environmental and regulatory issues
- To review the opportunities for financing potential power generation schemes

SUMMARY

There is considerable interest in the development of high efficiency clean coal power schemes in China as a result of measures taken by the Chinese Government to reduce pollution from small coal-fired power plants and the need to maximise coal resources. A previous project highlighted the opportunity for Underground Coal Gasification (UCG) schemes to provide a clean fuel gas for domestic/industrial use as well as power generation, in particular local power generation using small gas turbines. Both Alstom Power and Siemens Power Generation have turbine technology capable of utilising low calorific value UCG fuel gas.

There are also parallel technology opportunities in China for gas turbines and related gas cleaning equipment for power generation from other fuel gases produced by coke ovens, blast furnaces, etc.

Chinese researchers have been developing several variants of the UCG concept to suit local Chinese conditions and available resources. Although significant progress has been made, effort is required to ensure that the

small-scale UCG schemes currently being demonstrated at Chinese mines can produce the consistent quantities of gas with stable composition and properties needed for gas turbines applications.

In addition, UCG and other fuel gases are often laden with contaminants as a result of the high temperatures involved in the gasification process. Tars, particulates, ammonia, hydrogen sulphide, hydrogen chloride and trace metal species (Cd, Hg, Pb, Zn, Na, K, etc.) will all be present in the gas 'as-formed', along with the usual major constituents (H_2, CO, CO_2, H_2O, CH_4, N_2, etc.). A major technical concern affecting the commercialisation of the overall UCG – gas turbine concept is the need to ensure that these contaminants are removed in an environmentally friendly, cost effective way so that gas turbine entry requirements are met.

The project will examine the following topics:

- the suitability of the various fuel gases for gas turbine applications
- the potential for UCG, coke oven and blast furnace gas to power opportunities
- environmental and regulatory constraints
- the availability of suitable gas cleaning and other balance of plant technologies in China
- available funding/institutional opportunities and barriers

The provision of low cost electricity, using local fuel supplies will benefit many Chinese communities. With many small coal mines finding their markets lost due to the closure of local small power plants, this will provide a much needed boost to the communities concerned. Similarly, the use of coke oven or similar waste gases for the generation of heat/electricity will provide similar local benefits. Both of these approaches may be duplicated in many locations throughout China once successful demonstration projects have been developed.

For the UK, the opportunity to support the initial development of this novel clean power concept will place UK suppliers of equipment and services at the forefront if this opportunity proves successful for widespread deployment in China.

COST

The total cost of this project is £305,684 with the Department of Business Enterprise and Regulatory Reform (BERR) contributing £194,550.
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DURATION

38 months – August 2005 to October 2008.

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