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WAR CABINET

TECHNICAL SUB-COMMITTEE ON AXIS OIL

THE OIL POSITION IN AXIS EUROPE FIRST SIX MONTHS OF 1944

Offices of the War Cabinet, S.W. 1.

27th May, 1944.

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TECHNICAL SUB-COMMITTEE ON AXIS OIL.

The Oil Position in Axis Europe, First Six Months of 1944.

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Sir Harold Hartley.

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Squadron Leader D. A. C. Dewdney.
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Mr. A. F. L. Brayne, Ministry of Fuel and Power.
Wing Commander A. E. Houseman, Offices of the War Cabinet.

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Summary of Conclusions.

1. Excluding* military strategic reserves, stocks of oil in Axis Europe are at not more than the distributional minimum.

2. The reserves held by the armed forces are likely to be sufficient, if cut off from other sources of supply, to maintain active fighting for from one to two months.

3. As a result of the attacks on Roumania in April and on five synthetic oil plants on the 12th May, it is estimated that a surplus of production over consumption of about 155,000 tons per month in April has been converted into a deficit of about 65,000 tons in May, or equal to 5 per cent. below current consumption. There is likely to be a deficit of similar size in June if production is not further reduced or military consumption increased.

4. After allowing for the possibility that the damaged plants might be repaired within a short time, there is no possibility of any short-term substantial increase in production. Any further important cuts in non-military consumption would have results as serious ^{but not so immediate} to the war effort as cuts in military consumption.

5. The loss of Roumanian, Polish and Estonian oil would—

- (a) result in a reduction of supplies equal to 260,000 tons a month,* or 21 per cent. of present total consumption;
- (b) cause a general dislocation of the oil distribution system and serious shortages of certain petroleum products, especially motor fuel, which would be short to the extent of over one million tons, or 26 per cent. of present army consumption;
- (c) enhance the importance to Germany of her synthetic oil production upon which she would become dependent for 56 per cent. of her total supplies.

6. If a general Allied offensive starts on both the Eastern and Western fronts, military consumption would be increased above present levels by about 150,000 tons per month, or by 22 per cent.

7. If (5) and (6) should occur at about the same time, Germany would be faced with her consumption requirements being over 50 per cent. in excess of total production. This deficit would be equivalent to about 90 per cent. of the total non-military consumption of Axis Europe. Within two to three months, depending on the circumstances, military supplies would have to be cut to an extent that would cause a most serious contraction in operational mobility.

* This figure does not take into account any allowance for the present dislocation in Roumania. If Roumanian output has been cut by 50 per cent. as a result of air attacks, then these supplies are at present reduced by 160,000 tons.

REPORT.

INTRODUCTORY.

Our last report on the oil position in Axis Europe (J.I.C., (43) 463) was submitted in November last. It detailed the statistical position for the first eight months of 1943, indicated the trend for the remainder of the year, and suggested possible developments that might occur during the first quarter of 1944. We concluded that, in spite of the efforts that have been made to provide for a sufficiency of oil; this had not been achieved and stocks at the end of the year were at not more than the distributional minimum. It was anticipated that, provided progress was made with the construction of the new synthetic oil plants, the rate of production in the early part of 1944 would exceed consumption and there would be some recovery in the depleted stock position.

REPORT.

The following report gives the final statistics for the year 1943, calculated according to the best information available, and production and consumption trends are estimated for the first six months of 1944. The probable position that may arise under various circumstances is also indicated.

The Position in 1943.

In order to depict the status of the German oil position at the end of 1943, it is necessary to review briefly the course of events following the failure to secure the Caucasus in the autumn of 1941. Up to the end of 1942 consumption substantially exceeded production and reserves became depleted to a critical extent at the end of that year. By this time it was evident that Germany had lost the initiative, and those responsible for the administration of oil supplies must have realised that, without the prospect of being able to anticipate any reduction in the needs of the Armed Forces, there was no possibility of any substantial recovery in the position being brought about within a short time. Allocations to the home front and to the occupied countries were at levels then considered to be the essential minimum, and the Armed Forces were already feeling the severe shortage.

At the beginning of 1943 the Germans were consequently confronted with the task of having to increase production and to reduce non-operational consumption still further. In addition, special reserves had to be set up on the fronts threatened by invasion. How far they succeeded in attaining these objectives is discussed below. Such adjustments as were achieved during the past year were, however, nullified by the Russian offensives which forced military consumption to levels which made any accumulation of stocks impossible.

Attempts to increase Production.

The attempts that have been made to increase production have not resulted in sufficient additions to supplies to alleviate the serious shortage. Details of the production from the different sources are given in Annex II and in the Appendix.

In regard to synthetic oil, the progress of the construction of the new plants has been slow and the additional output gained during the year has not amounted to more than 600,000 tons. To what extent this increase has been offset by the direct and indirect effect of air attacks is not known, although the deduction for 1943 of 275,000 tons from the total output capacity of the synthetic oil industry to cover this factor may well be a low estimate.

In the case of crude oil, the rapid exploitation of the new fields in the Vienna Basin has offset the decline in production from other countries, and the total output of mineral oil in 1943 was maintained at the same level as 1942.

Reductions in Non-Military Consumption.

Notwithstanding the fact that in 1942 non-military consumption in Germany and the occupied countries was reduced to figures which at that time must have been considered to be the lowest practical levels, there have since been further curtailments in civilian supplies. (See Annex III.) These reductions have not

been materially offset by an increased use of producer gas or substitute fuels as the savings that have been made by these means have been relatively small, and the scope for further savings is limited. (See Annex IV.)

The lack of liquid fuels and lubricants for transport and industry have now become a major factor in the economic decay of enemy Europe. It is clear that these further reductions in allocations would not have been made unless either there was either an actual lack of oil to meet these requirements or military necessity caused these supplies to be earmarked for strategic purposes.

The Establishment of Strategic Reserves.

For some time the Germans have been establishing strategic stocks in the countries threatened by invasion. An approximation of the extent of these reserves is given in Annex V.

These military reserves have been supplied partly by transfers from stocks within Germany and partly by the drastic reduction in non-operational consumption. As the greater part of these reserves are in military dumps or are earmarked for consumption by the defence forces, they virtually represent additions to tied stocks, and as such they reduce rather than increase the resilience of the German oil economy.

Stocks at the end of 1943.

The statistics detailed in Annex I, which closely agree with the findings of the United States Enemy Oil Committee, show that consumption exceeded production in 1943, and that stocks had declined some 300,000 tons below the level at which they stood at the end of 1942.

Whereas our estimates for output are likely to be within a reasonable margin of error, it is possible that consumption in certain categories has been at higher levels than has been estimated. No claim is, therefore, made for the absolute accuracy of our statistics. They are, however, based upon detailed examination of a large volume of information and it is clear from intelligence that these figures correctly portray the trend during 1943. Heavy military demands have prevented any strengthening of the position, and at the end of the year Germany's oil economy was in an extremely brittle condition.

The Present Position.

A tentative balance sheet in Annex I has been prepared for the purpose of illustrating the production and consumption trend at the time of writing this report. The figures make allowance for some loss of output from Roumania* in May and June (the effect of the air attacks upon Roumania in April and May have not yet been assessed), and it is also assumed, pending damage reports, that the attack on certain synthetic oil plants on the 12th May reduced the output of synthetic oil by 85,000 tons in both May and June. Army consumption has been calculated on the hypothesis that military operations will continue at the same relatively low degree of activity as pertained during April and early May. These figures serve to show that production during the early months of the year has slightly exceeded consumption with the result that the trend during this period has been toward some recovery of the depleted stock position.

The attacks upon production sources in April and May have caused a reversal of this trend and the tentative balance sheet for June shows a deficit in that month of 65,000 tons, even if these attacks are not renewed.

Evidence of Strain.

We must emphasise that these figures do not reflect the tension under which the enemy's oil organisation is operating. For over two years supplies of liquid fuels and lubricants have been on no more than a hand-to-mouth basis and various factors are now coming into play that are contributing towards an overall weakening in the distribution system. The gradual slowing up of deliveries, the losses caused by black markets and by sabotage, and the emergency consumption of supplies following air attacks are all factors which play their part in adding to supply difficulties.

* It has been estimated, pending further information, that as a result of air attacks, Roumanian production had declined 50% below the average production for the first four months of 1944.

Intelligence reports make clear the gravity of the situation. A captured German army order gives proof of the difficulties of regrouping military units on account of the need to save fuel. Numerous reports are being received of the economic difficulties that are arising from the lack of oil for essential purposes and afford evidence of the growing paralysis of the economy of Axis Europe.

While Germany has so far succeeded in maintaining supplies to her forces in the battle areas, the outlook is bleak indeed. The imminent possibility of the loss of the oil resources of Roumania, Poland and Estonia, and the threat of further damage to the synthetic oil plants leaves Germany with the alternative of either weakening her present war potential by making further reduction in consumption for the purpose of building up stocks, or of risking a disastrous breakdown through lack of reserves.

Furthermore, with the expectation of having to increase greatly the use of road transport on account of damage to rail communications, there will be additional demands for supplies and for the establishment of dispersed reserves.

The Future Trend.

The effect of different circumstances upon the future trend is illustrated in a chart upon page . From this it will be seen that a general Allied offensive on broad fronts, combined with reductions in production through Allied attacks, would have far-reaching effects on Germany's power of resistance. The deficiencies that may occur, the consequent results, and the possibility of Germany being able to offset these adverse conditions, are summarised in the following paragraphs.

The Effect of Increased Military Activity.

Assuming that the present relatively low rate of military activity should continue to the end of June, and that production is not reduced further by air attack in the interval, then total Axis consumption during June is estimated at 1,220,000 tons as against a production of 1,155,000 tons, representing a deficit of 65,000 tons. (See balance sheet in Annex I.)

As any further important cuts in civilian consumption would have results as serious for the German war effort as reductions in military supplies, we have assumed, for the purpose of argument, that allocations to industry and transport will remain substantially at present levels. A general offensive from the East and an invasion from the West would result in army consumption increasing above present levels by from 75,000 to 150,000 tons per month. It is to be expected that there would also be a sharp increase in naval and air force consumption, such increase being possibly followed by a rapid decline on account of losses in battle. In these circumstances the total increase in consumption by all the services during the first month of a general Allied offensive might be to the order of 150,000 tons per month and thereafter continue for at least a time at this level, the possible declines in naval and air consumption being offset by the growing intensity of land battles. In these circumstances, and with production at the rate of 1,155,000 tons per month, Germany would be faced with a deficit of 215,000 tons per month.

The Effect of the Loss of Production.

The foregoing statistics have not taken into account the effect of the possible loss of important sources of supply. The probable consequences of the oil production of Roumania, Poland, Estonia and Hungary becoming totally denied to Germany are detailed in Annex VI. The loss of the first three of these countries would mean a net loss to Germany of 100,000 tons of oil a month. With no increase in the present level of military activity this would mean a monthly deficit of 165,000 tons. If fighting develops to the extent postulated in the preceding paragraph, this deficit would become 315,000 tons, which would be equal to a deficiency of 22 per cent. of requirements. (These figures are based on the assumption that Roumania's output is at present reduced by 50 per cent. as a result of bomb damage. If output should become restored, the net loss to Germany from the three countries would be 260,000 tons. At the present level of military activity this would mean a monthly deficit of 325,000 tons. At a high level of activity this figure would become 475,000 tons, equal to a deficiency of 35 per cent.)

German Inability to Increase Production.

As shown in Annex VI, the loss of these countries would be a more serious blow than the statistics indicate. Germany relies upon these countries for about 25 per cent. of her motor fuel requirements and also for important quantities of special products, including aviation fuel blending stocks, lubricants, fuel oils and special naphthas.

The possible steps open to Germany to remedy these losses are outlined in Annex VII. This Annex shows that, even on a relatively long-term programme, Germany cannot offset the loss of the oil resources of Eastern Europe by increasing production elsewhere.

The Hungarian oilfields are potentially capable of a large increase in production. We have assumed that, if the German exploitation of these resources proves to be successful, output may increase by half a million tons a year. If this increase begins to take effect during the second half of 1941, it is likely to be counterbalanced by a sharp decline in the production of Austria. We have estimated that the output of the Vienna Basin may have increased to a rate of 2,000,000 tons by the end of June, and then declining to a rate of 1,500,000 tons by the end of the year.

Effect of Oil Shortage on Military Activity.

The tabulation at the end of this Annex shows that Germany would be faced with a serious deficiency in all products with the possible exception of lubricant base stock. The cutting of consumption to meet this deficit would have to fall principally upon the armed forces. Such cuts would inevitably affect military activity, both directly and indirectly.

If the loss of Roumania, Poland and Estonia should approximately coincide with a general Allied offensive on broad fronts, Germany would be faced with her consumption requirements being over 50 per cent. in excess of total production. The only cushion of stocks available to meet this deficit are those supplies that have been accumulated by the armed forces as emergency reserves. The probable extent of these reserves is discussed in Annex V. If cut off from other sources of supply, it is pointed out that these reserves are likely to be sufficient to maintain from one to two months' active fighting.

The question then arises as to how soon serious operational shortages are likely to occur. This would naturally depend upon the rate of local consumption, the amount of local reserves, and the extent to which oil supplies could be deflected to vital points. While it is impossible to give a definite answer to this question, it is considered that in view of the shortages of particular products (especially motor spirit) that would arise, it is highly probable that operational requirements could not be met within two to three months of these events occurring.

Weak Points in the German Oil Position.

In all our previous Reports we have made clear the vital dependence of Germany upon her principal sources of oil production. We have also strongly emphasised the strain under which the enemy's oil industry was operating and the consequent sensitiveness of the distribution system to dislocation. The position is now more vulnerable than at any previous time.

Upon the loss of Roumania, Poland and Estonia, Germany would become dependent on the synthetic industry for about 55 per cent. of her total supplies.

Likewise the dislocation of a certain proportion of the available petroleum refining capacity would have far-reaching repercussions. A study of the relative importance of the European refineries is attached in Annex VIII.

Particular reference is made to the shortage of capacity for the production of high-grade lubricants. Destruction of from two to four of the specialised plants engaged in their manufacture would slow down the German war machine.

Signed on behalf of the Sub-Committee :
H. HARTLEY, *Chairman.*

ANNEX I.

THE STATISTICAL POSITION.

As a result of our previous detailed studies of the Axis Europe oil position it was agreed that stocks at the beginning of 1943 were then at such a level that further withdrawals to make up any material deficit between current supply and consumption were no longer possible. An estimate of the extent of these stocks cannot be satisfactorily calculated, although it is considered that since they comprise oil in process and in distribution, the extent to which a proportion of them might be potentially consumable at the expense of subsequent shortage would be very limited. In conjunction with the United States Enemy Oil Committee it was agreed that the nominal figure of 4,000,000 tons should be taken as a datum level as at the beginning of 1943. An analysis of the stock position is given in Annex V.

Balance Sheet, 1943.

	Metric Tons.
Stocks at nominal datum level at 1st January, 1943	4,000,000
Production (see Annex II and Appendix, Table I)—	
(i) Crude and Shale Oils	8,240,000
(ii) Synthetic Oils	5,425,000
(iii) Substitutes and Miscellaneous	2,300,000
	<u>15,965,000</u>
	19,965,000
Consumption (see Annex III)—	
(i) Armed Forces—	
(a) Armies	4,217,000
(b) Naval	1,731,000
(c) Air Force	2,423,000
(d) Todt	320,000
	<u>8,691,000</u>
(ii) Civil, including exports to Neutrals	7,147,000
Losses in retreats and by air attacks	325,000
Losses by tanker sinkings	100,000
	<u>425,000</u>
	16,263,000
Leaving a balance of Stocks at 31st December, 1943, of ...	3,702,000

Tentative Balance Sheet as at 30th June, 1944.

	Metric Tons.
Stock figure carried forward from above balance	3,702,000
Production 1st January–30th June, 1944 (see Annex II and Appendix, Table II)—	
(i) Crude and Shale Oils (Note 1)	3,907,000
(ii) Synthetic Oils (Note 2)	2,922,000
(iii) Substitutes and Miscellaneous	1,150,000
	<u>7,979,000</u>
	11,681,000
Consumption (see Annex III)—	
(i) Armed Forces—	
(a) Armies (Note 3)	2,305,000
(b) Naval	870,000
(c) Air Force	1,146,000
(d) Todt	160,000
	<u>4,481,000</u>
(ii) Civil, including exports to Neutrals	3,017,000
Losses in retreats and by air attacks (Note 4)	100,000
	<u>7,598,000</u>
Leaving a balance at 30th June, 1944, of	4,083,000

Note 1.—Assuming that Roumanian production during the first four months has been 10 per cent. lower than the estimate of 5,450,000 tons for 1943, and that production in May and June was reduced by 50 per cent. of the preceding months.

Note 2.—Assuming production in May and June lowered by a total of 175,000 tons as a result of air attacks on certain synthetic oil plants on 12th May, but not lowered further by later attacks.

Note 3.—Excluding losses in retreats estimated at 15,000 tons in both February and March and which are included in the 100,000 tons for all losses on account of Allied action.

Note 4.—Apart from the War Office estimates for February and March, there is no information as to the extent of these losses.

Tentative Balance Sheet for the Month of June 1944.

Based on the same assumptions as are adopted in the above balance sheet, and on the hypothesis that military activity will be at about the same level as during April-May, the following balance for the month of June indicates a deficiency of production to consumption of at least 65,000 tons.

					Metric Tons.	
<i>Production—</i>						
(i) Crude and Shale Oils	...	...	...	530,000		
(ii) Synthetic Oils	...	...	...	435,000		
(iii) Substitutes and Miscellaneous	...	...	...	190,000		
						1,155,000
<i>Consumption—</i>						
(i) Armed Forces—						
(a) Armies	...	...	...	345,000		
(b) Naval	...	...	...	145,000		
(c) Air Force	...	...	...	200,000		
(d) Todt	...	...	...	27,000		
					717,000	
(ii) Civil	...	...	...	503,000		
						1,220,000
Leaving a deficit of						65,000

Note.—This deficit does not allow for any losses that might be caused by Allied attacks during the month.

ANNEX II.

OIL PRODUCTION.

In Appendix A are shown the estimates of the yields, in terms of finished products, from the production of oil in Axis-occupied Europe for the year 1943, together with a tentative estimate of production for the first six months of 1944. The totals of these estimates are as follows:—

			<i>Annual Rate in Metric Tons.</i>	
			<i>1943.</i>	<i>First Half 1944.</i>
Crude and Shale Oil...	...	...	8,240,000	7,815,000
Synthetic Oil	...	...	5,425,000	5,843,000
Tar Oil	...	...	1,500,000	1,500,000
Substitute and Miscellaneous Oils	...	...	800,000	800,000
			15,965,000	15,958,000

Crude Oil Production.

Germany.

Production from the German fields has been assumed to have been maintained at former levels. However, an addition of 50,000 tons has been made to cover production from the Meldorf area which, from aerial reconnaissance, appears likely to have about the same output as the Heide field. An allowance of 2,000 tons per annum has been made for the production of natural gasoline from certain fields. The production trend for Germany is likely to be level, if not slightly declining.

Austria.

Production for the first six months of 1944 is estimated at the annual rate of just over 2 million tons. The production during this period, compared with 1943, in the various fields is estimated as follows:—

			<i>1943.</i>	<i>1st Six Months, 1944. Annual Rate.</i>
Zistersdorf	...	...	63,000	60,000
Gaiselberg	...	...	360,000	360,000
Kreuzfeld	...	...	65,000	165,000
Prinzendorf/St. Ulrich	...	...	750,000	1,440,000

Air cover in February 1944 shows no important changes in the Zistersdorf field, but important developments have taken place in the Prinzendorf area. Eighty-eight new locations have been detected, making the total number nearly 200, including drilling wells. The increase has been at the rate of 15 per month, although a number of the wells appear to be dry holes.

New locations are largely devoted to filling in the area already proved and there have apparently been no major extensions towards the south or north.

Production in the Prinzendorf field during the last half of 1944 is expected to fall to the annual rate of 1 million tons.

Czechoslovakia.

Air cover of the Gbely field, obtained recently, for the first time, is not complete, but a closely drilled area is seen one mile west of the field, and there are scattered wells a half to two miles south-west of the village. There is no indication of recent developments. Unless developments have taken place in the area further north, it must be assumed that the normal decline in production will not have been offset by recent discoveries. We have, therefore, allowed a decline factor of about 10 per cent. and thus reduced our estimates from 32,000 tons for 1943 to 30,000 for the current year.

Poland.

Recent reports indicate that the decline in the Polish fields has been halted and that crude production may now be somewhat higher than was reported last year. Production has been estimated at 400,000 tons, which includes about 40,000 tons of natural gasoline.

France.

Included in our current estimate is 15,000 tons for crude production from the St. Gaudens fields. It is evident that there is a certain amount of active drilling in this area, but it is considered that no substantial production of crude has yet been secured from this area. The details of a contract between the Kontinental Oil A.G. and French interests have been received which indicate that in return for certain drilling facilities, the Germans have secured a substantial interest in the resultant production. It may be expected that this area will be exploited as rapidly as conditions permit.

Hungary.

Prior to the assumption by Germany of greater control in Hungary, production had been restricted to a rate of 800,000 tons per annum. The fields in the Lispe area are capable of an appreciably increased output, although it is not known how many months would elapse before this increase could be achieved. It has consequently been assumed that, as a result of the steps taken by the Germans, the oil production of Hungary is now at the level of about one million tons.

Yugoslavia.

Production is estimated at the former level of 50,000 tons. There is, however, some evidence that larger production is now being secured from the Gojilo area and it is possible that the output of oil in Yugoslavia may be slightly increasing.

Roumania.

Our estimate of 5,450,000 tons, including 200,000 tons of natural gasoline, for 1943 assumed that the production level was the same as that obtaining in 1942. It was considered that production derived from marginal wells and from interspacing was sufficient to offset the normal decline in the various fields, and that some production, although probably on a small scale, had been secured from new areas.

The present rate of production in Roumania is not known. The trend is believed to be declining and it is estimated that production for the first four months of 1944 was at the rate of 4,905,000 tons (including 180,000 tons of natural gasoline), or 10 per cent. lower than the rate for 1943. To allow for the dislocation caused by air attacks up to the 12th May, it has been assumed that production during May and June will drop by 50 per cent. The rate of output for the first six months of 1944 is consequently estimated at 4,090,000 tons, which includes 150,000 tons of natural gasoline.

Synthetic Oil Production.

The estimated current capacities of the various plants are detailed in Annex II. The figures are based as far as possible upon aerial photographs. A deduction has been made equivalent to one month's capacity of the five plants which were attacked on the 12th May. There has also been deducted the equivalent of 5 per cent. of capacity to cover adverse factors due to war-time conditions.

The allowance of 230,000 tons per annum made in the November Report for unknown plants has been increased to 300,000 tons per annum.

The following information is disclosed by the latest aerial reconnaissances up to the time of the attacks on the 12th May :—

Bergius Hydrogenation Plants.

Blechhammer North.

Preliminary study of recent air cover shows that six of the eight stalls are vacant, and only one of the other two can definitely be said to contain high-pressure vessels. From this and from the fact that only a small portion of the refinery appears to be in operation, it can be deduced that oil production is at only a small fraction of the plant's planned capacity.

Blechhammer South.

As there has been no apparent increase in the number of hydrogenation stalls in operation during the last six months, production is estimated to be still at the same rate as it was in November 1943.

Böhlen Rotha.

No additions of plants have been made at the old works: there is, consequently, no reason to modify existing production estimates. The new section includes oil storage, additional distillation plant and a possible high-pressure gas synthesis plant. We have no knowledge of any data on which the probable output of this plant can be deduced.

Brüx.

At least ten, and probably eleven, of the twelve stalls of the first stage of construction are completed and in use. At a rate of production on brown coal tar of 62,500 tons per annum per stall, total production over the period will have been at a rate of 700,000 tons per annum. None of the six new stalls can be expected to come into operation before July at the earliest.

Gelsenkirchen-Nordstern.

There is now little sign of damage from the November attacks except that the largest gasholder is badly damaged. A high degree of activity is apparent. The stalls have been fitted with covers of heavy construction evidently intended to prevent bombs exploding in the stalls. No special protection of any other parts of the plant can be observed.

Leuna.

The boiler houses, injector house, stalls, refinery and various other parts of the plant were active in March. Four new isolated stalls have been equipped and may be in use. Almost the whole southern sector of the works is complete and in operation.

Lützkendorf-Mücheln.

There is abundant evidence of a high level of activity over the whole plant, including the catalyst plant. Steam emission from the end of the second contact oven house and from the cooling towers serving this house confirms the belief that both are in action.

Magdeburg.

The plant appears fully active. Vessels have been installed in the south stall, but no connections appear to have been made in the upper part. This stall may come into use in the near future.

Poelitz.

The plant shows a high level of activity. Construction of a new gasholder is proceeding slowly; a sixth carbonising oven has been completed and is in use. The ninth pair of stalls is still not equipped, though a start may have been made.

Scholven-Buer.

The works show a high degree of activity and the fourth and fifth pairs of stalls in the new plant are apparently in use. One new stall in the "old" section and two new pairs in the "new" section may well be in use. The rated capacity is, therefore, estimated at 375,000 tons, compared with the previous figure of 350,000 tons per annum.

Troglitz-Zeitz.

The plant appears generally active. One cell of each of the original additional pairs of stalls is being equipped; the set of quadruple stalls apparently remains empty.

Welheim Bottrop.

There was no major change in the plant during 1943. In April 1944 the works were damaged and largely closed down. One half of the boiler-house was wrecked and the lights blown out of the generator hall. The other half of the boiler-house remains in use. The current estimate has, therefore, been reduced from 100,000 tons to the rate of 75,000 tons per annum.

Wesseling.

Air cover prior to December indicated a low degree of operation, but photographs taken during that month showed increased activity. Reconnaissances carried out this year now make it appear as though activity has again declined. The boiler-house, water-gas purification and synthetic plants have recently been active, but there is no direct evidence of the use of the hydrogenation section or of the refinery. Progress has been made in the construction of the new pair of stalls, but high pressure vessels have still to be installed.

Auschwitz.

The hydrogenation section at the new plant at Auschwitz is only just coming into use. When the construction now in progress has been completed the output of this plant may be at the rate of 180,000 tons per annum. The planned capacity of the plant is probably to the order of half a million tons per annum.

2. Fischer Tropsch Plants.

Dortmund.

The plant was bombed last May and not all the damage has yet been repaired. The end of the contact oven house has not yet been restored and four of the seventy-two ovens are not in position. Apart from this, the rest of the plant is active and has presumably operated fully on the ovens in position, but output may have been reduced by 5 per cent. over the last ten months.

Holten Sterkrade.

All the bomb damage caused early in 1943 has been cleared away or repaired. The damage to oil storage and a cooling tower under construction is not likely to reduce output and the works are very active.

Construction in the new section has continued steadily. Among the new plant are four stout columns which might be Cowper Stoves, and suggest a High Pressure Fischer Tropsch plant.

Homburg.

The bomb damage has been repaired and the works show a high level of activity. No extensions have been made to the synthetic sections, but new construction can be seen on the south-east part of the site. The purpose of this is not as yet evident.

Kamen-Dortmund.

The plant is fully active. The extension to the water-gas plant does not seem to have been brought into use.

Wanne Eickel.

Activity is general, but little progress has been made with extensions.

Tar Oils.

High Temperature Tars.

Assuming that the German coke ovens were working to normal peacetime capacity, the quantity of coal carbonised would be 85 per cent. of the estimated annual rated capacity of 74.3 million tons, *i.e.*, 63.2 million tons with the coke yield (at 75 per cent.) about 47.4 million tons. Allowing for adverse war-time factors to the extent of 15 per cent. and 3 per cent. per annum on the rated capacities, according to the areas in which the ovens are situated, the amount of hard coke actually produced works out to 40 million tons. On this basis the production of high temperature tar oils in Greater Germany is estimated at 2.31 million tons. Production in the occupied countries is put at 1.34 million tons. About half a million tons is considered to be used as raw material for the synthetic oil plants. Thus there is available for distillation 3,150,000 tons.

Low Temperature Tars.

No new information has been received to indicate that the figures previously taken for L.T. tars from bituminous and brown coals require amendment. The figures of 200,000 and 500,000 tons for these items (shown in the November Report) are maintained.

Substitute Fuels.

Benzol.

In the November Report the quantity of benzol available for motor fuel purposes was estimated at 600,000 tons per annum. Output is now at a lower rate. The current production in Germany of crude benzol is estimated at 554,000 tons and 63,000 tons from coke ovens and gas works respectively; the production in the occupied countries is estimated at about 300,000 tons. Half of this total production of 900,000 tons is considered to be required for purposes other than automotive fuel. The benzol contribution to the liquid fuel position is therefore estimated at 450,000 tons.

Ethanol.

Our estimate of ethanol consumption has been reduced from the previous figure of 115,000 tons to 100,000 tons per annum. Approximately 50,000 tons are used to blend with motor spirit in the occupied countries, chiefly in Hungary and France; in the latter country alcohol is used to the extent of 29 per cent. of the mixture of motor spirit, benzol and alcohol. There is still no evidence that alcohol is blended with motor spirit in Germany, but we have allowed a figure of 50,000 tons to cover any small quantity which may be used for this purpose.

Vegetable Oils.

The maximum amount of vegetable oils available is thought not to exceed 50,000 tons per annum. As a substantial quantity is required for other purposes, the amount used as lubricants will probably not exceed 25,000 tons per annum.

Lubricating Oil Regenerated.

The estimate of 200,000 tons is not supported by definite evidence, but the amount of oil regenerated is probably slightly less than in former years. The previous figure of 240,000 tons has therefore been reduced to 200,000 tons, which is in agreement with the estimate of the United States Enemy Oil Committee.

THE GERMAN SYNTHETIC OIL PLANTS.

Estimated Annual Rate of Capacity for 1st half of 1944.

(In Thousands of Metric Tons.)

The Bergius Hydrogenation Plants.

Plant.	Raw materials used.					Total.
	Hard Coal.	Brown Coal.	Brown Coal Tar.	High Temperature Tar.	Pitch.	
Blechhammer North	125	...	...	...	...	125
Blechhammer South ... ..	...	...	...	300	...	300
(Reigersfeld)						
- Böhlen Rotha* ... ..	...	...	300	...	...	300
- Brück* ... ..	...	...	700	...	...	700
- Gelsenkirchen-Nordstern ...	400	...	...	...	...	400
- Leuna* ... ..	...	400	200	...	...	600
- Lützkendorf Mueheln* ...	...	...	125†	...	...	125
+ Magdeburg ... ..	...	...	250	...	...	250
+ Pöhlitz	200	...	...	400	...	600
Scholven-Buer	375	...	...	...	...	375
- Troglitz-Zeitz* ... ..	...	...	320	...	...	320
Welheim Bottrop ... ..	...	...	...	...	75	75
Wesseling ... ..	...	200	...	...	...	200
Auschwitz	20	...	...	...	...	20
France, Bethune and Lievin ...	20	...	...	...	...	20
Total	1,140	600	1,895	700	75	4,410
*Less deduction equivalent to one month's production from above five plants on account of air attacks ... ..	...	70	280	...	...	350
	1,140	530	1,615	700	75	4,060
Less 5 per cent. allowance for adverse factors due to war-time conditions	57	26	82	35	3	203
	1,083	504	1,533	665	72	3,857

† Gas Oil.

THE FISCHER TROPSCH PLANTS.

	Annual Capacity.
Deschowitz	110
Dortmund	90
- Holten Sterkrade	125
Homburg	190
Kamen-Dortmund	100
- Lützkendorf Mueheln (A) ...	140
Rauxel	100
+ Ruhland-Schwarzheide	350
Wanne Eickel	130
France, Harnes	30
Total	1,865
Less 5 per cent. allowance for adverse factors due to war-time conditions	65
Total	1,800

Note.—(A) After deducting the equivalent of one month's production on account of air attack.

ANNEX III.

AN ESTIMATE OF CONSUMPTION BY CIVILIAN AND INDUSTRIAL USERS, 1ST JANUARY TO 30TH JUNE, 1944.

The estimated oil consumption by non-military users during the first six months of 1944 is detailed in Table Ib at the end of this annex.

1. *Greater Germany.*

Table Ic shows the detailed figures for the annual rates of consumption by civilian and industrial users in Greater Germany for the period under review.

(a) *Motor Cycles.*

We share the view of the United States Enemy Oil Committee that the number of motor cycles operating is now reduced. Our estimate is based on the assumption that there has been a reduction of about 25 per cent. compared with the 1943 figure of 800,000 and that each cycle is consuming .075 of a ton per annum.

(b) *Private Cars.*

It is estimated that 200,000 private cars are operating, 147,000 on petrol and 53,000 on bottled gas. At an average annual consumption of one ton per car, the petrol consumption is equivalent to 147,000 tons per annum. Assuming the consumption of bottled gas is at the rate of 1.15 tons per car, the total bottled gas consumption is 61,000 tons per annum.

(c) *Omnibuses.*

No change has been made in our previous estimate of consumption by omnibuses, of which 2,000 are assumed to be running on town gas and 12,000 on Diesel oil. The total liquid fuel consumption is estimated at 168,000 tons per annum.

(d) *Trucks.*

Our estimates are based on the assumption that each of the 18,000 trucks is consuming 3 tons of petrol per annum, 38,000 are operating on Diesel oil, each consuming 9 tons per annum, and 60,000 are using bottled gas at the rate of 3 tons per annum. In addition, 10,000 trucks are working on high-pressure town gas. Thus there are 126,000 trucks in service, excluding the 25,000 Diesel trucks which have been converted to producer gas, and which consume both producer gas and also Diesel oil to the extent of 3 tons per annum.

These figures include the trucks operated by N.S.K.K. and Organisation Todt. The probable consumption by the latter may well be more than has been estimated. In view of the continued high level of activity upon fortifications, essential repair reconstruction and other projects, the amount of fuel being consumed in the transport of material to these undertakings may be considerable, and this notwithstanding the extensive use of producer gas-driven units. The amount of fuel consumed in stationary and semi-stationary equipment by the Organisation Todt is put at 320,000 tons, and is shown under consumption by the Armed Forces.

(e) *Railways.*

We have adopted the United States Enemy Oil Committee's estimate of 20,000 tons per annum for consumption of bottled gas, and have assumed that the consumption of gas oil is about one-third of the 1938 rate, viz., 22,000 tons.

(f) *Inland Shipping.*

Included in the estimate for inland shipping is the consumption by transport on the Danube, fuel oil 216,000 tons, gas oil 12,000 tons and lubricants 5,000 tons per annum. The estimates for the civil consumption of Roumania include allowances for consumption at Danube ports and for coastwise traffic, but not for other movements on the Danube.

(g) *Bunkers.*

Our estimates for 1943 were reduced to the low figure of 5,000 tons per month. It is believed that consumption continues at about the same level.

(h) *Commercial Aviation.*

The estimate of 24,000 tons per annum covers commercial aviation requirements for the whole of Axis Europe. German commercial aviation requirements have been reported to be at the rate of 12,000 tons per annum. The figure of 24,000 tons for the whole of Europe can, therefore, be regarded as a maximum.

(i) *Agriculture.*

In our November Report it was assumed that of the 110,000 tractors, 40,000 were operating on producer gas and 70,000 on liquid fuels. It is now thought that the number operating on liquid fuels has been reduced to 65,000, whose consumption at the rate of $2\frac{1}{2}$ tons per annum is equivalent to 156,000 tons. No allowance has been made under this heading for liquid fuel consumption by other agricultural machinery as it is thought that such machinery has by now been converted to operate on other fuels. We share, however, the view of the United States Enemy Oil Committee that some allowance should have been made in our previous estimates to cover this machinery as the conversions have probably only recently been completed.

(j) *Industry.*

Our estimates include 30,000 tons of gasoline, and 4,800 tons of lubricants, for aero-engine testing, compared with our previous estimate of 36,000 tons of gasoline, as it is assumed that aero-engine production is now on a reduced scale.

An allowance has been included for the consumption of technical gasolines to the extent of 240,000 tons per annum. Under the kerosine heading we have also allowed for 96,000 tons of liquid fuels which have been despatched to Moosbierbaum; possibly for hydroforming for toluol.

(k) *Kerosine.*

The estimate for kerosine for household use remains at the level of our previous estimate, namely, 96,000 tons per annum.

2 and 3. Czechoslovakia, Poland and Danzig.

Current consumption in these countries is estimated at approximately the same percentage of pre-war consumption as in Germany, namely, about 38 per cent.

4. Finland.

It is thought that there has been no recent change in the consumption level.

5. Norway.

Our estimates are in accordance with recent intelligence and show that consumption has fallen by about 20 per cent. during recent months, the reduction being largely in respect of motor fuels.

6, 7 and 8. Denmark, Belgium and Holland.

Small reductions have been allowed for in each of these countries. No official figures have been received recently but the trend of evidence is that allocations in these countries are now on a very meagre scale, particularly with regard to motor fuel.

9. France.

Our present estimates show a 10 per cent. reduction on those for 1943, in respect of which we received figures from a reliable source. The motor fuel and gas oil consumption is based on recent information. The former includes alcohol and benzol, which is blended with the petrol to the extent of 29 per cent. and 13 per cent. respectively.

10. Hungary.

It is believed that the German control of Hungary has not so far caused any reduction in internal consumption, which remains at a high percentage of pre-war consumption. The figure for kerosine is put at 68,000 tons, compared with our previous estimate of 48,000, in view of the recent report that allocations have recently been increased by 40 per cent.

11. *Italy.*

A token figure of 50,000 tons has been assumed to cover the present consumption in the parts of Italy now occupied by the Germans. Nothing has been included for civilian consumption in Albania, as it is assumed that what little fuel is available is derived from local production.

12. *Roumania.*

During at least the first few months of this year the internal consumption of Roumania continued at high levels. However, owing to (a) the loss of parts of Transnistria, (b) some replacement of fuel oil by natural gas, and (c) recent dislocations on account of air attacks, it has been assumed that consumption during the six months will have decreased by 10 per cent.

13 to 18. *The Balkans and Baltic States.*

There is no special item in these estimates which calls for comment. The consumption in each of these countries continues to be on a very low scale.

ANNEX III.

Table IA.—*Estimated Civilian and Industrial Consumption, 1943.*

Annual Rates—in thousands of Metric Tons.

	Motor Fuel.	Kerosine.	Gas/Diesel.	Fuel Oil.	Lubricants.	Total.	Percentage 1938 Consumption.
1. Greater Germany ...	732	166	1,414	348	600	3,260	40
2. Czechoslovakia ...	50	10	60	25	30	175	43
3. Poland and Danzig ...	48	36	36	12	24	156	42
4. Finland ...	12	10	5	...	5	32	13
5. Norway ...	31	9	74	3	7	124	22
6. Denmark ...	17	9	32	6	6	70	9
7. Belgium ...	18	6	15	5	10	54	6.5
8. Holland ...	16	10	19	9	12	66	4
9. France ...	96	12	66	26	48	248	3.8
10. Hungary ...	60	48	60	48	24	240	91
11. Italy and Albania ...	90	68	69	77	50	354	10
12. Roumania ...	140	305	150	1,250	30	1,875	93
13. Yugoslavia ...	6	3	7	5	2	23	}
14. Greece ...	11	7	12	11	5	46	
15. Bulgaria ...	6	3	5	3	2	19	
16. Estonia ...	3	4	...	...	2	9	
17. Latvia ...	3	4	...	...	2	9	18
18. Lithuania ...	2	3	...	...	2	7	13
19. Occupied Russia ...	35	40	60	40	25	200	14
Total ...	1,376	753	2,084	1,868	886	6,967	2.5
20. Exports to Neutrals ...	...	...	...	...	...	120	
Grand Total ...	...	...	...	...	...	7,087	

ANNEX III.

Table IB.—*Estimated Civilian and Industrial Consumption in Axis European Countries.**1st Six Months of 1944.*

Annual Rates—in Thousands of Metric Tons.

	Motor Fuel,	Kerosine.	Gas/Diesel.	Fuel Oils.	Lubricants.	Total.	Approximate Percentage of 1938 Consumption.
1. Greater Germany	801(a)	348(b)	931	528	573	3,181	39
2. Czechoslovakia	44	10	53	22	26	155	38
3. Poland and Danzig... ..	43	32	32	11	22	140	38
4. Finland	12	10	5	...	5	32	12
5. Norway	5	9	75	3	10	102	18
6. Denmark	6	10	36	5	7	64	8
7. Belgium	9	6	12	5	10	42	5
8. Holland	13	6	15	5	12	51	3
9. France	80	12	60	24	48	224	3.5
10. Hungary	48	68	48	40	24	228	90
11. Italy(c)	12	9	9	10	10	50	1.5
11a. Albania ... ..	...	...	...	...	...	...	...
12. Roumania(d)	115	255	125	1,040	25	1,560	78
13. Yugoslavia	6	3	7	5	4	25	} 13
14. Greece	10	4	12	10	3	39	
15. Bulgaria	4	6	5	2	2	19	
16. Estonia	3	4	...	...	2	9	
17. Latvia	3	4	...	...	2	9	18
18. Lithuania	2	3	...	...	2	7	13
19. Occupied Russia ... ..	...	...	...	...	...	...	14
Total	1,216	799	1,425	1,710	787	5,937	...
20. Exports to Neutral Countries (say) ... ..	...	...	...	...	...	80	...
21. Losses from evaporation and leakage ... ..	...	...	...	...	...	18	...
Grand Total ... ..	...	...	...	...	...	6,035	...

(a) Includes 24,000 tons aviation spirit.

(b) Includes 96,000 tons despatched to Moosbierbaum and 96,000 tons used for industrial purposes.

(c) Assuming rate equivalent to 10 per cent. of pre-invasion consumption.

(d) Assuming 10 per cent. reduction compared with 1943 consumption level.

ANNEX III.

Table Ic.—*Estimated Industrial and Civilian Consumption of Liquid Fuels and Lubricants.*

GREATER GERMANY.

(Annual Rate in thousands of Metric Tons.)

	Light Motor Fuel.		Total.	Kerosine and Technical Gasoline.	Lubricants.	Gas Oil.	Fuel Oil.	Total.
	Liquid.	Bottled Gas.						
Motor Cycles	45	...	45	...	0.8	...	...	45.8
Private Cars	147	61	208	...	4	...	...	212
Buses ... ..	...	...	...	...	2.4	168	...	170.4
Trucks	54	180	234	...	30	417	...	681
Total Road Transport	246	241	487	...	37.2	585	...	1,109.2
Railways ... ..	...	20	20	...	25	22	...	67
Inland Shipping(a) ... ..	...	...	...	...	12	72	240	324
Bunkers ... ..	...	...	...	...	8	36	24	68
Commercial Aviation	24	...	24	...	...	...	...	24
Agriculture ... ..	...	...	...	60	6	96	...	162
Industry(b)	270	...	270	192	484.8	120	264	1,330.8
Household ... ..	...	...	...	96	...	...	...	96
Grand Total	540	261	801	348	573	931	528	3,181

(a) Includes Danube Shipping: Lubricants, 5,000 tons; Gas Oil, 12,000 tons; Fuel Oil, 216,000 tons.

(b) Includes Gasoline for Testing Aero Engines, 30,000 tons, plus 4,800 tons Lubricants.

ANNEX III.

TABLE II.—ESTIMATE OF CONSUMPTION BY THE EUROPEAN AXIS ARMED FORCES—1942, 1943, AND FIRST HALF OF 1944.

(In thousands of Metric Tons.)

	Armies(b).			Naval.			Air Forces.			Todt Organisation.			Total.		
	1942.	1943.	1944.	1942.	1943.	1944(c).	1942.	1943.	1944.	1942.	1943(d).	1944(d).	1942.	1943.	1944.
January ...	390	382	440	162	155	145	169	200	195	40	27	27	761	764	807
February ...	330	315	410	135	156	145	160	196	175	40	26	26	665	693	756
March ...	363	366	420	129	156	145	167	212	192	40	27	27	696	761	784
April ...	317	248	345	173	156	145	170	213	192	40	26	26	700	643	708
May(a) ...	338	256	345	205	156	145	161	208	192	40	27	27	744	647	709
June(a) ...	365	295	345	205	156	145	161	211	200	40	27	27	771	689	717
Total for half year ...			2,305			870			1,146			160			4,481
July ...	417	360		205	156		161	224		40	27		823	767	
August ...	430	380		205	156		161	206		40	26		836	768	
September ...	384	380		205	121		160	201		40	27		789	729	
October ...	372	395		205	121		160	181		40	26		777	723	
November ...	358	405		165	121		161	184		40	27		724	737	
December ...	374	435		165	121		161	187		40	27		740	770	
Total ...	4,435	4,217		2,159	1,731		1,952	2,423		480	320		9,026	8,691	

NOTES.

(a) Estimates for May and June 1944 shown at approximate level of consumption in preceding months.

(b) Armies.—To allow for increased consumption during adverse weather on the Eastern Front, an excess consumption equivalent to 20 per cent. is assumed for the periods mid-November to mid-April.

(c) Naval.—Fuel and lubricating oil consumption for six months ending 30th June, 1944, is estimated as follows:—

	Fuel Oil.	Diesel and Petrol.	Lubricating Oil.	Totals.
Ægean ...	23,000	1,000	500	24,500
Black Sea ...	35,000	12,000	1,000	48,000
Western Mediterranean and Adriatic ...	29,500	8,500	1,000	39,000
Atlantic Waters ...	493,500	246,500	18,500	758,500
				870,000

(d) Covers consumption by mechanical equipment other than transport vehicles. The supplies to these vehicles are included in the civilian and industrial consumption figures.

ANNEX IV.

CONVERSIONS TO SUBSTITUTE FUELS.

The attached table is an approximation of the number of operative non-military motor vehicles in Axis Europe in March 1944. This table indicates our estimate of the extent of conversions to substitute fuels.

Germany.

In our November Report the broad conclusions were reached that all the readily convertible commercial vehicles and a considerable number of passenger cars had already been converted, that a limitation in the supplies of the various gases used as substitute fuels precluded any great increase in conversions to these fuels, and that further conversion to any substitute fuel on any appreciable scale was unlikely. Whereas there is scope for the further conversion of passenger vehicles, the information available since the beginning of the year tends to confirm the general accuracy of these conclusions.

We now estimate that out of a total of 400,000 commercial vehicles and 200,000 passenger vehicles in Germany, 332,000 and 53,000 respectively have been converted to use substitute fuels; these figures represent 82 per cent. and 26.5 per cent. of the total fleets and 64 per cent. of the combined motor vehicle strength of Germany.* No statistics are available from Germany upon the actual extent of the conversion of passenger vehicles and our assessment of the position is based largely upon two pointers which support the view that the programme is losing momentum and that no substantial additional conversion can be expected.

German legislation on this subject has, in general, been a barometer of the planned extent of activity in this direction; in the last six months the only regulation issued appears to be designed to tie up the loose ends of the conversion scheme and indicates the official view that conversion in Germany has shot its bolt. Secondly, the general tenor of all press references to the use of substitute fuels since November has been one of admission that the problems of fuel supply and maintenance, created by the conversions already achieved, are becoming continually more difficult to solve.

Other Countries.

There is considerable scope for further conversions in Eastern Europe, but the progress that has been made in converting vehicles has been slow and appears unlikely to gain any momentum. In Western Europe, on the other hand, and especially in Holland, Belgium, Norway and Denmark, saturation point has virtually been reached.

Conclusions.

Whereas there is still a considerable field for the more extensive use of substitute fuels in Axis Europe, the increasing difficulties in the manufacture of units and in the supply of fuel are reducing the scope for further conversions. Replacement of obsolete producer gas units is largely absorbing the available output of new units.

* These figures are in some disagreement with the statistics of the United States Enemy Oil Committee. Our estimate of the number of vehicles operating on solid fuels is substantially higher than the Washington estimate. This is partly due to a basic difference in the estimates of the present number of vehicles in Germany and the subject is still being studied.

ANNEX IV.

STATISTICAL REVIEW OF THE POSITION OF CIVILIAN MOTOR VEHICLES AS AT MARCH 1944.

Country.	Total Number of Vehicles in Use operating on Liquid or Substitute Fuels.			Vehicles divided according to Fuel used.						Vehicles divided according to type.			
				Substitute Fuels.			Liquid Fuels.			Operating on Substitute Fuels.		Operating on Liquid Fuels.	
	Cars.	Commercial Vehicles.	Total.	Producer Gas.	Other Substitute Fuels.	Total on Substitute Fuels.	Petrol.	Diesel.	Total on Liquid Fuels.	Cars.	Commercial Vehicles.	Cars.	Commercial Vehicles.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Belgium	6,800	24,200	31,000	9,300	13,400	22,700	8,050	250	8,300	2,300	20,400	4,500	3,800
Bulgaria	2,000	3,700	5,700	2,500	500	3,000	2,700	...	2,700	1,000	2,000	1,000	1,700
Denmark	6,500	26,000	32,500	31,000	1,000	32,000	500	...	500	6,250	25,750	250	250
Finland and Baltic States ⁽¹⁾	1,300	17,500	18,800	13,500	...	13,500	5,300	...	5,300	1,000	12,500	300	5,000
France	50,000	140,000	190,000	142,000	2,500	167,000	20,000	3,000	23,000	32,000	135,000	18,000	5,000
Germany	200,000	400,000	600,000	260,000 ^(*)	125,000	385,000	165,000	50,000 ^(*)	215,000	53,000	332,000 ^(*)	147,000	68,000
Greece	250	2,000	2,250	500	...	500	1,750	...	1,750	...	500	250	1,500
Holland	2,000	18,000	20,000	17,000	2,500	19,500	500	...	500	1,500	18,000	500	...
Hungary	2,500	5,000	7,500	1,000	1,000	2,000	5,500	...	5,500	800	1,200	1,700	3,800
Italy ⁽¹⁾	30,000	50,000	80,000	10,000	25,000	35,000	42,500	2,500	45,000	20,000	15,000	10,000	35,000
Norway	4,000	25,000	29,000	21,000	2,000	23,000	5,600	400	6,000	3,000	20,000	1,000	5,000
Protectorate and Slovakia	6,000	17,000	23,000	12,000	2,000	14,000	7,000	2,000	9,000	1,300	12,700	4,700	4,300
Roumania	3,500	9,000	12,500	...	400	400	10,000	2,100	12,100	100	300	3,400	8,700
Yugoslavia	300	3,000	3,300	1,600	800	2,400	900	...	900	300	2,100	...	900

⁽¹⁾ As at June 1943, further information not available.

^(*) Including 25,000 Gas/Diesel vehicles.

^(*) Excluding 25,000 Gas/Diesel vehicles.

ANNEX V.

NOTE ON THE STOCK POSITION AND THE SHORTAGE OF RESERVES.

At the end of 1942 stocks were considered to be at the distributional minimum. We defined the distributional minimum as the level at which further withdrawals from stocks to make up any material deficit between current supply and consumption were no longer possible.

During 1943 the position has been changing in that substantial areas of Europe have been lost to the Axis, military reserves have been established on the threatened fronts, and the distribution of oil for non-military purposes has markedly decreased.

Our statistics show that at the end of 1943 stocks were less by about 300,000 tons than they were twelve months previously. Although there is no evidence of any serious breakdown in distribution at the end of the year, intelligence confirms that the position was extremely strained, and that the essential strategic stocks being established for meeting invasion were only being accumulated at the cost of reductions in supplies urgently needed for other purposes.

The tentative balance-sheet for the first six months of this year shows that stocks have recovered to the extent of being back to the same level as at the beginning of 1943; during June, however, the stock trend will once again be declining. As increased military activity will seriously worsen the position it is important to know what cushion of stocks, if any, there will be to fall back on before consumption has to be reduced to the same level as production.

Oil that is in process and in transit is "tied" and, therefore, while in this state is not consumable. Consequently, consumable stocks might be considered as that amount of oil that is in distributional storage awaiting consumption. Such stocks might be divided into civilian, Navy, G.A.F. and Army:—

Civilian.—It is certain that allocations of supplies for non-military purposes are on a hand-to-mouth basis and that there are no free civilian stocks of any size available to be drawn upon.

Navy.—The extent of naval stocks is not known. It might be expected that fleet units would have a shore reserve equal to, say, two months' consumption, or about 290,000 tons. Last year it was reported that the German navy was embarrassed by the shortage of fuel and that stocks at that time were only 200,000 tons. It would seem unlikely at the present time that stocks would be very much above this figure.

G.A.F.—The operational reserve aimed at by the G.A.F. may be to the order of three to four weeks' consumption, or a total of about 250,000 tons. However, it appears probable from intelligence that reserves are lower than this figure.

Armies.—The strain imposed upon Germany's oil supplies by the prolonged duration of the Russian offensive last winter resulted in a critical depletion of stocks. Except for military reserves earmarked for other fronts, German army stocks must have been negligible at the beginning of this year. It is not known to what extent reserves have since been put aside, although the following tabulation gives some indication of the probable position:—

	<i>In metric tons.</i>
(1) Eastern Front (including Poland and Germany East of the River Elbe). From three weeks' to one month's fully active consumption	225,000-300,000
(2) Norway. From two to two and a-half months' requirements (figures based on intelligence)	30,000- 40,000
(3) Western Europe. For two months' requirements (figures based partly on intelligence)	150,000-200,000
(4) Italy. One month's requirements	30,000
(5) Balkans and Hungary. (N. Balkans one month, Greece two months)	30,000
(6) Satellite Armies	35,000- 50,000
(7) Germany (W. of the Elbe)	150,000-200,000
Total	650,000-850,000

Reserves are known to have been built up in Western Europe, Norway and Greece and intelligence suggests that these are to the order of two months' consumption at fully active rates. The figures given for the other parts of German-occupied Europe are speculative and have been based upon general evidence of the state of the supply situation and of German military practice.

In regard to the Eastern Front, it is probable that during and immediately after the Russian winter offensive supplies were on a producer to consumer basis and stocks in the rear areas depleted. Some accrual of supplies must have since been made and the estimate given is considered reasonable.

The stocks shown in each of these areas could only be transferred from one theatre of operations to another to a very limited extent and consequently they must to a large extent be regarded as "tied" in the areas where they are situated.

The size of the military reserves existing in Germany west of the Elbe is not known. By deduction, and in view of the general position, it is unlikely that these stocks exceed the figures given above. The estimate of 150,000 to 200,000 tons is equivalent to about the minimum to which these stocks would be allowed to fall except under urgent stress.

CONCLUSIONS.

1. Excluding military strategic reserves, present stocks are at not more than the distributional minimum.

2. Reserves held by the armed forces are likely to be sufficient, if cut off from other sources of supply, to maintain from one to two months' active fighting.

3. The periods within which an operational oil shortage is likely to develop, in the event of a decline in production and/or simultaneous offensives on the Eastern and Western fronts, would be largely governed by local supply difficulties.

(a) In Western Europe this period is likely to be at least two months. If rail communications are virtually severed this period might be shortened to six weeks.

(b) On the Eastern Front, supplies to the Northern and Central sectors can probably be maintained indefinitely so long as the synthetic oil plants in Northern and Eastern Germany continue to function.

In regard to the Southern sector, if—

(i) Oil refining in Roumania is brought to a complete standstill.

(ii) Rail communications through Hungary are seriously interrupted, an operational shortage may well develop after one month.

ANNEX VI.

EFFECT OF THE LOSS OF THE OIL RESOURCES OF ROUMANIA, POLAND AND ESTONIA.

Germany is now faced with the imminent threat of the loss of the oil supplies of these three countries. The probable effect of this loss is outlined below.

Statistical Effect of the Loss.

Roumanian, Polish and Estonian production is currently estimated to be at the rate of 2,812,000 tons of finished products per annum. The civil consumption of these countries is estimated at 1,660,000 tons. If, therefore, Germany loses these sources of supply she would suffer a net loss of approximately 100,000 tons per month. (If the production of Hungary were also denied, there would be an additional loss of approximately 660,000 tons a year, or 55,000 tons a month.)

The loss of supplies from these three countries would consequently add to Germany's present monthly deficit of 65,000 tons (see Balance Sheet in Annex I), making a total deficit of 165,000 tons. As pointed out elsewhere in this Report, this deficit is calculated on the assumption that military activity would be at the comparatively low level of April when no major offensives were taking place.

Deficiencies arising from the Loss.

These countries have been providing Germany with approximately 20 per cent. of her motor fuel requirements and also substantial quantities of diesel and fuel oils. Roumania has not only been producing an important proportion of the G.A.F.'s requirements for aviation fuel but, in addition, she has been

responsible for supplying large quantities of lubricating oil base stocks. Of scarcely less importance are Roumania's shipments of diesel oils and special boiling point spirits for the chemical industry.

Germany would endeavour to make up for the loss of special quality products by adjustments in her refining programmes. Although it might be possible to remedy quality deficiencies in due time this would not make up for quantity deficiencies. Furthermore, the loss of Roumania's important cracking capacity would reduce to an important extent the flexibility of the oil industry remaining to the enemy. Germany is deficient in cracking capacity and in consequence the gasoline offtake from the available crudes would be substantially below requirements.

Consequent Dislocation of Distribution.

Quite apart from the effect of the loss of this oil upon the German supply position, there would have to be drastic alterations in the organisation of distribution. The stoppage of supplies from the east would not only mean a reorientation of the movements from the remaining sources available to Germany but it would also involve additional burdens on the transport system.

A most serious implication of the loss of these sources of supply would be the extent to which Germany would become dependent upon her synthetic production. If bereft of the production of these three countries, no less than 56 per cent. of the remaining supplies would have to come from the synthetic oil plants.

ANNEX VII.

GERMAN INABILITY TO INCREASE PRODUCTION.

Even on a relatively long-term programme, Germany cannot offset the loss of the oil resources in Eastern Europe by increasing production elsewhere. The following notes indicate what possibilities Germany has of being able to augment the present output of oil from indigenous sources:—

Hydrogenation Plants.

The completion of Br  x, Blechhammer North and South, and Auschwitz, together with the additions that have been planned to other hydrogenation plants, would add materially to synthetic oil production. In spite of the high priority given to these developments, the progress of construction has not only been slow, but is decelerating, and no important short-term increase in production can be expected from these plants.

The conversion of the nitrogen fixation equipment at Leuna would result in additional liquid fuel capacity of about 400,000 tons per annum. This change might be made within about six months if it had been anticipated, but it would take at least a year if not prepared for in advance.

Fischer Tropsch Synthesis.

It is not possible substantially to increase the present production of existing plants except at locations where nitrogen fixation plant exists. At Holten Sterkrade, and possibly at certain other plants, it would be possible to supply hydrogen from nitrogen fixation equipment. Although the change could be made quickly, it is doubtful whether the increased production would be more than small figures.

Low-Temperature Tar.

The present output of liquid fuels from low-temperature tar in Germany is estimated at 5/600,000 tons per annum, of which about 20 per cent. is derived from bituminous coal. An increase in low-temperature tar production would necessitate the mining of substantial additional quantities of brown coal; for example, to produce a half-million tons of low-temperature tar about 7 million tons of brown coal would be required.

The tar could be used as fuel, but it provides practically no light products by direct distillation, and even after removal of tar acids (minimum 10 per cent.) would give only 38 per cent. of 50 Cetene Gas/Diesel oil, or some 170,000 tons, and 32 per cent. fuel oil, or 140,000 tons.

High-Temperature Tars.

No important increase in coke oven capacity is likely in present circumstances. There is the possibility that a greater use could be made of high-temperature pitch in proportion to the mineral oil residues which have been

hitherto supplied to certain of the hydrogenation plants; the additional production gained would, however, be relatively small.

Substitutes.

The use of low-pressure gases is likely to have approached saturation-point. It is possible that methanol and more ethanol could be employed for liquid fuel purposes, but, in view of other essential requirements for these products, their use on an extensive scale is unlikely.

Crude Oil.

There is scope for increases in the production of crude oil in certain areas, although such increases are likely to be offset by declining production in other areas.

The country where production is most capable of being increased is Hungary. On the other hand, production in the Austrian fields, which is estimated to have increased to the rate of 2 million per annum for the first half of 1944, is expected to decline to an annual rate of 1½ million tons for the second half of the year.

In the case of Hungary, production has been running during 1943 at the annual rate of 800,000 tons and, on the assumption that the Germans have already taken steps to increase output, the present level of production is estimated at 1 million tons. It is not known to what extent production from existing wells can be increased, or whether extensive drilling will be necessary before important additions to output can be made. Assuming that it might be possible for production to be further increased by 500,000 tons during the next six months, which would be a maximum estimate, this would only offset the anticipated decline in the Austrian fields.

The approximate quantities of primary finished products that would result from this additional Hungarian oil and a decline of ½ million tons per annum in the Austrian fields, are shown in the Table below. In this Table there is also shown an estimate of the reductions in the current (May/June) quantities of Finished Products available to Germany which would result from the total loss of Roumania, Poland and Estonia. In terms of individual products, the position would be—

Approximate Normal Breakdown of Primary Finished Products.
(Thousands of metric tons per annum.)

	Motor Fuel.	Kerosine.	Gas/Diesel.	Motor Lubs.	Other Lubs.	Fuel Oil.	Total.
(a) Hungary(A) ...	160	120	35	15	50	70	450
Less Austria(A) ...	15	...	190	140	70	10	425
	+145	+ 120	—155	—125	— 20	+ 60	...
(b) Roumania(B) ...	540(C)	70	170	...	25	...	805(D)
Poland(B) ...	55	65	90	20	35	5	270
Estonia(B) ...	10	10	...	...	...	115	135
	—605	— 145	—260	— 20	— 60	—120	—1,210

(A) Allowing for half a million tons increase and decrease in Hungarian and Austrian production respectively.

(B) Allowing for present internal civilian consumption as shown in Annex III.

(C) This includes upwards of 50 per cent. of gasoline suitable for blending into aviation fuel.

(D) This is in addition to the decline, equivalent to 2,450,000 tons per annum, already allowed for months of May and June. The breakdown of this quantity is (tons per annum): Motor Fuel, 657,000; Kerosine, 324,000; Gas/Diesel, 292,000; Lubricants, 50,000; and Fuel Oil, 987,000.

Conclusions.

1. Even on a relatively long-term programme. Germany cannot offset the loss of the oil resources of Eastern Europe by increasing production elsewhere.

2. No important short-term increase in production can be expected from the synthetic oil plants. Crude oil production is more likely to decline than increase.

3. Upon the loss of these countries German supplies of motor fuel would be short to the extent of over 1 million tons per annum, or 26 per cent. of the present army consumption.

4. The loss of Roumanian oil would have a serious effect on supplies of aviation fuel.

ANNEX VIII.

THE MINERAL OIL REFINING CAPACITY OF AXIS EUROPE, APRIL 1944.

Memorandum by the European Axis Oil Production Committee.

The probable effect of destruction of oil refining capacity in the various areas of German Europe is discussed in the following paper prepared by the Axis Oil Production Committee, to whom the report of the United States Enemy Oil Committee (J.I.C. 106/2) was referred by the War Cabinet Technical Sub-Committee on Axis Oil.

The United States Enemy Oil Committee, in their tentative estimates in March, showed the useful refining capacity remaining at the disposal of the Western Axis at 11,825,000 tons per year and the quantity of crude production at 8,342,000 tons per year.

A parallel study by the Ministry of Economic Warfare, allowing for further repairs to the Roumanian refineries, put the figures somewhat higher, namely, a useful refining capacity of 13,378,000 tons per year, against an estimated production of over 9 million tons of crude oil, leaving a margin of refining capacity of about 4 million tons per year.

All these figures are based on an evaluation of the destruction or damage to known refineries up to the end of April, and an allowance made for those which are considered to be of no practical value to the Axis mainly for geographical reasons, such as the bulk of the French and Italian refineries.

The capacity of the individual refineries is, in turn, based on pre-war information (not always very complete), and what little is known of any subsequent extensions and modifications. Some new refineries are known to have been built and certain equipment has been removed from some French refineries to unknown destinations.

With so many unknown factors* involved, it is felt that a global arithmetic approach to the problem is insufficient, particularly as minor errors in estimating either refining capacity or production would have a much bigger effect on the calculated margin.

Only limited consideration was given in these reports to the suitability of the various refineries for treating different sorts of crude oil and to the qualities of the products which they could turn out. Moreover, it is evident that some products are in shorter supply than others. It is consequently felt that a better approach to the problem of evaluating the potential effect of further damage would be by studying the nature, location and product output potentialities of the various refineries in the light of the shortages most likely to become acute.

Products most required from Crude Oil Refineries.

Though crude oil provides only a half of the Axis supplies of liquid fuels and lubricating oils, it is the major source of both Diesel and lubricating oils. The two products which, it is believed, are in shortest supply are just these same two, with particular emphasis on high grade lubricants.

The quantity of Diesel oil obtainable from the available crude supplies is certainly well below requirements, but is considerably increased by blending with motor spirit and with products obtained from coal (notably from the Fischer Tropsch plants). However, from a refining point of view, a straight Diesel oil is one of the easiest oil products to make, as it can be obtained direct from virtually any distillation unit.

Lubricant production, on the other hand, requires much more specialised equipment and the high quality grades can only be made in a few refineries. In addition, these high quality grades call for complex testing and refining equipment available in only a few centres.

* There is also the possibility of the synthetic oil plants being used for the treatment of mineral oil. Some spare capacity might be found in the refinery sections of certain of these plants, although its use would involve various difficulties. According to one calculation, this additional capacity might be as high as 1,000,000 tons per annum. Another possibility is that certain hydrogenation plants at present using liquid tar feedstocks could process mineral oil instead. This would, however, be at the expense of the loss of output from the feedstocks derived from coal.

Production and Refinery Capacities in each Area.

1. Roumania.*

Roumania forms a self-contained area with ample refining capacity for its present production. The spare capacity was estimated at the end of 1943 at 1,000,000 t.p.a. by the United States Enemy Oil Committee and 1,685,000 t.p.a. by the Ministry of Economic Warfare, or, say, 20 per cent. and 30 per cent. respectively on the production rate. Since these reports further repairs to the refineries have been effected, notably at the Steaua Romana plant, the full output capacity of which is $1\frac{1}{2}$ million t.p.a. Several of the refineries can produce ordinary grades of lubricating oil but, unless some unknown plants have been erected during the war, few, if any, are equipped for making the high grades.

2. The Danubian Countries.

Next in importance of crude production come the Danubian countries, Austria and Hungary, to which might be added the relatively small output from Yugoslavia and Czechoslovakia.

In peacetime all these countries possessed refineries (of small, and in many cases of very small, individual capacity), designed to handle mainly imported crude or crude oil blends prepared specially for easy refining. A number of them were equipped for making lubricating oil, but there was hardly a modern plant capable of producing really high-grade products. However, in Hungary two refineries have been extended, and a new refinery is in process of being completed at Szöny. In Austria a new refinery has been erected at Lobau with a capacity estimated between 200,000 and 300,000 tons.

From small beginnings before the war vigorous drillings has brought about a rapid increase in production. The total oil production of the Danube Basin is approximately 3,100,000 tons (Austria 2,020,000, Hungary 1,000,000, Yugoslavia 50,000 and Czechoslovakia 30,000) and the refining capacity in these countries is to the order of about 2,000,000 tons. This represents a deficiency of over 1,000,000 tons. If the Yugoslav refineries are assumed to be neutralised, this deficiency would be greater by another 180,000 tons.

A number of these refineries produce lubricants, but the output capacity for high-grade lubricants is believed to be small.

3. Poland.

In Poland there is some 775,000 tons per year capacity for a local production (including Eastern Poland) not exceeding 400,000 tons per year. But here, again, many of the refineries are small and of old design, and it is doubtful if the total capacity of efficient units is appreciably in excess of production. The production of high-grade lubricants is believed to be limited to one plant of small capacity.

4. Germany and the Low Countries.

Germany built up before the war a modern and efficient refining industry based essentially on working imported crudes. A number of these refineries were conveniently placed for handling both imported and indigenous crudes.

The refineries in the Hamburg and Hanover area contain sufficient plant for the production of high-grade lubricating oils to satisfy a large proportion of the total Axis requirements, but it is not possible to set an exact figure to this proportion as there may be some output from new plant and from the equipment transferred from the disused French refineries.

In occupied Western Europe the only refineries which appear to be of immediate practical value to Germany are the Pernis refinery in Holland and the comparatively small refineries in Belgium. None of these are lubricating oil producers.

Apart from crude oil refineries there is distillation and treatment equipment attached to each of the Bergius synthetic oil plants. This is normally installed with a small working margin of capacity above the normal synthetic production, and in the case of some plants, where the hydrogenation equipment is being built in two stages, refining equipment suitable for the full final capacity has been erected in the first instance.

* Since this report was written a series of attacks upon Ploesti and Campina have dislocated refining capacity to an extent that Roumania is at present incapable of processing more than a part of the country's potential crude oil production.

One estimate based on normal working margins and on photographic evidence puts this total spare capacity at 1 million tons per year, but this figure is probably much on the high side. In the case of serious emergency much or all of this could be used for simple refining of crude oil, though, of course, no lubricating oils could be produced.

In all, the Ministry of Economic Warfare estimates that the useful refining capacity available in Germany, Holland and Belgium is some 2,500,000 tons per year in the true oil refineries, plus a possible 1 million tons per year in the synthetic plants. In addition, there are certain special refineries for making lubricating oils from distillates received from other refineries.

Fullest use being made of the German Refineries.

Germany's indigenous production of crude oil is some 800,000 tons per year. In addition to treating this crude, the German refineries process the surplus crude oil from the Danube countries and also distillates from Roumania.

Whereas the Polish refineries treat a small part of the surplus crude from the Danube Basin, the remainder is evidently moved to Germany. In addition, it is known that considerable quantities of Roumanian heavy oil were exported for refining elsewhere and with the object of obtaining a greater yield of high-grade lubricants than the local refineries could provide.

It is clear that the German lubricating oil plants are being heavily relied upon for the production of large quantities of lubricants from these imports. Furthermore, the German refineries as a whole must now be running at about their full crude capacity.

Effect of Further Destruction.

In the light of all these considerations, the effect of the destruction of refinery capacity in the various areas can be considered:—

- (1) *Roumania*.—Any reduction in capacity below the minimum necessary to process indigenous production would necessitate exporting the crude elsewhere. Since the refineries in Central Europe and in Germany are already operating at capacity, the inconveniently situated refineries in Holland, France and Italy would have to be brought into use.

On the other hand, any possible surplus capacity in Roumania cannot be considered as potentially useful for crude from other areas made homeless by destruction of refineries in such areas. The transport system might be able to handle the resultant traffic, but under existing circumstances the Germans would not wish to add to their transport problems.

- (2) *Danubian Countries*.—The refining capacity of the Danubian Countries is deficient to the extent of 1 million tons. Consequently it is assumed that the principal refineries in this area are working at capacity. Of these there are eight, although it is not known whether the two new ones recently constructed (Lobau in Austria and Szöny in Hungary) are yet in full operation. None of these refineries is of large capacity.

It is believed that the bulk of the surplus is refined in Germany. Any serious impairment of the output of these refineries would not only entail transporting the crude a considerable distance but would also add to the burden on the refineries in Northern Europe.

- (3) *Poland*.—The destruction of the principal Polish refineries would add to the surplus crude from the Danube Countries that has to be transported to the Northern refineries.

In any event, the growing proximity of the Russian front reduces their potential value to Germany.

- (4) *Germany*.—Whereas the German refineries are of prime importance for the processing of indigenous crude and the unrefined surplus from the Danubian Countries, certain of them are of vital importance as being the principal sources of high-grade lubricants.

The destruction of only one or two selected refineries would begin to have its effect on the general lubricating oil position by eliminating a considerable proportion of the total high-grade lubricating oil capacity. It is difficult to see, from the knowledge available, how the Germans could replace the loss.

The Misburg refinery, and the Rhenania refinery at Harburg with the nearby plant at Grasbrook, constitute the key refineries as between them they handle the equivalent of the whole German crude production. Of no less importance is the fact that they probably produce at least one half of the total high grade lubricating oil now available to Axis Europe. The combined output capacity of high-grade lubricants from these plants may be to the order of 40,000 tons.

Much of the rest of the high-grade lubricants come from the Vacuum plant at Oslebshausen (3/40,000 t.p.a. of lubricants), and the recently enlarged Saltzbergen refinery (originally 25,000 t.p.a. of lubricants) so that if these four could be put out of action the German lubricating oil position would be very seriously affected.

The effect of destruction on a somewhat larger scale is difficult to assess as knowledge of the actual working capacities of all the available refineries is too uncertain and the extent to which distillation equipment in synthetic oil plants, &c., could in practice be drawn on is impossible to estimate with any degree of accuracy. Further, in case of real need, the Germans would doubtless be prepared to face the extra transport involved in sending crude oil to refineries now considered unsuitably placed (notably France) rather than accept a reduction in total output. But it might take two months to put the plants, which are not at present in operation, on a working basis. It is reasonably sure that qualities and yields of products would be upset, established routing of oil would be profoundly disturbed, and total transport possibly increased, immediately the important refineries in the Hamburg-Hanover area were rendered unusable. Actual output of products would almost certainly be reduced.

Conclusions.

1. To reduce substantially the total liquid fuels available to Germany by means of attacks on oil refineries it will be necessary to put out of action either—

- (a) over 50 per cent. of the refining capacity of Roumania; or
- (b) not less than 40 per cent. of the capacities of the following plants:—

- ✓1. Misburg, Germany. ✓
- ✓2. Rhenania, Harburg, Germany. ✓
- ✓3. Rhenania, Grasbrook, Germany. ✓
- 4. Oslebshausen, Germany.
- 5. Saltzbergen, Germany.
- ✓6. Ebano, Harburg, Germany. ✓
- ✓7. Eurotank, Hamburg, Germany. ✓
- ✓8. Lobau, Austria (if completed). ✓
- ✓9. Florisdorf, Austria.
- 10. Pardubice, Czechoslovakia. x
- 11. Kolin, Czechoslovakia. x
- ✓12. Bratislava, Czechoslovakia.
- ✓13. Czepele, Budapest, Hungary. ?
- ✓14. Almas-Füzito, Hungary. ?
- ✓15. Szöny, Hungary (if completed). ?
- 16. Pernis, Holland (not operating, but best placed as reserve for Hamburg area).

2. The refining capacity in Austria and Hungary is insufficient by a substantial margin for refining the production of these countries. The immobilisation of the group numbered 8 to 11 inclusive and of the group numbered 12 to 14 inclusive would necessitate a complex redistribution of refining arrangements and would cause a serious interruption in the flow of finished products.

3. Lack of high-grade lubricating oil refining capacity is the most vulnerable feature of the Axis Europe refining industry. The destruction of from two to four of the five refineries in north-west Germany, numbered 1 to 5 above, would, in view of the present shortage of high-grade lubricants, slow down the German war machine to an extent proportionate to the lack of these essential products.

NOTE.—The loss of control over Roumanian and/or Polish oil would not detract from the importance of the above refineries, as the minimum amount of crude oil which would have to be refined in Germany and the Danubian countries would be unchanged.

APPENDIX.

TABLE I.—OIL PRODUCTION IN AXIS EUROPEAN COUNTRIES.

Estimated Annual Rate of Production for 1943 in Thousands of Metric Tons.

The yields shown in terms of Finished Products are arbitrary as the breakdown is dependent on changing requirements.

Source Groups.	Raw Materials. A	Aviation and Motor Petrol.	Kerosine.	Gas/ Diesel Oil.	Aviation and Motor Lubri- cants.	Other Lubri- cants.	Fuel Oils.	Asphalt and Wax, Loss and Refinery Fuel.	Total Finished Products.	Key.
1. Hanover—										1
(a) Nienhagen	440	44	70	80	66 B	66	26	88	352	(a)
(b) Eichlingen	120	12	20	21	18 B	18	7	24	96	(b)
(c) Other fields	130	7	...	42	32 B	12	11	26	104	(c)
2. Reitbrook	50	3	...	16	13	4	...	14	36	2
3. Heide	12	2	2	2	2	2	...	2	10	3
4. Rhine Valley	100	20	20	25	11	11	...	13	87	4
5. Small or unknown German fields ...	1,200	36	...	462	342	168	30	162	1,038	5
6. Austria	32	2	...	12	9	5	1	3	29	6
7. Czechoslovakia	400	88	84	108	34	34	12	40	360	7
8. Poland	70	4	14	14	6	8	19	5	65	8
9. France	800 C	256	185	60	28	87	104	80	720	9
10. Hungary	50	15	10	5	...	10	6	4	46	10
11. Yugoslavia	10	7	1	1	...	...	...	1	9	11
12. Italy	100	13	...	2	...	18	10	57	43	12
13. Albania	5,450 D	1,460	720	650	45	65	2,195	315	5,135	13
14. Roumania	95	10	9	...	...	...	76	...	95	14
15. Estonia: Shale	15	2	2	...	...	...	11	...	15	15
16. France: Shale										16
Total from Crude and Shale Oils	9,074	1,981	1,137	1,500	606	508	2,508	834	8,240	Total

[Continued on next page.]

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Source Groups.	Raw Materials. A	Aviation and Motor Petrol	Kerosine.	Gas/ Diesel Oil.	Aviation and Motor Lubri- cants.	Other Lubri- cants.	Fuel Oils.	Asphalt and Wax, Loss and Refinery Fuel.	Total Finished Products.	
17. Synthetic Oils—										
Bergius Plants—										
(a) Bit. Coal, H.T. Tar and Pitch ...	1,708 F	1,529	...	...	...	...	...	...	1,529 E	17(a)
(b) Brown Coal and Brown Coal Tar ...	1,822	848	...	725	333	...	...	...	1,906 E	17(b)
(c) Hydrocarbon Gases—										
(i) C ₃ ...	...	100 G	...	...	...	...	...	...	100	17(c)(i)
(ii) C ₄ ...	...	450 G	...	...	...	...	...	...	450	17(c)(ii)
18. Synthetic Oil : Fischer-Tropsch Plants ...	1,516	980	36	358	21	...	45	76	1,440 E	18
Total from Synthetic Oil Plants ...	...	3,907	36	1,083	354	...	45	76	5,425	Total
19. Substitute Fuels (see Note H)—										
(a) H.T. Tars ...	3,150	32	...	94	...	...	819	...	945	19(a)
(b) L.T. Tars—										
(i) Bituminous Coal ...	200	10	...	10	...	...	100	...	120	19(b)(i)
(ii) Brown Coal ...	500	75	...	190	...	...	170	...	435	19(b)(ii)
(c) Benzol ...	...	450	...	...	...	...	...	...	450	19(c)
(d) Ethanol ...	...	100 I	...	...	...	...	...	...	100	19(d)
20. Vegetable Oils as Lubricants ...	...	...	...	...	...	25 K	...	...	25	20
21. Lubricating Oils regenerated ...	...	...	...	...	...	200	...	...	200	21
22. France : Anthracine Oil, &c. ...	...	...	...	...	...	25	...	...	25	22
Total Substitutes and Miscellaneous ...	...	667	...	294	...	250	1,089	...	2,300	Total
Grand Total ..	...	*6,555	1,173	2,877	960	758	3,642	910	15,965	

NOTES.

- A. "Raw Materials" represents total quantities put through refineries, including Casinghead Gasoline.
- B. The Motor and Aviation Lubricants may be considered as wholly Aviation grade.
- C. Whereas it is considered there is a possible production of 1½ million tons, output is at present restricted to these figures.
- D. Includes 200,000 tons of Casinghead Gasoline.
- E. After deduction from output capacities on account of adverse factors due to wartime conditions.

- F. Includes 400,000 tons from Leuna.
- G. It is assumed that any surplus hydrocarbon gases are not utilised.
- H. Producer and Town Gas has been deducted from consumption estimates, therefore not shown in this table.
- I. There is a large potential production; this figure represents estimated consumption.
- K. Could be raised to Aviation quality by the Voltol and Elektrion processes.

APPENDIX.

TABLE II.—OIL PRODUCTION IN AXIS EUROPEAN COUNTRIES.

Estimated Annual Rate of Production for First Six Months of 1944 (in Thousands of Metric Tons).

The yields shown in terms of Finished Products are arbitrary as the breakdown is dependent on changing requirements.

Source Groups.	Raw Materials. A	Aviation and Motor Petrol.	Kerosine.	Gas/ Diesel Oil.	Aviation and Motor Lubri- cants.	Other Lubri- cants.	Fuel Oils.	Asphalt and Wax, Loss and Refinery Fuel.	Total Finished Products.	Key.
1. Hanover—										1
(a) Nienhagen } ...	440	44	70	80	66 B	66	26	88	352	1 (a)
(b) Eichlingen } ...	120	12	20	21	18 B	18	7	24	96	1 (b)
(c) Other fields ...	100	6	...	30	25 B	8	11	20	80	2 (c)
2. Reitbrook ...	45	2	...	14	11	4	4	10	35	3
3. Heide ...	50	2	...	16	13	4	5	10	40	4
4. Meldorf ...	12	2	2	2	2	...	2	2	10	5
5. Rhine Valley ...	100	15	15	25	10	10	5	20	80	6
6. Small or unknown German fields	2	2	...	...	...	...	...	...	2	...
Natural Gasoline ...	2,019	60	...	760	560	280	40	319	1,700	7
7. Austria ...	30	2	...	10	9	5	1	3	27	8
8. Czechoslovakia ...	400	88	84	108	34	34	12	40	360	9
9. Poland... ...	85	10	15	15	6	9	25	5	80	10
10. France... ...	1,000 C	320	240	75	35	100	130	100	900	11
11. Hungary ...	50	15	10	5	...	10	6	4	46	12
12. Yugoslavia ...	4,090 D	1,080	585	470	30	50	1,635	240	3,850	13
13. Roumania ...	142	14	14	...	...	...	114	...	142	14
14. Estonian Shale ...	15	2	2	...	...	...	11	...	15	15
15. France: Shale ...										
Total from Crude and Shale Oils ...	8,700	1,676	1,057	1,631	819	598	2,034	885	7,815	Total

Source Groups.	Raw Materials.	Aviation and Motor Petrol.	Kerosine.	Gas/Diesel Oil.	Aviation and Motor Lubri-cants.	Other Lubri-cants.	Fuel Oils.	Asphalt and Wax, Loss and Refinery Fuel.	Total Finished Products.	Key.
16. Synthetic Oils—										
Bergius Plants—									1,620 E	16(a)
(a) Bit. Coal, H. T. Tar and Pitch ...	1,820	1,020	...	...	...	...	...	...	2,138 E	16(b)
(b) Brown Coal and Brown Coal Tar ...	2,037	956	...	827	355	...	...	...
(c) Hydrocarbon Gases—									100	16(c)(i)
(i) C ₃ ... ..	...	100 F	...	...	...	...	...	...	450	16(c)(ii)
(ii) C ₄ ... ..	...	450 F	...	...	...	...	...	...	1,235 E	17
17. Synthetic Oil : Fisher-Tropsch Plants ...	1,300	850	30	300	18	...	37	65	300	18
18. Unknown Plants ... ..	...	300	...	...	...	...	...	...
Total from Synthetic Oil Plants ...	...	4,276	30	1,127	373	...	37	65	5,843	Total
19. Substitute Fuels (see Note G)—										
(a) H. T. Tars	3,150	32	...	94	...	...	819	...	945	19(a)
(b) L. T. Tars—										
(i) Bituminous Coal	200	10	...	10	...	...	100	...	120	19(b)(i)
(ii) Brown Coal	500	75	...	190	...	...	170	...	435	19(b)(ii)
(c) Benzol... ..	...	450	...	...	...	...	...	...	450	19(c)
(d) Ethanol ... ..	...	100 H	...	...	...	...	...	...	100	19(d)
20. Vegetable Oils as Lubricants ... ..	...	...	...	...	...	25 K	...	...	25	20
21. Lubricating Oils regenerated ... ..	...	...	...	...	...	200	...	...	200	21
22. France : Anthracine Oil ... ..	...	...	...	...	...	25	...	...	25	22
Total Substitutes and Miscellaneous ...	...	667	...	294	...	250	1,089	...	2,300	Total
Grand Total ... ..	...	6,619	1,087	3,052	1,192	848	3,160	950	15,958	

NOTES.

- A. "Raw Materials" represents total quantities put through refineries, including Casinghead Gasoline.
- B. The Motor and Aviation Lubricants may be considered as wholly Aviation grade.
- C. Whereas it is considered that there is a possible production of 1½-1¾ million tons, output is at present probably restricted to 1 million tons.
- D. Annual rate for first four months estimated at 4,905,000 tons. Production during May and June assumed to be cut by 50 per cent. Includes 150,000 tons Casinghead Gasoline.

- E. After deduction from output capacity on account of adverse factors due to wartime conditions.
- F. It is assumed that any surplus hydrocarbon gases are not utilised.
- G. Producer and Town Gas has been deducted from consumption estimates, therefore they are not shown in this table.
- H. There is a large potential production of alcohols ; the figure represents estimated consumption.
- K. Could be raised to Aviation quality by the Voltol and Elektrion processes.