

## OBJECTIVES

To investigate the impact on performance and cost of coal based gasification plant of the installation and operation of CO<sub>2</sub> capture equipment at high pressure.

- Establishing three design cases. A medium pressure CO<sub>2</sub>-in Base Case, a medium pressure CO<sub>2</sub>-removed case and a high pressure CO<sub>2</sub>-removed case.
- Outline the advantages and risks of high pressure IGCC operation compared to medium pressure.
- Carry out an assessment to identify areas in which improvements to equipment are desirable and, if possible, propose solutions. Address expected problem areas namely the operation of lockhoppers at high pressure.
- Develop a device giving improved accuracy in the measurement of dense phase coal flow.

## SUMMARY

Removal of CO<sub>2</sub> from fossil fuels used in electricity generation is most easily facilitated pre-combustion, and for coal this would imply using Integrated Gasification Combined Cycle (IGCC) technology. The pressure at which IGCC plants operate has, until now, usually been chosen to provide syngas at the right conditions for the gas turbine. Efficiency of these processes is slightly higher than for an equivalent conventional coal-fired power station, and emissions of SO<sub>x</sub>, NO<sub>x</sub>, particulates, and mercury are significantly better. CO<sub>2</sub> extraction is also possible at these medium pressures (MP) using existing commercially proven equipment. There is, however, some scope to further improve the efficiency of coal-fed medium pressure IGCC with or without CO<sub>2</sub> removal: for example using dry- instead of slurry-feeds. The potential return on these could be high in both economic and environmental terms.

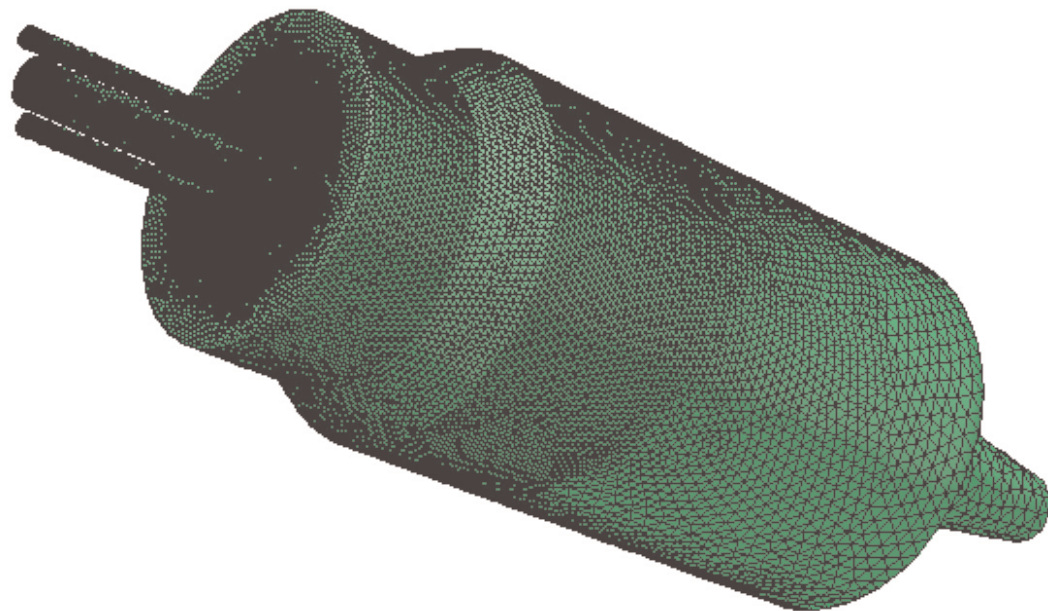


Figure 1. Finite Element Model - Gasifier Mesh, Nottingham University

A financial model will therefore be developed for the medium pressure, CO<sub>2</sub> not removed base case incorporating the best of the above and the effect of removing the CO<sub>2</sub> will be examined. This will provide a basis upon which the advantages of dry-feed high pressure quench gasification can be measured.

There are theoretically a number of advantages in increasing the gasification pressure as high as possible, the limit being the ability of air separation units to supply oxygen. These include the easier removal of CO<sub>2</sub> suitable for export from the site for long-term storage or use in Enhanced Oil Recovery (EOR). The confidence with which higher gasification pressures can be used is influenced by the extent to which existing equipment is required to operate beyond the envelope of current experience. An appraisal is needed to establish whether the benefits of HP operation are sufficient to outweigh these costs. The work will therefore also include the results of a high pressure, CO<sub>2</sub> removed financial model, and a clear statement of the techno-economic advantages of high pressure dry fed water quench gasification coupled with CO<sub>2</sub> removal.

**Further information on the Cleaner Fossil Fuels Programme, and copies of publications, can be obtained from:**

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## COST

The total cost of the project is £655,215 with the Department of Trade and Industry contributing £421,388.

## DURATION

21 months – January 2005 to October 2006

## LEAD CONTRACTOR

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