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Exploitation of the Natural Gas Resources of the Northern Sahara

Report[1]
Committee on Economic Affairs and Development
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1. 1958 - 10th Session - Second part

A. Draft Recommendation

1. The Assembly

2. Considering the substantial prospects of development opened by the creation of the European Economic Community and the setting up of a Free Trade Area;

3. Considering the vital importance of European energy supplies;

4. Considering that in their Report Target for Euratom the Wise Men forecast that for the next twenty years there will be an aggregate power shortage in the countries of the Six corresponding to more than 200 million tons of coal a year;

5. Considering that in the French Northern Sahara there are, apart from petroleum, several hundred thousand million cubic metres of reserves of natural gas which by themselves could each year make good a large part of the above deficit;

6. Considering that, though France can undertake the exploitation of these reserves from her own resources, the problem of distributing this natural gas raises extremely important questions of financing as well as technical, economic and political problems;

7. Recognising the great potential importance of these resources for the development of Africa, which was envisaged by the Consultative Assembly in its Recommendations 158 and 159;

8. Recognising also that such action would be a major contribution to the success of the European Economic Community and the European Economic Association (Free Trade Area).

9. Recommends to the Committee of Ministers

10. that it should invite the European and African Governments most closely concerned to study the possible realisation of a large-scale plan for transporting to and distributing in Africa and Europe the natural gas produced in the Northern Sahara reserves, the , potential of which could by itself make good a large part of the serious shortage of power which it is forecast will obtain in Western Europe and North Africa for the next twenty years.

B. Explanatory Memorandum[2]

1. Energy situation in Western Europe

1. The production of primary energy in Western Europe falls far short of actual needs. The table below shows the production and consumption of all forms of energy in the year 1956 for each of the OEEC countries.

2. Thus, in 1956 the total output of energy amounted to 616 M.T.C.E.[3]as compared with a total consumption of 781 M.T.C.E., the deficit of 165 M.T.C.E. being met by imports of coal (mainly from the United States) and crude oil (mainly from the Middle East).

3. These imports are a very heavy burden on the European economy, and their precariousness makes for a dangerous state of insecurity. The fact is t h a t Europe is no longer self-sufficient in energy.

4. Is this a passing phase or is it likely to persist ? The experts agree that energy requirements will continue to grow. The European countries cannot maintain their economic position in the world and go on raising the standard of living of their peoples without a constant increase in their consumption of energy. In the OEEC countries, total energy requirements are expected to reach 930 to 1,000 M.T.C.E. by 1965 and 1,100 to 1,300 M.T.C.E. by 1975.

5. What resources are available to meet these requirements ? A survey was prepared at the instigation of O.E.E.C. by an Expert Commission presided over by Sir Harold Hartley, and was published in 1956 in the form of a report entitled: Europe's growing needs of energy. How can they be mel ?

6. Oil and natural gas, production of which could be stepped up rapidly, are, unfortunately, scarce in the metropolitan territories of member countries: in 1956 output amounted to 21.5 M.T.C.E., i.e., 3.5 % of the total production of energy.

7. The report recommends the intensification of the search for oil in all countries possessing sedimentary basins but foresees a total output of only 40 M.T.C.E. in 1965 and 50 M.T.C.E. in 1975 for the European territories of the member countries as a whole.

8. There seems little prospect of a substantial increase in coal production, which at present provides 78% of European energy resources, without a prohibitive increase in costs. According to the report it will reach a ceiling of about 500 million metric tons, i.e. 481 million in 1956, 500 million in 1965 and 520 million in 1975.

9. Output of hydro-electric power may rise from 57 M.T.C.E. in 1955 to 80 M.T.C.E. in 1965 and 130 in 1975.

10. Altogether therefore, so far as the conventional forms of energy are concerned, it seems unlikely that the OEEC countries, or at least their metropolitan territories, will be able to produce more than 680 M.T.C.E. by 1965 and 750 M.T.C.E. by 1975. True, we may hope that the new oil or natural gas deposits discovered in the member countries will exceed the estimates of the Hartley Report. But this is unlikely to make very much difference, since Western Europe's prospects in this respect seem somewhat limited.

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2. Supplementary to that given in Document 821, the original motion for a Recommendation tabled by M. Lemaire.
3. Million tons (metric) coal equivalent

PRODUCTION AND CONSUMPTION OF ENERGY IN THE 17 OEEC COUNTRIES IN 1956 Unit = Million metri tons of coal equivalen

	AUSTRIA	DANMARK	GREECE	IRELAND	ISLANDE	NORWAY	PORTUGAL	U.K.	SWEDEN	SWITZERLAND	TURKEY	GERMANY	BELGIUM	FRANCE	ITALY	LUXEMBOURG	THE NETHERLANDS	TOTAL ECSC-EURATOM TOTAL C.E.C.A. - EURATOM	TOTAL O.E.C.E.
PRODUCTION																			
Coal	0,17			0;22		0,39	0,41	225,6	0,29		3,7	152,6	29,6	55,1	1,1		11,8	250,2	481
Lignite	1,9	0,4	0,2								0,6	27,2		0,6	0,1		0,1	28	31,1
Oil	4,4							0,1			0,4	4,6		1,7	0,8		1,4	8,5	13,4
Natural gas	1											0,6		0,4	6		0,1	7,1	8,1
Hydro-electric power	4,8	0,02	0,29	0,37	0,23	13	1,12	1,3	13,2	8,3	0,08	7,02	0,1	14,2	17,2			38,6	81,3
Geothermie energy géothermique															1			1	1
Total	12,3	0,42	0,49	0,59	0,23	13,39	1,53	227,0	13,5	8,3	4,8	192,02	29,7	72	26,2		13,4	333,4	615,9
CONSUMPTION-CONSOMMATION																			
Coal	4,86	5,42	0,23	1,59	0,04	1,56	0,86	216,2	5,70	2,99	3,72	138,34	28,62	76,12	12,29	3,66	18,33	277,36	520,56
Lignite	2,26	0,51	0,25			0,01	0,04		0,06	0,16	0,56	28,19	0,06	0,87	0,15	0,08	0,23	29,58	33,43
Oil	2,82	5,24	2,03	1,86	0,44	3,83	1,46	30,8	12,92	3,72	1,76	16,84	6,68	24,18	15,44	0,21	7,19	70,53	137,37

	AUSTRIA	**DANMARK**	**GREECE**	**IRELAND**	**ISLANDE**	**NORWAY**	**PORTUGAL**	**U.K.**	**SWEDEN**	**SWITZERLAND**	**TURKEY**	**GERMANY**	**BELGIUM**	**FRANCE**	**ITALY**	**LUXEMBOURG**	**THE NETHERLANDS**	**TOTAL ECSC-EURATOM TOTAL C.E.C.A.-EURATOM**	**TOTAL O.E.C.E.**
Natural gas	1											0,61		0,43	5,95		0,15	7,14	8,14
Hydro-electric power	4,13	0,04	0,29	0,37	0,23	13	1,12	1,3	13,26	8,02	0,08	7,90	0,14	14,26	17,31	0,02	0,02	39,3	81,05
Geothermie energy géothermique															1			1	1
Total	15,07	11,13	2,80	3,82	0,71	18,40	3,48	248,3	31,94	14,89	6,12	191,52	35,5	115,86	52,14	3,93	25,88	424,91	781,55
BALANCE																			
Surplus																			
Deficit	2,77	10,71	2,31	3,23	0,48	5,00	1,95	21,3	18,44	6,69	1,32	0,5	5,8	43,86	25,94	3,93	12,48	91,51	165,65

11. Finally, there is nuclear energy, with its almost unlimited possibilities. There can be no doubt that in the long run this will restore the balance but, at present, while the technique of atomic power plants is still in its infancy and the electricity they produce is not yet competitive, it is impossible to forecast the rate of development of atomic energy. The Hartley Report expects the OEEC countries as a whole to produce 25 M.T.C.E. by 1965 and 80 M.T.C.E. by 1975. In their report A Target for Euralom the Wise Men called for a far more rapid rate of development —40 M.T.C.E. by 1967 for the six Euratom countries alone.

12. However, according to the latest official reports the pace now envisaged will, in fact, be much slower. This shows the uncertainty surrounding prospects of nuclear energy production and explains why this new form of energy cannot be relied upon for many years to fill the gap in Europe.

13. If we accept the figures of the Hartley Report as broadly correct this deficit will increase from 165 M.T.C.E. in 1956 to 220/295 by 1965 and 270/470 by 1975. Not until after 1975 will the gap begin to close.

14. This is a disquieting prospect. During the next two decades if they wish to continue their economic expansion, the countries of Western Europe will have to obtain large supplies of energy from outside their metropolitan territories.

15. Now, Western Europe could obtain most of its energy from the French Northern Sahara. A plan for this purpose raises important problems, not only technical, economic, and financial, but also political. However, it does not seem, a priori, that the solution of these problems would meet with insurmountable difficulties.

2. The possibilities of the Northern Sahara as a supplier of natural gas in the light of American experience

16. The French Northern Sahara, less than 2,000 km. as the crow flies from the European consumption centres, contains, in addition to its oil, reserves of natural gas amounting to at least several hundred thousand million cubic metres.

17. To gain an idea of the significance of these reserves it will be of interest to consider what has been done in this respect in the United States, and is now being done in the Soviet Union and Canada.

United Slates

18. In the United States, where there is j very lively competition between different forms ' of energy, natural gas has rapidly made its mark as an economic proposition even at distances of several thousand kilometres from the source.

19. Annual output is now over 300 thousand million cubic metres, which is equivalent to 450 million tons of coal.

20. The natural gas industry has sprung up extremely rapidly, especially since the war. Between 1948 and 1956 the increase was tremendous, annual production rising from 70 to 300 thousand million cu. m. In other words, it increased fourfold in the space of 16 years—an average rate of expansion of over 9% per annum.

21. The contribution of natural gas to total supplies of energy in the United States rose from 11.3% in 1940 to 29% in 1956, exceeding that of coal, which fell to 28.3% in 1956.

22. This increase was made possible by intensive prospecting and development. Proved reserves rose from 2,400 thousand million cu. m. in 1949 t o 6,700 thousand million in 1956. Probable reserves are estimated at about 15,000 thousand million cu. m.

23. In order to make use of these enormous quantities of gas it was necessary to build a large network of feeders to carry it from the production areas (mainly Texas and Louisiana) to the consumption centres of the North East and Middle West.

24. The distances covered now amount to as much as 3,000 km. and the volume of gas carried over them by some feeders may be as much as 20 million eu. m. per day. The total length of the transport network is over 250,000 km.

25. This network is supplemented by nearly 200 underground reservoirs (usually exhausted veins) which make it possible to regularise output and thus ensure a more efficient use of the feeders. At the end of 1955 there were 178 underground reservoirs equipped with 6,500 injection and tapping shafts and with a capacity of 60,000 million eu. m. of which 32,000 million were utilisable.

U.R.S.S.

26. In t he U.S. S.R. the development of natural gas seems likely to be more rapid still. This fuel was practically unknown before the war and made its first appearance in 1942, when the Elchanska gas-field near Saratov was opened up.

27. Since then production has risen steeply, amounting in 1955 to 5.5 thousand million cu. m., to which should be added 3.2 thousand million cu. m. of gas of high calorific content derived from the degasification of crude oil.

28. The Sixth Five-Year Plan provides for the production of 40 thousand million cu. m. in 1960, i.e. seven times more than in 1955, a stupendous rate of progress but in keeping with the volume of known reserves, which exceeds 1,000 thousand million cu. m. and is still increasing rapidly. M. Khrushchev announced a few months ago that the U.S.S.R. expected to produce over 300 thousand million cu. m. of gas by 1972.

29. As in the U.S.A., the expansion of production is leading to the building up of a large network of feeders to convey the gas from production areas to the major consumption centres. For instance, the Stavropol-Moscow feeder recently put into operation is 1,300 km. long and 700 mm. in diameter.

Canada

30. In Canada very large deposits of natural gas have been discovered during the last decade in Alberta and British Columbia, particularly at Pincher-Creek Pembina. By the end of 1956 proved reserves were stated to be 650 thousand million cu. m. However, since Western Canada is not yet a highly industrialised area, local demand fell far short of productive capacity.

31. In order.to take immediate advantages of these enormous reserves it was decided to supply this gas to the nearest industrial areas, namely the Western States of the United States —Washington and Oregon—and Central and Eastern Canada. Two large long-distance feeders have been built for this purpose.

32. The West Coast Big Inch feeder, completed in 1957, carries natural gas from the Peace River deposits to the United States. It is 1,050 km. long and reaches the United States border just east of Vancouver, where it links up with the American network of the Pacific North West Pipe Line Corporation serving the Pacific Coast States of California, Oregon and Washington. With a diameter of 76 cm. it can carry up to 13 million cu. m. per day, a maximum which it will later be possible to increase to 22 mil- , lion cu. m. by doubling the number of re-compression stations. The construction of this feeder cost 152 million dollars, that is 65,000 million French francs. It came into operation at just the right time for the Pacific Coast States, whose supplies of natural gas from the New Mexico, Colorado and Wyoming deposits were becoming insufficient to meet the extremely rapid rise in consumption.

33. The second feeder, the Trans-Canada Pipe Line, is even more impressive; it is 3,700 km. long and at present the largest feeder in the world. It traverses the American continent from west to east, carrying gas from Alberta to Montreal via Winnipeg and the industrial area north of the Great Lakes. Its diameter decreases from 86 cm. when it leaves Burstall to 50 cm. when it reaches Montreal. Capacity ma be as much as 25 million cu. m. a day at the point of departure.

34. Since 1957 this line has been in operation as far as Port Arthur (Ontario). The final section, serving Toronto and Montreal, will be completed by next autumn.

35. This project, the cost of which will be 160,000 million francs, was financed partly by a loan from the Canadian Government and partly by American industry.

36. The foregoing facts show conclusively that natural gas is an exceptionally potent factor in economic development.

37. Although information concerning the natural gas deposits of the Northern Sahara is still far from complete, it is already clear that there is an urgent need for France, as their owner, and Europe, as their potential natural market, immediately to begin to study the problems of exploiting them and take steps to establish machinery for the joint solution of these problems.

38. There is already an assured minimum productive capacity of 15,000 million cu. m. of natural gas per annum from the Hassi R'Mel and Hassi Messaoud deposits, and there is no doubt that this figure will rise steeply as other sources are discovered.

39. In the present context we shall only consider this preliminary capacity of 15,000 million cu.m. per annum. Once exploitation and distribution are under way the process of development should follow its normal course.

3. The needs of North Africa

40. It is only to be expected that the first areas to benefit will be the French Departments of Algeria plus Morocco and Tunisia. However, it must be realised that North African consumption will absorb only a limited percentage of the prospective very large output.

41. In this region the main consumer would be "Electricité et Gaz d'Algérie (E.G.A.)" which would have no difficulty in turning over its electric power stations and gas works to natural gas instead of the imported coal and fuel oil on which they now operate. At the moment the only other factories which are major consumers of energy are two large cement works, one at Algiers and the other in the district of Oran.

42. On a somewhat optimistic assessment of their rate of development, it has been estimated that the total consumption of these industries might reach some 400 million eu. m. per annum about 1961.

43. There are plans to set up new industries using natural gas in Algeria: manufacture of nitrogenous fertilisers, concentration of Eastern Algerian phosphates and a steel works in the Bone area. However, even supposing that these industries can be established with great rapidity, it seems unlikely that Algerian consumption of natural gas can exceed 1,000 million cu. m. in 1965 and 1,500 million a few years later.

44. As regards Morocco and Tunisia, consumption is bound to be on a fairly small scale at first.

45. Thus, the natural gas of the Northern Sahara, a promising source of wealth for North Africa, is of far more than regional significance. Indeed, the greater the flow of gas and oil passing through North Africa, the greater the benefit that will accrue to the area as a whole.

4. Possibilities of supplying Western Europe with natural gas from the Sahara

46. We have already shown that in view of Europe's considerable and permanent energy deficit it would be absurd not to make the fullest use of the possibilities offered by natural gas from the Sahara.

47. This, however, implies that this gas can be brought to Europe at a sufficiently low cost. There are two obstacles to be overcome here: distance and the Mediterranean.

48. The distance from Hassi R'Mel to Strasbourg, centre of gravity of Western Europe, is 1,800 km. as the crow flies and 3,000 km. by land via Gibraltar, Spain, Southern France and the valley of the Rhone. This is a considerable distance, yet the conveyance of natural gas over such distances through high-pressure pipelines would be technically and economically feasible as we have seen, provided the throughput were sufficiently large and continuous, as indeed it could be.

49. The other difficulty is the crossing of the Mediterranean. Pipe-lines have never before been laid at such a depth and over such a distance as would be the case here.

50. There are several possible methods of transport:

50.1. transport by methane tanker;

50.2. transport by large diameter feeder across the Mediterranean by the use of new techniques in the form of under-water pipes or a tunnel under the Straits of Gibraltar;

50.3. transmission by submarine cable to Spain and Italy of high-voltage electric current produced in Algeria with Saharan natural gas.

51. This third solution which would involve setting up power-stations on the Algerian coast to supply continuous high voltage current to the European coast by means of submarine cables is undoubtedly of interest.

52. However, it would not be likely to lead to a vast consumption of gas—not at any rate on a scale commensurate with the possibilities we have mentioned—and we need not go into the technical aspects of it here.

53. On the other hand, methods 1 and 2, namely, transport by methane tanker or by feeder, call for explanation.

4.1. Transport by methane tanker

54. This would entail liquefying the natural gas (at about - 160°C), at which temperature it would occupy a volume 600 times less than in its gaseous state at atmospheric pressure, and transporting it in specially equipped vessels. At the receiving port the natural gas would be stored in its liquid form, then evaporated and despatched by pipe-line to the consumption areas.

55. The liquefaction and transport by methane tanker of natural gas have been studied in the United States, originally with a view to storing the gas in its liquid state and later in connection with long-distance waterway transport. However, there has been no major application of this method as yet. The idea was then conceived of using this method to enable countries short of energy to draw on the enormous quantities of natural gas available in Venezuela and the Middle East which, owing to the lack of consumers, are burnt or, at best, pumped back into the oil wells to keep up the pressure.

56. Transport by methane tanker is still at the small-scale experimental stage. The main technical difficulty is that at the temperature of liquid methane, i.e. about - 160°C, the normally used metals become brittle. The Americans are a t present building for an Anglo-American firm a first experimental tanker of this type with a burden of 2,000 tons which they expect will be transporting the first consignments of liquid natural gas from Lake Charles in Louisiana to England not later than this year.

57. If this experiment proves successful they plan to build a fleet of tankers to carry natural gas from Venezuela to England.

58. For its part, Gaz de France, which has followed these developments very closely, is considering the possibility of transporting gas from the Sahara by tanker and is at present setting up, in an Atlantic port supplied with gas from Lacq, a storage depot for liquid gas, where i t will be possible to test reservoirs and methods of liquefaction, handling and regasification.

Cost of transport by methane tanker

59. The question of the cost of transport by methane tanker is a complex one for it depends on:

the price of the natural gas on arrival at the liquefaction plant which, in turn, is made up of the price of the gas when it leaves the gas-field plus the cost of land transport to the port of shipment,

the volume handled and the distance covered by sea, which determine the tonnage and number of ships required,

the unavoidable difficulties and expenses arising from the geographical position of the port of shipment and the port or ports of unloading and from the installations to be provided.

60. Hence every problem of gas transport by methane tanker must be carefully considered individually.

61. For the transport of gas from the Northern Sahara to Europe by methane tanker the experts have considered building new vessels of medium and large tonnage, equivalent in size to oil tankers of 20,000 to 50,000 tons, or converting small oil tankers of 12,000 to 17,000 tons into methane tankers.

62. Since the density of liquid methane is 0.40 compared with 0.85 for petroleum, methane tankers must be much larger than oil tankers if they are to carry the same tonnage.

63. It has been estimated that the cost of transporting 5,000 million cu. m. of gas per annum from Hassi R'Mel by pipe-line to the Algerian coast, and then by a fleet of methane tankers to various European ports at an average distance of 2,000 kilometres, would be about 6 francs per cu. m., which price would include all processes of liquefaction, storage and regasificatioh. Adding 1.5 francs for the price of the gas at source we arrive at a total price of 7.5 francs per cu. m. (or 0.85 francs per therm). This price is competitive with that of fuel oil or coal in general and, above all, is much lower than that of ordinary coal gas, allowing for the fact that coal gas contains only 4,500 calories per cu. m. as compared with 9,000 calories for natural gas.

4.2. Transport by feeder

64. Here the only difficulty is the crossing of the Mediterranean. There are several possible methods and routes.

65. At Gibraltar where the distance across the sea is least—-12 kilometres at the narrowest point, it might be possible to build an underwater tunnel. This could hardly cost more than 10 thousand million francs. However—and this is a serious reservation—underwater faults might be encountered, and leakage of water would be difficult to control in view of the pressure exerted on the sea-bed at depths of as much as 400 m.

66. To begin with and, above all, to gain time, the best way of crossing the Mediterranean would be by pipe-lines resting on the sea-bed.

67. As, for technical reasons, it is hardly possible at present to contemplate using sea pipes of over 25 cm. diameter, the method would be to lay several pipes on the sea-bed and connect them to one large land feeder at the points where they emerge on the African and European coasts.

68. By this means it would be possible to take a route involving a much shorter land distance than the Gibraltar route, while keeping the length of the sea crossing within acceptable limits.

69. Via the Straits of Gibraltar the sea distance would be 20 to 30 kilometres; from Oran to Almeria, 160 kilometres, and from Mostaganem to Carthagena, 190 kilometres.

70. The distance from Hassi R'Mel to Strasbourg via Gibraltar, Barcelona and Lyons, would be 3,200 kilometres, via Oran and Almeria i t would be 2,700 kilometres and via Mostaganem and Carthagena, 2,400 kilometres.

71. It is the view of the experienced technicians who carried out preliminary research on this question that there are no insurmountable difficulties in the way of such a scheme, and we agree with them on this essential point.

72. However, in order to decide exactly what route should be adopted, a precise hydrographic survey of the configuration of the seabed should be made. Vessels such as Commander Cousteau's Calypso are available for this purpose. Should even more precise observations be required at certain points, recourse could be had to the bathysphere of the French Navy.

Cost Price

73. As regards land feeders there are no uncertain factors since the technique is well known.

74. When reckoning the cost of the sea lines it is advisable to allow a margin. It may be estimated that sea lines between Mostaganem and Cathagena capable of piping 10 thousand million cu. m. of gas per year would cost some 40 thousand million francs.

75. As for the total cost of transport, a fair estimate would be that transport by large feeder (about 1 metre in diameter at the point of departure) between Hassi R'Mel and Strasbourg (via Mostaganem and Carthagena: 2,400 kilometres) would cost 4 francs per cu. m. Adding 1.5 francs for the price of the gas when it leaves the well we arrive at a figure of 5.5 francs per cu. m. or 0.6 francs per therm, a highly competitive price for all uses.

5. General survey by geographical sector of the cost of natural gas from the Northern Sahara in Western Europe. Volume of investment required

76. Given an initial available supply of 15 thousand million cu. m. of gas per annum for Western Europe, it is reasonable to suppose that 5 thousand million cu. m. would be carried to European ports by methane tankers and 10 thousands million by the first large pipe-line.

77. When production exceeds 15 thousand million cu. m., thanks to the growing potentialities of the gas-fields, the main emphasis will have to be placed on conveyance by pipe-line which is cheaper for large-scale operations, as we have seen in the previous chapter.

78. The following tables, giving the general level of cost prices at consumer centres and the volume of investment required, should enable the reader to form an opinion as to the possibilities of using gas from the Northern Sahara in Western Europe.

5.1. Transport by methane tanker to the European coast

Transport of 5,000 million cu. in. of gas per annum from Hassi R'Mel to various ports in Western Europe

Distribution and cost price on delivery

Destination	Distance in kilom.	Annual supply in 1,000 million c. m.	Cost price of gas on delivery cent. per therm[4]	Cost price of gas on delivery francs per cu. m.
Marseilles, Naples, Barcelona	800 to 1.000	1,5	75	6,75
Greece, Turkey, Le Havre	1	3.000	90	8,10
London, Antwerp, Dublin	3.500	1,5	98	8,80

4. i. e. the French or U.S. therm.

Transport of 5,000 million cu. in. of gas per annum from Hassi R'Mel to various ports in Western Europe

Distribution and cost price on delivery

Destination	**Distance in kilom.**	**Annual supply in 1,000 million c. m.**	**Cost price of gas on delivery cent. per therm[4]**	**Cost price of gas on delivery francs per cu. m.**
Hamburg, Copenhagen, Gotenburg	4.000	1	105	9,45

Fleet required:

5 methane tankers of 3,500 tons

8 methane tankers of 15,000 tons.

Investment - (mean distance covered 2,750 kins)

	in thousand million francs
Land, transport from Hassi R'Mel to the Algerian coast	40
Liquefaction	40
Sea transport	50
Storage and regasiflcation	32
Total	162

5.2. Transport by feeder to continental Europe

79. Here it should be observed at once that, since the cost of transport by feeder is gradually halved as the annual throughput rises from 2,000 to 10,000 million cu.m., it is important to avoid too many small diameter lines. On the assumption, which we consider highly probable, that the quantity of gas available in the Northern Sahara would justify the construction of several large pipe-lines, gas could be supplied to all the major industrial areas of Western Europe at extremely competitive prices.

80. As regards plans for distribution, options would have to be taken as the work of prospecting progressed. Prospecting is therefore a matter of extreme urgency.

81. With these prospects in view, the following table may be given to indicate the cost price of natural gas by broad geographical and industrial areas:

Price of Hassi R'Mel gas in the various consumer areas, assuming a cost of 1.5 fr. per cu. m. at source

	Francs par m3	Centimes par thermie
Alger (Oranais)	2,00	22
Espagne (Catalogne	3,90	43
Provence	4,40	49
Région lyonnaise.	4,70	52
Suisse	5,20	58
Lorraine	5,50	61
Ruhr	6,10	68
Région Lille-Bruxelles	6,20	69
Angleterre, Londres	6,50	72

4. i. e. the French or U.S. therm.

Investment required for each large pipe-line carrying 10 thousand million cu. m. of gas per annum: 250 to 300 thousand million francs

6. Conclusions

82. It will be seen from the foregoing:

82.1. that this is a major problem of interest to both Africa and Europe;

82.2. that a speedy solution of this problem is vital to the future of Europe, Africa and the free world. Every year, or even month, gained may be equivalent to a decisive victory;

82.3. that we need to pool all necessary financial, technical and moral resources to carry out this incomparable undertaking.

83. IWe saw at the beginning of this report that the energy deficit of the OEEC countries might amount to 250 M.T.C.E. by 1965. Now 10 thousand million cu. m. of gas correspond to 15 M.T.C.E. and the Hassi R'Mel deposit alone probably contains more than a million million cu. m. of gas, enough for an output of 50 thousand million per annum or the equivalent of 75 million tons of coal.

84. Hence, the Power controlling these resources must lose no time, in exploiting them, the cost, incidentally, being relatively low.

85. There are other gas and oil deposits in the Sahara, and they are much closer to Western Europe and a much less precarious source of supply than the Middle East.

86. Europe's future position in the world will depend on its energy resources. These resources will be forthcoming if the peoples and Governments of our countries join together in basing their future development on what nature has provided within their geographical orbit.

87. The Sahara discoveries may be regarded as a providential opportunity whose significance i t would be foolish to ignore.

88. The Consultative Assembly of the Council of Europe, true to its traditional role, can and must urge the Governments of Member States to create Eurafrigas, a major instrument for the future development of Europe and Africa.