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THE CANMET COAL GASIFICATION PROGRAM

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by

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ABSTRACT

This report describes the current status of the CANMET coal gasification program. Experimental facilities for in-house research include a laboratory fixed-bed gasifier and a high pressure thermobalance reactor. At present the chemical reactivity of various Canadian coals in a gasification reaction is being assessed.

Research and development on coal gasification technology has been carried out by the private industry and the universities through external contracts. A major contract has been jointly funded by CANMET and the Saskatchewan Power Corporation to study the potential application of combined cycle gasification technology for power generation.

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## INTRODUCTION

In 1977, Energy, Mines and Resources Canada (EMR) instituted a coal conversion R & D program to assess technologies that might help achieve energy self-reliance by substituting coal for domestic and imported oil. The two main activities in this program are coal-gasification and liquefaction.

The objectives of the coal gasification program are to develop information on the gasification characteristics of various Canadian coals. This information provides the basis for the assessment of advanced gasification technologies for the conversion of coal to gas, electricity or methanol in various regions of Canada using local feedstocks. Topics of major importance are the utilization of low or medium calorific value gas for process heat, conversion of the product gas into liquid hydrocarbons directly or via a methanol intermediate, and application of gasification in the extraction and processing of heavy oils. The program is being implemented through in-house research and external contracts.

## IN-HOUSE RESEARCH

The in-house effort is carried out in the Coal Resource and Processing Laboratory at CANMET's Bells Corners complex near Ottawa. Research activities are directed towards the understanding of gasification reaction mechanisms and the assembling of chemical reactivity data of Canadian coals which are candidates for possible use in various gasification processes. Experimental facilities include a laboratory fixed-bed gasifier and a high pressure thermobalance reactor. Capable of processing 200 g of coal sample under atmospheric pressure in a batch operation, the gasifier is suitable for initial assessment of the gasification performance of various coals. The thermobalance reactor, designed for operation up to 14 MPa pressure and 1000°C is being used to obtain kinetic data of the gasification reactions of various chars under different environmental conditions. The construction of a high pressure fixed-bed gasifier for simulation studies of those reactions in a commercial Lurgi gasifier is underway. This equipment will be operated in a continuous process with a feeding capacity of 2 kg of coal per hour.

Gasification characteristics of various Canadian coals have been examined and their chemical reactivities ranked according to their rates of

carbon conversion. Saskatchewan lignites and bituminous coals from British Columbia, Alberta and Nova Scotia were among the coals under investigation.

#### EXTERNAL CONTRACTS

The contract program was established in 1977 to stimulate interest in private industry and universities in research and development of coal gasification technology in Canada. Federal funding may be 50% or 100% of project cost depending on the nature of the study. Work carried out to date has included R & D on new technology for Canadian coals, techno-economic evaluation of power generation technologies and a feasibility study of in-situ gasification. Fundamental investigations have been performed at universities on the chemical reactivity of Canadian lignites, petrographic analysis for coal assessment and product control in fluid-bed gasification.

Table 1 summarizes the contract expenditures during the period 1977 to 1982. Table 2 lists the 1980/81 contracts.

#### SUMMARY

Highlights of the gasification section included the development of an automatic gas sampling device and the organization of a technical seminar in October 1980. With this device, kinetic data of five Canadian coals during the gasification reaction were obtained, and a comparison of their chemical reactivities was made based on these data. The 2-day seminar presented up-to-date information to the public on the R & D of coal gasification technologies in Canada.

The national response and achievements in the first five years of the program have been very encouraging. For example, the first item in Table 2 is a major joint undertaking of a public utility and CANMET to demonstrate the feasibility of the gasification combined cycle process for electricity generation, which is more efficient and less polluting than the conventional pulverized fuel process with flue gas desulphurization. It is hoped that this technology will be introduced commercially. Also, the spouted bed technique studied at the University of British Columbia is a promising technology for Western caking coals.

Details on the above contract work may be obtained from the Energy

Research Program Office of CANMET, 555 Booth Street, Ottawa, K1A 0G1. Information on the in-house research is available from the author.

Table 1 - Value of CANMET coal gasification contracts, 1977-1982

Fiscal Year	No. of Contracts	Total Contract Value	EMR Contribution
1977-78	1	\$186,000	\$ 93,000
1978-79	5	303,000	272,000
1979-80	6	505,000	415,000
1980-81	7	428,000	393,000
1981-82	To be determined	750,000	500,000

Table 2 - Coal gasification contracts in 1980-81

Contractor	Project Description	Contract Value	EMR Contribution
Saskatchewan Power Corporation Regina	Feasibility study application of combined cycle coal gasification technology for power generation using Saskatchewan lignites Phase II.	\$ 20,000*	\$ 10,000
Onakawana Development Ltd. Toronto	Feasibility study of (1) economically converting Onakawana lignite into medium calorific value gas and (2) generating electric power by integrated combined cycle.	50,000	25,000
Chemical Engineering Dept. University of B.C.	Pilot plant study of a novel spouted-bed technology for gasification of Canadian caking coals.	77,000	77,000
B.H. Levelton and Associates Vancouver	A study of the suitability of British Columbia and Nova Scotia coal resources for underground gasification.	94,000	94,000
Saskatchewan Power Corporation	Reactivity study of a wide range of Saskatchewan lignites in a high pressure fixed-bed gasifier.	97,000	97,000
Chemistry Dept. Regina University	Development of petrographic methods for assessment of gasification performance of Western coals.	30,000	30,000
Asecor Limited Manotick, Ontario	Development of fluid-bed gasification control parameters for a range of Canadian coals Phase III.	60,000	60,000

\*Total contract value for Phase II is \$470,000