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ENDEAVOUR OIL COMPANY N.L.
REPORT FOR THE PERIOD
1st OCTOBER - 31st OCTOBER, 1975
EXPLORATION LICENCE 4/74
LAND DISTRICT OF DEVON
LOCALITY OF LATROBE
NORTHERN TASMANIA
BY
L.G. NIXON, L.G.B. NIXON & ASSOCIATES

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CONTENTS

L.G. NIXON

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24th November, 1975

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SUMMARY

The Mineral Industry Consultant has submitted a second report on the feasibility of mining the Tasmanian oil shale deposits. His present opinion is that the project offers breakeven on operating costs at likely present prices.

Results of tests carried out by the C.R.B. and A.R.R.B., on Tasmanian bitumen have not yet been received by the Mineral Industry Consultant.

Results of the geophysical survey are still being evaluated and were not available for incorporation in this report.

INTRODUCTION

Investigations were continued by the Mineral Industry Consultant into the economics of mining and treating the Tasmanian oil shale and methods of financing these operations.

A preliminary report by the M.I.C. based on investigations to date is given below.

WORK DONE

Preliminary Feasibility Report

Market. 220 gal. bitumen has a price of $110/tonne (about

50^{c}/gal.). By taking the ash content as indivisible, and complementing to performance -

i.e. not discounting for ash

- then 150 gal. asphalt is worth $75/tonne

Intangible savings may justify a price of $90/tonne now - savings such as foreign exchange. Road trials on asphalt produced from some future sub-commercial operation may show savings in extended pavement life which justify a higher initial product price.

Operating cost on the basis of ASPHALT tons

5 tons shale → 1 ton asphalt

7 tons run of mine shales → 5 tons oil shale at flotation.

		with economy	
Mining underground 7 t @ 7^{00}	49.00	@ 6.50	45.50
Milling 5 t @ 3^{00} met. tails disposal etc.	15.00	@ 2.70	13.50
Digestor/convertor labour at 3 men/shift 5 t @ 4^{00}	20.00	labour 2 men/shift @ 3.00	15.00
Environment @ 20^{c}/ton shale	1.00		1.00
Asphalt handling (excl. Freight)	0.50		0.50
Local overheads, research, management	3.00		2.50
PER TON ASPHALT	$90.00		$73.00

i.e. only marginal operating economy.

However, the cost estimates are extremely sensitive due to the multiple 5^{x} or 7^{x} re shale input. Mawson (1936) uses a figure of 4.25^{x} instead of 5^{x} used here, which if correct could drop the higher case down to $79/ton of asphalt.

Comment:

Successive layers of tasmanite oil shale have different oil yields and other different characteristics. Outcrop shale may have a similar oil yield to an underground shale, yet have different behaviour/performance in flotation. (For some reason orange-coloured spores behave differently to lemon-coloured spores). Metallurgical test work on core could perhaps delineate variations in oil shale zones, and possibly indicate areas where we might anticipate improved shale:asphalt ratios. This would have a significant bearing on the multiples used in these cost-estimates.

Note that the cost of oil yield analysis may be avoided to some degree: there is a demonstrable relationship between ash content and oil yield - to allow close approximation of yield from a $5 ash analysis.

Where open pit excavation is likely core drilling should be undertaken to

- establish the nature and extent of thin, high-yield layers above the easily recognisable "normal" horizon, as the thin layers may be extractable with self-loading scrapers.

and to provide overburden data.

Underground mining costs here are by comparison with current costs at Fingal Colliery, Tasmania. Opencut excavation costs are those on current contract or other PWD experience in Permian mudstones/shales.

- overburden ripping $1/cyd ± 10 cents.
- drill and blast $3.70 to $4.00/cyd., down to 50ft.

Capital Costs

1. Re production expense (excluding geology)

Surface rights purchase 100 ac @ $500/ac remainder crown lands	50,000	
Fencing requirements @ £1.50/meter	5,000	
Road construction $4000/km.quality	28,000	
Construction camp - assume largely use of local facilities,allow	50,000	
		133,000

2. Underground excavation

Assume by 4'6" min.height continuous miner.

9 day fortnight. 200 days p.a.

One miner - 100,000 t p.a. single shift

excalating to say 150,000 t p.a. double shift

i.e. one miner - shale for max. 300,000 t.asphalt

weak ore, strong backs, near flat dip; miner faulting

Initial mine development

Adit openings	70,000	
Vent raises	30,000	
Miscellaneous supplies, air etc.	70,000	
		170,000

Mine equipment ADIT ACCESS

Continuous miner, 2 shuttle cars, in situ	550,000	
Conveyors - main access	16,000	
- operating areas	20,000	
vehicles,ancillary buildings	150,000	736,000
compressed air and drainage, etc.	100,000	100,000

3.	Ore dressing		
	Primary crushing spiked rolls, conveyors, Various ore bins. Secondary/Tertiary crushing plus screens heavy media plant etc.	500,000	
	Flotation, Filtration, Storage bins (allow capacity 750 t.p.d.)	1,000,000	
	Drying concentrate, preheat to 150°C and digestor Feed.	2,000,000	
	Digestor, convertor (bank of 2 units See notes over 2 pages		
	Tailings, disposal	300,000	3,800,000
4.	Water Supply		100,000
5.	Power Supply substation and distribution		350,000
6.	Engineering and construction		350,000
	Excluding working capital outlays:		5,739,000

Capital Cost, underground operation	$5,739,000	
+ 20% for error say	1,148,000	
	$6,887,000	

Working capital

@ 10% of gross capital 700,000

OR

@ 4 months costs.

est. wages @ 70000/mo.) 480,000
supplies @ 50000/mo.)

150000 tons shale p.a. average of $600,000 wkg. cap.

PRODUCTION AT 300,000 tons shale p.a., underground i.e.

2 continuous miners

4 shuttle cars.

Capital cost increases are -

For initial development	70,000
added mine equipment	550,000
added crushing etc.	150,000
Flotation plant	500,000
2 extra digestors	1,000,000
add engineering & construction	130,000
	2,400,000

say $9½ million dollars

working capital @ $750,000

PRODUCTION AT 300,000 tons shale p.a.

MIX OPEN PIT AND UNDERGROUND

mine open pit by contract

added ore dressing as above

add a total 1,780,000

i.e. $7.7 million dollars

working capital @ $700,000

Mix: offers least outlay for production, but open pit sites need careful definition to avoid operating losses.

OPERATING COSTS (PER TON OF SHALE)

Mining costs Underground oil up	$7/ton shale	perhaps $6.50 with economy
Milling costs etc.	$3/ton shale	
Digestor	$4*/ton shale	
	3 men/shift	
	perhaps $3.00 if 2 men/shift	

Assumptions about digestor are

(1) that fuel oil yield during asphalt conversion will be about 70 gals/ton asphalt.

- that fuel oil consumption in conversion is 35 gal/ton

∴ yield will supply Fuel to heat convertor and also concentrate preheater.

(2) Size

Existing digestor 16' long x 3'6" int. diameter.

Half depth charge is 1 ton

Estimated conversion time if concentrate is introduced at 150°C is 12 hours.

i.e. capability probably 2T/day hot running.

only sub-commercial.

Digestor Size. 20' diameter x 20' long, same principle

Half depth charge 3000 cubic Feet concentrate

i.e. load 84,000 lbs. concentrate

production 62000 lbs. asphalt (+ oils)

27.7 tons/charge /.12 hours

OR hot run 50 Tons asphalt/day.

Say basis of operation 7 day week /4 weeks.

1 week downtime.

280 days p.a. - 14000 T.p.a.

say 15000

i.e. Bank of 2 digestors. 30,000 TPy asphalt.

Per digestor, operating costs. Fuel say NIL

* Labour 3 men/shift)
loading facility) exs $1000/day.
supplies,repairs)

equiv. $4/ton shale

PIT

Knights - Churchill area. (behind Saggers Hill)

Seismic work completed above holes 29, 30, 31. indicates a non-rippable layer as 7½ - 8½ metres 24'6" - 28'

From log, apparently the thin, hard sandy mudstone just above the oil shale horizon.

∴ area offers scope for open pit operation.

Strip area 1600 yds. x 400 yds.

± 2' shale depth. about 426000 yds. oil shale

approx. 285,000 tons available.

400 yds. across

∴ per lineal yard @ 6yds. deep.

2400 cubic yards/yd. @ $1/c.yd.	2400
($400^{yd} \times 2/3$ yd.) oil shale 270 cubic yds @ 1.50	500
i.e. about 180 tons/yd	$2900
about $16/ton shale	

∴ open pit costs excessive for only 2' thick shale band

check: If 20% + error (high @ $1)

2400 c.yd./yd @ 80c/c.yd.	1920
oil shale 270 cub.yd. @ $1.20	324
180 tons/lineal yd. -	$2244
about 12.40/ton shale	

- still excessive !! at 5 x multiple.

IF same stripping open 4'6" oil shale seam

2400 cubic yds/yd @ $1.00	2400
oil shale 600 cub.yds. @ $1.50	900
about 400 tons.	$3300
about $8/ton.	

Conclusion

Open pit feasible when

- seam is 4'6" plus
- at rippable depths less than 24 feet
- NO blasting is involved - seism c work precludes open pit operations at the Goliath mine area.

FURTHER WORK

Final feasibility study report to be prepared incorporating the results of test work currently being conducted by the C.R.B. and A.R.R.B.

COST ESTIMATES:

Costs for November were:-

1.	Geological Consultants	$150.00
2.	Project Engineer	$100.00
3.	Mineral Industry Consultants	$120.00
	Total	$370.00

L.G. NIXON

24th November, 1975

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