

2. Questionnaires

A. Requests for data or demand-supply situation of energy, etc.

It shall be highly appreciated, if the following items of data are provided to the Japanese study team during their stay in Zambia, as from end February to end March '86.

- (1) Any reliable data on coal reserves in the Republic of Zambia (hereinafter referred to as Zambia) such as geological survey study reports by experts, in order to confirm that the project life of waste slurry briquetting will be more than 10 years.
- (2) Domestic energy balance of Zambia in these 10 years with reference to all kinds of energy, such as electricity (either hydraulic or thermal power on coal and fuel oils), crudes, and oil products (either imports, exports or productions at INDENI refinery) such as LNG, LPG, light naphtha, heavy naphtha, gasoline, kerosene, diesel gas oil, domestic fuel oil (equivalent to AFO in Japan, which is mainly the mixture of straight run and desulphurized heavy gas oil with some light gas oil), and other black fuel oils.
- (3) Energy strategies of Zambia in these 10 years and future, particularly in terms of proportions of different energy sources.
- (4) List and its map of the towns or villages in/around Lusaka and their populations together with the numbers of families or houses, each forming one cooking unit.
- (5) Each number of different house types, either villagers' type or officials' type, and their cooking places either outdoors or indoors depending on the season. These data should correspond to the data requested by the above (4).
- (6) Typical patterns of different energy sources at houses in the urban area in/around Lusaka.
- (7) Typical income levels of people, such as businessmen, officials and farmers (or peasants) in/around Lusaka.
- (8) List and its map of petro-stations and NIEC-related stores such as those of Zambia National Wholesale & Marketing Company Ltd., NIEC stores and Mwaiseni Stores or the other stores which may be used for the sales/distribution of briquettes and stores.

- (9) Each annual turnover of the above stores raised in item (8) in terms of k.
- (10) Present transportation methods among these stores either trucks, railways, and human carriers.
- (11) Prices of charcoal, electricity and kerosene in/around Lusaka.

B. Budgeting and Organization

It is suggested that the following items of information should be provided to the Japanese Study Team as from end February to end March 1985.

- (1) Budgets and accounts of NCSR in 1984 and 1985.
- (2) Personnel, such as scientific and technical officers to be involved in R & D for coal briquetting and store manufacturing in 1986.
- (3) Zambian ideas on organization required for the implementation and operation of the pilot plants of waste slurry briquettes and stores.
- (4) Zambian ideas on possible means for budget appropriation for the local construction of the pilot plants and their operations.

C. Proposals for further studies on coal briquetting to be carried out by NCSR

It is recommended that the following items of studies should be tackled by NCSR before the visit of the Japanese Feasibility Study Team as from the end of February 1986, so that NCSR will be able to raise any technical problems that should be discussed with the Japanese experts on coal briquetting during their visit, in view of the fact that the Japanese coal briquetting technologies have been developed based on imported smokeless coals or domestic coals but with comparatively low sulphur contents, which seems to be different from the waste coal slurries of MCL. We believe that appropriate technologies for your coal briquetting will require some modifications and adjustments of the Japanese technologies, for which your technical cooperation would be highly appreciated.

- (1) Carbonization (at 600°C) of green briquettes from slurry
 - (1-a) Carbonization loss in terms of wt % on the total weight of green briquettes.
 - (1-b) Proximate analyses of carbonized briquettes, such as moisture (wt %), ash (wt %), volatile matter (wt %) calorific value (kcal/kg) and combustible sulphur (wt %).

All of the above analyses are those that must be carried out often as necessary also after the installation of the pilot plant. Your study and investigation whether each of the analyses is possible or not by the equipment available at NCSR will give a good indication to the Japanese Study Team for further installation of the testing equipment required, and moreover some of your researchers can be accustomed to these analysis methods through their investigations.

It is also recommended that, if time available on your side, further study should be carried out changing these two parameters of carbonization, namely its temperature (including its raising slope) and the duration, which will lead to different properties: analysis results on the carbonized briquettes.

As for the combustible sulphur, its analysis method should be referred to some industrial standards (British Standards ? or JIS: Japan Industrial Standards) of which JIS (coal) will be sent to you in due course.

(2) Desulphurization effect of limestone fines (-200 mesh) addition

Combustible sulphur in briquettes can be reduced by adding limestone to briquette materials before pressing. This effect should be checked. The effective amount (wt %) of limestone may be around twice the amount (wt %) of the total sulphur in briquettes.

(3) Combustion test by Mbaula

(3-a) Ignitability

Ignitability of various types of briquettes using molasses as its binder and also those made in different manners as explained in the above (1) can be checked by using Mbaula. The results would be that a certain amount of kerosene and charcoal is required for setting fire to the briquettes or no kerosene required, etc.

(3-b) Residue after burning

Residue after burning can be analyzed in terms of ash contents (wt %) and especially unburnt carbonaceous matter (% wt) using various briquettes explained above.

If there is much carbonaceous matter in the residue ash, it should be considered that the relevant briquettes are not good in qualities.

Further to this, the hardness and shape of the residue ash should be checked to determine the degree of clinkering for the future dumping of residue ash.

(4) Evaluation of the briquetting processes

After your processes prove to be technically feasible, financial feasibility should be pursued in such a manner that each process is evaluated from the cost/benefit viewpoint. It should be noted that the simpler processes will usually require less amount of initial investment, maintenance cost and operational manpower.

3. 入手資料リスト

	Title	By/From	Date
1.	Report : Coal Briquetting Project	NCSR	9/12/85
2.	" : Activities of the Industrial Minerals Research Programme during the Year 1983	NCSR (Mining and Industrial Committee)	28/2/84
3.	" : Woodfuel in Zambia, Summary of Activities	Forest Department (?)	---
4.	" : Wood Consumption and Resource Survey	FAO, Forest Department	27/9/85
5.	" : Utilization of Maamba coal mine waste	NCSR	---
6.	Analyses: Proximate and Ultimate Analysis of Maamba Coal	MCL	---
7.	Report : Study on the Treatment of Slurries and Rejects from MCL Volume I ... (German report)	GTZ	12/84
8.	" : Energy Production and Consumption in Zambia 1978-1983	NEC	---
9.	" : Annual Report and Accounts for the Year ended 31st Dec. 1984	NEC	25/10/85
10.	" : Monthly Digest of Statistics, Vol. XXI, No.6 to 7 June/July, 1985	Central Statistical Office (Lusaka)	
11.	" : Selected Socio-Economic Indicators	" (NEC)	4/84
12.	Brochure: National Council for Scientific Research, Activities up to 1983	NCSR	---
13.	" : NCSR Annual Report for the Years 1982 & 1983	NCSR	---
14.	Copy (1): Increase of Electricity Tariffs	Zambia Electricity Supply Corporation	1/10/85
15.	Synopsis: The Zambia Sugar Company Limited, Nakambala Estate	Zambia Sugar Company Limited	11/84
16.	Brochure: 10 years (1973-1983) Indeni Petroleum Refinery	Indeni REfinery	/83

4. 関連統計

主要鉱物生産 (1,000トン)

	1977	1978	1979	1980	1981
銅	659.8	655.6	584.8	609.5	560.1
鉛	40.0	42.5	38.2	32.7	33.3
鉛	13.3	12.7	12.8	10.0	9.9
石炭	708.1	615.1	598.5	579.1	507.3
コバルト	1.7	1.6	3.3	3.3	2.5

(出所：中央統計局資料)

主要農産品出荷表 (トン)

	77/78	78/79	79/80	80/81	81/82
メイズ	696,060	581,670	335,970	382,230	693,360
タバコ	5,900	3,968	4,972	4,681	2,984
砂糖キビ	691,000	775,000	888,000	930,000	893,000
綿実	8,928	8,430	14,916	23,000	16,752
大豆	1,252	1,180	1,300	3,420	NA
ひまわり	13,300	7,550	11,900	17,250	19,200
米	1,835	1,956	1,850	2,104	NA
落花生	7,464	2,232	2,736	2,032	1,320
小麦	5,323	4,541	6,528	6,966	NA
茶	634	1,230	1,528	1,731	NA

(出所：中央統計局資料)

農産物生産者価格の推移

	単位	1978	1981	1982	1983	1984
とうもろこし	90K袋	6.80	13.50	16.00	18.30	24.50
落花生	80K袋	28.60	42.70	48.00	52.00	65.00
ひまわり種	50K袋	12.50	17.60	20.75	21.50	21.90
大豆	90K袋	21.50	36.30	42.31	45.30	52.50
小麦	90K袋	20.00	26.00	32.00	35.75	42.50
ミルク	リットル	0.21	0.28	0.43	0.47	0.52
水稲	80K袋	14.40	18.60	28.00	40.00	40.00
たばこ	kg	1.29	1.65	2.40	2.70	2.80
綿実	kg	0.46	0.46	0.47	0.52	0.58

(Financial Report)

主要貿易相手国

(単位：1,000クワチャ)

		1976	1977	1978	1979	1980
対英国	輸出	103,728	113,349	99,634	144,739	135,551
	輸入	112,341	121,480	122,294	153,256	194,774
対南ア	輸出	1,806	1,735	800	4,162	5,687
	輸入	34,999	38,524	31,476	64,473	136,342
対中国	輸出	19,041	22,907	20,625	34,819	28,085
	輸入	8,959	6,697	6,286	2,283	5,748
対米国	輸出	116,371	72,847	70,101	111,606	110,282
	輸入	50,728	57,524	38,679	55,310	60,570
対日本	輸出	125,873	124,141	132,021	201,350	160,402
	輸入	22,065	25,401	21,832	24,410	43,590
対西独	輸出	106,021	102,406	79,285	100,308	81,308
	輸入	33,602	62,871	54,700	45,767	60,535
対東アフリカ諸国	輸出	7,206	6,322	5,019	6,531	6,733
	輸入	10,984	9,139	8,250	10,308	12,223

(出所：中央統計局資料)

主要輸出産品

		1977	1978	1979	1980	1981
銅	数量	666,600	589,200	651,800	621,700	551,800
	金額	644,900	597,700	897,200	850,700	835,700
亜鉛	数量	36,470	35,437	42,086	30,787	31,520
	金額	17,920	17,630	27,078	19,571	22,895
鉛	数量	11,673	6,649	8,465	8,749	8,282
	金額	5,705	3,277	6,079	6,528	5,132
コバルト	数量	1,682	1,793	3,060	1,924	2,211
	金額	16,226	36,679	129,891	80,693	38,979
タバコ	数量	3,425	1,610	1,631	2,604	1,231
	金額	5,783	3,481	2,577	2,700	4,025
メイズ	数量	25,606	61,008	—	—	—
	金額	3,517	7,830	—	—	—

数量：トン

金額：1,000クワチャ

(出所：中央統計局資料)

主 要 輸 入 物 品

単位 1,000 クワチャ

	1977	1978	1979	1980	1981
食 料	28,672	31,611	37,820	38,741	50,799
飲料・タバコ	879	678	1,299	776	1,175
原 材 料	8,807	9,025	10,965	12,106	13,570
鉱 物 燃 料	81,010	86,978	106,363	190,970	202,439
油 脂	9,108	7,169	10,018	7,386	10,673
化 学 品	58,928	65,042	79,128	108,260	126,302
生 産 資 材	117,856	98,038	121,705	178,677	173,480
機械・輸送機	205,102	175,793	201,241	302,165	314,443

(出所：中央統計局資料)

石 油 輸 入 の 推 移

	1979	1980	1981	1982	1983
数 量(千トン)	699	762	751	748	774
百万K (fob)	97.1	154.0	185.0	197.8	306.9

(Financial Report)

国 際 収 支 の 推 移

単位：百万クワチャ

	1978	1979	1980	1981	1982	1983 (暫定)
輸 出 (fob)	665.1	1,117.6	1,152.0	866.3	877.6	1,163.3
(うち銅輸出)	(597.7)	(897.2)	(872.4)	(835.7)	(856.1)	(1,049.0)
輸 入 (fob)	494.8	599.8	878.7	883.0	919.6	873.6
貿 易 収 支	170.3	517.8	273.3	-16.7	-42.3	289.7
貿 易 外 収 支	-245.9	-282.2	-417.9	-403.3	-375.1	-371.0
資 本 収 支	-150.9	-190.6	-253.5	-235.9	-221.5	-265.1
移 転 収 支	-26.4	-53.8	-113.8	-88.0	-27.5	-36.3
総 合 収 支	-252.9	-8.8	-511.9	-743.9	-666.4	-382.7

(Financial Report)

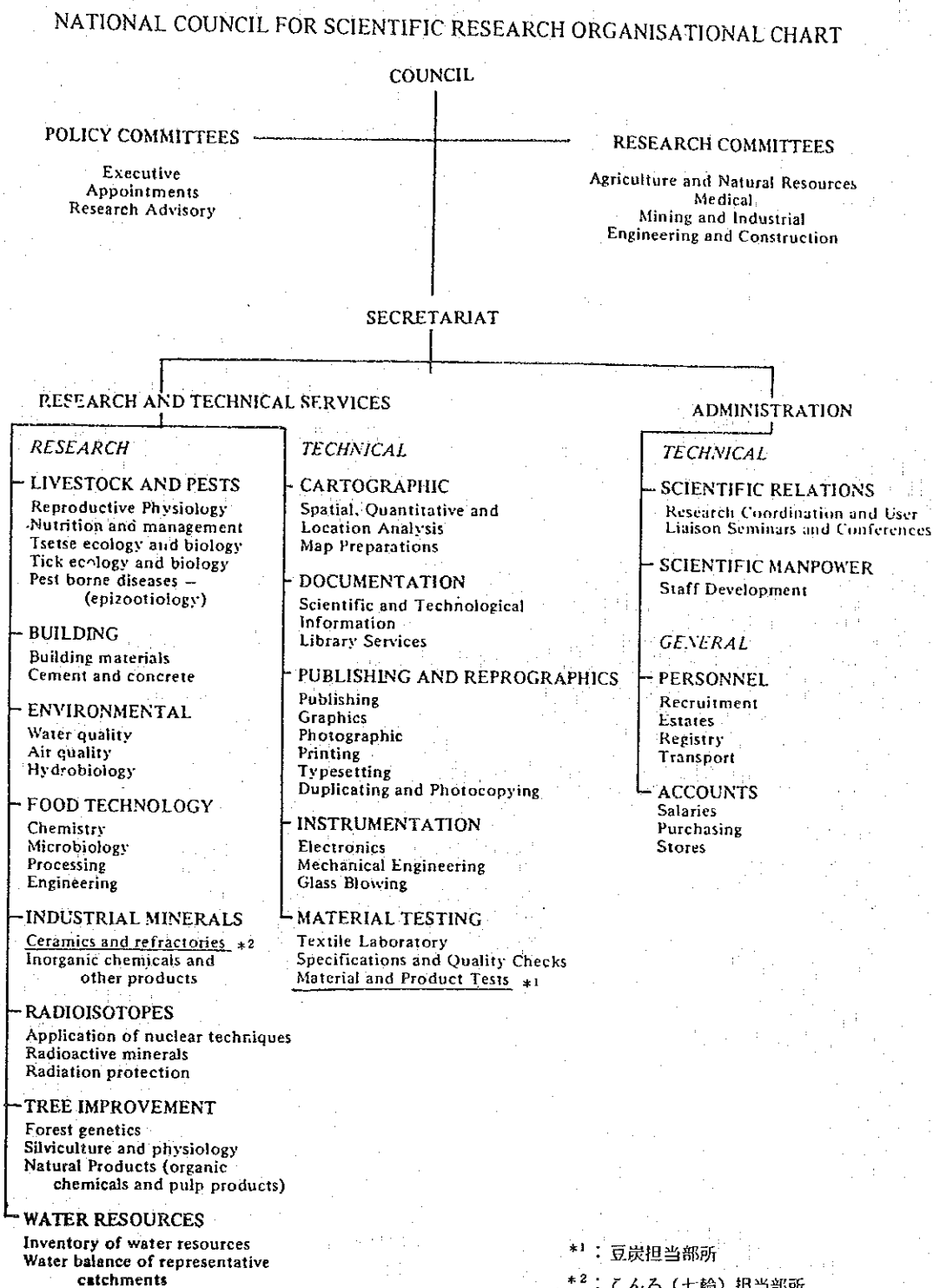
ザンビアの銅の交易条件

	銅 価 格 (1981年ベース実質価格, ドル)	交 易 条 件
1970-74	1.63	100
1975-79	0.87	54
1980	0.96	59
1981	0.79	49
1982	0.65	40

ザンビアの銅輸出相手国(1981年)

日 本	139,950トン
フ ラ ン ス	79,050
イ タ リ ア	57,785
英 国	50,790
西 独	49,200
オ ラ ン ダ	35,440
イ ン ド	30,831
ス ウ ェ ー デ ン	24,100
ユ ー ゴ ス ラ ヴ ィ ア	18,000
ギ リ シ ャ	16,000
米 国	12,000

5. NCSR 組織図



JICA