

# The Natural Gas Industry in Italy

by

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## 1 - The Foundation of AGIP (Italian General Petroleum Corporation), and the Development of Production.

1. — In 1860 Italy became the third country in the world to start prospecting for oil, having been preceded only by the United States and Roumania. Up till 1926 the prospecting was carried out solely by private companies. In 1926 the Italian Government intervened, and set up a public corporation under the name of *Azienda Generale Italiana Petroli (AGIP)*, which is known in English as the Italian General Petroleum Corporation. The new institution was authorised, in competition with the private companies, to engage in « all activities relating to the oil products industry and trade » (1). AGIP however was not empowered to prospect *directly* for new wells, or to exploit them. The Government had reserved this last activity to itself, although in practice it exercised it *through* AGIP. The practice was at first for AGIP to carry on the mineral activity « for account of the Government », which provided funds for this purpose and had exclusive right to the products. More precisely, the mineral activities were carried on by a special section of AGIP, called « AGIP-Mineraria » (AGIP Minerals) or « AGIP-Ricerca » (AGIP Prospecting), which keeps its own accounts and is separately managed.

(1) AGIP, which was established by Royal Decree No. 516 of 3rd April, 1926, became one of the Governments's so-called « economic participations ». For a classified list of such participations see G. Cosmo, *State Participation in Business Concerns in Italy*, Vol. IV of this Review, October-December, 1951, pp. 202 ff. It may be mentioned here that the fundamental characteristic of the « economic participations » is the exercise of a business activity by the State through a body having independent legal standing, in the form of either a public corporation or a joint stock company.

This was the state of affairs which existed until 1945. In that year the « mining section » changed its set-up, operating no longer for account of the Government but for « its own account ». The Government ceased to make any contribution to its funds, while the proceeds of production became in law the property of the Section. The practical effect of the new system was to oblige the « mining section » to cover its needs out of its own resources, whereas previously the Government had always authorised the Section to employ the entire proceeds of its output in new prospecting, and had in addition made sundry grants to it *à fonds perdu* (2).

From 1926 until the outbreak of the second world war the work of prospecting for oil products and natural gas continued on a larger scale than before, although it cannot be said that any spectacular results were obtained.

The position changed in 1944 when the first large gas-field was found in the neighbourhood of Lodi in the province of Milan. After a relatively blank period further discoveries were made in 1948; and others followed with growing frequency during the next few years. The Ravenna field, which was found in 1952, is perhaps the largest in Europe, and its position suggests that a number of other structures located just to the west of it are also gas-bearing. The Italian subsoil, which is in general so poor in natural resources, has revealed an unsuspected abundance of natural gases, and more particularly of methane. It has done so on such a scale as to change appreciably, and perhaps fundamentally, the prospects and the possibilities of Italian industrial development.

(2) See pag. 122 below.

A point which needs to be emphasised is that virtually all the gas-fields in question are

in relation to all the other companies engaged in similar activities. For instance:

TABLE I  
ITALIAN PRODUCTION OF OIL, GASOLINE  
AND NATURAL GAS

Period	Oil and Gasoline (m. tons)		Natural Gas (Thousands of c. metres)	
	AGIP	All concerns	AGIP	All concerns
1948 - Annual prod.	2,511	9,208	28,117	135,810
1949 - " "	3,630	9,218	109,580	253,000
1950 - " "	5,078	8,170	305,699	521,521
1951 - " "	17,075	17,596	723,583	971,264
1952 - " "	61,765	63,497	1,179,123	1,441,957

Source: AGIP, Balance Sheet for 1952; M.S.A., Quarterly Statistical Bulletin, Second Quarter 1953.

located in the Po valley, that is to say in the richest and most highly industrialised region of Italy.

A glance at Tables I, II and III will give an idea of the very large growth in output

TABLE II  
RESERVES AND PRODUCTIVE CAPACITY OF OIL,  
GASOLINE AND NATURAL GAS AT 30.6.1952

	Aggregate Production 1860-1951 (All concerns)	Reserves ascertained by AGIP from 1926 to 30.6.'52	Annual Productive Capacity in 1952 (AGIP)
Gasoline and liquid gas (m. tons) . . . . .	15,000	1,000,000	100,000
Oil (m. tons) . . . . .	470,000	1,200,000	120,000
Natural Gas (millions of c. metres) . . . . .	2,300	70,000	3,600

(a) The production of methane gas increased more than tenfold between 1948 and 1952. In the latter year AGIP's production of this gas was 80 per cent of the total for Italy, as against 41 per cent in 1949, and only 21 per cent in 1948 (Table I).

(b) The reserves of gasoline and natural gas of which the existence was ascertained by

TABLE III  
POWER CONSUMED IN ITALY  
(thousands of m. tons of bituminous coal equivalent) (a)

Period (monthly average)	Coal and lignite				Petroleum Products (b)		Electric Power				Hydrocarbides			
	Dome- stic	Import- ed	Total	% of total consum- ption	Import- ed	% of total consum- ption	Dome- stic	Import- ed	Total	% of total consum- ption	Pro- duction	% of total con- sum- ption	Pro- ductive Capa- city	% of total con- sum- ption
1938	120	960	1,080	44.45	371	15.34	879	15	984	40.20	1	0.01	—	—
1947	95	700	795	34.15	420	18.10	1,092	8	1,100	47.32	10	0.43	—	—
1948	92	732	824	33.10	410	17.17	1,202	11	1,213	49.20	13	0.53	—	—
1949	95	751	840	35.40	504	21.20	1,001	11	1,012	42.30	27	1.1	—	—
1950	91	736	827	30.0	565	21.0	1,264	14	1,278	46.70	63	2.3	—	—
1951	95	813	908	27.7	693	21.1	1,539	15	1,554	47.6	116	3.6	—	—
1952	98	830	928	26.4	792	22.5	1,592	18	1,610	45.8	177	5.3	581	17.1

(a) 1 ton of anthracite=1.33 tons of Sulcis and Triassico coal=1.42 tons of « lignite picea »=2.77 tons of xiloid lignite=0.57 tons of petroleum products=1 ton of petroleum coke=1,176.59 Kwh=667 c. metres of natural gas.

(b) Gasoline, kerosene, gasolio, fuel oil and petroleum coke.

which has occurred during recent years, more especially in 1952. The tables also suggest the future possibilities; and they show clearly the leading position which AGIP now occupies

AGIP alone in the period from 1926 to 1952 substantially exceed the total output of those products obtained in the years 1860 to 1951 inclusive (Table II).

(c) The potential yearly output of natural gas is a good deal greater than the actual output. Thus in 1952 the potential output was estimated at 3,600 million cubic metres, as compared with actual output of 1,179 million cubic metres (Tables I and II). The only thing which kept production down was the inadequacy of the gas pipe lines.

(d) In 1952 the quantity of methane consumed was no more than 5.3 per cent of the total sources of power used, although the potential output of methane was 17 per cent of that total (Table III).

2. — There are a number of facts which show the importance for Italy of the production of hydrocarbons (3), the value of which already bids fair to exceed that of the output of all other minerals in Italy. The following are among the principal points for consideration.

(a) In the first place Italy suffers from a shortage of sources of power, which places her in a position clearly inferior to that of other industrial countries. It is true that in normal times both solid and liquid fuels can be bought on the world market; but their high price, and the need to pay in scarce foreign exchange, prevent the buying of large amounts. The result is a great difference between the amount of power available in Italy and that in the other countries, as shown by Table IV.

According to estimates based on the E.C.E. study used in Table IV, the following amounts of power were available per head of population in the year 1950, the amounts being expressed in kilogrammes of bituminous coal: Italy 683, Czechoslovakia 2,675 (in 1949), Denmark

(3) « The Italian gas-reservoirs include: (a) dry-gas reservoirs like Cornigliano and Bordolano fields: they contain almost pure methane and from 1 to 1.5 percentage of N<sub>2</sub>; no higher hydrocarbons content; (b) wet-gas reservoirs like Caviaga and Ripalta fields; they contain liquid hydrocarbons at the state of vapour, which the separators turn out as gasoline; (c) condensate gas and oil reservoirs, like Cortemaggiore field: in this fields was found on oil sand underlying a condensate gas sand. Thus the Cortemaggiore field produces wet gas, gasoline and crude oil, according to the meaning now commonly assigned to these three terms in the oil prospecting industry ». See R. FABIANI, *Petrolio e metano* (Rome, 1952), p. 157. In the Polesine deposits near the mouth of the Po, and as a general rule wherever the deposits are shallow, the methane emerges together with water.

2,232, France 2,301, Switzerland 2,340, Sweden 3,457, Belgium-Luxemburg 3,566, Great Britain 4,689 and Norway 4,696. Only Spain (with 625) had less power available per head than Italy. Clearly the Italian poverty in sources of power is a handicap in all branches of the country's activity, acting as a drag on the mechanisation of agriculture as well as on the development of industries.

TABLE IV  
CALORIFIC AND MOTOR POWER CONSUMED  
IN SOME COUNTRIES IN 1949

Countries	Total (millions of mil- liards of calories)	Per inha- bitant (mil- liards of calories)
Poland . . . . .	116	5
Belgium and Luxemburg . . . . .	74	8
Western Germany . . . . .	281	6
United Kingdom . . . . .	463	10
Holland . . . . .	45	5
France and Saar . . . . .	228	5
Ireland . . . . .	11	4
Denmark . . . . .	19	5
Austria . . . . .	23	3
Italy . . . . .	57	1
Portugal . . . . .	7	1
Sweden . . . . .	42	6
Switzerland . . . . .	14	3
Norway . . . . .	20	6
Finland . . . . .	20	5
Total Europe (URSS excluded)	1,775	4
U.S.A. . . . .	5,000	34

Source: E.C.E., *Etude sur la situation économique de l'Europe en 1951*, Geneve, 1952, p. 171.

(b) The smallness of the number of calories available for industry in Italy has a serious effect on our balance of trade. As will be seen from Table V, in 1950 the value of our net imports of sources of power exceeded by 83 per cent the deficit on current account in the balance of payments; and in 1951 it did so by 36 per cent. Even in 1952, notwithstanding the crisis which affected our foreign trade relations, the net imports of sources of power made up fully 53 per cent of the total deficit. It is therefore safe to say that, if means could be found to dispense with fuel imports, or at least substantially to reduce them, we should be well on the way towards a

satisfactory solution of the problem presented by the chronic deficit in our balance of payments on current account (4).

TABLE V  
IMPORTS OF POWER SUPPLIES AND TRADE BALANCE  
OF ITALY  
(milliards of lire)

	1950	1951	1952
1. Imports of power supplies -			
Total . . . . .	150.39	266.08	271.18
— pit - coal . . . . .	79.29	139.75	118.—
— coke . . . . .	0.75	0.62	0.47
— raw mineral oil and by products of refineries . . . . .	69.36	124.16	151.62
— gasoline . . . . .	0.86	1.55	1.09
— petroleum . . . . .	0.13	—	—
— fuel woods (net) . . . . .	1.73	1.83	2.—
2. Exports of power supplies -			
Total . . . . .	13.63	45.66	60.29
— pit - coal . . . . .	0.15	0.04	0.06
— coke . . . . .	0.73	0.30	4.96
— raw mineral oils and by products of refineries . . . . .	5.69	30.48	31.28
— gasoline . . . . .	4.97	11.39	17.83
— petroleum . . . . .	2.09	3.45	6.16
3. Net imports of power supplies (difference between 1 and 2) . . . . .	138.49	220.42	210.89
4. Total imports (cif) . . . . .	900.3	1,354.5	1,445.8
5. Deficit of the trade balance . . . . .	153.4	325.1	581.6
6. Deficit of current items of the balance of payments (Bank of Italy's estimates) . . . . .	75.4	166.7	393.8
7. Per cent ratio of net imports of power supplies to the deficit of the trade balance . . . . .	90.0	69.6	36.13
8. Per cent ratio of net imports of power supplies to the deficit of the balance of payments . . . . .	183.0	135.9	53.55

(c) On a basis of equal costs methane is the most efficient fuel which can be obtained on an industrial scale; in fact, many countries which have much more coal and oil than Italy make very wide use of it. In 1949 for instance, when natural gas was providing only 1 per cent of the calories consumed in Italy, the amount of natural gas distributed to consumers in the United States represented

(4) For an account of recent developments in Italy's foreign trade position see G. PIETRANERA, *The Crisis in the Italian Balance of Trade*, No. 24 of this Review (January-March, 1953), pp. 44 ff.

25 per cent of the total power consumed, as compared with 26 per cent for coal, 45 per cent for liquid fuels, and only 1 per cent for hydro-electric power. During the next few years there was a continuous rise in the proportion of natural gas among the various sources of power. In 1952 the production of natural gas in the United States was about 250 milliard cubic metres. In terms of heating power this is equivalent to some 375 million tons of coal, which is more than 40 times the annual amount of coal used in the entire economy of Italy.

(d) Methane gas is not only a valued source of industrial calories, but it lends itself to many chemical uses in the production of nitrogenous fertilisers (5), synthetic resin (6), synthetic rubber (7), acetylene (8), synthetic petrol (9), lamp black, raw materials for rayon and nylon, textile fibres (10), soaps, detergents, oleons, paraffines, etc.

It can safely be said that methane gas now takes the place reserved till a few years

(5) To realise the vast possibilities opened up by the use of natural gas in this field, we need only remember that in the U.S.A. the annual output of ammonia amounted in 1939 to 300,000 tons, of which only 3% was obtained from natural gas. Today the output has increased fivefold, and half of it is obtained from methane gas. It is expected that by 1955 the annual output of synthetic ammonia will rise to 1,800,000 tons, of which at least 70% will be obtained from natural gas. In Italy, although the price of natural gas is higher than in the U.S.A., and although the production is only now beginning, yet when some of the works now being erected begin operating, the output of ammonia obtained from natural gas will exceed 100,000 tons per annum and will feed an important export trade (G. FAUSER, *Il Metano, materia per le grandi sintesi chimiche*, in « *Metano* », May, 1952, p. 150).

(6) In the U.S.A. some 700,000 tons of these resins are now produced annually valued at 600 billion lire (G. FAUSER, *op. cit.*, p. 151).

(7) A few years ago synthetic rubber was considered as a product for replacing natural rubber, now it meets essential technological and industrial needs. It may be considered qualitatively superior to the natural product. In 1951 no less than 850,000 tons of synthetic rubber were produced in the United States (G. FAUSER, *op. cit.*, p. 154).

(8) See G. FAUSER, *op. cit.*, p. 152.

(9) « In the U.S.A. a system for obtaining synthetic carburants from natural gas is now being tried out. The « Carthage Hydrocol Company » has erected a plant in Texas for producing 9,000 quintals of petrol and 1,900 quintals of alcohol and other chemical by-products » (G. FAUSER, *op. cit.*, p. 151).

(10) *Orlon* is a fibre possessing chemical and physical features superior to those of all the other synthetic fibres so far known, while its appearance approaches more closely to that of silk. In American the production of *Orlon* on a vast scale has already begun, and it is expected that in the near future it will rival in volume the output of *Viscosa*.

ago to coal, and may be considered as the leading raw material for great chemical syntheses. According to the illustrious chemist and experimenter G. Fauser (11), of the world output of organic synthetic chemical products, amounting to 16 million tons, some 10 million come from America, and no less than 70% of these are obtained from hydro-carbides.

(e) A further fact which makes the hydrocarbons industry especially important, is that, besides supplying a technically satisfactory fuel in such quantity as to save much foreign exchange, it provides the cheapest source of power available to us, as well as the raw material for the main synthetic processes in the chemical industry. In fact methane, even at present prices and without taking any account of the advantages offered by its use as compared with that of other fuels,

that this price is still considerably above its cost as variously calculated. Some technicians say (12) that the gas can be produced at well-head at a price of not much more than 50 to 60 cents of lira per cubic metre. According to others (13), if AGIP were to sell its gas at a price of 2 lire per cubic metre, it could easily meet all its financial charges, including depreciation, operating costs, costs of further prospecting, of building pipe lines and so forth. Still others (14) calculate that the « fair » price for methane is from 6 to 8 lire per cubic metre.

## II - The Production Cost of Methane.

3. — In order to establish with reasonable accuracy what methane costs, we have made some inquiries with a view to directly calculat-

PRICES OF METHANE, FUEL OIL AND BITUMINOUS COAL (a)

TABLE VI

Period	Methane Lire per c. metre	Fuel oil Lire per Kg.	Bituminous coal Lire per Kg.	Lower % price of methane in respect of —	
				Fuel oil	Bituminous Coal
1950 - March . . . . .	15.17	17.75	13.75	—	26.47
June . . . . .	12.70	15.60	13.50	4.81	37.25
September . . . . .	12.08	15.50	14.80	8.84	45.60
December . . . . .	12.92	18.55	15.50	18.54	44.45
1951 - March . . . . .	13.45	22.70	19.62	30.70	54.28
June . . . . .	13.98	20.55	21.—	20.44	55.61
September . . . . .	14.31	19.50	21.—	14.15	54.57
December . . . . .	14.29	19.60	19.80	14.75	51.86
1952 - March . . . . .	14.03	19.15	17.65	14.31	47.02
June . . . . .	12.99	18.30	18.—	16.93	51.86
September . . . . .	11.93	16.65	16.90	16.15	52.91
December . . . . .	10.91	16.50	16.60	22.63	56.16
1953 - March . . . . .	10.60	15.70	16.—	20.99	55.81
June . . . . .	9.01	13.30	15.70	20.70	61.72

(a) 1 Kg. of bituminous coal = Kg. 0.57 of fuel oil = c. metres 0.667 of methane.

Source: AGIP, and weekly bulletins of the Chamber of Commerce of Milan.

permits an overall average saving of 60 per cent as compared with coal, and one 20 per cent as compared with fuel oil (see *Table VI*).

There has recently been a heavy fall in the price of methane. In June 1953 it fell to nine lire per cubic metre as against 12.99 lire in June 1952. It is however generally admitted

(11) G. FAUSER, *op. cit.*, p. 148.

ing the cost of methane as produced by AGIP. We shall examine the matter under two heads. First we shall take the expenses which AGIP

(12) C. CARMINATI, *La politica degli idrocarburi in Italia*, in « *Il problema degli idrocarburi in Italia* » (Milan Automobile Club, 1951), p. 7.

(13) A. CAVINATO, *Gli usi del metano*, in « *Il Metano* » (Accademia Nazionale dei Lincei), No. 25, 1951.

(14) U. BOLDINI, *Il Metano* (Cya Editore, Florence, 1952), p. 462.

has borne from the date of its foundation until 30th June, 1952, this being the latest date up to which figures are available, in connection with exploration and drilling (expenditures on geological and geophysical studies, and on drilling wild-cats). Secondly we shall deal with the operating expenses entailed in exploitation and in products transportation.

#### A) Expenditures on exploration and drilling.

There are some different points of views as to the total cost of exploration carried out by AGIP from the date of its foundation until 30th June, 1952. Any calculation must be approximate; but we may attempt one on the following lines.

From 1926 to 1945 the Government directly provided, for exploration in Italy and the colonies:

	Millions of current lire
In money . . . . .	288.5
In material and machinery . . . . .	14.5
	<hr/>
	303.0

In addition there were used for these purposes all the proceeds of the output of crude oil, gas oil, methane and sundry other products, proceeds amounting between 1926 and 1945 to about 69 million current lire.

Thus the total amount spent by « AGIP-Ricerche » (AGIP Prospecting) from the time of its formation until 30th June, 1945 was 372 million lire (303 + 69). Of this amount a part was invested in fixed assets and materials; part was employed in oil exploration in Africa; and the rest was spent on geological and geophysical studies and on drilling wells in Italy. From the point of view of our present inquiry it is this last item which is important.

The sum spent on this account has been calculated at 254.8 million (current) lire (see Table VII), of which 30.9 million went on geological and geophysical studies, and 223.9 million on drilling activity. These amounts however are expressed in lire of unequal purchasing power. In order to reduce them to a uniform basis, we have revalued them by ap-

plying the coefficients laid down by law for the revaluation of companies' capital (15). The result is to give a total of 10,718 million present-day lire.

After 30th June, 1945, as already mentioned, « AGIP mining section » ceased to be managed for account of the Government. The latter therefore provided no further funds for the Section, which continued its activities on the basis solely of the sales proceeds of its products. From 30th June, 1945 to 30th June, 1952, the sum spent on geological and geophysical studies, on wild-cats and exploitation wells, amounted to L. 20,945 million. The lire in this case are of constant value, except those which were spent between 1st July, 1945 and the end of 1946. These have been revalued at the rates laid down by the aforesaid Law No. 74, the result being to increase the figure of L. 20,945 million to L. 20,974 million.

Taken in all, therefore, the expenditure entailed in exploration and discovery of reservoirs up to 1st July, 1952, is L. 10,718 + 20,974 = L. 31,692 million. To this must

(15) For practical purposes the depreciation of the lira began in the first world war, and continued with alternating movements until 1947. It set Italian companies the problem of adjusting their capital to the changing value of money. This process was made the subject of legal regulations, which from time to time laid down the maximum extent of revaluation permitted as well as the method of revaluation. See G. MANCINI, *Aspects and Problems of the Italian Stock Market*, in No. 5 of this Review (April, 1948), pp. 321 ff.

The last of these regulations was embodied in Law No. 74 of 11th February, 1952. This raised to 40 the maximum revaluation coefficient allowed for balance sheets drawn up in 1938 lire, as follows:

Year of investment	Revaluation coefficients
1938 . . . . .	40
1939 . . . . .	38
1940 . . . . .	33
1941 . . . . .	29
1942 . . . . .	26
1943 . . . . .	17
1944 { (for capital invested north the « Gothic Line ») . . . . .	17
{ (for capital invested south the « Gothic Line ») . . . . .	8.50
1945 . . . . .	3.60
1946 . . . . .	1.80
1947 . . . . .	1
1948 . . . . .	1
1949 . . . . .	1

Thus the revaluation coefficients fixed are now in close accordance with the extent of the depreciation of the lira as shown by the wholesale price index, which in 1952 was 52.70 on the basis of 1938=1.

be added L. 3,078 million employed in the Cortemaggiore natural gasoline plant, making a total of L. 34,770 million (see Table VII).

TABLE VII  
COST OF AGIP RESEARCHES FROM THE DATE  
OF INCORPORATION (1926) TO 30.6.52

	millions of:	
	Current Lire	Revalued Lire (a)
I. - Until 30.6.45: — Cost of geological and — geophysical studies and — research works . . . . .	254.8	10,718
II. - From 30.6.45 to 30.6.52: — Cost of geological and — geophysical studies and — research works . . . . .	20,945.0	20,974
III. - Expenditures for the Cortemaggiore establishment . . . . .	3,078.0	3,078
IV. - Total (I+II+III) . . . . .	24,277.0	34,770

(a) According to the Law for monetary revaluation (Law No. 74, February 11, 1952). See p. 122, note (15).

Against this cost must be set the result of the exploration: that is to say, the discovery of at least 70 milliard cubic metres of methane, about 1 million tons of condensates (gasoline, liquid gases and distillation residues), as well as a quantity of oil which cannot yet be precisely stated, but which may be estimated to be at least 1.2 million tons.

We now have to find the cost of the methane — a typical case of production at joint costs. As methane is obtained together with other products of known value, as they have a world market, we shall first calculate the present value of the production of gasoline, liquid gases and oil, assuming the current prices per ton of L. 33,000 (\$ 52.80), L. 50,000 (\$ 79.80) and L. 14,000 (\$ 22.20). The result (see Table VIII) is to show total proceeds of L. 13,358 million for the gasoline, L. 15,824 million for the liquid gases and L. 11,400 million for the oil.

The grand total is thus L. 40,222 million in present-day lire. As will be remembered, the expenditure entailed in obtaining these products has already been calculated at lire 34,770 million (in present-day lire).

Thus we may say that the expenses entailed in discovering the known reserves of hydrocarbons are covered by the proceeds, at the

TABLE VIII  
AGGREGATE RETURN ESTIMATED FOR THE PRESENT  
RESERVES OF GASOLINE LIQUID GAS AND PEROLEUM

	Annual Production (tons.)	Price (Lire per ton)	Annual return (mil- lions of lire)	Aggregate return for 10 years (present value discount- ed at 6% - mil- lions of lire)
	1	2	3	4
Gasoline . . . . .	55,000	33,000	1,815	13,358
Liquid gas . . . . .	43,000	50,000	2,150	15,824
Oil . . . . .	120,000	14,000	1,680	11,040
Total				40,222

current prices, of the petroleum and other liquid products alone. It follows that in calculating the cost of the methane we may neglect the expenditure on exploration and discovery of reservoirs, because that expenditure may be entirely charged against the oil and other liquid products.

#### B) Operating expenses.

In order to arrive at the cost of the methane to the consumer it will thus be sufficient to calculate the operating expenses, comprising those involved in fields exploitation, as well as in maintaining the gas pipe lines and covering their depreciation. We may attempt this calculation as follows.

(a) Expenses for fields exploitation. — From 1st July, 1951, to 30th June, 1952, the sum spent was L. 532 million, while the average daily output was about 4 million cubic metres. If it were true — which it is not — that this expenditure would rise in direct proportion to any increase in output, then it would be necessary to spend L. 1,600 million in order to produce 12 million cubic metres per day. If we add L. 1,000 million a year to cover contingencies and the drilling of new wells, we reach a total of L. 2,600 million; and this, if we assume an average

yearly output of 3,600 million cubic metres, works out at around L. 0.70 per cubic metre (16).

(b) *Depreciation of gas pipe lines.* — The calculations of this item are inevitably even rougher. We may however attempt an estimate by induction. The cost of the methane pipe lines and accessories in use up to 1951 inclusive may be put at L. 18 milliard; those built in 1952 at L. 12.8 milliard; and those to be constructed in 1953 at L. 17 milliard. By the end of that year the *maximum* daily capacity of the network will be about 20 million cubic metres, and its average capacity some 12 million.

If we assume that it is desired to write off the whole installation in ten years, and if we put the average daily yield at 12 million cubic metres, then, assuming an interest rate of 7½ per cent, the average cost of depreciation on the pipe lines would be around L. 1.93 per cubic metre.

According to AGIP, on the other hand, depreciation charges at present amount to L. 1.80 per cubic metre, but will in the future rise to L. 3.10 per cubic metre. This estimate by AGIP seems to us too high. It is based on the assumption that the «secondary network» is to be written off in five years; this however is contrary to the practice which is generally followed, even in countries like the United States, where amortisation is in general more rapid than here. It also seems likely that AGIP has assumed interest rates higher than those at which the required capital sums can in fact be obtained from the Government or other sources. However, even though we consider that the allowance of L. 1.93 per cubic metre for the cost of depreciation on the pipe lines and accessories is adequate, let us raise it by 25 per cent to the level of L. 2.40 per cubic metre. This should cover any further charges which may arise from the safety regulations that are about to be applied, as well as from the need to tie into the main pipe network those deposits which have been most recently discovered.

(c) *Maintenance of gas pipe lines.* — The figures provided by AGIP indicate that the

(16) This figure of 3,600 million cubic metres represents the potential output for 1952 (see Table III).

costs of operation and maintenance are at present L. 0.70 per cubic metre, but may be expected to rise in the near future to L. 0.90.

While allowing for the roughness of these calculations we think it reasonable to conclude, referring to the actual stage of exploration, that the methane at well-head is costing AGIP not more than L. 0.70, to which we must add L. 2.40 + 0.90 = L. 3.30 in order to arrive at the cost of the methane delivered to consumers. Even if we admit that temporary or unforeseen circumstances may cause the cost of transport to be greater than we have calculated, since our estimate of the cost at well-head is on the high side, it seems to us that the average cost of the methane to the user ought not to be more than 4 lire per cubic metre. The essential elements in this calculation are as follows:

	Lire per cubic metre
Cost of exploiting wells . . . . .	0.70
Depreciation of pipe lines . . . . .	2.40
Working and maintenance of pipe lines . . . . .	0.90
Cost of methane delivered to consumers	4.00

As will be seen, there can be no doubt that methane is the most economical source of power in Italy. The importance of that fact is inescapable if one bears in mind how essential it is in a modern economy to have cheap sources of power available. If the gas is sold to consumers at 4 lire per cubic metre, this would be equivalent in effect to giving them coal at L. 2,700 per ton instead of its present price of L. 17,000, or fuel oil at L. 4,600 instead of the present L. 12,500. This moreover takes no account of the technical advantages which the use of methane offers as compared with the employment of other fuels.

### III - The Arguments for and against Private Enterprise in the Hydrocarbons Industry.

4. — The discovery of large quantities of hydrocarbons confronted the Italian Government with the problem of what course to adopt in connection with exploration, as well as with their exploitation and sale. Four types of organisation have been discussed.

First, there was the solution of *purely private enterprise*, under which all prospecting,

operation and sales would be reserved only to private companies. That solution would require, amongst other things, that AGIP should be liquidated, and that all the Government's participations in this industry should be sold to private interests.

The second solution was that of a *Government corporation operating in competition with private enterprises*. The Government corporation would compete with private companies who could freely operate in exploration and exploitation anywhere in Italy. In particular, private companies would be granted the permits which were requested in such large numbers after AGIP's discoveries, but have not been granted, or at least not in the Po Valley.

The third solution was a *Government monopoly in certain areas*, while in others the Government corporation might operate in competition with private enterprise.

The final solution proposed was *complete nationalisation*. The advocates of this solution urged that «exploration for hydrocarbons which exist in the subsoil of Italy, as well as the exploitation of such deposits and transportation of the products by oil and methane gas pipe lines, should be reserved to the Government, while all present concessions and licences should be cancelled».

After lengthy discussions the Italian parliament adopted the Government's view and decided on the third solution: that is to say, a Government monopoly in the Po Valley, while in other parts of Italy the Government may operate in competition with private enterprise (17).

What then were the grounds on which our authorities and parliament decided to adopt the third solution? a solution which might seem at first sight to conflict with the economic principles that the Italian Government has followed since the war, and which clearly favours the encouragement of private initiative and the free market economy. An attempt fully to state and analyse the arguments put forward by advocates of the various solutions would carry us too far. We must confine our-

(17) The discussion took place in connection with the setting up of the «Ente Nazionale Idrocarburi», or ENI (National Hydrocarbons Corporation). See also Section IV, p. 128, below.

selves here to summing up the main points in broad outline.

The first point to bring out is that the case for pure private enterprise found very few supporters. In general, even the «ultra-liberalists» admitted the advantage of having the Government corporation competing with private companies. This attitude is due to the fact, which is now generally recognized, that private initiative in Italy contributed very little indeed to the exploration for oil and gas (18), while on the other hand AGIP was very active and efficient, and has the merit of having discovered the big deposits in the Po Valley. Although the private prospectors received bonuses and various facilities from the Government, and although they employed capital funds which, according to Prof. Jannaccone (19), exceeded in total amount those used by AGIP, the results of all their activities in the course of nearly a century are nowhere near comparable with those which AGIP achieved in a decade or so. Whatever else this difference in results may indicate, it does seem to us to show that, unless adequate technical and financial resources are employed, the cost of any result will be exceedingly high.

At the other extreme the case for complete nationalisation also received small support.

In practice therefore the two solutions between which the decision lay were the second and the third: that is, it lay between a Government corporation operating in competition with private enterprise on the one hand, and, on the other, Government monopoly in certain areas.

5. — The grounds on which our authorities and parliament decided to reject the second solution and to adopt the third can certainly not be regarded as a token of a spirit of «dirigisme». In order to understand these grounds

(18) On this point Minister Vanoni said in the Senate on 20th January, 1953: «If we look back we see how little the private prospectors in fact achieved at a time when they not only had freedom of action, but were in addition encouraged by the Government. The unfortunate truth is that in this field the representatives of private initiative showed extreme torpidity every time they were faced with a problem which was difficult to solve. That incidentally is also our current experience in Sicily».

(19) P. JANNACCONI, *Il regime per la ricerca e lo sfruttamento degli idrocarburi*, in «Studi Economici», March-June, 1950, p. 208.

thoroughly one must bear in mind the special factors affecting the hydrocarbons industry, in particular the fact that it is gathered in the Po Valley, which is the richest and most highly industrialised part of Italy. One also has to remember the special features of the Italian economy, including as it does a depressed and backward Southern region, which our authorities are trying at the cost of great effort to bring up to the level of the rest of the country.

The supporters of the third solution, namely Government monopoly in certain areas, particularly emphasised the danger of private monopolies. The fact is that the large amount of capital required for exploration activity reduces the possible prospectors to a very small number. In the light of experience in the distant and recent past, it was highly probable that this situation would lead to the formation of private monopolies, with all the attendant disadvantages as regards both the effect on prices and the development of production.

There are of course few private groups in Italy which have the economic and technical resources that would be required if they were to take up concessions in this field and achieve useful results; and it would certainly be extremely difficult to prevent these groups from reaching agreements aimed at obtaining monopoly profits and regulating output according to criteria that would be difficult to justify on grounds of the national interest. It may be added that the largest Italian companies, which did apply for prospecting permits, are also interested in the production and sale of electric power. Evidently, one cannot expect such companies to sell hydrocarbons at prices approximating their costs, thereby making methane the most economical source of power, and allowing newcomers to produce electricity at prices below those charged by them or their group.

It is even less conceivable that any foreign companies which might be admitted would follow a price policy tending to make Italian hydrocarbons cheaper than the liquid or solid fuels which those companies themselves export on a large scale to Italy.

As against this it was urged that the existence of a great Government corporation would open the way towards the lowering of prices.

It must however be remembered that competition in this industry cannot at best be more than highly imperfect, and that it is therefore likely to lead to agreements allowing more or less liberty of action to individual producers.

However, even if it be assumed that no private monopolies would have been formed, the effect of private initiative would have been to create a situation not in accordance with the interests of the country's economy as a whole. Let us make the improbable assumption that there would have been keen and effective competition, such as to bring the selling price of the methane very close to its cost of production. The only people to gain benefit from this would have been companies close to the methane pipe lines, which means in practice only those in Northern Italy. The Government could not remain indifferent to the possibility of creating, in the very part of the country which is richest, large supplies of power at a very low price, when its entire general policy is directed to improving the depressed conditions which exist in the South and in the mountains. Nor could the Government forgo the opportunity to adjust prices in a way which should tend to level up the starting conditions for all business units, whether located in the Po Valley or in the poorer areas in the islands and the South (20).

6. — There was also a further consideration in favour of the solution on the lines of at least partial public ownership. This was the necessity of establishing with all possible speed the extent of the reserves of hydrocarbons, so that an appropriate policy in regard to their exploitation and prices might be laid down. Indeed, in regard to both working and prices the course to be followed will need to be completely different according to whether the reserves are found to be relatively small or abundant.

(a) The first possibility is that the reserves are only of such size that it will be possible, for a number of years sufficient for complete amortisation of the plant and equipment used, to provide a substitute for almost all the foreign

(20) For a statement on these lines readers are referred to what was said by Signor Vanoni, the Minister of Finance, in the Senate on 20th January, 1953.

fuels which are technically capable of replacement at the present level of consumption. This would amount to providing a substitute for about half the foreign fuels imported. In order to achieve that result, with the present level of consumption unchanged, we should have to be able to produce about 18 million cubic metres per day. The maintenance of an output of that order of magnitude for at least 20 years would need 100 milliard cubic metres of reserves. It seems to be already an established fact that sufficient reserves exist for the attainment of that objective.

If the position turns out to be that the output and reserves are not much greater than those just mentioned, methane will have to be confined to those uses which give the highest return, while steps will have to be taken to limit or even discourage its use for purposes for which other resources will serve.

In that case it would not be appropriate to lower the price to the level of the cost. Instead it would be necessary to earn profits through the difference between the price and the cost of production, and to use those profits to pay for more prospecting for vapours of geothermic origin, to utilise our resources in solid fuels which are now little or inadequately exploited for lack of proper equipment, and to study ways of using new forms of power.

If our first assumption were correct, it would of course be a mistake to give too much encouragement to the use of methane in areas to which it would have to be conveyed through long pipe lines at great cost. Instead, if great differences existed between the price of methane and that of other fuels, some kind of national clearing house might be set up so as to make the use of those other fuels more economical.

(b) The second possibility is that reserves of hydrocarbons may be found to exist in Italy in such quantities as to make possible a genuine industrial revolution.

This would imply further explorations leading to substantial results. In that case the cost of methane at well-head could hardly stand far above the level calculated by us. Suppose that reserves of hydrocarbons should be found to exist to the extent of at least 400 milliard cubic metres, so that it would be possible to produce 40 to 50 million cubic metres a day

for 30 years. In that event it would be absurd to build new hydro-electric plants, at the great cost which these entail, or to use raw materials other than methane for the production of nitrates. It would also become advantageous to use methane on a larger scale for driving motor vehicles, especially if success should be achieved, as it well may be, in reducing the present ratio between the weight of the fuel and that of the container.

Should this second possibility be realised, then clearly the price of methane would be bound to move down towards the cost: that is to say, the price would have to be reduced below its present level. If at least 40 to 50 million cubic metres a day of methane were available at a price around 4 to 6 lire per cubic metre, this would permit savings such as would reduce or even eliminate the great handicap which Italy suffers through not disposing of the most important raw materials, or having access to these only at a high price. It must also be remembered that the amount of chemical fertilisers used in Italy is among the lowest in the world; and our farmers would greatly benefit from an adequate supply of cheap nitrate fertilisers, together with power and fuels at prices which would encourage further irrigation and the mechanisation of agriculture, while greatly lowering transport costs. Great increases could then be achieved in the output not only of grain, but also of vegetables, fruit and fodder plants, which last would lead to greater production of meat. As the result of all this there would be considerable savings on some large debit items in the balance of trade, such as those in respect of imports of cereals and meat.

We must however repeat that the choice of the most suitable policy requires action centrally planned in advance, such as can be obtained only in a public authority.

To sum up, the governing considerations were the need to prevent the arising of private monopolies; that of adjusting the price of power in such a way as to reduce the differences between the various areas in the country; and that of regulating prices and consumption in accordance with the size of the reserves. It would seem to be these considerations which caused the balance to tip in favour of the solu-

tion of partial public ownership (21). It was this that gave rise to Law No. 136 of 10th February, 1953, setting up the « *Ente Nazionale Idrocarburi* », or E.N.I.

#### IV - The Establishment of ENI, and the Rearrangement of the Government's Participations in the Hydrocarbons Industry.

7. — For an accurate understanding of the rules which govern E.N.I. one needs to keep in mind that, before this institution was set up, the Government's participations in the oil and hydrocarbons industry were distributed between a large number of corporations.

(a) In the first place there is AGIP, with a capital of L. 2,000 million, of which 60 per cent belongs to the Government, while 40 per cent is equally divided between the « *Istituto Nazionale delle Assicurazioni* » (National Insurance Institute) and the « *Istituto Nazionale della Previdenza Sociale* » (National Social Welfare Institute).

AGIP in its turn controls the following oil corporations: « *Industria e Raffinazione Oli Minerali* », or IROM (Mineral Oil Industry and Refining), owned 51 per cent by AGIP and 49 per cent by the Anglo-Iranian Oil Company; the « *Raffineria Oli Minerali* » (Mineral Oils Refinery), owned 50.01 per cent by the Government and 49.99 per cent by AGIP; the « *Società Nazionale Metanodotti* », or SNAM (National Methane Pipe Lines Company), owned 88 per cent by AGIP and 12 per cent by the Government; and the « *Società Termolet-*

(21) The solution of complete nationalisation was rejected. As already mentioned, the Government monopoly is limited to the valley of the Po, which however is the area where most of the reservoirs so far found are concentrated. As against the advocates of complete nationalisation the Government objected that:

(a) The situation in the Po valley is quite different from that elsewhere in Italy. In the Po valley the finds by AGIP have revealed wealth which it would be unwise to surrender to private interests, thereby giving rise to all the problems already mentioned.

(b) Outside the Po valley there have so far been no large finds, and the methods of prospecting and working have still to be planned and settled. It would be unreasonable to exclude private enterprise from these regions, the more so since the technical and financial resources of ENI will be largely engaged in the Po valley

trica Italiana », or STET (Italian Thermo-Electric Company), in which equal shares are held by AGIP, Montecatini, Edison, Falck, and the Milan Municipal Electric Undertaking.

(b) The Government also has a participation in another large oil concern known as « *Azienda Nazionale Idrogenazione Combustibili* », or ANIC (Fuels Hydrogenation National Corporation), in which 40.6 per cent belongs to the Government and 3.2 per cent to AGIP. ANIC in its turn has an equal participation with Standard Oil of New Jersey in a corporation known as STANIC.

(c) Finally mention should be made of the « *Ente Nazionale Metano* » (Methane National Corporation), which was created by Law No. 1901 of 2nd October, 1940 (22).

The existence of this large number of public corporations belonging to the Government either directly or indirectly naturally led to a certain amount of overlapping of functions and duties. Consequently, once it had been decided not to liquidate all the Government's « economic participations » in favour of private interests, the first problem was how to rationalise all these institutions on systematic and orderly lines, while coordinating all their activities at the national level. With this object in view, *the Government has transferred to E.N.I. all its own participations in the fields of solid and liquid fuels and of gas. E.N.I. thus assumes the form of a holding company*, that is to say, of a financial company controlling all the associated corporations. It will carry out its functions either through corporations which already exist, such as AGIP, SNAM, ANIC and the like, or through others which it may set up.

E.N.I. may also take participations in joint stock companies; may dispose of assets or activities which it does not wish to retain; and may rearrange or reorganise the controlled enterprises in a uniform manner, by branches of economic activity, in such a way as to ensure their efficient working and their coordination with other projects. In short, E.N.I. has been

(22) All these corporations of course have many minority participations in other concerns.

given *carte blanche* to reorganise the Government's participations in oil and hydrocarbons.

8. — It now remains to examine one final point, namely whether E.N.I. has the economic and financial strength required for carrying out the duties which have been assigned to it in connection with exploration, exploitation and transportation of products.

According to an authoritative estimate, the sum required for carrying out the initial work of exploration in those parts of Italy which have not yet been explored ought not to exceed L. 30 milliard (23). Of course, if many reservoirs should be found, the work of determining their nature would be more complex and more costly; but at the same time it would improve the basis required for obtaining the necessary capital.

E.N.I. has capital funds of its own amounting to L. 30 milliard. Of this amount L. 15 milliard consist of claims and property which have been transferred to it by the Govern-

(23) The cost of a reasonably accurate exploration, « on the assumption that it is conducted according to American methods and limited to a first reconnaissance, may be of the order of one milliard lire for each thousand square kilometres ». See M. GORTANI, *Intorno alla nostra politica petrolifera*, a speech delivered in the Senate, and reproduced in « *Metano* », August, 1950, p. 24. The area to be prospected in the plain of the Po is about 40,000 sq. km.; that which has been marked out in Central and Southern Italy and in the islands does not exceed 30,000 sq. km.; and it must be remembered that about 30,000 sq. km. have already been explored and drilled in whole or in part. In view of these facts it is evident that, at a cost of the order of a few tens of milliards, it should be possible to carry out a first reconnaissance, even if on a limited scale, and with the understanding that more thorough exploration and drilling will be afterwards required in order to determine the precise nature of the reservoirs.

ment (24), while the Government also gave it the remaining L. 15 milliard in the form of a contribution in cash. The annual receipts arising from the activities of the controlled corporations and available for self-finance are estimated to amount at present to a further L. 30 milliard. This last figure is however likely to increase rapidly. E.N.I. is of course empowered to issue bonds, on which the redemption and interest service may be guaranteed by the Government. Besides this, E.N.I. has assets which amount in the minerals field alone to some L. 500 milliard.

An idea of the size of these figures may be obtained by comparing them with those found in the balance sheets of Montecatini, Edison and Fiat, the three great Italian industrial companies, the total of which does not reach the level of ENI's. The extent of ENI's resources makes it in fact one of the most powerful Italian financial groups, if not indeed the most powerful of all; and should place it in a position to carry out the tasks which have been entrusted to it under its law of incorporation.

#### (24) Details of Government assets assigned to ENI:

	Millions of lire.
1. Par value of Government's participations in AGIP, ANIC, ROMSA, SNAM, and capital fund of Methane National Corporation . . . . .	4,582
2. ANIC bonds . . . . .	1,600
3. Building formerly the headquarters of the CIP (Comitato Italiano Petroli, i.e. Italian Petroleum Committee), now in liquidation . . . . .	218
4. Estimated value of contribution in the form of the oil prospecting carried out on Italian territory for account of the Government . . . . .	8,600
<b>Total . . . . .</b>	<b>15,000</b>