

The awakening of the coal giant

CSIR researchers conveyed their expertise in clean coal technology recently at a conference in Botswana, a country with grossly under-exploited coal resources.

Brian North, Trevor Hadley and André Engelbrecht from the energy and processes research group at the CSIR, presented a paper called 'Fluidised-bed Technology - Applications and Research in Southern Africa' at the conference. The event, organised by the Fossil Fuel Foundation, was the first of its kind to give insights into business opportunities, as well as ensuring sustainable development.

Southern Africa, in particular Botswana, has vast coal resources estimated at over 200 billion tons. The resources are grossly under-exploited with a production of less than 1 million tons per year in that country. With the impending power crisis in the SADC region, the use of Botswana's coal resources to meet both the national and regional energy requirements has become imperative. Several market opportunities for coal and the products of coal also exist in, among others, the Far East, highlighting the potential for coal-based economic development in the region.

The CSIR is actively involved in clean coal technologies (CCT) and industrial processes including CCT. The focus is on enhancing global competitiveness through process efficiency, novel design and the development of clean manufacturing processes. The group has a track-record of more than two decades in fluidised-bed technology, particularly for the combustion and incineration of biomass, conversion of wastes to energy and in minerals treatment.

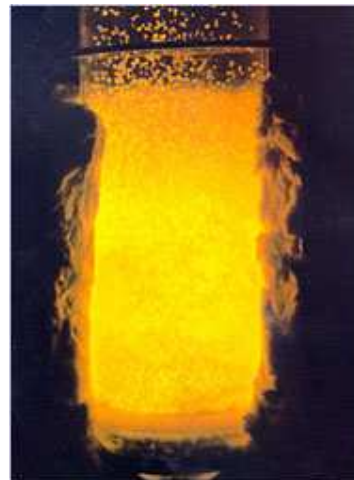
With regard to the cleaner use of coal, the CSIR has been involved in laboratory and pilot-scale test work and the design and commissioning of industrial fluidised-bed combustion (FBC) plants. Most of the FBC units installed in South Africa were designed to utilise 'problem fuels', such as low grade or fine coal, liquid and biomass wastes.

In the paper, the CSIR researchers summarise the phenomenon of fluidisation, which occurs when a bed of solid material is held in suspension by a fluid, being either a gas or liquid. The advantage is good vertical mixing and a high degree of fluid-solid contacting, and hence the technology has great applicability in minerals treatment, the petrochemical environment and for combustion and gasification.

A fluidised bed is highly suited to 'problem fuels' applications due to its ability to accommodate changes in fuel quality and moisture content. One particular application designed by the CSIR was an FBC incineration plant for Sasol in South Africa. A high sulphur pitch waste stream existed that required destruction via incineration. This stream proved particularly challenging as it is a high viscosity liquid with a high sulphur content. An FBC plant was designed to incinerate 2,5 tons per hour of the pitch together with 2 tons per hour of phenolic effluent. Addition of limestone directly to the bed enabled *in-situ* capture of the sulphur (the



A boiler after a fluidised bed



A fluidised-bed furnace

sulphur combines with limestone to form solid calcium sulphate). Some 85% sulphur capture was achieved, enabling adherence to legislation on sulphur dioxide emissions.

Many, generally smaller, coal-fired units designed by the CSIR and others have been installed to raise hot gas for drying materials, such as minerals and agricultural products. These units capitalise on the ease of operation and low maintenance costs of FBCs.

Research on FBC is being conducted by the CSIR, Mintek and Eskom, as well as by industry. Development of FB gasification technology at the CSIR has been supported by the recently-formed South African National Energy Research Institute (SANERI).

Several universities, such as the University of KwaZulu-Natal, concentrate on specific aspects of fluidisation, for instance sorbent characterisation and performance prediction, as well as coal and biomass gasification.

[Publication](#)

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