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CIA/RR CB 65-73
November 1965

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INTELLIGENCE BRIEF

ZAMBIA: THE KANDABWE COAL QUESTION

DIRECTORATE OF INTELLIGENCE
Office of Research and Reports

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ZAMBIA: THE KANDABWE COAL QUESTION*

Zambia's plans to extract coal from the Kandabwe fields in order to lessen the country's dependence on Rhodesian coal seem overly optimistic, especially in the long run. If the Kandabwe fields are exploited through strip mining, the proved reserves that could be stripped would be exhausted within 12 months. Total strip production would be only about 325,000 tons.** Underground mining of proved reserves would provide the equivalent of only about 2 year's supply at Zambia's present annual rate of coal consumption. Furthermore, the poor quality of the coal would present additional drawbacks. The calorific value of the coal is much less than that of Rhodesian coal, and therefore about 50 percent more Kandabwe coal would be needed to replace the Rhodesian imports. Moreover, the inferior quality also makes the use of the coal difficult for the railroads, in the thermal plants, and probably in producing blister copper.

1. General

The Zambian government contingency planning team in Lusaka is placing increasing reliance on future production of coal from the Kandabwe fields as a way of lessening the country's complete dependence on coal imported from the Wankie collieries in Rhodesia which supplied Zambia with about one million tons in 1964. Contracts have already been let to improve the road from the railhead at Choma -- 47 miles from Kandabwe -- and initial plans to mine 15,000 tons monthly by March have been increased to 30,000 tons. Moreover, some consideration has been given to the possibility of raising Kandabwe output to about 90,000 tons monthly. The prospect of replacing Wankie with Kandabwe coal raises three sets of related questions (concerning mining, quality, and truck transport) which can be only partly answered on the basis of available information. On balance, and with the available data, there are sufficient unresolved problems to cast considerable doubt on the feasibility of the projected Kandabwe operation, especially over the long run.

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* The estimates and conclusions in this brief represent the best judgment of this Office as of 26 November 1965.

** Tonnages are given in metric tons throughout this brief.

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2. The Mining Problem

Estimates of Kandabwe coal reserves range from 11 million to 17 million tons, of which only 3 million tons are regarded as proved. The thickness of the seam varies from 7 to 27 feet, much of which is impure. Only the bottom 6 feet of the average seam width of 12 feet is considered worth exploiting. The deposit itself slopes downwards from the outcrop and has an average dip of 20 degrees. However, the inclination increases markedly with depth -- to 40 degrees -- and at the same time the coal seam thins out. The immediate roof consists of carbonaceous shale and shaley coal seams and stringers. Although Kandabwe was not considered strippable in 1963, a subsequent report refers to some strippable coal at depths of 100 to 200 feet -- presumably limited stripping along the outcrop, or high part of the bed, to a depth of 100 to 200 feet.

It has been concluded that there is very limited potential for strip mining -- only about 10 percent of reserves -- and that a production rate of as much as 25,000 tons monthly would exhaust known proved reserves within 12 months. Furthermore, although details on the characteristics of the overburden are not known, the thickness of this cover -- 100 to 200 feet -- would create a serious problem in stripping. Underground mining could also pose major problems. Depending on the mining method used, the roof may well pose formidable difficulties. The roof-and-pillar method would imply a low recovery rate of 50 to 60 percent of coal in the ground and would thus limit recovery to about 2 million tons of proved reserves. Should the probable reserves of between 8 million and 14 million tons prove out, recovery could range between 5 million and 9 million tons. Long-wall mining would require a longer time to reach capacity than would either of the above methods, but ultimate coal recovery would be higher.

3. The Question of Quality

Kandabwe coal is decidedly inferior to Rhodesia's Wankie coal. The average ash content of the bottom 6 feet -- the better grade -- is 22 percent, and the calorific value is about 10,000 BTU per pound. By comparison, uncleaned Wankie coal averages 14 percent ash and 13,000 BTU per pound. Because of the lower calorific value of Kandabwe coal and its high ash content, roughly 1.45 to 1.50 tons of Kandabwe would be required to replace 1 ton of Wankie. On this basis the amount of Kandabwe-type coal necessary to maintain Zambia on a care-and-maintenance basis, with no copper production, would be about 600,000 tons per year.

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There are three major uses for coal in Zambia: to fuel the railroad, to produce smelter copper, and to run thermal electric plants. On the basis of available information, it seems likely that Zambian steam locomotives would require considerable modification of their fireboxes and grates to use Kandabwe coal. Furthermore, the ash-fusion temperature of Kandabwe coal is not known but could be very critical. A low ash-fusion temperature could give considerable trouble with equipment not especially designed for burning this type of coal -- for example, in the thermal plants. It seems likely that Kandabwe coal could be used in producing blister copper, but with lesser outputs of blister copper per ton of coal.

4. Trucking Kandabwe Coal

Thus far, three hypothetical levels of production of Kandabwe coal have been considered: 15,000 tons, 30,000 tons, and about 90,000 tons per month. The trucking of such quantities of coal from the mine to the railhead at Choma would not pose especially difficult problems. The distance is about 47 miles over an average ascending grade of 1.28 percent, although maximum grades over part of the route may be considerably higher. In the initial stage, coal would be loaded to truck by power shovel. Unloading would be either by dumping on the ground at Choma or into hoppers at the railhead. At a production rate of 15,000 tons monthly (a movement of 500 tons daily), 50 truck loads at 10 tons each would be required. With a round trip distance of only 94 miles, it is entirely possible for each truck to make two round trips daily, and the total trucks necessary would be 25. A factor of 20 percent for truck downtime for maintenance and repair raises the total requirement to 30 trucks. At a production and transport rate of 90,000 tons, 150 trucks would be required.

Fuel requirements for the trucks are estimated at a consumption rate of 6 miles per gallon of diesel fuel. Monthly fuel consumption for 15,000 tons of coal transport would therefore be 80 tons and for 90,000 tons about 480 tons.

Analysts: [redacted] 25X1A

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