

## FUELS AND MINERALS

1. The development of modern industry, agriculture, transport and construction, such as has been taking place in this country, requires a rapid increase in supplies of fuels and mineral raw materials. At the time of independence nearly all the known sources of high grade coal and iron ore, bauxite and most other metallic minerals in the sub-continent were left in India. Known resources of fuels and minerals in Pakistan were negligible. Since then, there has been a considerable increase in the production of fuels and minerals within the country. There also has been some intensification of efforts to find additional deposits in large areas of the country which have never been thoroughly explored. The increase in domestic mining and production of certain fuels and minerals is shown in Table 1.

TABLE 1

*Output of selected fuels and minerals in Pakistan, 1948—1956*

Item	Unit	1948	1949	1950	1951	1952	1953	1954	1955	1956
1. Crude petroleum ... ..	Million imperial gallons.	17	33	45	47	55	62	68	72	74
2. Petroleum products :										
(a) Diesel oil ... ..	"	1·34	1·33	2·30	2·82	5·85	9·06	12·28	13·96	15·2
(b) Motor spirit ... ..	"	2·21*	6·11	10·42	11·16	15·10	16·95	19·08	19·41	19·8
(c) Kerosene oil ... ..	"	0·30*	0·99	2·06	1·83	2·32	2·39	2·83	2·80	4·6
(d) Furnace oil ... ..	"	6·52	15·19	24·50	25·19	23·75	27·67	25·85	25·48	25·1
3. Coal ... ..	Thousand tons.	241	332	437	506	599	584	554	533	646
4. Chromite ... ..	"	18	17	18	18	17	23	22	29	23
5. Limestone ... ..	"	347	279	303	344	672	879	822	887	756
6. Gypsum ... ..	"	—	14	17	23	28	27	31	27	35

\*Data relates to 9 months (April 1948 to December 1948).

Source : (1) Ministry of Finance : Economic Survey and Statistic  
(2) Central Statistical Office.

2. Domestic production of fuels and minerals has not been enough to satisfy the demand. Many important minerals, including iron ore, have not been produced at all. Only about 33 per cent. of coal consumption and 20 per cent. of consumption of petroleum products in 1954 came from indigenous sources, the balance of the country's requirements being imported on the scale shown in Table 2. On the other hand, the country has been nearly self-sufficient in salt, ceramic clay, limestone and gypsum. Chromite has been exported, but very few other minerals, and no fuels at all. Consequently very heavy net expenditures of foreign exchange have been made to import coal, petroleum products, metals, chemicals and many other needed materials not mined or produced in the country.

TABLE 2

*Imports of fuels into Pakistan 1950—1956*

Item	Unit	1950*	1951	1952	1953	1954	1955	1956
1. Petroleum products	... Million imperial gallons.							
(a) Diesel oil	... ..	6.45	19.80	30.27	33.64	40.90	59.1	41.5
(b) Motor spirit	... ..	5.34	14.55	22.85	13.89	24.11	14.1	7.6
(c) Kerosene oil	... ..	18.31	37.92	30.53	54.83	41.87	46.7	34.2
(d) Furnace oil	... ..	33.03	79.42	129.27	123.08	115.05	117.3	39.5
2. Coal	... '000' tons	1,009	1,366	1,667	1,192	1,101	1,061	1348

\*Figures are for six months, *i.e.*, July—December, except for coal which are for full year.

Source : (1) Central Statistical Office.

(2) Coal Commissioner Office.

Imports of fuels and raw materials cost us roughly Rs. 319 million in 1954, of which Rs. 75 million were spent for petroleum products and Rs. 34 million for coal. This is a sizable part of the import bill. It is clearly of great importance to find and develop larger domestic sources of these materials.

3. It is necessary to plan on the basis of a continued steady rise in fuel and mineral requirements as the development of the country proceeds. The discovery of the very large pools of natural gas at Sui and Sylhet will replace sizable quantities of fuel which otherwise would have had to be imported. By 1960, the country should be obtaining from natural gas the heat equivalent of more than 200 million gallons of imported fuel oil. Despite this, the demand for petroleum products is expected to rise so rapidly as to require larger imports in 1960 than in 1954.

4. The major objectives of a development programme for fuels and minerals are very clear: first, to push ahead rapidly with the exploration of subsoil resources, in order to find out exactly what exists and how it can be exploited; second, to assure the rapid development of all economically useful reserves, in order to supply as much as possible from indigenous resources and to increase foreign exchange earnings through exports.

#### EXPLORATION, PROSPECTING AND DEVELOPMENT

5. Not much is known about the mineral deposits in this country. Only about 28 per cent of West Pakistan and a small part of East Pakistan had been covered satisfactorily by geological mapping before 1955. The first essential for a sound fuels and minerals programme is to expand greatly the work of exploration. This requires an immediate and large increase in the work of the Pakistan Geological Survey.

6. The Geological Survey has a sound tradition of professional work, and a well-trained staff. Its current operations, however, need to be greatly expanded. The Survey should be required to prepare and execute well-defined programmes of work, intended to explore rapidly the most promising areas and to prospect for the most important minerals. For example, the Survey should concentrate for the next few years on (a) the unexplored mountainous portions of West Pakistan; (b) important minerals needed for the development programme, such as ores of non-ferrous metals; coal and lignite, oil and gas, potassium salts and phosphates, and high grade clays; (c) ores of metals which have promising export markets, such as tungsten, titanium, antimony, cobalt, columbium, beryllium and monazite.

7. To carry out such programmes, the Survey will need a considerably larger staff and a good deal of additional equipment for both laboratory and field work. The Government should be prepared to give the Survey much stronger financial support than in the past, in view of the great significance of geological exploration to the country's development. A very substantial contribution to geological knowledge has been made by the Canadian Government, which has financed an aerial survey of most of West Pakistan (south of the high mountains), a ground geological reconnaissance of the former Baluchistan and Baluchistan States Union, and reconnaissance soil surveys of considerable portions of the Indus plain. It will take many years to complete the work of finding out what quantities and qualities of mineral resources lie within the country.

#### **Prospecting and development**

8. Geological mapping yields information on the geological structure of different areas and on the general types and quantities of mineral resources. The next steps are detailed prospecting to map much more precisely the shape and size of the deposits, estimating the cost of recovery, and, where good results can be expected, commercial exploitation. In this country, as in most other countries, it is generally considered desirable that private companies should be encouraged, to provide the capital and take the risks of prospecting and developing sources of fuels and minerals, under standards and safeguards laid down by the Government to protect the public interest. Where special circumstances exist, such as the needs of national defence, or where private companies perform poorly, public enterprise may be preferred.

9. To obtain good results from private enterprise in fuel and mining operations, the Government needs a clear policy, offering strong incentives for rapid and thorough prospecting, and providing for prompt exploitation of valuable deposits under appropriate safeguards so as to prevent waste or monopolistic practices. Current policy needs improvement. The Central Government regulates the granting, renewal and revocation of prospecting licences and mining leases, operating and safety conditions, and other aspects of mining. Some of these regulations are out-of-date, and their administration has not always been prompt and effective.

10. Under present arrangements, information on possible deposits is often not published promptly and fully, with the result that businessmen do not know what opportunities may exist. The system of "certificate of approval" and "prospecting leases" is cumbersome, and frequently results on the one hand in superficial and wasteful exploitation of known deposits, and on the other hand in leaving promising sites untouched. Private concerns are often faced with uncertainty and long delays in obtaining the necessary permits and licences to start work. The standards necessary in the public interest should be clearly laid down. The administration of the mining laws is split among several separate departments and this hampers the development of uniform and consistent policies.

11. There is general agreement among those concerned with mining laws and regulations about the deficiencies of the present situation and how to set them right. Two major steps are needed: first, the establishment of a single agency responsible for the rapid development of fuel and mineral resources, and second, a thorough overhaul of the mining laws and regulations.

12. The Central Government has already decided to take the first step, by establishing a Bureau of Mines to which would be transferred many of the existing controls over mining which are now in separate departments. The Bureau of Mines will be responsible for issuing claims, licences and leases; for collecting and publishing information on all phases of the mining industry; for economic and technical studies and advice; for stimulating and assisting the progress and efficiency of the mining industry; for encouraging the participation of foreign capital in fuel and mineral development; for expediting the import and production of necessary mechanical equipment and spare parts; and for other activities designed to make the best use of the country's fuel and mineral resources for development. We believe that the establishment of a Bureau of Mines is urgently required and should not be delayed.

13. The second step, overhaul of the present mining laws and regulations, is equally urgent. If the Bureau of Mines is established immediately, its first task should be to study and recommend a modern, simple, and effective system for Government licensing for private mining operations. There are excellent models to be found—for example in France, as well as in the States of New York, Utah and California in the U.S.A. Competent technical advice could easily be obtained through one of the foreign aid agencies. If, however, the establishment of a Bureau of Mines is delayed we recommend that a special group should be put to work on this task at once, as it is a necessary preliminary step towards the general improvement of the mining industry.

#### Mining personnel

14. Until recently there has been no organised training for professional and technical workers in mining industries. In October, 1954, however, the School of Mines, Lahore College of Engineering and Technology started its first class. The first batch of mining engineers will graduate from this school in 1959 or 1960. It is estimated that the country will need upwards of 50 mining engineers to carry out the mineral development programme we have recommended. It is clear that for some time the mining industry will have to depend in large part on foreign experts, on Pakistanis trained abroad, and on geologists or civil engineers trained in mining techniques through a combination of training on the job and short experience in foreign mining schools and installations. As in other fields of engineering, it is especially important that young mining engineers should gain a thorough appreciation of manual labour and be able to live amid the discomforts and hard conditions of field work.

15. Training of professional specialists is not enough. There must also be trained foremen (*sirdars*) and other supervisors for various types of mining operations. In coal mining, there are a number of competent managers and foremen, trained in Indian mines, where the seams are wide in contrast to those prevailing in this country, which are narrow and irregular. A considerably larger number will be needed as coal production expands. It would be desirable to send a number of selected managers and foremen abroad for training in North Africa or other areas with narrow coal seams. On their return, some of these men should be selected as instructors for a school designed to improve the number and quality of supervisors in the mines. This school, which might be attached to the School of Mines at Lahore, should be designed to train supervisors and junior technical staff for other types of mining operations as well as coal.

16. Except for the workers in rock salt mines and oil and gas wells, full time semi-skilled and unskilled mining labour does not exist in this country. Instead, the typical miner is a part-time worker—a farmer, a herdsman, or a nomad—recruited under a contract labour system giving him no relationship with the mine owner or manager except through the labour contractor. This is a very unsatisfactory system from the standpoint of both the miner and the manager. It leads to much exploitation of workers and an irregular, inefficient labour force. Some improvement is noticeable wherever quarters (no matter how primitive and crowded) are available at the mine site or transport to the mine is provided; in such cases something resembling a regular labour force begins to emerge, even though there are no organised training programmes, and the productivity per man is very low.

17. Training is one of the several steps needed to improve the mining labour force. It is primarily the responsibility of the management, whether public or private, to see that the workers are better trained and better paid, to employ them directly rather than through contractors, and to improve their conditions of housing, health and safety. The Government agencies concerned with labour, health and housing should all play their part in improving conditions for mine workers. The main responsibility of the Government should be through the Bureau of Mines. The Bureau should study the whole problem of assuring a sufficient number of well-trained persons for the mining industry—managers, engineers, skilled and unskilled workers—and should plan and promote the necessary action, by both Government and private agencies, to meet these requirements. For this, the Bureau will need to have one or two specially trained persons who can devote their full time to the problems of mining personnel.

## DEVELOPMENT PROGRAMMES FOR SPECIFIC COMMODITIES

## Oil and gas

18. A good deal of the territory in both the Wings is of geological formations which show some prospects of containing oil and gas deposits. Exploratory work and drilling had gone on for many years, with positive results only on the relatively small fields near Rawalpindi, until large deposits of natural gas were found at Sui in 1952. Since then there has been considerable interest in oil and gas prospecting in the country, and several of the large international oil companies have invested considerable sums.

In the spring of 1955, gas was struck in an exploratory well being drilled near Sylhet in East Pakistan. Unfortunately a fire started, burnt the equipment and ruined the well. Later in 1955 gas was struck at a second well near the earlier site and further exploratory drilling is under way.

19. The Government has entered into agreements with several companies under which Government shares part of the prospecting costs, and will receive a share of the profits in addition to a royalty on any oil or gas produced. It is not possible to foretell exactly how much will be invested in oil and gas prospecting, but our estimate, for the plan period is Rs. 417.5 million, of which 80.8 million might be public and Rs. 336.7 million private.

20. The Punjab oil fields were developed some years ago, and a refinery was constructed at Rawalpindi. At present a pipe line has been laid from the fields to the refinery in order to collect and use natural gas, which was being wasted. No other sizeable new investment is expected in connection with the present producing wells. A small but steady increase in output during the Plan period may be assured.

21. The natural gas reserves at Sui and Sylhet are a very large addition to the country's fuel resources. The latest estimates of proven reserves at Sui (October 1955) are some 4,000,000 million cubic feet, roughly equivalent in heating value to 143 million tons of coal. Estimates of proven reserves at Sylhet are not yet available. By the end of 1955, gas was being delivered through a transmission line from Sui to Karachi, and by the end of 1956 total daily output of the Sui gas field was averaging about 25 million cu. ft. per day. The Plan provides (in the industries sector) Rs. 141 million for the construction of another 16 inch pipe line from Sui to Lahore via Multan. On the assumption that proven reserves of gas will be sufficient the Plan also provides Rs. 54 million for the construction of a ten inch pipe line 145 miles from Sylhet to Dacca, together with distribution facilities in Dacca.

22. The use of Sui and Sylhet gas should have a very large impact on the country's heat and energy supply, on industrial costs, and on the balance of international payments. The policies relating to the gas should be designed to reap the maximum benefit for the country. Hitherto, there has been no definite public policy on the rate of exploiting the gas, its proposed uses and the prices at which it should be made available; this is a serious handicap, in view of the importance of gas to the country. Our own conclusions on the allocation and use of natural gas are reflected in the Chapter on Large-Scale Industry; we have not, however, attempted a comprehensive study of these matters. We strongly recommend that the Bureau of Mines (or, if the Bureau's establishment is delayed, a specially assigned group) should be directed as a matter of urgency to study and submit proposals for Government policy on natural gas. The absence of such a policy is already causing uncertainty leading to waste of valuable resources. It may be noted here that the output of Sui gas at present is less than 70% of the output anticipated by the consultants who drew up the scheme for the transmission and utilisation of the gas. This may be due partly to delays and difficulties in converting using equipment to gas, and partly to the high price of the gas. The cost of gas is a little less than the price of alternative fuels, but the difference may not be sufficient to encourage maximum expansion in the use of the gas.

## Coal and lignite

23. Coal is found in several places in West Pakistan, and lignite in East Pakistan. It is not possible to estimate the extent of the resources with any accuracy, because of lack of detailed mapping and prospecting. There are known to be sizeable deposits of coal at Makerwal in the former Punjab, and in the Sharig and Sor Ranges in the former Baluchistan and the former Baluchistan States Union, with further possibilities either at these sites or others, such as Jhimpir in the former Sind. One of the major elements in any development programme for coal is a systematic and persistent survey of deposits. It should be the duty of the Bureau of Mines, aided by the Geological Survey, to plan and execute this survey.

24. The most important consideration here is the very large savings in foreign exchange produced by investing in coal mining. Pakistan is at present importing over one million tons of coal each year valued at over Rs. 75 million. Import prices per ton range from about Rs. 60 for Indian coal up to Rs. 110 for coal shipped from China, (compared to local prices which vary from Rs. 35 to Rs. 70 per ton). We estimate that an investment of approximately 50 rupees is required to produce each additional annual ton of coal (under average conditions). This Rs. 50 is well below the foreign exchange expended on importing one ton of coal, which means that each rupee invested in the coal mining industry will save more than one rupee of foreign exchange each year, or more than 100% of the original investment. This is a much better saving than that obtained from investing in most industries, and coal mining should be given high priority by all concerned.

25. It is admitted that the quality of the coals found in the country is not good. The coals cannot be used for coking because they contain much sulphur and ash. The average heating value is about 10,000 BTU per pound, as compared with 12,000 BTU per pound of imported coal. However experience has shown that indigenous coal is satisfactory for use in boiler plants, if suitable firing arrangements are made. The soda-ash plant at Khewra, started in 1937, has always used it without difficulty. Beginning in late 1954, the North Western Railway too has been using it on the Quetta-Zahidan and Quetta-Chaman runs, and is ready to use much more of it.

26. There seems to be no doubt that a combination of habit, prejudice, and lack of clear-cut national policy has resulted in recent years in large imports of coal, at considerable costs in foreign exchange, to fulfil needs which could have been fulfilled economically by indigenous coal. We recommend that the Government declare their policy as being one of favouring the use of indigenous coal, wherever economic, and of supporting its development and conservation. To this end, the functions of the Coal Commissioner's Office or its successor in the Bureau of Mines, should be defined thus: first, to assist in increasing the output and improving the quality of indigenous coal; second, to encourage its increasing use in place of imports; and third, to authorise the importation of coal only to meet solid fuel requirements which cannot economically be met from indigenous supplies. This programme should be based on careful economic analyses of the relative costs and efficiencies of different types of local and imported coals for different uses, and of different types of coal in comparison with oil and gas as sources of heat for different purposes. This should be one of the first tasks of the proposed economic survey unit of the Bureau of Mines.

27. The mining equipment and methods used in most of the coal mines are extremely poor, even primitive. Steam or other mechanical shovels, drilling, undercutting, and material handling equipment are virtually unknown. Pumps, fans and electricity are rarely found. Explosives are seldom used. Even in relatively good and professionally managed mines, coal is moved and hoisted over steep grades in bags or baskets carried by men, without the aid even of ladders or steps. Donkeys are the standard substitute for conveyor belts or narrow gauge mine tubs. The limited mechanical equipment employed is usually obsolete, worn out, or unsafe. In these circumstances it is remarkable that more than half a million tons of coal have been raised annually in recent years.

28. The reasons for the lack of investment in better machinery and equipment are several. Mining equipment is not manufactured in the country and import licences have been granted only for small amounts and after

much delay, making it extremely difficult for mining companies to obtain essential equipment, supplies, spare parts, and replacements. Many mines are small and their seams are narrow and short, making mechanical equipment expensive and difficult to use. Many of the more highly mechanised types of equipment which have been developed in Europe and North America would not be economical in this country with its different ratio between capital and labour costs.

29. Over and above these reasons, and probably of greater importance, are certain aspects of the history of the coal industry. It has always suffered from a market instability. Since the turn of the century, there have been three or four periods of rising prices and rapid increases in output, followed by periods of low prices when most of the mines were closed down. Mine-owners have often followed the practice of making profits when they could, and re-investing little in the development of new capacity or the improvement of equipment. They have tended to regard the mines not as enterprises to be improved and developed over a long period of years, but rather as sources of occasional profits to be obtained at the lowest possible cost and with the minimum of investment. This is not a sound foundation for the long-term development of the coal industry. With a market larger than can be supplied, stretching far into the future, those who work the coal mines must establish long-term policies for their operation, maintenance and development.

30. This raises the question of the organisation of the industry. The small size and inadequate resources of many of the colliery companies have undoubtedly contributed to the poor condition of the mines. Although opportunities should be preserved for small entrepreneurs in this field, many of the existing units must be consolidated into larger ones which can be developed and operated more economically and efficiently. One such step has already been taken, by giving to the Pakistan Industrial Development Corporation responsibility for developing as a working unit several neighbouring mines at Makerwal, from which coal will be mined for a cement factory and a fertiliser plant. The same objective could be achieved by merging existing mines under private ownership. The Government should encourage private owners of the larger adjoining or related mines to merge them into strong companies, large enough to engage professional management and to support a consistent, long-range programme of investment in machinery and equipment. In such circumstances, it would be appropriate for the Government to make loans for the rehabilitation and development of the mines.

31. In conjunction with the Coal Commissioner and representatives of leading consumers, we have considered what target should be set for expanding the production and use of indigenous coal during the Plan period. We believe that an additional 500,000 tons could be used readily: about 300,000 tons in existing uses, including 100,000 tons on the railways alone in place of imported coal, and about 200,000 tons in new uses, including 150,000 tons in the cement and fertiliser factories at Daudkhel.

32. The Plan provides Rs. 29.3 million rupees for development of coal mining, of which Rs. 10 million is in the private sector. Approximately Rs. 25 million is required for expansion of output by 500,000 tons per year discussed above, and the balance of Rs. 4.3 million is to prepare for additional demands at the end of the plan period, such as for the iron and steel plant. At present PIDC have drawn up schemes totalling Rs. 17.7 million for developing Makerwal and Gullakhel Mullakhel mines in the former Punjab and former Baluchistan Collieries. Private mineowners have drawn up smaller schemes (these appear to be delayed due to non-issue of licences for import of equipment), and the PIDC is developing further schemes for the former Baluchistan area. High priority should be given to the implementation of these schemes.

33. East Pakistan has no proven coal deposits. There are, however, sizeable deposits of lignite, which have been partially explored and tested in recent years, with encouraging results. The lignite is found in easily mined seams only a few feet below the surface, although they could probably not be worked during the rainy

season. The water content is high, but air-drying makes it possible to burn the lignite satisfactorily in combination with coal, and further processing might give a fuel having even better characteristics. Because of the present dependence of East Pakistan on imported coal, it is important that the possibility of mining and using lignite on a sizeable scale should be fully investigated by means of a programme including:

- (a) Intensified prospecting and survey of deposits;
- (b) Determining appropriate mining techniques ;
- (c) Large-scale testing of samples to determine the best uses for the fuel; and
- (d) Preparing and executing a phased programme for the development and use of lignite.

The Bureau of Mines and the East Pakistan Government should both participate in these four steps and jointly work out the detailed schemes required. We have received no scheme covering lignite, but have included in the Plan funds to cover the first three steps listed above. When a scheme for actual development is ready, the additional funds needed should be provided.

### Iron ore

34. Until recent years no commercially exploitable deposits of iron ore were known in this country. This situation has now changed greatly. Substantial reserves of medium quality ore—hematite, containing on an average 34 per cent iron—have been found near Kalabagh. Although the size of these reserves is still under investigation, there would probably be enough ore to support a medium sized steel plant. Some much higher quality ore—magnetite, containing about 62 per cent iron—is reported to have been discovered in Chitral. Even though the area is relatively inaccessible, the ore is of such high quality that it should be rapidly surveyed and means of exploiting it investigated. Finally, some relatively low-grade ore has been found near Jhimpir, 74 miles from Karachi near coal deposits. This ore should also be surveyed rapidly, and tests made of the techniques and costs of smelting it.

### Chromite

35. About 22,000 tons of chromite are produced annually, all from the Hindubagh area, and all exported, principally to the United States. It may be possible to raise production and exports by 40 per cent during the Plan period. One major difficulty is the variable quality of the ore deposits—ranging from 30 to 57 per cent chromium oxide. To be exported at favourable prices, the ore must average 48 per cent chromium oxide. This calls for the blending of higher with lower grade ores and the present practice of each operator doing this separately is wasteful. What is needed is an export agency which could pool ores from different operators and obtain the largest possible quantities of suitable blends. The Government should sponsor such an export agency, either as a producers' co-operative or, if necessary, as a public or semi-public organisation. Recently, higher grade chromite has been discovered in kharan, this should be surveyed as a matter of high priority. In addition, a detailed scheme should be sponsored for processing some of the ore into sodium dichromate, which sells for a considerably higher price than ore. This scheme would probably show an attractive return on investment and prove a profitable undertaking.

### Gypsum

36. There are large deposits of gypsum in West Pakistan. In the preplan period, only about 31,000 tons was used annually in making cement. With the increasing production of cement during the Plan period, this requirement will double and the fertiliser plant at Daudkhel will need another 80,000 tons of gypsum annually. A gypsum industry big enough to meet these larger needs might reach a level of efficiency in quarrying and transport which would enable it to enter the export market. The possibility should be investigated by the Bureau of Mines.



## Sulphur

37. Requirements for sulphur in the country are at present fairly modest—about 6,000 tons annually; but they are certain to multiply in the next few years. Sulphur and sulphuric acid will be required for bleaching and chemical reaction—in such fields as rubber, insecticide, fertiliser, rayon and paper production. There are several sources of sulphur. High grade sands (40 to 60 per cent sulphur) exist in Baluchistan, and a small refinery has been established in Quetta to process them. Another source is coal; indigenous coals contain a high percentage of sulphur. Part of the process planned for the fertiliser plant at Daudkhel is to extract 1,500 tons of sulphur annually from the Makerwal coal and to use it for making fertilisers. Another potentially very rich source of sulphur is Sui gas; this sulphur will be extracted from the gas in the purification plant being constructed at the well-head, and it can be recovered for sale if that proves to be economically desirable. Finally, because gypsum can be used as a source of sulphuric acid its technological and economic possibilities should be explored as rapidly as possible.

## Antimony

38. Antimony deposits in Chitral were worked some years ago, and then abandoned. Now again systematic prospecting and development work is under way, which should permit some exports during the Plan period.

## Barytes

39. Finely-ground barytes are used as a lubricant in oil drilling and in paint manufacture. At present all the barytes used in the country are imported, though good quality deposits are reported in the former Sind and Baluchistan States Union areas. The Bureau of Mines should encourage the production of barytes in the country through private enterprise.

## Salt

40. There are deposits of rock salt of excellent quality in West Pakistan, and its sea coast offers particularly favourable conditions for the extraction of salt from sea water by solar evaporation. East Pakistan has no rock salt deposits, and extraction of salt from sea water is carried on under much less favourable conditions. The mining of rock salt and salt extraction from salt lakes are government monopolies. Extraction of salt from sea-water is carried on as a private business under government supervision. The country has considerable natural advantages in salt production, and should become a net exporter of salt. In recent years, however, the country has actually been an importer. Since the devaluation of the rupee, it should be possible to export considerable quantities of salt to countries like Japan and Canada. The government agencies concerned, particularly the Ministries of Finance and Commerce, should urgently review these possibilities.

## Limestone and clay in East Pakistan

41. East Pakistan in general is very short of stone. The only cement factory in East Pakistan, at Chattak, uses limestone imported from a quarry in India, just across the border. The Chandraghona paper mills also use limestone imported from India. Limestone, which used to be brought to Chattak for making quicklime in cottage industry operations, has been cut off by the new border. Even ordinary stone for making concrete or roads is extremely scarce. This creates a very special problem for the Geological Survey in East Pakistan and for the Provincial Government. It is important that the Province be surveyed rapidly—particularly the hilly sections—in search of limestone, construction rock and deposits of gravel. Until such deposits are found, the East Pakistan Government should explore the possibilities of developing sources in adjacent areas. A special contract should probably be made, to bring limestone to Chattak for cottage industry use as well as for the cement factory.

42. The most abundant mineral resource in East Pakistan is clay, which exists in many different qualities. Only ordinary loams and brick clays are used at present to any great extent. This represents a substantial unutilised resource, which should be developed. The equipping of the East Pakistan Glass and Ceramic Institute in Dacca should be completed without delay, and the Institute requested to conduct studies on the use of materials found in the Province.

## ESTIMATED COSTS

43. The development costs summarised here are for major changes or expansions. We do not include the normal development work which is—or should be—a part of everyday mining operations, such as the exploratory work to identify new workings at a given mine site and prepare them for mining. The cost of natural gas pipelines is included in the Chapter on Industries. Table 3 below summarises the estimated cost of developing fuel and mineral supplies on the scale proposed during the Plan period.

TABLE 3

*Estimated cost of development programme for fuels and minerals, 1955—60*

(Million rupees)

Purpose	Public Sector	Private Sector	Total
1. Expanding Geological Survey ... ..	7.6	...	7.6
2. Establishing Bureau of Mines ... ..	0.5	...	0.5
3. Special high-priority investigations :			
Chitral (Magnetite) Antimony, etc. ... ..	8.4	2.7	11.1
Jhimpir (Coal and Iron Ore) ... ..	0.2	...	0.2
East Pakistan lignite ... ..	0.6	...	0.6
4. Prospecting for oil and gas ... ..	80.8	336.7	417.5
5. Expansion of coal production ... ..	19.3	10.0	29.3
6. Expansion of chromite production ... ..		0.6	0.6
7. Expansion of gypsum production (PIDC) ... ..	0.4	...	0.4
8. Processing of sulphur ore ... ..	0.4	...	0.4
9. Expansion of salt ... ..	0.8	...	0.8
10. Establishing Minerals Development Corporation (W. Pakistan) ... ..	5.0	...	5.0
	124.0	350.0	474.0