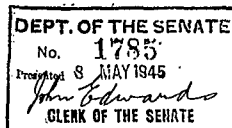


1945.



THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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PARLIAMENTARY STANDING COMMITTEE  
ON PUBLIC WORKS.

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R E P O R T  
together with  
MINUTES OF EVIDENCE  
relating to the

BAERAMI SHALE OIL PROPOSAL.

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Senator Lamp -

I present the Report of the Parliamentary  
Standing Committee on Public Works, together with  
Minutes of Evidence, relating to the following subject:-

Baerami Shale Oil Proposal -  
and move - That the Report and Evidence be printed.

1945.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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PARLIAMENTARY STANDING COMMITTEE ON  
PUBLIC WORKS.

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REPORT  
*together with*  
MINUTES OF EVIDENCE  
RELATING TO THE

BAERAMI SHALE OIL  
PROPOSAL.

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By Authority:  
L. F. JOHNSON, Commonwealth Government Printer, Canberra.  
(Printed in Australia.)

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.  
(ELEVENTH COMMITTEE.)

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ROWLAND JAMES, Esquire, M.P. (Chairman).

*Senate.*  
Senator WILLIAM EDWARD AYLETT.  
Senator CHARLES HENRY BRAND.  
Senator CHARLES ADCOCK LAMP.

*House of Representatives.*  
WILLIAM PATRICK CONELAN, Esquire, M.P.  
HONORABLE ERIC JOHN HARRISON, M.P.  
DANIEL MULLOCHY, Esquire, M.P.  
GEORGE JAMES RANKIN, Esquire, M.P.  
HONORABLE SIR FREDERICK HAROLD STEWART,  
M.P.

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EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES, No. 37,  
DATED 30TH MARCH, 1944.

14. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—BAERAMI SHALE OIL PROPOSAL.—Mr. Evatt (Attorney-General) moved, by leave, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1936*, the following proposed work be referred to the Parliamentary Standing Committee on Public Works for investigation and report:—Baerami Shale Oil Proposal.  
Question—put and passed.

# THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

## BAERAMI SHALE OIL PROPOSAL.

### REPORT.

THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS, to which the House of Representatives referred for investigation and report the Baerami Shale Oil Proposal, has the honour to report as follows:—

#### INTRODUCTION.

1. In Australia, the question whether natural petroleum exists in payable quantities or not is unsettled, but she has large deposits of coals and shales. Apart from the direct economic value of these deposits, they have another value which arises from the possibility of making this country less dependent on foreign supplies of oil. This is a matter which demands study under normal conditions, as in times of national emergency it may become of incalculable importance.

#### NATURE OF THE PRESENT PROPOSAL.

2. For many years it has been known that there exist deposits of shale in the Baerami district, and prospecting has been carried out to discover the extent of the seam and tests undertaken to prove the quality of the shale.

3. By arrangement with the Government of the United States of America and at the request of the Commonwealth Government, a Mission of American experts arrived in Australia towards the end of 1942 to inquire into the development of liquid fuel from the deposits of shale in this country, to meet the demands of the naval and military Forces as well as the normal civilian market.

4. The most extensive proved oil shale deposits in Australia are said to be at Glen Davis (Capertee Valley) and Baerami (between Muswellbrook and Rylstone). Glen Davis has been in production for some years, although not to the full extent of its capacity, but very little work has been done at Baerami beyond driving a number of tunnels.

5. The American Mission recommended the addition of plant, and the installation of new retorts, &c., at Glen Davis so as to step up production to 39,200,000 gallons of crude oil per annum, from which would be produced approximately 22,400,000 gallons of petrol per annum together with diesel oil, gas oil, wax, fuel oil and coke. In addition, it recommended that the shale deposit at Baerami should be developed to produce 37,350,000 gallons of crude oil per annum from which would be extracted 22,303,920 gallons of petrol together with other products.

#### REPORT OF THE MISSION.

6. The Mission's report to the Minister for Supply and Shipping was as follows:—

In the performance of certain duties for the Foreign Petroleum Policy Committee and in the interest of the United Nations' war effort we submit this memorandum covering the proposed development of the Baerami oil shale deposit for the ultimate production of gasoline,

diesel oil, gas oil, and fuel oil in varying quantities to meet the demands of the military or naval Forces as well as the normal civilian market. Certain mining practices contemplated are prerequisites of this memorandum. The first is the assumption that three shifts per operating day will be permitted. The second assumes that permission will be granted for the adoption of full mechanization of the mining operation.

A modified long wall system of mining will be adopted with panel arrangement to protect the acreage from the results of "squeeze" or "creep" conditions. Dependent on the rapidity of the development of the mine and the time available it may be possible to adopt "retreating" methods for the extraction of the long wall faces. If such a plan cannot be put into practice then "advancing" long wall methods may be used.

The application of fully mechanized mining operations is dependent on the sanction of the Minister for Mines of the State of New South Wales. The Mission discussed these matters with the Minister and he has given his assurance of the full co-operation of his department compatible with the Mining Act of the State of New South Wales. Because of the war emergency we are submitting this memorandum for your Government's early consideration without waiting for the Minister's decision in this matter. Should he find that our request cannot be granted then all recommendations contained herein must unfortunately be nullified.

The proposed operation contemplates the mining of 3,900 tons (run of mine) of oil shale and other retortable material 230 days per year and the retorting of this material at the rate of 2,300 tons per 24 hours 365 days per year for the production of 37,350,000 gallons of crude oil annually. The retorts will be placed adjacent to the mine in Ruben's Gully. From there the crude oil will be transported by pipe line to a refinery site tentatively selected in the vicinity of Muswellbrook. This site was selected because of the available water supply, suitable housing and satisfactory rail connexion. This pipe line could be extended to a suitable site at tidewater in the Newcastle area but the installation of a refinery in that area may need the approval of the military authorities.

Power for the mining and retorting and for the village will be generated by gas engine-driven generators using the waste gas from the retorts. When all retorts are not in operation one or more of these engines can be quickly converted for operation on crude oil coming from the retorts.

From observation and from such data as is available it appears that there is sufficient water in the Blackwater Creek basin for the mining, retorting and village requirements. The sum of £100,000 has been allowed for this purpose in the estimate of the amount of capital required for this project.

The feed to the retorts will be the crushed run of mine material without further preparation other than the removal of fine dust. It is contemplated to install six 450-ton retorts of the Renco type including the equipment for power generation as previously mentioned.

The crude oil will be transported to the refinery through a 4-inch pipe line 33 miles long. There will be one pump station located at the retorts. The estimated pressure at the pump discharge is 750 to 800 lb. per square inch gauge. Two multi-stage centrifugal pumps are contemplated either one of which will carry the full load. Power will be obtained from the generators located at the retorts.

The refinery will have a rated capacity of 140,000 gallons per 24 hours input which will allow for occasional shut-downs for repairs and which will permit of some increase in through-put if desired. The refinery will consist of primary distillation unit, a thermal cracking unit, a catalytic cracking unit, and the necessary treating, re-run, and stabilizing units and other auxiliaries. The power will be generated by the refinery's own turbo-generator utilizing the exhaust steam for process purposes. A complete complement of storage tanks is included with sufficient capacity for 30 days' storage of finished products. Also included in the estimate are the office, laboratory, machine shop, change house, sewer system and all auxiliaries necessary to a refinery of this type.

The Mulholland report of the Department of Mines of the State of New South Wales estimates the Barami reserves of oil shale and canal coal at 10,615,000 tons. The report also states that these reserves are for only that part of the deposit which has been explored.

The mining operations envisage the extraction of the oil shale, the canal coal and some of the bituminous coal and sandstone bands all of which is classified as run of mine. It is estimated that the oil shale and canal coal represents 68 per cent. by weight of the run of mine material. On the basis of mining 897,000 tons run of mine annually, the rate contemplated for this project, the depletion of the 10,615,000-ton reserve is at the rate of 897,000  $\times$  0.68 or 610,000 tons annually. Based on this conservative estimate reserves the length of life is 13.9 years assuming 80 per cent. extraction. It is reasonable to expect that future development work will prove additional reserves.

It has been noted that the construction of a village is contemplated at the mouth of Ruben's Gully. We understand that a housing project of this kind is self-liquidating and, therefore, it is not considered to be a part of the fixed capital invested in a project of the type under discussion. A suitable highway is necessary from Barami to the proposed development and it is understood that the proper authorities will undertake this work.

In connexion with the item for mine development set forth in the list of capital charges, attention is called to the fact that during the development period, 150,000 tons of retortable material will be produced. This material will be placed upon stock piles ready for crushing and retorting and the value of such (£112,500) may be considered a credit against the cost of mine development.

The Mission believes that this project can be completed within eighteen months and that in the interest of the United Nations' war effort you should strive for an earlier completion. To insure against any delays it will be essential that the highest priorities be given for the material required and that the administration of the work be such that orders for material can be placed as needed. In addition, the labour necessary for construction and for operation must be readily available. About 850 men will be required for the normal operation of this project.

Some of the material required is not available in Australia and it is contemplated that it will be supplied from the United States of America. In general, the large plate work, tanks, boilers, structural steel, &c. will be supplied from Australia and the special mining machinery, compressors, pumps, instruments, special valves, specially designed apparatus, drawings and supervision of erection and operation will be supplied from the United States of America. It is believed that in the interest of speed the decision on this distribution should be left with the United States of America authorities based on recommendations resulting from the Mission's present studies. The value of the material which it is contemplated will be supplied from the United States of America may be as much as \$965,000.

The Mission, upon notification by your Government of its wish to proceed with this work, will return to the United States of America and submit its report to the proper authorities so that upon their approval the work can be carried forward to an early completion.

#### SUMMARY.

7.—		
Mined per mining day—run of mine (tons)	3,900	
Mined per year—run of mine (230 days per year)	897,000	
Retorted per 24 hours (365 days per year)	2,300	
Crude oil per year	37,860,000	(gallons)
Petrol per year	22,303,920	(gallons)

#### PLANT AND CAPITAL REQUIRED.

	£
Mine equipment, crushers, trucks, road, shop, &c.	620,000
Retorts, spent shale disposal, &c.	600,000
Power house for mine and retorts	100,000
Water supply	100,000
Pipe line	87,000
Refinery	669,000
	<hr/>
10 per cent. war contingencies	217,000
	<hr/>
Capital invested in fixed plant assets	2,394,000
Mine development	220,000
	<hr/>
Self-liquidating capital, village	2,614,000
	<hr/>
Total capital required	2,914,000

#### OPERATING COST AND REALIZATION.

8. It was stated that the refining plant is designed for operations varying from that of maximum production of gasoline to maximum production of fuel oil either of which operation might be demanded by the naval or military Forces. For the purpose of analysis an example of diversification of saleable products was offered as an average of what might be expected.

#### VALUE OF PRODUCTS—1942 PRICES.

	£
Gasoline (59.7 per cent.) 22,303,920 gallons at 1s. 4d.	1,551,981
Light Diesel Oil (1.2 per cent.) 448,320 gallons at 7d.	13,079
Gas Oil (19.3 per cent.) 7,210,480 gallons at 4.5d.	135,198
Fuel Oil (9.5 per cent.) 3,549,200 gallons at 8d.	44,365
Annual value of products	1,744,613
Less operating costs—	£
Mining	672,750
Crushing	22,425
Retorting	72,000
Pipe line	8,400
Refining	130,000
	<hr/>
	955,575
Net annual realization before charges for interest, taxes, amortization and Crown royalties	789,043

#### TIME FOR COMPLETION.

10. As indicated in the report above, the Mission believed that the project could be completed in eighteen months and that about 850 men would be required for the normal operation of the project.

#### COMMITTEE'S INVESTIGATIONS.

11. The Committee visited Glen Davis, made a comprehensive inspection of the plant, travelled to the working faces underground, and was given a detailed explanation of the operations. A visit was also paid to the Barami area and an inspection made of the faces at the end of some of the tunnels, and of the retorting plant at Sandy Hollow.

12. As the question was raised whether other deposits might offer better facilities for development, a visit was paid to the Latrobe area in Tasmania. Evidence was also taken in Melbourne in respect of the Victorian brown coal deposits.

13. Following is a list of the witnesses examined:

Baragwanath, G. E., Research Chemist, State Electricity Commission of Victoria.  
 Baragwanath, W., Senior Geologist, Department of Mines, Victoria.  
 Bowdler, J. D., Mining Manager, Glen Davis.  
 Fry, J. L., Engineer, of the firm of Julius, Poole and Gibson, consulting chartered engineers.  
 Gadaby, F. C., representing Dr. Morgan's process of re-torting.  
 Gibson, A. J., of the firm of Julius, Poole and Gibson, consulting chartered engineers.  
 Griffiths, L. J., Managing Director, National Oil Proprietary, Limited, Glen Davis.  
 Hebblewhite, A. G., representing petrol consumers' interests.  
 Howarth, G. B., Fuel Technologist, Department of Mines, New South Wales.  
 Johnstone, J., General Superintendent, J. and A. Brown Abermain, and Seaham Colliery.  
 Kenny, E. J., Senior Geological Surveyor, Department of Mines, New South Wales.  
 Keany, J. P. L., Geological Surveyor, Department of Mines, Victoria.  
 Liddel, R., Manager, State Electricity Commission of Victoria.  
 Moate, J. H. M., Managing Director, Standard Oil Company of Australia Limited.  
 Mulholland, G. St. J., Geological Surveyor, Department of Mines, New South Wales.  
 Perkins, V., Chairman, Sherwood Ward, Latrobe Municipal Council.  
 Purves, S. S., General Manager, Goliath Cement Company, Latrobe.  
 Rayner, G. H., Assistant Paymaster, City Hall, Hobart.  
 Rayner, M. L., Insulation Engineer, Tasmanian Shipping Board, Hobart.  
 Reynolds, J., Research Officer, Premier's Department, Hobart.  
 Rodgers, W. L., Chairman of Directors, Shale and Oil Products Limited, Sydney.  
 Rogers, L. J., Technical Advisor, National Oil Proprietary Limited, Glen Davis.  
 Smith, A. C., Executive Officer, Minerals, Department of Supply and Shipping, Melbourne.  
 Walker, A., Chemical Engineer, Goliath Cement Company, Latrobe.  
 Williams, H. J., Chief Engineer, Peter's Ice-cream Company, Sydney.  
 Williams, W. H., Director, of Mines, Tasmania.  
*Witnesses, T. O., Manager, Director of Reports Proprietary Limited, Newcastle.*

14. Probably the earliest reference to the occurrence of oil shale in Australia was published in Paris in 1807, after the return of a French expedition from Australia in 1802. This was found "at the foot of the mountains near Parramatta." In 1839 Count Strzelecki mentioned similar material found at Reedy Creek, Hartley Valley. In 1862, shale from Murrurundi was exhibited at the London International Exhibition. The *Sydney Morning Herald* of 14th July, 1865, records "a proposed undertaking to distil oil from kerosene shale at Stony Creek near Maitland".

15. From this time onwards shale was discovered in many other localities, notably Marrangaroo, the Capertee Valley, Katoomba, the Wolgan Valley, Joajda, Torbane, Wollar, Barigan, Baerami and Rylstone in New South Wales; between Maryborough and Rockhampton, Queensland; and in the Mersey Valley, Tasmania. Several of these deposits have been worked with varying success, but with one or two exceptions not to any great extent.

16. During the early years of the industry shale was exported or used locally in admixture with gas works coal so as to increase the luminosity of the naked flames of those times. This lucrative market was lost when the Welsbach incandescent mantle was introduced.

#### SHALE OIL BOUNTIES.

17. In an endeavour to foster and encourage the shale oil industry in Australia, the Commonwealth

Parliament has, from time to time, granted assistance by means of bounties. The *Shale Oil Bounties Act 1910*, appropriated the sum of £50,000 during the three years ending 30th June, 1913, for the payment of bounties of 2d. per gallon on kerosene, and of 2s. 6d. per cwt. on refined paraffin wax, the products to be manufactured from Australian shale.

18. In 1917, a Shale Oil Bounty Act was passed under which £270,000 was appropriated for the purpose of paying a bounty in respect of the production in Australia of crude oil from mined kerosene shale. This bounty was to be payable for a period of four years from 1st September, 1917, but by subsequent Acts was extended until 31st August, 1929.

19. Under these Acts the rate of bounty was 2½d. on each gallon up to 3,500,000 gallons (raised to 3½d. in 1922); 2d. on each gallon exceeding 3,500,000 and not exceeding 5,000,000 gallons; 1½d. on each gallon exceeding 5,000,000 and not exceeding 8,000,000 gallons; and 1½d. on each additional gallon.

20. Up to the end of January, 1923, when the works at Newnes closed down, there had been a total production of 12,967,762 gallons of crude oil, and the total bounty paid was £125,156 all of which was drawn by John Fell and Company. The crude oil was refined in Australia, and the following products were obtained:

	Approximate quantity, gallons.
Gas oil . . . . .	7,744,869
Kerosene . . . . .	2,163,132
Motor spirit . . . . .	1,024,798
Grease oil . . . . .	413,595
Asphalt . . . . .	65,745
Pitch . . . . .	110,835

#### FORMATION OF SHALE.

21. For the benefit of those unacquainted with the subject, it might be explained that oil shale is formed by the deposition of certain organic matters in still water such as a lake or lagoon. The shales may be classified according to the chief components: For instance in "humus shales" decomposition products of cellulose form their chief components, and are mixed with resin, spores and cell-walls. In "spore shales" the chief component consists of plant spores. To this group belong the ordinary canal coals, canal shales, and oil shales which together make the main part of the shales. "Spores" are the reproductive cells or seeds of non-flowering plants, which vegetation flourished in coal-forming periods much more than they do to-day. "Cellulose" is the component of plants, which undergoes bacterial decay in presence of air and moisture most readily.

22. It is probable that the deposits of vegetation from which many shales are derived suffered in this way a partial removal of cellulosic constituents, with the consequent enrichment of the resins, waxes and oils, which intermingled with mineral matter, eventually consolidated under pressure to oil shales.

23. It should perhaps be explained that shale does not contain oil or oily substances; these are formed by the heating of the shale, and until it is heated they do not exist.

#### EXTENT OF OIL SHALES.

24. Contrary to the general impression, the extent of our shale reserves in New South Wales and in Australia generally, is very small. It was stated in evidence that in the last 40 years only three new shale deposits have been discovered in New South

Wales as against 20 discovered during the previous 40 years. Therefore the prospect of a new field being discovered in the future is comparatively remote. Moreover, of the 20 or 30 known fields in New South Wales, most are very small. Geological evidence is to the effect that each deposit represents the bed of a small fresh-water lake, of which there were many dotted about the country in those times. For that reason, it is represented that if any further deposits are discovered, they too would be small, so that future discoveries would not upset the premise that the quantity of shale in New South Wales and in Australia generally is comparatively small.

#### SITUATION OF BAERAMI.

25. The Baerami oil shale field is situated near the headwaters of Baerami Creek and Widdin Brook, tributaries of the Goulburn River, about 20 to 30 miles south-west of Sandy Hollow. The area can be reached by road direct from Muswellbrook or Denman, distances of 43 and 27 miles respectively. The nearest railway siding is at Sandy Hollow. The new Sandy Hollow-Maryville line (under construction) will pass within 15 miles of the field at the village of Baerami on the Goulburn River.

#### ROADS.

26. It would be possible to build gently graded roads along the floors of the valleys without much cutting or filling but it is possible that considerable damage would be done to these roads by flood waters after heavy rain unless properly constructed creek crossings are made.

#### RESERVES OF SHALE AT BAERAMI.

27. It will be noted from the American Mission's report, that it was working on the Mulholland report of the New South Wales Mines Department which estimated the Baerami reserves of oil shale and canal coal at 10,615,000 tons, and stated that these reserves are for only that part of the deposit which has been explored.

28. During the course of the Committee's inquiries evidence was given that other experts had estimated the reserves contained in the Baerami shale mine at 12,000,000 tons, while one witness stated that the probable amount extended beyond 20,000,000 tons in the areas surrounding the Baerami shale mine. The existence of this quantity is, of course, largely a matter of conjecture and even if it exists it is problematical if it could all be extracted as a practicable mining proposition.

29. Experience is that oil shale deposits are generally in the form of lenticular seams in isolated basins, varying in thickness from a few inches to several feet, and perhaps with irregular edges.

30. The average thickness of the composite seam at Baerami as given by the Mines Department is 2 feet 8 inches and the thickness varies from 10½ inches to 3 feet 6 inches. A typical section was described from the bottom to the top as follows: There is a clay shale floor, then 2 feet of high-grade oil shale, 2 inches of inferior canal coal, 1½ inches of clay shale, 1 foot 2½ inches of inferior canal coal, 1½ inches of coal, 4½ inches of clay shale and 1 foot 9 inches of coal. Over that there is the sandstone roof. It was stated that the seam at this point was a little thicker than usual, but its general behaviour is similar at practically all points. In this section, for instance, there is about 2 feet of high-grade oil shale whereas the usual thickness is 18 inches.

#### AVERAGE YIELD.

31. From an average of tests made by the Department of Mines in various parts of the field, it is calculated that there would be an average yield of 57 gallons of crude oil to the ton.

#### ESTIMATES.

32. It will be noticed that the estimates furnished by the American Mission for the development of Baerami were given in round figures and no details are available as to how the various sums are arrived at or by whom the estimates were made. The Committee, therefore, is inclined to view these figures with caution.

#### HOUSING.

33. It was stated that "about 850 men would be required for the normal operation of this project". On these figures the estimate of £300,000 for the construction of a village to accommodate this number in this isolated district, appears inadequate.

#### WATER SUPPLY.

34. From the Committee's observations during its visit, it would appear that there is practically no surface water at Baerami. The question of a water supply would demand close examination and survey, and inquiry from the Principal Engineer, Water Supply and Sewerage Department of Public Works, New South Wales, elicited the information that he knew nothing of the Baerami scheme from a water supply point of view.

35. The Committee was informed in evidence by another witness that it might be possible to get a limited quantity of water from the Widdin Brook side, but only enough to run a comparatively small plant. To obtain a large and assured supply it was stated that it would be necessary to bring water from the Goulburn River, 20 miles away, or to establish the works themselves there.

36. It will be noted that the American Mission stated that a refinery site had been tentatively selected in the vicinity of Muswellbrook because of the available water supply. This indicates some lack of investigation as the Committee was informed in evidence that the ordinary water supply for Muswellbrook has been dangerously short at times. If a refinery were placed alongside the town something would have to be done to improve the water supply.

37. It was stated that if Renco retorts are used at Baerami, as proposed by the American Mission, not a great deal of water would be needed, but if the "Fell" retort or any other kind than the Renco were used, a large condensing plant would be necessary, a large quantity of water would be needed, and the matter of a water supply would be most important. Whether the necessary supply could be obtained for the amount of £100,000 set down, is problematical.

38. The experience of Glen Davis should be kept in mind to emphasize the importance of an adequate and assured water supply. It was expected that the Wolgan River would provide an adequate and perennial supply, but the river has been dry and some operations had to be suspended for five months through lack of sufficient water. It was for this reason that the enterprise has had to become partners in the Fish River water scheme at a cost of £350,000 which was something outside the undertaking as originally planned.

#### DEVELOPMENT AT BAERAMI.

39. The presence of oil shale at Baerami has been known for probably 40 years or more, and an assay of material from the locality was made by the New South Wales Mines Department in 1912. Leases were acquired in the same year and a certain amount of prospecting done. A little further prospecting was carried out between the years 1918 and 1931 by a Muswellbrook syndicate, and in the latter year prospecting activity was resumed and encouraged by a subsidy from the Committee for the Development of the Shale Oil Industry, and several tunnels were driven on the oil shale horizon. From 1932 to date further prospecting has been carried out, and at the present time oil shale is exposed in fourteen tunnels and a small tonnage of oil shale has been won and shipped to other centres.

40. In the course of his evidence the Managing Director, Standard Oil Company of Australia Limited, stated that while that company held leases at Baerami, it expended approximately £80,000 in exploring the possibilities of the field. It was ascertained by the Committee that the above company has since disposed of its leases to Shale and Oil Products Co-operative Limited under an agreement which enables the present holders to mine shale for their own use, and pay 2s. 6d. a ton royalty to the Standard Oil Company of Australia Limited. The agreement also gives the Standard Oil Company of Australia Limited the sole right to dispose of any quantity above that required for the corporation's own use, and to receive 1s. a ton selling commission therefor. The Managing Director of Standard Oil Company of Australia Limited stated that if Baerami were developed to a production of 30,000,000 gallons of petrol per annum, Standard Oil Company of Australia Limited would, in terms of its agreement with Shale and Oil Products Co-operative Limited, be entitled to receive a royalty of £100,000 a year.

41. Whilst the Government is not particularly interested in this arrangement between lessees when the amount of shale being mined is small, the Committee is of opinion that if the volume of work done is tremendously increased as proposed, and if, as the result of Government intervention, the offer of financial aid by remission of excise or the granting of a subsidy is contemplated, the whole question of royalties, including retort royalties, should be reviewed.

42. At the present time the existing holders are treating about 60 tons of shale a week. During its visit to Baerami the Committee saw the work being done; only the richest portion of the seam was being picked out by hand and the remainder discarded. It was stated that it was costing about £3 a ton to mine the shale and 13s. 6d. a ton to transport it to the retorts situated at Sandy Hollow, 26 miles from the mine. The shareholders purchased the shale blend products at 8s. a gallon and vaporizer spirit at 5s. 6d. a gallon. It was stated that the products have been selling at "somewhat less than cost".

43. Another firm which was producing petrol for its own use stated that it purchased Baerami shale at £2 3s. 6d. a ton at Sandy Hollow and paid an additional £1 a ton to get it to its retorts. Their cost of producing petrol worked out at approximately 16s. to 17s. a gallon.

#### OTHER DEPOSITS.

44. While investigating the Baerami proposal, the Committee seized the opportunity of also inquiring into the potentialities of other known oil shale deposits as a matter of comparison, and

with the idea of ascertaining whether such fields might offer advantages from the point of view of accessibility or facility in mining. A rich thick seam of shale that could be worked from an open cut, would offer immense advantages over a mining proposition.

Inquiries were specially made in respect of the Victorian brown coal deposits and the Latrobe tasmannite deposits. The occurrence of shale deposits in Queensland was also considered but in view of information received from the Department of Mines, Brisbane, the Committee decided that no useful purpose would be served by further investigating the Queensland deposits.

#### LATROBE.

45. The occurrence of shale in Tasmania has been known for upwards of 70 years and development work has been carried on in a desultory fashion at intervals. The major occurrences are in the Latrobe-Quamby Bluff region where there are thirteen areas in a tract of country 27 miles long by 7 miles wide. Although it is admitted that the Tasmanian shale—generally referred to as "tasmannite"—is of a lower grade than the Mainland shales, the fact that the Latrobe deposits are situated near each bank of the Mersey River ensuring a plentiful water supply, and that the port of Devonport is only 9 miles away, has fostered the hope that the lower return obtainable may be offset by accessibility, ease of mining and probable lower working costs.

46. The Committee visited Latrobe and viewed some of the adits about 2½ miles from the town, although no work has been done there for some considerable time. Evidence was taken at Latrobe and from the Director of Mines, Hobart, and the Committee had access to various reports made concerning the field from time to time.

47. It was indicated that the shale series is troubled by faulting and seam irregularities and it is possible its pebbly nature might create some difficulty in regard to mechanized mining.

48. In the area recently drilled at Latrobe, the seam section comprises three bands of oil shale of 8 inches, 18 to 25 inches, and 21 to 26 inches thickness, with two intervening bands of mud-stone each containing a low percentage of spores. It was stated that if the middle and bottom bands of shale were to be considered for selective mining, the drilled area offers a proved reserve of 395,000 tons, with an average content of 32.9 gallons of crude oil per ton. If whole seam mining were adopted the drilled area offers a reserve of 516,000 tons with an average oil content of approximately 26 gallons per ton, and this with an appreciable percentage of sulphur content. An extension of drilling would probably add to the potentialities of the district.

49. The Committee was informed that from the crude oil approximately 15 per cent. of petrol could be extracted—that is from 4 to 5 gallons of petrol per ton of shale. This compares with 37.4 gallons of petrol to the ton of shale won at Glen Davis, and to the estimate of 22.88 gallons of petrol to the ton of shale expected from Baerami.

50. For the purposes of the Committee's investigations, therefore, this ruled out all consideration of the Latrobe field as a possible source of petrol on a commercial scale.

51. It may be added that the tasmannite of the Latrobe field is probably the only straight asphaltene shale in the Commonwealth, and the residual from retorting this shale is bitumen, whereas the residual from Glen Davis shale, for instance, is wax. Although



present indications are that there is little chance of economically extracting fuel oil from *tasmanite*, there is a possibility that these shales may be utilized for their asphalt content. As to whether it is more costly to extract asphalt from shale than it is to produce oil, there are no established precedents, and a prospective industry would have to pass through an intermediate stage at some expense finally to determine economical and commercial possibilities.

#### VICTORIAN BROWN COAL.

52. There are no known deposits of shale in Victoria, but there are extensive beds of brown coal, and while in Melbourne the Committee endeavoured to ascertain whether any recent information was available as to the prospects of obtaining petrol from that source.

53. The quantity of brown coal known to exist in Victoria is enormous. From Melbourne and Altona Bay to Bacchus Marsh, over an area of about 40 miles long by 5 to 10 miles wide, there is a seam of brown coal from 50 to 100 feet thick, which is estimated to approximate 20,000,000,000 tons. At Yallourn over an area of some 5 to 6 square miles is a seam of an average thickness of 150 feet with 30 feet of overburden. The quantity there is estimated at 1,000,000,000 tons. In the neighbourhood of Morwell, there is one seam 150 feet in depth, and there are underlying seams up to 500 feet thick; some of them coming to within 50 feet of the surface. In that area there are about 10,000,000,000 tons.

54. In the neighbourhood of Traralgon an area of between 5 and 6 square miles has been proven, where the thickness of the seam varies from 200 to 700 feet; in the neighbourhood of Sale there is a seam of between 200 and 600 feet thick and at Gellindale there is a deposit of 2,000,000,000 tons—a lot of it within 30 feet of the surface and within 3 to 4 miles of the coast.

55. It has been stated that before the war, Germany extracted oil from brown coal on a commercial basis, but the Committee was informed that the Victorian brown coal is of a different composition to the German coal.

56. Laboratory tests made some time ago showed that by low temperature distillation at a temperature of 500 degrees Centigrade, from one ton of dried Victorian brown coal there could be produced 27 gallons of crude oil and from that crude oil about  $\frac{1}{2}$  gallon of petrol. It was added that the Victorian brown coal, as mined, is very moist, and it takes about 3 tons of mined coal to yield 1 ton of dried coal.

#### HYDROGENATION OF BROWN COAL.

57. The Committee was informed that in 1934 arrangements were made with the Department of Scientific and Industrial Research, London, to undertake an investigation into the hydrogenation of Victorian brown coal. The work was completed in 1938 at a total cost of approximately £10,000.

58. The main conclusions from the 1938 report with which we are concerned were—

- (i) Brown coal is more readily and completely converted into oil than British black coals tested at the Fuel Research Station;
- (ii) One ton of coal substance, i.e. coal free of all ash and moisture, will yield up to  $\frac{1}{2}$  ton of commercial quality motor spirit. The octane number of this spirit is 66;

(iii) Capital cost of hydrogenation plant to produce approximately 45,000,000 gallons of petrol per annum would be approximately £12,000,000;

(iv) Waste liquor from the liquid and vapour phases is too toxic to admit to any fresh-water stream. Treatment at considerable cost would be necessary; and

(v) Operating costs per gallon including interest on capital  $3\frac{1}{2}$  per cent., amortization fifteen years would be 14.4d.

59. The Committee was informed that it would take about 18 to 20 tons of our raw brown coal to make 1 ton of petrol. On the figures given by the Department of Scientific and Industrial Research, London, this suggests that it takes 9 to 10 tons of raw Victorian brown coal to make 1 ton of "coal substance." At Yallourn it costs the State Electricity Commission about 2s. a ton to put the coal into the power station or the briquette factory.

60. As the cost of production figures above quoted did not include excise, and imported petrol was at that time being landed at about 7d. a gallon, the production of petrol from brown coal was not considered a commercial proposition and no further action was taken.

61. If it be decided that from a national point of view, it is desirable to make Australia less dependent upon foreign sources for its petrol, however, and strict economies are ignored, it appears to the Committee from the statement made in paragraph 53 (v) above, that the hydrogenation of brown coal in Victoria offers an attractive proposition which might well reward further detailed investigation. As the Committee has been informed that there have been very great developments in the extraction of oil from brown coal in Germany, the Commonwealth in the post-war years should possess itself of all available information from that source before embarking on any similar project.

#### RETORTS.

62. Opportunity was taken by some witnesses to bring to the notice of the Committee the merits of various systems of retorting in which they were interested. Apparently the number of types of retorts that the inventors hoped was going to revolutionize the production of oil from shale is legion, but so far no such retort has actually come to light. Some of the retorts mentioned were only in the blue print stage, some of them had been subjected to laboratory tests, and some few had been producing in a commercial way but only in small quantities. The claims made in respect of these various retorts were sometimes extravagant and at other times fantastic. But there is a vast difference in the performance of a small retort in a laboratory and a full sized one under working conditions; if you increase the size of a retort you are then in effect dealing with a new retort altogether.

63. Retorts at present in use were inspected, and detailed statements of results obtained from them were collected, in order to observe their relative efficiency and the degree of success attained with them.

The Committee found great difficulty in satisfactorily comparing results given in evidence, owing to the conflicting nature of the details produced. Various retorts have been installed in the past and have been gradually evolved independently, by different companies, on lines which have no relation to one another, and with a lack of comparable standards and types.

As mentioned in paragraphs 42 and 43, one co-operative concern is producing shale blend products and vaporizer spirit, and selling them to the shareholders at 8s. and 5s. 6d. a gallon respectively and making a loss on the transaction.

Another firm, producing petrol for its own use, estimates the cost of production at 16s. to 17s. a gallon.

As a contrast, the Committee inspected works at Hamilton, near Newcastle, which are producing approximately 4,000 gallons of vaporizer spirit a month, and making a profit by disposing of it at 5s. 6d. a gallon.

It was stated in evidence that Glen Davis was producing approximately 2,500,000 gallons of petrol a year at a cost of about 3s. 6d. a gallon. On completion of the present construction programme, however, it is expected that from 1st January, 1946, they will be producing at the rate of 9,000,000 to 10,000,000 gallons of petrol a year with a manufacturing cost of 1s. a gallon.

The American Mission recommended the installation at Baerami of six 450-ton retorts of the Renco type of which Mr. Jacomini the head of the Mission was the inventor. A Renco retort capable of treating up to 75 tons of shale a day was demonstrated at Newcastle in December, 1939, and made a favorable impression. As far as the short test went it was completely satisfactory but experts stated that the test was not long enough to detect weaknesses in material or construction, and they did not regard the tests as being sufficiently complete to justify recommending its use. However, they were sufficiently favorably impressed to recommend that a plant be operated under working conditions for three months to obtain the experience they lacked. The Renco retort has not operated anywhere on a commercial scale, and as each retort was to cost £100,000, the 1943 Public Works Committee recommended that a pilot plant of the Renco type be installed at Glen Davis for trial under actual working conditions. It was ascertained that this retort has not yet been erected at Glen Davis so that the information desired in respect of it is not yet available.

64. In the light of the latest evidence obtained the Committee is still of opinion that the installation of the Renco retort offers the best promise of improved results in the future, and it is urged that the work of installing and operating that retort in a thorough test should be completed without further delay.

65. The Committee was informed that from the organic material in shale the percentage recovered in the form of crude oil by the best retorting process now used is not considered satisfactory. It is obvious, therefore, that there is much opportunity for improvement in the process. It has been suggested that that opportunity should be seized before the Baerami field is developed, and a number of witnesses recommended that it would be wise to refrain from any further large scale shale oil development until the problems have been satisfactorily solved at Glen Davis.

With this view the Committee agrees.

#### OIL FROM BLACK COAL.

66. During the course of the Committee's inquiries the opinion was expressed by some experts that the extraction of oil from coal offers very much better prospects for the development of a national industry in Australia than the production of oil from shale. The supply of coal is vastly greater, and it occurs in forms in which it can be more readily mined—particularly with machinery.

67. Shortly before the outbreak of war a consignment of 40 tons of New South Wales coal was taken to England and put through a number of tests on a fairly large scale. The results showed that the coal compared extraordinarily well with anything available in England. In fact, Greta coal can yield nearly 100 per cent. more tar (the intermediate process) than the usual English gas coal.

68. It was pointed out, also, that when oil is recovered from shale a useless material is left, but when oil is taken from coal, by some processes, there remains a material which is as valuable as the original coal. This is known as semi-coke, or low-temperature coke which is quite unlike the coke produced at gas works; it is a much more desirable material and in England fetches a higher price on the open market. The Committee, however, had no evidence to indicate whether this coke could be absorbed in Australia to the same extent as it is in England.

69. In addition a great number of valuable chemicals can be made from tar, but the processes are elaborate and costly, and need not be contemplated in the early stages.

70. There are several alternative processes for the extraction of oil from coal and before making a decision as to which should be adopted a considerable amount of research would be necessary; perhaps the best solution would be a combination of several processes.

71. It was pointed out to the Committee that if it be proposed to use the hydrogenation process, or the Fischer-Tropsch process, it does not matter much which type of coal is used, but with the carbonization process the best results from black coal are obtained from Greta coal.

72. The Committee was impressed by the information placed before it and recommends that from the point of view of national security, and as a major post-war project, the hydrogenation of black coal and the treatment of Victorian brown coal to produce fuel oil and petrol—and later, by-products—should be given immediate and earnest consideration.

#### DEVELOPMENT OF BAERAMI.

73. The question was discussed as to whether the potentialities of the Baerami field should be exploited by the Government or left to private enterprise. Figures submitted by the American Mission purported to show that with an annual production of 37,360,000 gallons of crude oil and the sale of 22,303,920 gallons of petrol per annum at 1s. 0½d. per gallon, together with other products, there would be a net annual realization, disregarding charges for interest, taxes, amortization and crown royalties, of £333,969 per annum. On these figures the life of the mine was placed at 13.9 years.

74. To embark upon what purports to be a national enterprise, at an initial cost of £2,914,000 and exhaust the resources of the mine in 13.9 years does not commend itself to the Committee. It is therefore recommended that the development of the oil shale deposits at Baerami on the lines set out by the American Mission be not adopted.

75. The Managing Director, Standard Oil Company of Australia Limited stated in his evidence that—

I believe it would be possible for private enterprise to develop Baerami without any Government assistance apart from the remission of excise duty . . . I would like to stipulate that the Government consent to 60 per cent. of the capital being American capital and 40 per cent. Australian capital.

76. Mr. A. J. Gibson, of the firm of Julius, Poole and Gibson, who are acting as consulting engineers for the Standard Oil Company of Australia Limited stated in evidence—

Private enterprise could develop the field without any Government subsidy, but the Government would have to give its blessing to the undertaking, that is, it must refrain from doing anything that would make it impossible for us to proceed.

and later added—

When I said that private enterprise could develop the field and would require only the blessing of the Government on the venture, I had in mind, of course, a rebate of excise duty.

77. The Committee is aware that on 18th September, 1937, the then Prime Minister informed the Standard Oil Company of Australia Limited—

... the Commonwealth Government is particularly anxious to see the shale oil industry developed as extensively as possible, but it is equally determined that in the public interest Government assistance, either through the medium of protection or in any other way, will not be given until the merits of the various propositions have been properly investigated.

78. The Commonwealth Standing Committee on Liquid Fuels in its report to the then Prime Minister on 14th April, 1939, mentioned the above letter, and stated it felt there was no reason to suggest any departure from that principle.

The Liquid Fuel Committee added—

It is obvious that the successful development of the shale oil industry is dependent upon Commonwealth Government assistance in some form or other. Your committee feels that when the success of the Newnes venture is satisfactorily established the Commonwealth Government and the Government of New South Wales might give very careful consideration to further development, so that the industry may be expanded on the most economical lines for the benefit of the nation.

79. Having duly considered all the aspects of the question, this Committee recommends that subject to any action taken under paragraph 41, if the development of Baerami be undertaken by private enterprise, the Commonwealth Government should give the company undertaking the work such assistance for a limited period, in the form of remission of excise and/or bounties on oil produced, as will enable the business to be conducted without loss in the developmental stage.

#### SUMMARY OF RECOMMENDATIONS.

80. Briefly summarized the recommendations of the Committee are as follow:—

- (1) That the proposal that the Commonwealth undertake the development of the oil-shale deposits at Baerami, on the lines set out by the American Mission at an initial cost of £2,914,000, be not adopted (paragraph 74).
- (2) That the work of installing and operating the pilot Renco retort at Glen Davis for trial under working conditions be completed without further delay (paragraph 64).
- (3) That any further large-scale shale oil development at Baerami be delayed until further experience is gained at Glen Davis (paragraph 65).
- (4) That if the development of the Baerami field be undertaken by private enterprise, the Commonwealth Government give the company undertaking the work such assistance for a limited period, in the form of remission of excise duty and/or bounties on oil produced, as will enable the business to be conducted without loss in the developmental stage (paragraph 79).
- (5) That the shale deposits at Latrobe offer no prospect of being exploited for the economic production of petrol (paragraph 50).
- (6) That the brown coal of Victoria offers no attraction for retorting to produce petrol, but might prove valuable for hydrogenation (paragraph 61).
- (7) That from the point of view of national security, and as a major post-war project, the hydrogenation of black coal and Victorian brown coal to produce fuel oil and petrol—and later, by-products—should be given immediate and earnest consideration (paragraph 72).

R. JAMES, Chairman.

Office of the Parliamentary Standing  
Committee on Public Works,  
Parliament House,  
Canberra, A.C.T.

24th January, 1945.

1946.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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PARLIAMENTARY STANDING COMMITTEE  
ON PUBLIC WORKS.

BAERAMI SHALE OIL PROPOSAL.

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MINUTES OF EVIDENCE.

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By Authority:  
L. F. JOHNSON, Commonwealth Government Printer, Canberra.  
(Printed in Australia.)

F.3805.

# MINUTES OF EVIDENCE.

(Taken at Sydney.)  
MONDAY, 5TH JUNE, 1944.

Present:

Mr. JAMES (Chairman).

Senator Aylett.	Mr. Harrison.
Senator Lamp.	Mr. Mulcahy.
Mr. Conelan.	Sir Frederick Stewart.

Athol Campbell Smith, Executive Officer, Minerals, Department of Supply and Shipping, sworn and examined.

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1. To Senator Lamp.—I am aware of the efforts of the Commonwealth Government to obtain oil in Australia, both flow oil and oil from shale. I have been associated with the Glen Davis enterprise since 1930, and am familiar with the efforts that have been made to develop the field. I also know of the efforts to develop the deposits at Baerami, the Lattrobe field in Tasmania, the Alpha field in Queensland, and also another field near Mackay, in Queensland. The Alpha field is situated some considerable distance inland from Rockhampton. The Commonwealth Government has a substantial financial interest in the Glen Davis enterprise, and present indications are that we shall not reach maximum plant output from that field until the middle of 1945 at the earliest. The maximum output will be from 9,000,000 to 10,000,000 gallons of petrol per year. Following upon the recommendations of this Committee, steps have been taken to test the Bence retort at Glen Davis, but it will be some time before actual tests take place. The retort is not working yet, and it will be some months before it is. One of the reasons for the delay is that the various parts are scattered all over the place. Another reason is that it is necessary to obtain materials for the construction of a working unit as distinct from a pilot unit. In addition to these considerations, there is, of course, the limited amount of labour available. The company has striven to gain maximum plant output rather than to complete the retort. It is expected that the first batch of retorts will be converted to the improved Fell type by the end of this year, and that they will then be able to produce at the rate of 4,000,000 gallons a year. The last batch will be completed, it is hoped, on the 30th June, 1945, by which time they will be in commission, together with all ancillary equipment. It is hoped that the problem arising from the blocking of the condensers will be overcome. I have visited the Baerami field. As far as I know, the only money that has been put into the field is about £5,000 by the Shale Oil Development Committee. This was in 1930, and was for the purpose of prospecting work. I think the money was made available to the Widdon Baerami Company before the Standard Oil Company of Australia was interested in the field. At that time, there were two companies concerned with the field, the Widdon Baerami Company and the Baerami South Company. They carried on prospecting in order to prove the quantities of shale present, but they did not at any time progress to the point where they could obtain plant in order to produce oil. Later, the Standard Oil Company of Australia Limited interested itself in the field. About 1937 it obtained leases from the two previous companies and endeavoured to float a company for development. It was not successful in this attempt, and no real development has ever occurred. We have received various reports on the field, but the one upon which we place most reliance is that by the senior Geological Surveyor of New South Wales, who estimates the quantity of

oil shale present in the field at 7,600,000 tons. The yield from this shale is about 58 gallons to the ton, so that there is a potential reservoir of oil in the field amounting to about 400,000,000 gallons.

2. To Mr. Harrison.—The figures I have cited represent the total proved and probable resources of the field. The deposits at Glen Davis have been assessed at about 20,000,000 tons, but the quantity actually proved is substantially less than that. The average yield from the Glen Davis field is stated to be 100 gallons per ton, although recently they have been mining stuff which has given a yield of only 80 to 90 gallons a ton. The seam at Glen Davis is from 4 feet to 4 ft. 6 in. of shale, whereas the combined seam of shale and cannel coal at Baerami is 3 ft. 4 in. So far as I know, there has been no development work undertaken at Baerami since the American Commission was here, although I believe that certain interests have been in touch with the Standard Oil Company of Australia Limited regarding leases. The Standard Oil Company of Australia Limited, of which Mr. Moate is chairman, holds leases at Baerami of an area approximating 17,000 acres. My department holds no views regarding the outcome of development of the Baerami field. We are awaiting the development of developmental work at Glen Davis before concerning ourselves with the development of other shale resources in Australia. If the Government should decide to proceed with the development of the Baerami field the executive staff at Glen Davis could probably be used for Baerami provided that the Glen Davis project had been brought into full production. I believe that if Baerami is to be developed it will have to be done by the Government. The experience at Glen Davis has been such that I have no reason to believe that private capital would be particularly interested in Baerami. Unless we can evolve a process of extraction which would be much cheaper than anything known at present it would not be possible to develop any shale oil proposition on a basis to compete with flow oil.

Consideration has been given to the production of bitumen. Tests have been carried out by the Mines Department of Tasmania at Lunenburg for the production of bitumen from the Lattrobe deposit, and I understand that the experiments were fairly successful in that the quality of the material was satisfactory, but the costs at that time were considerably in excess of the cost of imported bitumen.

Proposals submitted by the Standard Oil Company of Australia Limited for the development of Baerami were examined by the Standing Committee on Liquid Fuel, the members of which were as follows:—F. C. Holmes Hunt (chairman), E. A. Box, Keith Butler, Dr. B. W. Harman, Sir David Rivett, A. E. Dawkins, A. C. Smith and L. J. Rogers. The committee prepared a report which has not been published, and I have no authority to publish it, but if it would be of any assistance to the Public Works Committee I am prepared to make a copy of it available. The concluding paragraph of the report, which is dated 14th April, 1937, is as follows:—

It is obvious that the successful development of the shale oil industry is dependent upon Commonwealth Government assistance in some form or other. Your Committee feels that when the success of the Newnes venture is satisfactorily established the Commonwealth Government and the Government of New South Wales might give very careful consideration to further development so that the industry may be expanded on the most economical lines for the benefit of the nation.

Investigations have been conducted for many years for the purpose of discovering flow oil in Australia. It has been said that as much as \$4,000,000 has been expended in this way—not all of it government money—yet we do not seem to be much nearer the discovery of oil than when the investigations first commenced. In recent times the Shell Company of Australia Limited has been conducting investigations in Queensland, and has spent a large sum of money there. I understand that those concerned believe that there is some possibility of finding oil, but at present the company cannot get the plant necessary to test the structure. Our experience in Australia is that, unless something unexpected turns up, the oil industry in Australia must depend upon shale or coal or both.

Plant suitable for the production of oil from shale would not be suitable for the production of oil from coal, but plant designed for the production of oil from coal would, with a few adaptations, probably be suitable for extracting oil from shale. I am referring now to the hydrogenation process used for the extraction of oil from coal.

From time to time we read statements to the effect that the life of the known oil fields of the world is limited to a certain period, but then some new discovery is made, or a new expert opinion is pronounced, and our ideas have to be adjusted accordingly. While it is necessarily true that the life of oil fields must be limited, it is very difficult to determine just what the limit is. I agree that, when the limit is reached, the world must turn back to coal or shale as a source of supply if fuel is to be obtained for driving internal combustion engines. As a general policy I would recommend that we in Australia should concentrate first on the production of oil from shale, because that is the easier process, but we should at the same time make plans for the production of oil from coal. In preparing our plans, we should not, in my opinion, be governed wholly by economic factors as we think of them to-day. We place the known shale fields of Australia in the following order of importance—Glen Davis, Baerami, Alpha and Latrobe. We do not regard the deposits outside Mackay as extensive enough to justify rating them higher than fifth. The Latrobe shale is poor in quality, and has a high sulphur content. I recognize that it might be possible to produce bitumen from that shale more cheaply than has been done up to date.

I know the man Jacomini. I believe that he has a very good knowledge of oil shales and their treatment, but beyond setting up a pilot unit for exhibition purposes in Newcastle—and the exhibition was of short duration—he has never demonstrated to us that he has evolved a process in advance of what we already know. The exhibition was given with a much smaller retort than would be used for commercial production. I do not know anything about the Sandy Hollow proposition, but I cannot believe that they are operating a Reno retort there. So far as I know, no such retorts are working in Australia.

We are not satisfied with the progress made in the development of the Glen Davis project. For one thing, the amount of capital sunk in it is very many times what we thought would be necessary, and the delay in achieving the maximum plant output is far beyond anything we dreamed of. Of course, there are reasons for this delay. The competition for labour and material due to the war is one reason, and another is that the wrong kind of retort was used at the beginning.

We expected that the total amount of capital required would be £2064,000, but it now looks as if the amount will be about £4,000,000—and that is without altering the maximum output. Private enterprise has not taken any active part for some time in the development of Glen Davis. The enterprise is run by a government board, three members of which are nominated by the

Commonwealth Government and one by the State Government. We feel that we have on this board the best men we can get. If we felt that there was room for improvement we would make changes. Nevertheless, we are not satisfied with the situation, but that is not due to the administration; it is due to factors outside their control.

The report of the Standing Committee on Liquid Fuel contains an expression of opinion regarding the prestige, standing, &c., of the Standard Oil Company of Australia Limited. Mr. Monte, the moving spirit in the Standard Oil Company of Australia Limited, has been associated with three companies—the Adelaide Oil Exploration Company, the Chilian Oil Company, and the Standard Oil Company of Australia Limited. It is understood that these companies raised between them £700,000 of capital. I do not say this in disparagement, but they have not provided their investors with any return for their money. Of course, that may be due to factors outside their control.

Regarding the proposal to bring out from America machinery for the development of Baerami, we found that the facts had been misrepresented to us. We were asked to sponsor the importation of the plant. Originally it was thought that the plant was required by the Standard Oil Company of Australia Limited as such, but we learned later that it was proposed to form a new company, to be known as the Shale Fuel Company, that was to provide the Standard Oil Company of Australia Limited with the finance necessary to use the plant. Between them these two companies would, if we had gone ahead with the scheme, have reached an arrangement whereby they would infringe the rationing regulations as they then existed. I shall leave with the Committee a letter from Mr. Beasley setting out all the circumstances relating to that matter. The letter is not a public document. I have not prepared any general statement on the subject of shale oil development in Australia, but I shall, at the wish of the Committee, prepare such a document.

3. To Mr. Conelan.—The canal coal associated with the Baerami reef varies in thickness from 9 inches to 16 inches. I cannot say what the oil content of the canal coal is, but the content of the coal and shale together in the Baerami reef is about 58 gallons to the ton, as compared with 100 gallons to the ton at Glen Davis. It may be that, although the Baerami shale is so much poorer than that at Glen Davis it can still be worked at a comparable cost because of the experience gained at Glen Davis. No doubt people will say that we went about the Glen Davis undertaking in the wrong way, and that we made mistakes from which it will be possible to profit, and there may be some truth in that. I do not remember what the yield figures are for the Alpha field, but I have an idea that one parcel of shale was assayed at 120 gallons to the ton. A good deal of work still remains to be done to prove the field, but the opinion in the Mines Department is that the ore body is substantial.

In my opinion, the talk of sabotage in connexion with the search for flow oil in Queensland is all "hoop". I am sure the major oil companies would be keenly interested to discover oil in Australia, but naturally they would like to get in on the ground floor and deal with it themselves. The fact that the Shell Oil Company of Australia Limited has already spent £280,000 in Queensland is a fairly good indication of its sincerity. The representatives of the company have approached me in an attempt to obtain modern equipment, and I have pressed the American authorities for it. The Caltex Company went into the Kimberleys in Western Australia and spent £100,000 in the search for oil there. Operations were only suspended when the war broke out, and I believe that they will be resumed as soon as the war is over. I cannot say whether there would be

good prospects of discovering oil in Australia if the most modern equipment were available. Much money has already been spent on the search, but I do not think we have gone about it in the right way. I believe that we would do better to begin with the preparation of proper structural maps, and then obtain modern drilling equipment that would put down a bore 8,000 feet to 10,000 feet in a very short time. Great advances took place in America just before the war in the design of drilling equipment, but none of that equipment had been brought to Australia. The American authorities now refuse to allow it to be sent here, not because they are afraid that we might find oil, but because, as they say, the amount of equipment available is limited, and it is better to use it for the restoration of known fields in the Netherlands East Indies, for instance, than in experimental areas in Australia when it is not known whether oil is there or not. That was General MacArthur's answer to us when I put the matter to him.

4. To Sir Frederick Stewart.—The target output of Glen Davis is 10,000,000 gallons a year. This was the first objective, and the idea was that at the same time, a pilot Reno retort should be tried out. The ultimate objective was to treble production, bringing it up to 30,000,000 gallons a year. The present production of Glen Davis is only about 2,000,000 gallons a year as compared with Australia's requirements of 300,000,000 gallons. The Glen Davis product is put into the general petrol pool, and used in the same way as imported fuel. Very rich oil-bearing shale creates difficulties of extraction, which is why the Pumphreton retort was found unsuitable at Glen Davis. Australian shales are far richer than those in Scotland, the average yield of which is 25 gallons to the ton. The shale in Manchukuo is even poorer, while the Californian shales give a yield varying from 25 gallons to 35 gallons per ton. No definite figures have ever been prepared to show what proportion of our oil requirements could be supplied from shale if all our shale deposits were worked by their full extent. Of course, the proportion would be governed by the rate of use—in other words, how long you wanted the deposits to last. At one time the life of the Glen Davis deposits were estimated at 25 years if they were worked at the rate of 10,000,000 gallons a year, but the latest expert estimate is that the field could produce 30,000,000 gallons a year for at least fifteen years. The Baerami deposits are, so far as I know, somewhat less than those at Glen Davis. I recognize that, only when the technical difficulties associated with the production at Glen Davis are overcome, will the experience gained there be of much use in the exploitation of Baerami or any other field. We hope that Glen Davis will be in full production by the end of June next year, but it is my opinion that we still have a long way to go before we can evolve a really satisfactory retort—something that can mark a world advance in the treatment of shale. The Reno retort may be the answer to our quest, but we cannot yet say. I should say that the problems encountered at Glen Davis are more or less common to all shale fields, and if we can solve them at Glen Davis we should be able to solve them anywhere.

5. To Senator Aylett.—At Baerami the average thickness of the shale and canal coal combined is about 3 feet, and the average yield about 58 gallons to the ton. Therefore, in relation to output, production would be more costly than at Glen Davis. Sulphur can be eliminated from the oil, but so far as I know, no process has been evolved that is not expensive. Some bores have been put down in the Alpha field. I have not the figures with me, but I am under the impression that it is a fairly thick seam. Some of the shale has assayed 120 gallons to the ton.

When war broke out the Australian Petroleum Company was conducting investigations in New Guinea in search of flow oil. That company represents a fusion of the Vacuum Oil Company Limited, the Commonwealth Oil Refineries Limited, and "Oil Search". They had spent £300,000 in New Guinea up to the time of the Japanese invasion. Operations had to be suspended, and have not yet been resumed, but the Company is anxious to resume as soon as possible. Their actions confirm the impression that they are fairly optimistic of success. They are interested in New Guinea proper, as distinct from Papua. The Papuan Apunapi Company, which is an Australian concern, has been engaged in the search for oil in Papua. Our geologists have investigated the position, and reports are favorable.

The witness withdrew.

(Taken at Sydney.)

TUESDAY, 6th JUNE, 1944.

PRESENT:

MR. JAMES (CHAIRMAN).

Senator Aylett. Mr. Harrison.  
Senator Lamp. Mr. Harrison.  
Mr. Conelan. Mr. Mulcahy.  
Sir Frederick Stewart.

Alexander James Gibson and Joseph Lievesley Fry, of Julius, Poole and Gibson, consulting engineers, Sydney, sworn and examined.

6. To Senator Lamp.—Mr. Gibson.—I served my time as a marine engineer. I have done a certain amount of ship building, railway and tramway building; and three or four years after coming to this country from China I went to the University of Sydney as a lecturer in engineering design. From there I went to Queensland as Professor of Engineering. During the last war I was in charge of general munition work, being acting general manager of the Commonwealth Arsenal. At the end of the war I joined up with the Broken Hill Proprietary Company Limited, and was on a very large construction programme for them. Subsequently I entered into partnership with Julius & Poole, and I am still with them as a consulting engineer. I am aware that the Parliament has directed this Committee to investigate proposals to develop the oil shale deposits at Baerami. My firm has made some research into the potentialities of the Baerami field. I have visited Baerami. We made our investigations on behalf of the Standard Oil Company of Australia Limited. We were asked to report on the possibilities of the field for the purpose of producing oil on a commercial basis. I dare say that the United States Shale Oil Mission used a good deal of the technical data supplied by us. We reported to the Standard Oil Company of Australia Limited. Mr. Monte was managing director of that company at the time and those reports are his property. Our estimate of the yield at Baerami on what we have got through the retort we have tested is 57.4 gallons of crude oil per ton. We take it as it comes but it has to be picked. We have to get rid of a certain amount of dead material, but we utilize the retortable material in the seam. We do not confine the retorting material only to kerosene shale, but we use the whole of the retortable material in the seam. Unless that is done the proposition could not be made economical. To put the thing on a commercial basis you would have to mine somewhere about 4,000 tons a day five days a week. That is possible; and it must be done if you are to get the necessary blend. You cannot get it all from one mine. You have to open up the field from several directions; and our examination showed that the minimum number of mines that should be opened up to get the average of the field passing to the retorts should

be five. The Baerami field cannot be compared with Glen Davis from a mining point of view because the two seams are totally different. With respect to mining we base our estimate on our own figures which have been checked by mining engineers. The estimate is based on machine working on three shifts a day. Our estimate of the costs at which petrol could be produced from the field is approximately 1s. 0½d. per gallon. Those figures can be ascertained by the Committee from a report which we made when an application was made for permission to raise capital. That report was put in in the ordinary way, and showed the estimates of costs that we expected. The figures also appear in detail in a report that was made by Sir Ernest Fisk, who examined the whole proposition as put forward by us very fully. In fact, I think that Sir Ernest Fisk is the only man who has at any time examined this thing fully. I do not know what was contained in his report.

7. *To Mr. Mulcahy.*—Regardless of the class of plant used, we as engineers are familiar with the operations involved. All those estimates have been placed before Sir Ernest Fisk in support of our application for a permit to raise money.

8. *To Senator Lamp.*—In order to give a picture of this proposition I shall outline briefly our association with it. We were asked by the Standard Oil Company of Australia Limited to report to them on the Baerami oil field as covered by their leases. At that time they held certain leases, and they wanted to know what was the value of the shale in those leases, and whether they could be utilized commercially. That company had been engaged for some time in developing a retort. At all events it had financed the development of a retort, and we were asked by that company to report also on that retort. In the film which you saw this morning you saw how we proved the field. I suppose at Baerami we have done the most thorough proving that has been done in any field in Australia. Our methods were much more thorough than those employed at Glen Davis. However, I repeat that you cannot use Glen Davis as a yardstick at all in this matter.

9. *To Mr. Harrison.*—You say that the Committee has had evidence that Glen Davis might subsequently be used as a yardstick in respect of the development of all shale oil fields. It is quite wrong to do so, both from the mining end and from the point of view of handling. We were also asked to report on the retort that had been developed by Mr. Jacomini, an American. We had all particulars of that retort given to us together with certain data on tests that had been carried out in America on the Renco retort; and the one that had been tested had a capacity of about 15 tons a day. It was a baby. We saw designs of that and the patent specification, and we were satisfied that the principles involved were sound. However, we were not satisfied with the figures that were claimed in respect of the retorting of certain shale sent from Australia to America and put through that retort. By that time we had analysed the field, and we knew what we could expect to get from the field. We knew for instance that the average figure for the field in a commercial retort working to an efficiency of somewhere about 90 per cent. would give 57.1 or 57.4 gallons to the ton of retortable material put through the retort. The figures that were given to us showed that 70 gallons to the ton had been gained. I did not doubt that for a minute, because it could have been obtained from certain sections of the seam. You have to remember that the kerosene shale on the Baerami field analyses 120 gallons to the ton. If the bulk of that went through the retort, 70 would be a low figure; and if the canal coal associated with it went through the retort 70 to 80 might have been a fair figure; but we could not certify that as representative of what could be obtained from the field by

using that retort. We made an estimate at that time on our knowledge of the retort in which we considered it would be possible through that retort from the average of the field to get 57 gallons to the ton of commercial oil. We could not say anything about the American figures. We therefore prevailed upon the managing director of the Australian Standard Oil Company of Australia Limited, either to have further tests carried out in America on material selected by us, and certified to by us, or to put up a retort in Australia which could be tested under our supervision. In what we appreciate the care we had to exercise in a case like that, because our reputation and our name goes forward with the retort and the result. It was decided to do that, and Mr. Jacomini came out bringing certain portions of the retort with him; but the bulk of the retort was made in Australia and the whole of it was made, put together and tested within three months. It was erected in Newcastle, and for the purposes of the test we obtained 150 tons of blended material from Baerami. In the film you witnessed this morning you saw the way in which that material was blended. Actually we obtained a total of 200 tons at that time because a certain quantity was required to work the retort in to ascertain the best method of operating before we started on the test. That material was delivered at Newcastle and checked for loss of fines, and was put through the retort. The retort was operated by Mr. Jacomini who was the designer and inventor. He was responsible for the working of the retort. We supervised the work, and we had nine assistants on the job. The retort ran for 72 hours to put through the 150 tons, and we varied the rates in order that we might obtain the point at which the retort was most efficient. We found that we could run the retort at from 75 to 80 tons a day. We also ran it as low as just over 40 tons a day, and at intermediate rates. The result of the test showed that the most economical and most efficient rate of running of the retort was at 50 tons a day. The yield from that 150 tons of the average of the field blended according to a very careful programme so as to be proved truly representative of the average of the field was 57.4 gallons to the ton. Full particulars were taken with regard to the shale and the oil, and all those figures are available in the report which we submitted to the Standard Oil Company of Australia Limited. There has been considerable criticism of that report chiefly by uninformed persons. Very few people saw the retorting operation, although some of those who criticized it have seen it in operation. The main criticism has been that the test was not sufficiently long to ascertain what the retort would do. The test was sufficiently long to enable us to say what the retort could do. We, as engineers, are used to testing, and we take boilers, furnaces and many other heating apparatus on tests of from six to eight hours. In this case the operation lasted 72 hours and at different periods we measured the varying conditions, temperatures and pressures. This retort is the most efficient that I have come across up to date. We can get an efficiency of 94 per cent. by running the retort at 50 tons a day; that is, the return is 94 per cent. of the oil that is in the shale by analysis. The outstanding characteristic of the retort is that the shale is retorted under high pressures, whereas most retorts are worked under practically atmospheric conditions. The retort works under a pressure of 250 lb. to the square inch, so that the hot gases that are supplied for distillation of the shale exerts sixteen times the amount of heat per cubic foot that there would be in the gases at atmospheric pressure. You can also imagine that those gases are moving at a velocity very much greater under this pressure than they are under atmospheric pressure, and consequently the bombardment of the shale particles in the retort is very much increased; penetration is quicker and distillation takes place very much quicker.

That is the basic reason for the high efficiency of this retort. Those are sound physical reasons. It has also been stated that this retort was not worked on a commercial scale. But this retort gave an output ten times greater than the output of the retorts at present used at Glen Davis.

10. *To Mr. Harrison.*—The Glen Davis retorts put through about 5 tons a day, whereas this retort at its maximum efficiency rate puts through 50 tons a day, although it can put through 75 tons. Therefore it is quite idle to say that this is not a commercial unit. Any single unit which will give as much as the present commercial units becomes a commercial unit. Therefore this retort is on a commercial scale. If necessary we could group a certain number of units of this size to obtain a larger output; but I would not do that. That retort can be increased considerably, and it could quite easily be brought up to an output of 300 to 350 tons a day. The only limit in that respect would be the size of the steel plates one would be able to obtain in Australia, if one wanted to build it in Australia at that time. I have heard it said that it would be a bold man who on the knowledge of that retort would increase its capacity to 350 tons. That statement is sheer nonsense. There would be nothing bold about that.

11. *To the Chairman.*—I am satisfied that the tests from the pilot plant at Newcastle are sufficient to indicate the possibility of taking from 300 to 350 tons. In some cases the results obtained in tests on small plants are not borne out proportionately on larger plants. However this is a matter of engineering knowledge and judgment. At Marangaroo, for instance, there is a Batch retort from 10 feet to 11 feet in diameter. It gets through 85 tons a day. That is working under atmospheric conditions, but the heat can be sent through that body of shale, and it is much easier to send it through when you have the shale under a pressure of 250 lb. to the square inch. Let us take gas producers, for instance, using bituminous fuel. Diameters up to 8 feet or 9 feet are common. By proper mechanical arrangement, and by proper holding of the temperatures and gases, there is nothing to prevent them being used satisfactorily so you get the gas at one end and the gases at the other. So, from the point of view of making sure you can penetrate the bigger volume of shale in the retort, it is quite certain that under pressure and control conditions, you can go up to a very much bigger diameter than I have mentioned. The increase in the size of the retort proper which is 3 feet at the bottom of the chamber, in order to step it up from 50 tons a day to 350 tons a day would be from 3 ft. 6 in.—the outside dimension of the retort—to 7 feet. That means that the internal column could be increased to 6 ft. 3 in. or 6 ft. 6 in. That is not a very large chamber, and you can imagine the shale going through it at a pressure of 250 lb. It is quite easy to push through the material under those conditions and make sure that the whole material is heated by the gases. Therefore, I have no doubt that larger sizes can be obtained, and I am of opinion that eight of these retorts with a capacity of 350 tons a day each could be erected at Baerami.

12. *To Mr. Mulcahy.*—The Renco retort being erected at Glen Davis is the identical plant, but personally I would not have done what has been done there. That retort was put up to prove certain things. If we were designing a retort for commercial purposes several alterations would have to be made, but for test purposes the retort provided was sufficient in itself. It was required to work only for a certain number of hours. Indeed, had it been worked continuously it would not have lasted more than five or six months. The point is that the retort was constructed purely for test purposes, but the new Renco can be made a perfectly efficient machine for commercial purposes. I

said that there might have been a difficulty at that time in obtaining the necessary steel plate in one wrap of 33 feet, 1½ inch thick. Probably we could not get that plate in Australia to-day; but I would make the retort a little smaller and use more of them. However, I think we could get plates now 1½ inch thick in two wraps. Our estimate of the cost of production at 1s. 0½d. per gallon of petrol would depend on the efficiency of the retort. However, that estimate would depend on the efficiency of the whole series of operation—mining, handling, retorting, transporting and refining. Details of those costs are available in the report to which I have referred.

13. *To the Chairman.*—I think that had Glen Davis stuck to the Pumpherson retort as it was when Fell left it, they would probably have got a reasonable return, but something was done which reduced its efficiency. I could not say whether that loss of efficiency was due to the change from three or four off-takes to one off-take. I could not say whether the provision of more off-takes was an improvement or not. It would depend on where your gases are forming and at what temperatures they are forming. From what I have seen of the shale after treatment at Newnes and Glen Davis, I think that there is still quite a considerable amount of oil left, but I have not seen any analyses in that respect.

14. *To Mr. Harrison.*—I know something about the search for flow oil in Australia. I have been associated with Oil Search Limited for the last twelve years. That company has spent a considerable amount of money. It has had the best advice obtainable. It found traces and gases, but so far we have not found any commercial quantities of oil. I still think that it is possible to find flow oil in Australia in commercial quantities, but that is purely an opinion. However we have met with more satisfactory results in our search for oil in New Guinea and Papua. The company did a considerable amount of work in those territories, at considerable expense. Financially, it recouped itself to a degree when it joined another company which had sufficient finance to go ahead and develop resources in Papua. I believe that we should go ahead with the development of shale oil in Australia regardless of the possibility of flow oil being discovered. Flow oil does not enter into the matter. The fact remains that oil is contained in the shale, and it could be obtained at a rate under our conditions, given reasonable freedom from exorbitant duty, and sold at a reasonable rate. The octane rating is purely a matter of refining. So far as the life of shale oil fields are concerned I can speak only of Baerami. I know Glen Davis to a certain degree, having been associated with a committee which recommended certain proposals to the Government in respect of Glen Davis. There are other fields, but they have not been prospected. In fact, Glen Davis has not been prospected with the thoroughness with which we have prospected Baerami. There are fields which could be drawn on by a central retorting plant in the Baerami area, sufficiently close to warrant transport for treatment of the shale obtained; but it might be better to put up a retort in each place and transport the gathered oil. I am unable to give an estimate of the total quantity of shale oil available in New South Wales. Some of the shale at Baerami is of considerable depth. Indeed, the figures for Baerami are surprising. We examined the leases held by the Standard Oil Company of Australia Limited. Giving evidence yesterday, Mr. A. C. Smith said that there were 7,000,000 tons of kerosene shale at Baerami which could be reckoned to give a return of 58 gallons to the ton. That figure of 7,000,000 tons for the field is wrong. In the five leases marked on this plan there are 12,000,000 tons of retortable shale. We have not done any boring to determine the depth of the shale; but we figured ourselves what would be in the

field as disclosed by the prospecting tunnels. At the time we were dealing with this matter the estimates of shale given in respect of Baerami in published reports were very low; and we did not accept them. To check our figures we got Professor Cotton, a geologist, to go over the field and report to us on the field so far as he could see it. He had the benefit of all the tunnels we had driven, and he himself went round the area. In addition to the tunnels that are on our own lease other tunnels have been opened up on other leases. For instance there is one at Jaegers and another at Widdin Brook.

15. *To the Chairman.*—Some of those tunnels are driven in about 150 feet or more. The grade from the outcrop is slightly dipping in. The coverage from the seam to the surface would be probably from 800 feet to 900 feet. It would not be possible to work as an open cut. Therefore we have a considerable extension of the shale over these leases. We have contoured the thickness of the shales that are met with at various parts of the field. This has been done in accordance with the check made by Professor Cotton. The Widdin seam is still 10 inches to 12 inches thick, and undoubtedly there is shale out beyond that area, but it is less than 10 inches thick. We have not considered in our estimates any shale less than 10 inches thick. There is the keroseene shale. At 10 in. thickness we still get a face carrying retortable material of 8 ft. 10½ in.

16. *Mr. Fry.*—The retortable seams vary from 3 ft. 6 in. to 7 feet.

17. *To Senator Lamp.*—You say that Mr. Smith said it was 3 feet. The average working face over the whole field is 4 ft. 10 in. The height varies from 3 ft. 6 in. to 4 feet.

18. *To the Chairman.*—*Mr. Gibson.*—That includes canal coals. Those are necessary to make the field an economical field. I cannot stress too strongly the wickedness of picking the eyes out of the seam and putting that material through retorts which are not capable of getting more than 50 per cent. of the oil out of the shale. I gave 13,000,000 tons as being in those leases; but taking the whole area up to 10 inches there is at least 20,000,000 tons of retortable shale available; and outside those limits there is shale which could be used which would extend that probable tonnage beyond 20,000,000. Therefore I find it hard to understand the figure of 7,000,000 tons cited to the Committee yesterday. Our figures are based on Professor Cotton's check, and those figures are available to the Committee.

19. *To Mr. Harrison.*—As to how these figures compare with Glen Davis, I can only say that when the Newnes Investigation Committee was sitting it naturally wanted to know what was ahead in the way of reserves of shale, and we could only see an amount of 3,000,000 in sight. We endeavoured to put down borings, but the cover on the cliff is so great that we were unsuccessful in trying to put a bore through the loose material. Consequently we could not prove anything more than what we saw. But taking what was known with regard to the thickness of the seam on the Newnes side and at Glen Davis, and assuming there was continuity, which I think exists, it looks as though there might be a maximum of 20,000,000 tons. However that is pure supposition. I have no picture with respect to Glen Davis; but I have a picture with respect to Baerami which enables me to speak with confidence about Baerami. I could not say definitely whether a retort used for the extraction of oil from shale could be adapted for the extraction of oil from coal. However, I am strongly of the opinion that it would be possible to use certain grades of coal through the Reneo retort. Except that one naturally wants to play perfectly safe in a matter of this kind we might

have considered the possibility of putting in bituminous coal as part of the retortable material. It is possible that with respect to certain coals the same method of retorting might be found feasible.

20. *To the Chairman.*—I have never heard of a test of the canal coal at Abermain No. 2 and Richmond Main as compared with the canal coal at Baerami. The canal coals at Baerami are readily retortable but they give a very much lower yield.

21. *Mr. Fry.*—These are our figures as proved—upper canal coal, 26.65 gallons to the ton; intermediate canal coal, 29.49 gallons to the ton; keroseene shale, 119.38 gallons to the ton; and lower canal coal, 21.82 gallons to the ton. Those are the figures for Baerami.

22. *To Senator Lamp.*—*Mr. Gibson.*—In between those seams there is sandstone, but that sandstone is not a nuisance. It can be picked out, or be put through the retort. The loss that occurs there would be due to the specific heat of the sandstone. It will bring down your average slightly, but that might be offset by the simplicity of your mining.

23. *To the Chairman.*—That sandstone is free. When it is shot down it separates.

24. *Mr. Fry.*—The sandstone does not occur between every seam. Two seams have no parting at all, namely, the intermediate and the keroseene shale, which adhere. There is a small sandstone seam between the intermediate and the upper canal coal of about 1½ inches, and between the upper canal coal and the roof there is about 5 inches of sandstone. The top 5 inches can be left out; so the only sandstone you have to deal with through the whole seam is 1½ inches in thickness.

25. *Mr. Gibson.*—We can put that through the retort.

26. *Mr. Fry.*—Really, the only place in which the sandstone occurs is between the intermediate and upper canal coal, and it is only 1½ inches thick.

27. *Mr. Gibson.*—The members of the Committee would be able to inspect the tunnels. There are about thirteen of them. I think that only one of them is being operated now.

28. *To Mr. Harrison.*—Provided the Government gave a permit to raise the necessary money private enterprise could develop the Baerami field. We were given a permit to raise £2,500,000. At first it was suggested that things might be made easier if we considered taking only a portion of that and instead of developing the field as we wanted to on the basis of producing 30,000,000 gallons of petrol a year we should produce only 10,000,000 gallons a year. I had to reject that proposition, because it would not be possible to make an economical proposition on an output of 10,000,000 gallons of petrol a year. The official letter covering that proposal and the reasons for our rejection of the proposal should be obtainable from Sir Ernest Fisk. Private enterprise could develop the field without any government subsidy, but the Government would have to give its blessing to the undertaking, that is, it must refrain from doing anything that would make it impossible for us to proceed. As I said earlier, we obtained a permit to raise £2,500,000, but that permit was accompanied by impossible conditions. First of all there was a condition which made it impossible to raise the money, and secondly, a condition which would have made it impossible to get the job completed in the time. Our permit was to last for two years, and we had to raise the capital within a matter of four months. We could have completed the job in two years. As engineers we could have completed the job in that period, and have got the machinery from either America or England if necessary; but the

conditions of the permit were such that we would not have had any hope of putting the proposition through. One condition was that we could not incur on any item an expenditure of more than £10,000 without obtaining permission from somebody for that expenditure.

29. *To Senator Lamp.*—That was about three years ago. These tests were carried out and all the information was before the Government in 1940, just after the war broke out.

30. *To Mr. Harrison.*—I have no evidence that the influence of major oil companies may have affected the development of the shale oil deposits; but I can think a lot on that point. I would not like to express any opinion on that aspect. However I might say that I was anxious to help this company all I could. This is not my business. As a consulting engineer I do not interest myself in companies; but here was something which I considered should be regarded as a national venture. I was convinced that we had a good thing from a national point of view. The return promised, assuming everything to be reasonable, was between 8 per cent. and 10 per cent. on the capital. That was not a very big return for a venture of this kind. The life of the field was estimated at 25 years on an output of 30,000,000 gallons of petrol a year. It was not a very enticing venture to put to the public. I interviewed one big financial concern who told me that it was not particularly interested in such a venture unless it looked like something of the order of 30 per cent., and in any case that concern asked why should it worry when in due course the leases would fall in and it could pick them up when it wanted them. That is the kind of thing that goes on in matters of this kind.

31. *To Mr. Mulcahy.*—We estimate that sufficient water will be available for our requirements at the rate of about 1,250,000 gallons a day. Water for domestic purposes can be obtained in the sands in the Baerami Valley leading down toward the river. By boring a considerable quantity of water can be got from there, but that would require some underground works to build the water up in the sands. At Blackwater Creek, an offshoot of Widdin Creek, about 5 miles from where the operations would take place in the Baerami Valley, there are good sites for dams, and we could get sufficient supplies there for the purposes of the field, and domestic purposes. The water would have to be pumped over the ridge to a head of 700 feet or 800 feet. That has been taken into account. The cost of obtaining that water is part and parcel of the estimates. Normally, two years would have been sufficient to get together a plant. We actually had an offer from England for the supply of refining plant at £700,000; that is, erected. This scheme was to be carried through from the mining until the petrol was with the seller; all those figures can be obtained from Sir Ernest Fisk. He was the only person who examined the proposition fully and checked our estimates both from the point of view of commercial production and construction.

32. *To Sir Frederick Stewart.*—Our present estimate of retortable material on the field is about 20,000,000 tons. An economic turnover would be approximately 4,000 barrels a day. That would presume a life of 25 years. We would put in eight retorts with a capacity of 350 tons each. One of those would always be a spare. We would be mining five days, but retorting seven days a week. The capital cost of the retorts and other equipment would have to be practically written off in fifteen years. In our estimate of operating costs certain items of plant were replaced twice; that is, we considered that during the life of the field those items would be worn out twice. All of those items of costs are included in our estimate of production at 1s. 0½d. a gallon of petrol. When I said that private enterprise

could develop the field and would require only the blessing of the Government on the venture, I had in mind, of course, a rebate of excise duty. The excise rebate was 5½d. a gallon. As you say, I have indicated that it is wickered to contemplate picking the eyes out of the field, that is, retorting the shale and leaving the canal coal. It would be wickered to do so for economic reasons. Supposing we have on the field a total of 7,000,000 tons of keroseene shale. I would then expect to get from the retort over 100 gallons to the ton; but my mining costs would blow the thing up. The canal coal has no commercial value as coal, but it has value as a retortable material. To really pick the eyes out of the seam and leave the rest is, from a national point of view, a crime; because there is a material that can give us oil and give it on an economic basis if it is mined properly. The canal coal in this seam has as good a value as Scotch shale which returns from 29 to 30 gallons to the ton. The set-up as we envisage it is this: we would mine and retort the shale at Baerami. That is, we would produce crude oil at Baerami, and the tankage for the crude oil would be arranged there so as to supply a refinery situated at Newcastle which would have a throughput of 4,000 barrels a day. Your refinery must work continuously and to capacity. Therefore everything at the back of it would have to be arranged so that it is both mined and retorted to keep a continuous supply to the refinery. That means you might mine five days and you would have to retort seven days, because you have to keep a hot thing like this going continuously. And you would have to have tankage to see you over any breaks in production. Distribution of units would be one advantage in separating the ultimate refining from the original mining site. Newcastle is a good centre. It has plenty of water, and you need plenty of water for refining. Whilst we have enough water at Baerami for retorting we would not have sufficient there possibly for both retorting and refining. In any case, you have to transport either your crude oil or petrol, and I think it is better to transport the crude oil. As you say, all of the constituents of crude oil are ultimately realizable. You would not be carting any waste material.

33. *To Mr. Mulcahy.*—I have no knowledge of any company that was operating at Murrurundi. At present there are several shows producing crude oil and distillate. One or two of them have done very well, for instance at Marangaroo where they have a Batch retort. They are supplying crude oil to Glen Davis, and I think that Glen Davis would be in a bit of a hole at present if they were not getting that oil from Marangaroo.

34. *To Senator Aylett.*—With regard to timber requirements a good deal would depend on the method of mining. Two propositions have been made, first the pillar and bord method; and secondly, the long wall. I favour the latter method, but in any case considerable timber would be required. Sufficient timber is available in the district for this purpose.

35. *To the Chairman.*—*Mr. Fry.*—*Mr. Gibson* gave 57.4 gallons as the yield. That was the yield from the test which unfortunately could not take into account light ends. That is the unstable part of the gases which could not be held. A sample of that was sent to America and tested, which brings the total yield up to between 58 and 59 gallons a ton. So, operating at a rate of 50 tons a day it can be assumed that you get somewhere between 58 and 59 gallons a ton from the average shale on the field. The only other point I wish to refer to is the yield values of the various shales. Those yields given were for average conditions over the field, that is the average for the whole of the shale in the deposits we tested. In many cases, particularly with regard to intermediate canal coal, we had analyses which showed as high as 37 and in one



case 43; so the figures given do not represent the maximum yield that can be obtained from the canal coal or the kerosene shale. In some cases the kerosene shale went up to 184 gallons a ton.

36. *Mr. Gibson.*—I have not been in the Newnes mine. The lower cost of a more economically mined shale would compensate for the lesser oil content. We have had our estimates on that point checked by mining people. You will notice that the seam at Baerami is easily workable. Our original estimate for mining at Baerami was 14s, but the estimate of the mining man who reported on this matter to the company was 8s. 6d., and another estimate was 11s. 6d. After reading various reports we came to the conclusion that we could adopt the figure of 11s. 6d., bearing in mind that the cost would tend to increase slightly as we came to the narrower portion of the field; but it would still be within the margin of 14s. That is landed on the surface. Mr. Robertson was the mining engineer who reported to the company on that cost.

37. *To Mr. Harrison.*—I do not think that Baerami would benefit in the slightest degree by the experience gained at Glen Davis. Glen Davis is put up as a yardstick by people who do not know Baerami, or who do not want to see it go ahead. There is no comparison between the two fields from that point of view. At Glen Davis you have a seam of kerosene shale of 4 feet which tapers out to 17 inches on the Newnes side. The mining there is between two hard surfaces, and there is an ironstone band on the top. Therefore in order to mine that the seam has had to be cut in the middle. That would be 4 inches to 5 inches wide and that is lost. That is a very big percentage of the seam. You do not get that at Baerami. The amount of dust or smalls that are raised in Glen Davis are altogether out of proportion to the width of the seam. The last time I was there I saw a heap of fines which would be about 25,000 tons, and all that was perfectly good shale, but it was wasted because it could not go through the retorts. We estimate that the fines at Baerami could be kept down to 3 per cent. between the mine and the retort. Our total loss in transporting the material to Newcastle despite all the handling involved was not more than 9 per cent. It must be borne in mind that in taking figures for the return for a field you do not want to take only the figure of the return from the shale retorted. The economic figure is the return from the shale mined. That has been our basis all the time. It is the mining end that either makes or mars your proposition. Once you have got over your retorting there is nothing in the rest of the proposition which is not standard practice. At Baerami the mining is straight forward and the retorting is straight forward, and our experience so far as retorting is concerned is such as to give us every confidence. You ask why Glen Davis has not proved the success it should have proved. To put it bluntly I think that the failure at Glen Davis was due to the fact that a man took on a job he did not understand, and he would not listen to those who could have advised him. As you say, the Government sunk a large sum of money into that proposition, although the control was inefficient. However, I point out that the Newnes Investigation Committee made a recommendation to the Government involving an expenditure of £750,000 but that recommendation was not followed. I refer to the Newnes Investigation Committee which sat in 1934.

38. *To Sir Frederick Stewart.*—Glen Davis was financed along the lines recommended in that report, but the Government did not adopt the Committee's other recommendations. For instance, we would not have disturbed the existing bank of retorts. They could have been improved slightly perhaps by the provision of special steel linings; but when operated

under Fell they had given an efficiency of 89 per cent. They were workable retorts and they could have been left there and the material could have been shifted over the hill either by roadway or by tunnel. And the whole scheme was worked out on the basis that Newnes would be left as it was and the railway rejuvenated.

39. *To Mr. Harrison.*—You ask me why if Fell worked efficiently he made no progress. I point out that Newnes was set up in the first place for the production of kerosene, and at that time it was over capitalized even for kerosene. It produced a certain quantity of wax. But it was not set up to produce petrol, and consequently when kerosene went out and petrol came in the whole machinery was practically useless for the purposes of modern development. But the retort section, by and large, was worked very satisfactorily under Fell.

40. *To the Chairman.*—We do not anticipate any difficulty in obtaining sufficient water supplies for human consumption and plant purposes at Baerami. I think that we allowed £150,000 for the provision of water supplies in our estimate.

*The witnesses withdrew.*

Athol Campbell Smith, Executive Officer, Minerals, Department of Supply and Shipping, recalled and further examined.

41. *To the Chairman.*—The hydrogenation plant for the treatment of coal could also be applied with minor adaptations for the treatment of shale. By using the hydrogenation plant for the manufacture of petrol from shale you would produce an aviation spirit as distinct from the petrol now produced. We took an average height of 3 ft. 1 in. overall as the height of the seam at Baerami. As to the strata above I can only speak from what I have seen myself, and that has not been in recent times. They had done only a certain amount of driving there when I was there last, and it looked to me to be a good roof. It would not require a great deal of timber, but Mr. Kenny would be able to answer that question more accurately.

42. *To Senator Lamp.*—You say that Mr. Gibson said that there was a seam of 4 ft. 8 in. of minable and usable shale, whereas yesterday I gave the figure of 3 ft. 1 in. I am taking the official figures supplied by the senior officer of the Geological Survey. I do not think that I can place reliance on any other figures. All of the figures which I quoted yesterday were supplied by the Mines Department. They may be conservative, but my experience is that with mining it is wise to be conservative because as you go on you find faults and the seam narrows.

43. *To Mr. Conelan.*—It is several years since I last visited Baerami. I visited Glen Davis about twelve months ago.

44. *To Senator Lamp.*—Most of the experimental plant erected at Newnes by John Fell has been transferred to Glen Davis. Very little of it still remains at Newnes. The last time I saw Newnes it had been practically denuded of plant. You say that there is a caretaker still employed at Newnes and you want to know who pays him. I shall make inquiries on that point. I shall not have any views as to the merits of the Renco and Pumpherton retorts until we have had some experience of the operation of this pilot plant at Glen Davis. Nobody has had sufficient experience in this country to be able to say whether the retort will be a success or not. They still have some months to go before they will have the pilot unit in operation, and producing as a unit of the plant that is there. They are still assembling it. They claim they have been held up for want of man-power and material, and have been concentrating all their available man-power

on the conversion of the other retorts in order to eliminate the very substantial loss we are now suffering at Glen Davis as quickly as possible. The conversion being made involves a provision of more offtakes instead of the central offtake which the Davis interests introduced when they were running the show. They are really getting back to where old John Fell was with multiple offtakes plus very extensive condensing plant to deal with the gases, and ancillary equipment. Fell obtained greater returns from shale than are being obtained at present. I cannot say what the difference is, but I think it springs mainly from the fact that Fell got more continuous running with his multiple offtakes, and not so much clogging of the retort as is the case with a single offtake. They have put in more joy loaders underground. The reason for the loss at Glen Davis is that they are not producing petrol to plant capacity, and therefore their revenue legs far behind their working cost, somewhere to the extent of about £170,000. But as they increase their output of petrol and get more revenue they will reduce that leg.

45. *To Sir Frederick Stewart.*—Glen Davis has been under control of Government nominees for a little over two years.

46. *To Senator Aylett.*—They are not working to capacity at Glen Davis because the retorts are not satisfactory.

47. *To the Chairman.*—I did not know that they were not making full use of the technical staff at the cracking plant. However, the managing director of National Oil Proprietary Limited, who, I understand, will be giving evidence before the Committee, can give full information on that point.

48. *To Senator Lamp.*—It is expected that half of the retorts will be converted by the end of the year.

*The witness withdrew.*

Edward Joseph Kenny, Senior Geological Surveyor, Department of Mines, New South Wales; and Charles St. John Mulholland, Geological Surveyor, Department of Mines, New South Wales, sworn and examined.

49. *To the Chairman.*—Mr. Kenny—I am aware that the Public Works Committee is examining proposals for developing the shale oil deposits at Baerami. In association with a former officer of the department, Mr. Morrison, I investigated the field in 1932. In the light of further information which had been obtained, the field was again investigated in 1938, and in 1942 Mr. Mulholland made another survey in the light of all the information then available. Mr. Mulholland will present to the Committee a copy of his report.

50. *Mr. Mulholland.*—The average thickness of the composite seam at Baerami is 2 ft. 8 in., and the thickness varies from 10½ inches up to 3 ft. 9 in. There is a fairly solid sandstone roof, under which there is a layer of coal varying from 1 foot to 1 ft. 6 in. in thickness, with some shale bands in it. Then we come to the composite seam of canal coal and oil shale. There is about 1 foot of coal and 6 inches of shale. Sometimes the shale splits the coal. I am inclined to think that the overlying stratum will come away with the shale, particularly if there was a wide bord. I cannot say whether the cost of timbering would be very much if it were decided to support this top layer; it would depend on the method of mining employed. From an average of tests made by the department in various parts of the field we have a calculated average yield of 57 gallons to the ton. An analysis was made of a type sample in which shale from various parts of the mine was mixed in the portions in which it actually occurred in the seam, and the yield from this gave an

average varying from 57 gallons to 60 gallons per ton. I cannot say whether the yield would be appreciably altered if the overlying coal were brought down and treated with the canal coal and the shale.

51. *Mr. Kenny.*—In the opinion of some experts the presence of this coal might have harmful effects with certain kinds of retorting. If it were to be accepted that the Renco retort was to be employed, perhaps the admixture of other kinds of coal might not be detrimental, but I think it would be harmful with such retorts as are now in use. In these it is necessary to keep the charge as free of coal as possible. So far as I am aware, no tests have been made of this overlying coal associated with the seam, but I should say it is essentially a hard coal in which tarry oils might run to about 20 gallons to the ton. I do not think that the thickness of the seam would make mining operations difficult or unduly expensive provided you face the possibility of taking a certain amount of the accompanying coal with the canal coal and shale.

52. *Mr. Mulholland.*—Several tunnels have been driven into the seam at various places. The field takes the form of a high sandstone plateau broken by the Widdin Brook valley and the Baerami Creek valley. A total of fourteen tunnels have been driven, and they show that the seam is practically identical all the way. I have here a map showing the position of the various tunnels. The section of the seam is practically the same in all places where tests have been made, and there is a hard sandstone roof up to 25 feet thick. It is very strong, and would not require much timbering.

53. *Mr. Kenny.*—Our experience is that oil shale deposits are generally in the form of lenticular seams in isolated basins varying in thickness from a few inches to several feet and perhaps with irregular shapes.

54. *To Mr. Harrison.*—It is generally supposed that shale deposits are formed by an accumulation of plant spores, and of algal matter from lagoons, &c.

55. *To the Chairman.*—The deposits are on Crown land which is at present leased to two separate companies. On the Baerami Creek side the land is leased by the Shale and Oil Products Co-operative Limited, and on the Widdin Brook side by the Baerami Shale Oil and Petroleum Company Limited. I think that compensation would have to be paid to these interests if the leases were terminated. In the ordinary way the leases could be terminated only if the lessees failed to keep the terms of the lease, including the labour conditions. At the present time, there is a partial suspension of these conditions. I agree that the same amount of compensation ought not to be payable for the compulsory termination of the leases at a time when the labour conditions are wholly or partly suspended as when they are fully in force. There is a tendency for the mine to make water in those places where the tunnels are down-dip, but I do not think that the quantity is any more than encountered in any ordinary mine, and it could be handled quite well by pumping. I do not know whether the water could be used in boilers. An analysis would be necessary in order to determine that point. Some of the tunnels are drained. In those tunnels which are driven downwards drainage by pumping would be required, but the cost would not represent much per ton of shale. I am chairman of directors of the Glen Davis enterprise. There, the cost per ton of shale landed in the bins varies from 23s. to 24s. I should say that, with the introduction of mechanized methods, the cost at Baerami ought not to be more than 14s., if we accept the estimate of the American Mission. It is expected that when the Glen Davis plant is in full operation the mining costs will be considerably reduced. At the present time, a good deal of developmental expenditure is charged against the product. Some time ago, we

installed two additional loaders at Glen Davis, and the output has been increased.

58. *Mr. Mulholland.*—There is practically no surface water at Baerami. It would be possible to get a limited quantity from the Widdin Brook side, but only enough to run a comparatively small plant. To obtain a large and assured supply it would be necessary to bring water from the Goulburn River 30 miles away, or to establish the works themselves there. I do not think that the country is suitable anywhere near the mine for the construction of a large dam. It would be necessary to go some distance up the Baerami Creek in order to get suitable foundations. Taking everything into consideration, it might be cheaper to get water from the Goulburn River. It might be possible to get sufficient water from dams to run the mining plant alone, but not enough to run a refinery as well, or even retorting.

57. *To Senator Lamp.*—Black Water Creek is a tributary of the Widdin Brook, but in order to get proper foundations for a dam it would be necessary to go a considerable distance up Black Water Creek, and you would then be 4 or 5 miles from where the mines would be.

58. *To Sir Frederick Stewart.*—Mr. Kenny.—It has been customary for people associated with prospecting ventures on the Baerami field to claim that a certain thickness of material varying from 10 feet to 12 feet below the shale seam included retortable material. The department has made an official examination of winces sunk in that material, and an analysis showed that the proportion of oil present was so low as not to be worth considering—not more than 10 or 12 gallons to the ton. The material can be considered only as something in the nature of carbonaceous shale, and there are much better deposits of the kind elsewhere. When we were preparing the top coal, the American Mission proposed to mine some of the overlying coal and clay shale which, when mixed with the oil shale, would reduce the yield to about 44 gallons per ton. Even that, of course, is higher than the yield from the average Scotch shale. I believe that at Baerami it ought to be possible to start with a clean sheet and avoid much of the difficulty that was encountered at Glen Davis. The estimates of the American Mission were based on the use of the Renco retort. For the development of Baerami either the Fell retort or the N.T.U. retort would be employed, unless experience demonstrates the superiority of the Renco retort. We are engaging from our difficulties at Glen Davis, but the process is a slow one. The whole plant is being reconstructed, but there are delays due to the shortage of labour. From a technical point of view one need not be dismayed by what has happened at Glen Davis, but the economics of the industry are a different matter. There have been both technical and economic difficulties at Glen Davis, but the economic difficulties were foreseen all along. The technical difficulties need not be encountered again.

59. *To the Chairman.*—*Mr. Mulholland.*—The shale outcrops at Baerami are weathered to white clay, and contain no oil, but once you get into the solid shale the oil content remains fairly constant. Of course, at no point have we gone in more than 400 feet. The country is too steep to work the seam by the open cut method. At some places there is more than 1,000 feet of cover.

60. *To Mr. Harrison.*—*Mr. Kenny.*—The difficulties encountered at Glen Davis were due neither to faulty administration nor to government interference. The trouble, basically, was that the wrong kind of retorts were installed in the first place. They failed to operate satisfactorily, and when the Commonwealth

Government became interested in the control of the works, the directors were confronted with a situation which was, in many respects, harder to rectify than if they had been setting out on a new job. Coupled with that, we have not been able to get the support we hoped for from certain quarters in regard to the supply of labour and materials, a fact which has delayed the work of physical reconstruction. We have got on better recently, and have set the date of 30th June 1945, as the time at which we expect to attain full production. Our experience at Glen Davis should be kept in mind in any attempt to exploit the Baerami deposits. Even in regard to the water supply too much was taken for granted at Glen Davis in the first place. Now we have had to become partners in the Fish River water scheme at a cost of £250,000, which is something altogether outside the undertaking as originally planned. If the Renco retorts are used at Baerami, as proposed by the American Mission, not a great deal of water would be needed, but if the Fell retort, or any kind other than the Renco is used, a large condensing plant will be necessary, a large quantity of water would be needed, and the matter of the water supply would become important. We are not satisfied that we are at present getting the maximum oil content from the shale at Glen Davis, but we are getting as much as possible without an efficient condensing plant. Nearly all the oil is extracted from the ash by the present process, but there is still a good deal lost in the gases. Probably not more than 4 gallons to the ton is left in the ash itself. Glen Davis is now run entirely by the Government, although the project was begun by private enterprise. We are satisfied with the progress being made, but not with the rate of progress. Although we have tried to obtain priorities for labour and material, we have been unsuccessful. Contracts for steel fabrication have been put aside by a higher priority. I would say that private enterprise could do as well in the new field at Baerami as the Government has done at Glen Davis. It is less difficult to mine the Glen Davis shale than the Baerami shale because the average thickness is greater at Glen Davis, and mining conditions are good. It is necessary to understand that at Glen Davis there are two seams of shale. There is one seam 4 feet thick, which yields 120 gallons of oil per ton. Above this, there is a band of inferior shale, which yields about 25 gallons to the ton. In working, the whole face is taken down, and the centre band rejected. It is a matter of economic balance whether you retort the whole lot, and get a yield of 90 gallons a ton, or carefully pick out the useless stuff, and thus get a higher yield. This useless stuff is partly screened out at Glen Davis because the Fell retort will not handle materials smaller than 2 in. The same thing would have to be done at Baerami unless a retort were developed to take small pieces of material.

61. *To Sir Frederick Stewart.*—It might be necessary to remove another foot of material at Baerami in order to get head room, and you will then have to decide whether you will stow this useless material in the mine, take it to the surface and separate it from the shale, or let the whole lot go through the retorts.

62. *To the Chairman.*—*Mr. Mulholland.*—There is a clay band about 1 inch thick between the oil shale and the canal coal at Baerami.

63. *Mr. Kenny.*—In the old days at Glen Davis they used to pick out the clay before machines were used above the seam of oil shale. At Baerami, the band between the canal coal and shale oil is harder than the band that divides the seam at Glen Davis, and it would have to be broken up in order to go through the retorts. It might be better to store it in the mine. My personal

opinion is that it would not be advisable to allocate public money for the development of Baerami until we can see definitely what happens at Glen Davis.

64. *To Senator Aylett.*—If you confine mining operations at Baerami to a 3-ft. section the cost would be probably 25 per cent. higher as compared with working a 6-ft. section. If a long-wall system were worked the cost for brushing would be greater than if the bord and pillar system were employed.

65. *To Senator Lamp.*—*Mr. Mulholland.*—A typical section of the Baerami seam from the bottom to the top is as follows: There is a clay shale floor, then 2 feet of high-grade oil shale, 2 inches of inferior canal coal, 1½ inches of clay shale, 1 ft. 2½ in. of inferior canal coal, ½ inches coal, ½ inches of clay shale, and 1ft. 9 in. of coal. Over that there is the sandstone roof. The seam at this point is a little thicker than usual, but its general behaviour is similar at practically all points. In this section, for instance, there is about 2 feet of high-grade oil shale, but the usual thickness is only 18 inches.

66. *To Sir Frederick Stewart.*—*Mr. Kenny.*—Technically we have overcome our difficulties at Glen Davis, and by the time we are operating at full capacity there we ought to have a better idea of the economics of the industry generally. The Newnes Investigation Committee, in its supplementary report, said that the establishment of a shale oil industry based on Newnes was justified only if and when the Commonwealth Government desires to get oil at any cost. The committee's final conclusion was that it was not an economic proposition. Even if private enterprise were willing to take the risk of developing Baerami, I think it would still be wise to tell them to delay until further experience was gained at Glen Davis—that is, unless it was decided in the national interest to get all the oil we could.

67. *To Mr. Mulcahy.*—The Renco retort at Glen Davis will not be in operation for three or four months. I understand that there has been some trouble between the department and the former owner of the retort, and that this has caused delays.

68. *To Mr. Harrison.*—This Renco retort has a capacity of 75 tons a day, but the Newcastle test proved that its best operating capacity was about 54 tons a day. The retort as it stood at Newcastle was constructed of mild steel designed to stand a short-range test only. It is a pressure vessel, and the boiler inspectors have condemned much of the material. The retort will have to be strengthened before it will be permitted to operate. The shale deposits at Mururundi are low grade, yielding only about 40 gallons to the ton. One portion of the seam is rich, but the quality generally is poor. The seam is about 8 feet high, but the roof is very bad.

69. *To Mr. Conelan.*—The Alpha deposits in Queensland are very rich, but I understand that they cannot be worked from an open cut. There is about 130 feet of cover, which is far too much for a 4-ft. seam.

70. *To Mr. Mulcahy.*—It is expected that the Fish River water scheme will be in operation at the beginning of next year, and that the Glen Davis plant will be in full production by the middle of the year. We have not this year been able to use the cracking plant at Glen Davis all this year because the water supply has been too low. It has been necessary to store the oil.

71. *To the Chairman.*—The staff which would normally be employed at the cracking plant has been kept on, but they have been employed in other parts of the works.

72. *To Mr. Mulcahy.*—I agree that the failure to provide an adequate water supply at Glen Davis in the

first place was a serious oversight. The original company made no provision for extra capital cost for services and housing.

73. *To Mr. Conelan.*—The provision of an adequate water supply at Baerami would be a costly matter. If we were to have the same sort of establishment at Baerami as we have at Glen Davis it would be necessary to have a water supply able to deliver between 1,000,000 and 1,500,000 gallons a day. That would be for a complete installation, including retorts, refinery, township, &c. The American Mission proposed to place the refinery at Muswellbrook. We know, however, that the ordinary water supply for that town has been dangerously short for the last two or three years. If a refinery were placed alongside the town, something would have to be done to improve the water supply. If private enterprise were allowed to develop Baerami the Government should exercise some control over expenditure in order to protect the shareholders.

74. *To the Chairman.*—The band of coal below the shale oil seam at Baerami has not been analysed for oil content. We have tested the Greta coal for oil. I understand that this overlying coal was used by the Sandy Hollow people for heating the retorts.

75. *Mr. Kenny.*—The Tasmanian shale has yielded from 40 to 45 gallons of crude oil to the ton. Several plants have been in operation there at various times, the last being used for the extraction of bitumen for the Main Roads Board. Tasmanian shale has a high sulphur content, so that if it is used for the production of petrol the cost of refining is relatively high. The presence of sulphur does not affect the production of bitumen. I understand that some of the deposits at Latrobe could be worked by the open cut method.

76. *To Mr. Harrison.*—*Mr. Kenny.*—It is estimated that there are about 50,000 tons of shale in New South Wales which would give an average yield of 75 gallons to the ton. This represents about 3,750,000 gallons, or 190,000,000 barrels, which is less than ten years' consumption of petrol in Australia. Our department believes that if Australia is to become even partly self-reliant in the matter of oil it can be done only by producing oil from coal. I confess that I am a pessimist regarding our chances of finding flow oil in Australia.

The witnesses withdrew.

(Taken at Sydney.)

WEDNESDAY, 7th JUNE, 1944.

Present:

Mr. JAMES (Chairman).

Senator Aylett.

Senator Lamp.

Mr. Conelan.

Mr. Harrison.

Mr. Mulcahy.

Sir Frederick Stewart.

John Henry McKinley Moate, managing director of Standard Oil Company of Australia Limited, sworn and examined.

77. *To the Chairman.*—I am aware that Parliament has asked this Committee to inquire into the possibilities of developing the shale oil deposits at Baerami. My company has investigated shale oil deposits at Latrobe, in Tasmania, and at Baerami. They are the only two fields my company has investigated. As a result of our investigations we believe that the prospects of both fields are equally sound. Yields are lower in Tasmania than at Baerami, but economic and geographical considerations offset the lower yields of oil from Tasmanian shale. The reason why we turned our attention to the development of the Baerami field was because the Tasmanian Government did not see its way

clear to make available to us shale areas of sufficient extent to warrant their commercial development. I submit the following prepared statement to the Committee:—

At the request of the secretary of your Committee, Mr. G. Whiteford, I have pleasure in submitting for your consideration a comprehensive review of the steps taken by the Standard Oil Company of Australia Limited, of which I am managing director, to prove the extent of the shale oil deposit at Baerami, to solve the retorting problem by demonstrating the merits of the Renco type retort, and to establish the industry on a commercial basis. These efforts have involved my company in an expenditure of approximately £30,000 of its funds, not one farthing of which was provided by other than the company's shareholders. I have also taken the liberty of indicating what could and what should be done to capitalize what is undoubtedly a national asset of great value and importance. The Standard Oil Company of Australia Limited was incorporated in South Australia on the 9th September, 1922, under the "Companies Act, 1922" of that State. It is not associated in any way with overseas oil interests but is registered in New South Wales as a "foreign company", in compliance with New South Wales company law.

**Company's Early History.**—The company was originally engaged in the search for petroleum oil within the Commonwealth of Australia. However, as the results experienced by the company were identical with those which, so far, have attended the efforts of all others similarly engaged within the Commonwealth, such search was discontinued. This decision was influenced both by the results of the company's operations and the advice of Mr. Kenneth A. Wright, of Los Angeles, California, a highly qualified and most successful petroleum geologist of world-wide practical experience, who, in 1925, was engaged by the company to review the possibilities of commercial supplies of petroleum oil being discovered within both the Commonwealth of Australia and the Dominion of New Zealand.

**Remote Petroleum Possibilities.**—Briefly stated, Mr. Wright's conclusions are that "the generally prevailing geologic series does not offer any chances for commercial petroleum production, the source material being of restricted local areal extent, too lean and not in sufficient quantity to be the origin of any appreciable volume of petroleum oil or gas".

**Shale Oil Development.**—This geologist, therefore, urged the immediate commercial development of Australia's oil-shale resources as presenting the soundest and most economical solution to this vital national problem. Consequently, the company thereupon directed its resources to an investigation of the possibilities of economically developing Australia's latent oil-shale deposits.

On the 31st August, 1927, the company acquired by purchase from Baerami South Shale and Oil Company Limited, six coal and shale leases comprising 9,840 acres of Crown lands situated in the Parishes of Caroola, Hungerford and Mirrie, County of Hunter, New South Wales. This property is known as the Baerami Shale Mine and the investigation of its potentialities was the inaugural step in effecting the company's policy as above.

I and my co-directors, when formulating such policy, relied with confidence upon the assurance that, in the event of the company's developmental proposals being sound, they would be afforded the sympathetic consideration of the Government, as is contained in a letter (more fully referred to hereafter) which I received from the then Prime Minister, Mr. J. A. Lyons, dated the 18th September, 1927.

**Development of Retorting Process.**—Immediately following the purchase of the abovementioned leases (Mr. Wright, after making a preliminary survey, estimated they contained 12,000,000 tons of retortable shales) the company, on the advice of Mr. Wright, for testing purposes forwarded approximately 25 tons of average quality oil-yielding material from one of the several then existing tunnels on the property to Refinery Engineering Company of Houston, Texas, United States of America, of which Mr. V. V. Jacomini is the president.

Mr. V. V. Jacomini appointed Company's Petroleum Technologist.—Mr. Jacomini was formerly vice-president of Petroleum Conversion Corporation of New York, New York, and president of T.V.P. Corporation, of Texas City, Texas. He—in August, 1927, after being appointed consulting petroleum technologist to my company—resigned from his former positions and formed his own company—Refinery Engineering Company—which left him free for the closest personal co-operation with us in the pursuit of our aims. He came to Australia in the interests of shale oil production at my company's request and expense on three occasions (in 1927, 1928 and 1929), and subsequently was the leader of the United States Special Mission on Shale Oil, which visited Australia during the period from the 7th December, 1929, to the 6th March, 1942. Mr. Jacomini is a graduate of the United States Naval Academy, Annapolis, Maryland, and in the later period of the Great War was gunnery officer of a large United States battleship. He is also a member of the Institute of Petroleum Technologists (London), and of the American Society of Chemical Engineers.

**Government's Representative Invited to Houston Tests.**—Mr. L. J. Rogers, the Commonwealth Government's fuel adviser, in company with Mr. G. F. Davis, of National Oil Proprietary Limited, was at Texas City (42 miles from Houston), Texas, at about the time the tests were conducted. Consequently, an invitation was sent by the company, and by Mr. Jacomini, to Messrs. Rogers and Davis to attend the tests. To the company's invitation, Mr. Rogers replied, under date the 22nd October, 1927:—

"As you probably know, my time is now at the disposal of Mr. G. F. Davis, of National Oil Proprietary Limited. We propose to visit Texas City to witness the cracking of some Newnes shale by Petroleum Conversion Limited, but we do not intend to be there before the 12th December, approximately. (The retorting tests were actually conducted during December, 1927, and January, 1928.) Moreover, the completion of my life is so urgent that it is unlikely that he will be able to spare me for sufficient time to witness your tests as distinct from merely seeing the pilot plant in operation. If time permits, I will be glad to call on Mr. Jacomini before he departs, but I regret, however, that it will be impossible for me to be present at the end of November or at any time to devote such attention to the tests as would enable me to endorse the results."

**Purpose of Tests.**—The purpose of the tests was to determine—(a) The behaviour of this shale under various methods of crushing; (b) the behaviour of this shale under conditions of continuous retorting; (c) the yield of crude oil under commercial operating conditions; (d) the quantity and quality of the gas made during the retorting operation; (e) the quantity and quality of the spent shale; (f) the ultimate yield of first quality gasoline when cracking the crude oil for the maximum production of gasoline.

An excerpt from the report, dated the 1st February, 1928, of Refinery Engineering Company to the company, is as follows:—  
"We have completed all the retorting tests on the Baerami oil shale which you sent to us last October. These tests have most pleasingly to us, for they definitely proved that we can handle this shale very successfully in large-scale continuous operation. We are quite satisfied that there are no more problems."

The average yield obtained in these tests, from run of mine material, was 61 gallons of crude oil per ton, from which an average of 60 per cent. of finished petrol, treated to 10 lb. vapour pressure, and less than 0.2 per cent. sulphur, was recovered.

**Retorting problem stressed in Cadman report.**—Lord Cadman, chairman of Anglo-Iranian Oil Company Limited, London, in his report, dated the 4th July, 1935, to the Prime Minister of Australia, on proposals for the establishment of the oil shale industry at Newnes, urged—

"With regard to retorting, it is apparent that the ideal retort, and method of working have yet to be found for this material, and if it were decided to move in the development of the proposal, a sound solution of the retorting problem is absolutely essential."

Embedded in Lord Cadman's report there is also a joint statement by Messrs. Robert Crichton and H. R. J. Conacher, of Scottish Oils Limited, Glasgow and London, which reads:—

"The opinion is expressed that a sound solution of the retorting problem has yet to be found and that the first step towards the development of the Newnes proposition should be a thorough experimental study of the question."

In this respect it is interesting to turn to the report (dated Canberra, 10th June, 1943) of the Parliamentary Standing Committee on Public Works relating to Newnes and Baerami shale oil proposals, certain clauses of which read:—

**Paragraph 10.**—The rich seams at Glen Davis have an oil content of over 100 gallons to the ton, while some of the other seams are of lower value. From "run of the mine" of 92.2 gallons of crude oil per ton. It was ascertained in an average sample that the material treated at Glen Davis during 1941 had an oil content of 55 gallons to the ton, and the recovery was 52.3 gallons per ton. (Approximately 60 per cent. recovery.)

**Paragraph 20.**—It is stated that all the processes associated with the production of retort oil at Glen Davis are in operation successfully, excepting the vital one of carbonising the shale. It is claimed that this is due to the unsatisfactory type of retort in use, and the lack of an adequate water supply.

**Paragraph 21.**—The first type of retort established at the old Newnes works was what is known as the Pumpherton retort, which for many years had been operated in Scotland. The Scottish shale, however, is of low oil content, and this type of retort was soon proved unsatisfactory for the treatment of the higher grade Newnes shale.

**Paragraph 24.**—The retort recommended by the American mission for the production of the increased quantity of oil projected at Glen Davis is one developed by Mr. Jacomini, and known as the Renco retort. This is said to be capable of operating in units capable of treating as much as 250 tons of shale per day, and will cost approximately £100,000. It has never, to the Committee's knowledge, been operated on a commercial scale, but under test conditions, capable of treating 75 tons per day, has been run for short periods under test conditions. The result of the test made in Australia showed that the optimum rate of throughput for this particular retort was 50 tons per day, when the efficiency of recovery was 65 per cent. day, the efficiency dropped to 70 per cent. The report of experts on this retort was to the effect that they had "every confidence that the retort designed by him (Mr. Jacomini) on the sound basic principle developed by him will give satisfactory and efficient service". Nevertheless, the Committee is loath to recommend the construction, at a cost of approximately £300,000, of retorts which have not been operated on a commercial scale. However, the retorting is the weakness in the present operation at Glen Davis, and if there can be discovered a retort which will give satisfactory service while extracting a greater percentage of the oil content of the venture, the output, as well as the financial aspect of the venture, will be greatly improved.

**Paragraph 25.**—After discussion with the Commonwealth representatives on the board of directors of the National Oil Proprietary Limited and others, the Committee is impressed with the possibilities of the Renco retort [which was developed through the assistance of this company] and considers it should be tried out under working conditions.

My company, too, appreciated that, owing to unsatisfactory retort design, former attempts to establish the

oil shale industry in Australia had ended in failure, loss of capital to the companies concerned and discredit to the industry generally.

**Reserves of Oil Shale.**—However, the company, being entirely satisfied that the vital problem of efficient retort design had been completely solved (this had involved an expenditure of approximately £27,000 of its funds) subsequently caused a geological survey of the Baerami property to be made by Leo A. Cotton, M.Sc., D.Sc., Professor of Geology in the University of Sydney, in collaboration with Messrs. Julius, Poole and Gibson, of Sydney, who, in February, 1938, were appointed the company's consulting engineers. These experts estimate the reserves contained in the Baerami shale mine to be approximately 12,000,000 tons of retortable material—comprising upper canal coal, intermediate canal coal, kerosene shale and lower canal coal—having an average crude oil yield of 60 gallons per ton. The results of Julius, Poole and Gibson's investigation under this heading are comprehensively covered by their report to my company dated the 18th November, 1938, submitted herewith, on loan to the Committee.

**Government's Estimate.**—The Mulholland report of the Department of Mines, New South Wales, estimates Baerami reserves of oil shale and canal coal at 10,615,000 tons. These are only for that part of the deposit explored.

**Probable Extensions.**—The company's consulting engineers consider—and Professor Cotton supports this conclusion—that the above-stated quantity of material can reasonably be expected to be at least mine, as the indications are that the latter covers only a part of the Baerami shale field and also that the materials show indications of improvement in both seam thickness and value to the south of the main property. This latter statement is based on the fact that, at the southern limits of the property, the materials exist in their greatest thickness and, moreover, that the seam of high oil-yielding kerosene shale is thickest in the southern limits of the present lease and may even become thicker as it extends southwards.

**A Vast Potential Oilfield.**—It can therefore be assumed that at least 1,500,000,000 gallons (6,000,000 tons) of crude oil are available to the nation from the Baerami shale field.

**Facts Established.**—After years of enterprise and the expenditure of approximately £30,000 of its shareholders' funds, this company has established certain facts. All of these are incontrovertible, are substantiated by reports from persons and firms of the calibre of Messrs. Julius, Poole and Gibson, other reputable experts, and the results of properly conducted and authenticated tests, which, for years, have been on the files of various departments of the Federal Government.

The most material facts are these—

(1) The available crude oil within that portion of the shale deposit actually proved by this company at Baerami, New South Wales, is estimated to amount to about 750,000,000 gallons.

(2) From the shale deposits referred to, 30,000,000 gallons (25 per cent. of New South Wales's normal peace-time requirements) of motor spirit could, by employment of the processes developed and proved—on a commercial scale basis, by the satisfaction of experts, Government and private—by experts on this company's account, be produced annually for a period of twenty years.

(3) Such motor spirit would be of a specification which has already been approved by the Federal Government's Fuel Adviser as being suitable for Australian requirements—vide Mr. V. O. Balmford's letter, dated Canberra, 21st February, 1941, which reads—

**NATIONAL SECURITY (CAPITAL ISSUES)**

**REGULATIONS.**

**THE STANDARD COMPANY OF AUSTRALIA LIMITED.**  
I refer to the letter dated 4th February, 1941, from Messrs. J. V. Douglas and Company, forwarding a specification of the petrol which will be produced by the above-named company. The specification is as follows:—

**Distillation test, D 80-85 A.S.T.M.—**  
Not less than 5 per cent. evaporated at 50° C.  
Not less than 20 per cent. evaporated at 75° C.  
Not less than 38 per cent. evaporated at 100° C.  
Not less than 60 per cent. evaporated at 185° C.  
Vapour pressure 8.16 lb. Reid, according to climatic conditions and market demands.  
Corrosion: Copper strip test negative.  
Gum: Copper dish gum 10 mgm. max.  
Sulphur: Can be reduced to 1 per cent. if necessary, otherwise we prefer to produce spirit with sulphur content of 45 per cent. Doctor test negative.  
Specific gravity: 0.73 to 0.745.  
Oxidation: 300 minutes minimum.  
Octane: 67 to 71.

This specification is acceptable to the Commonwealth Fuel Adviser as being suitable for Australian requirements in the terms of clause 10 of the consent granted under the National Security (Capital Issues) Regulations and dated 22nd October, 1940.

**Work Conducted at Government's Wish.**—The company, principally with a view to satisfying the Commonwealth Government's qualifications for the obtaining of a remission of excise on petrol to be produced by it, utilized its financial resources over a period of three years to obtain the foregoing results, following the receipt of an intimation, on 18th September, 1937, by the then Prime Minister (Mr. J. A. Lyons) that—

"The Commonwealth Government is particularly anxious to see the shale oil industry developed as extensively as possible. . . Any definite proposals which your company, or any other company, may make in this regard will receive the sympathetic consideration of the Commonwealth Government. It would be necessary, however, for the Government first to be assured that enterprises of this kind would be likely to succeed and in this connection it would need to be examined by the Government's technical officers."

**First Production Proposal—13th March, 1939.**—In March, 1939, the company submitted to Federal authorities full details of a proposal—evolved in close collaboration with Mr. Jacomini—for the large-scale production of petrol from the Baerami and contiguous shale fields. This proposal envisaged the eventual production of 4,000,000 United States barrels (140,000,000 gallons) of crude oil annually from which approximately 100,000,000 gallons annually of petrol would be produced, which amount represented approximately 25 per cent. of Australia's pre-war total peace-time consumption. The proposal included the offer of an American group, universally interested in the building of oil pipelines, to construct a steel pipeline 140 miles long to carry oil produced from the Baerami shale mine and from other shale areas within New South Wales to a central refinery, which was to have been built on the outskirts of either Sydney or Newcastle. The arrangements provided for the installation of bomb-proof tanks for the storage of oil at the line's terminal points. The cost of this pipeline construction was estimated at £500,000, the whole of which, in the terms of the agreement actually executed in Sydney on 21st July, 1938, by Mr. V. V. Jacomini, the attorney of the American companies concerned, would have been provided by American interests. In a letter dated Sydney, 7th July, 1938, which Mr. Jacomini wrote to the Honorable B. S. B. Stevens, then Premier of New South Wales, seeking the latter's aid in obtaining parliamentary authority for the necessary pipeline right of way, Mr. Jacomini, *inter alia*, stated—

Upon the signing of the various contracts next week, the machinery for the large-scale development of the New South

Wales oil shale deposits will be complete, and it is inevitable that the development of these deposits will be rapid, especially if the Government lends its financial aid, which it has been expending every effort and resource to establish this industry.

The completion of this work draws to a conclusion over two years' continuous effort on the part of myself and my associates, during which time the matter which we have been met and have been solved, among which is the development of a retort capable of handling large daily throughputs of oil shale, canal coal and other carbonaceous materials. . . I am satisfied at this time that the obstacles which we have encountered have been from those who have the "defeatist" attitude. First it was, "You can't retort these shales"; next, "The oil content is too low for commercial operation"; then, "The oil contains too much wax"; next, "You can't transport the oil by pipe line"; next, "The capital cost of the pipe line would be too great a burden on the industry"; and now, "Anyway, there isn't enough oil shale available in New South Wales". All of which is really absurd, and I am happy to say, is all behind us. Each of these criticisms, as well as many others, has been analysed and answered in detail. It is interesting to note that as late as 1921 similar "defeatists" in America were saying: "There is no more oil in Texas"; and now in 1938 the Texas oil wells are shut in two days per week to curtail production.

In making my predictions as to what may be expected of the oil shale industry, I know I am opening myself to attack by those "defeatists" who are always too willing to hide behind the false cloak of conservatism by saying, "This can't be done"; however, my investigations and studies of the Australian oil shales during the last two years, together with my experiences in the oil business throughout the world, including my experience with the oil shale operations in Scotland and in France, make me feel safe in predicting that if those who are in a position to help will lend their whole-hearted support to this industry, the production of crude oil from oil shale and other carbonaceous material will, in all probability, within the next several years, reach the amount of 4,000,000 barrels (140,000,000 gallons) annually, from which about 84,000,000 gallons annually of petrol will be produced, which amount represents approximately 25 per cent. of the present total consumption of Australia. In arriving at these figures I have estimated that the Baerami shale should produce in annual quantities of 1,000,000 barrels of crude oil, and that the National Oil deposits should produce a like amount, and in addition other deposits now being taken and to be taken will produce from 4,000 to 6,000 barrels daily.

In relation to the development of the industry after it has been once established, I might add that I am entering into the contract for my company to operate the Standard Oil Company's retorts. In connection with this work I am planning to establish a research laboratory in connexion therewith to ensure the continued development of the industry, which can have only one result, and that is the ultimate solution of the commercial production of oil from the very rich black coals of the Greta series.

**Government Refuses to Assist.**—The company submitted this proposal to the Federal Government in support of its appeal for financial assistance to facilitate local demonstrations of a pilot unit of the retorting process which would have been employed in giving effect to such proposals. The company had become exasperated with the demands of the Government's technical advisers for proof of its experts' stated claims; in endeavouring to comply with those demands its financial resources were fast becoming exhausted. In this present instance, although the Government's advisers deemed these demonstrations to be necessary and desirable, the Government, after causing the company's appeal to be investigated by the Commonwealth Standing Committee on Liquid Fuels, refused to assist in any way. On the 19th April, 1939, the Right Honorable R. G. Casey, Minister in charge of Development, advised that the recommendations of the committee (which had obviously misunderstood the purpose of the company's approach) were—

(1) That the Commonwealth Government should not advance money for the proving of any particular type of retort as this is regarded essentially as the responsibility of the designers or patentees, who should be rewarded according to the merits of their proposition through the usual commercial channels.

(2) That, unless there are special circumstances operating to the contrary, no further public money should be committed in respect of the shale oil industry by the Commonwealth Government until the expected satisfactory outcome of its present large investment (at Glen Davis) in the industry is confirmed by actual experience.

and stated—

In view of the recommendations of the standing committee, I am not prepared to recommend that funds be advanced to your company for the purpose mentioned.

**Proposal Rejected.**—Disregarding in its entirety the company's appeal for assistance, the above petrol production proposal was not seriously considered by the Federal Government—in fact, it was ridiculed, and consequently lapsed.

**Renco Process Demonstrated Locally.**—Solely through the employment of the company's funds, demonstrations were eventually conducted and tests carried out by Mr. V. V. Jacomini, the designer of the process, on 149.75 tons of Baerami shales, under the supervision of Messrs. Julius, Poole and Gibson in a pilot unit of the Renco retort at the Clyde-street, Hamilton, New South Wales, works of the Newcastle Gas and Coke Company Limited, between the 20th and 23rd December, 1939.

**Invitation to Government Technical Officers.**—Several weeks prior thereto, invitations to appoint technical officers to witness the complete test operations, in order that the Governments of the Commonwealth and New South Wales "might be completely satisfied with the results to be obtained", were extended to—(a) Department of Supply and Development, (b) Commonwealth Standing Committee on Liquid Fuels, (c) Department of Mines, New South Wales, and brought forth replies as follows:—

(a) Arrangements will be made for Mr. L. J. Rogers, the Commonwealth Fuel Adviser, to be present during retorting operations. . . . I am to say, however, that it must be clearly understood that, in the opinion of the fuel adviser, the duration of the test as indicated by the volume of shale which it is expected to treat will not afford convincing evidence of the commercial yield and it will not shed much light on the reliability and cost of retorting operations. In these circumstances, the fuel adviser would not be in a position to pronounce upon your company's scheme, based upon the proposed test.

(b) The witnessing of tests such as those which your company proposes to make is a matter which does not come within the standing committee's terms of reference. . . . (c) The department is not prepared to accede to the request that an officer be appointed to witness the complete operations, from the mining of the material to the final production of crude oil.

At the tests carried out in Newcastle, Mr. L. J. Rogers was present during two days of the three days continuous operation of the plant. The plant was at his disposal for any examination he desired; he saw exactly what was being done with regard to the handling of the material to and through the retort and has expressed himself as satisfied that, in the Renco retort, the company has a retort which is capable of doing the job it was set to do. Not only did Mr. Rogers witness these tests, but so also did a number of other experts, quite apart from the multitude of responsible persons who daily attended the tests. Amongst the former were Newcastle executives of the Broken Hill Proprietary Company Limited, the directors, chemists and engineers of the City of Newcastle Gas and Coke Co. Limited, naval and military engineering officers, representative members of both Federal and State Houses of Parliament, and officials of the press, industry, and labour.

**Renco Test Results.**—The tests were of a continuous nature, extending over a period of 76 hours 31 minutes. The pilot plant tested was designed for a throughput of 75 tons per 24 hours. Its actual rate of throughput—under severe test—varied between 38 and 89 tons per 24 hours. The optimum economic commercial operating rate of the pilot plant tested is stated by Messrs. Julius, Poole and Gibson to be 50 tons per day, at which rate it obtained oil yields of approximately 61 gallons per ton with the exceptionally high retorting efficiency of 98 per cent. Much unwarranted criticism has, in some quarters, been made of this plant's operation under test. However, the facts are—(1) The duration of the pilot unit's testing was determined by the tonnages of shale which Messrs. Julius, Poole and Gibson deemed sufficient to confirm their previously

expressed opinion of the process and to determine the crude oil yield per ton which could be expected in commercial practice from the previously determined average of the Baerami shales, and (2) Due regard was given by the above consultants to the fact that, in the terms of an agreement dated the 21st July, 1938, made between Mr. V. V. Jacomini and my company, the former contracted, *inter alia*, for a period of ten years from the date of the commercial plant's initial operation, to—

operate and maintain the crushing plant, the retorting plant, the power generating units which supply power for retorting, mining and general purposes, the office, the laboratory, the oil storage tanks assigned to its use, the pumping equipment to deliver the oil to storage, change room and any oil distillation unit, if and when one is installed "at a cost of 3s. per ton of shale retorted."

**Consulting Engineers Fully Satisfied.**—The results of the tests were entirely satisfactory and are fully covered by the report of the company's engineering consultants, dated 6th February, 1940, which, briefly stated, reveals—

"The tests have confirmed the opinion we previously expressed with regard to the suitability of this retort for your company's purpose. We are fully satisfied that the retorting process is one that lends itself admirably to automatic control and operation and can, therefore, be operated with a minimum of labour. We are fully convinced that the process and the plant do not introduce any mechanical difficulties which cannot be readily overcome by sound engineering principles and design.

We consider the plant capable of extension to provide commercial rates of retorting."

Messrs. Julius, Poole and Gibson's complete report, dated 6th February, 1940, on these tests is tendered herewith, on loan, for the Committee's information.

**Second Production Proposal—14th August, 1940.**—Application for Consent to Raise Capital—From Melbourne the Honorable Sir Frederick Stewart, Minister for Supply and Development, wrote the company on 26th June, 1940—

You will be pleased to learn that the Commonwealth Government has agreed to extend protection to liquid fuels produced in Australia from indigenous shale and coal. The extent of this protection is as follows—Import duty, 7.4d. per gallon; excise, 5.6d. per gallon.

The Government's decision is limited to enterprises which commence production within the next two years, and will be operative for a period of fifteen years.

I trust this will enable you to develop your shale oil project.

Thereafter, on 14th August, 1940, an application supported by sound technical data was submitted to the Commonwealth Government for authority to register Standard Oil Limited in New South Wales in the terms of the "Companies' Act, 1936," with a nominal capital of £3,000,000 for the production—at a net cost of 9.3d. per gallon—from Baerami shales of approximately 30,000,000 gallons of motor spirit per annum for a period of twenty years. Messrs. J. V. Douglas & Company, consulting accountants, of Sydney, were retained to negotiate with the Government for the registration of the proposed new company, "Standard Oil Limited" (its formation was sponsored by Sir Bertram Stevens, former Premier of New South Wales and Mr. Alex J. Gibson, of Julius, Poole and Gibson) to which was to have been transferred the existing company's former shale leases and the benefits of all plant developments for a consideration which was approved by the Treasury Department.

**Exhaustive Investigations.**—The proposals contained in the above application were investigated by the Commonwealth Government Fuel Adviser, Director of Substitute Fuels, Capital Issues, Control Board, Federal Government Actuary, and Director of Economic Co-ordination.

At positive variance with the expressed wish of the Prime Minister that "the Commonwealth Government is particularly anxious to see the shale oil industry developed as extensively as possible", the Director of Economic Co-ordination (Sir Ernest Fisk), during his

examination of the proposals, informed the company that: "It was considered desirable that the output of petrol be limited to 10,000,000 gallons per annum instead of 30,000,000 gallons as is proposed."

**Unhelpful Consent Given.**—On 22nd October, 1940, the Federal Government consented to the registration of Standard Oil Limited, subject to compliance with many stringent conditions imposed by the Treasurer. These onerous conditions completely nullified the value of the consent and, combined with the conditions governing excise remission, made it impossible to proceed with the proposals, the financing of which was unsuccessfully submitted by the sponsors of the company to most of Australia's recognized financial houses. The conditions to which objection was made were—

- (a) It was demanded that £1,500,000 of capital should be subscribed within 60 days of the registration of the prospectus.
- (b) First directors were to be approved by the Treasurer, but any major contract which committed the company to an actual or contingent expenditure of £10,000 or more was subject to the special approval of the Commonwealth Treasurer.

These were referred back to the Government for amendment on several occasions without success. Consequently, it was impossible to obtain the necessary finance and the consent had, perforce, to be allowed to lapse in October, 1941.

When consenting to the registration of Standard Oil Limited, the Treasurer (Hon. P. C. Spender) wrote—

After careful examination, the Government has decided to authorize the formation of a company along the lines set out in the above-mentioned application, subject to the certain special conditions which are embodied in the formal consent enclosed herewith. My consent to the proposed issue of shares is contingent upon all these conditions being fulfilled.

I desire to make it clear that the Commonwealth Government cannot be committed either directly or indirectly to render any assistance in connection with the formation or subsequent operations of the proposed company and the company must not expect any assistance or concessions from the Commonwealth other than such as are indicated in the Excise Tariff Proposals No. 2, which become effective on 21st day of August, 1940.

**Excise Remitted Subject to Impracticable Conditions.**—Without the remission of excise, any proposals for the local production of petrol from either coal or shale, when considered from an investor's viewpoint, would be quite uneconomical. Excise Tariff Proposal No. 2 granted certain excise remissions on such petrol as would be produced only by companies which could attain full-scale production on or before 21st August, 1942, and although this condition has since been modified, the relative position when, on 22nd October, 1940, the registration of Standard Oil Limited was authorized was anything but satisfactory to those approached in connection with the financing of the project. It was generally well-known that National Oil Proprietary Limited, after three years of endeavour, had not then succeeded in producing petrol from the Newnes shale field at the rate of even 1,500,000 gallons annually, despite the fact that governmental assistance had been lavished upon it. In order to qualify for remission of excise on the petrol to be produced from the Baerami field by Standard Oil Limited—which, even before it was incorporated, and notwithstanding the Government's promise that the company's proposals would receive the sympathetic consideration of the Commonwealth Government—was denied any form of governmental assistance—the terms of the consents required—in effect—that full-scale production, at the rate of 30,000,000 gallons per annum, should be attained within one year and ten months from the date of the

consent to finance. On 6th August, 1940, *Hansard* reports Sir Frederick Stewart, in the House of Representatives, as having said—

I am aware of the proposal to form a new company at Baerami. Indeed, it was largely because of the representations of that company that the Government recently decided to extend the principles of tariff protection, which has operated in respect of the Newnes deposits for several years, to cover all shale leases in Australia. By this means it is hoped that production will be encouraged and new companies formed to operate deposits of shale at Baerami and elsewhere.

**Third Production Proposal.**—16th October, 1941.—Having regard for Sir Ernest Fisk's statement that it was considered desirable for the company to limit the scale of its proposed petrol output, a proposal alternate to the company's major scheme of 30,000,000 gallons per annum was submitted, on 16th October, 1941, to the Federal Government for the production of an annual supply of 1,500,000 gallons of petrol and 1,000,000 gallons of fuel oil from the Baerami shale field. The capital involved was £75,000, the whole of which was to have been made available by essential users of petrol and the Jacomini-type retorting process was to be employed, requiring the supply of 1,000 tons of shale per week at the Baerami field. The proposed company—Shale Fuel Limited—could not commence to function until the following consents had been obtained:—(a) Consent by the Capital Issues Board to registration under National Security (Capital Issues) Regulations; (b) consent by the Division of Import Procurement for the importation of essential plant from America, under Customs (Import Licensing) Regulations. In considering the company's efforts to procure the above consents, it is interesting to bear in mind the fact that the Labour Government assumed office on 7th October, 1941.

**Registration Refused.**—With regard to (a), Senator the Honorable George McLeay, then Minister for Supply and Development, intimated to the company's representatives verbally, on 4th September, 1941, that in his opinion, no difficulty would be experienced in securing the necessary consent for registration from the Capital Issues Board.

On the 16th October, 1941, Mr. E. S. Wolfenden, chartered accountant (Australia), Sydney, submitted a formal application for such consent to the Capital Issues Board, but, under date the 4th November, 1941, the delegate of the Treasurer advised that approval could not be granted to the registration of the company, the proposal having been "submitted to the Department of Supply and Development which advised that it was not prepared to recommend any relaxation of existing conditions". In answer to a question in the House on the 20th November, 1941, by Mr. Spooner, the Supply Minister confirmed the attitude of his department towards the Baerami development by saying—

The honorable member is justified in considering that sufficient technical examination should have been made by this time of shale deposits at Baerami. The trouble in this instance is the question of a decision between the Baerami interests and the Capital Issues Advisory Board. The Department of Supply and Development has had something to do with that matter. A deputation from the Baerami interests was in Canberra last week, and a discussion between the three parties took place. I expected them to arrive at a final decision, but I am afraid that they did not.—(Ref. *Hansard*, No. 21 (20th November, 1941), page 637.)

With regard to (b), Senator McLeay stated, on the 13th August, 1941, that he would have the necessary items of plant imported from the United States under lend-lease. The Honorable E. J. Harrison, M.L.A., Minister for Trade and Customs, thereafter immediately set the machinery in motion to expedite the despatch of the plant from the United States of America. The company's representative interviewed Senator McLeay, Minister for Supply and Development, in Melbourne on the afternoon of Wednesday,

the 13th August, 1941. At this meeting there was submitted to the Minister a cable to the company from Mr. Jacomini, dated Los Angeles, the 4th August, 1941, as follows:—

Are finances available plant 30,000 gallons petrol weekly and will Government give their full co-operation? Must have immediate answer, as have been asked take important position in Federal Defense Administration of Oil Industry, which are duty bound accept, unless your Government considers my coming Australia build shale plants in best interest their war efforts.

It was explained to the Minister that the company for many years had retained, at considerable expense, the services of Mr. Jacomini as consulting petroleum technologist. This cable indicated that, unless the company acted promptly, it was likely to lose the benefits of this arrangement. The Minister immediately called Mr. A. C. Smith, of his department, to the conference and this cable was also read by him. Mr. Smith, in the Minister's presence, remarked: "I can quite understand a refinery engineer of Mr. Jacomini's calibre being sought by the government of his or any other country". The Minister then asked Mr. Smith what he knew of the Jacomini retorting process. Mr. Smith told the Minister that the department knew "quite a lot concerning very many different types of retorts, but, of them all, they were most favorably impressed with the Jacomini process". The Minister then definitely instructed Mr. Smith to do all in his power to get these people producing oil as quickly as possible" and stated he would hold Mr. Smith personally responsible for carrying out such instruction. The Minister authorized a reply being sent to the above cable in these words—

Government fully co-operating production petrol from indigenous materials. Expect early call from Clapp, Australian Representative, British Purchasing Commission.

Mr. A. C. Smith then drafted and had typed for signature by the company's representative a letter (16th August, 1941) to his Minister, requesting "the issue of an import certificate (defence priority) and, if possible, arrange for the plant and machinery to come in under the lend-lease scheme". Following Senator McLeay's undertaking, the company was officially advised on the 26th October, 1941, by the Division of Import Procurement, Sydney, that "a requisition had been lodged with the Australian Government Trade Commissioner in New York (Mr. F. B. Clapp) for procurement of the plant and equipment in question under lend-lease and that when advice of acceptance was received, the company would receive a further communication". Confirmation of this position is to be found in the following cables from Mr. Jacomini to the company:—

7th November, 1941.—"British Purchasing Commission informed me Baerami plant approved as eligible under our lend-lease and they requested specifications all material which am preparing."

18th November, 1941.—"Conferred Clapp has his approval my request obtain major plant equipment value about £30,000 under our lend-lease instrument. I have essentials thus greatly reducing your cash requirements and ensuring early completion. If you approve will include electric generator set thus materially reducing operating costs. Where will plant be located?"

4th December, 1941.—"Just talked Purchasing Commission New York. They calling Australia for authority procure major part of plant here according my specifications and recommendations which they now have. Please contact Government immediately to assure affirmative answer Commission cable."

**Plant Procurement Cancelled.**—The next advice received by the company from the Division of Import Procurement was dated Sydney, 8th March, 1942. This read—

I refer to previous correspondence in connection with the requisition placed in United States of America for a shale oil plant.

You are advised that it has been decided to take no further action to facilitate the procurement of this plant.

In connexion with this decision, the following cables, received by the company from Mr. Jacomini, are illuminating and speak for themselves:—

19th February, 1942.—"Purchasing Commission received cable 12th instructing cancellation procurement. This seems original in the light of developments in the Indies. We are starting manufacture essential apparatus this week. Contact Government and insist that they immediately withdraw cancellation so that we can proceed without further delay."

21st February, 1942.—"What action mine 16th. Cannot understand cancellation since procurement was under lend-lease without financial obligation to you. About 70,000 dollars essential material involved. Urge you have procurement reinstated immediately."

27th February, 1942.—"When expect Government decision reinstatement?"

Following these developments, strenuous efforts were made, unsuccessfully, to obtain any variation of these decisions, and this proposal also was finally abandoned.

**Prime Minister's Co-operation Sought.**—In view of the accentuation of the petrol supply problem, the company decided to approach the Prime Minister direct with a view to enlisting his personal co-operation. On 3rd January, 1942, a letter was accordingly sent to Mr. Curtin, wherein the company's technical ability and willingness to produce annually 25 per cent. of New South Wales's normal peace-time requirements of high-grade motor spirit was brought under his notice, together with other material facts. Mr. Curtin was asked to grant the company's representative the privilege of an interview thereon. Owing to pressure of business, Mr. Curtin was unable to arrange such interview and stated that he would take the matter of the company's representations up with the Minister for Supply and Development. On 24th January, 1942, the Prime Minister wrote, stating that he had consulted the Minister for Supply and Development on the matters referred to and was "satisfied that the operations of your company have not been impeded in any way by actions of the Commonwealth Government" and that "the company's every attempt to enter upon production was equally unsuccessful". Mr. Curtin's letter concluded: "It is understood that you have already discussed this matter fully with the Minister for Supply and Development". Further urgent representations were made to the Prime Minister, with the object of endeavouring to correct certain impressions on which he appeared to have formed conclusions at variance with the actual facts. As a result of these, the Prime Minister indicated by letter on 17th March, 1942, that, if the company would submit "a proposition for the production of oil and its distribution in a manner complying with the Commonwealth Government's policy" the proposal would "receive prompt consideration".

An unequivocal definition of the Government's policy in this regard was sought by the company from various quarters without success. Notwithstanding this, in view of the Prime Minister's invitation, it was considered expedient to formulate another proposal which would be practicable and, it was hoped, acceptable to the Government.

**Production for Cartel Companies Suggested.**—It should be here stated that representatives of the company were advised verbally in Canberra on 26th November, 1941, by Messrs. A. V. Smith and D. J. Nolan, officials of the Department of Supply and Development, that, if the company would apply to the Treasurer for permission to raise £75,000 to install plant at Denman, New South Wales, and make available the whole of the petrol produced to "cartel companies" at the price being offered—from time to time—for it by those companies, such an application would not be opposed by the Supply and Shipping Department. (The company's representatives herein referred to are myself and the

Honorable J. J. Graves, M.L.C. The latter may be contacted at Parliament House, Sydney, and he will corroborate this evidence if called upon to do so.) The departmental officials were informed that the estimated cost of producing petrol on the basis of a 30,000 gallons per week (1,500,000 gallons per annum) production was approximately 2s. per gallon. They stated the "cartel" was offering "about 1s. 8d. per gallon for petrol of an approved specification" and, when asked if they knew of anybody foolish enough to finance a petrol production scheme involving a guaranteed loss of 4d. per gallon, they replied, "Nobody". Repeated endeavours have unsuccessfully been made to obtain written confirmation of the foregoing. On 3rd December, 1941, Mr. Beasley wrote the company—

I refer to recent discussions you had with representatives of this department at Canberra regarding proposals by Shell Fuel Limited to raise £75,000 for the purpose of producing oil from shale at Berami. I desire to inform you that the Supply Department is not able to approve of the proposals placed before them in this connection.

No explanation as to why the department was unable to approve was given—

I am informed that the departmental proposal was not acceptable to you, whereby the Standard Oil Company of Australia Limited, of which you are the director, might apply directly for permission to raise £75,000 for the purpose of producing petrol from shale at Berami.

The Minister, on 2nd January, 1942, again wrote—

Production of oil would be subject to the same conditions as applied to Glen Davis.

Paragraphs 40 and 41 of the report relating to Newnes and Berami shale oil proposals by the Parliamentary Standing Committee on Public Works have since disclosed that the conditions upon which—"the same as apply to Glen Davis"—Mr. Beasley so generously offered to allow production by the company, are—

	Per gallon.
Production costs .. .. .	35.054
Price paid by cartel (say) .. .. .	23.000
Net loss .. .. .	12.054

The weighted average landed cost of imported petrol in all Australian capital cities on which the cartel's price is calculated is 18.7d. per gallon.

Fourth and Final Production Proposal—23rd June, 1942.—On the question of practicability, it was obvious that any scheme involving a large capitalization solely dependent upon public subscription would be ill-conceived. Bearing this in mind, the following proposal was eventually submitted to Mr. D. J. Nolan, Chairman, Allied Supply Council and Adviser to the Minister for Supply and Development, on 23rd June, 1942:—

- (1) Production weekly of 30,000 gallons (approximately 1,500,000 gallons annually) of petrol to a specification already approved by the Government's Fuel Adviser as being suitable for Australian requirements.
- (2) Jacomini-type retorting and treatment processes to be employed.
- (3) Plant to be installed in New South Wales, either at Denman (capital requirements £100,000) or at Berami (capital requirements £125,000).
- (4) (a) All petrol produced for the duration of the war and twelve months thereafter (or for a longer period if desired) to be delivered to the oil cartel, which consists of the major oil companies (which thus placing the product within the control of rationing, in conformity with the Department of Supply and Development's requirements), provided the

cartel was prepared to pay the company therefor 28d. per gallon f.o.r. Denman, or 26d. per gallon f.o.r. Sandy Hollow. These prices were based on existing conditions and were inclusive of excise of 4d. per gallon.

- (b) Alternatively, it was suggested that the Government, either Federal or State, or both, should purchase (during a similar period) the whole or such portion of the petrol produced as was not required by cartel companies, at net prices of 24d. per gallon f.o.r. Denman, or 22d. per gallon f.o.r. Sandy Hollow, exclusive of excise of 4d. per gallon.

Cartel price, ex pump at Muswellbrook (being the location of bulk fuel installations nearest to Denman and Sandy Hollow) depots, was, at the time the proposal was submitted, 33.6d. and was retailed at 36.6d. per gallon for petrol of a specification similar to that proposed to be produced—

- (c) It was further pointed out that the proposals, as submitted, if accepted by the Government, could be the nucleus of a petrol production scheme capable of being stepped up to a limit from the Berami field of 30,000,000 gallons per annum by direction of the Government.

Production Proposals Abandoned.—Mr. Nolan's reply (7th July, 1942) to this proposal was that he could see "no prospect of shipping space being made available for the importation of such plant and equipment as would be required . . .", and, on the 11th September, 1942, in reply to the company's further representations, he advised: "I have no further observations to make at this juncture with respect to the importation of plant referred to in your letter of 23rd June last". This final petrol production proposal, as were the three preceding ones submitted by the company to the Commonwealth Government, was also abandoned.

Development of Leases.—Having regard to the situation as disclosed above, it became imperative for the company to formulate and carry into effect alternative proposals for working and developing the Berami leases under, and as required by, the mining laws of New South Wales. These proposals were directed to the mining and sale of shale supplies to essential consumer groups for processing, so as to provide the fuel requirements of the members of such groups. Following representations by the Development and Information Bureau, Department of Labour and Industry, New South Wales, that the production of oil from shale—in conformity with the Federal Government's severely limited policy—in view of the expected deficiency in supplies, as a result of the Pacific situation, was most necessary and essential and was encouraged by the State Government, subject to control by the Capital Issues Board under National Security Regulations, the company agreed with the said department to make available to approved parties sufficient shale to ensure their individual requirements.

In pursuance of this arrangement, the company made firm offers to supply shale from its Berami mines to various "consumer groups" (within which category it was impossible for the company—being debarred by existing regulations—to function) then in process of formation, in conformity with the Commonwealth Government's policy. The business anticipated, however, did not materialize. The inexplicable apathy of essential consumers probably engendered by a disinclination to visualize the acuteness of the position regarding oil supplies in its proper perspective was, in the opinion of the Development and Information Bureau, mainly responsible, combined with inefficient

retort design in the majority of cases, for the company's very disappointing response to its efforts to facilitate operations in this regard.

Offer for Shale Leases.—On the 23rd April, 1942, the company received an offer from a Sydney group (Shale and Oil Products Co-operative Limited) interested in the production—in conformity with the Government's policy—of substitute fuel, to purchase the company's Berami leases, buildings erected thereon and plant. The group's offer was very carefully considered, and it was eventually deemed expedient and in the best interest of the company's shareholders to accept same. This decision was largely influenced by a letter, dated the 23rd April, 1942, from the Secretary of the Prime Minister's Department, in which it is stated—

There is no obligation on your part to submit a proposal to the Government but, under the mining laws of New South Wales, it is necessary to develop the leases.

Leases Disposed of.—On the 27th April, 1942, a formal agreement for sale was thereto concluded and such agreement was approved subsequently as was necessary under National Security (Economic Organization) Regulations by the delegate of the Treasurer of the Commonwealth. The consideration payable in connection with the sale was—(a) A small sum in cash on signing of contract; (b) a royalty per ton, payable monthly, on all shale mined from the leases. A copy of such agreement is tendered herewith—

Agreement made the 27th day of April One thousand nine hundred and forty two between the STRANBROOK OIL COMPANY or ASSOCIATED LIASONS a Company duly incorporated in the State of South Australia and registered as a foreign Company under the Companies' Act of the State of New South Wales (hereinafter called "Company") of the one part and SHALE AND OIL PRODUCTS CO-OPERATIVE LIMITED a Company duly incorporated under the Co-operation Acts 1923-1933 (hereinafter called "Society") of the other part whereby it is agreed as follows:—

1. The Company shall sell and the Society shall purchase—
  - (a) All those Shale and Coal Mining Leases numbered 905 to 908 and 921 and 923 (relating to the Company's Berami Oil Shale undertaking) situated in the Parishes of Carcoora, Hungerford and Mirrie County of Hunter in the said State belonging to the said Company;
  - (b) Such buildings erected thereon as belong to the said Company;
  - (c) Copies of all Survey Plans (mining and contour) relating to the said property;
  - (d) Copies of all Geological Reports by Messrs. Julius, Foels and Gibson, Consulting Engineers, relating to the said property;
  - (e) Copies of all other plans and written data belonging to the said property or to the winning of shale therefrom or to the extraction of oil from the said shale including all and sundry copies of all analyses of the said shale or oil and samples of oil extracted from the said shale;
  - (f) All plant, machinery and motor vehicles belonging to the said Company and used in connection with the said property, the principal items of which are set out in the Inventory hereunto attached.
2. The consideration payable by the Society to the Company in connection with the said sale shall be as follows:—
  - (a) The sum of Two thousand pounds, pounds representing the purchase money for items referred to in paragraph 1 (a) to (d) inclusive and pounds consideration for the purchase of items referred to in paragraph 1 (f) hereof;
  - (b) A royalty of Two shillings and six pence per ton on all oil yielding material comprising upper canal coal, intermediate canal coal, kerosene shale and lower canal coal mined by the Society its contractors agents or nominees successors and/or assigns and used in the production of oil or in any other way disposed of for profit (hereinafter referred to as "oil yielding material");
  - (c) The said sum of Two thousand pounds shall be paid upon the signing of this Agreement;

- (d) The said royalty of Two shillings and six pence per ton—

- (i) shall be paid monthly on the first day of each and every month or within seven days thereafter the first payment covering the period from the date of this agreement to the First day of June next being made on that date or within fourteen days thereafter;
- (ii) in respect of all oil yielding material mined and used or disposed of as aforesaid previous to the First day of November 1942 shall be based on the actual tonnage so mined and used or disposed of as aforesaid but on all such oil yielding material mined and used or disposed of after that date shall be based on a minimum output of two hundred tons of such material per week or on a tonnage actually mined used and disposed of whichever is the greater;
- (iii) the Society shall permit the Company's representative at all reasonable times to enter upon the Leases to determine whether mining operations are being conducted in compliance with the conditions of this clause;
- (iv) the Certificate of the Society's Auditor with regard to the quantity of oil yielding material mined and used or otherwise disposed of as aforesaid shall be final and conclusive subject to such Certificates being in agreement with the relevant annual return required by the Lessee to be lodged with the Department of Mines and being found by such Department to be correct.

3. The Company hereby warrants that—

- (a) The said plant and machinery referred to in paragraph 1 (f) hereof and in the Inventory attached hereto are its sole and absolute property and are not subject to any charge hire-purchase agreement or other encumbrance;
- (b) The said Coal and Shale Mining Leases—
  - (i) are registered in the books of the Mines Department in its name;
  - (ii) are not subject to any charge or encumbrance whatsoever;
  - (iii) are good valid and subsisting and that all rents and royalties have been duly paid and all labour and other conditions contained in the said Leases duly performed up to the date hereof;
  - (iv) are not liable to be taken in execution of any debts or liabilities due and owing by the said Company and that all amounts due for wages to the employees of the said Company, its contractors or others have been duly paid or if not paid will be paid by it out of the said amount of Two thousand pounds paid by the Society as aforesaid.

4. The Company shall on the signing of this agreement execute and deliver to the Society or its Solicitors:—

- (a) The said Coal and Shale Mining Leases, and
- (b) Transfers thereof to the Society in the proper form, such Transfers to be submitted to the Society and the Company and executed under the Common Seal of the Company.

5. Notwithstanding such Transfers and delivery of possession to the Society in accordance with the provisions of the next following clause if any imperfection appears in the title of the said Company to the said Leases or the said Plant or any of them or any part thereof or if the Company shall be unwilling to comply with any proper requisition or remove any objection which the Society shall be entitled to take to the title of the said Company thereto the said Society shall be entitled to transfer the said Leases to the said Company and to require the repayment of the said sum of Two thousand pounds paid by it to the said Company hereunder.

6. Possession of the said property so agreed to be purchased hereunder shall be given by the Company to the Society on the signing of this agreement and the Company shall be liable for all wages incurred up to and including the date hereof and the Society shall be liable for all wages which it may incur to any employees who shall be employed by it from and after the date hereof, but shall be under no further or other responsibility to employees of the Company.

7. All rates, taxes and other outgoings shall be adjusted between the Company and Society as from the date hereof.

8. Subject to the foregoing and so far as same are not inconsistent herewith the usual terms and conditions employed by the Real Estate Agents Institute of New South Wales in

the case of sale by private contract of leasehold property shall apply to this agreement as if the same were incorporated herein.

9. In the event of the Company, its successors or subsidiaries present or future, obtaining permission from the Federal Government to install Jacomini type processing plant the Society shall permit its contractors or any contractor appointed by the Company if approved by the Society to mine and supply the yielding material to the Company at cost plus ten per cent. after providing for the Society's own actual and immediate requirements.

10. Subject to the last foregoing clause the Society shall appoint the Company the Society's sole selling agent for the sale of supplies of oil yielding material from the said Leases to any person corporation or Society to whom the Commonwealth's consent has been given to produce substitute fuel in accordance with Government regulations such supplies being mined and made available by the Society to the purchaser at a price to be determined by the Society and the Company's agency commission in respect of sales hereunder to be one shilling per ton payable monthly in addition to the royalty herein provided for.

11. The Society shall pay all rents and other outgoings and perform and observe all the conditions covenants and agreements contained in the said Leases as from the date hereof.

12. If the Society abandons mining or royalty as hereinbefore provided or falls into arrears for a period of six months the Society shall re-transfer the Leases to the Company without cost to the Company.

13. Any obligations undertaken hereunder by the said Society shall be suspended during any period that mining or use of mined material may be prevented by strike, lock-out, war conditions or any cause beyond the control of the Society and the minimum royalty which may be payable hereunder shall be apportioned so as to relieve the Society from any such payment during any period of cessation of mining or use arising from any such cause.

14. The Company shall take all steps necessary to comply with the National Security (Economic) Regulations and any other Regulations prohibiting the sale or transfer of property. As witness the execution hereof the day and year first before written.

Signed for and on behalf of } For and on behalf of the  
Standard Oil Company } Standard Oil Company of  
of Australia Limited Inc } Australia Limited,  
of the presence of—

(Sgd.) ALEC. J. MALCOLMSON, (Sgd.) J. H. MOATE,  
Solicitor, Sydney. Managing Director and  
Attorney.

Signed for and on behalf of } For and on behalf of Shale and  
Shale and Oil Products Co- } Oil Products Co-operative  
operative Limited in the } Limited,  
presence of—

(Sgd.) LEBYARD COOPER, (Sgd.) W. L. ROBERTS,  
Solicitor, Sydney. Chairman of Directors.

Memorandum whereby the undersigned states that he has no notice of the revocation of the Power of Attorney under the authority of which he has just executed the above Agreement.

Signed at Sydney the 27th day of April, 1942.

Witness:  
(Sgd.) ALEC. J. MALCOLMSON, (Sgd.) J. H. MOATE,  
Solicitor, Sydney.

Conclusion.—The foregoing evidence discloses what has been done by my company—(a) to prove the resources of the Baerami shale deposit; (b) to develop a suitable retorting process to economically treat the vast quantities of oil-bearing material contained in them; and (c) to endeavour to secure the support of a succession of governments to implement various proposals evolved by us to establish the industry on a sound economic basis at Baerami, all of which—had such support been given—could have been effected years ago.

In my opinion what should be done for the development of this field is the immediate implementation of the proposals submitted to the Federal Government by the United States mission to Australia on shale oil and referred to Parliament by the Minister for Supply and Shipping on the 16th February, 1943. Considering that the United States mission's proposals were undoubtedly evolved and submitted "in the interest of the United Nations' war effort and the performance of certain duties for the United States Foreign Petroleum

Policy Committee" by such experts as Messrs. V. Y. Jacomini, H. S. Ball and H. F. J. Hobley, I feel that it would be presumptuous for me to suggest other than that they should be immediately adopted if Australia is desirous of successfully establishing an oil industry.

As being of possible interest to your Committee, I would like to make the following comparison.—The result of experience in the production of petroleum over many years of operation in the United States has established that the average petroleum sands developed in that country can be made to yield an average of 13,500 barrels of crude oil per acre. The evidence submitted herein indicates that at least 1,973 acres of shale lands at Baerami can be made to yield an average of 10,500 barrels (42 gallons) of crude oil per acre. It is generally known that these experienced in the production of petroleum that the drilling of one well to each 5 acres of normal producing sands is necessary. Consequently, to recover from a petroleum field the amount of oil which it is estimated is contained in the oil shales of the Baerami field would necessitate the drilling of 395 production wells at an average drilling cost of £7,000 per well. Therefore, the cost of drilling production wells to recover such oil would amount to £2,765,000. To this figure it would be necessary to add the cost of production tanks, field storage plants, gathering lines, gas traps, surface pumping equipment or pumping equipment that goes into the wells, such as tubing, rods and pumping barrels. These items in total will average at least £1,500 per well, which means an additional £600,000 odd. There would be some flush (or gusher) production at first, which would thus have a cheaper production cost, but most of the production would cost about 2s. per barrel, which is composed of maintenance, labour, repairs, replacements, etc. The buyer of the crude oil produced from flowing wells is the refinery company that has a capital investment in refinery equipment running into millions of pounds that would be added to the totals already mentioned. This comparison, therefore, very clearly shows how far the development of the Baerami shale field is justified.

In tendering Messrs. Julius, Poole and Gibson's complete report, dated the 6th February, 1940, to the Committee, I also submit photographs of the Renco retort tested at Houston, Texas, and the Renco test retort erected at Newcastle. The Committee will see that the former was quite a baby. Mr. Rogers considered that this retort, which was designed for a throughput of 10 tons a day, could not be stepped up in one step to a commercial unit of 350 tons a day as proposed by Mr. Jacomini. At the time the Newcastle test was being arranged, I cabled to Mr. Jacomini—

Regardless of Gibson's evidence Rogers maintains increase 25 to 500 tons impracticable in one step. Believe he so informed the Government.

Mr. Rogers said that if Mr. Jacomini stepped it up to something bigger than 10 tons and this proved satisfactory he would be inclined to accept that Mr. Jacomini could step it up to 350 tons a day throughout. That 10-ton retort had an internal diameter of 9 in. and operated at rates up to 24 tons a day. The Renco retort erected at Newcastle had an internal diameter of 2 ft. 9 in. and operated at rates up to 79.5 tons a day. The commercial units of 350 tons a day will be designed with an internal diameter of only 6 ft. 6 in. The retort proper at Newcastle is 28 ft. long with an average internal diameter of 2 ft. 9 in., and it handled comfortably 75 tons a day. The application of heat under pressure is the secret of the success of this type of retort.

78. To Mr. Harrison.—In reply to the cable I sent, Mr. Jacomini advised that the 10-ton retort would be ready to test Baerami shale upon arrival. I told that

to Mr. Rogers and he said he would not agree that the 10-ton retort could be stepped up in one step to 350 tons a day. I should like to explain that we wanted Mr. Jacomini to bring the Houston retort, which was designed to handle 10 tons, to Newcastle in order to demonstrate its operation to Mr. Rogers; but Mr. Rogers said that it was too small and would not satisfy him. Mr. Jacomini then agreed to make tests at Newcastle as planned, except to increase the capacity of the plant to approximately 75 tons daily; and it was for that capacity that the retort tested at Newcastle was designed and operated.

79. To the Chairman.—The difference of £25,000 between the capital required to install plant at Denman and at Baerami was due to the fact that electric power is available at Denman but not at Baerami.

80. To Mr. Harrison.—When I was dealing with the development of leases you asked me whether our proposal would not have conflicted with the rationing of petrol as laid down by the Federal Government. My understanding of the Government's policy with respect to shale oil production is that a number of people can form a group for the purpose of producing from shale their own requirements of petrol, provided they are classified as essential users.

81. To Senator Lamp.—You say that the Petros ice cream people do it. They are permitted to produce fuel for their own purposes. I pointed out that it was impossible for our company to come within that category. It was suggested that we produce petrol for the benefit of cartel companies or not at all, because if our company entered upon production it could only do so by producing the petrol requirements of those members of our company who may be deemed essential users by the Liquid Fuel Control Board in New South Wales.

82. To Sir Frederick Stewart.—The Sydney group, Shale and Oil Products Co-operative Limited, were an entirely distinct body from our company. The principal shareholders of that society are Tooth's and Toohy's Breweries, Grace Brothers, The Electric Light and Power Supply Corporation, Tancered, the meat people, and people like that. All of them have been approved as essential consumers by the Liquid Fuel Control Board. I stated previously that the £75,000 capital required to produce 30,000 gallons a week was to have been provided by essential users. As a matter of fact, the interests which subsequently formed and became Shale and Oil Products Co-operative Limited had promised to provide that capital to install a Jacomini process at Denman had the necessary permission been given.

83. To the Chairman.—The material retorted at Newcastle was selected only to this extent: it was carefully picked; it was blended so as to be representative of the average seam conditions which it was determined would be experienced over the entire field. Had we put run of the mine material from the face in any of those tunnels at Baerami through the retort for testing purposes at Newcastle, we would have got very much more oil per ton than we did; but that would have been misleading to us. I should like to stress the thoroughness with which these tests were conducted. This graph, entitled "Schedule of retortable shales—details" which I now show the Committee, reveals the amazing accuracy with which all estimates were borne out in actual operation. None of the band of sandstone in the seams was used in those tests. When the members of the Committee visit Baerami they will note a sandstone roof about 20 ft. in thickness. Underneath that is 11 in. of bituminous coal, and adhering to that is 4.7 in. of sandstone. That sandstone is frozen on to the bituminous coal. However, the sandstone would not mix with the ordinary retortable material because it has to go through a primary and a secondary crusher

before it reaches the Jacomini retort, and the sandstone would blow out on the conveyor belt after being pulverized in the crusher. When it goes through the crusher and dries it blows away as dust—that is, the clay and sandstone. Mr. Jacomini wants to mine the whole lot. There is no machinery at Baerami to-day. I suggest that the best way the Committee can get at the facts in this matter would be to arrange for the subject to be debated by the government officers and representatives of Julius, Poole and Gibson. You ask me why in view of my company's capital and its prestige we were unable to exploit the possibilities of the field while we held the leases. I think that we did that. We expended £80,000 of our capital, and as the result of that expenditure we obtained all the data which Messrs. Julius, Poole and Gibson and other experts considered necessary to support the company's request for a remission of excise duty and for permission to finance a commercial undertaking. We estimate the cost of mining of the material landed in the crusher bins at 14s. a ton maximum.

84. To Mr. Harrison.—I believe it would be possible for private enterprise to develop Baerami without any government assistance apart from the remission of excise duty, particularly if the Government would allow American capital to be included in the private company that could be formed to develop the field. However, I do not think we would succeed if we were obliged to ask only Australian people to finance the venture as a private undertaking. The fact that the Glen Davis undertaking has been so heavily subsidized by the Commonwealth Government has set rather a bad precedent, and if anybody approached the Australian investing public with a shale oil proposition without any Federal Government financial participation, the Australian public would immediately think that it was not good because the Government was not subsidizing the proposition. The Australian public would always have in mind the tremendous amount of assistance which the Commonwealth Government has made to Glen Davis. On the other hand the American investor, particularly with respect to oil, has a psychology different from that of the Australian. The American investor has a better understanding of oil ventures. When I say that private enterprise could undertake the development of Baerami without government assistance I should like to stipulate that the Government consent to 60 per cent. of the capital being American capital and 40 per cent. Australian capital. On that basis the venture could be financed without any financial assistance from the Commonwealth Government. Up to date outside finance has been excluded to a large degree, and that has been the main obstacle in the financing of this venture. I cannot see any possibility of the necessary finance being raised unless we are allowed to obtain the major portion of our capital from outside. I feel that the influence of major oil interests has tended to retard the venture. I have no evidence to support that statement. However, the fact that National Oil Proprietary Limited contracted their entire output of petrol to major oil interests at a price 2s. below production costs surely indicates the control which major oil interests are able to exercise in Australia. You ask me how that squares with my earlier statement that American capital would be interested in the development of the Baerami field. My answer is that there are many independent oil operators outside the ring even in America.

85. To Sir Frederick Stewart.—You ask me to explain the wide disparity between the estimated cost of production of 18. 04d. a gallon given by Mr. Gibson and the figure of 2s. a gallon on lesser production which I have given in my statement. Mr. Gibson's figure is on the basis of a production at the rate of 30,000,000 gallons a year. On that basis I have given

our net estimated cost of production at 9.8d. a gallon, Mr. Gibson's figures of 1s. 0½d. a gallon provided for a return of between 5 per cent. and 10 per cent. on a capital of £2,500,000, but on a production of 30,000 gallons a week, that is, 1,500,000 gallons a year, the production cost would soar to something like 2s. a gallon. You say that many important items of cost would not vary greatly in relation to the two figures given for total production. I point out that the plant was to be installed at Demman, and that meant transporting the shale by road a distance of 35 miles. That added considerably to the cost per gallon, because the road freight would have been 15s. a ton. Further, it was a hand mining scheme as against mechanized mining for the production of 30,000,000 gallons a year. The agreement set out in my statement between the Standard Oil Company of Australia Limited and Shale and Oil Products Co-operative Limited has actually been effected. Under that agreement any development of Baerami in the future would not be merely a matter of the Standard Oil Company of Australia Limited collecting royalties as a landlord. On that point I refer to clause 9 of the agreement. The society would be limited to an amount adequate to their own individual needs, and after that the Standard Oil Company of Australia Limited would still have the right to develop Baerami. All that the society wishes to ensure is the provision of their own shale requirements. Approximately £125,000 is the subscribed capital of Standard Oil Company of Australia Limited, and of that amount approximately £50,000 has been expended on the development of Baerami. The agreement contemplates a royalty of 2s. 6d. a ton, that is a halfpenny a gallon of crude oil. You ask me what was my purpose in analysing the cost of obtaining flow oil in the final paragraph of my statement. The Commonwealth Government is continuing to assist in the search for petroleum oil. I made that comparison because I feel that the Government should realize that it has an oil field at Baerami without looking for something which I do not believe exists in Australia. As you say, the suggestion is that even if they find flow oil it will cost as much to bring it to the surface as it will cost to develop shale. In that respect I refer solely to capital cost; and I also emphasize the productivity of oil sands as compared with Baerami shale. You ask me how, if the prospects at Baerami are so alluring, I can account for the serious failure at Glen Davis. I think that the retorts and planned production rates are the chief causes of the failure at Glen Davis.

86. *To the Chairman.*—I do not think that the fact that 9 inches of clay is going through the retorts at Glen Davis would have anything to do with the lessening of the production of oil per ton. With the type of retort employed at Glen Davis I think that that type of clay would be of assistance. With that type of retort the rich oil content of the shale would really be an embarrassment. It would tend to burn out the retort.

87. *To Senator Lamp.*—We say that the Renco retort is the answer to the disabilities confronting the shale oil industry in Australia. In that we are backed by the opinion of Messrs Julius, Poole and Gibson. In addition, the scale of production also has a very important bearing on the matter, quite apart from retorting and refining. When Mr. Jacomini first came to Australia in 1937 he was satisfied that there were vast deposits of rich oil shale in Australia, and he went to work in an endeavour to find out why previous attempts to establish the industry here had failed. He found that quite apart from inefficient retort design the main cause of failure so far in Australia has been that the problem has been tackled on too small a scale. Sir Frederick Stewart has drawn me out in respect of the cost of pro-

duction on a different annual output. Perhaps, if we were able to turn out 100,000,000 gallons a year we might get our costs as low as 4d. a gallon. I believe that when Glen Davis gets its production up to 30,000,000 gallons a year its costs will come down very considerably.

88. *To Sir Frederick Stewart.*—You say that in spite of my earlier statement the agreement I have set out represents a complete sell-out by Standard Oil Company of Australia Limited to Shale and Oil Products Co-operative Limited. The society would only deal with us on those conditions. I wanted to get control of the whole thing, and it now has that control. Apparently, I was under some misapprehension with regard to your earlier question on this matter. I now agree that the agreement represents a complete sell-out to Shale and Oil Products Co-operative Limited. They can take all the shale they want. At the same time, however, they would hand back those leases to us for major development at any time provided we made available to them their requirements of shale. As you say, this is a direct sale. You say that if Baerami is developed to a production of 4,000 tons a week Standard Oil Company of Australia Limited would be entitled to royalties at the rate of £500 a week, on an investment of £30,000. I point out that the effect of the agreement between National Oil Proprietary Limited and the major oil companies allows the latter to make about 2s. a gallon of petrol whereas we are asking for a royalty of 4d. a gallon on crude oil. If Baerami is developed to a production of 30,000,000 gallons a year, Standard Oil Company of Australia Limited would, in terms of its agreement with Shale and Oil Products Co-operative Limited, be entitled to receive a royalty of £100,000 a year. The minimum basis on which the venture should be tackled should be on a production of 30,000,000 gallons a year.

89. *To Mr. Conlan.*—That would reduce the life of the leases. The life of the field cannot be determined yet. With respect to statements made before the Committee yesterday by Mr. Kenny, I point out that when we first went to Baerami the Mines Department would admit that there was only 1,000,000 tons of shale on those leases. After we undertook some development on the field the Mines Department gave us another report in which they said there was 6,178,000 tons of shale on the field; and the latest report by that department is that made by Mr. Mulholland. He was up there after we had done further developmental work, and he now says that there is 10,615,000 tons of shale on the field.

90. *To Mr. Mulcahy.*—Professor Cotton determined the tonnage of the shale on an ash content. They sampled the outcrops after driving so as to get beyond the influence of weathering. They made approximate analyses of that and in that way identified that seam as being one vast seam, without the need to drill or drive tunnels. The estimate was made simply by sampling on the outcrops. You say that that is pretty rough guesswork. Professor Cotton definitely believes that the Baerami seam is a saucer-shaped lake. That has been confirmed by the work we have done, because the shale seam thickens as we drive in from the edge of the saucer. Even the Mines Department reported that the seam would be thicker in a southerly direction. The Baerami leases contain 12,000,000 tons of shale. The Baerami field, we believe, contains 20,000,000 tons of shale.

91. *To Mr. Harrison.*—We believe that all that could be worked economically.

The witness withdrew.

Gilbert B. Howarth, M.Sc., Fuel Technologist, Department of Mines, New South Wales, sworn and examined.

92. *To the Chairman.*—I have not myself made any tests of the shale from Baerami. That has been done by analysts attached to the Geological Survey Branch of the Mines Department. I understand that part of the shale seam at Baerami is of high quality, while other parts are of low quality. Before one could make any decision regarding the quality of material it would be necessary to know which part of the seam was to be mined, or whether it was all to be mined.

The value of laboratory tests depends entirely on the manner in which samples are taken. Before assessing the value of such tests it is necessary to know whether the material tested was taken from a selected part of the seam, or whether it purports to represent the whole of the seam to be mined. Any foreign material mixed with the shale will naturally reduce the output of useful oil, whether in a laboratory test or in a full-sized retort. I am not aware of any difficulties arising from the inherent qualities of New South Wales shale. The difficulties that I have heard of in connexion with the retorting of New South Wales shale arise, not from any properties of the shale itself, but from the methods by which the retorts are operated.

I am familiar with the Pumphreton retort as used generally in Scotland. It is a very successful retort which has gained considerable repute in that country, and has been used very successfully over a long period. I am satisfied that, used with New South Wales shale, it would give an equal output of oil per retort per day. I have not seen the Renco retort. I am of the opinion that, under present conditions, petrol produced from shale is likely to be more costly than imported petrol, but such costs are bound up with economic conditions and import duties. Those factors may change to an unforeseen extent at any time in the future. I know that there are considerable deposits of kerogen shale in New South Wales, but it would appear, from the latest information that has reached me, that they would be sufficient to satisfy Australia's peace-time requirements of petrol for only a very short period. I think it is essential that experiments should be made in order to determine the extent of our shale deposits, and to learn which is the best kind of retort and the best way to work it.

93. *To Senator Aylett.*—The Pumphreton retort as used in Scotland normally operates quite successfully with an output of 100 gallons per retort per day. I am certain that a greater output than that could be obtained from Glen Davis shale. I want to make it clear that the capacity and capability of a shale retort are to be judged by the amount of gases and vapours that pass through it, and not by the amount of shale soap, dirt, or other materials put through it from the top.

94. *To Mr. Harrison.*—The retorts used at Glen Davis are Pumphreton retorts, which have been modified in various ways, and they are being operated so as to give an output of oil very considerably in excess of that which was found to be the most suitable output in Scotland.

The original Pumphreton retort did not fail to produce the necessary amount of oil. It was operated at Newnes many years ago, and produced 130 gallons per retort per day, which was greater than the quantity normally obtained in Scotland. No retort will extract all the oil from shale, but it may be accepted that if the Pumphreton retort were operated at a rate of not more than 100 gallons per retort per day the yield of oil would be a very satisfactory percentage of the amount of oil

available from the shale. If you increase the size of the retort you are then, in effect, dealing with a new retort altogether, and it is difficult to foretell what would be the effect on its efficiency. With some kinds of retort you could increase the size without loss of efficiency, but I would not say that that applies in the case of the Pumphreton retort. A pilot plant cannot be used blindly as a sure indication of the result that will be obtained from a larger installation. Nevertheless, it can afford valuable information that would be useful in the designing of a large-sized plant.

95. *To Mr. Mulcahy.*—In my opinion the extraction of oil from coal offers very much better prospects for the development of a national industry than does the extraction of oil from shale. Tests have been made in England for the production of oil from coal on a large scale, but the Greta coal in Australia is entirely different from anything in England. We can benefit from English experience, but it is still necessary to make our own experiments here.

96. *To Senator Lamp.*—I do not know for certain why the Pumphreton retorts at Newnes were modified, but I believe it was because some people got the idea that if you are dealing with a shale that contains four times as much oil as some other kind you should be able to get four times as much oil out of a retort in the same time. In the light of that impression it can be understood that the brought-in from the Pumphreton retort would be regarded as unsatisfactory. I believe that all the modifications made at Newnes in the old days were undertaken with the object of forcing the retorts to give more oil than they had ever been expected to give in Scotland. It is my opinion that if more retorts had been installed in the first place, and they had been operated at the same capacity as in Scotland, no difficulties would have occurred. We should never have heard of the Fall retort, and a great many of the troubles encountered at Glen Davis would have been avoided. When the Pumphreton retort is operated properly there is surprisingly little waste, and a large percentage of the oil is recovered. Only a certain amount of carbonaceous material and ash would remain. The carbonaceous material burns inside the retort, and provides the internal heating necessary for proper working. If the retorts are worked so as to give only the output for which they are designed, there need be no trouble from dust clogging the condensers. The mechanical devices used at Newnes to control and remove dust are not needed in Scotland, where the retorts are operated at a lower rate.

97. *To Sir Frederick Stewart.*—It might be possible to put an increased quantity of rich shale through the retort, but it could be done only at the cost of a loss of efficiency. Oil would be wasted, and there would be overheating. In my opinion, that is what happened at Newnes.

98. *To Senator Lamp.*—The information supplied to me three years ago regarding the quantities of shale handled at Glen Davis was extremely vague. Certain figures were given to me at the works, and an entirely different set of figures was given to me at the head office. Clearly, there had been no effective stock-taking, and had the figures referred to pounds, shillings and pence instead of tons of shale no auditor would have passed them.

I am not attracted by the idea of using finely ground shale as bitumen. Shale does not contain oil or oily substances. They are formed by the heating of the shale, and until it is heated they do not exist. On the other hand, bitumen taken from the ground actually contains the oily substances. I should say that fine shale could be regarded as no better than blue metal



for road-making purposes. I agree that fine shale ought to be used, and if the retorts were operated at a reasonable rate there would be no difficulty in using a considerable part of it. Alternatively, there are some kinds of retort which can operate on fine shale without disadvantage. At Glen Davis, tests should be made with retorts particularly suited for fine shale.

99. *To Mr. Conlan.*—I have studied this work all my life, and can be regarded as an expert. I will not go so far as to say there are no difficulties associated with the retorting of high-grade shale as compared with low-grade shale; but I do say that high-grade shale, as such, introduces no difficulty in retorting provided you keep the output within the limits for which the retort was designed. The richness of the shale creates no difficulties if the retort is not overloaded. A large retort would naturally take more shale than a small one, but if it is of a different type the increased quantities taken would not necessarily be in proportion to the size.

The only value of adding inert bodies to the shale being retorted is to reduce the output of oil from the retort, and bring it within reasonable limits. That can be done equally well by feeding in less shale. The way to get more oil is to install more retorts. If you stick to the Pumphreston kind of retort you must keep the output down to the prescribed limit. In other words, you must put the meter on the output and not on the intake.

In 1936 two men, Mr. Crichton, general manager of Scottish Oils, and Mr. Conacher, works manager for that company, came from Scotland to advise the Newnes Investigation Committee, and their advice was that more retorts should be used. In my comment on their report I made these remarks:

The Committee's scheme is based on the assumption that the retorts at Glen Davis with reasonable repairs, are capable of operating satisfactorily with a shale throughput of five tons a day. Messrs. Crichton and Conacher are emphatically of the opinion that such a throughput can be obtained only by sacrificing smoothness of working and accepting heavy wear and tear on the retorts, and that costs for operation and maintenance of the retorts, and that the retort plant has been badly damaged by improper operation and unsatisfactory temperature control. I am entirely in accord with the Crichton-Conacher report in this respect. My own brief visit to Newnes gave me the impression that much effort to overcome difficulties that would never have arisen if the plant had been operated in a proper manner at the outset with due knowledge of the fundamental principles involved.

I am the fuel technologist in the Department of Mines, and Mr. Kenny and Mr. Mulholland are geologists employed in the same department. I would not attempt to give evidence on a geological point, and I do not think that they would deliberately give evidence on matters affecting retorting, which is something outside their province. If they made statements on the subject before this Committee, they probably did so in the course of examination.

100. *To Sir Frederick Stewart.*—The retorts at Glen Davis are a modification of those used by Fell at Newnes, which were themselves a modification of the Pumphreston retort. Many people have had a go at them, and they were not at all qualified. It is many years since the Pumphreston retort was designed, and although there have been developments since then, the general principles remain the same.

101. *To Senator Lamp.*—If the retort is worked with the proper flow of gases and vapours through the retort, you will not build up that high pressure which causes the gases to leak out of the top. The problem of high pressure cannot be solved by installing more outlets to the retort, because it is created by the inability to pass the steam and the gases, &c., through the retort itself. I do not believe that the Fell retort has any advantage over the other retorts tried out

at Glen Davis. They can all be worked with reasonable satisfaction at a proper output. This brings us back to the recommendation of Messrs. Crichton and Conacher that the number of retorts to be used should be increased. They recognized that the capital cost involved in installing the extra number of retorts recommended would be greater than for the Fell retort, but they maintained that operating and maintenance costs would be so reduced as to effect an overall economy. Their report was available from 1935 onwards, but it was not acted upon.

102. *To the Chairman.*—I believe that a considerable quantity of oil and carbonaceous material is left in the residue in the retorts at Glen Davis, but if the retorts were properly operated that would not occur. The presence of sandstone mixed with the shale would not substantially affect the quantity of oil recovered. Some of the oil otherwise left in the shale residue would be found in the accompanying sandstone, but the total amount would not differ greatly. I agree that from a purely retorting point of view it would be much better to treat pure shale, but against that it is often found to be more economical to mine a broad band containing good and bad than to mine a narrow strip only 1 ft. in thickness. I understand that the Renco retort operates under high pressure, so that it is possible to pass gas through the retort at a greater rate than if the retort were operating at atmospheric pressure. That being so, it is possible that the Renco retort can handle greater quantities of shale a day than other retorts of the same size. However, I understand that during the tests at Newnes it was found that, when the through-put exceeded a certain quantity, efficiency was great—put reduced, and I think that is typical of any retort. There are many reasons why I would prefer to see the establishment of an industry for the extraction of oil from coal rather than from shale. The supply of coal is vastly greater; it occurs in forms in which it can be more readily mined, particularly with machinery; the Greta coal produces a very substantial yield of tar and oil, greater than that obtained from any coal seam in Great Britain that I know of; when you recover the oil from shale you are left with a useless material, but when you take the oil from coal there remains a material which is as valuable as the original coal. I refer to what is called semi-coke, or low-temperature coke, which is nothing like the coke produced at the coke-works. It is a much more desirable material, and in England fetches a higher price on the open market. A great number of valuable chemicals can be made from tar, but the processes are elaborate and costly, and I do not think we should count on them in the early stages. If considered desirable, dyes could be obtained from the tar in the course of refining. Naphthalene is not a desirable constituent in tar, and its production is generally avoided. I have not seen a Fischer-Tropsch plant in operation in England for the treatment of coals. It is hard to decide between several alternative processes for the extraction of oil from coal. Before making a decision it would be necessary to know the conditions under which the plant is to work. The best solution would be a combination of several processes. It is necessary to think in big figures when contemplating the establishment of an oil-from-coal industry. The capital involved ought not to be less than £2,000,000 and it might be eventually as much as £50,000,000. The only people who know anything about the cost of the Billingham plant in England are Imperial Chemical Industries Limited. Their plant was developed gradually from one already in existence. On several occasions consignments of coal have been sent to England to be tested at the Fuel Research Station. Such a test in 1934 showed that the coal gave

an unusually high yield. Immediately before the outbreak of this war I took a consignment of 40 tons of New South Wales coal to England and put it through a number of tests on a larger scale. The results showed that the coal compared extraordinarily well with anything available in England. In fact, Greta coal can yield nearly 100 per cent. more tar than the usual English gas coal. I am very disappointed that Australia has made no serious attempt to establish an industry for the manufacture of oil from coal.

103. *To Senator Ajiell.*—If it is proposed to use the hydrogenation process or the Fischer-Tropsch process it does not matter much what type of coal is used, but with the carbonization process the best results are obtained from Greta coal.

104. *To the Chairman.*—It is most unfortunate that Greta coal is being used for purely combustion purposes when its greatest value lies in its being used as a source of gas and oil.

The witness withdrew.

John Henry McKinlay Moate, recalled and further examined.

105. *To Senator Lamp.*—The Standard Oil Company of Australia Limited is not interested in the Latrobe field. That is the concern of the Adelaide Oil Exploration Company Limited. We are not doing anything in the way of obtaining an amalgamation of the leases, and we have made no move since 1937 to proceed with the development of the field. As I said this morning, we would prefer to develop the Latrobe field before that at Baerami, because, although oil yields are lower, working costs would also be lower. We own the freehold of 714 acres in Tasmania which Mr. Rogers, the Commonwealth Fuel Adviser, estimated to contain 4,200,000 tons of shale. That would be sufficient to start the industry, but not to carry it on. I do not agree that it is the duty of the patentee of the Renco retort, Mr. Jacomini, to demonstrate it at his own expense. He is quite satisfied that no further experimentation is necessary, but Mr. Rogers wanted to see it demonstrated before he would accept our statement that it was all we claimed for it. He also wanted the tests to be conducted on a much larger unit than had been used in America. Mr. Jacomini said that if the Government wanted more experiments it should pay for them. Our company paid Mr. Jacomini a little over £21,000 for the development of the retort, for his engineering advice and for his supervision. This is provided for the supply and erection by Mr. Jacomini of a commercial unit, and its operation for six months.

106. *To the Chairman.*—The report of Mr. Kenneth A. Wright, dated 14th March, 1938, concludes with these words:

The deposits are located in an area and occur in such a manner as to make them accessible without undue expenditure and there is sufficient coal present for all fuel purposes.

This referred to the layer of coal over the shale seam at Baerami. Julius, Poole and Gibson took two samples and sent them for examination to Babcock and Wilcox Limited, which reported as follows:—

Neal's Tunnel: Two samples of coal were taken at the then face, which was still partially weathered material, and referred by Julius, Poole and Gibson on 10th November, 1940, to Babcock and Wilcox Limited for testing purposes. The report is dated 6th December, 1940, and states that this sample has a calorific value of 9,720 B.T.U. per lb. Widen No. 2 Tunnel: This sample was also taken from the face of the tunnel, which was then beyond the weathered zone, and consequently more indicative of the coal value. The calorific value was determined at 10,975 B.T.U. per lb. The report of Babcock and Wilcox Limited to Julius, Poole and Gibson states that there are no insurmountable difficulties in boiler design for burning this coal.

Thus, Baerami would enjoy an advantage over Glen Davis in the matter of fuel, because the coal would be mined automatically with the shale. Alternatively, it could be propped up and dropped when needed. My company does not hold any interest in shale deposits in any other part of New South Wales, but an associated company holds interests in Tasmania. Mr. Gibson is employed by our company purely as a consulting engineer. Mr. Jacomini has no financial interest in my company. I am convinced that the deposits at Baerami can be worked satisfactorily.

107. *To Mr. Conlan.*—I think that my present share interests in the company amounts to about 395 fully paid-up £10 shares. I am not certain of the exact number because I buy more shares whenever I can afford to do so. I have never been to Glen Davis, but the published figures regarding the yield per ton indicate that there must be still about 40 per cent. of the oil left in the shale after treatment. I do not think that sandstone in the retort would absorb oil, but a little would be absorbed by clay and other foreign substances of the kind. It would be better, therefore, to clean the shale before retorting it, provided the extra oil gained was sufficient to offset the cost of the operation.

108. *To Sir Frederick Stewart.*—Any further development at Baerami must be in accordance with the agreement between our company and the company which at present holds the leases. It is estimated that if the deposits were worked to their full capacity 3,200 tons of shale would be mined per day. The agreement provided that our company should be paid £2,000 for its physical assets. We are to receive in addition a royalty of 2s. 6d. per ton on all material mined and treated. In addition, the agreement provides that our company shall act as sole selling agents for all shale sold, and that our company shall collect for a commission of 1s. a ton on it. Up to the present, however, our income from this latter source has amounted to less than £15. It is true that, under the terms of this agreement, our company, for a capital expenditure of £80,000, would receive a return of £100,000 a year if the deposits were worked to full production, but I remind the Committee that this represents only a gallon royalty on the crude oil produced. Moreover, it may be remembered that the Renco retort, which makes satisfactory production possible, was developed at the request and expense of our company. If the Renco retort is adopted by the Commonwealth Government it will result in saving millions of pounds which the Government has invested at Glen Davis. I also point out that the Commonwealth Government is allowing the major oil companies approximately 2s. a gallon margin for distributing petrol produced from shale, and they have not allowed 1d. in the industry. We are proposing to take only 1d. on a gallon on the crude oil produced. The Standard Oil Company of Australia Limited, which was incorporated in 1924, is still functioning, and has expended £80,000 on the Baerami leases and in developing the retorting process. I have no doubt that if I were to approach Shale Oil Products Co-operative Limited I could regain possession of the leases to-morrow. They are mining only 40 tons of shale per week, and have no use for the 19,000,000 tons of shale which we know to be there. The shareholders of this company include Tooley's Brewery, The Electric Light and Power Supply Corporation, Grace Brothers and Mr. Cecil Crouch, motor car salesman. There are others, but I cannot recall them now. They are all drawing petrol from Baerami now.

109. *To Mr. Harrison.*—There is no other agreement between us and the Society except one in which we agreed to the surrender of two leases to the Crown in order to relieve the society of the obligation to man

them, and to pay lease rents amounting to £124 a year. Even after the society paid our company £160,000 a year royalty it could still make a profit. If we ran the enterprise ourselves our profit would be £160,000 plus what profit the society could now make. Therefore, the public would not be called upon to pay anything extra; it is merely a matter of dividing the available profit between two companies instead of all being taken by one. It would be suicide to attempt to sell the petrol below the price fixed by the major oil companies, so that the public cannot be affected by any arrangement entered into by our company and the society.

**110. To Senator Lamp.**—We paid Mr. Jacomini £21,000, part of the consideration being the right to operate the retorts free of royalty up to an amount of 1,000 tons per day. It is agreed that he shall receive 6d. a ton royalty on anything retorted over and above that. The amount would be charged against the operating company. Mr. Kenneth Wright, whose studies of Australian conditions were conducted over a period of two and a half years, has reported as follows:—

The area over which favorable conditions existed for the deposition and accumulation of oil shales, coal seams and closely associated substances is very large in the State of New South Wales. Nearly all of the work done on these shales, both in exploration and exploitation, has been confined to the western and south-western boundary lines of the sedimentary series in which these shales occur, and where erosion has made exposures more easily located and more accessible. By far the greater part of the probable area is really very slightly explored, and it is logical to predict that many favorable deposits with tonnages sufficient to support a refining industry of 4,000,000 barrels annually do exist. The necessary exploration work to locate and prove deposits in addition to those already known will be done once the industry is started.

**111. To Sir Frederick Stewart.**—At Baerami the Mines Department collects a royalty of 6d. a ton, but that has been waived in the case of Glen Davis. It may also be necessary to pay some refinement and treatment royalties. Reference has been made to the estimated return of 8 per cent. to 10 per cent. on a capital investment of £2,500,000. On this point Mr. Gibson has prepared the following comment:—

On this capitalization we have figured the company's operating costs and capital charges, additional to those involved in mining, retorting and refining, which are covered by the independent rates determined for each by experts other than ourselves. The results indicate that a 10 per cent. return on £2,500,000 of capital can be provided under the following conditions:—

- (1) With a selling price for the refined petrol produced of 1s. per gallon combined with a 65.6 per cent. yield of refined petrol from the crude oil.
- (2) With a selling price for the refined petrol produced of 1s. 1d. per gallon combined with a 69.5 per cent. yield of refined petrol from the crude oil.
- (3) With a selling price for the refined petrol produced of 1s. 2d. per gallon combined with a 65.6 per cent. yield of refined petrol from the crude oil.

*The witness withdrew.*

*(Taken at Sydney.)*

THURSDAY, 8TH JUNE, 1944.

Present:

Mr. JAMES (Chairman).

Senator Aylett. Mr. Harrison.  
Senator Lamp. Mr. Mulcahy.  
Mr. Conelan. Sir Frederick Stewart.

Harvey Justin Williams, chief engineer, Peters Ice Cream Proprietary Limited, Sydney, sworn and examined.

**112. To the Chairman.**—I am aware that Parliament has asked this Committee to inquire into proposals to develop the shale oil deposits at Baerami. My

company has had considerable experience in winning petrol from shale. Our retort is located at Mittagong. We obtain our shale from various sources. We have had shale from Baerami, Marrangaroo, Barigan, near Mudgee, and some from the Newcastle district. Our Baerami shale was loaded from motor trucks to rail at Sandy Hollow and brought by rail direct from there to Mittagong. The yield from the Barigan shale averaged 110 gallons to the ton. We got that in one type of retort. It is a rotary retort. It revolves very slowly. The Marrangaroo shale yielded 50.5 gallons to the ton in the same retort. We have never retorted any Baerami shale in that retort, because we had used our stocks of Baerami shale prior to the installation of that retort. Baerami shale was treated in the old type of retort, similar to that being used on the field at Baerami at present. It is a tubular retort with an inside diameter of 3 ft. 6 in. and a length of 22 ft., holding at each charge half a ton of shale. It took approximately 22 hours to retort that half-ton of shale. We have not treated any Baerami shale in our later retorts. Our average from Baerami shale in the old retort over a period of ten months was 40.93 gallons a ton.

**113. To Mr. Mulcahy.**—That was the old retort known in those days as the Gotting retort, which was 30 in. by 12 ft. long. We were getting the maximum extraction possible with that type of retort. The average assay value of Baerami shale over the ten months was 60 gallons to the ton. I estimate that with the new rotary retort we would get within 5 per cent. of assay value of Baerami shale. We would get at least 55 gallons to the ton. With the old retort we were obtaining only 63.3 per cent. of the assay value of Baerami shale.

**114. To Mr. Harrison.**—The Barigan shale from which we get 110 gallons to the ton is run of the mine shale. The Baerami shale was also run of the mine.

**115. To Mr. Conelan.**—I have not seen the deposits at Barigan, but people by the name of Viggers, sawmilling people in the district who are running it, tell me that there are large deposits of shale in the district.

**116. To Mr. Harrison.**—There is no canal coal at Barigan. It is pure shale and the seam is over 3 ft. thick. We are now developing a mine in the Burrigorang Valley with Clinton and Son. In one drive we have done 800 ft. and in a second drive 500 ft., and have made a cross-drive. The shale there is between 3 ft. and 4 ft. thick. We have prospected that on our own account and we know that there are vast deposits in the Burrigorang Valley. The average assay of that shale is 90 gallons to the ton. That deposit is situated about 30 miles south of Camden.

**117. To the Chairman.**—I do not know what work is being carried on at Baerami at present. I myself have never visited Baerami. The cost of Baerami shale at the time we bought it was about 2s. 3s. 6d. a ton at Sandy Hollow, and it was costing us about £1 a ton extra to land it from that point to our plant at Mittagong. Up to the present my company has expended approximately £50,000 on the production of petrol from shale. At no time have we produced what is known as a distillate. We have only produced the straight run of petrol to the American standard; and the next stage is power kerosene, and then a diesel fuel. Our cost of producing petrol has been approximately 16s. to 17s. a gallon. Our costs are not dropping very much, although the new type of retort has reduced the cost a little in the last six months. We are taking the cost of our power kerosene at 2s. a gallon, and the same cost for diesel fuel.

**118. To Mr. Harrison.**—The main reason why we chose the rotary type of retort was for the purpose

of agitating the shale during the process of retorting. The rotary retort is used in South Africa. It is not an entirely new process. We had no indication of the design of the rotary retort used in South Africa, but we knew they were being used there, and we designed this retort ourselves. We prepared our own drawings, and the retort was built in Australia. The assay value of the Barigan shale from which we are getting 110 gallons to the ton is 112 gallons to the ton. The rotary retort which we are using has not a name. The only experts who have had a look at it are Mr. Kenny and Mr. Dunstan, of the Mines Department, and also the Fuel Technologist, Mr. Howarth. We are not paying any royalty in any respect whatever. The average cost of shale delivered at the plant at Mittagong was 24 a ton. The better the quality of the shale the higher is the purchase price. For the last lot of Barigan shale we paid £3 16s. a ton. We purchased that on an assay test. The assay test for Baerami shale is 58 gallons to the ton, and our test averaged 60 gallons to the ton.

**119. To Mr. Conelan.**—We have never had the opportunity to put Baerami shale through the new rotary retort. The Baerami shale closely resembles the shale obtained from some people still operating at Marrangaroo. They are McGregor Wiggins, who supplied us with 300 tons of shale which resembled the Baerami shale very closely. From that shale in the ordinary retort we recovered only 39 gallons to the ton, and through the rotary retort we recovered 55 gallons to the ton.

**120. To Mr. Mulcahy.**—Our cost of 16s. to 17s. a gallon for the production of petrol is not due so much to the fact that we were experimenting to some degree, but principally to the high cost of maintenance of plant. The rotary retort is by far the cheapest to operate; but the first 13 retorts were placed in commission were of the Gotting type, which cost on an average £400 each. The last of those was discarded eighteen months after installation. They were no longer in a state where they could even be repaired. In normal times we should never consider continuing production at our present cost; but we have to have the petrol to-day regardless of cost.

**121. To Senator Lamp.**—On the ice cream buses used about the city it would be impossible to use charcoal burners. Similarly, it is impossible to use the distillate vaporizer, because for 50 per cent. of the time the motor is stopped.

**122. To Mr. Mulcahy.**—I have not heard of a man named Spies who you say conducted a retort at Katoomba.

**123. To the Chairman.**—That figure of £2 3s. 6d. a ton would be the cost of mining Baerami shale, and all freight charges would be in addition to that. We pay an additional £1 a ton for railings that shale from Sandy Hollow to Mittagong. I am speaking of Baerami shale as sold to us by the Standard Oil Company of Australia Limited. They charged us £2 3s. 6d. a ton for Baerami shale on rail at Sandy Hollow, and on top of that we paid £1 a ton railway freight to Mittagong. On this point I submit the following letter, dated the 14th July, 1942, which I received from Mr. Monte, of the Standard Oil Company of Australia Limited:—

DEAR Sir,

We refer to your recent inquiries for supplies of shale, as leases at Baerami, N.S.W.

These leases are now owned by Shale and Oil Products Co-operative Limited (hereunder referred to as the Society), for which we are sole agent in respect of the sale of oil-yielding material from the said leases.

We have now been authorized by our principal to quote, until further notice, £2 6s. 6d. per ton of 2,240 lb. for oil-yielding material, f.o.r. Sandy Hollow, upon the following conditions:—

- (1) The oil-yielding material will be the run of mine seams consisting of upper canal coal, intermediate canal coal, kerosene shale and lower canal coal (hereafter referred to as shale) having an average crude oil yield approximating 60 gallons per ton of the combined materials as determined by the average of the N.S.W. Mines Department Gray-King standard testing method laboratory analyses. In the event of disputes arising in regard to the values of the oil-yielding material supplied hereunder based on a three months' supply, the N.S.W. Department of Mines is to be asked to groove sample the face seams from which such oil-yielding material is supplied and to blend so as to make it representative of the average condition of such face seams and test five samples of the blended product in a Gray-King standard testing apparatus.
- (2) No sales shall be deemed to be made until acceptance by the Society of the order; date of acceptance to be date of contract.
- (3) Payment to be made at the office of the Society, in Sydney, free of exchange, on the basis of New South Wales Government Railways weights, which are to be accepted as final.
- (4) The Society to have the right to deliver within 10 per cent. of the tonnage ordered either under or over and payment to be made for the actual tonnage delivered in accordance with (3) above.
- (5) Where the period of delivery extends beyond one month the price is to be subject to increase by the amount which the costs at the date of contract are increased due to Federal and/or State legislative regulation or authority or if from any other cause, the leaving rate, wages or working hours or conditions of any employees engaged in the production, carrying or distribution of delivery of the shale or lories, duties, rates, royalties or other charges be varied by any authority or if any further revised charges or contributions of any kind be imposed on the Society.
- (6) Payment to be forwarded to the Society with order except where special arrangements are made with the Society when payment will be accepted seven days after receipt of railway weights and subject to a deposit of £2 per ton of average weekly requirements. The amount of the deposit, subject to any deductions which Shale and Oil Products Co-operative Limited is entitled to make therefrom by way of contra account, set off, or otherwise, is payable in cash on the termination of the contract for supply, at the office of the Society. If a person entitled to receive payment of the deposit desires it to be paid in some other manner or at some other place, Shale and Oil Products Co-operative Limited may, in its discretion, accede to the request of such person, provided that it shall be at liberty to deduct from the amount of the deposit all costs and expenses incurred by the Society in acceding to the request, whether such costs or expenses are by way of exchange, stamp duty or otherwise.
- (7) Orders will not be accepted for less than truck lots.
- (8) In the case of large or continuing orders the Society reserves the right to have a written contract drawn up and entered into by the parties.
- (9) The Society shall not be held responsible for the non-delivery of the shale through any of the following causes preventing the mining, delivery, shipment or receiving of the shale, viz: Act of God, King's enemies, restraints of rulers, princes or peoples, stress of war, mobilization, strikes of workmen and/or workmen lock-outs, combinations of workmen or by accident, breakdown of machinery, fire, failure on part of New South Wales Government Railways to supply trucks as required, loss of leases or any other circumstances beyond the control of the Society.

The Society also informs us that:—

"The minimum quantity of shale which will be sold is, at the present time, single truck lots. The maximum quantity is undetermined and will depend upon the ability of the Society to mine and deliver."

"The date when first deliveries will be available of—

- (a) minimum tonnage
  - (b) maximum tonnage
- cannot be given. The Society's mining agent will endeavour to supply all shale ordered and give delivery when required by the purchaser.

"To facilitate business, the Society will, as far as possible, reserve delivery dates at our request in anticipation of a contract being entered into. Apart from this, in allocating delivery dates, regard will be given to the date of the contract."

We shall be pleased if you will immediately advise us of your requirements in accordance with the foregoing conditions, which will be submitted to the Society's standard order form, which will then be submitted for your signature. On receipt by us of such signed order form, same will be forwarded to the Secretary of the Society, who will notify acceptance. At the same time, we will request the Society to reserve the delivery dates required by you.

If you desire to make any special arrangements with the Society as to payment (see condition No. (8) above) please notify us.

We sincerely regret the delay in furnishing you with these particulars, which have been withheld by our principal, pending registration (which has now been effected) of leases in its name and also completion of suitable arrangements with its mining agent.

#### FEES.

For your information, railway freight is chargeable at the crude ore rate, plus 25 per cent., and the rate applicable to the traffic between Sandy Hollow and Darling Harbour is as follows:—

Crude ore, plus 25 per cent.—15s. per ton.

If it is proposed to forward the traffic at frequent intervals between the points stated, the question of entering into an agreement will have consideration by the Railway Department. In the event of an agreement being completed (and this is a matter of arrangement between the parties concerned and the Railway Department) a reduction in the rate from crude ore, plus 25 per cent., to crude ore rate only (in this case, 12s.) will apply for the carriage of the traffic in truck load consignments.

In view of the fact that, as stated above, delivery dates are to be reserved as far as possible in accordance with our request, your early intimation of requirements is desirable.

#### Yours faithfully,

THE STANDARD OIL COMPANY OF AUSTRALIA LTD.,  
J. H. MOATE, Director.

Our cost of retorting alone is 1s. 11.3d. a gallon.

124. *To Mr. Condon.*—We received our last lot of Baerami shale in 1942, and we retorted the last lot of Baerami shale in May, 1943. The reason why we discontinued using Baerami shale was because of the low value of the shale. You have to remember that the cost of retorting is the same for low quality as for high quality shale. We do not find that a high grade of shale exerts greater wear and tear on the retort.

125. *To the Chairman.*—At one time we had a Jacomini retort offered to us on sale. It had been erected just outside Newcastle, and was dismantled and brought to Sydney. Mr. Moate, of the Standard Oil Company of Australia Limited, was one of the people who were instrumental in bringing that retort under our notice. However, after investigation we deemed it inadvisable to purchase that retort. At the moment I cannot recall what price they asked for that retort. Later, I shall forward that information to the Committee together with our reasons for declining to purchase that retort. If I remember rightly we did not purchase it because we did not think we could efficiently work that type of retort. It would be too costly to erect and maintain. Further, as replacement parts would have to be imported from America we could not see any chance of obtaining those parts during the war. I do not think that any royalty was asked for in respect of the use of that retort. They were to sell it straight out on the understanding—again, only on their word—that there was no patent covering this retort in this country. That was another point on which we were doubtful. Later, I shall make available to the Committee the correspondence dealing with the offer of sale of that retort to us. We use our allotment of petrol from the Fuel Board and this together with the quantity we are obtaining from our own plant is sufficient to keep all our vehicles on the road. We do not blend it.

*The witness withdrew.*

William Leallo Rodgers, chairman of directors of Shale and Oil Products Co-operative Limited, sworn and examined.

126. *To the Chairman.*—Shale and Oil Products Co-operative Limited is a co-operative society which was formed about the time that Japan came into the war. It was expected that Australia might be blockaded, and that there would be an extreme shortage of liquid fuel. Therefore, some of the larger firms in Sydney decided to co-operate in their endeavour to provide themselves with fuel. The original idea was that we would not mine shale, but buy it from the Standard Oil Company of Australia Limited. We proposed to retort shale and get a crude oil to be used as a substitute fuel in hot boxes. That programme has since had to be varied. Shortly after we began to erect our plant we received information which led us to believe that the Standard Oil Company of Australia Limited would not be able to carry out its undertaking to supply us with shale. We were then faced with the alternative of giving up the project altogether, thus losing the value of the plant which we had acquired, or of undertaking mining operations ourselves. We decided upon the latter course. We advanced money to the Standard Oil Company of Australia Limited to meet its immediate requirements, and we took over the shale leases. We entered into an agreement with that company to pay it a royalty of 2s. 6d. a ton on all shale which we used or sold. The nearest railway station to the mine at Baerami is Sandy Hollow, which is about 26 miles away. For about three-quarters of the distance the road is fair, but for the rest of the way it is very poor. Our society spent a good deal of money in improving the road, and the local council effected some improvements so that deviations might be made. There is practically no water available at Baerami itself, which is why we put the works at Sandy Hollow, where we get water from the Goulburn River. It would not be easy to construct dams to impound water near Baerami, but it would be possible to pipe water from some miles away. That, of course, would be costly. No dwellings have been erected in the vicinity of the mines, but there is a small settlement some distance away. Our purpose in taking over the leases was to get enough shale to keep the retorts going. We are now treating 60 tons of shale a week. We had expected to treat a great deal more, but the shortage of labour has prevented us. We use a horizontal retort into which about 15 cwt. of shale is placed at a time on trays, and baked for from 12 to 14 hours. The retort has no name in particular. The retorts are situated at a distance of 26 miles from the mine. It costs us 2s. a ton to mine the shale, on top of which we pay 12s. 6d. per ton cartage to the retorts, and 2s. 6d. per ton royalty to the Standard Oil Company of Australia Limited. We retort only the central shale seam, discarding the canal coal and the upper coal, which increases the cost per ton. When we retorted run-of-mine material the cost was about 30s. a ton. The best results we have had are 80 gallons of oil to the ton, and the worst about 30 gallons. Our society sells a shale petrol blend which includes some alcohol, and is much more expensive than the shale oil. The Standard Oil Company of Australia Limited has no interest in our holdings at Baerami beyond its right to receive 2s. 6d. a ton royalty on the shale we use. When we originally obtained the leases we expected to mine much more shale than we are doing now and we agreed with the Standard Oil Company of Australia Limited that they should act as selling agents for the shale we did not want to use ourselves. A few tons were sold in that way, but recently we have not been able to get enough shale from the mine to keep our own plant operating. I have seen illustrations of the Ronco retort, and Mr. Jacomini outlined its merits to me, but I have not seen it in operation. It pays us to

discard the canal coal associated with the shale. For one thing, our carting costs are very high, and our retorting methods are too crude to treat low-grade shale.

127. *To Mr. Harrison.*—Originally, we proposed to buy what shale we needed from the Standard Oil Company of Australia Limited, in the belief that we were dealing with a company of some substance. When we found that we would have to mine our own shale it was not our wish to take over all the leases, but the Standard Oil Company of Australia Limited wanted to keep the mine intact, and so did the Mines Department. It made very little difference to us, so we took them all over. We never gave any consideration to the possibility of working the deposits as an economic industry. When the war is over, and we are able to get supplies of petrol again from other countries, we shall probably fold up. Among the shareholders there are some big business interests and some very small ones. The Glen Davis show was in operation at the time that we took over the leases, and it had not been a great success, but it was an entirely different proposition from ours. We were not out to start a new industry. Our attitude was that of a man who puts a gas producer on his lorry as a temporary measure. I did not see Mr. Gibson's report stating that the Baerami fields could be worked profitably by private enterprise. There was nothing in the report which I saw to tempt us to embark upon the production of oil from Baerami shale as a commercial venture. We knew that if we were going into the business on a large scale the royalties payable to the Standard Oil Company of Australia Limited would amount to a lot of money. Had we had any such intention we would have bought the field outright. However, at the time, knowing that we were going to use only a small amount of shale, we were not prepared to pay out perhaps £5,000 extra in order to acquire all the rights which the Standard Oil Company of Australia Limited had in the field. When the war is over, we simply hand the show back to the Standard Oil Company of Australia Limited, and it can do what it likes with the leases. Our co-operative would not be prepared in any circumstances to develop the Baerami field as a commercial proposition. Under our agreement with the company we are committed to pay royalty at the rate of 2s. 6d. a ton on a minimum of 200 tons, which works out at £26 a week. This has to be paid even though we may mine only 60 tons a week, as is the case at present. Our shareholders buy our shale blend product at 8s. a gallon, and our vapourizer at 6s. 6d. a gallon. Our shale blend is somewhat similar to petrol.

128. *To Sir Frederick Stewart.*—The subscribed capital of our co-operative society is about £40,000. The directors are as follows:—W. L. Rodgers (chairman), chartered accountant; H. G. Conde, general manager of the Electric Light and Power Supply Corporation; G. E. Clift, director and secretary of Grace Brothers Proprietary Limited; M. A. Francis, assistant general manager of Toohy's Limited; F. Whiddon, director of Rogers Meat Company Proprietary Limited and director of Whiddon Brothers; J. McMahon, president of the National Roads and Motors Association; and R. A. Archinal, director of Wyld Brothers Limited and secretary of the Master Tanners Association.

Our production costs vary a good deal, but in general the price at which we sell the fuel to the shareholders represents approximately what it costs us to get it. As a matter of fact, we have actually been selling at somewhat less than cost, so that there is at present a trading deficit. Our primary purpose was to supply only our own shareholders, but if there is any surplus after they are satisfied, we sell to outsiders. Under our agreement with the Standard Oil Company of Australia Limited we may give notice that we are surrendering the leases, and they then revert to the Standard Oil

Company of Australia Limited, which can either take them up again or allow them to lapse. I can see that if the Government were to sponsor the development of the Baerami field it might be an advantage to the Standard Oil Company of Australia Limited to keep our society in existence by acquiring a controlling interest in it. In this way, as you suggest, it could continue to load an extra 2s. 6d. a ton royalty on to production costs, thus giving it a stronger claim for a rebate of excise duties.

129. *To Senator Aylett.*—We did not buy any retorts from the Standard Oil Company of Australia Limited, but we bought the buildings adjacent to the mine. We paid £2,000 for all assets, which included a motor lorry. We pay 26d. rent to the Crown for each of the leases. There were originally six, but we have given up two of them. There are no royalties to pay on any of the plant we are using. I do not know what our actual working costs are, but I am prepared to find out and prepare a statement on the subject.

130. *To Mr. Harrison.*—Our agreement with the Standard Oil Company of Australia Limited was made just about the time that the Mittagong show was beginning. Sometimes, when we have not been able to mine enough shale to meet our requirements, we have bought shale from other places and taken it long distances to our works for treatment. The mining position is very difficult.

131. *To Senator Aylett.*—Our working costs do not include interest on capital, but we allow an amount for depreciation of plant, which, over a period of years, will return the capital invested in it.

132. *To Senator Lamp.*—Sometimes we obtain shale from Barigan a place some distance from Mudgee. This is high-grade shale which yields about 70 gallons to the ton. It is a very thick seam, and is easily mined, but I cannot say what is the extent of it.

133. *To Sir Frederick Stewart.*—We were not very fussy about the terms of our agreement with the Standard Oil Company of Australia Limited because it was only a temporary arrangement. If we had contemplated working the deposits to their full capacity of 30,000,000 gallons a year we would have never dreamed of agreeing to pay a royalty of 2s. 6d. a ton on the shale. Rather would we have acquired the entire interest of the Standard Oil Company of Australia Limited in the field.

134. *To Senator Lamp.*—Royalty is payable to the State on shale only to the extent that it exceeds the ground rent for the lease. The provision has not become operative in our case.

135. *To Senator Aylett.*—We bought the assets of the Standard Oil Company of Australia Limited for £2,000, and in addition, we put in our own retorts. The original idea was that the Standard Oil Company of Australia Limited should supply us with shale at 30s. a ton. When it appeared that they could no longer undertake to supply us we came to the conclusion that it was better to take over the leases ourselves. We chose the Baerami field because it was the only one which had been tested and proved. Even if we were to pull out now we would lose only a few hundred pounds of the £2,000 which we paid.

136. *To the Chairman.*—The total height of the face in the mine is about 5 ft. 6 in. By our method of retorting we were obtaining less than 10 gallons of oil per ton from canal coal. We proved by trial that it pays better to retort only the richest part of the seam. I cannot say what percentage of oil would be left in the residue if foreign substances are mixed with pure shale, but the Government's chemists may, if they wish, examine the residue themselves.

*The witness withdrew.*

32:

(Taken at Sydney.)

FRIDAY, 6TH JUNE, 1944.

Present:

Senator Lamp (in the Chair).

Senator Aylett.	Mr. Mulcahy.
Mr. Conelan.	Sir Frederick Stewart.
Mr. Harrison.	

Frederick Cecil Gadsby, sworn and examined.

137. To Senator Lamp.—I appear before the Committee as representing the Morgan process of retorting, the inventor of which is Dr. J. Stanley Morgan, who resides in England. Full details of this process are set out in the file which I now tender to the Committee.

138. To Mr. Mulcahy.—A Morgan retort is at present operating at New Brancopeth, in the north of England. They are handling acid sludge. That retort was seen operating by Mr. Howarth and Mr. Davis, of the New South Wales Mines Department. The cost of retorting coal and shale is about 1s. a ton. I have included in the file which I have tendered to the Committee a report of the Morgan process by an independent expert, a Mr. Olaf Ollander. Also included in the file is a report by Dr. Morgan on a bulk treatment of Baerami shale. I now tender to the Committee a copy of a beam wireless message, dated 4th June, 1943, and received by me from Dr. Morgan, and submitted to the Department of Supply, Canberra, which reads as follows:—

Just returned from Iceland: If Government will guarantee build plant capable 5,000 tons per day in two years following successful demonstrations I will find half the finance for 50 tons per day unit. Royalty tenth penny gallon tax free plus fees of £1,500 for each 200 ton per day unit constructed. We have not been able to get either the Government or National Oil Proprietary Limited interested in this process; and I and most of my business friends could never understand why when the retorting at Glen Davis was so unsatisfactory, Morgan's process and plant were not accepted. I have no doubt that the unsatisfactory retorting is the main reason why Glen Davis so far has proved economically unsound. The proposal set out in that beam wireless message should be seriously out in that Committee. I submit that the considered by this Committee. I submit that the Committee should carefully consider whether Dr. Morgan should not be invited to carry out this work, and train others in the work, and conduct tests on other materials while he is in Australia. Dr. Morgan's retort on the Baerami shale submitted to him was commented on by the Minister for Mines in Australia this, "If you have much of Baerami shale in Australia this, you have something better than any gold-mine". As Dr. Morgan is asking for a royalty on the oil produced he is as interested in the recovery aspect as any other person. The royalty I at first suggested was of the order of a farthing a gallon, which although amounting to a considerable sum on a big production is less than you would have the use of Morgan's improved refining process. At present Dr. Morgan is working on extensive national works for the British Government, including a very dense cement process which took ten years to evolve. He is a chemical engineer and a doctor of science. As soon as the war broke out he was asked by the British Government to concentrate on machinery for cementing according to his process, and this is being used in the erection of piers, air strips, underground construction, and canal and reclamation work.

139. To Senator Lamp.—As to the capacity of the Morgan retort, we work on a standard-sized retort. If you ask for a plant to handle 100 tons of coal a day that will take two standard retorts, a standard unit being capable of treating 50 tons of coal or 75 tons of say, Baerami grade shale a day. Each Morgan retort would not cost more than £1,000 erected in Aus-

tralia. Particulars as to the operation and life of the retort is set out in Mr. Ollander's report contained in the file I have tendered to the Committee. The Morgan plant is designed for large-scale operations. Dr. Morgan in a letter, a photostat copy of which is included in the file I have tendered, says that the only difficulty he could see about the Baerami shale is that it is much more volatile than anything he has previously treated. However, we are not likely to be worried about that because we have successfully treated 100 per cent. volatile liquid.

140. To Mr. Conelan.—I myself have not seen the Morgan plant in operation. The test conducted by Dr. Morgan which I have mentioned was on pure shale only. I have not seen a chart of the various formations in the Baerami field.

141. To Mr. Mulcahy.—Although Dr. Morgan is now doing important national work in England, he said he could get his exit permit if a visit by him to Australia was of vital importance.

142. To Mr. Conelan.—You say that one firm is producing petrol from shale at a cost of 15s. a gallon. Petrol has been produced from shale in Scotland for over the last 50 years at a very low cost. I have not had any experience of any other type of retort. However, we know that the cost of the Morgan retort is about one-sixth of the cost of other retorts on the average, and we know that its recovery is as great as anything else, and that the quality of the oil is as good or better. The only reason I can give why the Morgan retort is not being used in Scotland is because the shale deposits there are controlled by the Anglo-Persian Oil Company. I have not visited Baerami or Newcastle. Our attitude is that I am not a company promoter. Our attitude is that if any one wants to utilize the Morgan process and plant we will make it available. We have offered the process on certain terms to each State government in Australia. That offer would be on the basis set out in that beam wireless message which I received from Dr. Morgan.

143. To Senator Aylett.—I cannot say definitely whether Dr. Morgan would still be prepared to repeat that offer. I think so many of his offers have been declined that possibly he has lost heart; and to-day, of course, he is busily engaged on national undertakings in England. Prior to the evacuation from Dunkirk he was engaged laying down air strips in France by his method. Dr. Morgan said that he would prefer to treat the Newnes and Baerami grade of shale, because sulphur in tasmantite presents difficulties, and there would be not only a loss of oil due to the sulphur content during retorting, but additional cost would be incurred also in washing losses. However he is of opinion that the presence of sulphur is not deleterious as a fuel. In fact the opinion is held that sulphur may be an improvement. In tests in connexion with tasmantite it was shown that when the sulphur was removed the petrol did not give the same mileage, and that when the sulphur remained more satisfactory results were obtained in hill-climbing tests. The cost of erecting a 50-ton daily capacity Morgan retort not including recovery equipment in Australia would be approximately £1,000. Over-loading of the retort would decrease its efficiency, although Dr. Morgan discovered that he could do more than 60 tons of shale on a standard unit using the Baerami class of shale. I think that if he were given certain guarantees he would be prepared to erect his own retorting plant in Australia and personally prove its efficiency to the Commonwealth Government, or any of the State governments. He is aiming at quantity production all the months. On a 5,000 tons a day plant he would be prepared to reduce the royalty from one farthing a gallon to a tenth of a penny a gallon. However, such a capacity could be obtained at few known places in Australia such

as at Plevna in the Bungolla district of Mackay district which is low-grade shale, yielding approximately 25 to 30 gallons to the ton, but can be worked by "open cut" methods. I do not know anything about the extraction of bitumen.

144. To Mr. Harrison.—I have included on the file a very full statement by Dr. Morgan with respect to the production of chemical by-products. He has taken out patents for another retorting process which is an improvement on what I have been describing as the Morgan process, but that new process has not yet crystallized as a commercial proposition.

145. To Senator Lamp.—I have not seen the rotary retort being used by Peters' Ice Cream Proprietary Limited, at Mittagong.

146. To Mr. Harrison.—There is no Morgan retort in Australia. I could not say definitely whether any retorts in addition to the plant at New Brancopeth are in operation elsewhere. Dr. Morgan is of opinion that the present method of refining in Australia would be quite capable of handling the crude oil produced from shale; however, his offer is that no royalty would be charged in respect of his method of refining. As you say, the Dubbs cracking process can handle our crudes, although not very cheaply. Dr. Morgan evolved his retorting process about six or seven years ago. You ask me why, in view of its advantages, the process has not been adopted universally. Perhaps, the explanation is the antagonism of what you call the major oil companies. Much of what has been written in various books in the past on that subject is being proved true to-day. The Morgan retort can be used for handling coal as well as shale. It is difficult to compare the recovery of oil from coal in this plant with results being obtained by the methods used at Billington-On-Tees because in the latter case several methods were employed; but the Morgan process is really an improvement upon low temperature carbonization. The Government's advisers here say that the production of oil from coal is uneconomic. On that point I tender a balance-sheet of Doncaster Coalite Limited whose parent company is Low Temperature Carbonization Limited, an English company which in 1936 distributed 35s for every £1 ordinary share less income tax. The point here of course is whether you can get the same price for smokeless fuel in Australia as is obtainable in England, but, ultimately, a smokeless fuel will be in universal demand. When Mr. Howarth and Mr. Davis, of the New South Wales Mines Department, visited England and made investigations there for a period of about three years, they accumulated much data with respect to the treatment of Mainland coal, but, apparently, the Mines Department will not release that information. I have tried unsuccessfully to obtain it. The Morgan process of retorting can be adapted for the extraction of oil both from shale and coal.

147. To Senator Lamp.—That is Dr. Morgan's opinion.

148. To Mr. Harrison.—Mr. Ollander's qualifications are set out in the file I have tendered. I do not know whether he holds any degrees. You suggest that a guarantee should be prepared to bear the cost of demonstrating his process and proving the claims made for it, but it is just as logical, particularly in war time to expect governments interested in the production of fuel oil to assist financially in such tests. For instance, the British Government has given financial assistance; and Limited a tremendous lot of financial assistance; and imports of oil the Australian Government should be equally interested in encouraging production from local sources. By using the Morgan process we could successfully compete with flow oil on pre-war terms. We have reached a stage when we refuse to

play around any further with tests. You say that no government is entitled to play about with the taxpayers' money in ventures of this kind unless each proposal is fully tested, and you add that the Government's experts have not reported favorably on the Morgan process. My reply to that is that the Government's experts evidently had a lot to do with Glen Davis, and that venture has not succeeded to success. At the moment I am a little perturbed as to whether we could get Dr. Morgan's services immediately should they be required. Possibly you people will have to make the next approach in the matter. The Morgan plant in England is hand-operated. It is doing from 20 to 25 tons per day of residue which is a waste product from benzol production. You suggest that a request might be sent through this Committee to the Australian High Commissioner in London, asking him if he could contact Dr. Morgan with the object of obtaining data dealing with the commercial production of oil from one of his plants actually operating in England. I think that that suggestion is quite worth following. It is the sort of thing I should like the Government to do.

149. To Senator Lamp.—A royalty at the rate of a farthing a gallon on the projected maximum production of 30,000,000 gallons a year would work out at £2,500 a month; but in return for that royalty Dr. Morgan might be doing a lot of work. He is a research man, and if he were employing a staff, which he would have to do in the case of large-scale production, that royalty would not be excessive. He was so impressed with Baerami shale that he wanted to bring his family out here and settle in Australia so that he could go on with the work.

The witness withdrew.

Arthur George Hebblewhite, sworn and examined.

150. To Senator Lamp.—I appear before the Committee as a representative of consumers of petrol distillate with the object of doing what I can to assist the Committee in its investigations into the production of oil from shale at Baerami. The principal suggestion I make to the Committee is that any decision in relation to Baerami should be made in relation to the development of the deposits at Barigan and other shale areas which might be contiguous to a central refinery. I am a director of the Mudgee Shale Oil Company, and I have personally investigated almost every plant and I have personally investigated the operations of the Berrima New South Wales producing oil from shale. We have also reorganized the operations of the Berrima Oil Company which controls the Airlie mine in the interests of the people who have put their money into that company. I find from my investigations that if we worked our shale deposits with the object of producing approximately 355,000,000 gallons a year we would be in trouble from five to ten years hence, that is on the basis of our total shale deposits as assessed by government experts. Therefore, we should rely on oil from shale mainly to provide only part of our requirement in an emergency. That means that the existing deposits should be conserved as much as possible with the object of falling back on them should an emergency arise. The need for such a policy has been demonstrated during the last three years. Glen Davis has signally failed to perform even what it is capable of performing in our present emergency. Consequently, we find plants established at Berrima, Emu Plains and Mittagong when we should not have allowed them to be established at those places because of the extra demands thus placed on our railways. Most of the shale has to be transported from Barigan, which is now the main source, and from other places which lie to the north of Glen Davis. In September, 1942, following a thorough personal investigation into the

matter, I wrote to the Minister for Supply and Shipping, Mr. Bessley, requesting that Glen Davis be immediately opened for the treatment of crudes from private companies, because all of these companies were in difficulties. The Minister replied that Glen Davis could not accept crudes from private companies. I saw Mr. Rogers on the matter but could not get anywhere with him. However, some members of the Commercial Motor Users Association, headed by Mr. A. E. Heath, who had lost £14,000 at Marrangaroo, persisted with the proposal with the result that I forwarded my scheme to Mr. Bessley. I tender to the Committee a copy of my letter to Mr. Bessley setting out my proposal. A few weeks after we had been turned down by Glen Davis we suddenly found that the Marrangaroo people, which is the Lithgow Oil Company, and a company at Mudgee, were having their crudes treated at Glen Davis; and to-day that scheme is being continued. Only a few weeks ago I found that Associated Newspapers and Longman's, of Mudgee, were also getting their crudes treated at Glen Davis. If all private companies were allowed to send their crudes to Glen Davis we would be able to get petrol.

151. *To Mr. Mulcahy.*—I cannot understand why Glen Davis can take crudes from some companies and at the same time refuse to take crudes from other companies.

152. *To Mr. Harrison.*—The crudes of any small plant could be regulated by standardized treatment to anything desired. We have ruined hundreds of engines by the use of bad distillate from shale, and many people have installed charcoal burners because Glen Davis will not carry out the function it is capable of carrying out. It is not too late now to get all these established companies to send their crudes to Glen Davis. It would cost my company roughly 2d. a gallon to send the 3,000 gallons of crude now have in store to Glen Davis. My plan, which I put up to the Shell Company of Australia Limited and to Mr. Bessley, and which is now in operation for two of these companies, is that the crudes be sent to Glen Davis, to be treated for petrol. It could then be measured and merged with the petrol that goes into the pool. This would then be distributed at the most economical points, in this case, principally in the areas to the west. Then a petrol coupon would be issued to each shareholder who as an essential user would be entitled to so many gallons according to the allotment of the Fuel Board or his interest in his respective company. To take a concrete example, a Marrangaroo shareholder would be paying 6s. for his petrol, so he would pay 3s. 3d. to the company for the coupon, and then would just pass the coupon into any bowser anywhere and get petrol he required. That system is now being followed. Under these conditions it would be competent for Glen Davis to treat crudes for a Melbourne, or Adelaide, firm, or a firm anywhere in Australia. That coupon could go to the man in Melbourne, for instance. The petrol companies would have their stocks there and the difference would be paid. That scheme is working well with two small companies to-day, yet these other companies are not allowed to initiate a similar scheme with the result that they are turning out rotten distillate which is ruining hundreds of engines. I do not know why they will not treat our crudes. Our discussion with Mr. Rogers was most unlightening. We could not get "yes" or "no" from him. I gave up the matter in disgust. I am not speaking for the Mudgee Shale Oil Company. The other company which has been refused participation in the scheme is the Berrima Oil Company, which controls the Airlie mine. Those affected are mostly members of the Commercial Motor Users Association, which I administer.

153. *To Mr. Mulcahy.*—My company now has 3,000 gallons of crude oil available for treatment, and that

quantity is mounting every day. Mr. Griffith has some idea that they would buy our crudes, but the price they would pay would be hopeless. All of the shareholders of my company are willing to pay 5s. or 6s. a gallon for petrol under our scheme, because it will enable them to carry out their commitments to the Fuel Board so far as their substitute fuel is concerned. Therefore, it is economical for them to pay 5s. or 6s. a gallon instead of incurring an expenditure of over £100 a unit for the installation of gas producers.

154. *To Senator Lamp.*—The crude oil to which I refer is now lying in vats at Emu Plains; and the Berrima Oil Company is just about closing up.

155. *To Mr. Harrison.*—I am not an expert in this matter, but it is apparent that the inefficiency at Glen Davis is due to the retort. The recovery they get from high-grade shale is much less than the smaller companies are getting from their retorts, due entirely to the fact that Australian high-grade shales can be more efficiently treated in small volumes. All the small companies have small volume retorts. Ours is 20 in. in diameter and as soon as we tried to expand to 24 in. we got into trouble because the heat became uneven. Companies which use a sort of ride retort with a bank of tubes of 7 in. would get a good result because the heat is evenly distributed, and the retorting can be done very quickly. They are all small retorts, locally constructed, and with small volumes to be treated. I suggest that Glen Davis is likely to fail in trying to experiment with retorts which in tests show they can handle 40 gallons to the ton shale but cannot handle 100 gallons to the ton shale. The field at Barigan is one of the best fields in Australia. It is very extensive. Our leases are extensive. Officials of the Mines Department could give the proved areas.

156. *To Mr. Mulcahy.*—The average depth of the seam at Barigan would be roughly 3 feet. Where the shale goes to a richness of say, 150 gallons to the ton, the seam is only 18 inches thick. Therefore, it becomes less economical to work the richer seam. Glen Davis has a very rich seam, but it is very narrow compared with the remainder of the seams; and they mix it in order to get a better overall return.

157. *To Mr. Harrison.*—There is very little canal coal at Barigan.

158. *To Senator Lamp.*—Our retort recovery from 120 gallons to the ton shale varies considerably. When the retort is worked by inexperienced people it drops to 60 gallons to the ton, whereas if you have a man carefully watching the retort and keeping the temperature right you will get up to 90 gallons to the ton.

159. *To Senator Aylett.*—It is difficult to estimate our cost of retorting on a gallonage basis because in the distillate you have your stills and run it off a second time, and it is more or less one operation. It is also difficult to give this cost because conditions at these small plants vary considerably, particularly owing to the intermittency of operations.

160. *To Mr. Harrison.*—I am mainly concerned with the establishment of a central refinery. The latter which I wrote to Mr. Bessley setting out my scheme is dated the 28th September, 1942.

161. *To Mr. Conelan.*—Since then my company applied to Mr. Rogers for permission to have our crudes treated at Glen Davis, but our request was refused. That would be within the last six months. Now, in desperation our retort operators have applied to Mr. Griffith to see if he will take the surplus crudes; but if they will take our crudes and pay for them why can they not take them and let us have them back in the form of petrol as suggested in our scheme? In that case we could give the operator a reasonable price and enable him to go on retorting.

162. *To Mr. Harrison.*—The refusal to take our crudes could hardly be based on technical considerations. As you say, Mudgee oil which they are taking is about the same standard as the Barigan stuff. I would not be surprised if both did not come from the same shale.

163. *To Mr. Conelan.*—We have not been given any reason for the refusal to take our crudes. Had Glen Davis originally taken the crudes from all these small companies it looks as though we should have been able to produce from six to seven million gallons a year. On the other hand, I understand that the cracking plant at Glen Davis at one stage was working only one day in five.

164. *To Mr. Harrison.*—According to American practice it would be quite practicable to pipe oil from our fields to Glen Davis. I had in mind as a war-time measure that the oil from the various fields could be piped from Capertree to Glen Davis. That is a distance of 22 miles, and I think you would get almost a downhill run from there to Glen Davis. It could be drilled to Capertree from the various fields. You ask me whether sufficient water is available at Glen Davis to enable a central refinery to be erected there. Glen Davis should lend itself to water conservation in that respect because it is well down in the valley. However, that is a matter for the engineers. One advantage of my proposal is that when you encourage the privately-owned plant to step in suddenly in a time of emergency you have the ideal set-up, because you have distributed all your mining troubles, and have all the benefit of incentive; and private money flows in immediately in order to provide itself with what it needs most urgently—transport. That has happened. Over £250,000 has been invested in the production of oil from shale in New South Wales by these small companies and probably £150,000 of that has already been lost. It will all go west when the war stops. However, had Glen Davis carried out its function properly, we would probably have had several million gallons of petrol annually going into transport, with all these small plants operating. I think that after the war even if a central refinery were established all of these small shows will lapse; and it will be just as well if they do. As I pointed out previously it is necessary for us to conserve our shale deposits for future emergencies. However, at the same time you would have to keep in operation a central plant turning out say, up to 10,000,000 gallons, so that you could boost that by opening up small plants in an emergency. Such small plants could be got into production within a period of two months. Should the production of oil from shale and coal subsequently be shown to be a commercial proposition even in peacetime, it would be practicable to continue these small plants provided the Government looked after the refining side and allowed the private man to use his own ingenuity under special conditions.

165. *To Senator Lamp.*—I do not think that under such conditions the private man would tend to pick the eyes out of the deposits. Indeed the private operator likes to mix all the available retortable material and, therefore, every bit of shale would be used in his retorts. You say that many small operators are taking only the good shale. The trouble to-day is that owing to the mistakes made at Glen Davis, the small operators have to carry the shale at £1 a ton, for instance, from Barigan to Mudgee, and at 17s. 6d. a ton from Gulgong to the plants at Mittagong, Berrima and Emu Plains. Under these conditions it does not pay them to take anything but the best shale; but if the refinery were handy you would have a different proposition.

166. *To Mr. Conelan.*—Owing to transport charges the cost of producing a gallon of petrol is beyond all

reason. I know that Peters' Ice Cream Proprietary Limited spent money like water at Mittagong. They tried every type of retort because they were mad for something other than charcoal. The cost of retorting at the mine in the average case could not exceed 1s.

The witness withdrew.

Leslie John Rogers, Commonwealth Fuel Adviser, sworn and examined.

167. *To the Chairman.*—I understand that the Baerami field is at present being developed on a very small scale by the Shale Oil Products Co-operative Limited, which is treating about 50 tons of shale per week. I do not know what yield they are getting. The last time I had any positive information they were using the whole of the seam, the torbanite and the canal coal also. I know that they wished to eliminate the canal coal because of the cost of carting it to Sandy Hollow. I do not know whether it would be practicable to mine 3,000 tons of shale a day as suggested by the American Mission; neither can I explain the discrepancy between the estimate of a yield of 44 gallons by the American Mission and my estimate of 41 gallons, except that I had no positive information regarding the quality of the shale. I am not a director of National Oil Proprietary Limited.

If the Baerami field were developed the work could be carried on in conjunction with the Glen Davis project if sufficient material and labour were forthcoming. It would be possible to take advantage of the technical experts at Glen Davis for the development of the Baerami field, and such a course would be advisable. I do not think that it would be practicable to retort crude oil at Baerami and transport it to Glen Davis for refining because the cost would be too great. I understand that there is very difficult country between the two places. Moreover, the pumping of wax crude oil would be a difficult operation in winter time. I cannot say offhand how much water would be needed to operate a complete plant at Baerami. It might be as much as 2,000,000 gallons a day. I have never been on the Mudgee field. I believe that the Mudgee seam is about 3 feet 6 inches through at its thickest part.

We put about 4½ tons of shale per day through each retort at Glen Davis. Mr. Jacomini claims that the Renco retort can put through about 250 tons a day. The maintenance of the retorts at Glen Davis is very heavy, but I cannot say whether the maintenance of the Renco retort would be heavy or not.

I think it is a great mistake from a national point of view that small shows should be allowed to work only the shale from seams and dump the canal coal. Contrary to the general impression, the extent of our shale reserves in New South Wales and in Australia generally is very small. In the last 40 years we have discovered in New South Wales only three new shale deposits, whereas, during the previous 40 years, something like twenty fields were discovered. Therefore, the prospect of a new field being discovered in the future is comparatively remote. Moreover, of the 20 or 30 known fields in New South Wales, most are very small. Geological evidence is to the effect that each deposit represents the bed of a small fresh water lake, of which there were many dotted about the country in those times. For that reason we may presume that if any further deposits are discovered they, too, will be small, so that future discoveries would not support the premise that the quantity of shale in New South Wales and Australia generally is comparatively small. It is very important, therefore, that we should strive to get every gallon possible out of the shale.

The largest deposit known at present is that at Glen Davis. It was first developed in 1937, the reason being the threatening international situation. It was necessary to develop the field quickly, and the best process known at the time was favoured. Had time not been such an important factor it would have been advantageous to delay operations for four or five years, or even longer, in order to obtain advice and information regarding other possible processes. The Baerami field is the next largest shale deposit in Australia. In my opinion, it is the only one in point of size and quality which would justify any large expenditure on research work. For that reason I should like to see its development deferred pending a close investigation of processes other than those which have been adopted at Glen Davis.

From the organic material in shale only 60 per cent. is recovered in the form of crude oil by the best retorting processes, and at Glen Davis we are getting 60 per cent. of petrol from the crude oil. It is obvious, therefore, that there is much opportunity for improvement in the processes. That opportunity should be seized before the Baerami field is developed. The fine pieces of shale from New South Wales fields cannot be used as bitumen. It is lacking in the binding qualities necessary for road making. The Tasmanian and, possibly, the Queensland shales have the necessary binding qualities, but not those of New South Wales.

168. To Mr. Harrison.—The Glen Davis proprietary is accepting crude oil for refining from two other small shows. So far as I know only one other offer has been made of crude oil to the National Oil Proprietary Limited, and I think that the quality of the oil was such that it was not attractive. I do not know of any refusal to accept the crude oil from the Barigan field.

It would not alter my opinion regarding the advisability of deferring the development of the Baerami field if I knew that a retort had been developed that could produce oil from both shale and coal. I had in mind a process which represented a departure altogether from retorts, perhaps a solution process followed by hydrogenation of the extract, such as has been used in Germany for the production of diesel fuel from coal.

I have seen a retort of the Morgan type near Strathfield, in Sydney, but I cannot say whether it is working at the present time. When I saw it they were having a lot of trouble with it. The retort did not impress me greatly. I am not in principle in favour of a rotary retort because it creates dust which is carried over with the gases. We have had trouble enough with dust at Glen Davis, without using the rotary process.

Technically, I am satisfied with the progress at Glen Davis, but the speed of development is disappointing, largely due to the difficulty of getting labour. We may regard Glen Davis as a proving ground for Baerami in the matter of extracting oil from shale, and the difficulties experienced at Glen Davis ought not to recur at Baerami once they have been solved at Glen Davis. However, further investigation is necessary. The Baerami seam does not consist entirely of torbanite as does that at Glen Davis. There is associated with it a layer of cannel coal, and even a layer of ordinary coal, factors which might be responsible for difficulty when it comes to treating the shale. So far as I am aware, no work has been done on mixed oils of that kind, and samples should be sent abroad for treatment before we embark upon large scale operations.

We are using at Glen Davis a modified Pumphreton retort. In the early days a parcel of Newnes shale was sent to Scotland for testing in the original Pumphreton retort. It gave a yield of 110 gallons of oil a ton, but the throughput was only  $\frac{1}{3}$  tons of shale per day, which must be regarded as unsatisfactory. Then Mr. Fell

installed four substitute off-takes on the Pumphreton retort which enabled it to put through 5 tons of shale a day, and still give a yield of 100 gallons of oil to the ton. However, the Fell retort cannot be regarded as anything more than a compromise. Present-day retorts recover about 90 per cent. of the oil formed in the shale during the process of carbonizing, but only about 60 per cent. of the organic matter in the shale is turned into oil.

The Renco retort impressed me very favorably. So far as the short test went it was completely satisfactory, but the test was not long enough to detect weaknesses of material or construction. Even if I were advising a private concern, in which case I might be justified in taking greater risks, I would not regard the tests of the Renco retort as being sufficiently complete to justify recommending its use. However, I was sufficiently favorably impressed to recommend that a plant be operated for three months in order to obtain the experience which we still lack.

Two parts of the Glen Davis set-up are unsatisfactory—the retorts themselves, and the plant used to recover the crude oil from the hot gases coming from the retort. The production plant is now being put into position, and we expect that it will be completed by the end of the year. Nothing has been done in the way of reconstructing the retorts because the Board took the view that it could not afford to shut down the plant completely. However, between now and the end of the year, it is expected that 40 retorts will be completed to the design of the Fell retort, and by the 1st January next they will be coupled up with the new production plant. We shall then have an efficient plant for treating 200 tons of shale a day, which means that our output will be 50 per cent. greater than at present. When those retorts are in operation we shall shut down the 60 retorts which are now working unsatisfactorily. During the ensuing six months they will be completely rebuilt to the Fell design, so that by December they will be in commission, and coupled with the new production plant. We shall then be operating at full capacity. I believe that there ought to be a refinery attached to each big field such as Glen Davis and Baerami. The smaller fields should produce crude oil only, and send it to the other places for refining. In the United States of America there is usually a refinery on each property.

It has been estimated from geological evidence only that there are 20,000,000 tons of shale at Glen Davis in a seam which in some places is no more than 6 in. thick. Probably, less than half would be commercially recoverable. By next year, we shall be carbonizing at the rate of nearly 200,000 tons a year, at which rate the field would last 40 years. At Baerami about 10,000,000 tons of shale are commercially recoverable.

169. To Senator Aylett.—The capacity of a retort is expressed in terms of tons of shale which can be carbonized in a day. If a retort were capable of passing through only 1 ton of shale yielding 50 gallons of oil it would not treat satisfactorily 1 ton of shale yielding 100 gallons of oil—probably only about three-quarters of a ton.

170. To Senator Lamp.—I do not believe that the retorts at Glen Davis are being overloaded at the present time.

171. To Sir Frederick Stewart.—Within the next few years there may become available an entirely new technique for the extraction of oil from shale. That is why I recommend deferring the development of Baerami for a few years. By waiting, we shall be conserving a national asset at Baerami, instead of wasting it by attempting to develop the field with

inferior equipment. I am not entirely without knowledge of what is going on in Germany in the production of diesel oil from coal. I believe that the process could be applied to shale, and experiments should be conducted towards that end.

172. To Mr. Harrison.—There is nothing novel in the idea of a retort that is able to treat both shale and coal. Nearly every shale retort would function with coal, but the opposite does not necessarily apply. Therefore, the existence of the Morgan retort does not modify my view regarding the advisability of deferring the development of the Baerami field until we learn more about what is being done overseas.

The Morgan retort has a very high throughput, but as regards the quality of the oil and the cost of maintenance, the retort is unimproved. I understand that Dr. Morgan has a plant in England, but that it has not operated on coal. It was constructed for that purpose, but is at present being used for the recovery of oil from sludge. When Dr. Morgan offered to bear half the cost of erecting a 60-ton plant for making tests, he was probably referring only to the cost of the retort itself, but that is only one item out of a number involved in producing oil from shale. Dr. Morgan would be committing himself to only about 10 per cent. of the total cost. The Metropolitan Oil Refinery Limited is operating at Strathfield a retort based upon the Morgan principle.

I have seen the retort invented by Mr. Spies. I was called upon to examine a small plant designed by him and set up in a garage at Canterbury. There was a length of piping with dome on the top, and then a pipe leading off with four branches from it. The first branch was for petrol, the second for kerosene, the third for diesel oil, and the fourth for heavy fuel oil. The suggestion was that these various oils would know which pipe they were supposed to come from. A commercial unit of the kind was installed at Baerami and operated there. It was decided that there was no ground for the claim of Mr. Spies that he was able to draw off the various kinds of oil without subsequent distillation. With that aspect removed, the thing became just an ordinary retort.

173. To Senator Aylett.—The retorts in use in Australia could be converted with little trouble to enable them to extract oil from coal. The Davidson retort, which is in use in South Africa, and Estonia, was first developed for coal, as was the Salerni retort, which has been used in the Saar and also in South Africa.

174. To Senator Lamp.—One cannot rely upon a commercial retort giving the same results as the pilot plant from which it is developed. For instance, a pilot plant with a 9-in. pipe might give very satisfactory carbonization of the material placed in it, but it would not follow that the same results could be obtained if the material were placed in a 3-ft pipe. However, the Renco retort is not externally heated. It is heated by the passing of hot gases through the retort. Of course, there is the possibility that if the size of the retort is increased unduly, the gases will not pass through evenly, but will channel up one side or the other. However, the diameter of the 250-ton retort designed by Mr. Jacomini is only 5 ft., and there is no reason to suppose that there would be channelling. Our experience of blast furnaces leads us to believe that the diameter could be increased to as much as 10 feet without channelling taking place. I agree that we should use all our shale resources possible, but I do not know where the line could be drawn between the usable and non-usable material. At Glen Davis we throw away material below  $\frac{1}{4}$  in.

The witness withdrew.

(Taken at Ladbroke.)  
SATURDAY, 17th JUNE, 1944.

Present:

Senator LAMP (in the chair).  
Senator Aylett. | Mr. Mulcahy.  
Mr. Conelan. | Sir Frederick Stewart.

Val Perkins, dairy farmer and stud stock breeder, Ladbroke, sworn and examined.

175. To the Acting Chairman.—I appear before this Committee in my capacity as chairman of the Sherwood Ward in the Ladbroke Municipal Council. I have not been associated with the development of the shale deposits here, but I have prepared the following statement on the subject:—

For many years now, the question of the practicability of the Ladbroke shale fields has been investigated and in various ways tried out, with the inevitable result to date, that apparently no substantial and lasting success has been achieved. The conditions under which all of these attempts were made, were such that economics had to enter very considerably into the scheme of things, and in all probability were the deciding factors. I submit, however, that present-day conditions are very largely different from anything that pertained in the past, and that therefore, the question of economics is not so vital to-day.

Speaking as a layman so far as shale and oil matters are concerned, but as the chairman of the Town Ward in the Ladbroke Municipal Council for several years, I would in all earnestness respectfully submit to you that the time has come when something definite should be done in relation to these works. By this I mean, that it appears as if the Ladbroke shale question has, for a long time, been very little, if anything more, than a political play-thing, and the effect has been very largely to hinder the progress of this town, inasmuch that many owners of vacant building blocks, many of them absentees, are seized with the obsession that some day the Ladbroke shale fields will function, and, therefore, they are either not disposed to sell their blocks, or else they want abnormally high prices for them. The effect of this is to hinder progress by rendering ineligible, for building purposes, many desirable blocks of land in the town area.

In conclusion, I submit for your earnest consideration that in fairness to this town and district, this Committee should arrive at a definite decision one way or the other. As citizens of Ladbroke and of the Commonwealth of Australia, we would naturally much prefer to see the works put into substantial and continuous production; but if it should so happen that this is impossible, then we are of opinion that this Committee should not hesitate to say so in no uncertain terms.

I submit that statement on behalf of the Ladbroke Municipal Council and the Ladbroke Citizens Committee. They represent all creeds, all political thought and opinion, and all classes, and their decision on this matter was unanimous. You ask me whether I know whether any of the major oil companies have endeavoured to prevent the development of the deposits here. I am not competent to answer that question.

176. To Sir Frederick Stewart.—The shale mine is about two and a half miles from the town of Ladbroke, and the deposits have been worked from time to time during the last 40 years. You ask whether land speculation here has been based on expectations of the development of the deposits. I would hardly call it "speculation." People have had the land for many years, and will not sell it, except at ridiculously high prices in the hope that one day the shale will boom and they will become millionaires. I consider that it

is the responsibility of this Committee to tell them whether or not those hopes will be realized. The basis of the municipal rating is, in the town area, 5 per cent. of the capital value; and the capital value is fixed by the State Taxation Department, now under Commonwealth control.

177. *To Mr. Mulcahy.*—The shale deposits here have not been worked for a considerable time.

178. *To Senator Aylett.*—The water supply in the vicinity of the deposits presents no difficulty; the shale is situated near each bank of the Mersey river. From the deposits to the nearest port, Devonport, is a distance of 9 miles. The road between the two places is a bitumen surface for seven miles of the way.

*The witness withdrew.*

Stanley Stewart Purves, general manager, Goliath Cement Company, Latrobe, and Alexander Walker, industrial chemical engineer, Goliath Cement Company, sworn and examined.

179. *To the Acting Chairman.*—*Mr. Purves.*—I have had considerable experience of the Latrobe shale field. The story of the deposits is told more fully and accurately than I could recount in the report of the Tasmanian Shale Oil Investigation Committee. That document was prepared after a great deal of investigation and with the exception of estimates of costs, which would no longer apply, is substantially a reflection of present conditions.

Briefly, I believe that we are wasting time in considering the prospect of developing the shale here. It is a low-grade material, difficult to handle. It has an optimistic oil content of 33 gallons a ton. A hard material to mine, the shale is also difficult to treat, and produces an undesirable oil with a high sulphur content. It costs 6s. to produce 6d. worth of oil. The Tasmanian Investigation Committee expressed the view that 1,000 tons a day was the maximum that could be extracted from the field here, but that estimate has to be established. Even if it were worked to capacity, the yield of liquid fuel per annum would not be greater than the quantity that two tankers could bring here.

I have heard the claim that the Jacomini retort will handle 300 tons a day, but I do not believe it. Retorting is only one part of a complicated process. It begins with a difficult mining proposition—a broken field, laminated and harsh material to mine—and extends through a difficult treatment process. My company lost £49,000 on the venture, over a period of thirteen years, so I may be rather biased on this subject.

We operated the Crozier type of retort. One company which preceded us in working the field had the idea of using the shale in the manufacture of cement, and in the process extracting oil as a by-product. The plan was so far-fetched that you can hardly regard it as a real attempt to exploit the field. My view is that each of the processes has enough complexities, without combining them.

The main railway line is less than one mile from the fields, which are fairly extensive, but very broken. Transport and water supply are not the difficulties in working the field. The problems arise from the mining and retorting of the material, and the low grade shale itself. You remark that low grade shale is being treated in Scotland, and is yielding between 15 and 20 gallons a ton. My reply is that the two shales are not comparable. The Scottish shale has a paraffin base and yields valuable by-products.

180. *To Senator Aylett.*—Our retort did not produce 83 gallons per ton. That is a laboratory figure, the result of many tests. Our retort produced 23 gallons per ton. The Latrobe field was the first in which the Crozier retort was established commercially, but later this type was used in Burma.

181. *Mr. Walker.*—You ask whether a Crozier unit is still in operation anywhere. A unit was built for use in Burma, but military disturbances upset the erection of it. Preliminary experiments had been carried out in the Burma shale fields, and the unit itself was carefully investigated in London by the Council of the Fuel Research Board. The unit here was the first to be tried on a large scale. The whole process was developed from a small scale, through three different stages, until the final operation. It was in 1923 that I first became interested in methods for the extraction of oil from shale and coal, and I worked continuously in that line until 1933. I came here in 1932, and we operated until 1935. After that, I did some work in Launceston for the Tasmanian Government.

You ask whether I have had any experience with later retorts. "Later" is a questionable term. I have a knowledge of all the latest plants designed for similar work in England. I know the difficulties encountered in treating shale found in various parts of the world, including the problems that arose in New South Wales in 1925 and 1926. I consider that a retort is not doing its job unless it recovers at least 80 per cent. of the laboratory yield; but no retort could recover the whole of the laboratory yield. Conditions are such that I am certain that no existing plant recovers the yields that are obtained under the ideal conditions appertaining to laboratory work. You state that you have reports of yields up to 100 per cent. My reply is that the whole question hangs on what is considered to be the laboratory yield. Even laboratory yields may vary according to the methods used; but I am assuming an absolutely ideal conversion of the organic material of the shale to oil.

Although I believe that the average width of the shale here is 5 feet, I prefer you, in the interests of greater accuracy, to get the information from the report of the Tasmanian Investigation Committee. There is a low-grade band running through the middle of the seam, and no oil is actually present in the shale. The yield depends on the efficiency of the conversion of the highly complicated organic resin to oil.

You ask whether any process has been devised for extracting the sulphur. The difficulty could be overcome with present-day technical knowledge, possessed by the staffs of oil companies and other persons who have been doing research in oil refining. I see no reason why the sulphur problem could not be solved. I did not overcome it in the sense of eliminating it.

Speaking technically, I consider that it is a simple proposition to get oil from the Latrobe shale. Retorting presents no difficulties such as those encountered in New South Wales. We can easily get oil from our shale here, but at a price. As to the quality of the product, we used it for years, even with the sulphur content. The sulphur is not a desirable constituent, but how deleterious it is, I am not prepared to say.

182. *Mr. Purvis.*—We used shale residue in the manufacture of cement when we were attempting to get oil from shale, but the shale residue had no more value than any suitable clay. Residues from retorting have been used as a filler in making asphalt from bitumen. I would say that a statement that all the residues from Latrobe shale can be used to commercial advantage is incorrect. It has no more use than has stone.

183. *To Mr. Conelan.*—*Mr. Walker.*—Our costs of mining shale varied according to whether we took shale from the seam or selected the top and bottom band. The information is contained in the report of the Tasmanian Investigation Committee. Mr. Purvis estimates the cost at 15s. a ton under present-day conditions—a substantial increase compared with the Committee's calculations. The cost of retorting depends on many factors, and on the size of the plant. The maintenance of retorts, which is heavy, has not been put on a basis which would enable one to make a definite statement. We have some high grade shale in a small isolated patch. The yield from it would be about 62 gallons. The figures in the report are based on a wide section of the field, and represent a fair average. I believe that it would be uneconomical to attempt to obtain oil from Latrobe shale, in competition with oil from wells. Whilst there is no technical difficulty in getting the shale, the process would not be economic.

184. *To Senator Aylett.*—I would not be prepared to say that oil could not be produced as cheaply from Latrobe shale as from New South Wales shale.

185. *To Mr. Conelan.*—You ask, what is the cost of producing a gallon of oil. Some years ago, I calculated the figure at 29 a ton for crude oil. I was told that it was hopelessly uneconomical as the Navy was getting it at prices varying from 25 15s. to 23 5s. a ton. According to my information, the cost of producing fuel oil in New South Wales approximated those figures, but that overlooked the fact that the New South Wales proposition was regarded as a petrol-producing one, the fuel oil being a residual product, and the petrol enjoyed an excise concession.

The retort which we operated here, handled 14 tons a day. Whether it is desirable to build up a number of small units or have one big unit is a question of local conditions. A large scale unit has certain advantages and certain disadvantages. Although I have not been to Glen Davis, I retorted and examined some of the oil from New South Wales shale when I was in England. I have not seen the Jacomini retort in action, but I read the literature and claims about it. It appeared to me that the trouble was that the figures had been based on shale which was not representative of the field. It is easy to be misled.

186. *To the Acting Chairman.*—You ask whether a small retort, or pilot plant, would yield proportionately as much oil as a big retort. Everything depends on the type of unit. When an essential dimension is altered, the effect on the yield must be known before estimates are made. Under certain conditions, when the pilot plant is a certain size, we can reasonably expect a pretty close parallel with a bigger unit. I do not mean to belittle any system; and I am not speaking against the Jacomini process, because I am not entitled to do so. But there is a possibility that the yields were based on samples that were not representative of the field. In our case, we began operations here on the basis of results obtained from one series of tests in London. A second parcel did not substantiate those results, and we assumed, carelessly, that the second sample included some of the roof and floor of the mine. When I came here, my tests paralleled the results that I got with the second sample. It proved to be more representative of the field than did the first sample. Our yields were not particularly high. We reckoned on 36 gallons a ton.

187. *To Mr. Mulcahy.*—You recall that I said that the difficulties experienced in New South Wales are not apparent at Latrobe. The main difficulty is, the richer the shale, the greater is the tendency to fuse in treatment; and that fusion created a problem. We overcame it in two ways, neither of which was very satisfactory. The first method was to mix this rich shale, which assayed 182 gallons a ton, with Murrumbidgee

shale, which assayed 70 gallons a ton. We managed to run the mixed shale quite satisfactorily. On another occasion, we mixed the shale with coke, with satisfactory results. But the results did not seem to parallel those obtained from the John Foll plant. Mr. Petrie seems to have done a better job on the Foll plant than they are doing now.

I have had a good deal of experience of extracting oil from coal. I am inclined to think that, in view of the large coal deposits in New South Wales, the process is more economical than that of extracting oil from shale, particularly as the residues have a high economic value. I have often thought that it was possibly a better avenue of approach. You say that shale oil cannot compete with low oil. As Professor Hytten said when I discussed the same matter with him, the question is getting into the realms of political philosophy and not political economy.

Despite the fact that this retort was relatively small, we produced by far the greatest quantity of oil obtained on this field. The production was slightly less than 250,000 gallons. We formed a syndicate, which included the men, and we worked on the basis of share-and-share alike. The net earnings of each man was about 30s. a week, and we were not covering any proper maintenance costs. The Government of Tasmania assisted by granting to each member of the syndicate an additional 30s. a week. We were running one unit, which was a hopeless commercial proposition, but it was a useful job during the depression. We handled about 14 tons a day, and we supplied the total requirements of the State for fuel oil. We had a satisfactory trade in power kerosene and used the petrol ourselves.

I have no information as to the most efficient retort available at the present time, but retorting is rather a minor matter. The economic difficulties arise on the mining and refining side. Retorting, in my opinion, has been over-emphasized. I met Mr. Petrie, who was manager in New South Wales for John Foll, and he told me of the difficulties he was encountering. He had a simple modification of the Scottish retort, which was not ideal for the type of work that they were doing. The results that Mr. Petrie obtained appeared to me to indicate that retorting was not such as to warrant the extraordinary investigation that has been made into that side of the process.

188. *To the Acting Chairman.*—You remark that Mr. Petrie's ideas were not put into effect at Glen Davis. In my opinion, they made a fatal mistake in not doing so. They should never have attempted to handle the shale there with the Pumpherson retort. In order to succeed, they should have used Mr. Petrie's modification.

I should like at this juncture to express my views on the utilization of concentrates obtained from floating above out of the shale. The concentrate so obtained from the shale by the flotation process is a material of considerable economic potentialities, and is well worthy of investigation. There is an organic material containing, say, 75 per cent. of oxygenated hydrocarbon, according to how you run your flotation plant, and that material is very scarce in the Commonwealth. We found that it produced a very satisfactory asphalt, with a by-product yield of about 40 gallons of very light crude oil, largely petrol. Outside that particular process, it appears to me that the material might well repay careful investigation by competent authorities. I have in mind such things as synthetic plastics. Considering the extent of the deposits here and the fact that this is one of the few to which the flotation process is applicable, by which it can be up-graded, it would be a pity if that concentrate were not carefully examined with a view to exhausting its potentialities. I suggest that that investigation could be approached via the Council for Scientific and

Industrial Research, and I would say that a firm like Du Pont in the United States of America or similar technical interests in Great Britain could undertake the work. If they could be relied on to give an honest opinion of the material, it would be well worth investigation. The raw materials for some of these industries are derived from the coal-fields, and are expensive to get. Speaking of synthetic plastics, we have here a large field which could easily become an economic proposition.

139. *To Senator Aylett*.—This material does some peculiar things. It has great possibilities. In our first attempt to convert it to asphalt, we had a very rubbery material, and further work on it gave us the asphalt. At first the process was not a simple one, but now it appears to be simple. What it would be like on a big scale remains to be seen. It is a most interesting departure from the normal treatment of shale. To my knowledge, this is the only shale which is amenable to that, so we have a unique industry with unique possibilities. With that particular process, all the by-products could be used ultimately to advantage.

140. *To Sir Frederick Stewart*.—*Mr. Purves*.—You ask me to outline briefly the history of the field. No one is operating it at the present time. In the past several companies have operated it. They are as follows:—

Year.	Company.	Gallons.
1910 ..	Tasmanite Shale & Oil Company ..	4,800
1915 ..	Balloon-Latrobe Shale Oil Company No Liability ..	24,000
1927-28 ..	Australian Shale Oil Corporation ..	65,000
1930 ..	Goliath Portland Cement Company ..	29,101
1930 ..	Tasmanite Shale Oil Company Limited ..	35,000
1931 ..	Goliath Portland Cement Company ..	15,878
1931 ..	Tasmanite Shale Oil Company ..	17,411
1932 (to 7th Oct.)	Tasmanite Shale Oil Company ..	65,726
		248,114

At a wild guess, I would say that £300,000 have been expended on the field. Some of the land is Crown land and some of it is leasehold, privately owned. In my opinion the private ownership of the leases has been responsible in some measure for the efforts made to exploit the deposits in the past. The Tasmanian Investigation Committee, after concluding its inquiries stated that the maximum output that could be obtained from the field was 1,000 tons a day. You will find on page 67 of the booklet an estimate of the life of the leases on that basis. The committee assumed a tonnage of 25,000,000, but that has not been proved. It was undoubtedly a guess.

191. *Mr. Walker*.—You point out that I said that when I submitted a price of £9 a ton, the mainland prices for the oil were influenced by a rebate of excise, and you ask whether that rebate would have applied to the Latrobe production. My point was that the New South Wales deposits at Newcastle were developed primarily as a petrol producing proposition, whereas the proposal which we had under consideration was the supply of fuel oil for the Navy. We decided, partly on account of the sulphur difficulty, not to produce petrol in a large way, but to make the whole process as simple as possible.

192. *To Senator Aylett*.—You ask what percentage of petrol would we obtain from 30 gallons of oil? The yields are set out in the Tasmanian committee's report. I think that the figure was about 10 per cent. But I remain of the opinion that there are other methods of dealing with the shale. For example there is the method of cracking, or, provided the company can bear the expense, you can improve the whole business by the hydrogenation process. That would be one method of

getting rid of the sulphur. You ask what depth is the seam below the surface. There is a small area near the Railton end where the seam is fairly near the surface and one suggestion was that it might be worked by means of the open-cut method. However, I consider that it is a mining proposition. Some of the holes are down to a depth of 300 feet. The seam itself is badly faulted. Details concerning the area are contained in the booklet.

*The witnesses withdrew.*

(Taken at Hobart.)

MONDAY, 19th JUNE, 1944.

Present:

Senator LAMP (in the chair).

Senator Aylett.  
Mr. Conelan.  
Mr. Harrison.

Mr. Mulehby.  
Mr. Rankin.  
Sir Frederick Stewart.

Maurice Lambert Rayner and George Halter Rayner, of Hobart, sworn and examined.

193. *To the Acting Chairman*.—*Mr. M. L. Rayner*.—My present occupation is that of installation engineer for the Tasmanian Wooden Shipbuilding Board and I am at present employed on the installation of engines in one ship. I have had considerable experience at Latrobe under the direction of Mr. Walker in producing oil from shale. I was with Mr. Walker for about four and a half years and I was with the late Mr. Petrie for about twelve years. You will recall that Mr. Petrie came from Scotland originally for the purpose of installing a plant at Newcastle. I have also done research work in the treatment of shale for three or four years at Latrobe. I have evolved a retort. It is a straight cylinder cast-iron retort from 15 feet to 17 feet high and 15 inches in diameter at the bottom and 12 inches in diameter at the top. The shale is placed in the retort, which is externally heated by suction gas and the residue of the gas from the retort itself. The retort itself, when in operation, is practically automatic. With reasonable conditions it can be left in operation for four or five hours.

You ask whether I have done any experiments in the automatic feeding of the waste gas back through the retort after it has been heated. I have done so. We used the gas here, but not entirely, to heat the retort. My retort was not sufficiently large to warrant my endeavouring to heat it entirely from gas. It was only one unit of a number of units and at any time the gas would not be sufficient without some extra suction gas to supplement it. But for the most part there will be sufficient gas from a number of retorts, arranged in nests of four. This retort has proved itself to the satisfaction of the people who were interested in it, namely Mr. Pencock who gave me permission to go on his land and who assisted me financially with my work.

The plant which I had at Latrobe was installed at my own expense about nine years ago, and I am still paying for it. It was on entirely the same principle as that which I have adopted in my retort in Hobart but was not carried out to the same extent that I carried out the Hobart plant. This plant at Hobart has the automatic principles that I wanted to install in the plant at Latrobe, but at that time the depression hit me and I was unable to finance the business. I financed it to the degree that it carried me over the depression; but I was unable to prevail upon any politician to watch it in operation. Only one member of the Parliament of Tasmania ever came to see it in operation and give me advice and assistance, namely the former Secretary for Mines, Mr. Scott.

I got 80 gallons of oil from a ton of shale. The laboratory test was 10 per cent. more than that in some cases. In point of fact, I obtained the 30 gallons from 40 cubic feet. There had to be a rather arbitrary measure of the shale, because some shales are heavier than others. It was an established fact that approximately 40 cubic feet made up 1 ton of light and heavy shales. The heavier the shale, the less is the oil content. We were getting back to the poorer class of shale, known as the middle band, and that, combined with the lighter class of shale, which is higher in oil content, balanced the 40 cubic feet. We got approximately 15 per cent. of petrol from the crude oil. A lot of the oil which I produced for petrol in Latrobe was used in my motor car, and I also obtained lubricating oil. I took it to the farmers and I used a lot of my own petrol, and sold lubricating oil, fuel oil and kerosene. A firm in Hobart—Darling and Reynolds—was the agent, and was prepared to take all that I could produce.

There are other commercial products to be obtained from the shale apart from petrol and crude oil. The diesel oil is the chief product and now it is just as valuable as petrol was when I was working at Latrobe. Mr. Walker was selling petrol to the public for 1s. Mr. Walker while I was there. Of course, that price did not pay him. The point was that he hoped to put in a commercial plant. Even the plant at Latrobe was not a commercial one because it was only one tenth of the size of a commercial plant. In fact it was only a demonstration plant.

You ask whether any use has been made of the residue from the retort. The residue could be used, if it were mixed with a certain amount of bitumen, for road material and as a fertilizer. I have had personal experience of its value as a fertilizer. I am unable to say what would be the cost of producing one gallon of bitumen, but at the time we operated that plant, we considered that we could make a profit of 25 per cent. on working it. The plant could be multiplied hundreds of times, without any alteration of the unit itself, by multiples of itself. I should point out that I could not make a bigger retort to handle more shale. That is the rock on which other experiments have perished, including the plant at Newcastle.

I do not think that a retort is suitable when its capacity is increased disproportionately to that of the pilot plant. Just assume that the retort is 25 inches in diameter. I made experiments at Latrobe, with Mr. Walker's sanction. We found that some portions of the shale in the retort were not being treated. The same thing took place in the Scottish retort operated by the Australasian Shale Oil Corporation. It was a Pumpherton retort. From the centre of that retort came a run of shale which had not been treated. They had to slow down the retort until it was not a payable proposition from the stand-point of speed. It had to be operated so slowly that it was no faster than my retort. From the centre of that retort to the outside periphery of the casing we put in a nest of pyrometers. The temperature was 800 degrees centigrade. Nine inches from the side, we got shale that had been treated. After 24 hours the shale in the centre had not been treated. Its original form had not changed. We went one better and put in a nest of thermometers, in a column, and 9 inches from the centre at 800 degrees centigrade. The result was that we got a rise of 200 degrees in temperature to a depth of 12 inches. My suggestion to Mr. Walker was that we could reduce the diameter of the retort. If you read Mr. Walker's report, you will find that the firm decided to reduce the diameter of its retort from 20 inches to 15 inches. That was due entirely to those experiments.

You ask whether that difficulty could be overcome by using forced pressure through the retort; in other words, forcing gas through for the purpose of heating

it. Whilst that would help, it is a difficult matter to find where you would acquire that heat to force through the retort. You have to get a neutral gas which would be put into the retort; otherwise, any gas which formed in the retort would burn. If you have anything but a neutral gas, it would ultimately burn the products that you are trying to provide. For example, steam can be super heated, but it is a costly process. My son and I have experimented on those lines of heating internally with super heated steam and suction gases.

You ask me to explain what is to prevent the use of waste gases. When Mr. Brouder came to Tasmania, I assisted Mr. Petrie to put in the plant which he used. His process was to return the waste gas from his retort. He got it hot enough by putting it through a super heater. After he had burnt out three super heaters costing many hundreds of pounds, he came to the conclusion that buying such super heaters was a costly process. The idea was then evolved of making fire-proof tiles to be used in the construction of fire-proof super heaters. That cost so much that he decided that building super heaters and using super heated gas was not a practical proposition. The retort failed as the result of mechanical difficulties. It was 9 feet in diameter. He had an experimental retort which was 30 inches in diameter. The smaller retort had some mechanical failures. There was a mechanical grate which was to discharge the residue. My retort also has a discharge, but it is not a mechanical grate. It is a mechanical arrangement, and probably I should patent it. Mr. Brouder failed because a mass of shale, when heated to 800 degrees centigrade, has a serious effect on mechanical contrivances. He had contrivances in the centre of his retort and each of them collapsed. When he secured the retort 9 feet in diameter, I remarked that he was multiplying by five the difficulties that he encountered with the smaller retort. It failed.

194. *To Mr. Conelan*.—I refined the petrol myself at Derwent Park. I cannot say what it cost to produce. You inform me that Mr. Walker said that it cost him 5s. to produce 6d. of petrol. I would not be surprised if it cost him £5 to supply 1s. worth of petrol under present conditions. But the present conditions were not on a commercial basis. Nor was Mr. Walker's project. He did not assume that it would cost 5s. to provide 6d. of petrol under working conditions, or it belied his report. I suggest that you obtain from the Mines Department here a copy of his report and prospectus.

195. *Mr. G. H. Rayner*.—You ask what is the area of the field at Latrobe. According to the report of the Mines Department, the field has many millions of tons of shale and in several directions it is 7 miles in length, on both sides of the river. It has a proved area of 19,000,000 tons. That has been proved by shafts and bores, and there is an estimated area of some 300,000,000 tons. It is impossible to estimate the number of bores and shafts that have been put down, because many companies still retain their lease, are still boring, and will not provide this information. Boring has been done since 1902; the Mines Department has a record of a large number of them. In fact, the department has sunk 30 bores in the last couple of years in the Latrobe area.

196. *Mr. M. L. Rayner*.—Nothing is being produced at Latrobe from the shale at the present time. The depth of the seam is about 5 feet. In some places it might be only a couple of feet, but in others it might be 7 feet. You ask whether the Latrobe shale could be economically worked. My answer is that, as a wartime effort, I am satisfied that it could be worked as an economic proposition. But conditions might return to the position that prevailed before the outbreak of war. There is only one reason why the deposits could not



be worked, and that is that imported fuels might come so cheap that they would upset the prospects of the shale-mining industry.

197. *To Mr. Mulcahy.*—You ask my opinion as to the production of oil from shale at Latrobe as a commercial proposition. I think that it is possible to work the deposits as a commercial proposition. We are not concerned entirely with obtaining petrol from shale because there are a number of by-products such as dieselene and bitumen.

198. *To Mr. Mulcahy.*—*Mr. G. H. Rayner.*—One cannot base costs on an estimated retort. The larger the retort becomes, the less the costs become because the labour required to supervise it is reduced. These processes are carried out almost entirely automatically. The larger the retort, the greater is the amount of work that a man can handle by means of the automatic apparatus on hand. Whilst it would be impossible to estimate what a 50-ton retort could do, it is reasonable to assume that a 10-ton retort would be 20 per cent. cheaper to operate than a 50-ton retort. My father is in favour of the treatment of shale in larger quantities by a nest of units of similar dimensions, but not by units of a larger diameter. It is only the cylinder which contains the shale. There is only one scrubbing and refining apparatus, for example.

199. *Mr. M. L. Rayner.*—I agree that there is sulphur in the Latrobe shale, and I have no comment to make upon it. We can reduce it to 2 per cent. As a matter of interest I shall give to you the views of two authorities about this sulphur content. The Tasmanian University declared that fuel containing 2 per cent. sulphur can be used without harming engines. The British Admiralty specifications provide that the sulphur shall not exceed 3 per cent.

About half a dozen companies have worked on the Latrobe shale deposits. They invested considerable sums of money in their projects, and if they were all like Mr. Bronders they were there definitely to spend the money. My instruction from Mr. Petrie was to put in a plant and pray that we would live long enough to get something that would operate. You say, "Surely they were not spending money for the sake of spending it?" I would not say that. The money was provided by shareholders.

200. *To Sir Frederick Stewart.*—I ceased my activities largely because the Commonwealth Government indicated that no more money was to be expended on the development of shale deposits other than at Newnes. Another reason why I ceased operations was that the Generosity Council prohibited me from working there any longer. You comment that no action of the Commonwealth Government could affect any private individual who desired to produce oil from shale. I remained you that one had to obtain permission from the Commonwealth Treasury before it could expend money for this purpose. The plant which I bought was perfectly satisfactory in every conceivable way. You state that a rebate of excise was granted by the Commonwealth Government and embraced all enterprises producing oil from shale. The point is that we were given to understand that oil produced in Australia would be free from excise for a period of ten years. When I produced the fuel in Tasmania, I was summoned to the Customs House and informed that I would have to pay excise on it. All my inquiries then showed that I was liable to pay the excise on the oil fuels, including petrol. That occurred about two and a half years ago when I was operating the plant.

I emphasize that the shale which was brought from Latrobe for demonstration purposes in my plant here was not specially selected. It was mined by a man who had never handled shale before. He took it from an open cut.

201. *To Mr. Mulcahy.*—There are many seams at Latrobe, and all of them are of more or less the same value. There might be 1 gallon a ton difference between them.

202. *To Sir Frederick Stewart.*—As I stated earlier, my recovery of petrol was equivalent to 15 per cent. of the crude oil. That was by the ordinary fractional distillation, and not by any cracking process. The percentage would be increased by the use of a cracking process. In other words, the production of petrol was equivalent to 5 gallons per ton of shale treated.

203. *To Mr. Harrison.*—The residuals from Latrobe shale are different from the residuals from Newnes shale. The explanation is that the Latrobe shale has a bitumen base, whereas the Newnes shale has a paraffin base. You ask, what is the assay content per ton of Latrobe shale. It is round about 40 gallons of crude oil. We recovered 30 gallons. A selected sample might yield 60 gallons. I consider that the development of Latrobe is a commercial proposition. There are a number of reasons why the deposits have not been exploited. In my opinion, the effort made by Mr. Bronders was not an attempt to produce oil from shale. By that remark, I imply that the process by which he tried to extract the oil never at any time warranted the expenditure of £80,000, much less £100,000. I put in the experimental plant—a 10-ton retort. A retort had to be installed in six months in order to enable the company to obtain concessions from the Commonwealth Government. We were to have a retort in operation treating 10 tons a day. The plant was installed, and I ran it continuously for 70 hours. Never at any time did it produce 1 gallon of clean crude oil. It did produce some tars and inferior oils which were practically useless for any purpose. The retort had so many mechanical difficulties that it was altered innumerable times after the original erection until it was put into operation. All the time the main plant was being built and designed on the same lines as the experimental plant had been designed twelve months before. If that was not a success, how could the larger plant be a success when all the difficulties of the smaller plant would be multiplied? Mr. Bronders was working for Australasian Shale Oil Corporation, a public company, and I suppose that he was using the shareholders' money for that purpose. The failures that attended the efforts of the various companies caused the public to lose faith in the enterprise.

204. *To Mr. Conlan.*—You ask whether my last remark would apply to the Goliath Cement company. It operated a Crozier retort, which Mr. Walker brought from Scotland and erected at Latrobe. I was employed in erecting it, and I was engineer in charge of operating it. The retort had problems in its discharge, but it did a fairly good job and produced many thousands of gallons of oil. But because of difficulties in the heating system, which badly burnt and distorted the retort, the plant, which cost £14,000 for castings alone, would never pay for itself, much less yield any profits.

205. *To Mr. Harrison.*—I submitted to Jones and Company details about my plant and working costs. The plant would handle all sorts of products in addition to crude oil and petrol. On those figures I base my estimate that it is a commercial proposition. I shall supply the figures to you.

206. *To Senator Aylett.*—I would not say that some of the companies formed to work Latrobe shale were formed more for profit-making purposes by the promoters than for working the shale. I also would not say that the companies were all making genuine attempts to produce shale on an economic basis. Earlier I referred to the expenditure of considerable sums of money by Mr. Bronders. At that time I could not see any results coming from the retort which

I was erecting. I believe that the company was interested in producing oil, but that its lack of success was due to incompetence.

207. *To Mr. Conlan.*—So far as I am aware, the managing director of that concern was not Mr. Monte. He is managing director for the Adelaide Oil Company, which is still in existence.

208. *To Mr. Rankin.*—No serious distortion occurred in my retort. That was the object in making a round retort, and the fact that there would be more than 9 inches for heat penetration. I worked that retort constantly for more than two months. The retort of the big company to which I referred earlier, operated only for a matter of weeks before serious distortion occurred. The Crozier retort began to give trouble from the first week of operation, and many mechanical difficulties subsequently arose. To the best of my knowledge, not a week passed without some mechanical difficulty developing in it. I attribute the satisfactory working of my retort to the experience that I have gained from difficulties encountered with other retorts. You ask whether it is possible to improve my present plant for the purpose of increasing production and reducing the cost of production. There are some mechanical contrivances that could be added to it, but they would not be substantial alterations.

209. *To Senator Aylett.*—I have not carried out experiments for the Tasmanian Government in the production of bitumen, although I was asked by the late Secretary for Mines, Mr. Scott, to work on an experimental plant at Latrobe.

210. *To Mr. Mulcahy.*—This shale is a valuable asset in the manufacture of cement.

211. *To Senator Aylett.*—Earlier I mentioned that I obtained 5 gallons of petrol from a ton of shale. The results would have been better if I had been able to obtain an improved refining plant. My apparatus was of the very crudest type; Mr. Walker's apparatus was also very crude. I think that I have used more of this petrol than has any other person in Tasmania. Australasian Shale Oil Corporation produced a lot of this petrol and Mr. Petrie permitted me to use it in my motor car, provided I gave him the right to overhaul the engine at any time. That petrol was just as good as, if not better than, any other petrol. Even on a frosty morning, I had no difficulty in starting the engine. I could get 23 per cent. better mileage with petrol from shale than I can now. That was the result that I gave to Jones and Company and they laughed at me. When my plant got under way, Jones and Company tested the first petrol obtained from it. I shall supply to you figures relating to the costs of production, &c., on a commercial basis. I have no idea of the life of the plant. For two and a half years the plant ran at Latrobe and did not deteriorate.

212. *To Mr. Harrison.*—I have no knowledge of the Morgan retort or the Renco retort, but I have some knowledge of the Fumpherston retort and one or two others. I have some knowledge also of a rotary retort. I saw one erected at Latrobe but it never ran, because of very apparent difficulties. It was a good thing that it never operated because it had some use later for cement making. I understood that it cost £48,000 in import duty to bring it into the country but it never treated one ton of shale. That retort came from Germany and was erected by a German engineer.

213. *To the Acting Chairman.*—*Mr. G. H. Rayner.*—I am assistant paymaster at the City Hall, Hobart. My father has not told me that this plant can be produced entirely in Tasmania if necessary. He did not mention that the period required to erect it is not long. In addition, it can be erected piece by piece so that one unit can be producing oil while the others are being added. The apparatus which he designed is for a complete plant of 100 tons capable of producing oil

not necessarily of a standard equivalent to that of oil now produced by the oil companies but nevertheless of a very high standard. Also in the possession of the Mines Department are several samples which we have not seen for eighteen months, so we cannot say whether they have deteriorated. They show our lubricating oils, bitumen, diesel oils and petrol. We make no lighting kerosene but there is a kerosene produced which is extensively used in tractors. As my father stated, the refining plant is of the crudest type and because it was financed by Jones and Company, it was very cheap and made chiefly out of scrap. A considerable amount of thought and research has been given to the matter of the refining plant and we have evolved a plant which we can erect ourselves. This plant follows the latest design in the United States of America; we obtained some knowledge of it from the Tasmanian University and Library. We can make the entire apparatus in Tasmania or it can be fabricated on the mainland and assembled here. We guarantee that the plant, once it starts, will cause no trouble for a considerable time and we shall produce oil as good as any which Newnes produces.

The sulphur question has often been raised adversely to Tasmanian shale but it has been proved here that oils with a high sulphur content are quite successfully used in diesel plants and ordinary internal combustion engines. Oils with a high sulphur content are being used in diesel engines in Great Britain because of the difficulty of the oil position there. I believe that our oil could be used with success.

214. *Mr. M. L. Rayner.*—When I was dealing with the Mines Department I received a questionnaire stating that I had no real reason for assuming that I could produce lubricating oil from Tasmanian shale. I said that the best reply was that I had produced the oil and was using it in my motor car.

215. *To Senator Aylett.*—I stated that we could build a plant to handle 100 tons of shale a day. We could assemble it and be producing in three months time 40 gallons a day and in six months time 400 gallons a day.

216. *To Mr. Harrison.*—The Government's fuel advisers have inspected my retort but their reports were not very complimentary to it. Quite a number of them are biased.

The witnesses withdrew.

(Taken at Hobart.)

TUESDAY, 20TH JUNE, 1944.

Present:

Senator LAMP (in the chair).

Senator Aylett.	Mr. Mulcahy.
Mr. Conlan.	Mr. Rankin.
Mr. Harrison.	Sir Frederick Stewart.

William Henry Williams, Director of Mines, Department of Mines, Tasmania, sworn and examined.

217. *To the Acting Chairman.*—I should like to refer to the Committee a short statement generally covering the position of the shale deposits in Tasmania, before I am invited to enter upon the details. This statement was prepared on the 30th December, 1942, and it is relatively consistent with the position to-day. The statement is as follows:—

Tasmanian oil shale occurs in northern, central and north-western parts of Tasmania, but the major occurrences are in the Latrobe-Quamby Bluff region where there are thirteen areas in a tract of country 27 miles long by 7 miles wide. Mineable areas and grades have been critical factors in efforts directed to

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converting the shale into a commercial asset. These two factors are comprehensively reviewed in the report of the Tasmanian Shale Oil Investigation Committee, a copy of which is submitted with this memorandum.

An application of underground mining practices is generally necessary, and, as the shale series is troubled by faulting and seam irregularities, difficulties have been attached to the definition of an area for initially any difficulty in the location of an area for initially servicing an industry has been overcome by a departmental drilling campaign that was advanced sufficiently to define an area to meet productive requirements for a considerable period of activity.

Possible grades of shale are detailed in the report of the committee, which determined that no general average figure could be presented for the oil yield, as such would have to be ascertained for each area and even for different portions of the same area. In the area recently drilled at Latrobe, the seam section comprises three bands of oil shale of 8 inches, 18 inches to 25 inches and 21 inches to 20 inches in thickness, with two intervening bands of mudstone each containing a low percentage of oil spores. It is anticipated that productive mining would be confined to the middle and bottom bands of shale and lower intervening band of oil-spore mudstone, the top band of shale and upper band of mudstone being left in the roof. The working height, for underground mining, would vary from 4 ft. 3 in. to 5 ft. 3 in. If the middle and bottom bands of shale are to be considered for selective mining, the drilled area offers a proved reserve of 395,000 tons with an average content of 32.9 gallons of crude oil per ton. The economics of selective mining may be prohibitive in which case it would be necessary to mine the two bands of shale and the intervening band of oil-spore mudstone as whole-seam mining. Calculated on this basis, the drilled area offers a reserve of 516,000 tons with an average oil content in the vicinity of 26 gallons per ton. Shale persists on the extremities of the drilled area, consequently it may be accepted that the total available tonnage in this one area greatly exceeds the calculated quantities. Having regard for other known areas, an extension of the drilling would substantially add to the shale potentialities of the district. Grade variations in the several areas may be anticipated in terms of the report of the Committee.

Critical factors of investigation for the conversion of the shale into a State asset have been—(1) Production of fuel oils by straight retorting and refining, with a by-product of bitumen, and (2) Production of bitumen (asphaltene) with by-products of fuel oils and siliceous residue.

Straight Retorting and Refining.—Exploitation of shale for its oil content with a by-product of bitumen is governed by practices of straight retorting and refining. For many years, efforts were made to commercially develop the production of fuel oils and bitumen, and, although various types of retort were tried out, the results did not encourage permanent operation owing to shale grades, mining problems, and costs of refining. This angle of exploitation was comprehensively investigated by the Shale Oil Investigation Committee. Economically, it would be unsafe to accept the costs arrived at by the committee for the purpose of calculations under current conditions.

In summarizing the economics of the industry, the committee referred to costs of mining, retorting, and refining, and considered that if those costs were used in attempting to decide the economic possibilities of the industry, it would probably be decided that the industry had no chance of success. Certain factors, however, were taken into consideration which might

place the commercial possibilities in a more favorable position, but the committee considered that there were too many unknown factors to make a very direct statement on the economic possibilities of the industry and concluded that, before large-scale operations could be thought of, the industry would have to pass through an intermediate stage at which profitable production could not be expected.

Following the report of the Shale Oil Investigation Committee, many examinations were made with the object of producing a further understanding of problems of mining, retorting, and refining, but no material advance was made and attention was then directed to an alternative scheme of exploiting the shale for its asphaltene content with by-products of fuel oil and siliceous residue.

Asphalt (Bitumen)—Extensive experimental work, carried out over a period of years, demonstrated that an asphalt can be produced from the oil shale and that the asphalt is admirably suited for road-sealing and other applications. Experimentation was not a sufficient indicator of the economic or commercial possibilities of an industry, and in the absence of similarly established practices, covering processing and costs of processing, it was considered that an intermediate stage was necessary to afford a better conception of costs, to convert experimental results into practical processing factors and to produce a clear understanding of commercial possibilities, before any consideration could be given to the establishment of a large-scale industry. This intermediate stage was directed to the installation of a small-scale commercial plant with a through-put of 4,200 tons of shale per annum.

Briefly, the process comprised crushing and grinding the shale to a size suitable for the extraction of the oil-spores from the gangue material by flotation practices, with a final conversion of the oil-spore concentrate, with a final conversion in a locally-designed horizontal stirrer retort. From the results of experimentation, it was calculated that there would be an annual recovery of 766 tons of asphalt and 128 tons (approximately 32,000 gallons) of fuel oil. When plant units were available, it was estimated that an amount of £18,800 would be necessary to establish this intermediate stage, but sufficient flexibility was provided in plant design to enable the through-put to be served in plant design to enable the through-put to be doubled at a relatively low cost. The recovered asphalt contained approximately 36 per cent. of ash-diller, and 146 gallons of product represented one long ton as against 219 gallons of straight bitumen.

In the exploitation of these comparatively low-grade shales by straight retorting and refining, there were established costs upon which calculations could be based and amended as an indicator of possible costs under current conditions, but in the production of asphalt there are no such established costs, and a prospective there would have to pass through the intermediate stage to finally determine economic and commercial possibilities. This stage was not proceeded with and, latterly, attention has been again directed to maintaining interest in utilizing the shales for the extraction of fuel oils, as a war-time essential, but material results have not yet accrued.

The Government of Tasmania has expended £8,005 at Latrobe. That includes experimental work on the production of asphalt. You ask me what advice I would give to the Commonwealth Government for making use of the shale deposits at Latrobe. I face the question economically. If oil authorities on the treatment of shale do not regard the oil shale of Tasmania as of a sufficiently high grade for the straight extraction of fuel oil, I think that further consideration should be directed to the possible utilization of these shales for the asphalt content. The actual utilization of the shales

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for that purpose would be governed by available supplies of bitumen and the price of that bitumen compared with the cost of production of asphalt from Tasmanian shale. You ask whether consideration has been given to the utilization of mudstone for making paint or varnish filling. Some consideration was given to the use of the siliceous residue after the extraction of the oil spore by flotation as a filler in the preparation of the polishes. I have seen some of it used, and the siliceous residue seemed to create quite a good foundation for an excellent type of polish.

I have no records of the commercial application of any by-products, other than asphalt and fuel oil, which might be allied with the shale elements. The Adelaide Oil Exploration Company is the only concern on record which is still interested in the Latrobe field. You ask whether anything has been done to amalgamate the leases and form one big "show" for the purpose of working the shale on a commercial basis. My association with the present organization is only a matter of five years. Nothing has been done during that period. What happened many years ago is past history with which I am not completely au fait. You ask whether it is a fact that the Latrobe shale contains a lot of pebbles which makes it difficult to cut. The shale is undoubtedly pebbly and that might create some difficulties in regard to mechanized mining. It depends entirely on the class of mechanization. The cost of mining Latrobe shale has been the source of many and varied opinions. Latterly opinions have varied from 16s. to 17s. 6d. and £1 a ton landed on the surface at works situated within the central area of shale.

You ask whether I have any figures showing the cost of retorting per ton. The only information in regard to the cost of retorting is that which is contained in the report of the Shale Oil Investigation Committee, of which I submit a copy. Nothing of any great magnitude has been done since that report was compiled. The oil content varies in the different localities. The area which was drilled by the department worked out at 32.9 gallons a ton on the selective mining basis and 395,000 tons and 26 gallons a ton on the whole seam mining basis of 516,000 tons; but that was only one small area which we proved by drilling.

You invite me to make some general observations on the subject of the shale deposits. It depends entirely on how I can arouse your interest in the asphalt aspect. The department was engaged for a period of years on intense experimental work to extract the oil spores by flotation and to convert those oil spores into asphalt. I understand that you have seen the experimental plant at Latrobe, the horizontal stirrer retort. Much depends on to what extent we feel that we should utilize one of the only asphaltene shales in the Commonwealth for the production of bitumen.

You ask whether an ordinary retort is used for making asphalt. For the production of asphalt it is necessary to take this fine oil spore concentrate, place it in a retort and constantly stir it under conditions of heat control until the temperature is raised sufficiently high to dissolve all the oil spores into asphalt which is drawn off from the retort. In the production of oil from shale, it is a matter of the application of heat to drive off the fuel vapours with subsequent condensation. So that the two processes are different. As to whether it is more costly to extract asphalt than it is to extract oil, there are no established precedents in regard to the production of asphalt from shale. We passed from the experimental stage to what we considered to be the intermediate stage on a small-scale commercial basis. We made representations to the Commonwealth for some assistance in that direction in 1940, but that assistance was not forthcoming.

218. To Mr. Rankin.—You ask whether there is any possibility of the Commonwealth making a commercial success of the extraction of bitumen from shale in

peace-time. That will depend entirely upon marketing conditions and the price of bitumen. Until such time as the small-scale commercial stage has been passed through it will not be possible to give a calculated set-up of the costs of production. But in the small intermediate stage, and endeavouring to strike a line on the cost of production, something on this basis might be taken into consideration.

With a through-put of 4,200 tons of shale producing 700 tons of asphalt, the cost per ton of asphalt has been tentatively cited as £13.72, with a plant cost of £13,950 and an annual operating cost of £14,393. In consideration of the oil spore ratio, it is to be realized that mining costs have a marked influence on the cost per ton of asphalt, and provided continuous conversion is successfully achieved with a small-scale commercial plant, having a through-put of 4,200 tons of shale and producing 766 tons of asphalt per annum, the following order of costs is envisaged:—

Cost per ton of shale.	Cost per ton of asphalt.
7.5s. . . . .	15.2
10.9s. . . . .	16.9
12.5s. . . . .	17.3
15.5s. . . . .	18.0
20.9s. . . . .	18.7

A further reaction upon cost is to be anticipated from plant operations, and with a preservation of flexibility in a small-scale commercial plant of the nature contemplated and an addition to the conversion capacity it has been anticipated that the cost per ton of asphalt, on an output of 1,225 tons, would reduce to £11.5 and £14.6 with shale at 10s. and 20s. a ton respectively. That indicates, as in the case of all new ventures where you must pass from the experimental stage to an intermediate stage before you get on to a large scale commercial production, that the costs are relatively high; but it is from the operation of that stage that you finally get a proper conception of what the costs are likely to be for a full scale commercial plant. The actual enterprise as directed to the intermediate stage must be regarded as being on the basis of whether or not that intermediate stage is worth pursuing to demonstrate whether an asset of a country can be converted to commercial use. I have only endeavoured to convey the impression that, so far as we can conceive at the present time, as the quantity of shale used was increased, so the cost of production would be reduced. We all anticipate that.

You inform me that evidence was given that the plant used for the production of oil from shale was affected greatly by the heat so that maintenance costs were considerable, and you ask whether the same was present in the production of asphalt. With the production of asphalt, you have various stages. For example, the materials have to be crushed. Then there is the flotation stage to produce the oil spore concentrate. Then you have the retorting stage to concentrate the heat the oil spore concentrate into asphalt. The asphalt is drained off from the horizontal retort in the form of very hot liquid and the actual amount of volatile fuel that comes away is reduced to about 8.6 gallons a ton. That constitutes the by-product, and the same wear and tear on a normal retort through the condensation tubes would not happen in this case. The wear and tear is in the stirrer itself.

219. To Sir Frederick Stewart.—You ask me to express my views on the question as to whether the Latrobe fields should be utilized for producing fuel oil. Personally, I prefer to rely upon the advice of highly skilled technicians on distillation practices. I have nothing from our experience of the Latrobe field in the last few years on which to build any opinion. Beyond some amount of work which was undertaken by an independent individual, no distillation work has

been carried out at Latrobe since I was connected with the organization in this position. As you remarked, most of the £200,000 which you were told had been invested in the Latrobe shale field, was lost prior to 1939. My interest in the shale industry has been concerned with the two angles of observation and application of oil shale. I have undertaken many investigations to create interest in the development of shale from the aspect of straight retorting and fractionating, but as yet I have not been able to produce any material results. You state that I said that a study of the report indicates that with selective mining the yield per ton might be expected to average 32½ gallons, but the yield from the entire seam would be 26 gallons per ton. Our experience has demonstrated that the oil content varied in the same seam and in different localities. The publication of the Tasmanian Investigation Committee comprehensively deals with recoveries and grades of shale as determined up to the time when that publication was issued.

A number of leases have been operated by various companies which have tried to exploit the field. Their experience, as you say, suggests that the maximum potentiality of the field is above 23 gallons and up to a maximum of 30 gallons of crude oil per ton of shale. You say that this is the best that any one has been able to suggest in relation to any part of the Latrobe field. I remind you that some of the shale has been assessed at a higher grade. The cost of mining would be less in the case of the whole seam than with selective mining. I tender as a part of my evidence a map showing an outline of the areas at Latrobe. The area which the department actually drilled in calculating the quantities of 395,000 and 516,000 tons is shown. You ask why we limited our operations to that area. The operations were limited to that particular area for their central location of plant to determine the quantity of shale upon which we could commence mining operations immediately, should we have gone forward with this process of the extraction of the asphalt content of the shale. You ask whether there has been any comprehensive survey of the whole field and any estimate of the total number of tons of shale available. When the report of the Shale Oil Investigation Committee was prepared, considerable investigations were undertaken regarding the possible quantities, and reference was made in this publication to 26,041,760 tons of shale in the areas, extending through a tract of country to which I referred in my early evidence. That quantity is based upon geological reconnaissance work and evidence obtained from working, from some old boring and from some shafting. It is naturally a very large quantity, but it must be borne in mind that before the quantity of mineable shale can be determined, it will be necessary to extend the drilling campaign. You remarked that the 26,041,760 tons is really geological speculation rather than a definite quantity. As I stated it is built up on reconnaissance work and evidence obtained from some boring and some shafting.

You say that I suggested that the interest of the State Government has been concentrated on the asphalt possibilities rather than the fuel oil possibilities of the field. I would not invite you to take that view. Rather I put it this way; the efforts to create interest in the utilization of the shale for the purposes of straight production of fuel oil not having accomplished results, it was considered desirable to investigate the possibilities of utilizing the shale for some other purpose and this brought about the direction of attention to the extraction of the oil spore concentrate for the production of asphalt. You ask whether there are any purposes for which this asphalt could be used but for which cement could not be used. Cement is not used for roofing and caulking purposes. But in the main our asphalt is used largely where

cement could be used. I do not know whether the cement works in Tasmania are working to full capacity.

220. *To Mr. Condon.*—You ask me whether in my opinion the shale at Latrobe is of a too low grade to work economically for the extraction of oil. Not being a technician on shale treatment for the production of oil, I prefer to evade the question. I admit that, on comparison with other shales, Tasmanian shale is of a comparatively low grade.

221. *To Mr. Harrison.*—I prefer not to express an opinion as to whether the shale deposits could be commercially developed by private enterprise. I have some knowledge of the fact that the Scottish shale fields, which you say are quite comparable to the Latrobe fields in oil content, are being commercially developed. I prefer not to enter upon the technical side by expressing an opinion as to whether the same class of retorting and the same methods used in Scotland could be satisfactorily adopted in Tasmania. I do not know of anything that has happened regarding the flotation of companies for the development of Latrobe which might have affected the field from a commercial standpoint in the opinion of the subscribing public. Definitely I would not like to give evidence about types of retort. A person who is not an expert on such a subject, even though he may have considerable knowledge about it, and presumes to have all knowledge down to the last detail, is very unwise. So far as the department is concerned, we know that we have certain occurrences of oil shale in Tasmania. In view of that, it must be appreciated that we have set out to contact every known authority to encourage interest in the exploitation of these shales on the basis of their knowledge of retorting practices. For a unit of an organization who has not been allied with retorting practices to claim 100 per cent. knowledge of the details of these practices would be a grave error.

You ask whether we found any difficulties associated with the mining of the shale at Latrobe. We know that the seams are troubled by faulting and that would add to the mining difficulties. But in the investigations which we set out to accomplish, we arrived at an area with very little effort from which we could carry on mining operations. You ask whether it would be possible for the whole of the seam, including the bands which separate the shale seams, to be retorted or whether the shale would have to be picked out. The band of mudstones to which I referred in the working height of 4 ft. 3 in. to 5 ft. 3 in. carries about 8 gallons of oil per ton, and on that basis it might be economical to mine the lot and to treat the lot.

You ask me whether the residuals from the Latrobe shale, such as bitumen content, are found in other shales in Australia. The Tasmanian shale of the Latrobe field is probably the only straight asphaltene shale in the Commonwealth. The shales of Newcas are wax; the residuals from retorting those shales are wax. In Tasmania the residual is bitumen. That gave us the great idea of doing something to utilize the shale for some purposes other than the actual extraction of the oil contents if our efforts failed to utilize it for the oil only. You ask whether the residuals associated with the Latrobe shale could be used in the production of plastics. We have not reached the stage of being able to give a definite assurance in that direction, although some work which was carried out on oil spore concentrate gave us some slight encouragement. But investigations were not carried sufficiently far to enable us to reach a final determination. You invite me to outline the attitude of the Government of Tasmania to the development of Latrobe. You ask whether the Government is completely in favour of the development of Latrobe or

whether it considers that the field does not show the possibilities that an oil shale field should show. My reply is that up to the time when the small scale commercial stage was designed, the State Government was desirous of doing everything possible to bring about some commercial exploitation of the Latrobe shales. In qualification of that statement, I would say that when the intermediate stage was prepared, the State Government made provision on its appropriations for the expenditure of £14,000. Representations were made to the Commonwealth Government to assist the State to demonstrate whether anything could be done usefully or nationally in that direction. The Commonwealth Government despatched one of its officers to Tasmania and as a result of that visit, no assistance was forthcoming. I do not know the nature of the report, but I think it would be only fair for me after saying all I have said to state that this projected effort is a completely new one. There are not metallurgical differentials anywhere in the world concerning the extractions of oil spore concentrate from shale by flotation practices, and the conversion of that oil spore concentrate into asphalt. It is something essentially new. I have already indicated that in so many essential new developments, it is often desirable to take a risk to demonstrate finally whether something new can happen. The expenditure would not have been great. In terms of monetary values during recent years, £20,000 would not be regarded as a very large sum. It would have seen this job established and would have demonstrated whether or not Tasmanian shale could have been utilized for the unique purposes of the production of asphalt.

222. *To Mr. Mulcahy.*—The Tasmanian Government was prepared to expend £14,000 on the work. An additional £5,000 or £3,000 would have enabled the job to be completed. The primary idea of the State Government was to get asphalt, but we would have recovered 128 tons of fuel oil as a result of distillation from the wet vapours from the stirrer retort. That would have totalled 32,000 tons of fuel oils with the production of 766 tons of asphalt from the treatment of 4,980 tons of shale a year. The State Government did not decide on any particular retort, because no retort existed in the world for this purpose. The department had to endeavour to plan a retort suitable for this purpose, and the horizontal stirrer retort which you saw at Latrobe was the result of that plan. There is nothing to say that that would be the final retort adopted because anything in the initial stages is generally in a relatively crude form. The retort had to be designed and built in Tasmania.

You ask whether the shale fields are held on mining leases. The areas of shale are occupied in different forms. Some are leased, some are on occupied land or private land, and other on unoccupied land. Those details are contained in the committee's report.

*The witness withdrew.*

John Reynolds, Commerce Development Officer, Government of Tasmania, sworn and examined.

223. *To the Acting Chairman.*—I have held my position under several titles since 1939. My duties are to investigate the State's industrial resources with a view to their development. The qualifications which I possess for such work are—Twenty years in chemical engineering, in both the chemical and the metallurgical branches of the industry. One of our difficulties—and this is the sole reason why I am appearing here to-day—is an endeavour to lay the foundation for an organic chemical industry in Tasmania. Every other State has this industry. The reason is that organic chemicals

are the ones upon which it appears that the industrial future of any community will depend. We only have to recall the very important products which come from such sources as dyes, fuels, plastics and lubricants to realize the importance to every community of having a supply of basic raw materials.

In the course of my duties in the last four and a half years I have been searching for this somewhat elusive organic basis, and to date the only encouragement that I have had is the bases which are available in the distillate from Tasmanian shale. I have caused a good deal of investigation to be made into the various tars which we get from distilling our wood. In the northern hemisphere wood tars are a valuable source of organic chemicals. In the southern hemisphere they are not. Our coals unfortunately do not yield very much tar when distilled, and the small yield gives disappointing results. So it was with a great deal of pleasure that I discovered two years ago that investigations were being carried out at the Hobart Technical College by Mr. Cane under the direction of Professor Kurth. They revealed that there are sufficient basic raw materials of an organic nature in the Tasmanian shale oil to justify our having some optimism for the establishment of an organic chemical industry in this State. The work was not carried, perhaps, so far as to enable us to say definitely that lubricants, propellants, dyes, pharmaceuticals or medicinals could be produced, but sufficient was done to indicate the value of the chemical raw material. Mr. Cane's work occupied two years, and at the end of that period I attended an exhibition at the Hobart Technical College at which he was able to demonstrate between 50 and 100 different organic chemicals or products which could be obtained from the distillate of Tasmanian shale. It was a striking exhibition and it opened our eyes to the possibilities. Mr. Cane went from Hobart to take up a position of a chief chemist on the Mainland when the Commonwealth Government became actively interested in a certain proposition. I suggest that you should invite Mr. Cane to give evidence in Melbourne. At present he is chief chemist at General Motors Holdens Limited.

Professor Kurth will be able to tell you what can be obtained from the shale. Mr. Cane will tell you a great deal more of the industrial possibilities. The lubricants alone would be economic possibilities. I ask you to recommend that further work be carried out in this direction.

224. *To Mr. Mulcahy.*—The laboratory in Hobart does work in co-operation with the Council for Scientific and Industrial Research, but I am not aware whether that body has done any extensive work on the oil. Certainly the Council for Scientific and Industrial Research has not given to this matter the same attention that has been devoted to it in Hobart. When the Government of Tasmania investigated this proposition, it was more interested in the production of bitumen than of fuel oil. As you remarked, the oil content of the Tasmanian shale is comparatively low. I know Mr. Walker, the industrial chemist of the Goliath Cement Company, but I did not know that he was of opinion that the Latrobe shale was not a commercial proposition.

225. *To Mr. Harrison.*—You ask whether the organic chemicals to which I have been referring are present in the Latrobe shale only or whether they are found also in other shales throughout the Commonwealth. I do not think that other shales have been investigated for the purpose of determining that question. As to plastics, we do not know yet, except in a few cases, the quantity which could be obtained. That information could be secured from Professor Kurth.

*The witness withdrew.*

(Taken at Melbourne.)

FRIDAY, 23rd JUNE, 1944.

Present:

Senator LAMP (in the chair).

Senator Aylett.	Mr. Mulehny.
Senator Brand.	Mr. Rankin.
Mr. Conelan.	Sir Frederick Stewart.
Mr. Harrison.	

William Baragwanath, Director of Geological Survey, Victoria, and John Philip Louis Kenny, Senior Geologist, Mines Department, Victoria, sworn and examined.

226. *To the Acting Chairman.—Mr. Baragwanath.*—You ask me to describe the researches that have been made into methods for the extraction of oil from brown coal in Victoria. I prefer to tell you the quantity of brown coal which has been proven in this State, leaving the extraction of oil from the brown coal to the chemists or those who have undertaken researches into that aspect.

There are extensive deposits of brown coal in Victoria. Forty miles in a north-westerly direction from Melbourne and Altona Bay to Baculus Marsh, and to a width of from 5 miles to 10 miles, there is a seam of brown coal from 50 feet to 100 feet thick. There is between 100 feet and 400 feet of basalt overlying that. The quantity of coal in that area has been estimated at 20,000,000,000 tons. That seam starts within 5 miles of the heart of Melbourne. Other deposits are located in Gippsland. One, at Yallourn, is operated by the State Electricity Commission. Over some 5 or 6 square miles there is a seam with an average thickness of 150 feet and 30 feet overburden. The quantity there is estimated at 1,000,000,000 tons.

On the opposite side of the river in the neighbourhood of Morwell the seams have been proven to even greater depths. The upper one is 150 feet in depth and there are underlying seams which in that neighbourhood are 500 feet thick. Some of them come within 50 feet of the surface. In that area there is about 10,000,000,000 tons. A seam is also located in the neighbourhood of Traralgon, and to the south-east of that town. An area of between 5 and 8 square miles has been proven, and the thickness of the seam varies from 200 feet to 700 feet. That is possibly an "open cut" area. Further east in the neighbourhood of Rosedale, and thence on to Sale, and south of Sale there are many square miles of country where coal has just been touched in boring, and the bores have not gone through the seam. There is between 200 feet and 600 feet of coal. I emphasize that it is all brown coal.

There are other areas to the north on the northern side of Latrobe where bores were put down. One bore was put down to a depth of 1,500 feet, and several seams of brown coal were located. Other bores were fairly shallow, being sunk to a depth of 1,000 feet, but further east bores were sunk by co-operation of the Commonwealth and Victorian Governments in the search for oil, and they proved coal seams to a depth of nearly 3,000 feet. They were relatively thin in the deeper bores, being only 20 or 30 feet thick, but the quality of the coal was good.

I have now given to you an outline of the quantity of brown coal in Victoria. We have adopted as a basis of calculation, that every 1 square mile of coal 1 foot thick will yield 1,000,000 tons. Therefore, if you have 10 square miles of coal 150 feet thick, the area will contain 1,500,000,000 tons of coal. The quality varies and the water content is also variable. Much work has been done by the State Electricity Commission in boring since the work of the Mines Department was somewhat curtailed. That body has carried out extensive borings in the neighbourhood of Yallourn

and Morwell. Apart from the Altona and Morwell deposits, near the coast, there is another large area about 130 miles from Melbourne at a place called Gelliondale. There is a deposit of 9,000,000,000 tons, and a lot of that coal is within 30-feet of the surface and within 3 or 4 miles of the coast. The quality of that coal also varies from 50 per cent. moisture to 65 per cent. moisture, whilst the ash is anything from .5 per cent. upwards and the sulphur content from .1 or .2 per cent. up to 3 or 4 per cent; if you get a high ash content, you have a low moisture, and vice versa.

You ask me to inform you how the Victorian brown coal compares with the German brown coal. Briefly, German coals are infinitely better than the Victorian coals. The brown coals in this State are of a very low grade. The German brown coals are in the neighbourhood of 30 per cent. moisture, but the Victorian brown coals have between 60 and 65 per cent. moisture. I have heard it said that before the war Germany extracted oil from brown coal on a commercial basis. There was a brown coal known as *Pyropisitt*, which was a distillation coal. The only coal similar to it that we found in Victoria was obtained from a thin seam in the old "open cut" at Morwell. It was a hard 1 foot thick, which yielded up to 60 gallons of oil to a ton on a dried basis. Of course, that 60 gallons was not petrol. The quantity of petrol was very small, being about .5 per cent. of the total. The Mines Department undertook researches into brown coal and gave the figure of 27 gallons of crude oil to the ton of dried brown coal; and out of that 27 gallons the percentage of petrol was .65. That amounts to less than half a gallon of petrol to a ton of dried coal.

227. *To Sir Frederick Stewart.*—You ask how much ordinary brown coal would have to be mined to yield 1 ton of dried coal. The basis of calculation is that it is necessary to mine 3 tons of brown coal and when you have got rid of 2 tons of water you have 1 ton of dried brown coal left. Actually, it would require more than that quantity of coal to drive off 2 tons of water. I consider that you would have to mine between 4 tons and 5 tons. Three tons of ordinary brown coal would yield .65 of a gallon of petrol.

228. *To the Acting Chairman.*—I prefer not to reply to your question as to whether there are any usable by-products from the residue after the oil has been extracted, because I have not kept in touch with that aspect. However, I shall cite some figures that are contained in a report prepared by my predecessor, Dr. Herman, who investigated this matter for the Mines Department, before the State Electricity Commission came into being. The information is contained in Bulletin No. 45, *Brown Coals of Victoria*. This was oil obtained by low temperature distillation at a temperature of 500 degrees centigrade. The following quantities of marketable oil products should result from 1 ton of dried brown coal—27 gallons of crude oil yielding 18 gallons of benzene, 17 gallons of heavy benzene, 2.16 gallons of phenols and acids, &c., 2.7 gallons of kerosene, 2.7 gallons of gasolene, 9 gallons of cresote oil, 1.9 gallons of wax, and 50 lb. of pitch. If you intend to produce oil alone and do not propose to utilize the gas, you can obtain an additional .5 gallons of benzene, and 1.5 gallons of heavy benzene. I am not able to say whether the cresote oil wax or pitch would be commercial propositions.

I cannot see any possibility of oil being extracted from brown coal on a commercial basis. I shall read you the conclusions of the former Director of Survey, Dr. Herman—

In considering the best method of treatment for low temperature oil derived from Morwell brown coal, not only must local conditions re marketing and sales of the product be borne in mind, but the cost of dephenolating must be taken

into account. At present and for the near future, the price of caustic soda for oil washing purposes in Australia is prohibitive unless a ready market should be available for all the phenols recovered at a remunerative figure. Unfortunately, especially in view of the competition of black coal tar phenols and cresols for new disinfectant raw material is very limited and only relatively small sales of brown coal phenols could be expected initially. On the other hand there might be a large market for cresote oil as a timber preservative and as a fuel oil for the Navy and elsewhere. The wax must be removed, but there is a ready market for refined paraffin.

Assuming that, in the first place, brown coal oil could be extracted at a sufficiently low cost, it might, at a future date, perhaps be commercially feasible to establish a scheme on lines somewhat as follows:—

Preliminary distillation of the dehydrated oil into benzene, light oil, wax fractions, pitch, washing the benzene and light oil with caustic soda to remove phenols, tar acids, neutral oils, &c., and subsequent recovery of these bodies by the passage of retort gases rich in carbon dioxide into soda solution recovering the soda as carbonate of soda, and its subsequent causticification with lime; steam distillation of the washed benzene and light oil into motor spirit, heavy benzene, kerosene, and gas oils. The wax fraction should be sent direct to the paraffin press house for cooling and compressing in the customary manner; the scale resulting would then be treated by the usual washing and crystallizing methods of brown coal wax refiners. The pressed oil could without further treatment, be utilized for fuel purposes, disinfectants and timber preservative. It would be directly suitable to work on a continuous system of distillation, using special boiler stills for the removal of benzene and light oils, and "cooking" stills for the distillation of the wax fractions.

229. *To Senator Brand.*—You ask whether a Mr. Knox is conducting successful mining operations at Gelliondale. As I stated earlier, there are 2,000,000,000 tons of brown coal in that area within a few miles of the coast and handy to a railway. Mr. Knox has installed a plant for the removal of 30 feet of overburden, and he dries and pulverizes the coal and makes briquettes. Incidentally, these briquettes are not hard like the briquettes made at Yallourn. Mr. Knox is interested in processes for extracting oil from coal, and went to Germany to inquire into the subject. The company in which he is interested is the Gelliondale Coal and Oil Company. I do not know whether any plant has been erected by that concern for the recovery of oil from coal. The State recently granted to Mr. Knox some financial assistance. We were desperately short of coal and he wanted to complete the erection of some machinery to enable him to market either raw coal or briquettes. Apart from that, however, the State has not assisted him financially.

230. *To Mr. Conelan.*—In my opinion, there is no possibility of extracting oil from our brown coals on a commercial basis; but I should not put my own opinion against that of a chemist whose function it is to make oil or some other product out of brown coal. From available evidence, the quantity of oil obtainable by ordinary distillation from brown coal is altogether too small, if petrol is the objective.

You ask whether any shale deposits are located near the brown coal seams. I point out that shales belong to much older formations. Geologically speaking, the brown coals are very young. They are all tertiary. The shale deposits usually belong to the carboniferous or permo-carboniferous. Victoria has no such deposits. Later Mr. Kenny will tell you about our black coal deposits. Incidentally, a miner calls a lot of material shale, although it is not necessarily an oil or coal shale. That often leads to confusion. Some one will tell you that a lot of shale is to be found in a certain district, but it has no value for burning purposes. Instead of calling it mudstone, some people call it shale.

231. *To Mr. Mulehny.*—You ask my opinion of the prospects of getting flow oil at Lakes Entrance. Well, the Commonwealth Government is searching for it. Authorities from America have examined the spot, and we bow to their wisdom. I understand that machinery

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has been installed there, and that operations are proceeding. We did search for flow oil by drilling and what is more, we got a little oil but the quantity was very small. Even if it had been ten times more valuable than it is, it would not have been of much use. In addition, there was no petrol in it. It was just an oil which had no kerosene. The lightest fraction was a lubricating oil. We were very disappointed; so were others. It is the only oil so far known in Australia. Of course, we should very much like to see them strike a "gusher", and we live in hopes that it will happen.

232. *To Senator Aylett.*—I believe that about £200,000 has been expended on bores at Lakes Entrance by the Commonwealth and State Governments and by private enterprise. The money which has been expended in Victoria in the search for oil is very small compared with the amounts that have been spent in other parts of the world. Other countries would expend considerably more than the sums that have been spent in Victoria in geological and geophysical surveys before anything was started. We had to begin from "scratch", with our own surveys and try to get the companies that were genuinely searching for oil. We did not hold out a great deal of hope in the past, because the conditions that are essential for oil fields were not known to exist here. Nor have they been proven since. The oil which has been found, has been located under unique conditions. The oil is there, but in disappointingly small quantities. From the evidence available in that particular area, I do not consider that it is worth spending any more money on bores to get flow oil. When we got the oil at Lakes Entrance, we had several possibilities. It could not come in from the north because the bedrock was on the surface. If it came in from the south, we could not prospect for oil in that direction because of the ocean there. On the eastern side it was just as bad, because of the rock or the ocean. Therefore, the only course to take for further prospecting lay in a westerly direction towards the brown coal deposits of Yallourn and Morwell. In that direction we were hopeful of finding better conditions for the accumulation of oil than those which were evident at Lakes Entrance. Unfortunately, we drew a blank. I would not say that the possibilities are exhausted. In consultation with the Oil Advisory Board and the former Commonwealth Geologist, Dr. Woolnough, we decided on a campaign of boring at intervals of about 8 or 10 miles. Those bores have been examined by the Commonwealth Palaeontologist, and a record was taken of every 10 feet of boring throughout eastern Gippsland. We bored until we went through the tertiary formation. The deepest bore was about 2,900 feet.

233. *To Mr. Harrison.*—You ask whether the low petrol content that we found in the oil extracted from brown coal was due to inefficient retorting or whether it was the result of a laboratory assay. The figures which I gave were obtained from laboratory tests and represented a summary of hundreds of individual tests. I see no reason to doubt those figures. At the same time, other methods of hydrogenation and cracking may be in vogue in other parts of the world which would give a different result. It is said that if the oil obtained from Lakes Entrance were cracked or hydrogenated, petrol could be taken out of it. I prefer you obtain information in that respect from a chemist.

234. *To Sir Frederick Stewart.*—You ask what is the depth of the seam at Yallourn. Where the "open cut" is now operating, there is 30 feet of overburden and 150 feet of coal. On the opposite side of the river, there is about 60 feet of overburden, and 90 feet of coal above the level of the stream. Where they are working at Yallourn the top of the seam is level with

the river and goes 150 feet below. In the neighbourhood of Morwell, some seams are between 400 and 500 feet thick. They are without fault. Bores have been put down at intervals of 10 chains, and they disclosed a uniform top and a uniform bottom to the seams. To date, we do not know of any fault at Yallourn; but we know that you can get faults in those seams.

You ask whether it is a fact that all the evidence suggests that the oil content is simply not present. That is a fact. We have the analyses of the coal, and I believe that unless it is combined in some different way by hydrogenation, you cannot hope to get a different result. Briefly, the constituents from which we expect to get petrol are not there unless they combine in some new form.

235. *To the Acting Chairman.—Mr. Kenny.*—I understand that coals which were being successfully treated in Germany, were of a much higher grade than are the Victorian coals; and they were of a limited extent. Now Germany is trying to treat the lower grade brown coals. Whether the efforts have been successful I am not able to say.

236. *To Mr. Conlan.*—Our black coal deposits are very limited. The seams are small and are much disturbed by faulting. We are working seams now. The best we have are from 3 feet to 4 feet thick. The State coal mine is working more as an insurance against shortages of supplies from New South Wales and is run at a loss of £90,000 a year. Apart from the State coal mine, four privately controlled mines are operating in the west of Kilkennia and are working on a small scale. There are also two mines at Korumburra. One has produced an overdrift of £20,000 in twenty years and the other showed a small profit. At present the only mine working at Korumburra has been financed by the State and is operating on a seam 3 ft. 2 in. thick. There are between 6,000 and 8,000 tons in sight where they are working. Apart from that, it needs further development and opening up other seams. We cannot say that we can see more than twenty years ahead for our own black coal supplies for Victoria. Victorian black coal does not compare in quality with New South Wales coal.

237. *To Mr. Harrison.—Mr. Baragwanath.*—You mention that publicity was given recently to the discovery of a new mine in Victoria. I am not able to recall it.

The brown coal deposits in Gippsland could be worked by open cut. The cost to the State Electricity Commission of winning coal is about 2s. a ton. The deposits of brown coal to the west of Melbourne would have to be mined, and the cost of winning that coal would be between 6s. and 6s. a ton.

You ask whether over a period of many thousands of years, brown coal eventually becomes black coal. That would require millions of years. Incidentally, brown coal is not the original base of black coal. Black coal is formed from palms, whilst brown coal is formed from pines.

238. *To Mr. Conlan.*—Our Victorian brown coal is used mostly as a fuel and for the manufacture of briquettes. You ask why this coal is not used at Newport. The explanation is largely a matter of boiler capacity. If a plant is designed for burning brown coal or wood, the firebox is much larger than would be required for the burning of black coal or oil. You ask whether the alteration of the fireboxes at Newport to enable brown coal to be used would be an extensive operation. It would mean the remodelling of the whole plant and would be an engineering problem. At Yallourn, brown coal is burnt satisfactorily. The boilers are designed to burn the coal as it comes out of the pits. There are places in Melbourne which, during the last war, burnt brown coal, and liked it. Then the

supply fell off and they began to use black coal. At present, there are three small mines at Bacchus Marsh which hope to cater for the brown coal market in Melbourne. They are within 40 miles of the city.

239. *To Mr. Mulcahy.*—As you say, Victorian brown coal must resemble the peat found in the Old Country. Some dried peat cannot be distinguished from brown coal. Dried peat has less moisture in it than the brown coal will dry down to.

240. *To Mr. Rankin.*—You ask whether our laboratory tests for determining the petrol content of the brown coal were extended to other fuels. That was tried at the time. Investigations were also made into the possibility of utilizing the char which resulted from the heating of the coal. When you distill the coal, you get, not a coke, but a material classed as char. It is not charcoal or coke, and it is dangerous to handle on account of its readiness to ignite. I do not know that the oil was tested for the purpose of determining the prospects of obtaining diesel fuel. It was a heavy tar oil. There was a lot of pitch when it was finally distilled. So the oil would have been rather too heavy for diesel oil. Lubricating oils were made from it, but there was a lot of trouble in cleaning the oil in order to get rid of the sulphur. It has a high sulphur content. In addition, you have to get rid of the wax.

You mention that there is a coal seam in the Dookie area, and you ask whether it has been tested. It was tested recently by the Commonwealth. Before that, the New South Wales Government did a good deal of work on it. Victoria was also interested because, when the Riverina railway was being constructed, this area would have been a source of supply of coal for the northern part of the State, not necessarily for locomotives, but for hospitals and the like. They could have used this coal, thus obviating the necessity for hauling Newcastle coal from Melbourne to the north-east of Victoria. But the company which was working the seam experienced various difficulties, including flooding, and no work was done until a small company re-opened the mine about four years ago. Within the last two years the Commonwealth Government, through the Mineral Resources Survey Authority, has carried out some boring. That coal is a mixture between our black coal and our brown coal. The deposits are up to 50 feet thick, and extend over a number of square miles. In my opinion, that coal would not be suitable for burning in locomotives.

241. *To Senator Aylett.—Mr. Kenny.*—There is enough black coal at the State mine to provide supplies for twenty years on the basis of the present output of 4,000 tons a week. That is about the limit; it might be worked out even before the expiration of that period. The area has been extensively bored, and the seams are thinning out in all directions. Originally they were working 24 ft. seams, but now they are working down to 18 inches.

242. *To Senator Brand.*—Maitland coal is far better than Wonthaggi coal. Maitland coal is used on the best Victorian expresses, but Wonthaggi coal is not suitable for that purpose. Some of it is very dirty, and it contains a lot of impurities.

243. *Mr. Baragwanath.*—You ask whether there are any shale deposits or brown coal deposits in the Grampians. The area has not been completely tried out.

In the neighbourhood of Horsham many years ago, a bore was reputed to have passed through many feet of brown coal. We did not bore on the exact site, but we bored very close to it, and although we got indications of lignite, we had no evidence that would lead us to expect a large seam. At the southern end of the Grampians between Hamilton and Ararat, or Hamilton and Maroona, we have heard that bores have been sunk and indicated the presence of brown coal. We know that some deposits of lignitous clay are there. Although we have seen the clay, we have not seen

any evidence of brown coal; but there is no reason why, under some of those seams in the neighbourhood, there should not be brown coal deposits.

In 1924, the Commission investigated with the Fuel Research Board (Department of Scientific and Industrial Research, London) to undertake an investigation into the hydrogenation of Victorian brown coal. Small scale investigations were conducted immediately, and an approved programme of research, and were followed by more extensive experiments, for which the Commission had designed, and erected at the Fuel Research Station, in a new continuous plant. The work was completed late in 1938 at a total cost of approximately £20,000.

244. *To Mr. Rankin.*—I do not know the oil content of the deposits at Wensleydale and Dean's Marsh. There are possibilities of quite a lot of pockets of brown coal being discovered under conditions similar to those under which deposits formed in Gippsland.

245. *To Senator Brand.*—Unfortunately, the brown coal of Victoria and the brown coal of Germany are not identical.

246. *To Mr. Conlan.*—The water content of German brown coal is decidedly better than the water content of Victorian brown coal. I mentioned earlier that the water content of our brown coal is about 60 per cent, whereas that of the German brown coal is between 35 and 50 per cent. That is a substantial difference. The brown coal, which we obtained originally north of the present "open cut" had only 40 per cent. moisture.

*The witnesses withdrew.*

*(Taken at Melbourne.)*

MONDAY, 26th JUNE, 1944.

Present:

Senator LAMP (in the chair).

Senator Aylett.

Mr. Conlan.

Senator Brand.

Ray Liddell, manager, State Electricity Commission of Victoria and George Ernest Baragwanath, research chemist, State Electricity Commission, sworn and examined.

247. *To the Acting Chairman.—Mr. Liddell.*—At the outset let me say that I have no pretensions whatsoever to technical knowledge of this very technical subject relating to the extraction of oil from coal. That is why I have brought with me Mr. Baragwanath, who was in charge of the hydrogenation experiments in collaboration with fuel research authorities in England. He will answer questions on the technical side. I have prepared the following statement:—

Investigations for the extraction of oil from coal have proceeded along three lines, namely:—(1) Low temperature carbonization. (2) Hydrogenation of brown coal. (3) Fischer-Tropsch synthetic process. The Commission's research has been directed to the first two processes abovementioned:—

(1) LOW TEMPERATURE CARBONIZATION.

In 1922-27 experiments were carried out, first on a laboratory scale in Melbourne, and then on a semi-commercial plant at Yallourn, to determine the possibility of:—(a) providing from the State's own brown coal resources a solid fuel suitable for locomotive purposes, as well as for other purposes, for which a high grade solid fuel is required; (b) obtaining from brown coal a gas suitable for town's gas supply. Although primarily undertaken for these purposes, in relation to oil from coal, the experiments showed that the yield per ton of dry coal at a carbonizing temperature of approximately 550° C. was 2.5 cwt. to the small dry per ton carbonized; this process cannot be relied on for

any large supplies of gasoline, though the tar produced may have some value as additional raw material for hydrogenation.

(2) HYDROGENATION OF VICTORIAN BROWN COAL. General.—In 1924, the Commission investigated with the Fuel Research Board (Department of Scientific and Industrial Research, London) to undertake an investigation into the hydrogenation of Victorian brown coal. Small scale investigations were conducted immediately, and an approved programme of research, and were followed by more extensive experiments, for which the Commission had designed, and erected at the Fuel Research Station, in a new continuous plant. The work was completed late in 1938 at a total cost of approximately £20,000.

Scope of Investigations.—In the first instance, discontinuous experiments of a preliminary and exploratory nature were carried out in small 2-litre converters. These were followed by more extensive tests with continuous plants, and the products obtained therefrom furnished sufficient material for detailed laboratory examination, for bench and road trials of the motor spirit, and for bench tests on diesel oil. A study was made of the variables likely to be encountered in the liquid and vapour phases; catalysts were examined and the possibility of recovering the liquid phase catalyst was considered in some detail. The composition of the various sprits and oils and also of the liquor produced in the process was investigated, and a comparison was made of the properties of the motor spirit and diesel oil with those of corresponding liquid fuels on the English market.

Conclusions.—The principal conclusions from the 1938 report were:—

- (i) Brown coal is more readily and completely converted into oil than British black coals tested at the fuel research station.
- (ii) The catalyst that produces greatest activity for black coal (a tin compound) is surpassed for brown coal by molybdenum compounds.
- (iii) One ton of coal substance, i.e., coal free of ash and moisture, will yield up to one half ton of commercial quality motor spirit and octane number of this spirit is 95 (motor method).
- (iv) A first-grade motor spirit is obtained by the addition of lead tetraethyl or by adding methyl or ethyl alcohol.
- (v) A motor spirit with a higher octane number than 90 may be produced by aromatisation. Higher resistance to knocking temperatures are reached in this process, resulting in more gaseous constituents but less petrol.
- (vi) The consumption of hydrogen is 80,000 cubic feet per ton of petrol produced. The hydrogen required is obtained from gaseous constituents evolved in the process and from other sources.
- (vii) First-class diesel oil is prepared simply by passing the oil twice through the vapour phase. Its octane number is 90.
- (viii) A higher yield of lower grade diesel oil is obtained by passing the oil only once through the vapour phase. The octane number of this oil is only 42, which is satisfactory for most purposes.
- (ix) Diesel oil has not been obtained from black coal under similar conditions.
- (x) The tests were not successful in producing lubricating oils. So far, such oils have not been produced by hydrogenating either black or brown coals.
- (xi) It is suggested that efforts in future should be directed to obtaining lubricants by starting with low temperature tar.
- (xii) Waste liquor from the liquid and vapour phases is too toxic to admit to any fresh water stream. Treatment at considerable cost would be necessary.
- (xiii) Disposal of the centrifuge sludge cake can be effected by carbonizing it and so producing a useful coke fuel.
- (xiv) The hydrogenation process is in a state of flux; new catalysts and new methods of catalyst manufacture are constantly being developed, with promise of greater throughputs and yields, longer catalyst life and wider ranges of products.

Costs.—The researches dealt particularly with the more scientific and technical aspects, and did not give information on which could be estimated the cost of petrol and other products from brown coal on a commercial scale.

The only indications of the commercial costs of hydrogenation are contained in the second report of the Commonwealth Committee appointed to inquire into the question of establishing a plant in Australia for the production of oil from coal by the hydrogenation process. This report, published in 1937, gives the following estimates:—

- (1) Lightest case plant that to produce approximately 150,000 metric tons of petrol (about 45,000,000 gallons) per annum—£12,000,000.
- (2) Black coal—approximately £A12,000,000.
- (3) Brown coal—approximately £A12,000,000.

(H) Operating costs per gallon—

	Black coal.	Brown coal.
	d.	d.
(a) Including interest on capital, 3 1/2 per cent.; amortization, 16 years ..	13.8	14.4
(b) Including interest on capital, 6 per cent.; amortization, 10 years ..	17.3	18.2
(c) Including interest on capital, 8 per cent.; amortization, 10 years ..	18.5	19.4

Under pre-war conditions several years of very large experience of hydrogenation on both black and brown coals in Germany and England shows that the cost of a gallon or ton of petrol so derived has apparently not undergone any appreciable variation, but the increasing knowledge of technique is steadily leading at least to an improvement in the quality and range of commercial products.

Facility of hydrogenation and rates of throughput, when compared with tests on black coals, furnish good grounds for the belief (supported by independent information of experience with large scale English and European commercial plants) that the merits of Australian black and Victorian brown coals must be very seriously compared if hydrogenation of coal should be commenced in Australia.

(3) FISCAL PROSPECTS.

The Commission is aware that considerable development has been made with this process and that large plants have been erected in Germany.

The latest estimates of costs received by the Commission from an authoritative continental source in March, 1929, indicate that the capital cost of a plant having a capacity of 60,000 tons per annum would be approximately £3,000,000, exclusive of plant for processing the brown coal to provide raw materials for synthetic gas. These are pre-war figures. We all know the trend of costs since.

Estimates of cost per gallon, including interest 3 1/2 per cent. and amortization fifteen years, at the same time show little variation from those given in the Hydrogenation Committee's 1927 Report (referred to above), namely, 13.25s. per gallon as against 13.0d.

Fischer-Tropsch synthesis normally calls for a mixture of relatively pure carbon monoxide, and hydrogen in the ratio 1:2 by volume; this synthesis gas is converted into various hydrocarbons, chiefly of the paraffinic type, in reaction chambers which work at some plants at atmospheric pressure and in others at pressures between 8 to 10 atmospheres.

248. Mr. Baragwanath.—To produce 1 ton of motor spirit you would require between 18 and 20 tons of raw brown coal.

249. Mr. Liddellow.—You ask whether I have any knowledge of the yield per ton of German coal compared with that of Victorian coal. There are wide variations in the brown coals both as to moisture and ash content and even in physical structure. The coal that we are winning at Yallourn is 66 per cent. moisture coal and very low ash. Within half a mile of it, there is a much harder coal about 50 per cent. moisture and relatively low in ash. It is a different coal altogether.

250. Mr. Baragwanath.—The coals in the Rhineland of Germany are much the same as the Victorian brown coals. They are very moist coals—the moisture is from 60 to 65 per cent.—and 18 tons of coal would be required to produce 1 ton of spirit. The high grade brown coal of Germany is found in the Leipzig district, and has 40 per cent. to 50 per cent. moisture. You would require 14 tons to 18 tons of that coal to produce 1 ton of petrol. The actual coals must be analysed very carefully before statistical comparisons can be made between them. Some of the coals in central Germany have a high oil tar content. Yallourn coal will give only about 8 gallons, but some of the German coals when subjected to low temperature carbonization will give between 20 and 40 gallons of oil.

251. Mr. Liddellow.—Most of the German coal is obtained from "open cuts" but there are substantial deposits over nearly all Germany and in contiguous countries, and they vary in character just as much as

do our Victorian brown coals. Mr. Baragwanath mentioned the Leipzig area. In eastern and central Germany and in the Rhineland there are big variations in the characteristics of the coals, just as there are between coal obtained at Gellendale and Wensleydale. I believe that since the report to which I referred in my statement was made, costs have increased by 25 per cent. to 30 per cent. I do not consider that it would be a commercial proposition to produce oil from brown coal in Victoria. When the costs compiled by Sir David Rivett were published, it was obvious that the process would not be a commercial proposition. Since then, the relationship has not changed very much.

252. To Mr. Conlan.—You point out that I showed in my statement that an estimate of the operating costs of 1 gallon of spirit from black coal was 13.6d. and the production of oil from coal in Australia, but I think that at that time the landed cost of petrol was about 7d. a gallon. You state that, even taking that point into consideration, the costs would be economical to-day at that figure. I should make it clear that the costs which I read did not include excise. As to whether a rebate of excise could be granted is another matter. There is a tremendous difference between the actual operating costs of imported petrol and petrol manufactured from black or brown coal. I do not wish to be put into the position of appearing to "knock" the production of oil from coal in Australia, but I think that you are making a comparison between those costs and a selling rate for petrol. The true comparison is between the landed cost and the manufacturing cost in Australia.

253. To the Acting Chairman.—Mr. Baragwanath.—By hydrogenation methods you could convert 80 per cent. or 90 per cent. of crude oil into petrol.

254. To Mr. Conlan.—You ask how much brown coal would be required to yield 1 ton of crude oil. It would take from 18 to 20 tons of raw brown coal to make 1 ton of petrol, and petrol would represent about 80 per cent. of the crude oil which was produced.

255. To the Acting Chairman.—Mr. Liddellow.—When the hydrogenation process is employed, there are no by-products.

256. Mr. Baragwanath.—It is economical not to take hydrogenation to its furthest limits. It pays to withdraw certain products at a certain stage. Those products are chiefly very thick tars, which can be carbonized. The oil goes back and you have a coke which can be used in ordinary grates. By the hydrogenation process you can make phenols and so forth; but you would make them at the expense of the petrol.

257. Mr. Liddellow.—You have to decide what your main product will be. If it is to be petrol, then you cannot at the same time produce all these other things. If petrol is your object, there is very little else left.

258. To Senator Brand.—Mr. Baragwanath.—We have no information from England later than that contained in Sir David Rivett's report. The only hydrogenation plant that we know of is that at Billingham. The German coal seldom exceeds 60 per cent. in moisture, but Victorian brown coal goes up to 65 per cent. The less the moisture the more valuable is the coal. At Yallourn, on one side of the river, the moisture content is between 65 per cent. and 67 per cent., but on the other side it is only 48 per cent. and 50 per cent.

259. Mr. Liddellow.—The only factories in Melbourne which are using our brown coal get it in the form of briquettes, from which a great deal of the moisture has been dried out. A big majority of the factories would use briquettes if they could get them. We are now producing briquettes at the rate of 420,000 tons per annum, and the total requirements of Victoria, apart from the railways, are in the region of 1,750,000 tons a year. After the war, an extension of briquette manufacture will be undertaken.

260. To the Acting Chairman.—The only other comment which I desire to make is to draw special attention to the first of the conclusions in my statement. Brown coal is more readily and completely converted into oil than British black coals tested at the fuel research station. In other words, if serious consideration is given to the establishment of hydrogenation plants in Australia, brown coal deserves to be given attention.

261. To Mr. Conlan.—I would not say that oil is being produced from coal in Great Britain on a commercial basis. The plant of the Imperial Chemical Industries Limited at Billingham is producing oil from black coal. That is the only plant of which I have any knowledge. Broadly, it may be said that the production of oil or petrol from coal cannot compete commercially with natural flow oil.

262. To Senator Aylett.—Mr. Baragwanath.—A number of plants are co-operating in Great Britain at the present time extracting oil from coal under low-temperature carbonization methods. Gas works produce a certain amount purely as by-products. The gas and the coke are the main constituents.

263. To the Acting Chairman.—Mr. Liddellow.—You ask whether I have any figures relating to the cost of mining brown coal. At Yallourn, it costs the State Electricity Commission 2s. a ton to put the coal in the power station or into the briquette factory.

The witnesses withdrew.

(Taken at Sydney.)

WEDNESDAY, 28th JUNE, 1944.

Present:

Senator LAMP (in the chair).

Senator Aylett. Mr. Mulcahy.  
Mr. Conlan. Sir Frederick Stewart.  
Mr. Harrison.

Leslie James Griffiths, managing director, National Oil Pty. Limited, sworn and examined.

264. To the Acting Chairman.—I am aware that Parliament has directed this Committee to investigate the possibilities of extracting oil from shale at Baerami. I have never visited the Baerami field. I am aware of the proposals made by the United States Mission to develop the field. The deposits at Baerami are of a lower grade than those at Glen Davis. Run of the mine shale at Baerami would yield considerably less than run of the mine shale at Glen Davis. The report submitted by the American Mission to the Commonwealth Government shows that the yield of crude oil from run of the mine shale at Glen Davis would be 68 gallons to the ton, including secondary seam, whereas the yield from the Baerami deposits would be 41.8 gallons to the ton. Undoubtedly, production would be more expensive at Baerami than at Glen Davis. The American Mission, with which I agree on this particular point, estimated that the cost of crude oil from Baerami shale would be 4.92d. a gallon and the cost of crude oil from Glen Davis shale 3.48d. a gallon, making a difference in favour of Baerami of 1.44d. a gallon, which, converted into petrol on the basis of a yield of 55 per cent., represents a difference of 2.0d. a gallon of petrol in favour of Glen Davis. Mining the rich material only would make it more expensive per ton, and it is only a matter of calculation as to whether it would make it more expensive on a gallonage basis. A similar problem existed at Glen Davis. If we decide ultimately to mine only the rich seam it would be more costly per ton but we would be recovering from 110 to 120 gallons instead of averaging from 80 to 85 gallons a ton when we mix the primary and secondary shales. At the end of

1943 the shale being mined at Glen Davis consisted of 4 feet of primary rich shale running 126 gallons to the ton. In between there was a band of 9 inches of valueless shale, and superimposed on that was a thickness of 1-ft. 3-in. of secondary shale averaging 20 gallons a ton. At present we are mining the whole lot and discarding what we call the absolutely valueless shale. The secondary shale which yields 80 gallons to the ton is 38 per cent. by weight of the two seams of shale, but contains only 9 per cent. of the total oil in the two seams.

265. To Mr. Conlan.—It would be possible to mine the good shale only, but the cost of mining would be higher.

266. To the Acting Chairman.—The question as to whether we should mine rich shale only must be determined from the point of view of the national economy. Obviously, a cost of 21s. per ton in respect of shale yielding 120 gallons to the ton would be as cheap as a cost of 14s. a ton for mining the 80 gallon shale. Therefore, it becomes a question as to whether the cheaper cost of mining the lot would outweigh having to put through more of a lower grade. The indications are that we can put through the retort more of the 80 gallon shale a day than the rich shale. In the past we found that we could put through 6 tons a day in each retort of high grade shale running over 100 gallons to the ton. In our experimental retort we are now putting through from 7 1/2 to 8 tons a day of the lower grade 80 gallon shale. The Committee has been told that we are picking the eyes out of the mine at Glen Davis. That is not correct. Indeed, we are doing the reverse. We are mining both the primary and secondary shales. Whether that will be continued in the future is a matter of national economics; but to-day we are mining the lot. On the conveyor belt we pick out only the valueless stuff. I am aware that the American Mission proposed to mine at Glen Davis 575,000 tons per annum for 39,200,000 gallons of oil, and at Baerami 897,000 tons per annum for 37,260,000 gallons of oil; and that on that basis they gave to Glen Davis a life of twelve years and to Baerami a life of 13.9 years. From a national point of view I do not think that exploitation of the field at that rate is advisable. It would be better to continue at the rate of production for which we have planned, namely, from 9,000,000 to 10,000,000 gallons of petrol per annum. This would give Glen Davis a life of from 37 to 40 years on our present estimate of reserves of shale in the mine at Glen Davis. On a similar basis, taking the figures in respect of reserves given by the American Mission, Baerami will have a life of 30 years. A long-range plan with respect to housing for workers would enable us to get better results, and the longer the life of the field the greater would be our opportunity to provide efficient housing. The experience gained at Glen Davis should be of benefit in the exploitation of the Baerami field, because the retorting of rich shale is but a little known science. Therefore, the experience gained at Glen Davis would be extremely useful in the development of Baerami when it is decided to develop that field. In view of the lower-grade shale and the higher cost of mining at Baerami, the development of Baerami should be postponed at least until the tests being carried out on a commercial basis on the Renco retort, as advocated by the American Mission, have been completed. The very best in retorting practice will then be available for Baerami and we should then be able to benefit by the mistakes that have been made at Glen Davis. You ask me to outline the progress of the work at Glen Davis. Originally it was proposed to put in the Fall retort and unfortunately a change was made and a different type of retort was put in. Following the deliberations of the Carbonizing Committee in 1940, a

recommendation was made that the retorts that were in operation then be changed back to the Fell type of retort, and that 44 retorts which had been built so far as the brickwork was concerned to the Fell type of retort, should be completed; and a naphtha recovery plant should be installed to serve the two batteries. In addition, in order to obtain the 9,000,000 production it was necessary to extend the steam and power plants considerably. It was also necessary to provide crushing, screening and handling equipment for the extra amount of shale which would have to be mined, and for which no provision was made in the original plan. In addition an adequate and perennial water supply was essential. We have been dependent upon the weather at Glen Davis, and favorable weather combined with a running stream will give us sufficient good water for our boiler and plant. However, the weather is very uncertain. For five months of this year we have been unable to run our cracking plant because of shortage of water. We did not run our cracking plant from the end of December to the end of May owing to the shortage of water. Therefore, an adequate supply of 1,000,000 gallons a day for every day is required. For this reason the Fish River scheme recommended by this Committee has been gone on with, and it is expected that water will be available at Glen Davis at least by February next. All of the work I have just mentioned is in hand—construction work, the products plant, the boilers and crushing and screening plant, and the water supply scheme. We expect the first part of our programme to be completed at the end of December, and this will involve putting into operation the No. 2 battery of Fell retorts. We expect by June of next year to have our present plan completed, and thereafter to work up to a producing rate of 17,000,000 gallons of crude oil per annum, which will crack into 9,000,000 or 10,000,000 gallons of petrol. We expect to produce our petrol on that production for 1s. a gallon. That is our estimate of the cost. That does not include interest on capital. We expect the manufacturing cost to be 1s. a gallon.

207. To Mr. Conelan.—We expect to have our present construction programme completed by June of next year, but there is always a working-in period; and I would say that from the 1st January, 1946, we would be on a producing rate of from 9,000,000 to 10,000,000 gallons of petrol per annum with a manufacturing cost of 1s. a gallon. I think that one witness who gave evidence before this Committee said that at Glen Davis the eyes were being picked out of the mine and the shale was being put through the retorts at less than 60 per cent. recovery of the oil in the shale. It is true that in the past the yields have not been much more than 60 per cent., but at present our yield is 65 per cent. We do not regard that as satisfactory, and it is in order to improve that yield that we are constructing our new plant and going in for the recovery of naphtha. We expect our yield to be 85 per cent. of the oil in the shale when our new plant is in operation, and with our present knowledge of the retorting of rich shale we think that 85 per cent. is a pretty fair return. It is a very marked advance on the yields we have got up to the present.

208. To the Acting Chairman.—You ask me how the costs are actually being reduced at present, and you add that when I gave evidence on the last occasion before the Committee the cost was approximately 3s. per gallon. You now want to know how we propose to reduce the cost to 1s. We shall do that, first, by increased production. By mechanization of the mine we expect to reduce the cost of mining shale from 23s. a ton. Before going to the retorts it has to be crushed and screened. We expect the cost to be about 18s. a ton compared with approximately 28s. a ton at present. In addition, we expect

to recover 85 per cent. of the oil and naphtha instead of about 65 per cent. being recovered at present. We expect to produce 17,000,000 gallons of crude oil per annum at our retorts compared with about 4,000,000 gallons at present, and without substantially increasing our total rate of costs. All of those factors will play a part in reducing the cost of crude oil from about 3s. 3d. a gallon at present to 44d. a gallon when the plant is in full production; and on the basis of 44d. a gallon for crude oil we will produce petrol at 1s. a gallon. The cost of coal at present delivered at Glen Davis is 36s. a ton. We buy our coal from the western collieries, and most of that cost is in respect of transport averaging about 2s. per ton. We have been prospecting for coal for a long time in the vicinity of Glen Davis, and as from the beginning of next year we expect to be producing coal from our own mines for our own use. That pit is situated about three-quarters of a mile from the mine towards the Capertee.

209. To Senator Aylett.—Our present consumption of coal is about 700 tons a month, but bearing in mind the possibilities in respect of petroleum coke, we shall require about 25,000 tons per annum.

210. To the Acting Chairman.—We have impressed the Renco retort which was tried out in Newcastle some years ago, and have taken steps to design and build a pilot Renco retorting plant at Glen Davis. It was found that the original retort would not pass the safety regulation in respect of a pressure vessel, and therefore we had to make alterations to it, strengthening it for safety purposes. In addition, we are designing, and have on order proper handling equipment for the pilot Renco retort. We propose screening the fines that are now stored. We will screen the coarser material from the fines as a feed for the Renco. Therefore, we have to have proper equipment to handle the shale to the retort and to handle the ash away from the retort. We have to design proper heating furnaces for the gases; and, in all, we expect that plant to cost £20,000. It is essential to have a good pilot plant. We do not want to be bothered with hand-labour conditions. Several vital points in the Renco have yet to be tried out. From reports of tests on the Renco it appeared to live up to the claims made for it. What we want to know is whether this retort will live up to its experimental tests in commercial service. We want to know whether the valves will have to be changed very frequently, whether we will have many delays from carbonising-up. In general, we want to know whether the retort will operate 90 per cent., 70 per cent., or 50 per cent. of its time. We want to iron out mechanical and other difficulties which may be encountered. We have hopes that it will be successful, but we are going to prove it. Many plants have given good results in a two or three days' test, but have not lived up to those tests commercially due to delays for repairs and maintenance and other stoppages. We will not have the Renco in operation before the end of this year. We have a lot of work to do, and we will have very little change out of £1,000,000 after reconditioning our plant. Further, we find it difficult to get labour. Therefore, it is a slow job.

211. To Mr. Mulcahy.—On the northern side of the Capertee River there are reserves of shale, but we have not taken any account of those in our estimate of reserves at Glen Davis. As you suggest, that may be really the Baerami seam, but I could not say definitely. I think the characteristics are somewhat different between the two seams. We have not tested the seam north of the Capertee River within the last few years. I understand that when they first started up they used shale from that side of the deposits, and in general characteristics it is practically the same as the shale on the Glen Davis side. There is a band of coal in that seam. The construction of a modern condensing plant at Glen Davis is now well in hand. Whether

we can compete with flow oil will depend entirely on the degree of relief which we may obtain from excise, or, conversely, the degree to which flow oil is not granted such relief. This is the position: on the one hand, nature has done the equivalent of mining and retorting shale by putting the oil in the ground, whilst in our case we have to do the mining and retorting. At present we receive tariff relief at the rate of 74d. a gallon of petrol, which is equal to approximately 34d. a gallon of crude oil, because it takes 2 gallons of crude oil to make one gallon of petrol. Therefore, we have to mine and retort shale for the equivalent of 34d. a gallon to start off square with flow oil; and that is some job.

212. To Sir Frederick Stewart.—On full production we hope to reduce our cost to 44d.; therefore, as you point out, we shall not even then break even with flow oil. The actual figure on the basis of the American Mission's plan was 5.01d. a gallon of crude oil. That is our estimated cost on a full-production basis, which will mean 1s. a gallon of petrol.

213. To Mr. Mulcahy.—You say that in estimating the life of Glen Davis they could not possibly have had sufficient borings through the mountain to be able really to tell the quantity of shale. We have had that matter before us for some considerable time, that is, to close here. It is an expensive proposition but we think that should be done. However, in the development of the mine we have had nothing to show that the estimates made in the past will not be proved correct. In fact, the indications invariably are that they will be more than the estimate of 6,000,000 tons given by Mr. Kenny. Our Chief Surveyor estimates that there are 6,700,000 tons of an average thickness of 35 inches excluding anything north of the Capertee River, and not counting the secondary shale at all. That figure is in respect of the rich shales only. Our estimate is really conservative. It takes into account only thicknesses from 2 feet up to 4 feet, that is an average overall thickness of 35 inches which we can mine economically. None of the reconditioned retorts is working to-day. We have only one experimental house of four retorts. They are Fell retorts and they are being experimented with in order to determine the best operating conditions for the Fell retort. When we have all of them converted next year we will produce about 470 gallons a day on each retort excluding naphtha which will be the equivalent of another 30 gallons a day for each retort, making the full daily production for each retort 500 gallons compared with about 220 gallons a day for the other retorts. Our experimental Fell retort is living up to what it did in the past under John Fell, and also under the Nevnes Investigation Committee. We have no qualms in counting on 500 gallons a day for each retort. Our cracking plant is modern and effective. Cracking and refining methods are improving all the time, but our plant is modern; and with slight additions we can keep abreast of new developments. Only recently our plant was examined by several experts from overseas and they agreed with the view expressed by the American Mission that our plant is modern. We are cracking for some small retorts in the district. We are purchasing oil from the Lithgow Oil Pty. Limited and from Mudgee Motor Fuels. We have also had a request from the Mudgee Oil Shale Proprietary to crack their oil. We have had a sample of their crude oil, and when we find out whom we are dealing with we will be prepared to crack their oil on the same conditions as we are cracking for the two other contractees I have mentioned. However, up to the present two people—a Mr. Field and a Mr. Hebblewhite—have come to me on behalf of Mudgee Oil Shale Proprietary, and as yet we do not know with whom we are dealing. This Committee has been told that we

have refused to crack crude oil from Mudgee Shale Oil Proprietary. We have never refused to do that. We were given a sample from which the light ends had already been extracted, and we were not very keen on cracking that; but the sample we have now is crude oil similar to that being supplied by the Lithgow Oil Proprietary Limited and Mudgee Motor Fuels, and we are prepared to crack that on conditions similar to those extended to those two companies.

214. To Sir Frederick Stewart.—When we are in full production we expect to produce crude oil at a cost of 5.01d. a gallon. On that basis, as you say, we shall still require greater advantage in customs duty than we now enjoy at the rate of 74d. a gallon of petrol. We shall require additional excise relief of approximately 14d. a gallon in order to enable us to break even with flow oil, that is, assuming that we are to make the same profits as the oil companies. I cannot say what those profits are. We expect to produce petrol at a cost of 1s. a gallon and as we are now receiving 1s. 9.5d. a gallon that sounds all right. That is a recent price. At the beginning of last year it was 1s. 4d. a gallon, but we are now receiving net 1s. 6.8d. The oil companies are paying us 1s. 10.8d. a gallon, but we have to pay 4d. a gallon excise. On an annual production of from 9,000,000 to 10,000,000 gallons our trading profit on those figures will be approximately £230,000 a year out of which we will have to pay interest and depreciation. The price paid to us is based on the full cost of importing petrol plus all incidental war and peace-time costs excepting only the 74d. a gallon tariff relief granted to us. I think that the present figure of 1s. 10.8d. would cover the cost at Gulf ports plus transport charges and all other charges plus 114d. a gallon duty. The oil companies would pay 114d. a gallon duty whereas we pay only 4d. a gallon. You suggest that we still require more than 74d. a gallon tariff relief in order to give us full protection against flow oil. That would be very desirable from our point of view; but that is a matter of government policy. If we were given the full protection of 114d. a gallon our figures would come out very much better, but the Government would be receiving so much less in duty. You say that evidence has been given to the Committee that it is not necessary to hold up Baerami because there is no longer any unsolved retorting problem. I disagree entirely with that statement. The Renco retort has not yet operated anywhere on a commercial basis. It proved all that was claimed for it in a three-day test at Newcastle, but we do not know what mechanical and other difficulties will be experienced when it is put into commercial operation. We have hopes that the Renco retort will prove a very marked advance on our present knowledge of retorting at Glen Davis. Basically the Renco retort appears to be on a very sound line, but, as I have already said, we do not know what mechanical difficulties have still to be solved or what has to be done to make it completely satisfactory as a commercial operating plant. Our pilot plant will be the first demonstration of the Renco retort as a commercially operating unit. Shortly after the beginning of next year we will be producing at the rate of from 9,000,000 to 7,000,000 gallons of crude oil representing from 3,000,000 to 3,500,000 gallons of petrol. That will be when the first part of our programme is put into operation. When the second part of our programme is put into operation in about September of the same year we expect to be producing at the rate of 17,000,000 gallons of crude oil or from 9,000,000 to 10,000,000 gallons of petrol. Our present rate of production is 4,000,000 gallons of crude oil, that is 2,000,000 gallons of petrol. None of our estimates takes into account the possibility of the Renco retort improving. If the Renco proves out we have

two alternatives. We could put up Rencos, and if they are that much better, we could shut down our Fells; or we could put up Rencos together with the Fells and double our production, as recommended by the American Mission. Personally, I think that if the Renco proves a pronounced success, we should substitute Rencos for the Fell retorts and shut down the Fells, and continue production steadily at the rate of from 9,000,000 to 10,000,000 gallons a year, giving the field a life of 40 years, rather than double the production and considerably reduce the life of the field. There is a possibility that, if the Renco proves itself, the figures I have given will be greatly improved upon. When I suggest that we should operate at a steady rate of production of from 9,000,000 to 10,000,000 gallons a year instead of tearing out our resources I have in mind the provision of the best basis for a housing scheme at Glen Davis involving the ownership of houses. Houses would not be worth much if the life of the field were to be only ten years. Further, it does not look as though Glen Davis will be of very much use to our war effort so far as the production of petrol is concerned; but when we are able to produce petrol at a cost of 1s. a gallon the undertaking should be of considerable help to us in the post-war reconstruction period, inasmuch as employees at Glen Davis will not have to be found jobs elsewhere. I do not think that we can use the argument that the production of petrol at Glen Davis at a cost of 1s. a gallon will tend to keep down the price of petrol, because our annual production of 10,000,000 gallons is insignificant in relation to the 400,000,000 gallons of petrol now imported into this country annually. Further, as you say, it would have no effect whatever so long as it was merchandised under present conditions because it is now linked with floor oil. It is now sold to the oil companies and retailed by them. At present all petrol produced at Glen Davis goes into the one pool with flow oil, although prior to this arrangement it was sold from bowlers marked "Glen Davis Petrol". At present petrol produced at Glen Davis is distributed in districts contiguous to Glen Davis, that is, sales are confined to districts west of Newnes Junction.

275. *To Senator Aylett.*—The petrol from Glen Davis is produced to a rigid specification, and it has to pass that specification before the oil companies will take it. At present we are producing 70 octane petrol, and it is marketed with the other petrol sold by the oil companies. We expect that we will have to raise the octane number to 80, and preliminary plans are now in hand to do that. At all times we have to produce specification petrol equal to the imported articles. Tests have shown that Glen Davis petrol is well spoken of for pulling on the mountains. Prior to the war 80 octane petrol was super-grade and 70 octane petrol was standard grade. We will be supplying coal to ourselves from our own mine, next week and the saving thus effected will be 16s. a ton. Consumption is 700 tons a month, so that will represent a saving of £3,000 a year. If the Commonwealth Government requires our petroleum coke for the aluminium industry, our saving in respect of coal will be £20,000 a year on what we are paying for it at present; and that will reduce the cost of producing petrol on a full-production basis by approximately a half-penny a gallon. At present we have about 570 employees at Glen Davis and from 60 to 60 contractors engaged on construction work. Even if we were able to obtain additional labour I do not think that we could improve very much on our present construction programme. The Government is assisting us to some degree and we have the work let on contract. I do not think that anything we could do now would help us to improve our present target dates. The provision of

additional labour would not assist us in speeding up production during the war. It would not assist us to any great degree on new construction. We are dependent upon some stuff coming from abroad. We are having trouble with absenteeism, but we are gradually getting over our difficulties. Our housing problem has been very bad. We cannot get men, particularly married men because we have nowhere to house them. The more correct way of evaluating a retort is its capacity to produce so many gallons of oil a day rather than the quantity of shale it is capable of putting through in a day. I have already said that where we count on putting through 6 tons of 100-gallon shale a day we are putting through  $\frac{7}{8}$  tons of 80-gallon shale.

276. *To Mr. Conlan.*—The greater through-put would have more wear and tear on the retort but it will enable us to regulate our production rate. There is something in the contention that the more stuff going through the retort the greater the abrasion and wear, but if you are mining the lot the cost of your shale would be less than if you select only the rich shale.

277. *To Senator Aylett.*—If you are handling only 120-gallon shale you would have to reduce your through-put, because you would not be able to handle the oil or gases away from the retort.

278. *To Mr. Harrison.*—The annual trading losses at Glen Davis up to the present are as follows: 1940, £158,000; 1941, £78,000; 1942, £164,000; 1943, £170,000. You ask what is the explanation for those losses, particularly in view of the fact that our hope to get the Fell retorts back to their original condition presupposes that some years ago the retorts were satisfactory. That question has been asked many times. We have to expend £1,000,000 to make the alterations and additions to put the Fell retorts and ancillary plant in a sound operating condition. That is too big a job to attempt piecemeal. If you did it in that way you would have to scrap the plant when the job was completed. Glen Davis has not been a successful commercial venture. The extensions to plant will cost £1,000,000. Had we been given in 1942 an A1 priority in respect of man-power and material, perhaps at the end of last year we would have been on a satisfactory basis; but we have had a B1 priority. The Government had other problems. However, we were not given the priority in respect of man-power and materials that would have enabled us to obtain our objective by now. We could have achieved a much better result had we been given the help we required.

Therefore, as you suggest, it was in the hands of authorities other than Glen Davis to enable us to attain our objective. I say that without criticizing any other department. From a national point of view I would say that an annual production of from 9,000,000 to 10,000,000 gallons of petrol will establish Glen Davis on a profitable basis. We estimate that when the plant is in full production, showing a trading-profit of about £234,000 per annum, much money will be available to meet interest and depreciation of plant, depending, of course, on how the ultimate capital reconstruction is made. It will set up an amortization fund. That, of course, is dependent upon what the Commonwealth Government ultimately decides will be the reconstruction of capital. There is £325,000 of private money involved and the rest has been contributed by the State and Commonwealth Governments. The total expenditure at Glen Davis, including housing, is £3,000,000. You say that Mr. Gibson said that there was a considerable quantity of oil left in the shale after retorting at Glen Davis. That is not true. We conduct regular analyses of the spent shale from our retorts and the average oil content of that spent shale is 3 gallons to the ton. The spent shale represents 60 per cent. of

the shale going into the retorts. Therefore, the loss of oil in the spent shale is only the equivalent of 2 gallons a ton raw shale. You point out that we are using 80 to 85 gallon raw shale and that we are recovering only 59 gallons crude oil to the ton; and you ask me to explain what becomes of the difference. There are 6 gallons a ton of naphtha, which is the light ends, which we have not the machinery to recover. Those 6 gallons go away in the gases. There will always be some losses of oil in gases owing to the retort getting tight, and oil and gases leaking through from the retort into the flues and up the chimney. Further, there are losses by actual cracking of oil in the retort itself, but we can and shall reduce those losses. However, in every metallurgical process you cannot get away from some losses. You ask me whether Baerami can be developed on a commercial basis without outside assistance. I would not buy shares in the company. May I also say that if Glen Davis, with its richer shale, were offered to the public and none of the big companies took it on, that would not mean that from a national viewpoint we should not work Glen Davis. The Fish River scheme, as recommended by this Committee, was put in hand about twelve months ago. I said that we had not been able to run our cracking plant for five months, from last December to last May, and that we did not have sufficient water to run our cracking plant owing to adverse weather conditions. I should like to point out that the capacity of our cracking plant is far in excess of the capacity required to crack the quantity of crude oil we are now able to deliver to it, and that at our present rate of production we can do the cracking job in a period of three months. However, we have to pay regard to continuity of operations. For instance, we were sending 160,000 gallons a month to the companies, and we shut down on that because we did not have sufficient water. Consequently, deliveries from Newnes Junction to the west had to be stopped and the requirements of the western district had to be obtained from Sydney.

279. *To Mr. Mulcahy.*—You say that the original company lacked foresight in failing to make provision for an adequate water supply. One reason why the old Nevnes Investigation Committee recommended putting in the plant at Nevnes was that the Wolgan River was a perennial and adequate supply. However, I have seen the river dry. We had water for eighteen months, but we did not have adequate water for five months. We had to use bore water, but we can get only 14,000 gallons an hour from our two bores, and bore water has a very bad effect on boilers and engines. When we are running the cracking plant we require 25,000 gallons of water an hour.

280. *To Mr. Harrison.*—All of the recommendations made by the Public Works Committee have been implemented at Glen Davis. The main recommendations were the Fish River scheme and the tests on the Renco retort. We have been given permission to build another 40 houses this year. If the Renco retort lives up to the results of its three-day test it will be infinitely better than the Fell retort. I do not know anything about a retort that has been patented by Dr. Morgan. Our retort is practically the Pumpherson retort with modifications. The residues at Glen Davis can be used commercially in many ways. We are taking steps to produce creosylic acid. On our present production basis we expect to produce 8,000 gallons of creosylic acid a year, and when we are in full production about 32,000 gallons a year. There are three varieties of creosylic acids—para, meta and ortho. Ortho is used largely in the manufacture of disinfectants such as lysol; and para and meta are valuable for use in plastics. We expect to market these by-products at satisfactory prices. We do not make bitumen. Other by-products that could be made

from residues include gas oil, metallurgical coke, ammonia. At present we have in mind only creosylic acid. We could not adapt our present plants, with either Fell or Renco retorts, for the extraction of oil from coal when the shale deposits run out. An entirely different plant would be required for that purpose.

281. *To Mr. Conlan.*—Up to date we have not been satisfied with the progress made at Glen Davis, but we are more satisfied now. The field will be showing a loss until we get into full production. I estimate our future trading results as follows: 1944, a loss of £190,000; 1945, a loss of £97,000; and 1946, a profit of £234,000. Had we been given a No. 1 priority in respect of man-power we would have required good average workmen, and, as you say, that would possibly have interfered with the war effort. I do not know anything about the rotary retort. The number of retorts that are going to revolutionize the extraction of oil from shale is legion, but so far no such retort has actually come to light. It now costs us from 3s. to 3s. 6d. a gallon to produce petrol at Glen Davis. Manufacturing costs in the past were as follows: 1940-41, 3s. 3d. a gallon; 1942, 3s. 6d. a gallon; 1943, 3s. 6d. a gallon. This year we expect the cost to be 3s. a gallon, next year 2s. a gallon, and in the following year, 1s. a gallon. It would be possible to pipe crude oil from Baerami to Glen Davis, but the conveyance of shale from Baerami to Glen Davis is out of the question. The piping of crude oil from Baerami to Glen Davis would relieve Baerami of the necessity of having a water supply. We could concentrate the cracking and refining of the oil from the two fields, at Glen Davis. However, the weather in the mountains is very cold, and there would be a possibility of the oil freezing if it were piped. Perhaps that difficulty could be got over. The Renco pilot plant will not be ready for operation for another six months. We are putting it up as a pilot unit, which will be operated more or less on a small commercial basis. We will have for feed shale to that retort the coarser material screened from fines which, in size, will be ideal for that purpose. At the same time, we will thus be enabled to make use of the fines which at present have no value on our books. If we are able to recover 80 per cent. in the Renco, that retort will be much preferable to the Fell. If we can get 90 per cent., which is envisaged from the Renco with its higher-producing capacity and lower operating cost, it would be a matter of adding to our existing plant or substituting Rencos for our existing retorts.

282. *To Sir Frederick Stewart.*—The arrangement made with Mr. Jacomini for the use of the Renco retort provides that no royalty is to be paid during the war and six months thereafter. Speaking from memory, I think that the royalty which will then be charged will be at the rate of 6d. a ton of shale.

283. *To Mr. Mulcahy.*—The distance of the shaft at Glen Davis would be between three-quarters of a mile and 1 mile. The distance through the mountain from Glen Davis to Nevnes would be about 2 miles.

284. *To the Acting Chairman.*—The fine shale which does not go through the retorts is being stored in heaps in the same way as tailings at metal mines are stored. The fines will be held until methods of treatment are discovered. I do not know anything about the making of asphalt. At present we are screening out of the fines all material under three-quarters of an inch, and the coarser sections will be retorted either in the Fell retort or in the Renco. I estimate that the loss through dust will ultimately represent only 3 per cent.

285. *To Sir Frederick Stewart.*—We have not seen any indication of cementing in the fines after long storage. We do not expect that those fines will be wasted. Ultimately, the loss will be only 3 per cent.

The witness withdrew.



(Taken at Newcastle.)

THURSDAY, 20TH JUNE, 1944.

Present:

Mr. JAMES (Chairman).

Senator Aylett.	Mr. Harrison.
Senator Lamp.	Mr. Mulcahy.
Mr. Conelan.	Sir Frederick Stewart.

James Johnstone, superintendent, J. & A. Brown and Abermain Seaham Collieries Limited, sworn and examined.

286. *To the Chairman.*—I am aware that Parliament has directed this Committee to investigate proposals to develop the shale oil deposits at Baerami. To a degree, I am acquainted with the potentialities of the Baerami district. I have had experience in the working of shale deposits in Scotland and at Glen Davis. On behalf of the Government of New South Wales I estimated the potentialities of the Glen Davis area. At the request of a member of the American Mission I accompanied the Mission on a trip to Baerami to give them some idea of the location and to assist them with my knowledge of the shale-mining industry in this country. I made an inspection of the various tunnels which have at one time or another commenced operations at different points in the valley. I also made an inspection of an area in another valley, of which I cannot recall the name, where there had also been some prospecting. As I was not aware until late yesterday that the Committee wished to hear evidence from me, I have been unable to refresh my memory with respect to data at Baerami such as the thicknesses of the shale, height of ceiling, &c. I gave all of my notes on the visit which I made with the American Mission to Baerami to Mr. Hebley, who was a member of that Mission. However, I have my notes in respect of one section. That section was made up of a 6-in. band of coal on the floor, 18 inches high grade torbanite, 9 inches of stone, and an 18-in. seam of inferior shale which we call cannel. Cannel is really a cross between oil shale and coal, very high in gas content and in oil content, but not so good as high grade shale. The cannel coal at Baerami would be much better in oil content than the cannel coal which we have in one of our Abermain mines. We are extracting oil from the cannel shale at Abermain. We have been doing that now for some years for our own use. Cannel coal and cannel shale are the same. The average yield of crude oil at Baerami would be about 57 gallons to the ton, that is from low grade and high grade mixed; but the yield from torbanite would be much higher. The cost of mining an average thickness of 2 ft. of 8 in. would be high. The cost of mining in a low seam must necessarily be higher than in a thicker seam because there is so much more secondary work to be done where headways have to be brushed or ripped down in the workings. The yield from the high grade shale would be about 100 gallons to the ton; and you might get a lower quality shale in another part of the seam yielding, say, 50 gallons to the ton. If that material were treated in equal proportions you would get 75 gallons to the ton if it were properly mixed. Part of the material which I saw at Baerami could be worked in solid work, that is leaving pillars and treating on the long wall principle. When the seam gets down to 3 feet I would work it on the long wall principle taking everything in front of me and leaving no pillars at all. I should recommend mechanization wherever possible in shale-mining.

287. *To Mr. Mulcahy.*—That would apply to coal, too, and that is my objective.

288. *To the Chairman.*—I could not give an estimate of the cost per ton of mining shale for retorting without making a thorough investigation. When I

made an estimate for the American Mission, those gentlemen, particularly Mr. Hebley, stated that it was essential to get an early and big output as quickly as possible for war purposes. Therefore, the first cost was not so important, as is the case in normal times. War exigencies demand that certain things be done, and that means a very much higher degree of mechanization, including experimental mechanization, than would be the case in normal times. Speaking from memory, the estimate we prepared was approximately 2s. a ton higher for shale delivered to the pit mouth or retort at a central point than the cost at Glen Davis at that time. I think the cost was 14s. on particular prices and rates, and on the understanding that the State Government would assist in mechanization on the long wall method, which would really be large pillars. You would not do it for that cost to-day. No doubt, this Committee is aware of the increases of costs at Glen Davis. I should be surprised if the cost at Glen Davis to-day was not in the vicinity of 17s. or 18s. a ton. You would have no hope under the present method without mechanization of reducing the cost to 14s. a ton. You say that you have had evidence that the shale can be landed for retorting at 14s. a ton. You may have had evidence that that might be done, but you certainly have not had evidence of its being done at that price. The provision of adequate housing and social amenities for workmen should be regarded as number one priority on any project of this kind. That would involve creating a village on the field. Speaking from memory, we estimated that from the river at Baerami we could get the necessary supply of water. On this aspect however, I should like to refresh my memory and give definite evidence later to the Committee. The American Mission proposed to mine 897,000 tons run of the mine a year on which basis they would work out the deposits in approximately 13.9 years. I should favour working at a normal rate, thus lengthening the life of the field, unless sheer war emergency dictated the exploitation of the field as quickly as possible. I should like to add that after a very exhaustive inspection of the Baerami area, and after discussing the matter with the American Mission, I looked upon Baerami as having great potential value to this country. Shale-mining should be complementary to coal-mining, and not in opposition to it. In the provision of housing for workmen the idea should be to enable the workmen to live permanently on the field. Certain phases of oil production are common to both Glen Davis and Baerami, such as the method of retorting, refining, &c. In these circumstances it would be very desirable that the difficulties met with in that particular phase at Glen Davis should be completely solved before we embarked upon another big scheme involving the expenditure of a large amount of money. Baerami should be developed on the basis of its being supplementary or complementary to Glen Davis; and the greatest possible efficiency in retorting should be achieved at Glen Davis before other retorts are erected at Baerami. You ask me whether I consider it practicable to produce petrol from Baerami shale as a commercial proposition without government assistance. Before answering that question I should like to investigate three points: First, what output of shale would be required annually to make Baerami a sound going concern; secondly, the cost of producing that petrol under approved methods; and, thirdly, the efficiency of the retort in relation to the yield from the shale to be treated. I saw a survey and a record of that survey of the shale area at Baerami, and from that survey I worked out an estimate of the area that could be worked. Speaking from memory, I think I estimated the deposits at 10,000,000 tons. In Scotland we used the Pumpherton retort, and treated shale yielding

about 30 gallons to the ton. I visited Newnes when Mr. Fell was there, and he was handling the richer shale with fairly good success, using a modified Pumpherton retort. His trouble was in the mining and not in the retorting. At present I am not in a position to say why the retorting return at Glen Davis is not equal to the laboratory return. That is something for investigation; and from that investigation will be found a solution of the most important aspect of this problem. However, I am not a chemical engineer, and therefore that is outside my sphere. Fell modified his retort on the Pumpherton principle; but I think he drew off his oil at various points a little differently from the method used in Scotland. I entered five of the tunnels at Baerami, and the longest of those tunnels would not be more than 300 yards. They have no water to contend with. The physical conditions above and below the seam are very fine. The roof is good. It does not require heavy timbering. These tunnels are only prospecting tunnels and are only of value in proving the existence of the seam. From the floor to the roof including the cannel coal and sandstone band the height would vary from 3 feet to 5 feet depending upon the amount of rubbish that was in the seam or had been thrown back, which of course, would give added height. I suggest that as far as possible the 9-in. stone band be picked out before the shale is sent to the surface. As to whether the shale should be thoroughly cleaned before going into the retort, I should like to find out from a retorting expert what effect extraneous stone would have on the retorting. At Baerami the shale was brought out by horses, and in some instances sent down the hill in a chute to a loading point. The scheme upon which Mr. Hebley and I agreed was that there should be a common point in the valley for retorting, and the various small mines would deliver their shale to a bin at the tunnel mouth, and from there it would be conveyed to a central point for crushing and retorting. Sandy Hollow is the nearest railhead, and the embankment goes to Baerami Village. There is no branch line to Baerami now.

289. *To Senator Lamp.*—Cannel coal has a very small percentage of carbon, a high percentage of hydrocarbon from which gas is drawn, and a higher percentage of ash than black coal. It has not the carbon content of good coal, and it is higher in ash content than good coal. I have not yet read Mr. Hebley's report. If the Committee wishes me to give expert evidence as to whether Mr. Hebley's report is sound and to investigate the various estimates and proposals put forward by Mr. Hebley and his colleagues, shale is not a good proposition for cutting by machinery; therefore it is not out at Glen Davis. But if there is any coal or more pliable shale underneath the oil shale it is possible to cut it with a machine. That possibility would have to be thoroughly investigated before you would know whether to put in a cutting machine or not. Power boring is essential, and it is desirable to load shale by some form of mechanization according to the special circumstances. If you are going to store shale for future use it should be put where it can be lifted cheaply. Some hillsides form a natural bin, and if you build a receiving end at the bottom of the hillside from which the stored shale can be shot into a motor truck or wagon you will be getting the full benefit of a bin made by nature. By all means create a bin but make it as cheaply as possible. The depreciation on shale is not very heavy.

290. *To Mr. Harrison.*—I had experience in Scotland in the Pumpherton, Broxburn, and Tarbrax districts. The by-products obtained from Scottish shale such as ammonia sulphate really saved the industry.

I do not think it would be a sound proposition to pipe the crude oil from Baerami to Glen Davis or Newcastle. I should like to make further investigations before I could say whether there would be sufficient water at Baerami for refining and cracking purposes as well as retorting. The bituminous coal in the seam at Baerami would not be of any great value in working at Baerami except that holding would make production easier. If that coal is of value it could be held separately, but my recollection is that it was not of high grade. However it should be of some value as a shale getting proposition. The adaptation of the same plant for the extraction of oil from both shale and coal should be very carefully considered; but oil from shale and oil from coal must come as surely as the sun will rise to-morrow, and our first venture should be the production of oil from shale. The development of our shale oilfields will be of inestimable value in helping us in the extraction of oil from coal. We have only a very simple retort, which we use for our own purposes. It is installed about 10 miles from Newcastle. We are simply heating our cannel shale externally to a given temperature and drawing the crude oil from that. We put the crude oil through various boilings, brushings and scrubblings until we get a crude petrol or a good quality diesel; and we are using that through a pre-heating arrangement on our cars and lorries. We run that retort as a necessity; we must have fuel for our cars and lorries. We have never looked into the matter as a commercial proposition.

291. *To Mr. Mulcahy.*—I used to think, and I still wish to think, that oil from coal would be the best, but the results of various experiments in the old country, both in low temperature carbonization and hydrogenation, particularly the very high cost of initial plant and maintenance, have dampened my ardour in that respect. The war will have brought out many developments and improvements in the production of oil from coal, and it is only after we obtain full information on these developments, particularly in Germany, that we will know whether we will be able to go direct to coal or not. Until that evidence is available to us the production of oil from coal must remain an open question. Our small retorts at Abermain are our own idea. We constructed them locally. With three small retorts we produce sufficient fuel to service about four or five cars.

292. *To Mr. Conelan.*—I did not see the Jacomini retort which was erected in Newcastle. I am not in a position to be able to criticize the Jacomini retort or any other type of retort. We get the shale which we use in our small retorts at Abermain for nothing, because it is a residue. We have not made any estimates of costs of operating those retorts. The shale we use would be dumped if it were not used for this purpose. I have considerable knowledge of Glen Davis. It appears to me that the retorting problem is the major problem at Glen Davis. When that is solved Glen Davis should be an economical proposition. I think it would be wise not to tackle Baerami at present but to wait until Glen Davis is put on a sound commercial footing. You should solve the retorting and refining problem at Glen Davis before starting elsewhere.

293. *To the Chairman.*—I shall obtain for the Committee later my estimate of cost of the plant above the surface that would be required at Baerami.

294. *To Mr. Harrison.*—It takes a certain output to make a field pay. I suggest that it would be better to maintain the output at that figure and to extend the life of the field than to try to exploit the field as quickly as possible. First, you have to make sure that oil from shale is a payable product. Secondly, you

have to find out if Baerami is a commercial proposition. And, thirdly, you have to find out whether recent developments will make oil from coal a better proposition after the war than it was before the war. On those three factors you will base your decision as to whether Baerami is a sound national undertaking running either parallel with Glen Davis or behind Glen Davis. If you make a success of the extraction of oil from coal it will be just as well to clean up shale deposits as quickly as possible.

295. *To Senator Aylett.*—The initiation, stimulation and improvement of the production of oil from either shale or coal will depend to a great degree on what the public of Australia are prepared to pay for oil. It will be some time yet before oil from either shale or coal will be able to compete with flow oil without special government protection. If it is the desire of the country to be self-contained we should go ahead with the production of oil from either shale or coal.

296. *To the Chairman.*—I believe that future improvements in the production of oil from coal will be along the lines of the latest German methods. When we know more about them, they should help us to solve many of our problems.

*The witness withdrew.*

*(Taken at Glen Davis.)*

WEDNESDAY, 5TH JULY, 1944.

*Present:*

Senator Lamp (in the chair).

Senator Aylett. | Mr. Conelan.  
Mr. Harrison. | Sir Frederick Stewart.

John Daniel Bowdler, mine manager, National Oil Pty. Ltd., Glen Davis, sworn and examined.

397. *To the Acting Chairman.*—I am aware that Parliament has directed this Committee to inquire into the possibilities of extracting oil from shale at Baerami. I first visited Baerami two years ago, and on another occasion I went there with the American Mission. I have inspected the drives at Baerami. The mining cost at Baerami would be higher than the mining cost at Glen Davis. The coal on top of the seam at Baerami could be used for firing purposes but you would probably require specially constructed grates to use that coal. The cost of delivering retortable material to the bins depends largely on the rates of pay and hours of work. Our costs at Glen Davis vary from 16s. a ton for the machine section to 30s. a ton for another section, that is, carrying all Glen Davis charges. Australian measures lend themselves to long wall working but our industrial conditions do not lend themselves to long wall mining. At Baerami I would prefer working on the bord and pillar system, or long wall retreating. By proper working methods it is possible to get from 90 to 95 per cent. extraction before the mine finally closes. In the development of the mine you would leave from 60 to 70 per cent. of the mineral in pillars but ultimately those pillars are extracted. At present we are getting out from 500 to 550 tons a day at Glen Davis. The same methods, with slight modifications could be used at Baerami. The coal roof at Baerami could be cut by machine but it would be better to avoid cutting the coal. Perhaps the best method would be to grunch the shale. The members of this Committee saw that method in operation in our mine last night. The Baerami proposition is rather different from Glen Davis. Baerami lends itself to operations in two or three small mines, and with three mines working, production at Baerami could probably reach 1,000 tons a day within twelve months. The present road to Baerami is bad. However, the grades are fair and a good all-weather road

could be constructed there without much difficulty. I am unable to say what the cost of such a road would be. Mine operations at Glen Davis have not been hampered by the shortage of man-power. We have always been able to keep the shale in excess of retort requirements. As labour shortages became apparent we have been able to put in machines and thus overcome the shortage. In order to obtain sufficient miners for Baerami the first prerequisite would be the provision of good housing conditions and reasonable social amenities on the field. By such means you could attract a good class of labour. Our coal-mining industry is mostly carried on near the towns where the social life offers greater attractions than would be the case at Baerami at present. You ask me whether I think it would be better to postpone the development of Baerami until we reach our maximum capacity at Glen Davis. That is largely a national question. Personally I believe that as Glen Davis is now so near to full production everything would be gained by postponing the development of Baerami until we have made a success of Glen Davis. The huge reserves of shale in Australia, particularly in New South Wales, are worthy of every consideration. In the post-war period their exploitation will offer useful employment to a large number of miners now engaged in the coal-mining industry. As oil producing shale is a national asset its value has not yet been fully exploited. As yet we know very little about the by-products. We should study that aspect of the industry very carefully. We should not waste money in that direction but reasonable experimental work would be more than justified. Improvements are now being made to the Joy-loaders. So far as we know the action and design of the Joy-loader is the most suited for handling shale. There is a Joy known as the 14 B.U. type of machine which will operate on material as low as three feet, and that renders the winning of low shale much easier. Last year our small Joy-loader loaded 70,000 tons of shale and our bill for repairs and spares was £600. At present, maintenance on our machines is very light indeed except for wear on the moving parts owing to the abrasive nature of the shale. However, we have been running our present machine for three months without incurring any maintenance charge at all. On that experience I think that our maintenance cost will be very light indeed.

298. *To Sir Frederick Stewart.*—When I say that our mining costs are carrying all Glen Davis charges, I mean that our mining costs stand a share of all the pump site maintenance on the place; that is, mining pays its share of the administration involved in the total establishment. I believe that we could start at Baerami or any other field on present mining technique. I do not contemplate that we have anything to gain from the point of view of mining technique by postponing the development of other fields. Any postponement awaiting the full development of Glen Davis would be related to considerations other than mining. In my opinion, the cost of mining at Baerami will never be as cheap as that at Glen Davis. I do not think that our present mining technique could be improved upon in any other field. At Glen Davis my duties are confined solely to mining.

299. *To Mr. Harrison.*—I accompanied the American Mission to Baerami. I have seen the Mission's report and I agree with the recommendations made by the Mission with the exception that I believe operations should not be started at Baerami until Glen Davis has been proved a success. Further, I am not in full agreement with the Mission's recommendation in respect of long wall mining. As to whether Baerami could be developed commercially, the American Mission's figures have not yet been proved. I agree generally with the views expressed

by the Mission concerning production possibilities. However, I feel that with the plant and equipment we are now installing at Glen Davis we should know within a couple of years whether we can really make Glen Davis a commercial proposition. Although the cost of mining at Baerami will never be as cheap as that of Glen Davis, I am satisfied that mining at Baerami can be successful. I estimate that mining costs at Baerami will be 30 per cent. higher than at Glen Davis. I cannot speak with respect to costs on the retorting side, but I accept the views expressed by the American Mission on that aspect. The mining at Glen Davis is very suitable for mechanization. By mechanization we have already reduced our costs considerably, and those costs will be still further reduced. Up to date we are not satisfied with our retorting at Glen Davis. I believe that no money should be expended at Baerami until Glen Davis has been proved a success on the retorting side. I do not visualize any set of conditions arising at Baerami that would cause industrial unrest. The primary consideration in that respect is the provision of reasonable housing and social conditions amenities. If Baerami is developed under modern conditions I would not anticipate the same industrial disturbances which have occurred on the coal-fields, provided that the mine is fully mechanized and the rates of pay are fixed on a shift work basis in order to avoid jealousies and unrest which are caused when one man receives much more money than another man engaged in the same undertaking. As you say, the labour for Baerami would be drawn from the coal-miners. I do not agree that the coal-miners have set their face against mechanization as such. You ask me why the coal-miners have resisted the mechanization of the coal-mines. That is a long story, and there are two sides to it. I emphasize that Baerami should not be operated without mechanization, because operating conditions at Baerami are less favorable than at Glen Davis. I do not think that the Baerami field has been proved. It has only been tested from the outcrops. At Glen Davis, only the main seam has been proved. That seam varies from 2 feet to 4 feet in thickness and is estimated to contain approximately 9,000,000 tons. The deposits at Rylstone, Mudgee and Murrumbidgee have not been proved. They have only been tapped at the outcrops. Our total shale deposits in Australia would not be sufficient to make us self-sufficient in the production of petrol. Our shale reserves as a whole should be proved for retorting and refining and for the production of by-products. Whether our reserves should be fully exploited now or held to meet possible future emergencies would be a question for the government of the day. The production of oil from coal offers wonderful opportunities in Australia. The technique has been proved in Great Britain and during the post-war period. You ask me whether in view of our huge deposits of coal I think it would be more advisable to go ahead immediately and prove the extraction of oil from coal rather than the extraction of oil from shale. We should do all we can now to prove the extraction of oil from Glen Davis; and probably the next best step would be the production of oil from coal by the hydrogenation process.

300. *To Senator Aylett.*—I suggest that if Baerami is worked it should be mechanized right from the start. I am aware that some of our coal-mines are highly mechanized. I do not know of any case in which mechanization in metalliferous mines has caused industrial disturbance. Unfortunately, however, with the advent of machinery men are often taken off contract work and put on to a daily wage, and very often they thereby have their earnings reduced. That seems to me to be the great trouble in mechanization in Australia. In addition, the miners are naturally afraid of losing their jobs through mechanization. If Baerami were

mechanized right from the start, I think that every workman at Baerami would welcome mechanization. There would be no danger of industrial trouble at Baerami if the mines on the field were mechanized right from the start.

301. *To Mr. Conelan.*—I have no knowledge of the shale-fields in Queensland. Coal has been known for a long time to exist in this valley, but it was only recently that we located a seam here which we consider to be workable. That will be of considerable advantage in our operations at Glen Davis. As we install new mining machinery our mining costs will come down very much. When we have the full plant on mechanized mining, and this equipment is properly bedded-down, our costs will fall still further. At present over 40 per cent. of our miners are working on hand-won shale. We have all the machinery necessary to mechanize the mine for immediate needs, and it will be only a matter of time before it is installed. In my opinion, it will be wise to wait until Glen Davis is proved to be an economic proposition before we attempt to operate at Baerami.

302. *To Senator Aylett.*—At present we have 132 miners employed at Glen Davis. Our full staff would bring that figure to 140. Our absence rate is from 10 per cent. to 12 per cent. The reason for absenteeism is that many of our men go out of the valley into Lithgow, and they probably lose one or two days on a pay week-end. On pay week-ends, absenteeism would reach about 20 per cent. Some of the men probably have one drink too many. Another factor is that some of the boys get too much money.

303. *To the Acting Chairman.*—Combined with the waste gases from the retorting, the overhead coal at Baerami would probably provide sufficient fuel for the working of the retorts. But the saving would not offset the extra mining cost of more than, say, 5 per cent. The coal itself is not such a good roof as the roof at Glen Davis. Shooting would probably blow out the timber and the cost of resetting the timber under a soft roof would exceed any saving that might be effected by using the overhead coal. If the coal is loaded out with the shale it would have to be taken out before the shale goes to the retort. Therefore, the conditions at Baerami are not as good as having a good clean face of shale to work.

304. *To Mr. Conelan.*—The roof and floor at Baerami are not quite as good as at Glen Davis. For a few years there would be ample supplies of timber at Baerami for timbering the mines, but by that time probably the tendency will be to go in for steel props.

305. *To Senator Aylett.*—If the coal at Baerami were not suitable for the retorts, and you wanted to load it separately, I would suggest that you cut that coal with a machine and load it separately; that is, take the coal out first.

*The witness withdrew.*

*(Taken at Sydney.)*

TUESDAY, 10TH OCTOBER, 1944.

(SECTIONAL COMMITTEE.)

*Present:*

Mr. JAMES (Chairman).

Mr. Harrison. | Mr. Mulcahy.

Sir Frederick Stewart. |

Frank Oswald Viggers, managing director of F. Viggers Pty. Ltd., Newcastle, sworn and examined.

306. *To the Chairman.*—I am aware that the Committee is inquiring into a proposal to produce oil from shale at Baerami. My company is producing oil from shale at Hamilton. We have been operating the retort

there for about two years and four months. The retort consists of sixteen tubes. The following statement showing the expenditure for July, 1943, is an accurate calculation of our normal production costs:—

	£	s.	d.
92 tons of Barigan shale .. ..	345	0	0
Wages .. ..	253	4	11
Wages tax .. ..	0	0	1
Holiday pay .. ..	10	0	0
Workers compensation .. ..	7	10	0
Electric power and light .. ..	20	0	0
Office expenses .. ..	14	0	0
Rent .. ..	4	0	0
Maintenance and repairs .. ..	35	0	0
Cartage of spent shale .. ..	29	0	0
Telephone rental .. ..	0	0	0
Depreciation (three years) .. ..	210	0	0
Rates .. ..	14	0	0
General expenses .. ..	3	0	0
Insurance .. ..	6	15	0
Supervision .. ..	8	0	0
Water .. ..	7	10	0
Sulphuric acid .. ..	3	3	0
Caustic soda .. ..	16	0	0
Oxy-acetylene .. ..	2	0	0
Total .. ..	991	18	10
Production—			
3,859 gallons of vaporizer spirit at 5s. 6d. a gallon .. ..	1,000	4	0
640 gallons of crude oil at 2s. a gallon .. ..	64	0	0
Production expenses .. ..	1,060	4	0
Margin .. ..	891	18	10
	68	5	8

From 92 tons of shale we produced 9,607 gallons of crude oil, or 104.42 gallons to the ton. The shale was estimated to produce 120 gallons to the ton. The shale costs £3 15s. a ton on rail at the works or £2 a ton at the mine. The cartage to Mudgee costs £1 a ton, and freight from there to Hamilton costs 14s. 8d. a ton plus shunting charges.

307. *To Mr. Harrison.*—It is not picked shale, but the normal output of the mine.

308. *To the Chairman.*—The only place where oil can be manufactured economically is at the mine, because cartage and freight charges to Hamilton are too heavy. Three sets of retorts would handle 276 tons of shale a month. If 9-inch instead of 7-inch sleeves were used, the spent would be reduced and would compete with imported petrol. That would enable 450 tons of shale to be treated each month, and would yield 45,000 gallons of crude oil a month. The cost of treatment would be as follows:—

	£
450 tons of Barigan shale at £2 a ton .. ..	900
Labour cost of treatment, based on previous experience .. ..	280
Overhead expenses .. ..	207
Total .. ..	1,387

That would give the total cost of crude oil at the mine about 7.38d. a gallon. If the mine were run independently oil production shale could be produced for 25s. a ton. We are operating the mine at a profit. We are supplying shale to Lithgow and Emu Plains at a profit. The present cost of shale, namely, £2 a ton, covers only war-time production. If the war finished to-morrow and we scrapped our oil-producing equipment, shale could be produced at 25s. a ton. That would reduce the cost of crude oil to 3d. a gallon. Labour costs 2½d. a gallon, and if we add another ¼d. a gallon to cover maintenance and repairs and general expenses we would arrive at a cost of 6½d. a gallon at the mine. I am not aware that petrol is being produced at Glen Davis at a cost of 3s. 3d. a gallon and that it is estimated that next year, when the plant there will be in full production, the manufacturing cost is estimated at 1s. 0½d. a gallon. Our associates are prepared to put in their own

refining plant without any Government assistance and to produce petrol at 1s. 6d. a gallon. They would produce petrol at the mine for 1s. 2.60d. a gallon. That cost is made up as follows:—

	£	s.	d.
Crude oil .. ..	0	7	35
Loss on recovery .. ..	0	2	25
Refining .. ..	0	0	450
Tax of royalty .. ..	0	0	4.50
	1	2	60

On our retort of sixteen tubes six men are employed. We are working 3½-hour cycles with two men to a shift.

309. *To Mr. Harrison.*—If 9-inch sleeves were used, 48 tubes would be required to handle 450 tons of shale.

310. *To the Chairman.*—The present tubes have been running non-stop for eighteen months. We started with electrically welded tubes, but had to scrap them after three months. We then put in solid drawn tubes and they have lasted for eighteen months. The only tubes that have been discarded were electrically welded tubes. If we were installing a new plant we would have special tubes made. We would have aluminum tubes which would stand a temperature of 1,000 degrees centigrade. Such tubes would give a retorting time of three hours instead of three and a half hours.

311. *To Mr. Harrison.*—Our retort has no name. It is a tubeless steel retort. It is different from the Dye retort. It is something that we have evolved and it is foolproof. It is not covered by patents. It would not be worth while to erect a sixteen tube retort together with distilling and other equipment for the complete production of petrol as its capacity would not be sufficient.

312. *To Sir Frederick Stewart.*—If the Government desired to produce petrol from shale, I would suggest that it install a battery of retorts with sufficient capacity to maintain a modern refining plant. I understand that in the United States of America standard plants of a certain capacity are obtainable at a fixed price. They quote plants which will convert shale into oil at 5 cents a gallon. The Government would be wise to investigate the latest methods of refining.

313. *To Mr. Harrison.*—I have seen the Jacomin retort at Newcastle where it ran for a short period, after which it was resold for a low figure. We had proposed to install one of those retorts at Mudgee, but we found that the cost of installing certain equipment was too great. The plant was not more efficient than the one we are using. Our object was to get the greatest output possible. The Renco retort was supposed to handle 90 tons of shale a day. My company is pleased that it has experimented in a small way, because our plant is paying. We believe that it is better to experiment on a paying basis than to expend a lot of money unsuccessfully. I would not say that the Renco retort would operate at lower cost than our retort. I believe that the Renco necessitates heavy maintenance charges. I am convinced that the Renco retort is not the most economical.

314. *To the Chairman.*—A set of three retorts of 48 9-in. tubes (sixteen tubes per set) would produce 45,000 gallons of oil a month. On that basis, six retorts would produce 90,000 gallons; twelve retorts would produce 180,000 gallons; 24 retorts would produce 360,000 gallons; and 48 retorts would produce 720,000 gallons a month or 8,640,000 gallons of crude oil in a year. In order to produce 96,000,000 gallons of oil per annum 192 batches of 16-tube retorts would be required. The cost would be about £280,400 for retorts exclusive of distillation plant.

315. *To Sir Frederick Stewart.*—If production on that scale were planned, our methods would be considerably improved. If we were operating 192 sets of retorts more mechanical processes would be used.

316. *To Mr. Mulcahy.*—We have not tried any other shale than Mudgee shale, which is a dry variety. We know that the deposits at Mudgee are extensive. The No. 2 mine there has a 3-ft. face, and the No. 1 mine has a 4-ft. face which is increasing. The mines are tunnels.

317. *To the Chairman.*—The work of firing the retorts is not dangerous. If we mechanized the plant still further we would install an extractor. We have not had a burning accident at our retort. Before building our plant we inspected a number of retorts, and we found that men were getting burnt because they were working too close to the flame. We designed the plant to avoid that danger. There is no oil left in the spent shale after it has passed through the retort. We find some difficulty in cleaning the tubes because of their small diameter. It is necessary to place them on end and to tap them, but that method could be improved. That is one reason why I suggest a 9-in. sleeve. If a spinner were used the spent shale could be discharged by a mechanical means in a few seconds. That could easily be arranged. Our recovery of crude oil was 99.52 gallons from each ton of shale. Other retorts give about 80 or 85 gallons from the same shale. The remainder is lost entirely. Our retort does not produce more gas than we use in firing the retort. If there were more gas it would be beneficial to the plant because we could condense the gas and get more petrol. Unfortunately, we use more gas than we produce. We are using our residual oil to heat the retorts. I am not in a position to state the value of the by-products. The by-products are plastics, and at this stage I cannot state their value.

318. *To Sir Frederick Stewart.*—In order to produce plastics it would not be necessary to vacate the field of shale oil entirely. From the tar distillate one property is obtained whilst other materials produce other properties.

319. *To the Chairman.*—The plastics could be used mostly in housing construction, such as in making interior walls and mouldings. The tensile strength of the plastics is 45 tons to the square inch. We can produce acrylic acid and many other things such as nitriles, but I do not know in what quantities. They are obtainable from the tar distillates. The by-products are of more commercial value than the petrol, but the plant to extract them would be costly. In my opinion, it would be best to concentrate on one by-product after getting what petrol is obtainable. I do not know what quantity of water we use, but it costs £7 10s. a month. We use town water. The figures were loaded against us in order to put us off producing oil from shale. In my opinion, the plant should be installed at Louis where there is natural water and there would be no restrictions on its use. We crush the shale to a uniform size. I do not admit that we are using an improved Dye type retort. We have no patent rights in our retort.

320. *To Sir Frederick Stewart.*—I do not think that it would be possible to obtain patent rights for it, as it is only a tube and sleeve retort, which is a standard process. It would be possible to patent a "gadget" used in connexion with a standard retort.

321. *To the Chairman.*—My company is supplying oil from shale to companies at Lithgow and Emu Plains. At Emu Plains a new batch of retorts has been installed. They are vertical and oval-shaped. It would be well to reduce the costs of operation there. The plant at Lithgow is 4 ft. 6 in. wide and 10 in. in diameter. The deepest penetration is 8 in. I suggest that the committee should get the cost of the retort in use by the Mudgee Shale Oil Company of Emu Plains.

322. *To Sir Frederick Stewart.*—They do not use the sieve principle, and they are not in a position to give their retorting costs of the new set, but the new set

is better than the old. That retort may have some advantages, but the penetration is only 8 in. because it is oval-shaped. The penetration in our plant is 3½ in. With a retort of 9 feet diameter the penetration would be one foot. The plant at Lithgow is one of the most economical vertical retorts that I have seen. Our retort is entirely different. Theirs is a vertical plant. Their retorting period is about sixteen hours compared with 3½ hours in our retort. There is a point at which a round retort is most economical. I should say that 9 in. diameter is about the extreme distance, giving a penetration of 4½ in. I suggest increasing the diameter of the tube and working at 750 degrees centigrade. That would require carbon steel tubes or aluminum solid drawn tubes.

323. *To Mr. Harrison.*—Mr. Rogers, the Commonwealth Fuel Adviser, has seen our retort on two occasions. The last time he saw it was yesterday. When he saw it on the first occasion, we were having some trouble; we had difficulty with the welded tubes. That was about two years ago. We pulled out those tubes and installed others. There has been no inspection of our plant by any government inspector during the last two years. Mr. Rogers made an extensive examination of the plant yesterday. I gave to him a statement of our production costs.

324. *To the Chairman.*—There have been complaints about odours from our plant, but the Council's health officer gave evidence in our favour. He made 28 tests at all hours of the day and on each occasion he reported that there was no noise or smell. Those reports were submitted to the court.

325. *To Sir Frederick Stewart.*—The Barigan shale people and the purchasers of the Mudgee Shale Company are prepared to install plant sufficient to produce any quantity of oil required. They are prepared to expend £250,000 without asking any government help. We engaged in this undertaking because we had been told by the Fuel Board that our supplies of petrol would be reduced by 75 per cent. We were asked to fit substitute units, such as producer-gas units, to our vehicles. I made investigations and came to the conclusion that producer-gas units would not be suitable for our work. We then decided to produce spirit from shale. We have carried on our own business as timber merchants and have also supplied spirit to between 80 and 100 consumers in the Newcastle district. We distribute about 3,000 gallons of spirit a month and charge 5s. 6d. a gallon for it. We use our own residual oil in the burners, and also incandescent gas, which is present in every oil plant. We have no costs for coal. If we expanded our plant considerably we would improve our methods of handling the retorts. Our present plant is economical for a small plant, but with 192 batches of retorts it would be necessary to have some mechanical appliances. The charging of the tubes and the withdrawal of the shale could be done mechanically. Improved handling methods would reduce costs only by a fraction of a penny for each gallon. The labour costs per gallon are small when it is remembered that 29,000,000 gallons a year is the production aimed at. A batch of sixteen tubes could be installed for £1,200. I have allowed £5,000 for three sets, but that is an overestimate and includes the provision of storage. The cost of the equipment other than retorts would depend on the quantity of oil to be treated. Our present plant cost £8,200, inclusive of retorts. It also includes £1,200 losses incurred on the first plant. A complete plant of 48 tubes with 9-in. sleeves, distillation plant, storage tanks, conveyor, &c., could be installed anywhere for £10,000. We did not install 9-in. sleeves in the first place because at that time we had not the benefit of the experience that we have had since. As the result of trial and error

methods, I now think that 9-in. sleeves would be an advantage. The heat could be increased considerably.

326. *To the Chairman.*—For a batch of 48 tubes we would have three men for each shift of eight hours. That is nine men for a day. That would be a fair basis on which to estimate the number of men required for a bigger plant.

327. *To Sir Frederick Stewart.*—With a plant of 48 tubes and ancillary equipment costing about £10,000, it should be possible to produce about 11,000 gallons of crude oil a week, or, say, 45,000 gallons a month. That would give 5,000 gallons of vaporized spirit per week, with a specific gravity of 800. That is a heavy spirit. That would be 45,000 gallons of crude oil a month, which would represent about half that quantity of usable motor oil. The cost of the crude oil would be about 3d. a gallon plus labour costs of 24d. a gallon and 14d. a gallon to represent losses on conversion. That would give 64d. a gallon, or petrol at 1s. 12d. a gallon. These are the approximate costs of a plant to produce petrol only. So far, we have not attempted to produce anything beyond heavy oil.

328. *To Mr. Mulcahy.*—The other 50 per cent. is not all lost as from it we get certain by-products. With an efficient cracking plant, it would be possible to utilize 75 per cent.

329. *To Sir Frederick Stewart.*—So far, we have produced petrol only on a small scale, but if the plant were installed at the mine, the company would import the best known cracking process, because there would be sufficient oil to justify it. With an expenditure of £10,000, we could produce 22,000 gallons of vaporizer spirit each month. For such spirit we now obtain 6s. 6d. a gallon.

330. *To the Chairman.*—All that our associates desire is that the Government should co-operate with them in obtaining the material necessary for the construction of a plant at the mine. They do not ask for financial assistance.

*The witness withdrew.*

Leslie John Rogers, Commonwealth fuel adviser, recalled and further examined.

331. *To the Chairman.*—I am familiar with the retort being used by F. Viggers Proprietary Limited at Hamilton. I inspected it first about two years ago, and I visited the works again yesterday to see what alterations had been made. I have been furnished with a statement prepared by Mr. Viggers setting out the results obtained from his retort. Since I gave evidence on a previous occasion the retort has been materially improved, particularly in regard to arrangements for handling the shale and the spent shale. The results as set out in the statement supplied by Mr. Viggers are satisfactory for a small plant. Within its limitations the plant is doing a good job. Broadly, I can compare the results obtained by Mr. Viggers with those at Glen Davis. The yield of oil from the Viggers plant is at present better than the yield from the main bench of retorts at Glen Davis, but the yield from the Viggers retort and from the experimental house of Fell retorts now operating at Glen Davis, which are prototypes of the retorts which will be installed there next year, are substantially the same. Approximately 600 men are employed at Glen Davis, exclusive of contractors' labourers who are working on the additional plant. Of those 600 men, probably 130 are employed in the mines. That number may include a few surface hands. About 120 men are employed on the retorts. There are four shifts of about 30 men each, and also about a dozen men on day shift. About 500 tons of shale are being mined each day for five days a week, a total of about 2,500 tons a week. In order to deal with approximately 4,000 tons of shale a day, in tube retorts,

about 20,000 tubes and 1,200 men on each shift would be required. In my opinion, it would not be practicable to install and work that number of retorts, even if more ground were available. From the main bench of retorts at Glen Davis between 65 per cent. and 70 per cent. of the assayed amount of crude oil per ton of shale is being obtained, and from the experimental house of Fell retorts about 80 per cent. is being obtained. It should be understood that the yield of 80 per cent. from the Fell retorts is exclusive of oil fog and scrubber naphtha.

332. *To Sir Frederick Stewart.*—The assay expectation was 65 to 70 gallons a ton. We obtained only 65 per cent. of that.

333. *To the Chairman.*—The claim of Mr. Viggers is not extravagant. Indeed, it is quite reasonable. We expect to do as well when our new plant is in operation. So far as I know, experiments are not being carried out in connexion with the solution process which I mentioned to the Committee on a previous occasion. I cannot give any information about that process except that it is used in Germany for the production of diesel oil from coal. I believe that the process could be applied to shale as well as to coal. I am not conversant with the extent of the shale deposits at Barigan. I have not been in touch with the Metropolitan Oil Refinery Limited people at Auburn for about eighteen months, and cannot say whether the retort which I mentioned on a previous occasion is still in use there. From my knowledge of shale oil in Australia, I do not think that sufficient could be produced to supply Australia's demands. I think that the Committee should consider the production of oil from coal. I saw a sample of plastics produced at the Viggers works when I was there yesterday, but I do not know anything about the uses to which it could be put. I do not think that Mr. Viggers' claim that plastics produced by his firm would stand a strain of 45 tons to the square inch is extravagant. I know that there are plastics which will stand such strain. Such plastics could be used for building material if they could be produced cheaply enough. I have no idea of their cost of production.

334. *To Mr. Mulcahy.*—I have never visited Lakes Entrance in Victoria. The interests of the Commonwealth in the oil deposits there are cared for by the Geological Branch of the Department of Supply and Shipping, which is under the control of Dr. Raggatt. The Lakes Entrance deposits do not come within the scope of my activities. I have visited Glen Davis recently. The Reneo retort there is still in the early stages of construction. Not much work has been done on it during the last three months. I do not think that the plant will be completed by the end of this year unless we can get more labour than we consider at present we are likely to obtain. Most of the equipment is lying there, but sufficient men to erect it cannot be provided. The work of converting the retorts to the Fell principle has proceeded only to the extent that where substantial repairs have been necessary we have availed ourselves of the opportunity to put in additional offtakes. There are now probably sixteen retorts at Glen Davis which could be converted to the Fell design as soon as we are ready to proceed with the total conversion scheme.

335. *To Sir Frederick Stewart.*—It would not be possible to obtain any benefit from the work that has been done until a batch of 40 retorts had been converted. By multiplying the number of batches of tube retorts it would be possible to get a proportionately larger output of oil at the same unit cost, but that cost would be greater than it now is at Glen Davis and considerably higher than what we expect in twelve or eighteen months' time. We are already producing crude oil at Glen Davis for less than it costs Mr. Viggers. We hope

to do still better in the future. His figures show that his plant is working well, but they are not as good figures as ours are. His recovery in gallons of oil per ton of shale is better than we can show at present, but it is not better than we expect to get. The position is that Mr. Viggers is recovering more oil per ton of shale than we are, but his costs are higher. Our per gallon cost is lower than his despite the fact that his gallonage is greater.

336. *To the Chairman.*—There is not a great deal more oil left in the shale at Glen Davis than in the shale at the Viggers plant. The amount of oil left in our spent shale is equal to about 1½ gallons to the ton of shale. Our losses are in the gases. Our largest loss is due to the gas plant not being completed. When the plant is completed we shall be able to recover another 8 gallons to the ton, bringing the 65 per cent. or 70 per cent. recovery up to about 80 per cent. I am satisfied that the claim of Mr. Viggers that there is no oil left in his spent shale is correct. There is no significant loss in his spent shale.

337. *To Mr. Mulcahy.*—The production of oil from shale should be cheaper than production from coal, but our shale resources are comparatively small when measured by our consumption of petrol and petroleum products. I see no reason why we should not be able to produce oil from coal in Australia as well as can be done in Europe, provided that we can get the benefit of the experience of people elsewhere.

338. *To the Chairman.*—Our present mining costs at Glen Davis are a little over £1 a ton. When the scheme is complete we hope to reduce the cost to 15s. a ton. I have seen the plant at Billingham, England,

for the extraction of oil from coal and shale. I have also seen the Fischer Tropsch process. I would not say that it is a more economical plant to install than a hydrogenation plant. I think that the results from the two different kinds of plant are nearly equal, but I do not know sufficient about them to say definitely that one is better than the other. I think that the Fischer Tropsch plant would have an advantage in that it is applicable to coal of all types. It is used considerably in connexion with brown coal. It could be used to deal with western and Queensland coals. The hydrogenation process, as used by I.C.I. at Billingham, is more applicable to the valuable coals which we have in Australia but which are in comparatively short supply.

339. *To Mr. Mulcahy.*—I have read of the method of extracting gas from coal as adopted in Russia, but I do not know much about it.

340. *To the Chairman.*—Immediately before the war it was understood that Germany was producing rather more than half of its oil requirements in the form of synthetic oil. In Great Britain about 100,000,000 gallons of a petrol consumption of 1,200,000,000 gallons were produced synthetically. Many of the countries which have been extracting oil from coal and shale are largely dependent on imported oil. Seeing that Australia is so far from known sources of flow oil, I am of the opinion that we should obtain some of our requirements of oil from our mineral deposits and by other synthetic processes.

341. *To Sir Frederick Stewart.*—I have no information regarding the discovery of flow oil in Great Britain.