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The Coal Mining Industry in India

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STUDY OF THE ENERGY SECTOR IN INDIA

THE COAL MINING INDUSTRY

A REPORT PREPARED FOR

THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

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THE COAL MINING INDUSTRY

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STUDY OF THE ENERGY SECTOR IN INDIA

PREAMBLE TO THE REPORT ON THE COAL MINING INDUSTRY OF INDIA

It is thought that before introducing the report on the Coal Mining Industry of India, some background knowledge of the industry from the time of its inception to the time of this study might be of value to the reader.

The first recorded working began exactly 200 years ago in the Raniganj coalfield in West Bengal, but expansion was slow and by 1860, nearly 90 years after the first mine began working, 50 mines in the Raniganj area were producing a total of about 280,000 tons per annum. Output from the Jharia coalfield started in 1890; both it and the Raniganj field establishing a pre-eminence which they have maintained to this day.

Development of many other fields followed quickly in the train of the exploratory work conducted by the Geological Survey of India. Among these was the Singareni Coalfield opened in 1886 and destined 62 years later to be the first coal mining area in India to be publicly owned.

By the end of the 19th Century output was 6 million tons per annum and rose by 1910 to 12 million tons. Despite the opening up of further new fields in the interim - Bokaro, Pench Valley and Chanda were among them - the Raniganj and Jharia fields, with outputs of 10 million tons, contributed 83% of total production. Up to this time coal had only been used for steam raising by railways and industry until, in 1911, the establishment of the Tata Iron and Steel Company diverted coking coal from the Jharia field to its proper use - that of steel-making.

After rising to 21 million tons per annum, output slumped in the early 1920's and, but for a short-lived boom, languished until the Second World War. After Independence the importance of coal in the Indian economy was illustrated by the target of 39 million tonnes set for the First Five Year Plan. In fact in 1955/56, 38.4 million tonnes of coal were produced. Up to that time the Government's only stake in the coal industry was the Singareni Collieries Company Limited, formerly part of the holdings of the State of Hyderabad, and the eleven collieries owned by the railways. Using the latter as a base, the National Coal Development Corporation was formed in 1956 for the purpose of expanding output through the development of new mines. The sinking of new mines by private owners was prohibited though they were permitted to expand existing mines.

The Second Five Year Plan demand of 60 million tonnes in 1960/61 was not achieved, only 55.67 million tonnes being produced, but nevertheless considerable growth was secured. The private sector increased annual output from 34 to 45.08 million tonnes, and exceeded its target, but the public sector although increasing annual output from 4.85 to 10.59 million tonnes failed by 6 million tonnes to reach its objective.

The output obtained in response to the Third Five Year Plan demand of 97 million tonnes in 1965/66 was only 67.73 million tonnes and both sectors fell short; the private achieving 54.09 compared with a target of 61 million tonnes and the public 13.64 compared with a target of 36 million tonnes.

The Third Five Year Plan was followed by a period of three one-year plans during which time output from the private sector was practically stationary whilst the public sector increased production from 13.64 to 16.52 million tonnes per annum.

The Fourth Five Year Plan, coming to its end, set a target for the industry in its final year of 100 million tonnes. Less than 80 million tonnes is expected to be produced. A comparison between public and private sectors can no longer be made for by the beginning of the Fifth Plan's final year all mines had become nationalised.

The activities of both public and private sectors have been the subject of a great deal of critical comment. It has been said that the public sector was tardy in developing new mines and grossly optimistic in estimating its growth; but this ignores the problems of new developments in difficult virgin areas and the constraints under which it operated at the time. The private sector was said to be guilty of mismanagement, of raping its collieries and of refusal to make new and adequate investment in them; but this ignores the natural reaction to threats of nationalisation sustained over long periods of time.

In October, 1971, all coking coal mines, with the exception of mines owned by the two major steel companies T.I.S.C.O. and I.I.S.C.O., were nationalised and placed under the management of the specially formed Bharat Coking Coal Limited. In May, 1973, the private and public non-coking coal mines, with the exception of Singareni Collieries Company Limited, were brought together under the single management of the Coal Mines Authority Limited having as its nucleus the mines and management of the National Coal Development Corporation. Thus the position has been reached that after many years of having only a minority holding the State has, within the space of only eighteen months, placed the whole of the mining industry under public ownership.

Quite apart from the moral issues of ownership and management of a country's natural resources; the need for vast investment in mines, in the reconstruction of older mines and for the purchase of new equipment; the need for rational exploitation of reserves and their conservation; and the need for concentration of management skills in the fields in which they can best contribute are perhaps the most telling arguments for the rationale of nationalisation of the Indian Coal Mining Industry.

Lest its prime objective be forgotten, however, it might be pertinent to comment that in January, 1974, the capacity of the industry has not yet reached the 1965/66 target of production set in the Third Five Year Plan.

There is a prodigious task ahead.

STUDY OF THE ENERGY SECTOR IN INDIA

THE COAL MINING INDUSTRY

I. INTRODUCTION

This report has tried faithfully to record the impressions gained in a short study of the mining industry in India. Its actual content results from a concentrated analysis in England of the information gathered during the course of the study. The survey on which the report is based has of necessity been selective. Nevertheless, those sectors of the industry personally examined and the information and opinions collected, have been sufficiently representative to ensure that a balanced view has been obtained.

The main object of the report is to up-date, and if possible extend, understanding of the mining industry in India; to examine the way in which the internal and external environment influences the industry; to consider those factors which contribute to its successes and those which constrain its further development - withal, to give an objective view of the industry's place in the Government of India's Fifth Plan.

Since the report is intended to serve as part of the input to that section of the 1974 Economic Report on India dealing with the energy sector, it has concentrated mainly upon those aspects of the coal mining industry which might have relevance to the total energy scene.

There will be no concluding list of recommendations; their inclusion in a report of this type would be both inappropriate and impertinent. One general conclusion, which the report makes evident, is that further material help would be of great benefit to the industry. The best way of providing such help could well be the subject of a further study.

II. TERMS OF REFERENCE

The original programme of work as laid down by the study co-ordinator, and thereafter modified only slightly, comprehended the following terms of reference:

a) To analyse, in the context of the Fifth Plan
   i) the prospective demand for coal
   ii) the availability and future supply of coal.

b) To consider the investment programme in and beyond the period of the Fifth Plan with particular reference to
   i) grades of coal and their source
   ii) expansion or increased utilisation of existing capacity and the creation of new capacity each in relation to the balance between deep-mined, shallow-mined and opencast coal production

iii) the need to expand coal-washing capacity

iv) constraints on the use of key resources.

c) To examine the coal mining industry with particular regard to

i) colliery operations including production costs, plans for improving efficiency and operating procedures

ii) the pricing of coal products

iii) the organisation of the industry

iv) research and development.

d) To consider problems of coal transport and the extent to which these affect

i) coal production

ii) producer/consumer relationships

e) To examine proposals for the supply of coal to thermal power stations.

It had been thought that the production and supply of coking coal, mainly involving a separate sector of the industry, would fall outside the scope of an energy study, but since there is a high degree of interdependence between all sections of the industry, particularly in relation to the sharing of scarce resources, the coking coal sector was included in the study.

III. THE DEMAND FOR COAL

Despite the increased use of oil, which by the end of the 1960's had overhauled coal as the principal form energy, coal has still a key part to play in the Indian economy. Whilst some Western European Countries, having, like India, substantial reserves of coal, permitted their mining industries to decline in favour of increased oil usage, India has expanded her coal output. No doubt important considerations including balance of payments problems and the need for rapid industrialisation conspired to sustain the demand for coal.

Whatever the reasons for continued dependence on coal might have been, India now finds herself having not only a significant form of indigenous energy in her vast reserves of that fuel, but having the plans already laid to meet an increased demand in production from them.

There is then no doubt about the fact of increase in demand for coal, the doubt surrounds only the extent to which the demand will grow within the period of the Fifth Five Year Plan. There have been a number of assessments of likely future demand - each falling within an extremely wide range - but this is not unusual. The Fourth Five Year Plan, now in its final year, was subject to similar wide variations in estimates of coal demand. At the beginning of the Plan an estimate of 100 million tonnes by 1973/74 was gradually evolved. It was reduced in 1971/72 to 85 million tonnes by 1973/74 and again in January, 1973 to 80 million tonnes by 1973/74. Latest estimates of output from the mining companies indicate that 77 million tonnes will be produced in 1973/74 and although the Draft Five Year Plan suggests that 79 million tonnes will be obtained, the mining companies' estimates have continued to be used at appropriate points in text and tables.

Estimates of coal demand for the Fifth Plan period have been prepared by four different bodies. Firstly, in Part I of its Report published in May, 1972, the Fuel Policy Committee estimated demand in 1978/79 (the final year of the Plan) at 164.5 million tonnes. In January, 1973, the Planning Commission in its "Approach to the Fifth Plan" produced an estimate of 141.2 million tonnes. In the same month the Report of the "Task Force on Coal and Lignite for the Fifth Plan" concluded that 143 million tonnes was the likely demand and lastly the Fifth Plan, when finally published, contained a revised estimate of coal requirements amounting to 135 million tonnes. The range of estimates gives a mean value of 150 million tonnes ± 10%. The wide divergency in the estimates illustrates only too well the problems of forecasting for a period up to five years ahead. In my view it would be better to express estimates in terms of a range of values the upper and lower limits of which would vary as the range of assumptions.

Table I shows three of the four estimates for which details are available. Comparison of the estimate of the Fuel Policy Committee (which to be achieved, would have implied a growth rate of 15.5% per annum for the five years of the Plan) with the Planning Commission's estimate (requiring a growth rate of 11.0% per annum) and that of the Task Force (requiring a growth rate of 12.3% per annum) is most interesting, but before making comparisons some adjustment to the figures is required.

Firstly, whilst the Planning Commission and Task Force estimates of coal for steel plants are in terms of raw coal, the Fuel Policy Committee estimate is as charged to ovens. Secondly, whilst the Planning Commission and Task Force estimates of coal for thermal power stations exclude middlings from washeries, the Fuel Policy Committee estimate includes them. An attempt to reconcile the estimates is made in Table I by reallocating the middlings in the Fuel Policy Committee Estimate (see notes f and g in Table I).

It would most certainly lead to easier comprehension, and to a better understanding of the problems facing the estimators, if all estimates were prepared upon a strictly comparable basis.

Relying upon work done by the Technical Committee on Coal Washeries and upon an estimate of hot metal production made by the Department of Steel before May, 1972, the Fuel Policy Committee arrived at a demand for coking coal far in excess of any later estimates. Estimates of coal for thermal power requirements made by the Fuel Policy Committee were also pitched at a high level, and this presumed higher level of activity affected estimates of coal demand in the industrial sector too.

Of the three estimates, that made by the Fuel Policy Committee with its implied growth rate of 15.5% per annum is clearly too high. It has been superseded by later estimates - the final figure being the 135 million tonnes included in the Draft Plan. However, there is insufficient supporting information in the Draft Plan to permit a meaningful analysis to be made and therefore, throughout this section on coal demand and in the succeeding sections on coal supply, reference will continue to be made to the Task Force estimates.

a) Demand for Coal for Steel Plants and Merchant Coke Ovens

Estimating the demand of raw coal for steel plants is an extremely complicated exercise. Partly because of some flexibility in the proportions of different types of coking coal which go to make up the blend, partly because of the variability in the source of each type of coking coal and partly because of the difference in washery characteristics, the demand for prime, medium and blendable coking coals, either raw for direct use or washed, can vary significantly. Furthermore each steel plant has its own factor relating coal consumption to hot metal production, so that total demand will fluctuate with the variability of steel output from individual plants.

The translation of hot metal production into coal equivalent as charged to the ovens is shown in Table II. Table III illustrates the types of coking coal required to provide the necessary blend and shows the total equivalent raw coal requirement. Both tables have been derived from information contained in the Task Force Report. It would appear from Table III that the existing washeries are capable of meeting the increased demand for washed prime coking coals. The demand for new washery capacity appears to be largely in the medium coking coal range.

It is known that plans are being laid for new washeries at Ramgarh and Kedla, but with capacities of only 1.0 and 0.5 million tonnes per annum respectively, more washeries or further extension to existing washeries will certainly be required. The Draft Five Year Plan refers, in paragraph 5.136 to increasing washery capacity by 10 million tonnes, but it is not clear whether washery input or washery output is meant.

One important aspect of the increase in steelmaking capacity is the plan to erect steel plants in Southern India at Visakhapatnam and Vijayanagar. In the final year of the Five Year Plan the demand for coal for these plants is estimated in the Task Force Report at 1.56 million tonnes, but this could double or even treble in the first two to three years of the Sixth Plan. In seeking new washery capacity in the medium/semi-coking coal range, the contribution which can be made to the wider demand for coking coal by the Western Division of the Coal Mines Authority Limited should not be overlooked.

Although the Task Force Report refers to the work of the Technical Committee on coal washeries, there is no specific reference to steel plant/washery linkages. However, Bharat Coking Coal Limited in its "Fifth Plan for Coking Coal" does provide such a linkage. Compiled on a monthly basis, the appropriate estimates have been recalculated on an annual basis and are shown in Table IV. There is complete agreement between Bharat Coking Coal Limited and the Task Force as to Total Demand and Total Supply from washeries, but the two estimates diverge sharply both in respect of the grades of coking coal to individual steel plants and in respect of the identity and load of the supplying washeries.

Part of the reason for the divergency lies in the fact that the estimates of the Task Force are based upon the recommendations of the Dutt Committee (Committee on Rational and Equitable Distribution of Coking Coal), on the ratios of Prime Medium and Blendable Coals to be used in steel plants. These presumed a higher utilisation of Medium Coking Coal, but Bharat Coking Coal Limited point out that the proposed blend pattern has not been commercially established and would in any case require facilities for selective crushing and preparation at steel plants which could not be provided in time to accept the proposed higher inputs. Bharat Coking Coal Limited have preferred, and in the short term they could well be justified, to use existing blends to arrive at the balance between supply and demand. The result of the difference is that whilst the Task Force assumes sufficient washery capacity for prime coking coal (see Table III) and sees the need for appreciable extension of medium coking coal washing capacity, the Bharat Coking Coal Limited sees a greater need for extending prime coking coal washery capacity. Bharat Coking Coal Limited estimates of washery outputs are 11.232 million tonnes of prime and 6.996 million tonnes of medium whilst the Task Force estimate is 9.92 million tonnes of prime and 8.61 million tonnes of medium - not inconsiderable differences (see Table IV).

Perhaps in anticipation of these problems, the Task Force recommends that an annual review of the blends of coal requirement should be conducted by the Steel Authority of India Limited. A consistent set of projections is preferred as a basis for firm proposals for meeting the demand for increased coking coal envisaged in the Fifth Five Year Plan.

There appears from most estimates to be agreement on the demand from Merchant Coke Ovens. During the last three years demand has risen for all types of coke and, with the sole exception of hard coke, this increase in demand has been met. The actual growth rate of 9% per annum has been extended to 10% per annum by the Task Force estimators to give the following demands and outputs during the Fifth Plan. From the Durgapur Batteries - .30 to .60 million tonnes of coke requiring an increase in coal from .65 to 1.34 million tonnes. From other By-product Plants - .40 to .90 million tonnes of coke requiring an increase in coal from .60 to 1.65 million tonnes. From Beehive Ovens - 1.40 to 1.60 million tonnes of coke re iring an increase in coal from 2.10 to 2.40 million tonnes. The resultant co l demand for all types of hard coke is expected to increase from 3.35 million tonnes to 5.39 million tonnes.

The Planning Commission's estimate has combined the steel plant and merchant coke-oven demands and arrived at a requirement of 32 million tonnes of coking coal in 1978/79. This is 0.8 million tonnes less than the Task Force estimate. In view of the forecast trend in hard coke demand being so close to the historical trend and the fact of the general unanimity in the estimate of demand (note that even the generally high estimates of the Fuel Policy Committee were in this instance in line), it is inferred that the Planning Commission have reduced the Task Force estimate of coal requirement for the steel plants from 27.4 to 26.6 million tonnes. It is felt that even the reduced estimate might be too high, for, against a background of no growth over the last three to four years, the forecast predicts an annual growth rate of 10.33% during the Five Year Plan. This rate is based on the assumption that 12.830 million tonnes of coal are charged to ovens in 1973/4. If this high initial level is not achieved the requ red growth rate during the plan would need to exceed 11%.

b) Demand for Coal for Thermal Power Stations

Like the estimates of demand for steel plants, those for power stations have shown wide variations. The most important estimates quoted by the Task Force, in addition to its own, were those by the Fuel Policy Committee and the Central Water and Power Commission. These together with the Planning Commission estimate are shown in Table V, but one other important source of information, the Coalfields Linkage Committee, made estimates only in respect of those power stations already approved for the Fourth Plan and since it is an incomplete estimate, it has not been included. As would be expected from the previous paragraphs the Fuel Policy Committee estimate is high, reflecting its estimate of the high supply of middlings. But, based solely upon its estimate of the rate of thermal station construction the Central Water and Power Commission arrived at a demand estimate far in excess of others - so high in fact that a growth rate of 17.4% per annum for six years would be required to achieve it.

In considering previous estimates the Task Force, whilst rightly stressing the need for substantial growth in generating capacity, held to the view that so rapid an expansion was not achievable. However, it did take cognisance of the work of the Coalfields Linkages Committee and to that body's estimate of the consumption of 42.68 million tonnes for stations in the Fourth Plan, the Task Force added a demand of 8.82 million tonnes for more new schemes, so arriving at a total demand of 51.5 million tonnes in 1978/79 including 6.5 million tonnes of middlings. The estimate of the Planning Commission at 50.0 million tonnes is 1.5 million tonnes less than that of the Task Force, but since an availability of only 5 million tonnes of middlings is assumed, the net raw coal demand at 45 million tonnes is the same as the net raw coal demand estimated by the Task Force.

When the Draft Five Year Plan was finally published, coal demand for thermal power stations was stated to be 43 million tonnes even though the total demand agreed with the Planning Commission's estimate of 135 million tonnes. The explanation of this difference is not clear. Indeed, a further complication arises since there must also be a difference of 2 million tonnes in some other demand sector or sectors. There is no indication of where that difference might lie.

If the lower estimate of 43 million tonnes of raw coal to power stations is correct and if the estimated availability of middlings remains at 5 million tonnes, then the Draft Five Year Plan demand is 48 million tonnes. This means that a growth rate of 11% in coal demand for power generation is expected, the same as the Planning Commission's estimate of growth in total demand.

c) Railways

Consumption of coal by the railways, the third of the major consumers, has steadily declined as programmes for dieselisation and electrification have progressed. There is little variation in the different estimates shown in Table I since, as might have been expected, the Ministry of Railways has been the main contributor to each of them. The estimated demand of 13 million tonnes is in line with the trend in declining consumption.

d) Other Users

Both the Task Force and Planning Commission agree that two thirds of the demand will be from the three major users. In quantitative terms the differences between the two estimates lie with the small industrial users. There is little point in attempting to analyse the individual small users. Their rate of growth will depend so much upon the achievement of the targets set for growth in steel and electricity production, that demand by them will almost inevitably follow the trend of the major users. There is one area of coal demand, however, which because of its impact upon the economy, is worth special mention. Domestic soft coke production was 2.4 million tonnes in

1971/73 for which 3.6 million tonnes of coal were provided. The Fuel Policy Committee estimated a demand for 6.3 million tonnes of soft coke in 1978/79 which would have required 9.5 million tonnes of raw coal. Conscious of the problems of transporting so much coal in small consignments to so many small plants, the Task Force reduced the estimate to 5 million tonnes of soft coke requiring 7.5 million tonnes of coal. With plans formulated to erect two low-temperature carbonising plants for the production of soft coke, the Task Force suggests that the production of a further .7 million tonnes of coke from these plants would not unduly stretch transport facilities and has thus arrived at a total demand for 8.7 million tonnes of coal for soft coke production.

With greater quantities of soft coke at its disposal, the Government of India would be better placed in its efforts to discourage the use of wood and cow-dung, the so-called non-commercial fuels, so reducing both the threat of deforestation and the loss of natural fertiliser. These factors will almost certainly ensure that the use of coal in producing soft-coke will be given a high priority during the Fifth Plan.

e) General

It is difficult, without specialist knowledge of each of the consuming sectors, to evaluate the estimates of the demand for coal. Whilst it is clear that many of the estimates have an element of targetry in their make-up, in the particular circumstances of India's desperate need to expand her economy, that is no bad thing. On the other hand, the difference between targets and estimates of the likely outcome of ev[illegible]s must be recognised or there is a danger of unrealistic demands resulting in the preparation of unrealistic plans to produce an unrealistic supply. Nor must failures to meet targets in one sector be permitted unduly to effect progress in another. If, as has happened in the past, supply of coal begins to outstrip demand then the use of strategic stocking to act as a buffer between the two should be closely examined. It would be wrong, in circumstances where the long-term demand for coal is beyond doubt, to have a repitition of the situation recorded in the report of the Department of Mines in the Ministry of Steel and Mines for the Year 1972/73. There, commenting upon the reduction of stocks from 9.58 million tonnes to 6.96 million tonnes (both incidentally far lower levels than would normally be acceptable as adequate for strategic stocking) the report states - "The reduction in stocks was also due in some measure to curtailment of production by the collieries in order to clear stocks". One would not wish to see this situation developing during the course of the Fifth Plan.

Adopting a qualitative view, it would appear that the estimates of coal demand are too high, but even if lowered by as much as 10%, they are in my view as high as, if not higher than, coal output is likely to be by 1978/79. It is right that the higher levels of estimated demand should stand so that the coal mining industry should be induced to expand output as fast as possible, for it is almost certain that every ton of coal that can be produced will be required.

IV. THE AVAILABILITY AND SUPPLY OF COAL

a) Reserves of Coal

India is endowed with extensive reserves of coal. The exact amount is difficult to assess since estimates vary widely. The reserves shown in Table VI have been especially summarised from a table published in Geological Survey of India News in April, 1972. These are preferred to other estimates because they are the latest available. Other estimates quoted by the Fuel Policy Committee in May, 1972, and by the Energy Unit of the Planning Commission in February, 1970, appear to have the common and undated source of the Committee on Assessment of Coal Resources, but must predate the Geological Survey of India's assessments by more than two years.

The Geological Survey of India's reserves estimates of coking coal are, at 20,119 million tonnes, somewhat higher than the 18,448 million tonnes quoted by the Fuel Policy Committee. When each estimate is discounted for losses in working and washing, the difference between them is negligible. In his book on the "Coal Industry in India", the late Mr. S. Mohan Kumaramangalam carries out such an exercise. The Fuel Policy Committee Estimate is first reduced to 13,468 million tonnes by disregarding the poorer coking coals of West Bokaro, Ramgarh, Giridih and Per...-Kanhan and then is further discounted by 9,795 million tonnes for losses in mining and in the washeries. The resultant net availability to coke ovens of 3,673 million tonnes is a dramatic reduction on the in-situ assessments, but even so, these reserves are theoretically sufficient to permit a three-fold increase in steel production and still last for 100 years.

In a series of papers on the "Problems of Coking Coal in India", Dr. A. Lahiri makes the telling point that the availability of prime coking coal is the key factor determining the effective life of the total coking coal reserves, since reserves of medium and blendable coking coals are of little use without prime coking coal with which to blend them. He concludes that, by judicious use of all coking coal reserves, they should be adequate to last for at least 75 years. It was, of course, with these factors in mind that the Dutt Committee, the Fuel Policy Committee and the Task Force all stressed the importance of increased use of medium coking coals.

The Geological Survey of India's estimates of reserves of non-coking coal are, at 60,833 million tonnes, substantially lower than the Fuel Policy Committee's assessment of 94,734 million tonnes. There are minor differences in every coalfield but the main reasons lie in the differences in unclassified reserves in two fields - Talcher and Sohagpur. The G.S.I. estimates of 2.84 and 0.73 million tonnes respectively compare with the Fuel Policy Committee estimates of 30.00 and 3.84 million tonnes respectively, a total difference of 30 million tonnes. Translation of either set of estimates into saleable coal depends upon a number of factors the most important of which is the nature of the in-situ coal seams of India.

But for a very small part of the coal reserves which are Tertiary in origin, the coals of India occur within the Upper Palaeozoic formations and are known as the "Gondwana Coal". The coal seams are believed to have been deposited during Permian times among a succession of fresh-water sedimentary rocks. That fact, their thickness (sometimes exceeding 45 metres), and the very high ash content of WITH EXCEPTION the seams are all evidence of their having been laid down in wide valleys, lakes or flood plains, and possibly by the processes of drift and accumulation rather than by deposition of coal-forming material in situ.

The fact of the high ash content and the thickness of the seams are serious disadvantages to marketability and workability. In past years when output from the higher quality lower ash coals of the Jharia and Raniganj coalfields accounted for as much as 80% of the total coal production, then average ash content of 14% could be maintained. Despite greatly increased production from both these fields, the percentage contribution from them has decreased as output from other fields has expanded at an even greater rate. Jharia and Raniganj fields are themselves producing more of the higher ash coals so that inevitably the average ash percentage has been increasing over the years and now exceeds 20%.

The importance of ash as an indicator of quality is seen in the standard procedure for classification of coal which is briefly summarised in Appendix IV. Extended only to proved reserves, the classification grades coal within clearly defined ash limits, and when applied to Table VI it is seen that 9,040 million tonnes out of a total of 12,343 million tonnes of proved reserves of non-coking coal fall within the reserves classes I to III. Thus 73% of proved reserves have ash/moisture contents of less than 40%, and if this percentage were applied to total reserves some 45,000 million tonnes would be in the -40% ash/moisture range. Hitherto seams with ash contents exceeding 40% have not been generally worked and if this policy were to continue, in-situ reserves would be reduced to 45,000 million tonnes.

An accepted factor in Britain for translation of workable reserves (which are generally less than in-situ reserves) into saleable coal is .5 and on that basis the reserves at 22,500 million tonnes would, like those for coking coal, permit a three-fold increase in production and still last for 100 years.

The same reasoning applied to the higher Fuel Policy Committee estimates of non-coking coal reserves would extend the life to 150 years.

The Geological Survey of India Table of Reserves has again been especially summarised in Table VII, but this time by Mining Company and by State. It shows that whilst Bharat Coking Coal had in the Jharia field the major reserves of prime coking coal, the Coal Mines Authority had nearly twice as much coking coal available. It is understood that this balance is in the process of being redressed and that many mines worked by the Coal Mines Authority for medium coking coals are being transferred to Bharat Coking Coal and, incidentally, from the Department of Mines to the Department of Steel.

The table also demonstrates one of the major problems in the coal-mining industry. 55,000 million tonnes of the total reserves of 80,000 million tonnes are concentrated in the States of West Bengal and Bihar. In 1971/72 69% of total production came from them and although the Fifth Plan attempts to reduce the reliance on the fields in these States, both the Task Force and Planning Commission estimates show the output from them in 1978/79 as equating to about 61% of the total production. Their importance is illustrated by thought being given to projects to make more theoretical reserves available for working. One such project - certainly a long term one and having implications far beyond the conservation of reserves - is the physical removal of the township of Jharia. Not only are large reserves sterilised by the town, but those that are worked at shallow depth are "hand-got" by most inefficient methods solely for the purpose of avoiding the social nuisance which would be caused by the noise of explosives. A second potential project relates to reserves of some 65 million tonnes of excellent quality medium coking coal in the East Bokaro coalfield. To work them would involve diversion of the Damodar River and a tributary of it, diversion of a railway line and the removal of Bermo township. The total cost of the diversions has been estimated at 10 to 11 crores of rupees.

b) Exploration

With reserves of all types of coal available in sufficient quantities to last some hundred years or more there is a temptation to speculate on the reasons for contemplating socially disturbing projects such as those referred to above or to ask why so much emphasis is being placed on exploration work during the Fifth Plan.

It is argued that with the suspension of drilling in non-coking coal areas from the mid 1960's - when the demand slumped - much leeway has to be made up.

The point is also made that much of the exploration work in the period of the Fifth Plan will form the basis of projects for expanding output in the Sixth Plan for which a possible production target of 238 million tonnes per annum has been mentioned. A great deal of the extra output will need to come from virgin areas and this increases the exploration load since, inevitably, it is higher for the exploration of new as distinct from existing working areas. But in the older fields too, further work will be required. Expansion of output from the Jharia field, envisaged for the Sixth Plan period, will mean working seams at greater depth and only now are these deeper seams in the process of being investigated. The policy of coking coal conservation, demanding a greater use of medium coking coal, will accelerate exploration in the Raniganj, Bokaro and Pench-Kanhan-Tawa coalfields.

Exploration in India is carried out by a number of different agencies. Regional drilling is controlled by the Geological Survey of India which might either drill the holes itself or call upon the services of the newly formed Mineral Exploration Corporation. Detailed drilling would either be carried out by the Mining Company itself, by the Mineral Exploration Corporation or very occasionally by the Geological Survey of India. The Geological Survey of India is a long established, highly regarded institution founded in 1851. Initially involved in coal exploration, it has always been responsible for resources investigation. Its programme for the Fifth Plan includes 700,000 metres of drilling, 400,000 metres of which will be for strategic coal exploration. The programme has been worked out with the appropriate Ministry and mining officials, but where time and resources permit the Geological Survey will undertake some exploration on its own account. To equip it for the task, 170 new drill-rigs will be required bringing the number in the field to 250. 72 of these will be for coal exploration, a substantial increase on the present allocation of 45.

Strategic drilling will continue in the Jharia and Raniganj fields, but more emphasis will be placed on exploration in the important Singrauli, Pench-Kanhan-Tawa, Korba, Talcher, Karanpura and Godavari as well as other minor outlying fields.

Detailed, or tactical, drilling will be carried out under the auspices of the mining companies, but only the Coal Mines Authority has firm plans for significant expansion. It has 17 drills deployed for exploration in the Singrauli, Talcher, Korba, Kamptee, Pench-Kanhan and North Karanpura fields, but to extend this work, a total of 85 new drill-rigs will be required; 34 of these will be operated by the Mineral Exploration Corporation under the guidance of the Coal Mines Authority and the remaining 51 drill-rigs will be operated by the mining company - a threefold increase on its present complement. In addition to this ambitious programme a further 50 drill-rigs are considered necessary for detailed drilling in the erstwhile private sector mines, and even though it is intended that this further extension of work should be undertaken by the Mineral Exploration Corporation, the total work load is formidable. The bulk of the work is required to be completed in the first two years of the Fifth Plan if the information is to be of value for output expansion by 1978/79.

To meet this work load it is said that staffing of the Geological section of the Coal Mines Authority would need to be expanded as shown below.

	Staff Complements *		
	Present	Future	Additional
Geologists	24	180	156
Surveyors and Draughtsmen	22	219	197
Drillers and Rig-men	226	433	207
Supporting Administrative Staff	25	150	125
Others	264	1451	1187
Total Staff	561	2433	1872

* The Report on the Establishment of the Central Mine Planning and Design Institute prepared by Polish Experts of "KOPEX" estimated a general requirement of 27 rigs and 1087 staff.

Bharat Coking Coal has 11 old drills at its disposal and will need 35-40 new drill-rigs which are likely to be operated by the Mineral Exploration Corporation. Singareni Collieries Company, has 20 old drills and has purchased 10 new ones for tactical drilling to the dip of its existing mines. Newer areas will be investigated on behalf of the company by the Mineral Exploration Corporation.

It appears that at least 130-140 drill rigs will be operated by the Mineral Exploration Company on behalf of the mining companies. If to these are added the mining companies' own rigs and those of the Geological Survey about 300 rigs will be in operation compared with about 80 currently deployed. If the complement of staff for manning of the rigs as assessed by the Coal Mine's Authority is taken as standard, the demand for skilled personnel - geologists surveyors and drillers - as well as for drill-rigs, reaches quite staggering proportions. Part of the problem is caused by the need to complete so much of the work within the first two years of the Plan. Geological reports on the potentialities of seams to be worked, rightly form such an important part of project submissions that, unless the exploration is completed quickly, many projects essential to the Fifth Plan might not be conceived before its term is run.

fact that in its "Development for the Fifth Plan" the Coal Mines Authority, unlike Bharat Coking Coal and Singareni Collieries Company, does not show any matching of supply and demand.

Table X compares estimates of the breakdown of supply by regions made by the Task Force and the Planning Commission with a similar breakdown compiled from the suppliers' estimates. From this it becomes apparent that, with the Bengal/Bihar supply estimates from the mining compan[illegible] already exceeding the Task Force estimate of supply from Bengal/Bihar, it could not have been intended that T.I.S.C.O. and I.I.S.C.O. should submit separate estimates additional to those supplied by the mining companies. It follows that the T.I.S.C.O. and I.I.S.C.O. demand must be catered for in the Bharat Coking Coal's estimate of supply.

By and large, the Task Force estimates of the amounts from supplying regions coincide with those of the suppliers. There is some discrepancy in the Central Indian Coalfields and the Task Force estimate appears to be high. The Singareni Collieries Company's estimate of supply of 12 million tonnes is higher than the original estimates of demand.

In reducing the estimates of supply, the Planning Commission have taken 8 million tonnes from the Task Force estimate of 143 million tonnes. This reduction of 5.6% has not, of course, been applied indiscriminately to each coalfield. It is noted that the Bengal/Bihar field supply is cut by 4.48 million tonnes (5.1%) and the outlying fields by 3.63 million tonnes (6.5%). It is assumed that the cut in the Bengal/Bihar supp[illegible] is apportioned between the companies in the same proportions as their projected outputs. It would ease the problems of transport if production from outlying fields could be extended rather than reduced since this would lessen reliance on the heavily concentrated Bengal/Bihar field.

Table X also shows a comparison between the mining companies' estimates of production in 1973/74 and 1978/79. Using the 1973/74 estimates as a base, the following group of tables show the growth rates over the span of the Five Year Plan and the compound annual growth rate required to achieve the estimates. Table XI compares the expected production level for 1973/74 with the Task Force estimate for 1978/79; and shows the required growth rates. Table XII makes a similar comparison with the estimates of supply of the Planning Commission, but, as noted above the apportionment as between companies is estimated. Table XIII makes the same comparison with a personal estimate. This is based upon consideration of the constraints which in the past have hindered, and unfortunately in the future will still hinder, the more rapid progress of the mining industry. The reasons for the substantial reductions in certain sectors will be referred to later in the report.

The reduction in the estimates of supply is not to infer that a similar reduction should be made in estimates of capacity. To the contrary, extra capacity will be required and plans laid to increase it up to and even beyond the level of 143 million tonnes per annum should be pursued vigorously.

V. THE MINING INDUSTRY

How well equipped is the industry to face up t and accomplish the tasks set it? A judgment based upon a few days examination is clearly difficult since many of the problems must of necessity be new to the experience of an observer from a different environment. They can, however, be identified if not solved.

a) The Geographical Location of the Coalfields

Because of the presumed nature of their deposition, either in deep rift or glacial valleys, the coalfields of India lie along clearly defined lines. Some hundreds of kilometres in length but in most cases less than fifty kilometres in width the lines contain groups of coalfields varying from the very large such as Raniganj with an area of 1550 square kilometres, to a number of small fields, many as yet unexploited, only a few square kilometres in size. The line connecting Singareni to the Pench Valley coalfields is 800 kilometres in length; that connecting Raniganj to Singrauli is 650 kilometres. The distance between Raniganj and Pench Valley is 1,000 kilometres, which is also the distance between Raniganj and Singareni.

Excluding the small north-eastern fields and the lignite deposits, none of which were visited, the coalfields ext over the states of West Bengal, Bihar, Orissa, Madhya Pradesh, Maharashtra and Andhra Pradesh. West Bengal and Bihar contain most of the reserves, produce most of the coal, and have most of the problems. The other states contain most of the new fields of non-coking coal, so that a natural extension into them must be constrained by the need to expand coking coal as well as non-coking coal output. Appendix III lists the coalfields and shows which mining company manages them. The accompanying map identifies and locates each coalfield.

b) Organisation of the Mining Industry

Prior to May, 1973, the industry was organised into four major sectors. The oldest state-owned organisation was Singareni Collieries Company, which since 1948 had managed the mines in Andhra Pradesh owned jointly by that State and the Government of India. The next oldest Government-owned sector was the National Coal Development Corporation which, since 1956, had been charged with the main task of increasing capacity by the creation of new mines. Bharat Coking Coal had been in existence a little more than two years and had been charged with the management of the coking coal mines. Finally, the private sector, accounting for about two thirds of total output in 1971/72, was organised as private colliery companies - some large and efficient, many more of them small, ill equipped, under-capitalised and poorly managed. Apart from some minor regrouping and exchanges, the private sector and the National Coal Development Corporation were regrouped into one organisation - the Coal Mines Authority. This produces about 75% of the present total output. It has been organised into three divisions, the headquarters of each of which is situated at or near the coalfields, but the Authority's headquarters are in Calcutta. From here it also controls directly the small group of coll ies in the north-east states. The major groupings of the coal-producing secti ns of the mining industry, and the associated but non-coal producing organisations are as follows.

i) The Eastern Division of the Coal Mines Authority with headquarters at Sanctoria in the Raniganj coalfield is centred on that coalfield and the nearby Mugma field. The mines in it numbered about 300 at the time of nationalisation but have been reconstituted into 86. They produced 19.5 million tonnes of coal in 1972/3 and have laid plans to produce 33.8 million tonnes in 1978/79. The Division consists of six Areas, one containing two Groups, two containing three Groups and three containing four Groups of collieries. The Groups themselves vary in the number of collieries allocated to each but none has fewer than two and none more than eight. Area outputs average about 3 million tonnes per annum and Group outputs about 1 million tonnes per annum. The Division is compact, but because the mines were all privately owned some difficulty in welding together a newer larger organisation can be anticipated.

ii) The Central Division of the Coal M s Authority covers the coalfields of East and West Bokaro and North and South Karanpura, all in the state of Bihar; Singrauli in Madhya Pradesh; and Talcher in Orissa. It is much more widespread than the Eastern Division, but of its 53 mines 26 were previously publicly owned so that the nucleus of the new organisation already existed. Indeed Ranchi, which is the headquarters of the Central Division, was the Headquarters of the National Coal Development Corporation and still houses its planning wing which, now planning on behalf of the whole of the Coal Mines Authority, is becoming the new Central Mine Planning and Design Institute. The Central Division produced 15.5 million tonnes in 1972/73 and although smaller in output than the Eastern Division, the geographical spread of its coalfields demands one more area. The seven Areas are divided; five into two Sub-Areas and two into three Sub-Areas, and each Sub-Area produces about 1 million tonnes annually. This division has the most coal reserves and the most ambitious plans for expansion (from 15.5 to 37 million tonnes of annual production in the Five Year Plan). Its operational units will undoubtedly require regrouping during the course of the Plan. The process may in fact have already started if, as has been reported, Bharat Coking Coal has taken over management of some of the division's medium coking coal mines.

iii) The Western Division of the Coal Mines Authority is even more widely spread than the Central Division, having mines in Madhya Pradesh, Orissa and Maharashtra. It has seven Areas, most of which cover three or four widely separated coalfields. Of its 76 mines only 58 are in production, though plans to reopen most of the closed mines are being pursued. Four Areas have three Sub-Areas each whilst the remaining three Areas have two Sub-Areas each, the arrangement depending primarily on their geographical locations rather than on the number of collieries in them. Average annual output of each Sub-Area is just under 1 million tonnes. As with the Central Division, there is a mixture of publicly developed and ex-private mines. These produced 15.7 million tonnes of coal in 1972/73 and it is planned that output should be extended to a level of 31.5 million tonnes by 1978/79. Nagpur, the headquarters of the Division, is not as centrally placed in relation to its outlying coalfields as is Sanctoria or Ranchi.

iv) The Singareni Collieries Company administers the collieries in Andhra Pradesh. These are situated in the Godavari Valley Coalfield more than 200 kilometres from Hyderabad, the State capital, which houses the nominal headquarters, although the registered offices and operational headquarters of the company are at Kothagudam, in the coalfields. With only 25 mines producing 5 million tonnes of coal in 1972/73, its size demands a different type of organisation than the Coal Mines Authority. It has seven divisions and their numbers may be expanded as production increases. The company's own plans were to increase output to 12 million tonnes in 1978/79, but the Draft Fifth Plan has reduced this to 10 million tonnes. The company, because of its geographical location could help considerably in supplying the Southern States so reducing the alternative long haul from the northern coalfields.

v) Bharat Coking Coal is centred largely on the Jharia coalfield, but has some collieries in the Raniganj coalfield and will be taking over others in the medium coking coalfields of the Central Division of the Coal Mines Authority. The 388 mines taken over from the private sector in 1971 have been reorganised into 87 producing collieries. To control them there are five Areas split into 22 Sub-Areas, each producing on average a little more than 0.5 million tonnes per annum. The Sub-Areas share with the collieries responsibility for production and costs, and the Areas have the additional responsibility for future planning, development and profitability. There is no central planning service as in the Coal Mines Authority, but it is intended that the Central Mine Planning and Design Institute will function for all sections of the industry. The company is a subsidiary of the Steel Authority of India Limited, so that its responsibility is to the Department of Steel and not to the Department of Mines, although both are in the same Ministry. The output for 1972 was 12.7 million tonnes, a little less than the 14 million tonnes in the previous year, though it is not clear if the same number of collieries were producing in each year. The company plans to increase annual output to 28 million tonnes by 1978/79. Like the Eastern Division of the Coal Mines Authority, the concentration of activities onto one main coalfield must help the organisation. Its headquarters, situated at Jharia, is in the coalfield itself.

vi) The Coal Board is one among a number of non coal-producing organisations which, because of their relationship to the mining industry in India, need to be mentioned. It has in past years had a not inconsiderable role to play in conservation of reserves, provision of transport facilities for sand stowing, grading of coal, collection of certain cesses, and disbursement of subsidies. The Chairman of the Coal Board is also Coal Controller and in that capacity he co-ordinates the supply, allocation and delivery of coal. It is understood that the Coal Board is about to be wound up, mainly because since all mines are now nationalised the essentially "watch-dog" nature of the post has disappeared. Control of coal movement has also been greatly simplified and the Coal Controller's duties could also disappear.

vii) The Central Fuel Research Institute, although working closely with the mining industry, is a Government sponsored body which works equally for other fuel industries. There is no research establishment under the direct control of the mining industry. There is no counterpart, for example, of the British National Coal Board's Coal Research Establishment working solely on problems associated with promoting coal and only coal as a fuel. However, very important work has been carried out on coal products, on high and low temperature carbonisation and on gasification. Other important functions of the Institute include quality control of output from coal preparation plants and from carbonisation plants. Sampling and analysis of drill cores and of coal from underground workings are routine operations - there are 450 men in the field taking samples. Work on synthetic oil, fuel cells, hydrogen storing and energy from organic waste (rice husks for example) are other areas in the energy field which are pursued by the Institute

viii) The Central Mining Research Station, again a body independent of the mining industry, in carrying out its work, concentrates mainly on matters related to mine safety and health. Testing of equipment occupies 15-20% of the Station's resources. Work on environmental conditions - ventilation, dust, gas, mine fires, spontaneous heating, humidity, workings at depth and the study of the physiology of work people are important areas of research. This aspect of its work is carried out in Britain by the Government's Safety in Mines Research Establishment, whilst the National Coal Board's own Mining Research and Development Establishment concentrates on fundamental research into operational problems and researches and develops new equipment and techniques. Strata behaviour, subsidence and roof support are some of those activities in which the

Central Mining Research Station also involves itself, but there is a wide area of research relating to the development of new mining machinery and its application in which a great deal of work has yet to be done before the Station can be as effective as its British counterpart. No doubt more could be done, if financial resources were made available. The amount of money available for research is referred to in the section on Research and Development VII (j) page 43.

ix) <u>The Mining and Allied Machinery Corporation</u>, a subsidiary of the Ministry of Heavy Industry was set up for the purpose of providing the industry with mining equipment. Reduced demand led to its diverting its productive capacity into other fields, but plans are now afoot to concentrate its capacity to its original purpose. As far as can be seen, there is no formal link between the manufacturer, the research establishment and the consumer aimed at providing the right equipment to suit changing conditions. There is a "Committee on Standardisation" formed in 1973, but without the benefit of detailed research there is no guarantee that the best available equipment is adopted as the accepted standard. In Britain, the National Coal Board's Mining Research and Development Establishment provides that key link and in addition carries out important research work on machine design and, in collaboration with operating collieries and manufacturers, is involved with the development and field trials of equipment. In this way it is seen that the equipment produced is what operational management requires and not what the manufacturer thinks is required. formal relationship between the mining companies, the Mining and Allied Machinery Corporation and the Central Mining Research Station should be established with a view to developing the type of equipment best suited to the needs of the mining industry of India, and so reducing the risk of manufacturing equipment ill-suited to the conditions under which it has to operate.

The coal-producing section of the mining industry, although it is publicly owned, has no single top level of management. Central control is exercised by the Ministry of Steel and Mines, but even then the coking and non-coking coal sections of the industry are controlled by different departments - the Department of Steel and the Department of Mines. Neither department contains the financial, marketing, purchasing, engineering or industrial relations expertise so essential to the successful management of large corporations, nor can either give its undivided attention to the task of management. Whilst the mining companies have such expertise their very separateness means that expertise is spread that much more thinly than if they were organised into a single management unit. It appeared that many of the advantages claimed for nationalisation by its protagonists, including integrated management and control and the more efficient allocation of scarce resources, were not being realised.

c) Colliery Operations

This section of the report is not intended to be, nor could it be, a treatise on the operation of coal mines in India. It merely endeavours to illustrate some of the problems, particularly in the context of increasing output to meet the objectives of the Fifth Plan. Appendix II gives more detail of collieries and specific operations but even there, descriptive narrative is of necessity brief and selective.

In a mining industry as widespread as that of India, identical mining conditions would not be expected to persist throughout the industry. Nevertheless, there are a number of common factors which could be said to typify mining in the sub-continent.

The seams are generally of such a thickness that in underground workings multi-level extraction is required. Seams are worked at fairly shallow depth and the gradients are moderate. Drift mines or mines with shallow shafts predominate but opencast mining continues to grow, particularly in the newer coalfields. Some deeper mines were sunk in recent years by the National Coal Development Corporation in the Jharia coalfield and more will be required in that coalfield for the exploitation of the deeper reserves of prime coking coal.

i) Opencast Mining Currently about 10% of all production comes from opencast mining. The range of techniques employed is wide - from the small manually worked quarry to the large fully mechanised mine. The former method is generally restricted to areas where the reserves are small and the coal/overburden ratio is low. For highly mechanised working - normally using large mechanical shovels and dump trucks - a maximum coal/overburden ratio of 1/3 is usual. This means, of course, that the average ratio is much less than this, and in most workings it seldom exceeds 1/2. To increase it substantially would require the introduction of large drag lines and the problem then would be to consider whether the extra capital cost paid for the extra coal won.

It is planned that there will be a substantial increase in the amount of opencast mining. The target of an extra 20 million tonnes will increase production to the range of 25-30 million tonnes of opencast coal, nearly 20% of the total planned output for 1978/79.

In my view, the industry is correct to place so much emphasis for increased production on opencast working, but it would seem that a revision of attitudes to the economics of opencast working is required. If costlier heavier equipment, including draglines, is to be purchased then it must be used not merely to produce more output per day, which is the current intention, but to extend the working areas by substantially increasing the coal/overburden ratios. In Europe, with softer overburden and better quality coal seams, opencast mines, with coal/overburden ratios in excess of 1/20 can be profitably worked. Because of the hardness of both overburden and coal and the poor quality and low selling price of the latter it is doubtful if such high coal/overburden ratios would be economical but there is little doubt that they could, and should, be extended beyond the present 1/3 or 1/4 limits.

In the short term, the possibility of extending opencast working with existing equipment, even to the extent of increasing the coal/overburden ratio so that some of the coal is worked at an "uneconomic" level (though a total profit would still accrue), could well be examined. In the longer term more use must be made of the newer heavier shovels and draglines, but an adequate supporting spares service and maintenance programme must be assured or - vide Kathara Opencast Mine Appendix II - the new investment will have proved abortive.

The short gestation period for opencast mining has proved a decided advantage in providing short-term increases in output and it would seem that the chances of achieving the Fifth Plan production objectives must increase in proportion to the amount of opencast coal in the total output.

ii) Deep Mining In the underground mines bord and pillar work is the main system of extraction. This is not unusual in shallow mines, but the system continues to be used at depths at which its use in many other parts of the world would not be contemplated. Th coal is extremely hard and of strength in many instances as high as 6,000 p.s.i. The super and sub-adjacent beds are of stronger rocks than is common in coal measures strata. High wide galleries can be driven (3 metres high and 5 metres wide was not uncommon) and are more often than not completely unsupported, even at junctions.

If the system of extraction is common to most collieries, the working methods are not, for they vary from the most primitive method of "pick-mining" through solid-blasting or cutting and blasting to highly mechanised methods. The exact state of mechanisation cannot be assessed accurately since the last statistics available are for the year 1969. At that time 800-850 mines were being worked, more than three quarters of them in the Jharia and Raniganj coalfields. The output for the year was 71.41 million tonnes.

	No. of Items	No. of Mines	Output in Mill. Tonnes	% of Total Output
Coal Cutters	982	226	25.77	36.1%
Mechanical Loaders	55	20	1.95	2.7%
Conveyors	373	39	6.90	9.7%

How these figures compare with the current situation in mechanisation, can only be surmised. Many small mines have disappeared in the rationalisation following public ownership and more equipment was deployed during the Fourth Plan so that statistically the situation must have improved. The picture remains one in which large investment has to be made to improve the current levels of mechanisation. Further statistics have been produced and are quoted in the report on "Demand and Supply of Coal Mining Machinery" by Mr. Neithard Petry. They show that in 1973, [illegible]0 coal-cutters, 52 loaders and 340 conveyors were in use - a decrease in every item on the 1969 statistics. The figures quoted in this report are from "The Task Force Report" and "The Development Programme - Fifth Plan of the Coal Mines Authority". Mr. Petry's later statistics are from Coal Board sources. If all the figures are correct it shows that, contrary to the expectation expressed above, percentage mechanisation is declining. The conclusion reached above does not change.

The extent to which mechanisation should progress at this stage of development of the industry is debatable. The hardness of the coal has often precluded the use of heading machines, and many instances were noted where attempts to use Lee Norse Miners and Joy Continuous Miners were abandoned - ostensibly for lack of spares but in fact, the arduous working conditions had a great deal to do with the problems of maintenance. At one mine a vintage Anderton Shearer was still in commission, but only by dint of the ingenuity and perseverence of the mine management (Appendix II Chinakuri Colliery). The share of the increased output expected from underground mines (about 45 million tonnes) is more than double the increase expected from opencast mines (about 20 million tonnes). This demonstration of the important role underground mines still have to play in the expansion programme, is a pointer to the real problems of attaining even the Fifth Plan target of 135 million tonnes, much less the mining companies' own more ambitious plans for an output of 143 million tonnes.

Excepting for output from new deeper mines in the Jharia field, and some expansion of output from deep mines in the Raniganj field, the bulk of the expected increase in output (some 40 million tonnes) is to come from shallow mines. This means that the conventional bord and pillar working with sand stowing will still account for a high percentage of the total output. Here there are dual constraints, the first being the amount of equipment required for extra working places with concomitant problems of extra manpower, spares and maintenance and the second the amount of sand required for stowing, and these will almost certainly affect the prospects for achieving the planned increase in output.

One alternative - to reduce the amount of stowing - would undoubtedly remove one major constraint and by permitting better utilisation of equipment would alleviate the other. The price paid would be the sterilisation in pillars of precious reserves. Already in the Jharia and the South Karanpura fields many millions of tonnes of coal have been sterilised in pillars either never to be worked or to be worked only when sand for stowing is available. Normally, one would never countenance the wilful sterilisation of reserves for short-term gains, and only complete failure of alternatives could ever justify this course of action.

Another alternative - caving - does not suppo the roof but permits it to subside or fall into the worked out area. Bu. it is known that there would be difficulty in inducing some of the more massive super-incumbent sandstone beds to collapse, and there is the danger that if they did collapse in an uncontrolled manner, nearby coal pillars would be crushed. There is also the fact of the thick seam's liability to spontaneous combustion (increased when pillars are stressed and broken by adjacent caving), and the probability that seams above and below could be rendered unworkable by the caving of thick seams.

Longwall working has been proved to give a better utilisation of equipment and manpower although stowing reduces the effectiveness of the system since it is carried out as a completely separate operation during which time production stops. Caving of the goaf behind the long-wall face would undoubtedly lead to increased production and productivity, but the same problems apply here as with the caving of bord and pillar workings. In experimental caving panels, the roof has been artificially induced to break by shotfiring, a method clearly restricted to non-gassy seams.

One colliery is experimenting with su evel caving in a thick seam and if this is successful the way to greatly improved production potential would be open. There may be scope in seams of 5 to 8 metres thickness, where double extraction is practiced, to extract the lower section with stowing and to cave the upper section.

Whether increased mechanisation with its attendant problems is the right answer has already been asked. At this stage in the development of mechanised methods any suggestion which might ease the problems without retarding the advance to higher production is worth consideration. It would certainly make sense in selected cases to use more solid blasting (that is blasting solid coal without first slotting it with a coal-cutter). Admittedly, this would increase the already high demand for explosives, but at least explosives require neither spares nor maintenance.

The increase in output from faces must, of course, be matched with an improvement in the transport system. Many cases of shortages of rails, tubs or mine-cars, conveying equipment and haulages were noted. These shortages were specifically stated to be reasons for shortfalls in output in many cases. A full investigation to check requirements, not merely for the planned increase in output but to make good present inadequacies, would be a worthwile exercise.

In fact it is in this area of activity that some of the few natural advantages, which the Indian mining industry has over others, are not being fully exploited. The thick shallow seams can be worked without the need to handle the large quantities of adventitious dirt which are associated with the working of the thinner seams of Europe, a which often call for a separate transport system. Faces generally close to shafts or drifts, and therefore within short walking distance, do not need to be served by the extensive manriding systems which are a feature of so many other mining industries. Roadways standing without support not only reduce the need for transporting supports to them but, because they stand so well, the problem of establishing facilities for repairs does not exist. The generally small amounts of equipment used on faces and in developments means that a materials transport system can generally either be rudimentary or not required at all. It is often the case that the only transport system required underground is a coal transport system and it was therefore all the more disappointing to note so many instances of the inadequacy of this most essential service.

d) Coal Preparation

Although most coal is prepared in some way, washing is normally confined to prime, medium and blendable coking coal. The sole exception is Gidi washery, which is intended to wash non-coking coal, but some fraction of its output could be used as blendable coking coal

Most washeries deliver three products - clean for coking ovens, middlings for thermal power stations, and rejects. There are some two product plants among the older washeries but these are to be converted to give three products because the middlings/reject fraction has too high an ash content to be accepted with good grace by thermal power stations. The reject from Swang washery, for example, is 40-45% ash whereas the thermal power station demand is for middlings of 30-35% ash, a demand normally satisfied by three-product washeries.

The existing and proposed new washeries are listed in the Washery/Steel Plants Linkage Plan (Table IV). The plan for expansion includes new prime coking coal washeries at Bhowra and Monidih and two medium coking coal washeries at Ramgarh and Kedla. The rate of washery expansion in the 1960's shows that such a programme is feasible. Differences between estimators as to what the real supply of prime and medium coking coal should be (see page 5 of text and Table IV), need to be reconciled before a decision can be made as to the exact number required and their location.

The only preparation for markets of non-coking coal is either crushing or screening. In the former case only one product is prepared, normally -5cms in size. In the latter case two products (+ and -5cms. for example) or three products (-5cms., 5cms. to 8cms. and +8cms.) are made. In the most rudimentary method, screening is done by fork, (with tines spaced at appropriate intervals) during the process of manual loading of wagons. In other cases the screening plants, such as those used by the Singareni Collieries Company, are quite substantial and handle 4,000 to 5,000 tonnes per day.

Loading of wagons, the final act in the process of preparing coal for market, is a most contentious topic leading to endless recrimination between mining and railway officials. The background to this friction is dealt with in the section on Transport.

Loading facilities vary from the mechanical systems referred to in Appendix II to the manual loading practiced at many collieries. For mechanical loading 5 hours is allowed to fill a rake of wagons and for manual loading 10 hours is allowed. A rake of wagons will vary in size and capacity but a total of 2,000 tonnes capacity appears to be the average. To fill a rake manually requires a team of 300-350 people. The organisational problem posed of requiring such a large body for what amounts to casual work is solved in part by using the same team to serve a group of collieries.

e) Manpower and Productivity

A critical resource in the mining industry of other parts of the world, manpower in India is anything but that. There are many instances of over-manning due partly to the nature of the industry, partly to the attitude to manpower of the old private owners, and partly to the attitude of the tráde unions.

Before nationalisation a number of mines were found to have fewer employees recorded on books than were working, a ploy to escape provident fund charges. They were also paying less than standard wages for a larger unrecorded number of employees, who could mine extra coal which was not disclosed but was sold outside official marketing channels. When the mines in the Jharia coalfield came under public ownership the official manpower level was said to be 87,941. In fact, it was found that 123,131 persons were in employment. Taking advantage of the confused situation many men, whether old employees or not claimed to be that, and were supported by Unions anxious to increase their membership. Reports of similar discrepancies in employment figures were received when the non-coking coal sector was nationalised. That there were malpractices has not been denied, in fact confirmation of some were personally received, but the extent is difficult to assess because of the amount of casual employment, particularly among wagon loaders, amounting even now to nearly 10% of the total labour force in the Jharia field.

It would seem, in these circumstances, that scope for establishing proper manpower norms at many ex-private mines is small. The unskilled surplus labour will need to be trained before it can make an effective contribution to increasing productivity. The new mines will be planned with proper manpower levels and this must be the field where scope for increased productivity lies. Most new mines are manned on the basis of an assumed productivity of 0.80 tonnes per manshift in underground mines, and 4.5 tonnes per manshift in opencast mines. In themselves modest enough, they are nevertheless a marked improvement on the current productivity level of 0.67 tonnes per manshift. It is, however, at the new mines that the one constraint associated with manpower will be evident. Each new mine will demand new roads, services, houses and all the social infra-structure normally required for a new community.

Two factors cloud the manpower picture. On the one hand the mining engineer's desire to improve is expressed by increased use of equipment, improved productivity and reduced manpower. The Government, however, is concerned and rightly, to create the maximum job opportunities. There could be conflict between these principles. The other factor is the state of the notoriously bad industrial relations in the Bengal/Bihar fields. Without the opportunity to investigate them it is difficult to assess their effect on future plans. Bad as they may have been in the past, industrial relations have not prevented these coalfields from expanding their outputs. Expansion will almost certainly continue and it could be that in the after-math of nationalisation, and with the realisation that <u>their</u> aspirations have been achieved, union attitudes may be more cordial.

Only the Coal Mines Authority provided estimates of manpower requirements; therefore a total requirement cannot be illustrated. This is perhaps an indication of the general view that availability of manpower is not a problem, but it is hoped that it does not show a lack of concern for effective utilisation of manpower - a most costly resource.

f) <u>Costs and Proceeds</u>

The relevance of costs and coal prices in the circumstances of a world shortage of energy is perhaps debatable. Those presented here will, it is certain, be of little more than historical interest within a short space of time.

i) <u>Production Costs</u>

It is unfortunate that total costs for the whole mining industry are not available. All that can be done is to show two typical examples - one of a company and one of a colliery.

At the collieries visited cost-consciousness seemed rare. Costs were not always available and seldom were they in an easily assimilable form. Singareni Collieries Company Limited had a most comprehensive cost information service, distributing monthly to each operational unit full details of its own and other units costs. These, abbreviated for convenience, are shown with costs supplied by Saunda Central Colliery in Table XIV.

Whilst the two sets of costs are not completely disparate, neither are they strictly comparable. The wage levels in each case are the same (R15 to R16 per day) but the higher productivity of Singareni produces a lower wages cost per tonne. The administrative costs of Singareni are relatively high but it is suspected that those of Saunda Central exclude the costs of higher administrative levels. Each cost sheet shows a profit, most of Singareni's coming from enhanced proceeds and most of Saunda Central's coming from subsidies. The item subsidies and the cost loading of cesses form an interesting chapter in the financing of the industry, which however may be about to be closed. Cesses have been charged at different rates at different times and have been used by the Government for financing the Mines Welfare Commission, Rescue Stations and a fund for the payment of subsidies. Subsidies have been paid in respect of sand-stowing, gassy nature of seams, depth of shaft, inclination of seams, pumping costs, thinness of seams and high transportation costs to the rail head. With the industry nationalised and the dispenser of subsidies - the Coal Board - about to be declared defunct, there is no reason for their continuance.

The expansion planned in the Fifth Plan will involve heavy additional expenditure. In December, 1973, the Coal Mines Authority was negotiating new wages agreements with unions which undoubtedly will affect the position of the other mining companies. Inflationary trends in most other costs will lead inevitably to substantial increases in production costs. This should be recognised and the price of coal adjusted to permit the industry to be self-financing in a way in which it was not during the recent era of cheap fuel.

ii) <u>Coal Prices</u>

Statutory prices were first imposed in 1944 and remained in force until 1967 when non-coking coals were freed from control. Prices since then have been the subject of regular negotiation between major consumers - notably the Railways Board - and the supplying collieries.

Both major mining companies are pleading for substantial increases in coal prices and are currently preparing new price structures. Latest prices available are unfortunately not related to the same point in time, making meaningful comparison difficult, but the Coal Mines Authority in its "Development Programme" publishes prices for all grades of coal which were effective on 31st January, 1973, and do permit comparisons to be made. These, illustrated in Tables XVI and XVII show:

There is little difference between coking and non-coking coal.
There is little difference between steam coal and slack of the same grade in non-coking coals.
The difference between the highest and the lowest grades of non-coking coal are very small, particularly in the outlying coalfields.
The railways appear to have preferential pricing.

There seems to be little incentive for customers who can exercise a choice to select the poorer cheaper grades, and when freight rates are added to the cost for distant customers, the incentive is negligible. Freight rates range from 7 Rupees/tonne up to 10 kilometres to 87 Rupees/tonne at 5,000 kilometres. For distant customers the difference between the best and worst grade is no more than 4%.

A new price structure when formulated should take into account

The need to increase the price differential between large and small coal, which currently would not appear to cover the cost of separation.

The need to increase the differential between different grades of coal.

The need for a regional pricing policy which will ensure that coal of identical quality is sold to the customer at a set price, leaving the choice of coalfield from which it comes to the supplier.

The need for establishment of quality control procedures.

g) Mining Law and Safety

Mining legislation in India is largely patterned on that in Britain, and it would not normally be expected that the Indian mining industry would be any more constrained by legislation than is the British mining industry.

Unfortunately, shortages of vital equipment, the use of which is a condition of working in particular environments, does inhibit progress, but it must be stressed that the fault lies more with the supply of equipment than with the legislation.

Shortage of flame-proof equipment (a legal requirement for electrical apparatus in gassy mines) and of fans - particularly for mines in the erstwhile private sector - is inhibiting expansion of production in some sections of the industry.

The spread of longwall working, particularly if caving is adopted, will be limited by the availability of steel supports. Wooden supports will still be allowed on stowed longwall faces.

As in Britain, the use of aluminium underground is forbidden. This affects not only the availability of mine fans, in which light alloy was used for casings and blades, but of coal drilling machines the casings of which were of aluminium. There is an associated labour problem arising from the replacement of the lighter aluminium casings of drilling machines by heavier steel casings - for already two men are required to handle the "lighter" equipment. Alternatives such as the coating of the aluminium with a light plastic cover or the use of a Russian produced alloy, which it is claimed does not produce incendive sparking, are being investigated.

Solid blasting in non-gassy mines has been done in the past by using normal permitted explosives. Now deemed less safe, even in these most favourable circumstances, it is intended that less dense explosives should be used for the operation. This means that increased cost and the near-certainty of reduced supply will prevent the wider spread of solid-blasting as a coal-winning technique.

These few instances of the actual or likely effects of legislation are not exhaustive, but are merely illustrative. It is clear that if some of the Acts and Regulations were relaxed or were not applied certain constraints to production would be removed. To do this would be, in my view, completely wrong and a rejection of the purpose of safety legislation. A major objective of the industry must still remain the safe working of its mines.

The extent to which the fact that Mine Law is administered by the Ministry of Labour affects co-operation between inspectors and managers in the industry is difficult to assess. The Director-General of Mine Safety (equivalent to the Chief-Inspector) and his key staff are mining engineers in close contact with professional colleagues. Co-ordination must nevertheless be impeded by the involvement of two Ministries in legislative procedures affecting the operations of only one of them.

h) <u>Mine Planning and Design</u>

That this is the concluding section on the Mining Industry is not to infer that Planning is relegated to the last place. Indeed, its importance in a mining industry with as massive an expansion programme as that of India, is evident.

i) <u>The Role of Mine Planning in the Past and Present</u>

Formal mine planning in India began with the establishment of the National Coal Development Corporation, mainly for the purpose of creating new production capacity.

The Mine Planning Wing at Ranchi, to which reference has already been made, has developed as a Reconstruction Department. Strategic and tactical drilling programmes have been focussed on areas of potential expansion and, on the basis of excellent geological information, projects have been devised.

The form of presentation, the technical content, the details of costing and estimates of profitability contained in project reports has been of an enviably high standard. The sole defect is the lack of evaluation of possible alternative schemes. Assurance was given that these were considered during the design stage, nevertheless senior management responsible for investment policies should be put in a position to judge for themselves whether or not the project is the best of all available alternatives.

The Mine Planning wing has also the responsibility for assembling the information required for the National Five Year Plans. It was understood that these, compiled at one point in time, are only revised as and when the call for a revision of the Five Year Plan is made. There is no Corporate Planning, no rolling Five Year Mining Plan - keeping strategy under constant review. There is no medium term planning, none of the resource planning epitomised in an Action Programme. There is little in the way of operational planning at colliery level - only at one colliery was a chart produced showing the development/production programme. There are no trained planners in the field. These points appear to be illustrative of a major problem noted in the low performance levels of the Third and Fourth Five Year Plans - the difficulty of putting well-conceived plans into effect. Thus for example, effective forward planning would surely have highlighted the likely consequences of the earlier cut-back in the drilling programme. Now the industry is faced with the almost insuperable task of completing a five or six year drilling programme in two years or less.

This may result from the fact that an industry controlled as rigorously by Government as is the mining industry, must feel obliged to gear its planning to the "point-in-time" Five Year Plans of the Government. At the other end of the scale, an industry with so few resources to deploy in the short term might well believe that there is little need for Action Programmes or Operational Plans.

ii) The Role of Mine Planning in the Future

The function of project planning, already so well performed by the Mine Planning Wing, is seen as its main task in the future. To meet the demands of a greatly expanded reconstruction programme the Mine Planning Wing is being re-formed into a Central Mine Planning and Design Institute. The proposed scheme (which has been prepared by Polish Mining Consultants) is for this to be set up in two phases, the first being the establishment of a central organisation, the second being the establishment of regional centres 12 to 18 months later at Dhanbad, Asansol and Nagpur with the central organisation undertaking regional work in its own locality at Ranchi.

Excluding geologists and field staff, the complement at Ranchi is now 206. The intention is to build this staff up to 350 in the first stage of development and then to 558 in the second stage. In addition to this number at Ranchi, the second stage will see the establishment of 293 staff at each regional centre - a total of 879 at the regional centres and 1,229 in all - a six-fold increase in technical and administrative staff. Even spread over two or three years this presents a formidible training programme but add to it the expansion of geological services from 561 to 2,433, referred to in IV (b) page 13, and the unidentified numbers who will be required to undertake reconstruction work in the field, and the task this expansion represents begins to take shape.

It is intended that the Central Planning and Design Institute will prepare project reports for all mining companies. The Coal Mines Authority alone require the preparation of 141 projects, 3[illegible] of which are old National Coal Development Corporation projects and with Bh[illegible]t Coking Coal and Singareni Collieries Company projects added to the list, it must number at least 200. No less than 100 of these will need to be prepared during the first two to three years of the Five Year Plan, if they are to contribute to it. Considering in addition the size of the exploration programme, the recruitment programme and the training programme required during these same two to three years, and the problem of establishing a new organisation, it can only be concluded that planning the new expansion programme is perhaps the greatest constraint of any yet discussed.

It is not intended to belittle the tremendous efforts being made in the planning field, but it is felt that if fewer reconstruction schemes were projected in the Five Year Plan and more emphasis placed on strategic, tactical and operational planning then, although less capacity would be created, what there was would be much more effectively used.

This review of the mining industry has of necessity been brief and has, in the main, concentrated on areas of constraint which as stated at the outset, "have some relevance to the total energy scene".

VI. THE DISTRIBUTION AND TRANSPORT OF COAL

The large distances separating many coal consumers from the coalfields means that distribution needs to be co-ordinated to a degree not usually necessary in smaller countries. The relationship between distribution and the main form of transport - railway, is also closer than in smaller countries. The involvement of the Railways Board as the link between the producer and most of the customers means that it must be involved at almost every stage of customer/producer relationships.

a) Distribution of Coal

In an earlier part of this report the forecasts of demand and supply were analysed. Reference was made to linkages of large customers to coalfields, groups of collieries or washeries. Planning of distribution in these cases is carried out by "linkages committees." Thus, distribution of two-thirds of the total output - to steel plants, thermal power stations and railways is formally and fairly simply planned. The problems of actual distribution are not, however, as simply solved and it can be as difficult to ensure constant and adequate supply to the large consumers as it is to the miscellany of widely dispersed small consumers who make up the remaining one third of the customers.

i) Large Consumers

Distribution to steel plants is perhaps more involved than to other large consumers. This is caused by the cross-flows between collieries, washeries and steel plants and by the need to blend inputs to the plants. Some indication of the linkage required is shown in Table IV, although only steel plants and washeries are shown. If the linkage between collieries and steel plants and collieries and washeries were superimposed, a very complicated pattern would emerge. With the exception of Bhilai Steel Plant, most are reasonably close to either washeries or collieries or both. Whilst having the advantage of short runs, this means that a great deal of traffic movement is concentrated in a relatively small area. When the planned southern steel plants are operating, the mines of the Western Division may contribute some coking coal so spreading the distribution load.

Distribution to thermal power stations is relatively simple, but whereas the collieries - washery - steel plant links are relatively short, the links to thermal power stations are often long. Power generation capacity has been extended both in the coalfields and in the distant States far from coal supplies. To reduce coal transport by rail and to use more lower grade coal, many new thermal power stations are to be sited near collieries. A "Standing Linkage Committee" now determines the pattern of supply to each power station.

Distribution to railways is, of course, simply negotiated between the railways and the mining companies without the need for the intervention of any third party.

ii) Small Consumers

The first group of "small" consumers - large industries such as cement, paper, fertilisers and cotton - arrange distribution through the appropriate Ministry. The very small consumer is sponsored by the Government of the State in which the business is situated. There is then, it is believed, a system of permits, sanctions and allocations sometimes involving, and sometimes not, private distributing agents. There was, unfortunately, neither time nor opportunity to investigate the system.

iii) Organisation of Distribution

In the past, responsibility for the co-ordination of distribution has rested with the Coal Controller, but in practice the Railways Board have had a great deal of influence on the pattern of distribution. It is almost certain that "linkage committees" will be the established medium for deciding future distribution patterns.

It might appear that in an economy as controlled as India's there is no need for "marketing" - but it is also true that marketing is not merely the selling of a product. What is clearly lacking in the mining industry is a strong marketing organisation. It surely is the function of the producer to market and distribute his commodity by whatever means is found either commercially advantageous or, and this should be the same thing, to the advantage of society. A marketing organisation in direct contact with every mine and every consumer would surely co-ordinate to much better effect than the proliferation of linkage and other committees. It is clear, however, that such a body can never be established whilst the industry remains as three separately identified public undertakings, each with its separate management structure.

b) Transport of Coal

A small percentage of total coal movement is by direct link between colliery and consumer either by conveyor - in the case of colliery to power station, or by lorry - in the case of colliery to small local consumer. In 1971/72 the railways moved 65 million tonnes of coal or 90% of the total production of 72 million tonnes. Whilst the percentage moved by rail in future years is likely to decline in favour of colliery/power station direct linkages, the total moved by rail will, nevertheless, increase substantially. It is, therefore, on transport by rail that attention needs to be focussed.

i) The present Position of Rail Transport of Coal

About 70% of all coal trains are moved in rakes from collieries to consumers, a percentage which the railways would like to see increased to 90%. A loading time of 5 hours is allowed for automatic loading of a 2,000 tonnes rake, or 10 hours for manual loading of the same size rake. The railways would like to see these times reduced to 4 hours and 8 hours respectively as part of the process of economising on the use of wagons, but instances were quoted of rakes standing 3 to 4 days in railway sidings and it is said that the average turn-round time for a rake of wagons is 13 days. If this is true, there seems little point in burdening collieries with the operational problem of reducing loading time by 20% when the total time saved is only 0.3 to 0.6% of the total average turn-round time.

Relationships at operational level between the collieries and the railways in the Bengal/Bihar area are not good. Some instances of the poor service received by colliery and washery loading points are noted in Appendix II, but one other incident does deserve special mention, because it illustrates the procedures and their inadequacies.

Dakra-Bukbuka Mine, with manually operated sidings for which a rake a day was normally required, had been receiving only 15 rakes per month. The wagon-loaders employed on a casual basis had threatened strike action unless one rake per day was delivered. On 31st October, 1973, with the sidings empty, they struck work. The railways were informed that no wagons could be loaded, and within hours responded by putting two rakes into the sidings. The men remained on strike and the railways were so informed yet, on three successive days, a locomotive appeared to pick up loaded wagons. When this happens and the rake has not been filled, demurrage is charged at the rate of 40 rupees per wagon, and the rake is taken from the monthly indent as "short supply to colliery account." In this instance, for the three days of the incident, the colliery was charged for demurrage on six rakes and the account was short supplied by the same number.

The motive for such action is difficult to understand. When senior mining officials were asked to explain it the opinion was given that the action was not malicious but was an over-reaction to cover the railways' previous inefficiency. Senior railway officials were aware of the incident and were investigating it. This procedure does not seem designed for harmonious relationships imposing as it does swingeing fines and with-holding wagon-supplies as a punishment. Indeed this system is so one-sided as to be unfair, since failure on the part of the railways to deliver empty or collect full rakes goes unpunished. There might be merit in a system of "reverse demurrage" whereby the railways are fined the exact amount of normal demurrage for failure to deliver or collect on time.

To be fair to the railways, Bengal/Bihar is the busiest, most congested area in the whole of India. Railway operational staff are somewhat militant and are in many cases irked by the loss of income which they obtained in the form of unofficial payments by the former owners of private mines to ensure an adequate supply of wagons. Organising a transport system in such an atmosphere is an unenviable task.

Table XVIII shows that more than twice as much coal is produced, and moved by rail, from the Bengal/Bihar fields than in the rest of India. Wagon requirements for those fields are an even higher percentage, implying a slower turn-round of wagons than elsewhere in India. Average daily loadings were 7,800 in 1971/72.

ii) The Future Position of Rail Transport of Coal

The Task Force estimate of movement of coal by rail in 1978/79 amounts to 125 million tonnes. In apparent disbelief the railways, whilst willing to provide capacity for that amount, quote 108 million tonnes as the likely movement, but show 106.62 million tonnes in their own estimates. Table XIX shows movement in the Bengal/Bihar and outlying fields, measured against an estimate lower than that of the Task Force, the 135 million tonnes estimate of the Planning Commission.

The table shows an unwelcome, but unavoidable trend - even though the percentage of output from Bengal/Bihar declines, the percentage moved by rail remains as high as ever. It is in the outlying fields, where rail bottle-necks are fewer, that the movement away from rail is taking place particularly by increased use of direct colliery/thermal power station conveyor links. Comparison of the wagon supply in Tables XVIII and XIX shows that the same wagon turn-round times are expected to operate in Bengal/Bihar and outlying fields in 1978/79, a situation not borne out in 1971/72. If turn-round times in Bengal/Bihar do not improve, then future wagon requirements will have been under-estimated.

To equip the railways for the extra burden, no only of coal traffic but of other expanding trade, 100,000 new wagons, mostly capable of carrying coal, will be required. There are three workshops with a low capacity which will be extended so that by the end of the Fifth Plan 25,000 wagons per year are being produced. The major works for the carriage of coal, including new or extended line capacity, sidings and communications, are estimated to cost 2,200 million rupees. The total amount to be spent on extensions, improvements, new stock, etc. is 23,500 million rupees. It is clear that if completion of such a massive expansion is a serious constraint, then the ability of the railways to handle the extra coal output could be in doubt.

Two operational features of traffic movement and distribution which the railways wish to implement are movement by block rake, already referred to, and the creation of dumps. These would be situated at key points and would be served by block rakes. They would stock 25,000 tonnes of non-coking coal, hard coke and soft coke which would be distributed to consumers by lorry. These ideas have been mooted for the last 15 years, but only movement by block rake has so far been accepted as a practical proposition.

The closely related problems of transport, and distribution might be considerably eased, if strategic stocking of coal at collieries and by major users were to be a planned feature of the distribution pattern, as suggested on page 8. Stocks at collieries, no larger than the dumps referred to above, would give a strategic holding of 10 million tonnes. Large consumers, such as power stations, could hold similar amounts. This must, of course, be a long-term solution because before stocks can be built up they must be surplus to immediate demand. It would appear that some years will elapse before supply outstrips demand. Similar arguments, incidentally, are advanced by the opponents of dumps, who claim that the dump will never be created because coal will be required from the site before 25,000 tonnes can accumulate.

The ability of the railways to accomplish their Fifth Plan objectives must be in some doubt. Unless the traffic problems of Bengal/Bihar can be resolved, there is little hope, in my view, of the objectives being achieved. Perhaps if a start could be made by putting into practice some of the routine procedures of the Southern and Central Railway and Singareni Collieries Company some progress towards better relationships and a better flow of traffic could be made.

iii) Alternative Form of Transport

Schemes for transport of coal by inland waterways, by aerial ropeway and by hydraulic pipeline have all been examined. Only the last of these is considered to have potential and development work is proceeding in the hope that an application will be available in time for the Sixth Plan.

Another alternative form of transport, coastal shipping shows promise of reducing inland congestion. At the new port of Haldia near Calcutta, a new coal handling plant with a capacity of 3.5 million tonnes per annum is being installed. The potential movement through the port could be far greater and could include 5.0 million tonnes per annum to southern and western thermal power stations, 1.0 million tonnes to other industries in the south and west and 0.5 million tonnes for export. Add to this the future coal requirements of the southern steel plants and the total potential movement through the port could exceed 10 million tonnes.

To use the port to the extent suggested above would certainly reduce the total flow of inland traffic to the south and west. But in so doing the increase in the already overloaded Bengal/Bihar - Calcutta line might cause further restrictions, hardly the perfect solution to the tremendously complex problem of rationalising movement of traffic.

VII. RESOURCES REQUIRED FOR INCREASED CAPACITY

The current production capacity of the industry is estimated at 90 million annual tonnes against an expected production in 1973/74 of 77 million tonnes. The increase in capacity necessary to achieve the lowest official estimate of production - that of the Planning Commission at 135 million tonnes - is 50%. Because production always lags behind capacity, the expansion programme must aim for a larger capacity than is theoretically required for the production target. Whatever views may have been expressed about the feasibility of the various production estimates, there is little doubt in my mind that even to achieve a production objective set in the range 110-120 million tonnes per annum, a capacity of 130-140 million tonnes per annum must be aimed at. The Planning Commission estimate at 135 million tonnes per annum falls within this range, and the Task Force and Mining Company estimates at 143 million tonnes per annum fall just outside the range. Each estimate of output increase has been accompanied by an estimate of investment required to achieve the increase.

a) Capital Investment

The Task Force estimated that 8,435 million rupees would need to be invested in the five year expansion programme. Later estimates from the mining companies have increased this figure to 9,209 million rupees, although the output estimate remains the same as that of the Task Force. The Draft Five

Year Plan, with the estimate of 135 million tonnes of output in 1978/79, contains a new estimate of investment during the plan amounting to 7,658 million rupees.

Estimates from both Bharat Coking Coal and Singareni Collieries Company are extremely detailed. Those from Coal Mines Authority are analysed only in respect of the total capital requirement of each of its three divisions. This is understandable, because, having only recently taken over more capacity from the private sector than it commanded as the National Coal Development Corporation, the Coal Mines Authority is still assessing the potential of the erstwhile private sector. This does mean that detailed analysis of the total industry investment programme is, regrettably, impossible.

Table XX shows the Planning Commission and the Mining Company estimates of investment required during the period of the Fifth Plan. Each has been translated into a ratio of investment cost per tonne of output. For the industry as a whole it can be seen that whereas the mining company estimated the investment to be 144 rupees per tonne, the Planning Commission has reduced this to 131 rupees per tonne. This reduction is probably reasonable since it would be expected that the 8 million tonnes difference in the estimates of output would be that fraction of the increase having the highest investment cost per tonne. The calculated investment cost for the marginal difference in output would then come to 185 rupees per tonne.

Their own estimates show that both the Coal Mines Authority and Singareni Collieries Company, with their opencast and shallow mines have similar investment/increased output ratios, at a somewhat lower level than the national average. The Fifth Plan reduces the estimates, those of Singareni Collieries Company more than those of the Coal Mines Authority, but the inferred marginal investment/increased output ratios for the reduced outputs are, at 140 and 154 rupees/tonne respectively, of the same order. Bharat Coking Coal is not only involved with the restructuring of many old under-capitalised mines, but has a construction programme including the deepening of many shafts and the erection of new washeries. For this reason its investment costs per tonne are appreciably higher than those of the other companies. The reduction in the estimates of total capital investment shown in the Fifth Plan is quite dramatic. The extent to which the output has been cut back to match the new investment level is uncertain since the Draft Fifth Plan, although allocating investment to companies does not show the allocation of output to companies. The assumption made here is that the cut-back in production in Bharat Coking Coal output is proportional to the cut-back in Bengal/Bihar output (see page 15 and Tables X and XII). If this is so then Table XX shows the astonishing result that the cut from 28 million tonnes to 26.5 million tonnes has saved an investment of 903 million rupees or 600 rupees/tonne. This is greater than the investment rate required for completely new deep mines, none of which were in the Five Year Plan. If the saving in investment/tonne is 200 rupees, a most reasonable figure, then all the reduction in Bengal/Bihar output would be at the expense of Bharat Coking Coal - an untenable proposition with coking coal in such short supply. There is the possibility that it is the Sixth Plan investment programme, against which there is no output in the Fifth Plan, which has been curtailed. Whilst this is an explanation which readily fits the facts, it would be extremely short-sighted if longer term investment were to be markedly reduced.

It would appear that there is scope for detailed investigation of the whole question of investment costs/tonne of output for various kinds of mine - deep, shallow, opencast, new, extended etc., so that the effectiveness of capital investment in new capacity can be correctly assessed. There is also uncertainty as to how much of the investment is for the replacement of existing assets.

Even the reduced programme is ambitious. Average annual expenditure, allowing for inflation and currency differences, is as much as the peak annual rate achieved in Britain during its mining industry's previous reconstruction period.

b) Equipment

Nearly 40% of the total capital requirement will be for machinery. Opencast equipment of the Coal Mines Authority will account for nearly 33% of the total equipment investment. There is virtually no other investment in opencast mining and since it will account for more than one half of the Coal Mines Authority's increased output and more than one third of the total increased output, investment of no more than 13% of the total capital is well worthwhile.

A full examination of equipment and its availability is being made by Mr. Neithard Petry in another report as part of the Bank's energy study. It will almost certainly reach the conclusion that availability of equipment, whether manufactured in India or imported, and of the necessary spares to keep the equipment operating, will be the most severe of constraints.

From the point of view of the user, some of the equipment will be almost certainly ill-suited to Indian mining conditions. More important than increasing the amount of face equipment, is ensuring the adequacy of the transport systems necessary to get the coal away from the face. Investment in small portable conveyors or slushers which would reduce reliance upon the carriage of coal in baskets could make a significant contribution to increased production and productivity.

c) Sand

Sand for solid stowing is yet another resource which could constrain achievement of production targets. Investment in sand-stowing is mainly for winning and transporting it, and 1,230 million rupees have been estimated as being needed to assure supplies. In the Jharia field alone 22 million tonnes more sand per annum, increasing the total annual demand to 28 million tonnes in 1978/79, will be required. A further 15 million tonnes per annum will be required for outlying fields, but it seems that none will be available for Karanpura where, already, pillars are waiting to be extracted. Because of the fear that sand will not be available in the quantities required, experimental work on the suitability of other materials is being undertaken.

Blast furnace slag, washery debris, overburden from opencast, boiler ash are all being tested, but since all these materials compact to a far greater extent than does sand, more coal might need to be sterilised if their use becomes widespread. Even if stowing materials are available in the quantities required, the operation of stowing will itself severely curtail the possibility of rapid expansion of output at individual working places.

d) Explosives

The consumption of explosives in 1974/75 the first year of the Five Year Plan is expected to be 20,000 tonnes in coal mining and 25,000 tonnes in other industrial sectors. By 1978/79 the demand of the coal mining industry is expected to be 28,000 tonnes and other sectors 31,000 tonnes. Total demand is, therefore, expected to increase from 45,000 to 60,000 tonnes during the Five Year Plan. Current production is only 35,000 tonnes and manufacturers need to increase production rapidly even to meet the demands of the first year of the Plan. They will then be at maximum production and a new factory, for which an investment provision of 60 million rupees has been made, will be needed in 1975/76 capable of producing 15,000 tonnes by 1978/79 if shortages are to be avoided. It is clear that increasing the amount of solid blasting as a solution to the equipment/spares/maintenance problem will only exacerbate this situation.

e) Steel

Exact figures of current steel consumption by the coal-mining industry are not available, but it must be at least 50,000 tonnes per annum. The 1978/79 estimates of steel requirements are 91,000 tonnes. Acute shortages of certain types of steel - rails and sheet steel are examples - have already reduced current output. These items are in greatest demand by far and are, of course, key materials in the provision of tub and mine-car transport. In December, 1973, a special rolling of rails was ordered by Government - an indication of how critical are adequate steel supplies to coal mining production plans.

f) Power Supply

Demand for power supply in 1978/79 was estimated to be 440,000 KW. No information is available as to the present demand, but it is assumed that it must be of the order of 250,000 KW. The present inadequacies of power supply in Bengal/Bihar particularly cause grave concern. Load shedding is a regular feature which seriously disrupts production. Reference has been made in Appendix II to the stopping of production compl ly at Sudamdih colliery in the Jharia field for three whole weeks, but that is an extreme case. In the neighbouring Raniganj field a request for details of the interruptions endured by a typical colliery elicited a sample two-week period in November/December, 1973, covering 13 working days on only one of which was there no power cut. The range of stoppages was from 30 minutes to 225 minutes and the average was 180 minutes per day. Each day's stoppages were made up of 4 or 5 separate cuts of about 45 minutes duration each. Operating mines, particularly gassy mines, in conditions of such uncertainty must lead to considerable inconvenience and appreciable losses in production.

Similar information was obtained from the Central Division of Coal Mines Authority, but in this case the loss of output was quantified. In November, 1973, 40,000 tonnes of raw coal and a further 37,000 tonnes of washed coal were lost as a result of power cuts.

The consequences of the instability of supply are that the mining industry is to construct two stations of about 100 M.W. capacity, one in the Jharia field and one in the Raniganj field. These will clearly increase the reliability of supply, but until they are operative, and no definite date was given for that event, production will continue to be affected by the uncertainty of the public supply. The Singareni Collieries Company already generates its own power and could extend capacity if and when that is necessary.

In an earlier section (page 20) the case was argued for a single management structure for the mining industry. It would appear difficult to justify the extension of power generation by the mining companies since equally strong arguments should apply for a unified power generation organisation. The fact that power generation is already fragmented organisationally across individual States and that coal mines are often low on the electrical power priority ratings is justification for the proposed building of power stations for the mining industry's own use.

g) Transport

This important resource has been adequately covered in its own section. The particular problems in the Bengal/Bihar area are, like power supply, a significant constraint. The information supplied by the Central Division of Coal Mines Authority on output losses due to power failure, contained similar information on losses due to wagon shortage. Whereas losses due to power failure were concentrated mainly in November, those due to shortage of wagons were a feature of every other month but November. It is concluded that the losses due to power cuts enabled the railways to supply sufficient wagons in that month to reduce losses of washed and raw coal to 118,000 tonnes. The average losses due to shortage of wagons in the previous 5 months were 155,000 tonnes per month.

h) Manpower

As has been made clear throughout this report, there is no shortage of manpower and it is unlikely to be a constraint. It is nevertheless the industry's most important resource and will be needed in large numbers in the new mining areas. There, the amount of construction work needed to house incoming miners will be more of a restriction than the availability of manpower.

The "Law and Order" situation in Bengal/Bihar has been a serious hindrance to good industrial relations. The need for the establishment of good relationships is self-evident. Training of men for specific tasks is not referred to in any documentation. It is suspected that this is one aspect of "manpower as a resource" which could command more attention. There are proposals to invest 30 million rupees in two installations of sophisticated European face equipment. This expenditure will surely be abortive unless a long and thorough training in all aspects of its use is undertaken by the potential operators.

i) Management

Indian mine-management is well-qualified and well-trained. Training in particular techniques may be required as new equipment is introduced during the Fifth Plan. Training must also be available for the large number of new managers who will be required to supervise the new construction and reconstruction programme. Lack of sufficient numbers of skilled managers could retard the expansion of the industry.

j) Research and Development

This most important of resources is outside the control of the mining industry. The two research organisations are independent of it, albeit working closely with it. They are engaged in essential research, but the necessary flow through into fully developed application of techniques or processes appears to be lacking. Whether a direct link with the industry would supply the impetus for successful extension into the development field is worthy of examination.

The work being done by the Central Fuel Research Institute into new or improved uses for coal has won wide acclaim. It has no direct influence on the operations of the mining industry, but its work on washery blends, on coal utilisation and on metallurgical problems has indubitably extended the market for coal and for grades of coal which would never otherwise have been used in the steel industry. Because of the wide nature of its researches it could never be linked solely to the mining industry and to hive off that section dealing with coal would certainly weaken the organisation. On balance this research institute is probably better left as it is presently organised.

The work being done by the Central Mining Research Station, exemplary in its way, does not go far enough. The Task Force Report provides a list of items to be considered as a Research and Development Programme which includes:

Problems associated with the working of thick seams.
Problems of mine ventilation.
Control and isolation of mine fires.
Problems of mine mechanisation.
Problems of solid packing.
Degasification of mines.

The effort being applied to these problems appears somewhat limited, and certainly research into one important item referred to in the list - problems of mine mechanisation - has hardly begun. This is not to deny the important work that the Central Mining Research Station does in the fields of safety, testing of equipment and fundamental research into mining problems, but the impact of this type of research on production and productivity is slight.

It is difficult from the Draft Fifth Plan to establish the exact amount allocated to Research and Development the Coal Mining Industry. The Department of Science and Technology list shows 690 million rupees allocated to mines but, 400 million of this is for the work of the Geological Survey of India and the Bureau of Mines and only a small but undisclosed part of that amount could possibly be available for research. The remaining 290 million rupees is for research and development for all mining but if it were to be allocated in proportion to total investment, that available for coal mining would total 147 million rupees. To this could be added a proportion for Bharat Coking Coal (included in the Steel Departments total investment and research programme) which, estimated in the same way as for coal mines, would amount to 18 million rupees. The total on the basis of these rough apportionments amounts to 165 million rupees or about 0.5% of expected turnover. A normal proportion for research and development in extractive industries would be about 1.0%, but in my view with the need to expand the industry and with so much fundamental work to be done, a proportion nearer 2.0% might be more appropriate.

Very little of the research and development work starting in the Fifth Plan period can be applied during the course of its run, and unless a concentrated effort is made to expand research and establish an integrated programme, results might not be available for application even in the Sixth Plan.

k) The Central Mine Planning and Design Institute

To include "planning" as a resource might seem incongruous in some circumstances, but at this stage in the development of the Fifth Plan its resource value is critical.

Firstly, a staggeringly large exploration programme has to be launched. Although 750 million rupees is allocated for the work, drill-rigs, rods and casing have yet to be made and new staff has yet to be trained. Then evaluation of results and preparation of reports must be completed before effective planning can begin.

Project report preparation will have to be undertaken whilst the processes of reorganisation, re-staffing and re-training are carried out. The result will be, in my opinion, that projects particularly in the later stages of the Five Year Plan would be anything between one and two years late in being approved. The recent move to streamline the procedure for approval of projects by the Public Investment Board in Delhi, so saving four weeks, can do little to help this situation.

Not all projects require elaborate treatment and some proportion of the reconstruction work, including expansion of output from existing mines could go forward quickly. Concentration on projects with short gestation periods - opencast mines for example - could reduce the total impact of delays in project preparation.

In item (a) of this section, dealing with Capital Investment, it was suggested that an exercise should be carried out to assess the effectiveness of capital investment in different types of mine. In the same exercise, the time constraint should be considered so that those projects which can be brought into operation cheaply and quickly are given precedence at the planning stage.

VIII. THE PROSPECTS OF ATTAINING THE PLAN

The plans for attaining the output from the different sectors of the mining industry are, as technical plans, well laid. There are several constraints, principally the lack of physical resources, which will affect different sectors in different degrees. The ways in which this might happen are shown for each mining company, and each division of the larger Coal Mines Authority, by relating prospects to the likely availability of resources.

It should be made clear that the feasibility assessments relate to the mining companies' own plans for producing 143 million tonnes per annum by 1978/79, since estimated inputs for this output are available. The Draft Fifth Plan output of 135 million tonnes per annum by 1978/79 shows no input other than capital investment. As will be demonstrated, the assessments show that, in my view, the resources required to achieve even the 135 million tonnes level of output are unlikely to be available. It is, therefore, valid to base the assessments upon the mining companies' higher output and input figures. As will be clearly seen in each of the assessments, the constraints interact and it is, therefore, difficult to estimate the likely effect on output of the lack of any single resource. Where references to potential losses in output are made, these should be accepted as subjective judgments made mainly for the purpose of assessing the effect of a particular constraint upon one section of the industry as compared with the effect on another.

a) Bharat Coking Coal Limited

The plan to increase production from the expected 12.5 million tonnes for 1973/74 to 28 million tonnes in 1978/79 gives the largest percentage increase of all plans. It is intended that modernisation of existing collieries by improving haulage systems, modernising pit top and pit bottom, mechanisation and large scale increase in the use of explosives, could increase output to 24 million tonnes while shaft deepening, and application on a large scale of horizon mining techniques could account for the other 4 millions.

Major inputs, and the effects that lack of them could have on the expansion programme of Bharat Coking Coal are enumerated as follows.

i) Capital Investment per tonne of increased output is by far the highest of any mining company. Total investment in the plan is estimated to be 2.637 million rupees of which 830 millions are to be spent in 1977/78 and 950 millions in 1978/79. It is difficult to see how two-thirds of the expenditure for a five-year programme can be crowded into the last two years and produce the planned result for the whole of the last year. Nearly half the total estimate of expenditure is for construction and reconstruction producing 4 million tonnes per annum by 1978/79 whereas the other half of the estimated expenditure, which is for modernisation, is intended to increase output from 12.5 million tonnes in 1973/74 to 24 million tonnes in 1978/79. The construction and reconstruction programme is the more likely to suffer from shortfalls in the investment programme and the expected 4 million tonnes per annum could well be halved.

ii) Equipment for the modernisation programme makes the greatest demand on the company's total equipment input. The need to increase mechanisation in the Jharia field, now less highly mechanised than others, is shown by the requirement for a higher level of investment/tonne for equipment (see "Report on Demand and Supply of Mining Machinery" by Neithard Petry). This is recognised as a constraint, as is the need for certain specialised flame-proof equipment for working at greater depth, and could result in a shortfall in output amounting to as much as 2 million tonnes per annum.

iii) Sand for stowing is another constraint affecting the Jharia field more than most others. Many of the schemes to transport sand from sources other than the depleting Damodar River reserves, or to develop alternatives to sand as stowing materials, are long term projects. Shortage of stowing material is likely to be a constraint but since output is likely to be reduced by other causes in any event, the demand for increased sand is likely to be only 60-70% of the amount being forecast. There is also the possibility that development of coal seams could proceed well in advance of pillar extraction so that, for a limited period, demand for stowing materials could be reduced.

iv) Explosives consumption is planned to double from about 2,000 tonnes in 1973/74 to 4,150 tonnes in 1978/79, and this is nearly three times the rate at which it is planned to increase production of explosives. The company itself expresses fears that there could be acute shortages of explosives. Because this would reduce the pace of mechanisation, resulting in the continuance of "pick-mining", the demand for equipment would reduce. Taking into account the 2 million tonnes per annum shortfall due to the possible lack of equipment, it is felt that only a further 1 million tons loss might accrue because of lack of explosives.

v) Steel is in extremely short supply, particularly to meet the demand for rails and tubs. It is felt, however, that this is one sector in which priority could be given to coal-mining. Consequently, despite the problem of supply, it is not expected to result in any substantial shortfall in coal production.

vi) Power Demand is likely to increase from the present 90 MVA to 199 MVA by 1978/79 and the supply is likely to be inadequate to meet it. However about 100 MW is to be installed in the form of a company-owned power station, but even if it is ready by the end of the plan period, failure in supply in the interim would almost certainly hinder progress towards the final year target. The loss of output due to shortage of power supply could be as high as 1 million tonnes per annum.

vii) Transport of coal by rail, amounting to 24 million tonnes in 1978/79 will demand an increase in the railways' yard capacity from 2,644 to 3,150 wagons per day. In fact, the railways have only been handling some 1,500 wagons per day during the last three to four years and would need to double their present operational level to meet the new demand. Unless a considerable improvement in movement of coal-traffic develops during the course of the plan, output could be lost which, based on present experience, could amount to 1 to 2 million tonnes per annum by 1978/79.

viii) Manpower is not a constraint but bad relationships, or failure on management's part to provide training for the new techniques which will be required, could adversely affect production.

ix) Management skills may need to be extended as mine capacities, the size of the labour force at mines, the amount of equipment deployed and the administrative problems all increase in size. Many mining engineers will require training in modern management techniques to equip them for their changing roles.

x) Research and Development for the best methods of working many millions of tonnes of coal locked in pillars in the Jharia field is badly needed but this, a longer term problem, should not affect the outcome of the Five Year Plan.

xi) Planning will be a major constraint in this, as in every coalfield. It is impossible to attempt quantification of the effect of planning as a resource since, as has been demonstrated, even with fully developed plans, shortfalls are expected because of the lack of other resources to implement them.

xii) Other Factors peculiar to the Jharia field which might result in reduced output relate to the major collieries of Monidih and Sudamdih both developed by the National Coal Development Corporation in geologically disturbed areas which private companies found too difficult to exploit. These mines, now building up to full output, are expected to contribute in excess of 2 million tonnes per annum each by the end of the plan. It is my belief that, particularly because of the poor geological environment pertaining in the Sudamdih take, the expected output could fall short by 1 to 2 million tonnes per annum by 1978/79.

Collieries in the Jharia field will be making greater demands on the most scarce resources than any other group of collieries. Proportionately requiring the largest investment, having the greatest demand for sand and explosives, being in the area with the greatest transport and power supply problems, with a history of poor labour relations - it seems unlikely that expansion could proceed at the rate proposed.

The personal assessment of a production level of 18-20 million tonnes per annum by 1978/79 might be too low at the lower end but, I would not expect output to rise beyond 20 million tonnes per annum in the Fifth Plan. If this prognosis is correct, then the supply of coking coal will fall far below the demand. The stated intention of increasing the use of medium coking coal in steel-making might have to be put into effect earlier than planned. A special exercise to examine the likely effects of constraints in this, the most important single coalfield, and to seek more radical ways of removing them is, in my opinion, clearly necessary.

b) The Coal Mines Authority (Eastern Division)

The Eastern Division of the Coal Mines Authority is entirely made up of ex-privately owned mines. There are no plans for extensive new reconstructions and the planned increase in production, from an expected 22.50 million tonnes in 1973/74 to 33.80 in 1978/79, is one of the most modest.

Table XXI shows that nearly two thirds of the increase is planned to come from existing mines. All but 1.7 million tonnes of the increase will come from opencast or shallow mines. Clearly the prospect for this sort of increase from the Raniganj field is brighter than that proposed from the Jharia field. Nevertheless there are constraints, some of which could react just as strongly as those in the Jharia field. These are referred to as follows.

i) Capital Investment at 1118 million rupees represents almost exactly 100 rupees per tonne of increased annual output. Most of the investment will be in existing shallow mines, a small proportion will be in existing deep mines and the investment for new output will be in small easily developed opencast mines. Expenditure is well spread out across the five years of the plan and even the last year's expenditure of 277 million rupees does not exceed 25% of the total estimate. (Note that it is only 29% of the Bharat Coking Coal estimated expenditure for the final year). The programme appears to be feasible.

ii) Equipment required for the Division is not available in detail but the same constraints apply as elsewhere, equipment is likely to be in short supply. However, there is evidence that long years of under-investment had developed in management an ability to get the best out of old equipment. The loss of output due to non-availability of equipment could be somewhat less than in the Jharia field - 1 to 2 million tonnes per annum by 1978/79.

iii) Sand supplies for stowing are not the acute problem that they are in the Jharia field. Demand at 7.6 million tonnes per annum can be supplied but it is essential that the ropeways and other sand conveying or sand-getting equipment be well operated and maintained.

iv) Explosives consumption is estimated to increase from about 5,000 tonnes per year currently to 7,700 tonnes per year in 1978/79. Although the increase of about 50% appears modest it is greater than the planned increase in production of explosives. Shortages are almost certain to result in some loss of output and this could be as high as 1 million tonnes per annum by 1978/79.

v) Steel supplies could be extremely short in this Division where there is a greater tendency to experimentation with steel supports. This is one resource which can be diverted, particularly to fields like Raniganj supplying blendable coal and Jharia supplying prime coking coal. It is assumed that steel supplies to the coal mining industry will be maintained.

vi) Power demand is thought currently to be about 70 M.W. and is expected to increase to 104 MVA by 1978/79. Like the Jharia field, the Raniganj field is one which suffers from frequent reduction in supply and has been selected as the site for the second of the approximately 100 M.W. power stations which are to be constructed for the sole use of the coal-mining industry in Bengal/Bihar. Although the proposed capacity of the power station more nearly matches the demand than does the power station in the Jharia field, losses of output could still occur due to lack of supply affecting progress towards reaching planned output during the period before the plant is operative. This loss could be as high as 1 million tonnes per annum.

vii) Transport of coal by rail is yet another problem common to the coalfields in Bengal and Bihar. Nearly the whole of the planned increase in output is to be moved by rail. This is one of the areas where regular payments were made by private mine-owners to railway staff to ensure an adequate supply of wagons, and suspension of these payments, now that the mines are publicly owned, has affected the service provided by the railways. There are no detailed estimates of wagon demand available but, assuming that transport problems will continue to be as difficult as in the Jharia field then losses amounting to 1 to 2 million tonnes per year could be expected by 1978/79. In neither field has credit been assumed for the provision of more central loading stations. Observation showed that even those which were capable of operating effectively, were inadequately serviced.

viii) Manpower is not a constraint but again the warning needs to be sounded that good industrial relations and better training will be essential to getting the best from the labour force.

ix) Management should cope well with the relatively modest increase in both reconstruction activity and the ultimate increase in output.

x) Research and Development problems in this coalfield consist in large measure of finding the right machines for the conditions. It was in this field that evidence of Lee Norse Miners being withdrawn after relatively short service, and Anderton Shearers being worked under adverse conditions, was seen and recorded. There possibly is scope, if action is taken quickly, for some researches into this topic to bear fruit before the end of the Fifth Plan.

xi) Planning should not be a serious constraint in this field since most of the projects are relatively simple and make few demands for extensive resources. However, feasibility studies at the collieries are still being carried out and it is too early to say whether or not delays in planning could affect the output prospects.

xii) Another Factor which could improve, rather than impede, the chances of attaining the planned output is further extension into opencast mining. This, as has been reported, can be effected more cheaply in the Raniganj field than anywhere else in India. I would not expect the planned output to be attained but would consider it possible that an output lying between 28 and 30 million tonnes per annum could be produced by 1978/79.

c) The Coal Mines Authority (Central Division)

Most of the mines of the old National Coal Development Corporation were concentrated in this Division. As would be expected, there are more plans laid for new capacity than in any other group of collieries. The Division has a number of mines in Bengal/Bihar and a number, where large expansion is planned, in the outlying fields.

The planned increase from the expected 17.55 million tonnes in 1973/74 to 37.10 million tonnes in 1978/79 is the largest in the Coal Mines Authority. As Table XXI shows, more than half will come from new capacity though nearly three quarters of the increase will come from opencast working.

Because it is widespread, many constraints will react in different ways in different parts of the Division. This is illustrated as follows.

i) Capital Investment of 2,163 million rupees is required to increase output by 19.55 million tonnes per annum. The Division has the largest projected increase in output of any Division of the Coal Mines Authority and, at 110.6 rupees per tonne of increased annual output, has the highest investment to increased output ratio. That the Division with three-quarters of its increased output scheduled to come from opencast mines has the highest investment to output ratio, is surprising. One inference could be that it is not planned to use the equipment to its full capacity, but another, and more likely, explanation is that with wage rates still relatively low the best return is obtained from the cheaper more manpower intensive methods of mining. I am certain that it is right to increase investment in opencast mining as the sure means of getting large and rapid increases in output even if the cost is somewhat greater than investment in underground mines. There must, however, be some uncertainty in assuming that so large an investment can be made in the time available.

ii) Equipment is, in this Division, taking such a large proportion of the total capital investment that they are in effect, identical constraints. If there is any appreciable delay in the implementation of plans the expected output from opencast mining in 1978/79 instead of being 14 million tonnes could be between 10 or 12 million tonnes.

iii) Sand is not available in the Karanpura field and, as has been mentioned in this report (page 40), pillars are standing waiting to be extracted. The problem of extracting these pillars without stowing has yet to be solved. In my view 25% to 50% of the expected increase from the Ramgarh area of 2 million tonnes per annum could be in jeopardy unless this problem is solved.

iv) Explosives consumption at present is about 6,600 tonnes per annum but this is expected to more than double to 14,000 tonnes per annum by 1978/79. Such a large demand for a resource which, as has been made clear, is likely to be in short supply could affect production. Perhaps as much as 0.5 to 1 million tonnes per annum by 1978/79 could be lost if supplies are insufficient for the demand.

v) Steel demand is bound to be somewhat lower than average for this Division, with its emphasis on opencast-mining. It is unlikely to be a constraint.

vi) Power Supply which will be expected to meet a demand of 106 MVA by 1978/79, will almost certainly continue to be a problem in that part of the Division situated in Bihar. Unlike the Jharia and Raniganj fields no special provision, such as a captive power station, is to be made. The opencast mines should not be unduly affected and although problems could arise in the event of power cuts stopping the washeries which are fed from opencast workings, for a short time raw coal could still be stocked and production could still continue. Thus, although without the safeguard of a power station, the effect of reduced power supply on mines in Bihar is unlikely to be any more serious than in the Jharia or Raniganj field. A similar potential loss of 1 million tonnes by 1978/79 in respective of insecure power supply would be appropriate. Mines in the outlying fields would not be subjected to the same risk of reduced power supply.

vii) Transport, like power supply, affects the Division in different ways. It will be recalled that much of the evidence illustrating difficulties in rail transport was gathered in the Central Division in the State of Bihar. All but 2 million tonnes per annum of the projected increase is to be moved by rail and, although transport of that proportion in the outlying coalfields should present little difficulty, there is no evidence which suggests that the transport problems in Bihar will have been effectively solved by the end of the Five Year Plan. Between 1 and 2 million tonnes of the output in 1978/79 could be at risk if rail transport is less than adequate.

viii) Manpower is not a constraint, but the need to make provision for the houses and services required for the new mines does mean that more resources have to be made available to ensure that the mines are manned than is the case in the other Divisions or mining companies. With such a large proportion of the increased output (10.20 million out of 19.55 million tonnes) coming from new mines, training of so many new recruits is likely to raise problems. Away from the Bengal/Bihar fields industrial relations problems are likely to be somewhat easier.

ix) Management problems are likely to be more acute in this Division than in the Eastern Division or in Bharat Coking Coal. The much larger training programme for men, the more extensive reconstr. 'ion programme, the more widespread area must increase the task of manage ient but this is unlikely to prove a serious constraint.

x) Research and Development could well be focussed on the problem of extracting thick seams in the Karanpura Area without the need to solid stow. Unless this problem is solved, output could be 0.5 to 1 million tonnes per annum lower than planned by 1978/79. (see (iii) above).

xi) Planning could be expected, in the circumstances outlined in the paragraphs above, to be a serious constraint to achieving planned output. Many of the new projects were already being prepared by the National Coal Development Corporation before its absorption into the Coal Mines Authority. To some extent, therefore, the planning constraint is reduced but there is still a very heavy load of geological exploration which needs to be undertaken in this Division. This could affect the final outcome of the plan to the extent of 0.5 to 1 million tonnes per annum by 1978/79.

The expansion programme for this Division is the largest in absolute terms and, as a percentage increase, falls onl; .ightly short of that of Bharat Coking Coal. At their worst, factors mitigating against achieving the planned output could react almost as severely as they could in the Jharia field. At their best, the effect could be relatively modest. It is my belief that the planned output of 37.10 million tonnes per annum could be too difficult to achieve but that one ranging between 27 and 32 million tonnes could be attained.

d) The Coal Mines Authority (Western Division)

Another widespread Division, the Western Division plans to expand from an expected 1973/74 output of 18.23 million tonnes to 31.47 million tonnes in 1978/79. Table XXI shows that two thirds of the increase is expected to come from existing mines.

The first section of the coal industry so far assessed, having its mine all outside the States of Bengal and Bihar, this Division suffers from fewer constraints to its plans. It will be seen that:-

i) Capital Investment at 1,314 million rupees or 99 rupees per tonne of annual increase in output is similar to the Eastern Division but, unlike that Division, the investment is largely in new mines. More than 60% of the total investment (83 million rupees) is intended to be in new mines from which only a little more than 30% of the increased output (4.49 million tonnes per annum) can be expected by the end of the plan. Although I am unaware of the exact amount, a proportion of the investment is allocated for the re-opening of a number of flooded mines. Opencast output at 2.5 million tonnes per annum by the end of the plan requires a relatively small portion of the total investment. It will be clear that with so much of the investment allocated to new and re-opened mines the risk of not achieving the planned output could be quite high. 1 to 2 million tonnes per annum could be lost by 1978/79 if the investment programme is delayed.

ii) Equipment is required for new methods of working as well as for expanding output from new and existing mines. The general problem of equipment availability is felt to be no less constraining here than elsewhere. 1 million tonnes per annum could be forfeit by 1978/79 if equipment is not made available in the planned quantities.

iii) Sand stowing is necessary in the Kamptee and Wardha Valley Coalfields because of the presence of the water-bearing Kamptee Series rocks on top of the coal seams. New major sand gathering schemes are being prepared but nevertheless the problems associated with the working of these seams have not been completely resolved and losses amounting to 0.5 to 1 million tonnes per annum could be a measure of the difficulties of this working environment.

iv) Explosives consumption at an estimated 9,500 tonnes in 1978/79 is slightly less than double the present consumption and inadequate supplies could reduce final plan annual output by 0.5 to 1 million tonnes.

v) Steel supplies are no more likely, assuming priority is given to the mining industry, to affect output than in any other sector of the industry.

vi) Power Supply is unlikely to be a constraining factor to achieving the plan in the outlying coalfields of the Western Division. The consumption at 77 MVA is in any event, less than in any other Division of the Coal Mines Authority.

vii) Transport of coal outside the highly congested Bengal/Bihar coalfields is not a problem. Although the operational relationship with the railways is not as formalised as in the Singareni Collieries Company, no problems are envisaged.

viii) Manpower constraints are similar to those in the Central Division - that is the need for housing new recruits in distant coalfields and a large training programme - but on a somewhat smaller scale. They are not sufficiently large to produce insurmountable problems.

ix) Management tasks will again be like those of the similarly wide-spread Central Division but are not expected to be so onerous that problems arise.

x) Research and Development has a particularly difficult problem to solve in the effective working of the coal seams underlying the heavily water-bearing Kamptee Series rocks. The Division plans to extend new methods of working including longwall and caving without yet knowin how effective these could be. Clearly there is scope for research into the best equipment for the methods of working envisaged and into the strata control problems likely to arise with adoption of the new methods. If solutions to these problems are no reached in good time, output to the extent of 0.5 million tonnes per annum could be lost by the end of the plan period.

xi) Planning is unlikely to be a serious constraint.

xii) Other Factors include the really serious problem of re-opening old mines. From these about 2.75 million tonnes per annum are expected by 1978/79. Many are flooded and there could well be difficulties in re-opening them. It is possible that some might never be re-opened and writing down the potential output from this source by up to 1 million tonnes per annum could be a prudent measure.

Constraints to the achievement of the planned output are perhaps fewer than in other Divisions, nevertheless, it is unlikely that the production plan of 31.47 million tonnes in 1978/79 can be achieved, but a range of outputs between 25 and 28 million tonnes per annum is a asible objective.

e) The Singareni Collieries Company Limited

The Singareni Collieries Company, in its own plan, intended to expand output from 5.5 million tonnes per annum expected in 1973/74 to 12 million tonnes per annum by 1978/79. Because its policy is to develop mines of a capacity reaching no more than about 250,000 tonnes per annum the 25 mines, currently producing at about the required level, give little scope for extension of existing capacity. However, the Company has developed a high degree of expertise in the development of shallow drift mines and would continue its present policy by developing a sufficient number of these to build up output to 12 million tonnes per annum. A further 24/25 mines would be required together with a single small opencast mine.

The major inputs and their effect on the plans of the Company are discussed as follows.

i) Capital Investment was estimated by the Company to be 600 million rupees to provide the extra capacity of 6.5 million tonnes per annum, at an investment to increased output ratio of 92 rupees per tonne. The Draft Fifth Plan indicates that only 320 million rupees will be invested and that 4.5 million extra tonnes will be required. The investment to increased output ratio is reduced to 71 rupees per tonne. This would appear to be a significant reduction and one must either infer that, the original estimate of 600 million rupees was too high or that insufficient capital is now being provided to permit the new planned level of output to be attained. In any event, because of the reduced capital investment 2 million tonnes per annum is a basic reduction in the plan but if, as I believe, the investment rate of 71 rupees per increased tonne is too small, investment might have to be increased to avoid too low a capacity being provided.

ii) Equipment is less of a constraint for this Company than for others since a balanced blend of cutting and blasting, and solid blasting, seems to be the general policy. However, there has been some delay in the development programme because of scarcity of heavy duty haulages. The system of mining will require a large number of these but even if they continue in short supply the reduced level of planned output reduces the demand to levels which the supply should meet.

iii) Sand stowing could be a constraint if plans were to stow all production faces. Some of the thinner seams can be worked without caving and an intended extension in these seams into longwall caving methods could be successful. The supplies of stowing sand, quite separate from those of other coal companies, are adequate for planned purposes.

iv) Explosives consumption originally estimated to rise from about 1,800 tonnes per annum to 3,800 tonnes per annum by the end of the plan will now, of course, be reduced to about 3,000 tonnes. This is still a high demand and in view of the incidence of solid blasting, which as a technique demands more explosives per tonne of coal mined, shortage of explosives could be a constraint to achievement of the planned output.

v) Steel supplies, bearing in mind the provisos made in other parts of the report on priority being given to the mining industry, is unlikely to result in a significant shortfall in production.

vi) Power Supply for the reduced output of 10 million tonnes per annum will be of the order of 40 MVA. Approximately 26.7 MVA can be supplied from the Company's own power houses at Kothagudam, Ramagundam and Bellampalli. The additional 13.3 MVA can be easily purchased from the Andhra Pradesh State Electricity Board.

vii) Transport does not present a problem. Reference to Appendix II Part B.3 page 8 will show that a good formal relationship, ensures regular and speedy transport of coal from central loading stations, to the customer. The railways have been involved in the plan for increased output and can cater for the new demand for daily wagons from the present 670 to the 1,100 which will be required in 1978/79.

viii) Manpower estimates of the numbers needed to produce the planned output by 1978/79 have been made. About 20,000 more men will be required. The company has been building new townships as it has expanded in past years, but the new rate of expansion will demand increased activity in this respect. Again the problems of training and re-settling a large labour force must exercise the management talents of the Company during the course of the Five Year Plan.

ix) Management is quite capable of coping with the changes. There will be few new techniques to be mastered and each extension of output will come from a mine identical in type to those with which the Company management is already familiar. In fact, familiarity with the standardised production unit is one of the great strengths of the Company.

x) Research and Development techniques might well be applied to the proposed move into longwall working. Unless the technique is mastered, and it is essentially the only new one in which the management intends to involve itself, output could be lost. No more than approx 1-dozen a dozen such installations would be required but provided they are developed gradually there is no reason why output should be lost as the new techniques are being learned.

xi) Planning is almost a standard procedure. Prospecting has extended into new fields to be followed by tactical drilling to be followed by new drift mines. There is no reason to doubt but that the established systems will continue to provide the new facilities in the time by which they are required.

Had the Planning Commission not concluded that 10 million tonnes per annum was the level of output for which the Singareni Collieries Company should aim, it would have been my conclusion. I believe that 10 million tonnes of output per annum can be achieved by 1978/79, but if a number of minor constraints conspired to react together there could be some shortfall.

f) The Mining Industry in Summary

It must be stressed again that the assessments made in the preceding pages are most subjective. If they are not accurately quantified at least a sufficient number of constraints have been identified to show that the executives, mining engineers and all who support the mining industry are likely to find it quite impossible to meet the extremely high objectives set in the Fifth Plan.

Table XXII shows the production pattern since the end of the First Five Year Plan. Alongside it is the same pattern in graph form with the various estimates added to it. Projection of past trends would indicate that even an output of 100 million tonnes per annum could not be achieved by the end of the Fifth

Five Year Plan. The burden of expanding output by so much in so short a time is far heavier than many technologically well-advanced countries could carry. I believe that much more could be done to make use of existing capacity. It is said to be 90 million tonnes per annum, only 10 million tonnes more than the Planning Commission forecast of output for 1973/74, but so many instances of collieries producing outputs significantly below capacity tempt one to wonder whether it really is as low as is stated. I would suggest that a thorough scientific investigation into the capacity of the coal-mining industry should be undertaken as a matter of urgency.

Despite my apparent pessimism about the outcome of the plans being formulated to expand output, the fact is that even my personal prediction of an annual output by 1978 ranging between 110 and 120 million tonnes, (the lowest of all the estimates), ignores historic trends and concludes that they can be exceeded by some 10% to 20%.

IX. CONCLUSION

The introduction to this report indicated that no long list of conclusions or recommendations would result from it. The report itself, and in particular the preceding section, is sufficiently explicit to serve that purpose.

X. ACKNOWLEDGMENTS

The patience, tolerance and unfailing courtesy of Officers of the Indian Civil Service, the Railways Board and the Mining Companies is gratefully acknowledged.

Any implied criticisms of procedures, of plans or of prognoses has been for the sole purpose of improving the prospects of achieving the objectives set out in the Fifth Five Year Plan.

APPENDIX I

MEETINGS AND CONFERENCES

1. DELHI
   - (a) Minister of Planning
   - (b) Planning Commission (four meetings)
   - (c) Railways Board (two meetings)
   - (d) Ministry of Heavy Industry
   - (e) Ministry of Mines and Steel
     - i) Department of Steel
     - ii) Department of Mines (three meetings)

2. CALCUTTA
   - (a) Coal Mines Authority Limited
     - i) Chairman (two meetings)
     - ii) Finance Director (two meetings)
     - iii) Purchasing Department
     - iv) Marketing Department
   - (b) Geological Survey of India
   - (c) Railways Board

3. JHARIA
   - (a) Bharat Coking Coal Limited
     - i) Technical Director

4. RANCHI
   - (a) Coal Mines Authority Limited
     - i) Technical Advisor and Planning Staff
     - ii) Managing Director (Central Division)
   - (b) Chief Inspector of Mines

5. SANCTORIA
   - (a) Coal Mines Authority Limited
     - i) Managing Director (Eastern Division)
     - ii) Technical Advisor and Staff

6. NAGPUR
   - (a) Coal Mines Authority Limited
     - i) Managing Director (Western Division) and Staff

7. HYDERABAD
   - (a) Singareni Collieries Company Limited
     - i) Chairman
     - ii) General Manager and Staff
   - (b) Railways Board

8. DHANBAD
   - (a) Director of Central Fuel Research Institute
   - (b) Director of Central Mining Research Station

APPENDIX II

CATALOGUE OF FIELD STUDIES

A. COLLIERIES AND OPENCAST MINES VISITED

1. Sudamdih Colliery of Bharat Coking Coal Limited
2. East Bhuggatdih of Bharat Coking Coal Limited
3. Jealgura Colliery of Bharat Coking Coal Limited
4. Saunda D Colliery of the Coal Mines Authority (Central Division)
5. Saunda Central Colliery of the Coal Mines Authority (Central Division)
6. Gidi C Opencast Mine of the Coal Mines Authority (Central Division)
7. Kathara Opencast Mine of the Coal Mines Authority (Central Division)
8. Chinakuri Colliery of the Coal Mines Authority (Eastern Division)
9. Kenda Opencast Mine of the Coal Mines Authority (Eastern Division)
10. Kenda Colliery of the Coal Mines Authority (Eastern Division)
11. Kunustoria Colliery of the Coal Mines Authority (Eastern Division)
12. Pathakhera Colliery of the Coal Mines Authority (Western Division)
13. Ramagundam Colliery of Singareni Collieries Company Limited

B. WASHERIES, SCREENING PLANTS AND LOADING POINTS VISITED

1. Kathara Washery of the Coal Mines Authority (Central Division)
2. Kunustoria Loading Station of the Coal Mines Authority (Eastern Division)
3. Loading Stations of the Singareni Collieries Company Limited

C. OTHER VISITS

1. Area Workshops of the Coal Mines Authority (Eastern Division)
2. Mining and Allied Machinery Corporation

APPENDIX II

CATALOGUE OF FIELD STUDIES

A. COLLIERIES AND OPENCAST MINES VISITED

1. Sudamdih Colliery of Bharat Coking Coal Limited

This colliery in the Jharia field had been originally planned by Polish consultants for the National Coal Development Corporation. Developed on horizon mining lines, its two large diameter shafts, housing cages and skips, are connected to the 200 metres and 300 metres deep working horizons and the 400 metres deep developing horizon. Output, currently less than 1,000 tonnes per day is expected by management to increase to 10,000 tonnes per day.

The face visited was working to the full rise of 30° from the 300 metres to the 200 metres horizon (a most unusual use of the horizon system of mining). The 130 metres long face was being worked by the "Jankowitz" method whereby headings driven forward from the face for 7 metres are widened towards each other so that when work is complete, an area 7 x 130 metres is exposed ready for stowing. Coal winning occupies 12.5 shifts and is then followed by 9 shifts of sand-stowing. Surface arrangements for the delivery of sand are most efficient. It is doubted, in view of the steep gradients and restricted nature of the take, if production will ever rise far beyond 4-5,000 tonnes per day.

In May, 1973 this colliery was so affected by power cuts that 3 whole weeks production was lost.

2. East Bhuggatdih of Bharat Coking Coal Limited

This small shallow mine in the Jharia field has a shaft capacity of 600 tonnes per day, but was only producing 300 tonnes per day. Coal was won by hand-wielded picks (the use of explosives being forbidden under the township of Jharia) and carried to tubs by basket. Developments were to the full height of the 8-10 metres thick seams and pillars were being split by headings which were sand-stowed. Substantial reserves were contained in pillars left to support the township of Jharia.

3. Jealgura Colliery of Bharat Coking Coal Limited

This medium sized shallow mine in the Jharia coalfield has a shaft capacity of 1,200 tonnes per day, but only produces 500 tonnes per day. Development headings were slotted by coal-cutter, drilled by hand held drills and fired. Coal was loaded into baskets, then into tubs which were tippled at a central point into a bunker. From the bunker coal was conveyed to the pit bottom and re-loaded into tubs. The acute shortage of tubs, rails and haulages was said to be the reason for shortfalls in production.

4. Saunda D Colliery of the Coal Mines Authority (Central Division)

This colliery in the South Karanpura coalfield has been developed by inclines, but a new shaft started in 1964 was completed some 18 months ago. Producing 1,150 tonnes per day, the colliery has capacity for 2,900 tonnes per day, but would require a large investment in equipment and an increase in manpower to achieve it. The standard bord and pillar method of working, with cutting, drilling, firing, hand loading into baskets and into tubs, prevails. Although a new seam is currently being developed from the shafts, other seams have been extensively developed from the surface inclines and, but for the critical shortage of sand for stowing, de-pillaring could begin, resulting in highly profitable production.

5. Saunda Central Colliery of the Coal Mines Authority (Central Division)

Saunda Central, also in the South Karanpura field, has been developed by inclines and has three fully developed seams waiting to be de-pillared. Caving would be attempted but for the fear of spontaneous combustion and the stress effects on the pillars of the other developed seams. Development of rise-side pillars were seen. Filling of the cut and blown coal by hand into baskets by one man, and their carriage on the head by two others, was the method of disposal. Noteworthy, however, was the fact that the capacity of the baskets was 15 to the tonne and that the three man team loaded and carried 9 tonnes per shift. Dip haulages operated, but hand-tramming on the level roadways was said to result from non-availability of level haulages. Output per day was 1310 tonnes, but could be doubled by providing equipment and extra manpower.

Special Note: In crossing the coalfield the first evidence of the problems of rail wagon supply were noticed. Two collieries operating central loading points had stopped production with bunkers full and sidings empty.

6. Gidi C Opencast Mine of the Coal Mines Authority (Central Division)

Although in a neighbouring administrative area, Gidi C Opencast Mine was still in the South Karanpura coalfield. It was developed as a new project by the National Coal Development Corporation. The tonnage available on site is just under 12 million tonnes to a depth giving a coal/overburden ratio of 1:3 and an average ratio of 1:1.88. Nearly another 6 million tonnes lies beyond the 1:3 coal/overburden ratio.

Two shovels of 4.6 cubic metres capacity remove overburden, one similar capacity shovel loads the 3 bottom discharge coal haulers, each of 52 tonnes capacity. Drilling and blasting is required. Production is at the rate of 600,000 tonnes per annum at a productivity of 4 tonnes per manshift.

The nearby washery is not operating since its potential input has yet to be tested. It will handle non-coking coal but it is thought that 10% could be blendable. Its capacity will be 2.8[illegible] million tonnes per annum of which 2.0 million tonnes could be recovered as clean coal and 700,000 tonnes as middlings with 36-38% ash.

7. Kathara Opencast Mine of the Coal Mines Authority (Central Division)

This Opencast Mine is in East Bokaro coalfield. Reserves of more than 100 million tonnes of coal are available in three seams. The Kathara seam containing 7.5 million tonnes, the Uchitdih seam containing 4 million tonnes and the 27 to 42 metres thick Kargali seam containing 93.5 million tonnes are available up to a 1 to 4 coal to overburden ratio. After drilling and blasting, overburden is loaded by 4.6 and 8.0 cubic metres capacity shovels into 35 to 45 tonne rear dumpers. The coal is hauled in 50 tonne bottom dishcarge dumpers to Kathara washery. The mine produces about 1 million tonnes/year (only half of its capacity) at 2.12 tonnes per manshift. Breakdown of equipment is largely responsible for the shortfall; many machines have been idle since 1967/68 because of non-availability of spares. These include 2 out of 4 Shovels, 6 out of 15 Euclids, 13 out of 30 Haulpack Rear-dumpers, 1 out of 5 Athen Bottom Dumpers, 5 out of 8 Caterpillar Bulldozers and 1 out of 2 Galion Graders.

Kathara Washery, also visited, is reported on separately.

8. Chinakuri Colliery of the Coal Mines Authority (Eastern Division)

Situated in the Raniganj coalfield, Chinakuri Colliery is the deepest mine in India. Owned before nationalisation by the Bengal Coal Company, an admittedly progressive company, it works two seams of coal, the shallower by incline and the deeper from a pair of shafts each about 2,000 feet deep. Coal in the shallower seam is won by conventional bord and pillar methods, but the deeper seam is worked by longwall. The 4.1 metres thick Dishergarh seam is taken in two lifts. The bottom 1.8 metres is retreated using an Anderton Shearer loading onto an armoured face conveyor which then feeds a gate conveyor delivering into 3.5 tonne capacity mine cars. The face is supported by Huwood T.C.R. props and bars and after about 5 to 6 metres of advance the goaf is sand-stowed. If any coal face in India epitomises the problems facing the Indian mining engineer this is it. The system is well conceived and well operated and soon after it was installed, a peak performance of 500 tons per day was achieved. But that was in 1963. The shearer has an old type full pick drum with boxes completely worn, but refurbished time and again; even then picks are lost through coming out of loose boxes. Tungsten-carbide picks are no longer available and colliery-workshops-manufactured carbon steel picks are used instead. The wedges on the friction props are badly worn.

Not only is the coal harder than any Anderton shearer can have operated on in Britain, but it contains iron-stone nodules. The hydraulic rams once holding the conveyor to the face were blocked by sand from the sand stowing and have been abandoned. Consequently, only 30 cms. instead of the normal 60 cms. is sheared on a shearer run. The daily production from the face is now only 200-250 tonnes. It hardly needs saying - new equipment is badly needed. The top 2.3 metres of the seam, worked as second extraction, is retreated, not on strike as is the bottom section, but to the rise, so permitting the goaf to be sand-stowed without the risk of disturbing the previous stowing.

The colliery produces 1,250 tonnes per day from both seams and aims to increase this to 2,000 tonnes per day. Sand for stowing is won from the nearby Damodar River. The sand collection site was visited. Two pontoon pumps moored in the river, each capable of delivering 100 tonnes of sand per hour, were pumping sand into separator/bunkers. From these it was delivered to the faces, in 7" diameter pipes, via specially driven inclines.

9. Kenda Opencast Mine of the Coal Mines Authority (Eastern Division)

This opencast mine is in the Raniganj coalfield. Its significance lies, not in its present performance, but in its potential for producing very cheap coal. The measures above the Kenda and Dobrana seams, and the seams themselves, are soft enough to be worked without the use of explosives. Two bulldozers equipped with rip-picks can break overburden or coal seam and keep 4 loader/scrapers continually employed. Only 1,000 tonnes per day is produced, but clearly the potential is greater for larger mines with more equipment. It is planned to produce 10,000 tonnes per day for the whole of the Eastern Division from this type of working, but in my opinion, it would be worthwhile diligently scouring old quarry sites and shallow mine sites in the hope of establishing more of this type of mining and possibly doubling the projected output.

10. Kenda Colliery of the Coal Mines Authority (Eastern Division)

Associated with Kenda Opencast Mine, this colliery works the same seams (below the limits of opencast working, but still at shallow depth) by shafts and inclines. The standard method of bord and pillar development, extraction of pillars and sand-stowing is employed. Current production of 1,600 tonnes per day is to be doubled. For the new output level more face equipment and heavy duty haulages will be required.

11. Kunustoria Colliery of the Coal Mines Authority (Eastern Division)

This shallow mine in the Raniganj coalfield has shafts 120 metres deep, and is a new mine having started production in 1961. Perhaps the most interesting feature, in terms of this report, is its attempt to introduce fully mechanised mining using Lee Norse Miners and shuttle cars. The two Lee Norse Miners were deployed to one part of the mine, the remaining sections being worked by arc-wall cutters and loaders.

At that time, output reached a maximum of 1,200 tonnes per day. The Lee Norse Miners and the mechanical loading equipment has had to be withdrawn because of lack of spare parts. Universal Arc-wall cutters, now used in conjunction with shotfiring and hand-filling, produce 1,200 tonnes per day - an indication that more sophisticated equipment is not necessarily the answer to the production problem. Mechanical wagon-loading arrangements on the surface were inspected, but are the subject of a separate report.

12. Pathakhera Colliery of the Coal Mines Authority (Western Division)

This drift mine, designed by the National Coal Development Corporation, is in the Pathakhera coalfield of Madhya Pradesh. Its output (somewhat less than 2,000 tonnes per day) is delivered by belt conveyor to the nearby Satpura Thermal Power Station, which takes the remainder of its requirement from further afield. The intention is that more drift mines in the same area as Pathakhera will deliver coal by the same conveyor system to Satpura making for a self-sufficient power station/mine complex.

Bord and pillar methods are employed, but this new mine is at the development stage and no de-pillaring is contemplated for some time to come. The cut and blown coal is loaded by M. & C. loaders into Joy Shuttle-cars and onto belt conveyors.

Some idea of the problems of development of new capacity in the outlying fields was obtained. This mine is situated in the middle of a teak forest, part of which had to be cleared. New roads and housing estates with the complete services required for any small town have had to be created from nothing. The problem of rail communication has been averted only by the nearby market and alternative transport system.

13. Ramagundam Colliery of Singareni Collieries Company Limited

This drift mine in the Godavari coalfield of Andhra Pradesh is one of a series of such mines developed from the outcrops of the coalfields worked by the company. A deeper pair of seams has been extensively developed and in part de-pillared but, as with many others of the company's mines, work on de-pillaring the lower seams is being suspended so that upper seams can be developed. The latter are of poorer quality and have not commanded a market in the past, but now with increased demand, for coal, it is deemed better to work them before further de-pillaring of lower seams rather than risk their being rendered unworkable.

Part of the mine is mechanised with M. & C. loaders and Joy Shuttle-cars. A tractor mounted cutter cuts the heading before the coal is fired. The gradients are steep and, when working to the rise, the scatter of coal after shotfiring is extensive. Both loader and shuttle-car are, in these circumstances, operating under great difficulties. In the hand-filled headings the face is solid-blasted.

The scope for further expansion in this coalfield is good, but most of the mines are designed to produce no more than 1,000 tonnes per day. Expansion of output must depend upon more mines being developed. There is in the company an acknowledged expertise in the rapid development of small drift mines and their linkage to central screening and loading points - both of which activities were seen.

B. WASHERIES, SCREENING PLANTS AND LOADING POINTS VISITED

1. Kathara Washery of the Coal Mines Authority (Central Division)

Kathara washery is adjacent to and treats coal from Kathara and Jarangdih collieries. Like other medium coking coal washeries and medium coking coal mines, it is to be taken over by Bharat Coking Coal Limited. It is currently only running at half capacity, partly because of reduced output from Kathara Opencast Mine, but also because of uncertain power supply. At its full capacity of 3 million tonnes per annum, it would produce 1.5 million tonnes of washed coal for steel plants, 1.2 million tonnes of middlings for thermal power stations and 0.3 million tonnes of rejects.

Coal from the supplying mines is crushed to -75mm and stored in a 10,000 tonnes capacity blending and storage bunker. At the product end of the plant there is storage for 5,000 tonnes of clean coal and 5,000 tonnes of middlings. At current output levels the stocking room is equivalent to two days production, and should have served as a very useful buffer in the event of non-availability of wagons. In fact on the day of the visit - 1st December - so bad was the wagon supply position, that stocks had built up to 12,000 tonnes of clean coal and 7,000 tonnes of middlings. To keep the plant running, coal had to be bull-dozed away from the discharge points and in the process the reclamation equipment had been buried.

The normal wagon requirement per day is 2.5 rakes of 40 wagons/rake, each wagon having a capacity of 56 tonnes. It had been promised in the previous week that this level of demand would be met. In fact, the supply of wagons had been:

Monday,	26th November	-	1 rake
Tuesday,	27th November	-	1 rake
Wednesday,	28th November	-	2 rakes
Thursday,	29th November	-	1 rake
Friday,	30th November	-	1 rake
Saturday,	1st December	-	None

Further representations had been made to the Railways Board on 28th and 29th, but these elicited only promises and no action.

This incident is dealt with fully because, like many others which were cited but not personally seen, it illustrates most vividly one of the constraints to substantial increases in production.

2. <u>Kunustoria Loading Station of the Coal Mines Authority (Eastern Division)</u>

This loading station was visited because it is typical of the many which it is proposed should be established to meet the increase in block or rake loading. Coal to be loaded is first crushed to -5cms. and then ploughed off a conveyor sited above the ground stock pile. A V-trench below the pile houses a conveyor for reclamation of the stock and its transfer to wagon. Loading is carried out by one man who controls a two way chute for loading and a remote controlled haulage which moves the wagons. The wagons are filled on a weighbridge and the weigher signals when it is full. This point is important - the railways will not accept under or over-filled wagons. Empties are not weighed, the tare weight on the wagon is accepted. There is no communications link between the loading point and the nearest railway sidings. The rake, when loaded, is left to await the coming of a locomotive. In turn the locomotive might come before the rake is filled and then leave because it is not full. It would reappear 24 hours later, by which time the whole loading system could be waiting for wagons.

There is clearly need for a sensible system of communications between railway and colliery.

3. Loading Stations of the Singareni Collieries Company Limited

These were visited because, not only are they long-established, but they employ systems said to be unworkable in other parts of the country. Two stations were visited at Bellampalli and at Ramagundam, but since each is similar, it will be sufficient to describe only one of them.

Two or three neighbouring surface drifts are connected by conveyor to the loading station. Coal from two or three more outlying mines are brought by lorry. Raw coal is collected in a 1,000 tonnes capacity bunker and is fed to a screening plant where -5cms., 5-8cms. and +8cms. sizes are graded. The coal is then stored in concrete bunkers directly over the siding for future out-loading. The total capacity of the bunkers is 4,000 tonnes. This system is ideal for the loading of rakes of mixed products, but if rakes of a single coal size are required the system, although operable, is not as flexible.

Relationships between the Company and the Railways Board are excellent in this State. This is said to be because:

a) extensive bunkering facilities for 1 to 1½ days output have been supplied.
b) loading is done in rakes.
c) wagons are accepted whenever supplied.
d) loading is carried out even on weekly off-days.
e) weekly rest days are staggered so that every day there is a standard and regular indent of wagons.
f) consumers in the same area are linked to one loading station.
g) coaling and watering arrangements are available at each loading point.
h) sidings modifications to suit the railway's requirements are readily provided.

The railways in return ensure that demand is met and to help iron out local difficulties, have provided radio telephone links with their headquarters and the coalfields.

A standard procedure for indenting and supplying wagons has been established.

An indication of the effectiveness of the liaison is that over the last 4 years not only has normal production been cleared without delay, but 1 million tonnes of coal stocks have been reduced to 0.2 million tonnes.

It is significant that many of the proposals being mooted as the answer to the pressing problems of wagon supply in the north are part of normal practice in the south.

C. OTHER VISITS

1. Area Workshops of the Coal Mines Authority (Eastern Division)

Repeated references to the problems of maintenance made it essential that some investigation of the role of workshops should be made. That visited at Sanctoria near the headquarters of the Eastern Division was more like a small manufactory than a repair shop. Spare parts are in such short supply that many have to be manufactured, but often the metallurgy is inadequate and the home-manufactured spares last but a fraction of the life of the original parts.

Casings and impellers for pumps of all types (water and sand) were cast in the foundry.

Coal-cutter picks of carbon steel were manufactured in quantities to equip the whole Eastern Division.

Haulages of 50 H.P. were manufactured at the rate of 1 per month, and slushers for coal stocking were made at a similar rate, but gears for both had to be bought in.

Conveyor structure was made at a rate of 240 yards of structure per month and Meco-type rollers at a rate of 2,500-3,000 per month.

Pipes for stowing were cast at a rate of 60 or 300 yards per month.

Clearly more emphasis was placed on manufacture than on repair and by and large equipment being made was of a relatively simple type. Nevertheless, it was equipment in short supply and a worthwhile contribution was being made.

2. Mining and Allied Machinery Corporation

The briefest mention is made of this visit, since evaluation of the corporation and its contribution forms part of the brief of another study-team member.

Situated at Durgapur in West Bengal, M.A.M.C. is the biggest engineering complex in India and in terms of mining machinery manufacturing must be the biggest in the world outside Russia. The Russians were responsible for its design and development. It has the capacity to produce 45,000 tonnes of equipment, a curious way of measuring machinery output.

Originally designed to manufacture mining equipment it has diversified during the "lean" years but must, if it is to make a worthwhile contribution, return to manufacture of mining machinery on a 100% basis as fast as possible.
My personal view is that some of the equipment being manufactured is not well suited to Indian conditions. The standard Russian coal cutter, which it is intended to supply in large numbers, is too cumbersome for either shortwall or longwall working. Many of the gear-boxes are too big for use underground.

Armoured conveyors too are of Russian design, but being of the open bottom pan type could well give problems. Belt conveyors have rollers and structural steel work of a size far greater than is needed for the duty they perform. It was clear why output is reckoned in tonnes rather than in numbers.

Note: The visits to the Western Division of the Coal Mines Authority and the Singareni Collieries Company Limited were somewhat curtailed, partly because of time lost by national transport difficulties but also because the vast distances to be covered in these two sectors reduce effective working time. This cannot ease the load of the executives of the Western Division of the Coal Mines Authority and the Singareni Collieries Company Limited.

APPENDIX III

THE COALFIELDS OF INDIA*

1. Hura
2. Gilhura
3. Chuparbhita
4. Pachwara
5. Brahmani
6. Kundit Kararia
7. Saharjura
8. Jainti
9. Giridih
10. Deogarh
11. Chope
12. Itkhore
13. Raniganj East
14. Trans Adjoy
15. Raniganj West
16. Jharia
17. Chandrapura
18. Bokaro
19. Ramgarh
20. South Karanpura
21. North Karanpura
22. Aurunga
23. Palamow
24. Hutar
25. Daltonganj
26. Binda
27. Talcher
28. Ib River
29. Hingir (Surguja)
30. Singrauli
31. Talapani
32. Ramkola
33. South Raigarh
34. Raigarh
35. Mand River
36. Korba
37. Hasdeo (Surguja)
38. Pench Bhaiyani
39. Damhamunda
40. Sundargarh
41. Chirimiri
42. Kharsia
43. Koreagarh
44. Ambikapu-Bisrampur (Surguja)
45. Bansar
46. Lakhanpur
47. Jhilmeli
48. Sonhat
49. Jhagrakhand
50. Sohagpur
51. Johilla River
52. Umaria
53. Korar
54. Mohapani
55. Pench Valley
56. Kanhan Valley
57. Betul
58. Shahpur Tewa
59. Sonada
60. Dulahra Tewa
61. Pathakhera
62. Kamptee
63. Umrer
64. Bandar
65. Warora Area
66. Wun Berer
67. Ghugus Telwasa Area
68. Chanda Town Area
69. Ballarpur Area
70. Wamanpalli Area
71. Sasti Rajura Area
72. Antargaon Aksapur
73. Tanduru
74. Chinnur Sandrapalli
75. Kantapalli (Kamvaram)
76. Gundal Allapalli
77. Lingal Padmar Tiramu
78. Singareni
79. Kottagudom
80. Madukkur
81. Damarcherlu Ganaparam
82. Ashwaraopet Bedadanuru

THE COALFIELDS OF THE COLLIERY COMPANIES

The Coal Mines Authority Ltd.	(Eastern Division)	13-15
	(Central Division)	17-30 (exc. 28-29)
	(Western Division)	31-72 (inc. 28-29)
Bharat Coking Coal Limited		16
The Singareni Collieries Company Limited		73-82

* Excluding North-east Coalfields and Lignite fields.


SCALE OF KILOMETRES
0 50 100 150
0 50 100
SCALE OF MILES
UTTAR PRADESH
MADHYA PRADESH
MAHARASHTRA
BIHAR
W. BENGAL
ORISSA
REPUBLIC OF BANGLA
KANPUR
MUZAFFARPUR
KATIHAR
JHANSI
ALLAHABAD
VARANASI
MUGHAL SARAI
CHUNAR
PATNA
BARUN
GAYA
BINA
KATNI
GARWA RD
BHOPAL
JABALPUR
RANCHI
TATANAGAR
CALCUTTA
INDORE
ITARSI
BILASPUR
CHAMPA
KHANDWA
NAGPUR
RAIPUR
CUTTACK
BHUBANESWAR
PURI
TITLAGARH
KHARAGPUR
COALFIELD
STATE BOUNDARY
HYDERABAD
KOTHAGUDAM
Bay of Bengal
MAIN COALFIELDS OF INDIA

APPENDIX IV

STANDARD PROCEDURE FOR THE CLASSIFICATION OF COAL *

A. RELIABILITY OF DATA

1. Proved Reserves are those within 200 metres of workings, outcrop or borehole.

2. Indicated Reserves are those within points of observation no more than 1,000 metres apart, or 2,000 metres for beds of known continuity.

3. Inferred Reserves are those based upon broad knowledge of the measures even though there is no quantitative evidence within 1,000 to 2,000 metres.

B. OVERBURDEN AND DEPTH RANGES

1. Overburden/Coal Seam Ratio

   a) Overburden equal to one times thickness of seam or seams.
   b) " " " two " " " " " "
   c) " " " three " " " " " "
   d) " " " four " " " " " "
   e) " " " five " " " " " "

2. Depth Ranges

   a) 0 metres to 150 metres
   b) 150 " " 300 "
   c) 300 " " 600 "
   d) 600 " " 900 "
   e) 900 " " 1200 "

C. THICKNESS RANGE (excluding partings greater than 5cms.)

1. 0.5 metres to 1.5 metres
2. 1.5 " " 3.5 "
3. 3.5 " " 5.0 "
4. 5.0 " " 10.0 "
5. above 10.0 "

D. RANK AND QUALITY

1. Anthracite

2. Bituminous - further sub-divided into:

a) Low to medium volatile coals or coking coals.

CLASS I -	Ash	not exceeding	17%
CLASS II -	" exceeding 17% but	" "	24%
CLASS III -	" " 24% "	" "	35%
CLASS IV -	" " 35% "	" "	50%

b) High volatile or high moisture coals.

CLASS I -	Ash and moisture	not exceeding	19%
CLASS II -	" " " exceeding 19% but	" "	28%
CLASS III -	" " " " 28% "	" "	40%
CLASS IV -	" " " " 40% "	" "	55%

c) High sulphur coals - no quality classification needed.

NOTE: Further classifications e.g. by specific gravity exist, but are not appropriate to this report.

* Abbreviated from Memoirs of the Geological Survey of India - Volume 88 - Coal Resources of India.

APPENDIX V

STUDY OF THE ENERGY SECTOR IN INDIA

THE COAL MINING INDUSTRY

BIBLIOGRAPHY

I. THE COAL MINING INDUSTRY - THE FIFTH FIVE YEAR PLAN

a) Report of the Task Force on Coal and Lignite for the Fifth Plan.

b) Fifth Plan for Coal - Bharat Coking Coal Limited.

c) Development Programme - Fifth Plan - Coal Mines Authority.

d) Development Programme - Fifth Plan - Western Division of C.M.A.

e) Development Programme During the Fifth Plan - Singareni Collieries Company.

II. THE COAL MINING INDUSTRY - GENERAL

a) The Coal Industry in India - S. Mohan Kumaramangalam.

b) Report for 1972-73 of the Department of Mines.

c) Memoirs of the Geological Survey of India - Vol. 88 - Coal Resources of India.

d) Report on the Establishment of the Central Mine Planning and Design Institute.

e) Appraisal Report - The Indian Coal Industry - The International Bank for Reconstruction and Development.

f) 52nd Annual Report and Account - Singareni Collieries Company.

g) Director's Report to Shareholders - Bharat Coking Coal Limited.

h) Project Appraisal Reports of the National Coal Development Corporation.

III. UTILISATION OF COAL

a) A Study of the Problem of Coking Coal in India - A. Lahiri.

b) Coal as a Source of Power and Energy - Planning Commission (Energy Unit).

c) Final Report of the Coalfields Linkages Committee Regarding Coal Requirements of Existing and Approved Power Stations Till 1978-1979.

IV. RESEARCH AND DEVELOPMENT

a) Annual Report for 1971-72 of the Central Mining Research Station.

b) Annual Report (Technical Summary) for 1972-73 of the Central Fuel Research Institute.

V. GENERAL

a) Draft Fifth Five Year Plan 1974/79, Government of India, Planning Commission.

b) Numerous Pamphlets, Papers and Private Communications.

FIFTH FIVE YEAR PLAN TABLE I

ESTIMATES OF COAL DEMAND IN TONNES MILLION

CONSUMING SECTOR	PLANNING COMMISSION ESTIMATE	TASK FORCE ON COAL ESTIMATE	FUEL POLICY COMMITTEE ESTIMATE
STEEL	32(a)	27.4 (a)	27.9(b) (36.9)(c)
MERCHANT COKE OVENS		5.4 (a)	5.3(b)
THERMAL POWER	45(d)	45 (e)	56.5(f) (47.5)(g)
RAILWAYS	13	13	14
FERTILISER FEEDSTOCK	3	4.5	24.7
FERTILISER UNITS (FUELS)	2		
CEMENT	7	7	
TEXTILE	13	2.5	
PAPER		3.5	
OTHERS		13.5	26.6
EXPORT	1	1	
BRICK	6	7.5	
COLLIERY CONSUMPTION	4	4	
DOMESTIC SOFT COKE	9	8.7	9.5
TOTAL	135	143	164.5

(a) In terms of raw coal

(b) As charged to ovens

(c) As charged to ovens + 9 million tonnes of middlings

(d) Excluding 5 million tonnes of middlings

(e) Excluding 6.5 million tonnes of middlings

(f) Including 9 million tonnes of middlings

(g) Excluding 9 million tonnes of middlings

Source Planning Commission and Task Force on Coal Report.

FIFTH FIVE YEAR PLAN TABLE II

ESTIMATED OUTPUT OF HOT METAL FROM STEEL PLANTS AND COAL REQUIREMENT (AS CHARGED TO OVENS) IN TONNES MILLION

Steel Plant	1973/74			1978/79		
	Hot Metal Production	Coal To Hot Metal Norm	Coal Require-ment	Hot Metal Production	Coal To Hot Metal Norm	Coal Require-ment
BHILAI	2.500	1.66	3.660	3.600	1.09	3.933
ROURKELA	1.350	1.62	2.190	1.770	1.60	2.830
DURGAPUR	1.573	1.21	1.910	1.440	1.17	1.699
BOKARO	1.035	1.38	1.430	3.960	1.27	5.041
TISCO	1.850	1.19	2.200	1.950	1.53	2.990
IISCO	1.000	1.44	1.440	1.300	1.44	1.861
TOTAL	9.308	1.38 (a)	12.830	14.020	1.31 (a)	18.354 (b)

(a) Calculated average

(b) Added to this is 1.56 million tonnes for the Southern Plants making 19.91 million tonnes.

Source Task Force on Coal Report (Information re-compiled)

FIFTH FIVE YEAR PLAN TABLE III

EXISTING AND NEW WASHERY CAPACITY AND RAW COAL REQUIREMENT IN 1978-79 TO MEET THE STEEL PLANT DEMAND IN TONNES MILLION

	Raw Coal Requirement	Prime Coking	Medium Coking	Blendable	Coal To Ovens
In Existing Washeries	23.5 (before washing)	9.09	4.26	-	13.35
In New Washeries		- .17	2.85	-	2.68
Raw Feed	3.88	1.00	1.50	1.38	3.88
TOTAL	27.38	9.92	8.61	1.38	19.91

Source Task Force on Coal Report (Information re-compiled)

ALLOCATION OF COAL WASHERY OUTPUTS TO STEEL PLANTS IN 1978-79 (B.C.C. ESTIMATE) AND COMPARISON OF THESE WITH TASK FORCE ESTIMATES - IN TONNES MILLION

WASHERIES	BHILAI STEEL PLANT	ROURKELA STEEL PLANT	DURGAPUR STEEL PLANT	BOKARO STEEL PLANT	TISCO STEEL PLANT	IISCO STEEL PLANT	DURGAPUR COKE OVENS	SUNDRY	SOUTHERN STEEL PLANTS	B.C.C. TOTAL	TASK FORCE TOTAL (a)
PRIME COKING COAL											
Dugda I				1.284						1.284	1.27
Dugda II	.348	.612								.960	1.18
Patherdih		.96								.960	1.03
Rhojudih	1.296									1.296	1.45
Lodna						.216				.216	.29
Chasnalla					.444	.816		.060		1.320	1.60
Jamadoba					1.056					1.056	1.09
Durgapur S.P.			.672							.672	.89
Durgapur C.O.							.480			.480	.30
Bhowra	.484			.456.				.072		.972	
Monidih				1.296						1.296	
Lodna Bagdigi											.29
Raw Jharia Coal			.240		.360		.120			.720	.53(c)
Total Prime B.C.C.	2.088	1.572	.912	3.036	1.860	1.032	.600	.132		11.232	
(b)Total Prime - Task Force	2.163	1.273	.849	2.268	1.644	1.024			.700		9.92
MEDIUM COKING COAL											
Durgapur C.O.							.156			.156	
Kargali	.840	.492		.288						1.620	1.80
Kathara	.648			.732						1.380	1.62
Sawang		.480								.450	.48
West Bokaro					.324					.324	.36
Ramgarh				.984						.984	4.35(c)
Raw Medium Coal			.528		.516	.636	.204	.168		2.052	
Total Medium B.C.C.	1.488	.972	.528	2.004	.840	.636	.360	.168		6.996	
(b)Total Medium - Task Force	1.573	1.274	.595	2.773	1.047	651			.700		8.61
BLENDABLE COAL											
Crucha	.360									.360	NOT
Pongisti		.060			.120	.072	.060			.312	
Dissergarh		.228	.240		.228	.120	.180			.996	SPECIFIED
Total Blendable B.C.C.	.360	.288	.240		.348	.192	.240			1.668	
(b) Total Blendable - Task Force	.197	.283	.255		.299	.186			.160		1.38
Grand Total B.C.C.	3.936	2.832	1.680	5.048	3.048	1.860	1.200	.300		19.896	
(b)Grand Total Task Force	3.933	2.830	1.699	5.041	2.990	1.861			1.560		19.91

(a) Derived from Annexure I (Statement H) of the Task Force on Coal for the Fifth Plan.
(b) Derived from Annexure II of the Task Force on Coal for the Fifth Plan.
(c) Inferred to effect balance between (a) and (b) and including new washery capacity.

Source Task Force on Coal Report and Fifth Plan for Coal - Bharat Coking Coal Limited (Information re-compiled).

FIFTH FIVE YEAR PLAN

TABLE V

ESTIMATED COAL DEMAND FOR THERMAL POWER STATIONS

SOURCE OF ESTIMATE	THERMAL CAPACITY MILL. K.W.	COAL DEMAND (a) (MILL' TONNES)		GROWTH RATE
		1972/3	1978/9	
Central Water & Power Commission Estimate	23.9		67.0	17.4%
Fuel Policy Committee Estimate	18.8-21.8		56.5	14.1%
Task Force on Coal Estimate	17.155	25.62(b)	51.5	12.3%
Planning Commission Estimate	19.008		50.0	11.8%

a) including middlings.

b) was used in all cases to estimate the growth rate

Sources - As shown in the Tables.

TOTAL RESERVES OF COAL IN INDIA (IN MILLIONS TONS)

TYPE OF COAL	PROVED RESERVES (MILLIONS TONS)						OTHER RESERVES		TOTAL RESERVES
	CLASS I	CLASS II	CLASS III	CLASS IV	UNCLASS-IFIED	TOTAL	INDICATED	INFERRED	
PRIME COKING	977	2186	226	–	264	3653	1538	461	5652
MEDIUM COKING	185	1164	1224	382	897	3852	4311	1272	8435
SEMI-COKING	164	202	699	5	171	1241	2427	570	4238
WEAKLY COKING	135	88	–	–	53	276	174	344	794
ALL COKING	1461	3640	2149	387	1385	9022	8450	2647	20119
NON COKING	486	3655	4899	1375	1928	12343	22309	26181	60833
TOTAL RESERVES	1947	7295	7048	1762	3313	21365	30759	2882[illegible]	80952

Source Tabled compiled from Reserves Estimates in G.S.I. News, April, 1972 based on data from G.S.I., N.C.D.C., N.L.C., Singareni Collieries Co. Ltd., and Gujarat, Orissa & Maharashtra State Governments.

21,365
30,759
52,124

TABLE VII

TOTAL RESERVES OF COAL IN INDIA (IN MILLION TONNES)
ANALYSIS BY STATE AND BY MINING COMPANY

MINING COMPANY	TOTAL RESERVES COKING COAL	NON-COKING COAL	STATE
C.M.A. Eastern Division	2480	17085	Raniganj in West Bengal
		54	Other fields in West Bengal
	2480	17139	Total in West Bengal
Bharat Coking Coal Ltd.	7760	5058	Jharia in Bihar
C.M.A. Central Division	9570	12807	Other fields in Bihar
	17330	17865	Total in Bihar
C.M.A. Central Division		3243	Talcher in Orissa
C.M.A. Central Division		9121	Singrauli in Madhya Pradesh
Total Central Division	9570	25171	
C.M.A. Western Division	309	6124	Other fields in Madhya Pradesh
	309	[illegible]	Total in Madhya Pradesh
C.M.A. Western Division		1837	Ib River in Orissa
		5080	Total in Orissa
C.M.A. Western Division		2621	All fields in Maharashtra
Total Western Division	309	10582	
C.M.A. Assam Division		828	North Eastern States
Total Coal Mines Authority	12359	53720	
Singareni Collieries Co. Ltd.		2055	All fields in Andhra Pradesh
All Mining Companies	20119	60833	All States

Source As for Table VI.

FIFTH FIVE YEAR PLAN

ESTIMATES OF SUPPLY IN TONNES MILLION

TASK FORCE ESTIMATES

TABLE VIII

SUPPLYING SECTOR	COKING COAL			NON-COKING COAL	TOTAL SUPPLY
	PRIME	MEDIUM	BLENDABLE		
Bharat Coking Coal	11.18	5.63			
National Coal Dev. Corporation	3.72	7.28	0.7	34.47	67.48
T.I.S.C.O. & I.I.S.C.O.	3.70	0.8			
Singareni				10.00	10.00
Private			2.10	63.53	65.63
Total	18.60	13.71	2.80	108.00	143.11
Total of Coking and Blendable Coal					35.11

Source Task Force on Coal Report.

SUPPLIERS ESTIMATES

TABLE IX

SUPPLYING SECTOR	COKING COAL	NON-COKING COAL	TOTAL SUPPLY
Bharat Coking Coal	19.50	8.50	28.00
Coal Mines Authority	* 10.08	93.29	103.37
Singareni Collieries		12.00	12.00
Total Supply	29.58	113.79	143.37

* The C.M.A. breakdown was not available. The figures quoted are those in the Task Force Estimate.

Note:- The Task Force Estimate was made before the Private Mines were nationalised.

Sources Fifth Plan for Coal - Bharat Coking Coal Limited.

Development Programme - Fifth Plan - Coal Mines Authority.

Development Programme during the Fifth Plan - Singareni Collieries Company.

Task Force on Coal Report.

FIFTH FIVE YEAR PLAN

TABLE X

ESTIMATES OF SUPPLY BY MAJOR COALFIELDS IN TONNES MILLION

GEOGRAPHICAL OR COALFIELD LOCATION	SUPPLY ESTIMATES 1978/79			1973/74	MINING COMPANY
	PLANNING COMMISSION	TASK FORCE	MINING	COMPANY	
Bihar (Jharia)	-	-	28.00	12.50	Bharat Coking Coal
West Bengal	-	-	33.80	22.50	C.M.A. Eastern Division
Bihar	-	-	26.54	13.86	C.M.A. Central Division
Bengal-Bihar	83.00	87.48	88.34	48.86	
Singrauli	7.00	7.30	7.30	2.30	" " "
Talchar	3.00	3.83	3.26	1.39	" " "
Central India	14.00	15.35	12.48	7.77	C.M.A. Western Division
Pench-Kanhan-Tawa	7.00	7.[illegible]	7.79	4.61	" " "
Maharashtra	5.50	5.70	6.34	2.87	" " "
Korba	4.50	4.60	4.86	2.98	" " "
Singareni	10.00	10.00	12.00	5.50	Singareni Collieries
North-east States	1.00	1.00	1.00	0.58	C.M.A. Assam Division
Total Outlying Fields	52.00	55.63	55.03	28.00	
Total All Estimates	135.00	143.11	143.37	76.86	

Sources Planning Commission and as for Table IX (Information re-compiled)

FIFTH FIVE YEAR PLAN

PRODUCTION ESTIMATES FOR 1978/79 AND REQUIRED GROWTH RATES

SOURCE OF ESTIMATE AND SUPPLIER	INCREASE IN PRODUCTION (MILLION TONNES)		INCREASE IN GROWTH %	
	FROM 1973/74	TO 1[illegible]/79	TOTAL GROWTH	ANNUAL GROWTH

TABLE XI TASK FORCE ESTIMATE

Bharat Coking Coal	12.50	28.00	124.0	17.5
Coal Mines Authority	58.86	103.37	75.6	11.9
Singareni Collieries	5.50	12.00	118.2	16.9
Total	76.86	143.37	87.0	13.3

TABLE XII PLANNING COMMISSION ESTIMATE

Bharat Coking Coal	12.50	(a)26.50	112.0	16.2
Coal Mines Authority	58.86	(a)98.50	67.3	10.8
Singareni Collieries	5.50	10.00	81.8	12.7
Total	76.86	135.00	75.6	11.9

TABLE XIII PERSONAL ESTIMATE

Bharat Coking Coal	12.50	20.00	60.0	9.9
Coal Mines Authority (b)	58.86	80/90	35.9/52.9	6.3/8.9
Singareni Collieries	5.50	10.00	81.8	12.7
Total (b)	76.86	110/120	43.1/56.1	7.4/9.3

(a) Proportions are estimated but cannot be more than $\pm .5$

(b) A range is shown for the larger producer and for the total.

Source As shown in the Tables.

TABLE XIV

TYPICAL SAMPLE COLLIERY COSTS (a)

COST HEADING	SINGARENI COLLIERIES CO. LTD. RS./TONNE	CENTRAL SAUNDA COLLIERY RS./TONNE
Wages and Salaries	20.50	25.65
Stores	5.86	4.29
Power	2.05	1.11
Royalties and Cess	1.90	1.94
Contractor's Costs	-	0.59
Miscellaneous Costs	2.03	0.05
Administrative Expenses	5.25 (b)	1.05 (b)
Depreciation	2.08	1.38
Interest	1.62	0.36
Coal Transport	0.77	0.50
Total Costs	42.06	36.92
Coal Realisation	44.01	37.00
Profit	1.95	0.08
Coal Board Subsidy	-	0.89
Final Profit	1.95	0.97

(a) Singareni costs relate to the period March to September, 1973. Central Saunda costs are for an unidentified "typical" month.

(b) Singareni costs include heavy prospecting and building costs (resulting from expansion and building townships - R2/42) as well as colliery group and headquarters costs.
Central Saunda Administrative costs are not identified but it is suspected that they do not include some of the sub-area, area, division and headquarters costs.

TABLE XV

PRICE OF RAW COKING COAL TO STEEL PLANT, WASHERIES AND OTHER CUSTOMERS

ASH %	GRADE	PRICE/TONNE RUPEES
Not exceeding 13%	Special Grade	48.20
Exceeds 13% but " " 15%	Steel Plant Grade I	45.29
" 15% " " " 17%	Steel Plant Grade II	43.07
" 17% " " " 20%	Washery Grade I	41.68
" 20% " " " 22%	Washery Grade IIA	40.55
" 22% " " " 24%	Washery Grade IIB	39.43
" 24% " " " 25%	Sub-Grade	38.93
" 25% " " " 26%	Sub-Grade	38.43
" 26% " " " 27%	Sub-Grade	37.43
" 27% " " " 28%	Sub-Grade	36.43
" 28% " " " 29%	Sub-Grade	34.93
" 29% " " " 30%	Sub-Grade	33.43
" 30%	Rejected	1.00
Premium Hard Coke		195.00
Washed Coal from Kargali Washery		64.52
Kathara Washery		74.52
Sawang Washery		69.52

Source Development Programme - Fifth Plan - Coal Mines Authority.

TABLE XVI

PRICE OF NON-COKING COAL PER TONNE

GRADE		STEAM/RUBBLE RUPEES	SLACK/R.O.M. RUPEES
BENGAL/BIHAR	Selected A	48.00	47.00
	Selected B	45.00	42.00
	Grade I	42.00	39.00
	Grade II	38.00	35.00
	Grade III A	35.89	32.62
	Grade III B	34.74	31.45
OUTLYING FIELDS	Selected	46.50	44.50
	Grade I	44.25	41.25
	Grade II	42.25	39.25
	Grade III	41.25	38.25

Source for Tables XVI and XVII - Development Programme - Fifth Plan Coal Mines Authority.

TABLE XVII

PRICE OF COAL TO RAILWAYS PER TONNE

GRADE		RUPEES
A. BENGAL/BIHAR	Selected A	43.20
	Selected B	41.64
	Grade I	38.09
	Grade II	33.11
B. OUTLYING FIELDS	Selected	40.45
	Grade I	37.06
	Grade II	34.97
C. ORISSA	Selected	43.50
	Grade I	40.00

TABLE XVIII

COAL PRODUCTION AND RAIL TRANSPORT 1971/72

ITEM	BENGAL/BIHAR	OUTLYING FIELDS	TOTAL
Coal Production (million tonnes)	49.18	22.38	71.56
% of Total	68.7	31.3	100.0
Coal By Rail (million tonnes)	45.0	20.0	65.0
% of Total	69.2	30.8	100.0
% Total Production by Rail	91.5	85.5	90.7
No. of Daily Wagons	5617	2183	7800
% of Total	72.0	28.0	100.0

Source for Tables XVIII and XIX. Study Report on Coal Transport Planning for Fifth Five Year Plan - Ministry of Railways.

TABLE XIX

COAL PRODUCTION AND RA[illegible] TRANSPORT 1978/79

ITEM	BENGAL/BIHAR	OUTLYING FIELDS	TOTAL
Coal Production (million tonnes)	83.0 (a)	52.0 (a)	135.0 (a)
% of Total	61.5	38.5	100.0
Coal By Rail (million tonnes)	73.7	32.9	106.6
% of Total	69.1	30.9	100.0
% Total Production by Rail	88.8	63.3	79.0
No. of Daily Wagons	9211	4116	13327
% of Total	69.1	30.9	100.0

(a) Planning Commission Estimates

RETURN TO NDO

10 Year Perspective Plan

1978-79 TO 1987-88

2·5 (1)

Coal India Limited

A reprint from

Project Black Diamond

Contents

Chapter 1

Introduction

Roll-on Planning

1.1.1 In a fast changing socio-economic environment of the present day world, particularly in an organisation like Coal India with its vast size and complexity of operations, the importance of and need for corporate planning to help ensure its survival and growth, cannot be overemphasized. Soon after the formation of Coal India Limited in November, 1975 with five subsidiaries, viz. Eastern Coalfields Limited, Bharat Coking Coal Limited, Central Coalfields Limited, Western Coalfields Limited and Central Mine Planning & Design Institute Limited, efforts were initiated towards evolving appropriate plans for development and growth Therefore by November, 1976 Coal India had formulated its long-range perspective plan 'Project Black Diamond 1976-77 to 1985-86.

1.1.2 In as much as this was the first ever exercise, the methodology of planning and forecasting that was followed left much scope for improvement. Moreover, planning is a continuous process and in the light of changing environmental conditions and experience gained in implementation, the plan requires to be revised at periodical intervals. It was thus decided that 10 year long-range plan would be of a roll on nature, updated every two years or so. The present document — 10 Year Perspective Plan (1978-79 to 1987-88) — is the result of continuous efforts at evaluation and revision undertaken so far.

Environmental Outlook

1.2.1 Any long-range planning exercise has to be based on, among others, an analysis of the long term environmental outlook. The energy scene across the continents is characterised by an increased awareness towards conservation of energy, self-reliance in meeting energy needs and greater reliance on coal, the known and exploitable reserves of which are by far the largest among all fossil fuels. All these are reflected in the strategy developed in Warsaw in June, 1977 for the joint energy development programme till 1990 of the Soviet Russia and other East European Socialist Countries. The National Energy Plan of the United State of America also lays stress on control of energy demand through conservation, of the relatively scarce fuels and greater utilisation of the more plentiful sources like coal and nuclear power and development of new and unconventional sources like solar and geo-thermal energy. The basic objective in Britain and other member countries of the European economic community is on energy savings through its rational use and reduction in the dependence on imported fuel supplies. Japan which imports about 73% of its energy needs at present and which has very little endowments of fossil fuel reserves has already launched an ambitious "Sun Shine" project which is expected to yield results by the turn of the century. The table below shows the exploitation and utilisation of coal in different countries over the next few decades.

Long Term Projections for Major Coal Producing Countries

(In mt)

Country	1975 A D				1985 A D				2000 A D			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Australia	75	35	29	—	130	64	61	—	NA	NA	101	NA
Canada	23	13	12	15	45	45	25	25	NA	100	60	NA
F R Germany	126	101	23	10	129	105	25	6	NA	NA	NA	NA
India**	98	92	—	—	185	175*	6	—	327	313	13	—
P R China	470	470	—	—	920	920	—	—	NA	NA	NA	NA
Poland	181	144	39	1	238	198	40	NA	333	288	45	NA
S Africa	69	67	2	—	119	96	20	—	233	178	40	—
United Kingdom	129	122	2	5	137	132	10	NA	173	164	NA	NA
U S A	599	515	60	1	842	767	68	NA	1341	1250	91	NA
U S S R	614	553	26	8	851	824	37	10	1000	NA	NA	NA

(a) Production, (b) Consumption, (c) Export, (d) Imports.

*Based on World Energy Conference, 1977 papers.

**Coal India's present projections vary from these estimates particularly regarding exports in the long-run.

1.2.2 In broad terms, there has been switch-back in favour of coal — following the energy crisis in 1973, triggered off by the sharp hike in oil prices and control on oil supplies on the part of the oil-rich middle east countries. The role that has been assigned to coal is one of meeting the growing energy needs during the period when oil supplies start peaking off and then declining and till suitable methods of exploiting the non-exhaustible sources of energy become feasible on a large scale and on commercial basis. Beyond that, coal is expected to make an important contribution to the multi-fuelled energy economy. In the immediate future, however, coal production will have to be increased to help conserve relatively scarce oil reserves, through substitution to meet the bulk of the incremental energy needs and to enter in a big-way as a source of feedstock for chemicals and fertilizers. In developing countries like India it has yet another role to play. The large dependence on non-commercial sources of energy such as firewood and animal and vegetable wastes has to be brought down so that forest resources are protected for maintaining ecological balance and for diverting animal and vegetable wastes to more productive use as fertilizers.

Coal in Indian Economy

1.3.1 One of the major determinants of economic growth is the endowment and exploitation of natural resources. Naturally, therefore, the role and contribution of natural resources like coal depends, among other things, on the material-use policies the country follows and the rate of expansion of economic activities which are linked with coal. With the vast endowment of the coal deposits and an environment congenial for their exploitation, the coal industry played a significant role of pace-setter in the history of Indian economic development. This was natural in view of the high linkages of coal industry. Being an 'intermediate primary production', coal mining is characterised by very high forward linkages as reflected in the high percentage ratio of its inter-industry sales to total demand. Moreover, the industries, such as, iron and steel, railways and electricity, the initial development of which were explained by, among others, the forward linkage effects of coal mining. In their turn are charac-terised by high linkage effect. In fact, these are among the basic economic activities on which a large number of other activities depend. Interestingly again these three industries together with coal constitute a very closely inter-dependent group ; the performance of any one of these can considerably influence the performance of others.

1.3.2 Although coal has been major source of commercial fuel in the country all along, use of alternative fuels has also been increasing over the years. With the emergence of petroleum oil as a cheap and convenient source of fuel for chemicals and fertilizers, the market for coal became restricted. Though, theoretically coal can yield all the petro-chemical products including oil itself, its use for such purpose did not prove to be economically attractive or commercially profitable given the state of technological development and the relative prices of petroleum and coal. Naturally, over the years potential industries which could have been based on coal were competed away; at the same time some hitherto coal using industries shifted to oil-based technology. Besides, since independence increasing attention was being paid to the exploitation of the country's hydel resources for electricity generation.

1.3.3 As a result of all these, the direct use of coal in relation to other fuels steadily declined since the mid-1950s. The share of coal in total consumption of commercial energy fell from 66.5% to 50.0% during the decade 1960-61 to 1970-71. But for the continued rise in coal use for generation of electricity, this share would have gone down further. At the same time, the consumption of petroleum oil was increasing at a faster rate. Over the decade prior to the energy crisis, India's dependence on imported petroleum oil was more than doubled. The Fuel Policy Committee appointed by the Government of India, in its report submitted in 1974, recommended that coal should be considered the primary source for fuel in India for the next few decades. This clearly was in conformity with the country's relative endowment position with regard to fuels.

National Energy Policy

1.4 Based on the recommendations of the Fuel Policy Committee, the Government adopted the following 7-point outline for a National Energy Policy :

(a) Oil will be substituted wherever technically and economically possible by other forms of energy.

(b) The exploration, exploitation and utilisation of coal will be programmed according to this policy, while indigenous production of oil will be maximised and imports reduced to that extent.

(c) The National Energy Policy will require production of electricity from water, coal and nuclear sources.

(d) High priority will be given for fulfilment of rural energy needs.

(e) Optimisation of energy and other inputs of the transport system will be attempted.

(f) Efforts will be made for conservation of energy.

(g) A pricing pattern will be evolved which will give industry an adequate return at a reasonable level of operating efficiency.

Objectives of Coal India

1.5 The objective of the Coal India that are sought to be realized through the formulation and implementation of plans as have been recently laid down by the Government, are :

(i) To promote the development and utilisation of coal reserves in the country for meeting the present and likely future requirement of the national economy with due regard to the need for conservation of non-renewable resources, and safety of mine workers.

(ii) To raise the productivity of coal mining and related activities through introduction of improved technology, streamlining of organisation and management and improving the skills and motivation of the work-force.

(iii) To generate surpluses by optimum utilisation of productive capacity, improving efficiency of operations, and adopting appropriate cost reduction and cost control methods.

(iv) To make efficient arrangements for marketing and supply of coal so that coal, coke and other similar derivatives are available to consumers throughout the country conveniently and at reasonable prices.

(v) To promote research and development activities on a continuing basis in the areas of coal mining, beneficiation, development of new coal-based products or by-products, fuel technology or any other areas having a bearing on conservation, development or utilisation of coal reserves of the country.

(vi) To provide suitable facilities for training with a view to up-grading the knowledge and skills of employees in different categories and enabling them to make full use of their capabilities.

(vii) To look-after the welfare of the employees and promote the establishment and maintenance of healthy relations between management and workers, and foster a sense of fellowship and belonging to the company among personnel at all levels.

The Long-term Plan

1.6 Based on the analysis of the environmental factor and guided by the need to achieve the objectives set for Coal India Limited, the long-term plan for the 10 year period of 1978-79 to 1987-88 has been formulated. The different chapters of this document present the detailed analysis of environmental factors and the programmes set and targets laid down in different spheres of operations of the organization. Assessment of demand is the basic starting point for all planning which has been covered in Chapter 2. Based on the demand forecast and the assessment of present and potential capacity of existing mines, the need for capacity expansion for prospecting and exploration has been identified (Chapter 3) and programmes drawn up (Chapter 4). The trend in mining technology implicit in the production plan has been covered in Chapter 5. The requirement of different inputs in quantitative and qualitative terms and their availability have been dealt with in the Chapters 6 to 10 and 12. Ancilliary activities on end-use of coal, coal products including coal chemicals on which would depend the actual demand of coal in the long-run is covered in Chapter 11. The R&D support required by the organization is detailed in Chapter 14. The safety, conservation and ecological considerations that influenced the drawing up of the production and technology plans are outlined in Chapter 15. The organization has to put up considerable efforts at meeting its obligations of employees' welfare. The ten-year programmes in this area comprise Chapter 13. The final Chapter 16 works out the financial implications of the entire plan in terms of capital outlays required.

The Planning Process

1.7 Even at the very initial stages of long-term planning when the first excercise was initiated in 1975-76, efforts were made to involve all concerned including Field Executives, in the process of plan formulation.

The present edition is primarily based on the detailed ground work done by the Regional Institutes in close interaction with the subsidiaries and their producing units. The CMPDI and CIL head quarters provided overall co-ordination and made complementary contributions. This procedure has brought about wider participation and greater involvement at all levels.

Chapter 2

Growth of Coal Demand

Introduction

2.0 Notwithstanding the presence of considerable difficulties in predicting the growth of coal demand — it being dependent on the expansion of activity levels of a large number of consumers in different sectors of the economy, demand forecast has perforce to be made as this constitutes the basic input for evolving production plans. In view of the considerable uncertainity with regard to the materialisation of demand forecasts, particularly of longer term demand, and in view of the fact that even a relatively small error in forecasting may imply relatively large impact on the extent and phasing of capacity expansion required, capacity utilisation, requirement and phasing of investments and particularly costs of production, Coal India has adopted the approach of forecasting two levels of demand : (a) Ceiling level, and (b) Floor level.

The Ceiling Level

2.1 Since Coal India has the responsibility of meeting as much as 88% of the total coal requirements of the nation, its plans have to be based on the overall demand estimates prepared by Governmental agencies, like the Department of Coal and the Planning Commission. In-as-much as such estimates are essentially influenced by the consideration of meeting the maximum likely requirement of the planned levels of activity of various sectors, and because the experience so far has been generally one of the actuals falling short of planned levels, these estimates form the basis of the ceiling-level demand forecast. The latest available estimates of annual coal demand are for the period 1978-79 to 1982-83 and for the year 1987-88, as contained in the interim report submitted in February, 1978 by the Working Group on Coal and Lignite appointed by Government of India in September, 1977. These estimates, however, provided for an annual import of 1.00 m t of coking coal upto 1982-83. In this document, the ceiling level of demand forecast although largely based on the Working Group estimates does not assume any import of coal.

The Floor Level

2.2 As regards the floor level demand forecast, based on the past growth trends and the known facts regarding the future performance, the output of different sectors have been projected and the demand for coal derived in respect of each of the following sectors : Steel, Power, Railways, Cement, Textiles, Fertilizer, Brick-kilns, miscellaneous industries, domestic households (soft-coke) and processed fuels and collieries internal consumption. The floor-level demand forecast provides information on the extent of rescheduling that may be required and the degree of flexibility that may have to be built into the production and financial plans.

2.3 Table 2.1 presents the 'ceiling' and 'floor' level demand forecasts in respect of various sectors in a summary form. The share of ceiling level of demand between Coal India and others is shown in Table 2.2. It is apparent from Table 2.1 that Coal India's share in total coal demand in India would marginally rise from 88.6% in 1978-79 to 89.6% in 1987-88. In absolute terms, the demand will go up from 100.2 m t to 189.7 m t during the same period.

TABLE 2.1

Forecast of Coal Demand on Coal India Limited

(In m t)

Sector	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	Ceiling	Floor	Ceiling	Floor	Ceiling	Floor	Ceiling	Floor	Ceiling	Floor	Ceiling	Floor
Steel	23.5	21.9	23.3	22.5	25.8	23.1	27.3	23.7	29.1	24.3	44.4	27.9
Power	29.0	28.6	32.9	31.7	36.9	35.2	41.5	39.1	47.2	43.4	78.2	69.8
Railways	11.6	11.6	11.3	11.3	11.0	11.0	10.7	10.7	10.3	10.3	8.8	8.8
Cement	3.5	3.5	3.8	3.7	4.3	4.0	4.6	4.2	5.0	4.5	7.1	6.1
Fertilizer	1.3	1.3	2.2	2.2	2.7	2.6	3.0	3.0	3.5	3.5	4.6	4.6
Export	1.0	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Brick-burning	6.3	6.3	6.5	6.4	6.7	6.5	7.0	6.6	7.5	6.7	8.3	7.2
Soft coke & L T C	4.5	4.5	5.0	5.0	5.6	5.6	6.4	6.4	7.2	7.0	9.7	9.1
Other industries	16.4	16.4	17.4	17.0	18.0	17.5	18.4	18.1	18.9	18.7	24.5	22.7
Colliery consumption	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Total	100.2	98.0	106.5	103.9	115.1	109.6	123.0	115.9	132.8	122.5	189.7	160.3
All India demand	113.1		120.7		131.1		140.9		153.0		213.0	
% share of Coal India in total demand	88.6		88.2		87.5		87.3		86.8		89.6	

TABLE 2.2

Estimated Demand for Coal for Different Time Horizons

(In m t)

Sector	1978-79			1979-80			1980-81			1981-82			1982-83			1987-88		
	CIL	Others	Total	CIL	Others	Total	CIL	Others	Total	CIL	Others	Total	CIL	Others	Total	CIL	Others	Total
1. Steel	23.5	2.7	26.2	23.3	3.0	26.3	25.8	3.5	29.3	27.3	4.3	31.6	29.1	5.2	34.3	44.4	5.3	49.7
2. Power	29.0	4.8	33.8 (2.5)	32.9	5.0	37.9	36.9	5.7	42.6	41.5	6.4	47.9	47.2	7.3	54.5	78.2	9.6	87.8
3. Railways	11.6	1.5	13.1	11.3	1.5	12.8	11.0	1.5	12.5	10.7	1.5	12.2	10.3	1.5	11.8	8.8	1.4	10.2
4. Cement	3.5	1.75	5.25	3.8	1.9	5.7	4.3	1.9	6.2	4.6	2.1	6.7	5.0	2.2	7.2	7.1	2.5	9.6
5. Fertiliser	1.3	0.2	1.5	2.2	0.5	2.7	2.7	1.0	3.7	3.0	1.2	4.2	3.5	1.2	4.7	4.6	1.4	6.0
6. Export	1.0	—	1.0	1.0	—	1.0	1.0	—	1.0	1.0	—	1.0	1.0	—	1.0	1.0	—	1.0
7. B R K	6.3	—	6.3	6.5	—	6.5	6.7	—	6.7	7.0	—	7.0	7.5	—	7.5	8.3	—	8.3
8. Soft coke & L T C	4.5	0.05	4.55	5.0	0.3	5.3	5.6	0.3	5.9	6.9	0.3	6.7	7.2	0.3	7.5	9.7	0.5	10.2
9. Others including Textile	16.4	1.6	18.0 (.5)	17.4	1.7	19.1 (.6)	18.0	1.8	19.8 (.6)	18.4	1.8	20.2 (.7)	18.9	2.1	21.3 (.8)	24.5	2.2	26.7 (.8)
10. Colliery consumption	3.1	0.3	3.4	3.1	0.3	3.4	3.1	0.3	3.4	3.1	0.3	3.4	3.1	0.4	3.5	3.1	0.4	3.5
Total	100.2	12.9	113.1	106.5	14.2	120.7	115.1	16.0	131.1	123.0	17.9	140.9	132.8	20.2	153.0	189.7	23.3	213.0

(Figures in brackets indicate washery middlings)

*Based on ceiling level of demand.

Gradewise Distribution

2.4.1 Based on the type of coal required by different consumers, the gradewise distribution of the forecast demand has been worked out in Table 2.3. There will be marginal change in the distribution between coking coal and non-coking coals. But within non-coking coals, the share of superior grades will decline over the period partly due to efforts at conservation.

2.4.2 Each of the subsidiary companies will be increasing their production levels substantially. However, over the ten year period, the relative shares of different subsidiaries in coal production will undergo some change. CCL alone will account for about 40% of the incremental demand. The relative shares of different subsidiaries and the North Eastern Coalfields in the demand on Coal India, based on the location and requirement of different consumers, likely availability of production of different grades from different fields and linkages have been worked out in Table 2.4.

2.4.3 Details of the ceiling level of demand with consumer sectorwise, qualitywise and companywise break-up are given in Tables 2.5 to 2.10

TABLE 2.3

Forecast of Gradewise Distribution of Demand on Coal India Limited*

(In m t)

Grade	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
Coking Coal						
(a) Prime	14.3	14.2	15.1	15.9	16.8	24.5
(b) Medium	8.6	8.3	9.9	10.5	11.4	18.2
(c) Semi-coking	1.1	1.3	1.3	1.4	1.4	2.2
Total coking	24.0	23.8	26.3	27.8	29.6	44.9
Non-coking Coal						
(a) Selected	7.1	7.2	7.2	7.3	7.5	8.0
(b) Grade I	34.4	35.7	36.6	37.0	37.7	45.6
(c) Grade II	9.7	10.9	11.7	12.8	13.6	17.1
(d) Grade III/J/K	21.4	24.9	28.7	32.9	37.6	57.9
(e) Ungraded	3.6	4.0	4.6	5.2	6.8	16.2
Total non-coking	76.2	82.7	88.8	95.2	103.2	144.8
Grand total	100.2	106.5	115.1	123.0	132.8	189.7

* Based on ceiling level of demand.

TABLE 2.4

*Forecast of Subsidiarywise Distribution of Coal Demand**

(In m t)

Subsidiary/Area	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
Eastern Coalfields Limited	27.9 (27.9)	29.8 (28.0)	31.4 (27.3)	33.1 (26.4)	35.0 (26.4)	45.2 (23.8)
Bharat Coking Coal Limited	23.6 (23.6)	23.7 (22.2)	25.1 (21.8)	26.1 (21.2)	27.8 (21.0)	38.5 (20.3)
Central Coalfields Limited	23.0 (23.0)	24.8 (23.3)	29.3 (25.4)	33.5 (27.2)	38.0 (28.6)	59.2 (31.2)
Western Coalfields Limited	25.0 (25.0)	27.5 (25.8)	28.5 (24.8)	29.5 (24.0)	31.1 (23.3)	45.9 (24.2)
North Eastern Coalfields	0.7 (0.7)	0.7 (0.7)	0.8 (0.7)	0.8 (0.7)	0.9 (0.7)	0.9 (0.5)
Coal India Limited	100.2 (100)	106.5 (100)	115.1 (100)	123.0 (100)	132.8 (100.0)	189.7 (100.0)

NOTE : Figures in brackets indicate percentage share of total Coal India demand.
* Based on ceiling level of demand.

TABLE 2.5

Estimated Gradewise, Sectorwise & Companywise Coal Demand — 1978-1979

(In m t)

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	13.9	—	—	13.9
	Medium	—	—	1.3	7.0	0.2	8.5
	Semi-coking	—	1.1	—	—	—	1.1
	Total	—	1.1	15.2	7.0	0.2	23.5
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	0.8	0.2	1.8	1.9	4.7
	III/J/K	—	1.3	2.8	1.0	6.7	11.8
	UGR	—	—	—	3.6	—	3.6
	Total	—	6.2	3.0 (1.2)	7.4 (1.3)	12.4	29.0 (2.5)
Railways	Sel.	0.2	0.5	—	0.2	0.6	1.5
	I	0.1	3.9	0.4	1.9	2.9	9.2
	II	—	0.3	0.3	0.2	0.1	0.9
	Total	0.3	4.7	0.7	2.3	3.6	11.6

1	2	3	4	5	6	7	8
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	—	0.8	—	0.5	1.6	2.9
	Total	0.1	0.9	—	0.7	1.8	3.5
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.1	—	0.2	0.2	0.5
	II	—	0.1	—	—	—	0.1
	III/J/K	—	—	0.4	0.2	—	0.6
	Total	—	0.2	0.4	0.5	0.2	1.3
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	II	—	2.5	—	—	—	2.5
	III/J/K	—	0.2	1.8	1.7	0.1	3.8
	Total	—	2.7	1.8	1.7	0.1	6.3
Soft coke	III/J/K	—	1.8	1.7	1.0	—	4.5
	Total	—	1.8	1.7	1.0	—	4.5
Others	Sel.	0.2	0.8	—	0.8	1.2	3.0
	I	0.1	6.7	—	0.7	4.8	12.3
	II	—	0.6	0.1	0.3	0.1	1.1
	Total	0.3	8.1	0.1	1.8 (0.2)	6.1	16.4 (0.2)
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	1.1	15.6	7.1	0.2	24.0
Non-coking		0.7	26.8	8.0	15.9	24.8	76.2
Total		0.7	27.9	23.6	23.0	25.0	100.2

(Figures in brackets show washery middlings)

TABLE 2.6

Estimated Gradewise, Sectorwise & Companywise Coal Demand—1979-80

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	13.8	—	—	13.8
	Medium	—	—	0.9	7.1	0.2	8.2
	Semi-coking	—	1.3	—	—	—	1.3
	Total	—	1.3	14.7	7.1	0.2	23.3
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	1.2	0.2	1.8	1.9	5.1
	III/J/K	—	1.8	2.9	1.6	8.6	14.9
	UGR	—	—	—	4.0	—	4.0
	Total	—	7.1	3.1	8.4	14.3	32.9
Railways	Sel.	0.2	0.5	—	0.2	0.6	1.5
	I	0.1	3.8	0.4	1.8	2.8	8.9
	II	—	0.3	0.3	0.2	0.1	0.9
	Total	0.3	4.6	0.7	2.2	3.5	11.3
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	—	0.8	—	0.6	1.8	3.2
	Total	0.1	0.9	—	0.8	2.0	3.8
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.2	—	0.5	0.3	1.0
	II	—	0.1	0.6	—	—	0.7
	III/J/K	—	—	—	0.4	—	0.4
	UGR	—	—	—	—	—	—
	Total	—	0.3	0.6	1.0	0.3	2.2
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	II	—	2.6	—	—	—	2.6
	III/J/K	—	0.2	1.8	1.8	0.1	3.9
	Total	—	2.8	1.8	1.8	0.1	6.5

1	2	3	4	5	6	7	8
Soft coke & LTC	I	—	—	—	—	—	—
	III/J/K	—	2.0	2.0	1.0	—	5.0
	Total	—	2.0	2.0	1.0	—	5.0
Others	Sel.	0.2	0.9	—	0.8	1.2	3.1
	I	0.1	7.0	—	0.8	5.2	13.1
	II	—	0.7	0.1	0.3	0.1	1.2
	Total	0.3	8.6	0.1	1.9	6.5	17.4
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	1.3	15.1	7.2	0.2	23.8
Non-coking		0.7	28.5	8.6	17.6	27.3	82.7
Total		0.7	29.8	23.7	24.8	27.5	106.5

(Figures in brackets show washery middlings)

TABLE 2.7

Estimated Gradewise, Sectorwise & Companywise Coal Demand — 1980-81

(In m t)

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	14.7	—	—	14.7
	Medium	—	—	1.0	8.2	0.6	9.8
	Semi coking	—	1.3	—	—	—	1.3
	Total	—	1.3	15.7	8.2	0.6	25.8
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	1.7	0.2	1.8	2.0	5.7
	III/J/K	—	2.3	3.0	3.6	8.8	17.7
	UGR	—	—	—	4.6	—	4.6
	Total	—	8.1	3.2	11.0	14.6	36.9

1	2	3	4	5	6	7	8
Railways	Sel.	0.2	0.5	—	0.2	0.6	1.5
	I	0.1	3.8	0.3	1.8	2.6	8.6
	II	—	0.3	0.3	0.2	0.1	0.9
	Total	0.3	4.6	0.6	2.2	3.3	11.0
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	—	0.9	—	0.8	2.0	3.7
	Total	0.1	1.0	—	1.0	2.2	4.3
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.2	—	0.6	0.4	1.2
	II	—	0.1	0.6	0.1	—	0.8
	III/J/K	—	—	—	0.6	—	0.6
	UGR	—	—	—	—	—	—
	Total	—	0.3	0.6	1.4	0.4	2.7
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	II	—	2.6	—	—	—	2.6
	III/J/K	—	0.2	2.0	1.8	0.1	4.1
	Total	—	2.8	2.0	1.8	0.1	6.7
Soft Coke & LTC	III/J/K	—	2.2	2.2	1.2	—	5.6
	Total	—	2.2	2.2	1.2	—	5.6
Others	Sel.	0.2	0.9	—	0.8	1.2	3.1
	I	0.2	7.2	—	0.8	5.4	13.6
	II	—	0.8	0.1	0.3	0.1	1.3
	Total	0.4	8.9	0.1	1.9	6.7	18.0
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	1.3	16.1	0.3	0.6	26.3
Non-coking		0.8	30.1	9.0	21.0	27.0	88.8
Total		0.8	31.4	25.1	29.3	28.5	115.1

(Figures in brackets show washery middlings)

TABLE 2.8

Estimated Gradewise, Sectorwise & Companywise Coal Demand — 1981-82

(In m t)

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	15.5	—	—	15.5
	Medium	—	—	1.0	8.7	0.7	10.4
	Semi-coking	—	1.4	—	—	—	1.4
	Total	—	1.4	16.5	8.7	0.7	27.3
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	2.5	0.2	1.8	2.2	6.7
	III/J/K	—	2.5	3.1	6.0	9.1	20.7
	UGR	—	—	—	5.2	—	5.2
	Total	—	9.1	3.3	14.0	15.1	41.5
Railways	Sel.	0.2	0.5	—	0.2	0.6	1.5
	I	0.1	3.7	0.3	1.7	2.5	8.3
	II	—	0.3	0.3	0.2	0.1	0.9
	Total	0.3	4.5	0.6	2.1	3.2	10.7
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	—	0.9	—	0.9	2.2	4.0
	Total	0.1	1.0	—	1.1	2.4	4.6
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.2	—	0.6	0.4	1.2
	II	—	0.2	0.5	0.2	—	0.9
	III/J/K	—	—	—	0.8	—	0.8
	Total	—	0.4	0.5	1.7	0.4	3.0
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	II	—	2.7	—	—	—	2.7
	III/J/K	—	0.2	2.0	2.0	0.1	4.3
	Total	—	2.9	2.0	2.0	0.1	7.0

1	2	3	4	5	6	7	8
Soft Coke & LTC	III/J/K	—	2.6	2.5	1.3	—	6.4
	Total	—	2.6	2.5	1.3	—	6.4
Others	Sel.	0.2	0.9	—	0.8	1.3	3.2
	I	0.2	7.3	—	0.9	5.6	14.0
	II	—	0.8	—	0.3	0.1	1.2
	Total	0.4	9.0	—	2.0	7.0	18.4
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	1.4	16.9	8.8	0.7	27.8
Non-coking		0.8	31.7	9.2	24.7	28.8	95.2
Total		0.8	33.1	26.1	33.5	29.5	123.0

(Figures in brackets show washery middlings)

TABLE 2.9

Estimated Gradewise, Sectorwise & Companywise Coal Demand —1982-83

(In m t)

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	16.4	—	—	16.4
	Medium	—	—	1.0	9.4	0.9	11.3
	Semi-coking	—	1.4	—	—	—	1.4
	Total	—	1.4	17.4	9.4	0.9	29.1
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	3.1	0.2	1.8	2.4	7.5
	III/J/K	—	3.2	3.6	7.6	9.6	24.0
	UGR	—	—	—	6.8	—	6.8
	Total	—	10.4	3.8 (2.1)	17.2 (1.7)	15.8 (0.3)	47.2 (4.1)

1	2	3	4	5	6	7	8
Railways	Sel.	0.2	0.5	—	0.2	0.5	1.4
	I	0.1	3.6	0.2	1.7	2.5	8.1
	II	—	0.3	0.3	0.1	0.1	0.8
	Total	0.3	4.4	0.5	2.0	3.1	10.3
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	—	0.9	—	1.0	2.5	4.4
	Total	0.1	1.0	—	1.2	2.7	5.0
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.2	—	0.8	0.6	1.6
	II	—	0.2	0.4	0.2	—	0.8
	III/J/K	—	—	—	1.0	—	1.0
	UGR	—	—	—	—	—	—
	Total	—	0.4	0.4	2.1	0.6	3.5
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	II	—	2.8	—	—	—	2.8
	III/J/K	—	0.3	2.2	2.1	0.1	4.7
	Total	—	3.1	2.2	2.1	0.1	7.5
Soft coke & LTC	III/J/K	—	2.9	2.8	1.4	0.1	7.2
	Total	—	2.9	2.8	1.4	0.1	7.2
Others	Sel	0.2	1.0	—	0.9	1.4	3.5
	I	0.3	7.3	—	0.8	5.7	14.1
	II	—	0.9	—	0.3	0.1	1.3
	Total	0.5	9.2	—	2.0 (0.2)	7.2	18.9 (0.2)
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	11.4	17.8	9.5	0.9	29.6
Non-coking		0.9	33.6	10.0	28.5	30.2	103.2
Total		0.9	35.0	27.8	38.0	31.1	132.8

Figures in brackets show washery middlings)

TABLE 2.10

Estimated Gradewise, Sectorwise and Companywise Coal Demand — 1987-88

(In m t)

Sector	Grade	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
Steel	Prime	—	—	24.1	—	—	24.1
	Medium	—	—	1.3	15.9	0.9	18.1
	Semi-coking	—	1.7	—	—	0.5	2.2
	Total	—	1.7	25.4	15.9	1.4	44.4
Power	Sel.	—	0.8	—	0.1	0.6	1.5
	I	—	3.3	—	0.9	3.2	7.4
	II	—	4.5	0.2	1.8	4.0	10.5
	III/J/K	—	6.9	-6.2	11.1	18.7	42.9
	UGR	—	—	—	15.9	—	15.9
	Total	—	15.5	6.4 (2.4)	29.8 (2.3)	26.5 (0.3)	78.2 (5.0)
Railways	Sel.	0.2	0.5	—	0.2	0.5	1.4
	I	—	3.0	0.1	1.4	2.2	6.7
	II	—	0.3	0.3	0.1	—	0.7
	Total	0.2	3.8	0.4	1.7	2.7	8.8
Cement	Sel.	0.1	0.1	—	0.2	0.2	0.6
	I	0.1	1.0	—	1.8	3.6	6.5
	Total	0.2	1.1	—	2.0	3.8	7.1
Fertilizer	Sel.	—	—	—	0.1	—	0.1
	I	—	0.2	—	0.8	1.4	2.4
	II	—	0.2	0.3	0.3	—	0.8
	III/J/K	—	—	—	1.0	—	1.0
	UGR	—	—	—	0.3	—	0.3
	Total	—	0.4	0.3	2.5	1.4	4.6
Export	Sel.	—	0.1	—	—	—	0.1
	I	—	0.9	—	—	—	0.9
	Total	—	1.0	—	—	—	1.0
Brick burning	I	0.1	—	—	—	—	0.1
	II	—	3.3	—	—	—	3.3
	III/J/K	—	0.2	2.3	2.3	0.1	4.9
	Total	0.1	3.5	2.3	2.3	0.1	8.3

1	2	3	4	5	6	7	8
Soft coke & LTC	I	—	1.3	—	—	—	1.3
	III/JK	—	3.4	3.0	1.8	0.2	8.4
	Total	—	4.7	3.0	1.8	0.2	9.7
Others	Sel.	0.2	1.2	—	1.0	1.6	4.0
	I	0.2	10.1	—	1.3	7.5	19.1
	II	—	1.0	—	0.3	0.1	1.4
	Total	0.4	12.3	—	2.6 (0.2)	9.2	24.5
Colliery consumption	Prime	—	—	0.4	—	—	0.4
	Medium	—	—	—	0.1	—	0.1
	Sel.	—	0.1	—	0.1	0.1	0.3
	I	—	0.8	—	0.1	0.3	1.2
	II	—	0.2	—	0.1	0.1	0.4
	III/J/K	—	0.1	0.3	0.2	0.1	0.7
	Total	—	1.2	0.7	0.6	0.6	3.1
Coking		—	1.7	25.8	16.0	1.4	44.9
Non-coking		0.9	43.5	12.7	43.2	44.5	144.8
Total		0.9	45.2	38.5	59.2	45.9	189.7

(Figures within bracket show washery middlings)

Chapter 3

Prospecting and Exploration

Introduction

3.0 The exploration programme has been drawn up keeping in view the anticipated demand levels in the terminal years 1982-83 and 1987-88 and tentative projection of the demand for the terminal year 1992-93. Further, while drawing up the exploration programme the gestation period involved for the development of a project has also been considered. However, it may be mentioned that the exploration programme in the past had to be tailored according to the fluctuation in demand and as such the desired lead time for the development of a project could not be obtained. It would be possible to improve the lead time if the exploration programme is not linked rigidly with the demand. The present exploration programme, is designed to meet both the short term and long term requirements of the Industry. There is a provision in the exploration programme for the creation of 'Shelf of reports' not only to facilitate a choice of the blocks but also to meet sudden spurts in the demand if any.

3.1 Keeping the above in view, the exploration programme drawn up in February, 1978 for the Working Group on coal and lignite has not been changed not withstanding some revisions in the demand pattern. This approach has purposely been adopted so that the exploration needs are not strictly linked with demand. This programme would only need marginal adjustments from time to time to suit the planning requirements.

Methodology

3.2.1 The methodology adopted for evolving the exploration programme is as follows :

(a) The qualitywise and companywise additional requirement of coal to meet the demand in the various terminal years has been identified on the basis of the production levels likely to be obtained from the 1977-78 projects vis-a-vis the demand.

(b) Based on the additional qualitywise requirements appropriate blocks have been selected. Further, in selecting the blocks preference has been given to the quarriable areas over the underground projects particularly for the lower grade coals which are required in large quantities for the power sector. Areas where exploration has already been carried out have been given preference over virgin areas.

(c) The quantum of drilling for each of the blocks has been assessed based on available geological knowledge about the deposit resulting from regional drilling/mapping carried out by the G S I or State Governments. The reserves thus envisageed to be proved would not only meet the demand in the various terminal years but also prove adequate resources to meet the marginal extra production, wherever planned. In this context, it may be mentioned that there is no correlation between the meterage drilled and the reserves proved, because the reserves in any area are directly linked with the vertical density of seams. Similarly, direct correlation cannot be established between the reserves required to be proved in an area matching with the grade and those not required because in the process of proving the desired type of coal reserves the associated reserves of different types and grades get automatically proved (on account of their vertical heterogenity).

(d) Provision has been made to provide production support drilling to the continuing schemes either for sustaining the existing production or to achieve increased production. It may be mentioned that efforts have been made to identify the blocks areas which would require production support drilling but where this was not possible, an adhoc provision has been made to take care of the situation in the future.

(e) Provision has been made to create a shelf of reports. For this, blocks/areas have been selected based on the qualitywise not additional requirement for each coal company in the various terminal years. Shelf has been provided to the tune of nearly 50% of the net additional requirements. The shelf created for one terminal year (1982-83) has been drawn upon in the next terminal year (1987-88) for attaining the desired production level and a fresh shelf has been provided for 1987-88 terminal year. Similar approach has been adopted for the terminal year 1992-93. It may be mentioned that in respect of ECL in particular, as against shelf of reports, additional areas have been identified for exploration in 1982-83 and 1987-88 to yield production in 1987-88 and 1992-39 respectively for which advance action has to be taken in the previous terminal year.

(f) It is proposed to introduce geophysical techniques on a large scale involving both well logging and surface geophysical surveys. Towards this, non coring drilling coupled with well logging will be introduced to accelerate the progress of exploration and effect economy in the operation. Surface geophysical techniques viz. resistivity, seismic refraction and reflection techniques and high resolution seismic reflection surveys, will be introduced to unravel the geological structure, basin geometry, estimation of overburden thickness and its characteristics. With the successful implementation of the above mentioned R&D efforts, it is expected that a total saving of about a crore of rupees will be effected.

3.2.2 Keeping the above in view, the total quantum of drilling required to meet the demand in the various terminal years for production support as well as for the creation of shelf of reports has been worked out.

Exploration Programme

3.3.1 The exploration programme has been drawn up for meeting the net additional production requirement of about 23 mts in 1982-83, 24 mts by 1987-88 and about 40 m ts by 1992-93. For proving the necessary resources for meeting the net additional requirements in the various terminal years a total of about 1.48 million metre of drilling is required. Marginal adjustments in the annual drilling programmes may be necessitated on the basis of any changes in the production programmes.

The entire exploration programme has been divided into two phases viz. Phase I covering the terminal years 1982-83 and 1987-88 and Phase II covering the terminal year 1992-93. The summarised position of the quantum of drilling required for (a) meeting the demand, (b) production support and (c) for the creation of shelf of reports, companywise and terminal yearwise, is given in Table 3.1.

TABLE 3.1

(In 000 metres)

Items	Coal Company					
	NEC	ECL	BCCL	CCL	WCL	Total
1	2	3	4	5	6	7
Phase I (Jan' 78 to Oct' 82)						
1. Meterage to be drilled for meeting the demand in 1982-83.	—	46	52	—	29	127
2. Meterage to be drilled for production support	11	16	17	66	36	146

1	2	3	4	5	6	7
3. Meterage to be drilled for creation of shelf of reports/as advance action	—	41	40	45	23	149
Sub Total	11	103	109	111	88	422
4. Meterage to be drilled for meeting the demand in 1987-88	3	25	38	—	103	169
5. Meterage to be drilled for production support	5	25	29	33	30	122
6. Meterage to be drilled for shelf of reports/ as advance action	8	31	30	72	70	211
Sub Total	16	81	97	105	203	502
Total for Phase I	27	184	206	216	291	924
Phase II (Nov. '82 to Sept. '85)						
7. Meterage to be drilled for meeting the demand in 1992-93	—	35	10	133	95	273
8. Meterage to be drilled for production support	5	25	20	20	12	82
9. Meterage to be drilled for creation of shelf of reports	—	76	39	52	35	202
Total for Phase II	5	136	69	205	142	557
Grand Total	32	320	275	421	433	1481

3.3.2 The entire exploration programme (Phase I and Phase II) as outlined above will be executed during the period from January '78 to January '86 (i. e. 8 years) including documentation. The drilling for Phase-I would be completed by October '82 and the documentation would be available by February '83. It may, however, be mentioned that nearly 50% of exploration work (including documentation) for meeting the demand by 1982-83 has already been completed and the balance work is scheduled to be completed by March '79. The drilling for Phase II would be taken up in November, 1982 and completed by September '85 and the geological reports would be available by January '86.

3.3.3 From what has been indicated above, it will be seen that while the exploration work including the submission of geological reports will be completed about 4 years ahead in respect of the 1982-83 and 1987-88 projects the same will be completed about 7 years ahead of production schedule in respect of projects for 1992-93.

Resources

Drilling

3.4.1 Currently 50 drills of CMPDI, 78 drills of MEC, 16 drills of State Governments of M P , Orissa and 14 drills of private contractors (158 drills) are deployed. The MEC has been requested to increase their strength by another 10 drills in the Eastern Coalfields Limited.

However, it is proposed to deploy on an average about 158 drills over the entire period of exploration for the programme out-lined earlier and drill on an average @ 1,90,000 metres per annum. The allocation of the drills to individual areas would entirely depend upon the quantum of work involved and their priority.

Financial Investment

3.5 The total financial involvement for executing the exploration programme as outlined earlier would be about Rs 51.5 crores, of which Rs 32 crores will be required during the VIth plan period and the balance for the period beyond.

Chapter 4

Production Planning

Strategy

4.0 The production strategy is to maximise production from the existing mines and the mines sanctioned so far. This has been done to minimise additional capital requirement and increase capacity utilisation. The remaining gap between demand and availability as indicated in Table 4.1 has been sought to be met next from incremental output from reconstruction of some of the existing mines, as the capital investment on a reconstruction mine is generally less than that of a new mine. In chosing the existing mines for reconstruction, the gestation period as well as resultant production requirement for the period beyond 1982-83 has also been kept in view.

TABLE 4.1

(In m t)

Classification	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
Total Demand (Coal India)	100.20	106.50	115.10	123.00	132.80	189.70
1. Availability from existing and sanctioned mines (Coal India)	94.78	98.08	102.46	103.84	105.45	100.35
GAP (—)	5.42	8.42	12.64	19.16	27.35	89.35
Proposed reconstruction Projects Opencast (a)	3.12	3.37	4.39	6.00	6.75	10.31
Proposed reconstruction Projects Underground (b)	0.94	2.36	4.04	6.91	9.69	24.86
2. Total availability from proposed Reconstruction Mines (a+b)	4.06	5.73	8.43	12.91	16.44	35.17
Proposed New Mines Opencast (c)	1.35	1.86	2.99	6.15	13.99	53.62
Proposed New Mines Underground (d)	—	0.06	0.51	1.06	1.80	11.63
3. Total availability from proposed New Mines (c+d)	1.35	1.92	3.50	7.21	15.79	65.25
Total production availability (Coal India)	100.19	105.73	114.39	123.96	137.68	200.77

* The production availability shown is only incremental output. Existing component of the mines under these category are included in item No. 1 above.

Task Ahead vis-a-vis Past Performance

4.1 Table 4.2 depicts the performance during the 5th plan. Although, production increased by about 10 million tonnes during '74-75 and '75-76, it had to be regulated thereafter to match the actual demand, resulting in retarded growth of constructional activities as well.

While the industry is currently beset with problems of power and explosives shortage making the task of increasing production by over 12 million tonnes during current year ('78-79) more difficult, the success of achieving the steep rise in production in the following years will be largely dependent on the tempo of construction and other development activities which will need much more attention than hitherto. The production potentialities of existing mines cannot be stretched beyond elastic limits and such possibilities will rapidly decrease in future necessitating greater and greater reliance on creating fresh production capacities opening newer units.

TABLE 4.2

Production of Coal by Coal India Limited

(In m t)

Company	Production in Year			
	1974-75	1975-76	1976-77	1977-78
NEC	0.53	0.56	0.57	0.62
ECL	23.16	26.18	26.47	25.26
BCCL	17.74	20.09	20.68	20.21
CCL	18.31	20.69	20.72	21.20
WCL	19.26	21.46	21.04	21.67
CIL	79.00	88.98	89.48	88.96

Planning Preparedness

4.2 From Table 4.3, and Diagram 4.1 showing production strategy as well as planning preparedness, it may be seen that for meeting the coal need, upto '82-83, about 12 million tonnes of production (out of total incremental production of 48 million-tonnes) has to come from projects yet to be formulated. Project reports for this are expected to be completed well in time.

TABLE 4.3

Coal India Limited — Production Programme

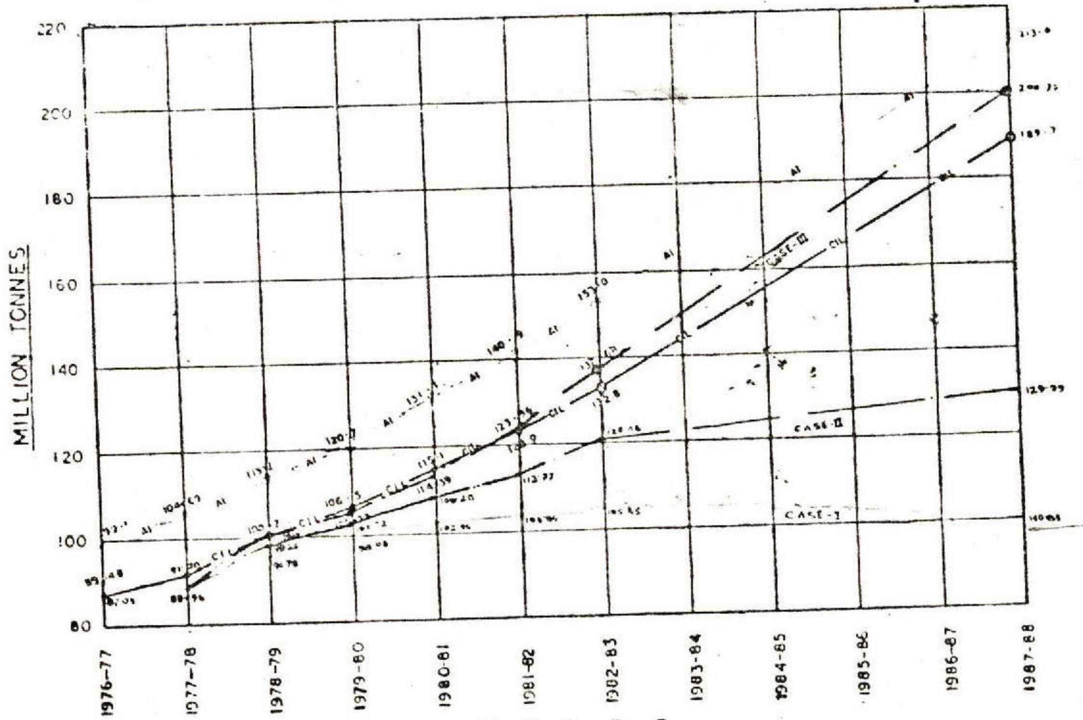
(In m t)

Sl. No.	Classification	Actual Production				Production Programme			
		1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7	8	9	10
I	Existing mines not identified for major reconstruction			45.50	45.07	44.51	42.20	41.01	35.20
	Total I	45.78	44.69	45.50	45.07	44.51	44.20	41.01	35.20
II	Sanctioned Projects								
	(a) Continuing schemes	10.64	10.71	12.99	14.47	16.40	18.12	18.77	19.73
	(b) Reconstruction projects	10.09	9.38	10.88	11.49	12.37	13.24	15.03	16.55
	(c) New projects	1.72	2.67	4.99	6.97	9.90	12.50	13.97	15.38
	Total II	22.43	22.76	28.86	32.93	38.67	43.86	47.77	51.66

1	2	3	4	5	6	7	8	9	10
III	Mines for which project reports have been formulated					(a) Reconstruction projects			
		5.24	5.47	7.35	8.19	9.04	10.28	11.36	16.57
						(b) New projects			
		—	—	0.35	0.80	1.12	2.86	7.83	17.06
	Total III	5.24	5.47	7.70	8.99	10.16	13.14	19.19	33.63
IV	Mines for which project reports are yet to be formulated					(a) Reconstruction projects			
		16.00	16.04	17.13	17.62	18.87	20.41	21.75	32.09
						(b) New projects			
		—	—	1.00	1.12	2.38	4.35	7.96	48.19
	Total IV	16.00	16.04	18.13	18.74	21.05	24.76	29.71	80.28
	Grand total	89.47	88.96	100.19	105.73	114.39	123.96	137.68	200.77

DIAGRAM 4.1

Production Strategy & Planning Preparedness of Coal India Limited



AI : All India coal demand. CIL : Coal India coal demand. CASE I : Production of CIL from existing & sanctioned project. CASE II : Production of CIL from Case I + reports already formulated. CASE III : Production of CIL from Case II + reports yet to be formulated.

Analysis of Production Programme

4.3 From Table 4.4 showing gradewise production analysis vis-a-vis demand, it can be seen that the total coal production as also coking coal production is planned to increase one and a half times

TABLE 4.4

Demand & Production Programme — Coal India Limited

(In m t)

Quality	1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	De.	Prodn.	De.	Prodn.	De.	Prodn.	De.	Prodn.	De.	Prodn.	De.	Prodn.	De.	Prodn.	De.	Prodn.
Coking																
Prime-coking	12.3	11.91	13.0	11.43	14.3	13.97	14.2	13.96	15.1	14.51	15.9	15.53	16.8	15.99	24.5	24.81
Medium coking	7.2	7.85	7.6	7.76	8.6	9.47	8.3	9.77	9.9	10.84	10.5	11.61	11.4	12.87	18.2	19.19
Semi-coking/ Blendable	0.9	1.28	1.0	1.48	1.1	1.26	1.3	1.31	1.3	1.42	1.4	1.56	1.4	1.70	2.2	2.50
Total coking	20.4	21.04	21.6	20.67	24.0	24.70	23.8	25.04	26.3	26.77	27.8	28.70	29.6	30.56	44.9	46.50
Non-coking																
Superior	38.4	40.70	40.9	39.10	41.5	40.70	42.9	42.27	43.8	43.47	44.3	44.99	45.2	46.81	53.6	54.95
Lower	29.2	27.74	31.1	29.19	34.7	34.79	39.8	38.42	45.0	44.15	50.9	50.27	58.0	60.31	91.2	99.32
Total non-coking	67.6	68.44	72.0	68.29	76.2	75.49	82.7	80.69	88.8	87.62	95.2	95.26	103.2	107.12	144.8	154.27
Grand total	88.0	89.48	93.6	88.96	100.2	100.19	106.5	105.73	115.1	114.39	123.0	123.96	132.8	137.68	189.7	200.77

20.7
3.5
24.2

by '82-83 and to double by '87-88. By far the highest increase is contemplated in the lower grade non-coking coal (doubling by '82-83 and tripling by '87-88), which is in keeping with the stress towards conservation of better quality coal and rapidly increasing demand from power sector. The companywise details of gradewise production for the next 5 years and for '87-88 are given in Table 4.5.

TABLE 4.5

Companywise & Qualitywise Production Programme of Coal India Limited

(In m t)

Year	Quality	NEC	ECL	BCCL	CCL	WCL	CIL
1	2	3	4	5	6	7	8
1976-77 (actual)	Prime coking	—	—	11.91	—	—	11.91
	Medium coking	—	—	1.16	6.34	0.35	7.85
	Semi-coking	—	0.92	—	—	0.36	1.28
	Superior	0.57	19.18	0.23	6.58	14.14	40.70
	Lower	—	6.37	7.38	7.80	6.19	27.74
	Total	0.57	26.47	20.68	20.72	21.04	89.48
1977-78 (actual)	Prime coking	—	—	11.43	—	—	11.43
	Medium coking	—	—	1.28	6.18	0.30	7.76
	Semi-coking	—	1.06	—	—	0.42	1.48
	Superior	0.62	17.58	0.25	6.50	14.15	39.10
	Lower	—	6.62	7.26	8.51	6.80	29.19
	Total	0.62	25.26	20.22	21.19	21.67	88.96
1978-79	Prime coking	—	—	13.97	—	—	13.97
	Medium coking	—	—	1.53	7.15	0.79	9.47
	Semi coking	—	1.26	—	—	—	1.26
	Superior	0.68	18.58	0.13	6.87	14.44	40.70
	Lower	—	8.47	7.37	9.68	9.27	34.79
	Total	0.68	28.31	23.00	23.70	24.50	100.19
1979-80	Prime coking	—	—	13.96	—	—	13.96
	Medium coking	—	—	1.73	7.25	0.79	9.77
	Semi-coking	—	1.31	—	—	—	1.31
	Superior	0.80	19.41	0.13	6.96	14.97	42.27
	Lower	—	9.43	8.29	10.37	10.33	38.42
	Total	0.80	30.15	24.11	24.58	26.09	105.73

1	2	3	4	5	6	7	8
1980-81	Prime coking	—	—	14.51	—	—	14.51
	Medium coking	—	—	1.74	8.27	0.83	10.84
	Semi coking		1.42				1.42
	Superior	0.85	19.76	0.15	7.22	15.49	43.47
	Lower	—	10.89	9.02	12.57	11.67	44.15
	Total	0.85	32.07	25.42	28.06	27.99	114.39
1981-82	Prime coking	—	—	15. 3	—	—	15.53
	Medium coking	—	—	1.85	8.83	0.93	11.61
	Semi-coking	—	1.56	—	—	—	1.56
	Superior	0.97	20.09	0.15	7.67	16.11	44.99
	Lower	—	12.09	8.99	15.96	13.23	50.27
	Total	0.97	33.74	26.52	32.46	30.27	123.96
1982-83	Prime coking	—	—	15.99	—	—	15.99
	Medium coking	—	—	1.92	9.96	0.99	12.87
	Semi-coking	—	1.70	—	—	—	1.70
	Superior	1.18	20.86	0.09	7.85	16.83	46.81
	Lower	—	14.26	9.86	20.26	15.93	60.31
	Total	1.18	36.82	27.86	38.07	33.75	137.68
1987-88	Prime coking	—	—	24.31	—	—	24.81
	Medium coking	—	—	2.09	16.00	1.10	19.19
	Semi-coking	—	2.10	—	—	0.40	2.50
	Superior	1.57	24.11	0.09	8.69	20.49	54.95
	Lower	—	18.99	13.12	39.56	27.65	99.32
	Total	1.57	45.20	40.11	64.25	49.64	200.77

The steep-mark up in the production from opencast mines, as is evident from Table 4.6 will also help the cause of conservation, safety and economy, besides enabling Coal India to build-up rapidly production capacity. Out put from opencast mines will be more than doubled by '82-83 and more than tripled by '87-88. From the companywise break-up of U/G vis-a-vis O/C production, in this table , it can be seen that CCL will continue to contribute by far the largest share of the opencast production.

TABLE 4.6

Companywise Production Programme (O.C. & U.G.)

(In m t)

Sl No	Company	UG/OC	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1.	NEC	UG	0.57	0.62	0.66	0.77	0.66	0.70	0.85	1.19
		OC	—	—	0.02	0.03	0.19	0.27	0.33	0.38
		Total	0.57	0.62	0.68	0.80	0.85	0.97	1.18	1.57
2.	ECL	UG	22.82	21.78	25.66	26.96	28.12	29.41	31.09	39.06
		OC	3.65	3.48	2.65	3.19	3.95	3.95	5.73	6.14
		Total	26.47	25.26	28.31	30.15	32.07	33.74	36.82	45.20
3.	BCCL	UG	19.28	18.14	19.72	20.76	21.50	22. 20	22.56	26.03
		OC	1.40	2.08	3.28	3.35	3.92	4.32	5.30	14.08
		Total	20.68	20.22	23.00	24.11	25.42	26.52	27.86	40.11
4.	CCL	UG	6.86	7.22	7.78	0.32	9.10	10.10	10.46	15.08
		OC	13.86	13.97	15.92	16.26	18.96	22.36	27.61	49.17
		Total	20.72	21.19	23.70	24.58	28.06	32.46	38.07	64.25
5.	WCL	UG	17.41	17.57	20.02	21.14	21.08	22.62	23.60	29.27
		OC	3.63	4.10	4.48	4.95	5.91	7.65	10.15	20.37
		Total	21.04	21.67	24.50	26.09	27.99	30.27	33.75	49.64
	CIL	UG	66.94	65.33	73.84	77.95	81.46	85.03	88.56	110.63
		OC	22.52	23.63	26.35	27.78	32.93	38.93	49.12	90.14
		Total	89.48	88.96	100.19	105.73	114.39	123.96	137.68	200.77

4.8. The statewise break-up of production programme is indicated in Table 4.7. Dispersal of demand centres and logistics of coal transportation have been kept in mind while working out the production programme for different coalfields, details of which are shown in Table 4.8.

TABLE 4.7

Statewise Production Programme

(In m t)

State	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
Assam	0.57	0.62	0.68	0.80	0.85	0.97	1.18	1.57
Bihar	39.42	39.25	44.19	45.62	48.81	52.04	56.07	78.27
West Bengal	23.81	22.78	25.22	27.27	28.99	30.53	32.66	39.93
Orissa	2.30	2.16	2.75	2.82	3.56	4.10	4.57	5.33
Madhya Pradesh	19.53	20.57	22.80	24.15	26.26	28.46	33.79	62.96
Uttar Pradesh	—	—	0.25	0.50	1.00	2.00	2.50	3.00
Maharastra	3.85	3.58	4.30	4.57	4.92	5.86	6.91	9.71
Total	89.48	88.96	100.19	105.73	114.39	123.96	137.68	200.77

TABLE 4.8

Coalfieldwise Production Programme

(In m t)

Sl. No.	Coalfield	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1.	Makum	0.57	0.62	0.68	0.80	0.85	0.97	1.18	1.57
2.	Rajmahal	0.19	0.20	0.32	0.38	0.38	0.38	0.63	2.25
3.	Raniganj	23.81	22.78	23.80	25.80	27.06	28.37	30.15	37.79
4.	Mugma	2.89	2.73	3.22	3.07	3.33	3.49	4.18	3.78
5.	Jharia	20.26	19.76	22.55	23.54	24.79	25.86	27.21	39.35
6.	Giridih	0.29	0.20	0.34	0.33	0.33	0.34	0.36	0.37
7.	East Bokaro	5.88	6.04	6.56	6.84	7.28	7.80	7.99	8.25
8.	West Bokaro	2.06	2.44	2.54	2.85	3.04	3.48	3.60	8.14
9.	Ramgarh	0.16	0.22	0.26	0.18	0.90	1.02	2.02	3.00
10.	South Karanpura	5.58	5.57	5.78	5.80	5.74	5.97	6.09	6.75
11.	North Karanpura	1.97	1.93	2.50	2.50	2.88	3.55	3.85	5.36
12.	Daltonganj	0.08	0.10	0.06	0.06	0.06	0.05	0.04	—
13.	Hutar	0.06	0.06	0.06	0.07	0.08	0.10	0.10	0.12
14.	Singrauli	3.34	3.37	3.90	4.30	5.50	7.50	11.00	28.30
15.	Talcher	1.30	1.26	1.70	1.65	2.25	2.65	3.02	3.96
16.	Ib River CIC**	1.00	0.90	1.05	1.17	1.31	1.45	1.55	2.27
17.	Chirimiri	8.97	10.65	11.10	11.94	12.66	13.57	14.33	18.18
18.	Korba	2.88	2.22	3.44	3.63	4.20	4.81	6.17	14.57
19.	Pench Kanhan	3.54	3.30	3.41	3.39	3.39	2.91	2.92	2.54
20.	Kamptee	1.31	1.05	1.29	1.41	1.53	1.82	1.97	2.74
21.	Tawa River	0.80	1.03	1.20	1.39	1.51	1.67	1.87	2.37
22.	Umrer	1.00	0.86	1.01	1.02	1.05	1.05	1.05	0.95
23.	Wardha Valley	1.54	1.67	2.00	2.14	2.34	2.99	3.89	6.02
24.	Salanpur	*	*	1.42	1.47	1.93	2.16	2.51	2.14
	Total	89.48	88.96	100.19	105.39	114.39	123.96	137.63	200.77

* Production included in Raniganj coalfield.
** (Sohagpur, Korea-rewa etc.)

Projectwise details are incorporated in the perspective plan of each of subsidiary companies. Currently there is a suggestion for providing and additional cushion over and above the production programme which has been worked out in detail on the basis of the companywise demand, projections of the various size/types and grades of coal, the stocking need at the pit heads and at the consumers' ends and other related factors. It is proposed to provide for the additional cushion of about 5 m t in the year 1982-83 and about 15 m t in the year 1987-88. But since this will involve heavy extra capital investment it is proposed to provide limited resource allocation only to enable in relation to the proposed cushion—for identification of perspective blocks, prospecting and drilling, preparation of geological reports, preparation of feasibility reports/ project reports and limited advance action in the form of land acquisition survey, skelton office and functional accommodation and a nucleous of residential accommodation only. For long gestation project, resources have to be provided additionally, for long lead items like shaft sinking, drivage of long drifts etc.

Chapter 5

Mining Technology

Introduction

5.0 This chapter has been drawn keeping in view the present extent of modernisation and progress in the last two years in this field. The valuable feed back received has been fully kept in view in deciding the future pace of modernisation, and the trend of technology thus forecast is quite pragmatic.

Coal India's Production Programme of Opencast and Underground Mines and Future Mining Perspective

5.1 Coal India's production is to be increased from the present level of 89 m t to 201 m t by the year 1987-88, i.e. an increase of 125%. During the same period the production from underground and opencast mines will go up by 69% and 281% respectively. The percentage increase for different time horizons can be calculated from the figures given in Table 4.5 of Chapter 4.

A considerable technological transformation is foreseen in next decade for purposes of economy, conservation, increased safety and to reduce human drudgery by adopting suitable technology. With almost 90% production now coming from Coal India, it is envisaged to have a co-ordinated thrust towards introduction of new technology.

Number and Size of Mines and Concentration of Production

5.2 For concentration of production and reduction of cost from new and reorganised mines, it is essential that relatively larger-output mines are planned. This is also in confirmity with the trend in other countries where production has gone upto as much as 4 to 5 mty (15,000–20,000 tonnes per day per mine). Presently about 90% of CIL mines produce below 0.5 mty per mine and only 2% produce above 1 mty. By the year 1987-88 68% will be producing below 0.5 mty and 10% will be producing above 1 mty.

The number of mines and average production per mine per year are shown in Table 5.1. The experience gained in planning and executing 1.5 to 2.0 mty mines may materially change the situation in the 90's.

5.3 It is seen that number of mines will increase marginally from 338 in 1978-79 to 349 in 1987-88 but the production will increase by 125%. The average production per mine will also rise from 0.30 mty in 1978-79 to 0.58 mty in 1987-88. This is envisaged to be achieved by reorganising existing units (by amalgamation of existing small units), incorporation of additional reserves adjacent to existing mines and from deeper horizons, opening of new mines and introduction of new technology. It has also been found that except for BCCL mines, reconstruction/reorganisation of existing mines cost anything between Rs 80 to Rs 140 per annual tonne of additional coal output whereas it costs as much as Rs 150 to 250 per tonne of annual output for new mines, which necessitates new sinking, drifting etc. In mines of BCCL, due to extant peculiar conditions, reorganisation will not be able to utilise existing infrastructure and will not be much cheaper than opening of new mines, but still reorganisation will be necessary to scientifically mine the residual reserves for better percentage extraction of the ever growing scarcer coking coal reserves. The attempt is therefore to reorganise and reconstruct as many existing mines as possible. The percentage share of additional production from new mines is shown in Table 5.2.

TABLE 5.1

Number of Mines According to Production Size

Year	0 to 0.2	0.2 to 0.5	0.5 to 1.0	1.0 to 2.0	Above 2.0	Total	Prodn (mt)	Av. prod/ mine(mt)
1	2	3	4	5	6	6	7	9
NEC								
1978-79	3	2	—	—	—	5	0.7	0.14
1979-80	5	2	—	—	—	7	0.8	0.11
1980-81	8	1	—	—	—	9	0.9	0.10
1981-82	8	1	—	—	—	9	1.0	0.11
1982-83	8	1	—	—	—	9	1.2	0.13
1987-88	6	2	—	—	—	8	1.6	0.20
ECL								
1978-79	45	63	4	—	—	112	28	0.25
1979-80	46	55	7	—	—	108	30	0.28
1980-81	51	51	10	—	—	112	32	0.29
1981-82	48	53	10	1	—	112	34	0.30
1982-83	45	53	14	1	—	113	37	0.33
1987-88	33	47	18	5	2	105	45	0.38
BCCL								
1978-79	35	55	2	—	—	92	23	0.25
1979-80	37	51	5	—	—	93	24	0.26
1980-81	35	49	5	1	—	90	25	0.28
1981-82	36	49	5	1	—	91	27	0.30
1982-83	35	49	4	2	—	90	28	0.31
1987-88	35	39	8	5	2	89	40	0.45
CCL								
1978-79	25	19	9	1	2	56	24	0.43
1979-80	24	19	10	2	2	57	25	0.44
1980-81	25	20	10	2	3	60	28	0.47
1981-82	23	21	10	3	4	61	32	0.52
1982-83	24	22	10	4	4	64	38	0.59
1987-88	17	15	21	6	7	66	64	0.97

1	2	3	4	5	6	7	8	9
WCL								
1978-79	30	30	11	2	—	73	25	0.34
1979-80	26	34	13	2	—	75	26	0.35
1980-81	28	33	15	2	—	78	28	0.36
1981-82	28	33	15	2	—	78	30	0.38
1982-83	21	30	19	4	—	74	34	0.46
1987-88	15	26	32	5	3	81	50	0.62
CIL								
1978-79	138	169	26	3	2	338	100	0.30
1979-80	138	161	35	4	2	340	106	0.31
1980-81	147	154	40	5	3	349	114	0.33
1981-82	143	157	40	7	4	351	124	0.35
1982-83	133	155	47	11	4	350	138	0.39
1987-88	106	129	79	21	14	349	201	0.58

TABLE 5.2

Production

(In m t)

		1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
NEC	(a)	0.68	0.80	0.85	0.97	1.18	1.57
	(b)	—	0.12	0.22	0.34	0.46	0.51
	(c)	—	15	26	35	39	32
ECL	(a)	28.31	30.15	32.07	33.74	36.82	45.20
	(b)	2.70	3.27	4.06	4.87	6.56	10.76
	(c)	10	11	13	14	18	24
BCCL	(a)	23.00	24.11	25.42	26.52	27.86	40.11
	(b)	1.00	1.00	1.00	1.50	2.68	11.76
	(c)	4	4	4	6	10	29
CCL	(a)	23.70	24.58	28.06	32.46	38.07	64.25
	(b)	1.17	1.81	4.17	6.70	10.65	32.93
	(c)	5	7	1	21	28	51
WCL	(a)	24.50	26.09	27.99	30.27	33.75	49.64
	(b)	1.47	2.69	3.95	6.30	9.41	24.67
	(c)	6.0	10	14	21	28	50
CIL	(a)	100.19	105.73	114.39	123.96	137.68	200.77
	(b)	6.34	8.89	13.40	19.71	29.76	80.63
	(c)	6	8	12	16	22	40

NOTE : (a) Total production.
(b) Production from new mines.
(c)—(b) as % of (a).

(f) Existing fires in the mines will be dealt by blanketting and digging out etc. A fire cadre may be formed to undertake all these activities. R&D activities will also be stepped up for new methods for dealing with such fires.

(g) Schemes are being and will be worked out for mining below water filled goaf/water horizon and goaves liable to heating.

(h) Schemes will be worked out for mining under Jharia town to recover valuable coal. Harmonic and semi-harmonic methods of extraction is envisaged for working under built up areas in the later half of 80's.

(i) Wider and judicious application of roof bolting and Rigid I — section steel props will be resorted to, for economy.

(j) Use of Auger mining as R&D is foreseen in 2 WCL mines by 1987-88.

(k) For faster liquidation of reserves standing on pillars, modified longwall, knife edge and depillaring with side loaders and scrapers, will be resorted to. Use of continuous miner and load haul dumpers for extraction of pillars is under examination.

(l) Road headers, scrapers and similar equipment will be used in increasing number for fast development of longwall gate roads in particular and main & trunk headings at some mines.

(m) Hydraulic mining will be used as R&D for working mines in Baragolai coalfields, Assam in 1979-80.

(n) Caving in Mahakali under water bearing horizons in Wardha coalfield will be done in 1979-80.

The methods of mining, in all the new mines are not being spelled out, considering that the technology may undergo some changes by the time the mine comes into production. Sufficient flexibility is being kept in mine design to switch over to more suitable methods at the time of actual implementation, if need be.

As indicated earlier, the major thrust in mining methods will be to switch over to longwall and bord & pillar with intermediate technology. The trend is indicated in Table 5.4.

The share of production from longwall mining and bord & pillar with intermediate technology out of the total underground production will be 33% and 17% respectively by 1987-88. However, projections are indicative and may need some revision based on the results of actual trials. Compared to the previous plan, the thrust has only slightly changed to (i) A marginal drop in the share of longwall percentage, and (ii) A greater use of caving in preference to stowing.

It is proposed to create trial teams under various companies for implementing the new methods of mining.

5.4.4 Table 5.5 shows the Companywise trend of longwall and bord & pillar system in different years. The table also shows Companywise production from stowing and pick mining. It is seen from the table that B&P development as percentage of total underground production, will decrease from 51 in 1978-79 to 28 in 1987-88 but there is no appreciable change in B&P depillaring percentage. WCL and BCCL will be reducing B&P development percentage to 24% and 26% respectively i.e. half of the 1978-79 figure. By 1987-88, longwall share of CCL and BCCL will be 40% each and WCL and ECL, 31% and 28% respectively. It may also be seen from the table that there is hardly any change in total production from bord & pillar in next 10 years. The additional production is envisaged from longwall mining.

Strategy for Equipment Required for New Mining Method

5.4.5 It is proposed to import equipment like shearers, self advancing supports, side loaders, load haul dumpers and road headers, to the extent not available indigenously in the first 1 to 3 years, generally

TABLE 5.5

Companywise Trend of Longwall, Bord & Pillar and Share of Stowing in Different Years

(All production Figures in m t.)

Years	Total Underground Prodn.	Longwall: Caving Prodn.	Longwall: Caving (3) as % of (2)	Longwall: Stowing Prodn.	Longwall: Stowing (5) as % of (2)	Bord & Pillar: Development Prodn.	Bord & Pillar: (7) as % of (2)	Bord & Pillar: Depillaring Prodn.	Bord & Pillar: (9) as % of (2)	Pick Mining	(11) as % of (2)	Production from stowing face	(13) as % of (2)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1978-79													
NEC	0.66	—	—	—	—	0.07	11.0	0.59	89.0	0.05	7.6	—	—
ECL	25.66	0.34	1.3	0.24	0.9	12.82	50.0	12.26	47.8	0.64	2.5	3.50	13.6
BCCL	19.72	0.80	4.0	0.23	1.2	10.35	53.4	8.16	41.4	1.50	7.6	3.85	19.5
CCL	7.78	0.14	1.8	0.07	0.9	4.87	62.6	2.70	34.7	1.42	18.3	1.20	15.1
WCL	20.02	0.50	2.5	0.20	1.0	9.66	48.2	9.66	48.3	—	—	1.50	7.5
CIL	73.84	1.78	2.4	0.74	1.0	37.95	51.4	33.37	45.2	3.61	4.9	10.05	13.6
1979-80													
NEC	0.77	0.04	5.2	—	—	0.11	14.3	0.62	80.5	0.06	7.8	—	—
ECL	26.96	1.08	4.0	0.32	1.2	12.55	46.5	13.01	48.3	0.45	1.7	3.80	14.2
BCCL	20.76	1.68	8.1	0.34	1.6	9.89	47.7	8.85	42.6	0.90	4.3	4.38	21.1
CCL	8.32	0.53	6.4	0.20	2.4	4.50	54.1	3.09	37.1	0.70	8.4	1.34	16.1
WCL	21.14	1.35	6.4	0.60	2.8	8.69	41.1	10.50	49.7	—	—	1.86	8.8
CIL	77.95	4.68	6.0	1.46	1.9	35.74	45.8	36.07	46.3	2.11	2.7	11.37	14.6

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1980-81													
NEC	0.66	0.07	10.6	—	—	0.11	16.7	0.48	72.7	0.06	9.1	—	—
ECL	28.12	1.82	6.5	0.40	1.4	11.77	41.9	14.13	50.2	0.15	0.5	4.20	14.9
BCCL	21.50	2.54	11.8	0.54	2.5	9.39	43.7	9.03	42.0	0.50	2.3	5.40	25.1
CCL	9.10	0.89	9.8	0.32	3.5	4.54	49.9	3.35	36.8	0.20	2.2	1.48	16.3
WCL	22.08	2.75	12.5	0.96	4.4	7.77	35.1	10.60	48.0	—	—	2.25	10.2
CIL	81.46	8.07	9.9	2.22	2.7	34.58	42.3	37.59	46.1	0.91	1.1	13.33	16.4
1981-82													
NEC	0.70	0.09	12.9	—	—	0.11	15.7	0.50	71.4	0.06	8.6	—	—
ECL	29.41	2.76	9.4	0.72	2.4	11.70	39.8	14.23	48.4	—	—	4.80	16.3
BCCL	22.20	3.42	15.4	0.66	3.0	8.81	39.7	9.31	41.9	0.20	0.9	5.60	25.2
CCL	10.10	1.45	14.4	0.40	4.0	4.88	48.3	3.37	33.3	—	—	1.59	15.7
WCL	22.62	3.90	17.2	1.16	5.1	6.83	30.2	10.73	47.5	—	—	2.60	11.5
CIL	85.03	11.62	13.7	2.94	3.5	32.33	37.9	38.14	44.9	0.26	0.3	14.59	17.2
1982-83													
NEC	0.85	0.24	15.3	—	—	0.14	16.5	0.58	68.2	0.08	9.4	—	—
ECL	31.09	3.75	12.1	1.20	3.9	11.11	35.7	15.03	48.3	—	—	5.35	17.2
BCCL	22.56	4.22	18.7	1.17	5.2	7.83	34.7	9.34	41.4	—	—	5.80	25.7
CCL	10.46	2.06	19.7	0.40	3.8	4.24	40.5	3.76	36.0	—	—	1.70	16.3
WCL	23.60	4.70	19.9	1.24	5.3	6.35	26.9	11.31	47.9	—	—	2.96	12.5
CIL	88.56	14.86	16.8	4.01	4.5	29.67	33.5	40.02	45.2	0.08	0.1	15.81	17.9
1987-88													
NEC	1.19	0.18	15.1	—	—	0.14	11.8	0.87	73.1	0.09	7.6	—	—
ECL	39.06	9.58	24.5	1.20	3.1	12.43	31.8	15.85	40.6	—	—	5.50	14.1
BCCL	26.03	8.32	32.0	2.14	8.2	6.63	25.5	8.94	34.3	—	—	7.50	28.8
CCL	15.08	5.59	37.1	0.45	3.0	4.77	31.6	4.27	28.3	—	—	1.80	11.9
WCL	29.27	7.60	26.0	1.44	4.9	6.94	23.7	13.29	45.4	—	—	3.28	11.2
CIL	110.63	31.27	28.3	5.23	4.7	30.91	27.9	43.22	39.1	0.09	0.1	18.08	16.34

for trials of new mining methods. After establishment of the technology, indigenous manufacturing capability will be encouraged to indigenise the supplies. The strategy in case of scrapers, hydraulic props, shearers and armoured flexible conveyors whose utility is established, is to develop indigenous manufacture straight way based on either Indian or foreign knowhow.

Underground Transport

5.5 Transport constitutes 15 to 30% of total project capital cost and 18 to 32% of operating cost and hence needs careful assessment. Underground coal transportation will undergo considerable rationalisation to meet the new demands of coal production from new methods, and with a view to greater economy, better supervision, safety and maintenance ; selective use of belt conveyor; vis-a-vis rope haulage and/or locomotives, planning and execution of material transport; rationalisation & standardisation of pit top and pit bottom layouts; optimising the transport capacity; and use of modern safety devices like gravity control, automatic tub detector to detect the speeding tub and such other small equipment for increasing transport capacity and improve safety. Reduction of travelling time & introduction of simple man riding haulages is also envisaged on trial in a few mines in 1979-80 and 1980-81 to start with.

Coal Transport

5.5.1 The main underground transport system at present is by rope haulages which accounts for almost 80% of production. This system of coal transport is economic over belt conveyors and locomotive haulages under certain physical conditions when the output is generally not more than 0.45 mt per annum but belt conveyor becomes cheaper over 0.45 mt of production.

Table 5.6 below shows the techno-economic comparision of various systems for 1 km level distance. Figures in bracket indicate the same for 0.75 km, 1 in 5 inclined roadways.

TABLE 5.6

Techno-Economic Comparision Between Belt Conveyor, Locomotive and Rope Haulage

Sl. No.	Transport System	Cost per tonne (Rs) for Annual Production (mt)		
		0.60	0.45	0.30
1.	Belt conveyor	4.96 (4.08)	6.66 (6.69)	9.92 (9.68)
2.	Locomotive and mine cars	5.12	5.34	7.16
3.	Rope haulage and coal tubs	Difficult (4.18)	3.56 (5.22)	4.45 (4.24)

In view of larger output mines being planned, belt conveyors will find greater use. Locomotives are also being introduced in some mines based on the economics. However, rope haulages will still continue to be the main mode of underground coal transport. By 1987-88 about 50% of production will be transported by rope haulages, 39% by belt conveyors and 11% by locomotives. A perspective contribution of various methods is indicated in Table 5.7 and Diagram 5.1. The mines planned with flight loaders and shearers will have conveyor or locomotives as the main transport system. Hand tramming will be considerably reduced.

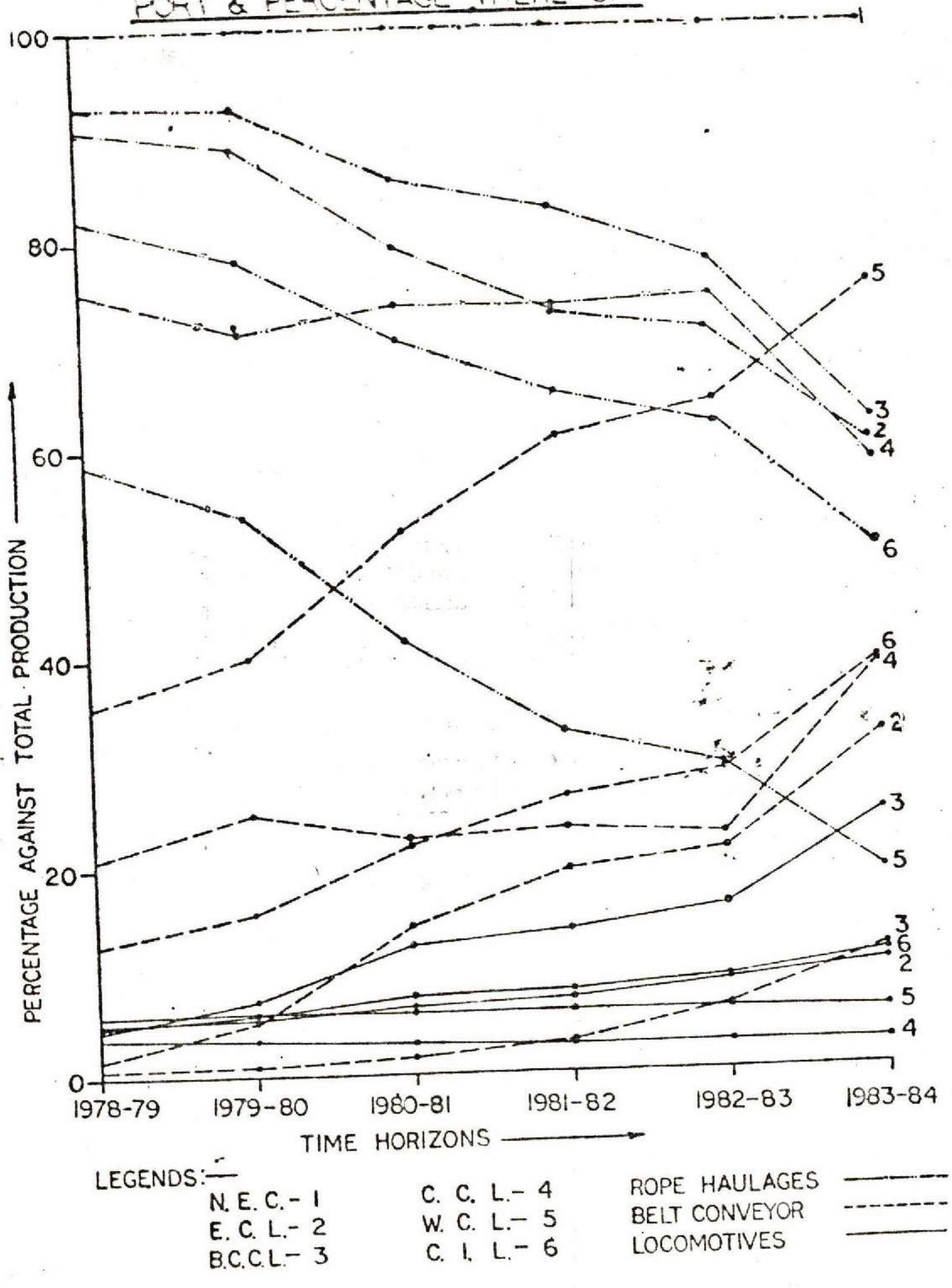
TABLE 5.7

Trend of Type of Main Underground Transport and Percentage There of

Main underground transport	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	Prodn. MT	Percentage	Prodn. MT	Percentage	Prodn. M T	Percentage	Prodn. M T	Percentage	Prodn. M T	Percentage	Prodn. M T	Percentage
1	2	3	4	5	6	7	8	9	10	11	12	13
N E C												
Rope haulage	0.66	100	0.77	100	0.66	100	0.70	100	0.85	100	1.19	100
Belt conveyor	—	—	—	—	—	—	—	—	—	—	—	—
Locomotive	—	—	—	—	—	—	—	—	—	—	—	—
E C L												
Rope haulage	23.80	92.8	23.91	88.7	22.14	78.7	21.52	73.1	22.11	71.1	23.58	60.4
Belt conveyor	0.50	2.0	1.46	5.4	4.11	14.6	5.78	19.7	6.40	20.6	11.74	30.0
Locomotive	1.36	5.2	1.59	5.9	1.87	6.7	2.11	7.2	2.58	8.3	3.74	9.6
B C C L												
Rope haulage	18.68	94.7	19.10	92.0	18.42	85.7	18.39	82.8	17.52	77.7	16.51	63.4
Belt conveyor	0.15	0.8	0.21	1.0	0.38	1.8	0.73	3.3	1.45	6.4	3.03	11.6
Locomotive	0.89	4.5	1.45	7.0	2.70	12.5	3.08	13.9	3.59	15.9	6.49	25.0
C C L												
Rope haulage	5.82	74.8	5.90	70.9	6.66	73.2	7.36	72.9	7.70	73.6	8.69	57.6
Belt conveyor	1.66	21.3	2.12	25.5	2.14	23.5	2.44	24.1	2.46	23.5	5.99	39.7
Locomotive	0.30	3.9	0.30	3.6	0.30	3.3	0.30	3.0	0.30	2.9	0.40	2.7
W C L												
Rope haulage	11.72	58.5	11.33	53.6	9.20	41.7	7.40	32.7	6.96	29.5	5.61	19.2
Belt conveyor	7.11	35.5	8.48	40.1	11.52	52.2	13.81	61.1	15.14	64.1	21.97	75.0
Locomotive	1.19	6.0	1.33	6.3	1.36	6.1	1.41	6.2	1.50	6.4	1.69	5.8
C I L												
Rope haulage	60.68	82.2	61.01	78.3	57.08	70.0	55.37	65.1	55.14	62.3	55.58	50.2
Belt conveyor	9.42	12.8	12.27	15.7	18.15	22.3	22.76	26.8	25.45	28.7	42.73	38.6
Locomotive	3.74	5.0	4.67	6.0	6.23	7.7	6.90	8.1	7.97	9.0	12.32	11.2

DIAGRAM 5.1

TREND OF TYPE OF MAIN UNDERGROUND TRANSPORT & PERCENTAGE THERE OF



Material Transport

5.5.2 At present the material transport arrangement in mines is mostly by the rope haulages which transport the coal, apart from hand tramming or manual carrying in some mines or over some distances. Small rope haulages will be used for transport of material where belt conveyor system has been planned. Mono rail system will be introduced in 3 to 4 highly mechanised mines during the next 5 years in a phased way. Small mechanical devices will be tried for transport of timber in isolated patches, where no tracks are available for hand tramming.

Man Riding Arrangements

5.5.3 Longer travelling distances to working faces, steeper gradients and existance of obstacles contribute to human fatigue and subsequent loss in the effective working time of the workers. Considering the above and the fact that at some mines the gradients are very steep or travelling distances are long, man riding arrangement will be needed. With this in view man riding systems on trial basis will be introduced in 2 to 4 selected mines each during 1979-80 and 1980-81. More mines will be taken up in subsequent years depending on the trial results.

Vertical Transport System

5.6 A careful selection of the winding system, being a vital link, is of paramount importance. With this in view attempt is being made to plan and design shafts to handle large outputs both in new and reorganised mines. Greater use of skips and friction winders are being envisaged in deeper mines.

As there was no expertise available in the country for preparing detailed design drawing for such installation, it was decided to develop such expertise in CMPDI. With concerted efforts this objective has been achieved and CMPDI is now preparing detailed design drawings. Hydraulic transport of coal where feasible, is being theoretically examined to do away with widening of shafts required for higher production.

Surface Coal Handling and Transport

5.7 Surface transport of coal in many existing mines is not rationalised leading in to higher cost and inefficiency, and reorganisation of the same for providing economy and better utilisation of manpower has been started. Smaller mines are being clubbed together to provide mechanised coal loading by the Mini Coal Handling Plant (CHP). The process started 3 years back, will be accelerated further in the next 7 years, when the work will be completed. Mines with production over 0.5 mt/annum are to have modernised coal loading arrangements by 1980-81. 48 Nos. of front end loader, 24 of 3.5 m^3 capacity and 24 of 6.0 m^3 capacity are planned to be imported in the next 3 years for mechanised loading of coal in to wagons. In addition a number of small indigenous front end loaders of 1 to 2 m^3 capacity will be developed for loading of coal. Table 6.4 of Chapter 6 shows the anticipated requirement of CHP/Mini CHP during next 10 years.

Sinking, Drifting & Construction

5.8 In view of additional output and mining from increased depth in existing mines, sinking of additional shaft and deepening and widening of existing shafts will be required. A tentative programme is indicated in Table 5.8. ECL and BCCL are developing some capacity to take up sinking and drifting work, while CCL's and WCL's requirement being less, the work will be off loaded to other parties. All the four Companies are having skeleton construction division, but in view that production programme beyond 1983 will have to be met from reconstruction, this vital activity is being expanded gradually in the next decade.

TABLE 5.8

Tentative Programme of Taking up New Shafts for Sinking, Deepening/Widening upto 1981-82

New Sinking

New Sinking	Shaft to be sunk (No.)	Dia Range (m)	Depth Range (m)	Tentative Year of Starting Sinking (Nos)			
				'78-79	'79-80	'80-81	'81-82
NEC	—	—	—	—	—	—	—
ECL	17	5.4-7.5	65-350	7	4	—	6
BCCL	3	4.8-7.5	280-520	2	1	—	—
CCL	5	5-6.5	130-300	2	2	1	—
WCL	7	5.18-6.5	60-200	6*	1	—	—
CIL	32	4.8-7.5	60-520	17	8	1	6

* One already started in 1976-77.

Deepening/Widening

Deepening/ Widening	Shafts to be Widened/ Deepened	Dia Range after Widening (m)	Depth Range after Deepening (m)	Tentative Year of Starting Widening/ Deepening			
				'78-79	'79-80	'80-81	'81-82
NEC	—	—	—				
ECL	10	5.4-7.2	70-340	6	—	4	—
BCCL	6	4.2-6.0	44-268	3	1	2	—
CCL	1	6.0	100	—	—	1	—
WCL	1	5.18	240	1	—	—	—
CIL	18	4.2-7.2	44-340	10	1	7	—

Mechanised sinking and drifting using grab and shovel loader, side discharge loader and scraper respectively will be progressively adopted. Most of the shafts will be lined as it is techno-economically cheaper in the long term. In drifting, a progress of 1.2 m/day to start with and to rach upto 2.5 to 3.0 m/day (inclusive of arching) in the next decade is targetted. In sinking the aim is to obtain a progress of 1.0 m/day rising to 1.8 m/day with lining in next 10 years.

Environmental Conditions in Mines and Mining Areas

5.9 During the next decade, better environmental conditions in mines in respect of ventilation and prevention of spontaneous heating will be provided, the former by installing bigger capacity fan, dehumidification and district air conditioning for deep and/or extensive mines, and degassification of gassy mines. Two dehumidification plants are envisaged as trial by March, 1980 and 4 degassification plants by September, 1979. The latter include Amlabad and Moonidih in BCCL and Ghusick and possibly Chinakuri in ECL. Control and prevention of spontaneous heating shall be achieved by early detection of carbon monoxide, fly ash/mud flushing, pressure balancing and nitrogen/carbon-dioxide filling of goaves. Trial installations will be done in Kottadih and possibly Kunustoria in ECL, Alkusa and Moonidih in BCCL and Gidi 'A' in CCL in 1979-80 or early 1980-81 and at Tirap, Assam in latter 1980-81. Multi point and single telemonitoring for methane and carbon monoxide shall also be provided. Inhibitors will be used for preventing coal stack fires, and 2 trials will be started in early 1979. Water infusion techniques will be tried at shearer and road-header faces to assess their effectiveness to suppress the dust.

Existing Mine and Coalfield Fires

5.9.1 Past method of exploitation of thick seams, leaving large quantity of coal in pillars as well as in partings and without stowing, has resulted in many fires. There are 70 active fires out of a total of 110 fires in Jharia coalfield itself. These fires, apart from posing danger to men & material and loss of valuable coal are also posing danger to vital structures and installations. It is estimated that about 34 mt of extractable coal is already lost in major fires and another 46 mt remain locked up.

The total area under fire at present in BCCL is 6 Sq Km. The fires have been/are being isolated by blanketing of the affected area and water pooling on the surface; surface blanketing and underground isolation; partial or full stowing of the underground workings; water infusion through boreholes; underground injection of inert gases of the affected workings which can be isolated easily; stowing of the affected area; trench cutting on surface; and bulldozing and blanketing with sand. The work of isolating the fires has started actively since last 2 years. In case of 3 fires e.g. Jogta, Lodna and Sudamdih, project reports are being prepared to suggest necessary protective measures in detail. In case of Lodna where 284 mt of coal is blocked by four fires, the total investment for dealing with the fire is likely of the order of Rs 9.9 crores. Further, it is proposed to establish a small core group of fire fighting officers, which will be entrusted with the job of designing methods to deal with the fires, R&D studies, evolving new methods and extension of the method to deal with other fires.

Strata Control, Rock Mechanics and Mine Support

5.10 With the continuous increase in output from longwall systems and also inview of the mines becoming deeper and more difficult, strata control problems in bord & pillar mining and longwall are correspondingly increasing. The behaviour of the roof, calls for suitable studies to be done in respect of longwall mining. The studies being carried out/will be carried out in collaboration with CMRS and educational institutions are :

- (i) Subsidence and design of buildings, harmonic and semi harmonic extraction;
- (ii) Physico-mechanical properties of rocks, development of models and design of barrier pillars;
- (iii) Optimum support density and standard support system;
- (iv) Study of cutting resistance and ploughability of coal; and
- (v) Subsidence studies.

These studies will help in determining the support density, designing of support system, cavability of roof rocks etc., and also selection of proper winning machine.

Studies have been started in longwall faces at Ningah, East Katras, Banki, Surakachhar, Saunda 'D' and Dhemo-Main collieries and have been mostly completed at Gidi 'A' and Moonidih. More mines will be covered progressively. Studies are in hand at Chinakuri with USSR collaboration.

Availability of timber will be poor due to deforestation. Steel props of both rigid and yielding type are being used for increased safety and efficiency. The use of steel props will also go a long way in conserving timber which is becoming scarce. Roof bolting and roof stitching are being tried increasingly in suitable condition as they are cheaper by 20-40% as compared to conventional support. Similarly treated timber is also being used in semi-permanent roadways for conservation of timber. Perspective use of these methods in quantified terms will be assessed after further field trials.

Stowing

5.11 During the next decade the thrust is to produce maximum coal from caving. However, in case of thick seams with shallow covers and in close contiguity stowing will be required to achieve maximum possible recovery with adequate safety. Stowing will also be required for working below water bearing strata, below fires and built-up areas.

Table 5.9 shows the Companywise production of coal from stowing. It may be seen from the above table that in 1978-79, 14% of underground coal will be won by stowing while in the year 1987-88 this percentage will be about 16%. In absolute terms, the quantity of stowing material will increase.

In BCCL more than 70% of the reserves occur in thick seams with a thickness of more than 4 m and one of the mining system applied for their exploitation will be with stowing. In the year 1976-77, 5.56 mt of material was stowed for a production of 2.90 mt (15% of underground production) of coal against a total underground production of 19.28 mt. In the year 1987-88 the production of underground mines of BCCL from stowing will be 7.5 mt (19% of underground production) and 15 mt of sand will be required. The present annual capacity of mechanical plants is about 8 mt which at 70% efficiency can meet the requirement to the extent of 5.6 mt only. The existing sand deposit in Damodar river is limited, alternatives including quarry debris, washery rejects and boiler ash will be used. Two trial projects one at Bhurkunda, CCL and another at Kankani, BCCL has been taken up for finding out the suitability of crushed stone material. These will be commissioned by 1980-81.

TABLE 5.9

Quantity of Coal to be Obtained from Stowing

(In m t)

Sl. No.	Name of Company	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1.	NEC	—	—	—	—	—	—
2.	ECL	3.50	3.80	4.20	4.80	5.35	5.50
3.	BCCL	3.85	4.38	5.40	5.60	5.80	7.50
4.	CCL	1.20	1.34	1.48	1.59	1.70	1.80
5.	WCL	1.50	1.85	2.25	2.60	2.96	3.28
	Total for CIL (a)	10.05	11:37	13.33	14.59	15.81	18.08
	(a) as % of total underground production	14	15	16	17	18	16

Transport of sand from Durgapur barrage, Maithon tail end and river Sone is also contemplated in future to meet the requirement of BCCL.

As, a number of mines do not have efficiently designed stowing system, the work of reorganisation of these systems have been taken up. The improvements proposed are to use full bore stowing using trough system, use of mobile stowing plant (at Nimcha and Kajora collieries) and to develop and install automatic control devices for optimum solid water ratio.

Explosives & Blasting Practices

5.12 Explosives constitute a major portion of stores cost and almost 7-12% of the cost of production. As a result of extensive field trials by R&D wing of CMPDI, it is found that this cost can be reduced by 10 to 30%, and therefore the major emphasis during the next 3-4 years will be for evolving a better blasting pattern and right quantity of charge coupled with strict control on explosive consumption to achieve economy. Already 50 mines have been covered in the last 2 years for evolving suitable pattern and achieving economy.

To achieve more economy and safe blasting the following approaches will be followed :

(i) Combination of P1, P3 and P5 types of explosives in solid blasting for economy. The experiment could not be proceeded as conceived in last plan as are some difficulties being expressed in the combined use of P1 or P3 with P5 in solid blasting trials from Directorate General of Mines Safety and General Managers of the field. It is proposed to follow this further.

(ii) Wider use of ANFO in opencast mines. The initial trials have proved saving as much as 20-30%. Six big opencast pits have been selected for greater use of ANFO in deep hole blastings with provision of using mechanical mixers for mixing ANFO before loading into the holes and trials will start by October '79.

(iii) Pourable slurry will be tried further as a R&D scheme. Limited trial was done at one mine 2 years back.

(iv) Controlled blasting techniques for safe vibration limits and reducing flying of fragments. Twelve mines have been studied for the above technique and the same has been successfully used in the last one year. More mines will be covered in the next 10 years.

(v) Development of cheaper and effective explosives by explosive manufacturers will continue.

(vi) Modified liquid oxygen for example LOX 'C' will be experimented with.

Requirement of explosives for CIL is indicated in Table 5.10 which also gives source of supply. It will be seen that the explosive requirements can be met by the already indentified manufacturer for next five years only. A limited quantity of permitted type may have to be imported in 1978-79. As the requirement by 1987-88 is quite high, suitable arrangements for its availability to the industry shall be made before hand. The explosive requirement for other industries have been worked with 1972 base and taking a rate of increase at 7% per annum.

TABLE 5.10

10 Years Perspective of Explosive Requirement

Explosive Requirement (Tonnes)	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7
I. Explosive requirement of CIL						
NEC						
Total	187	221	283	340	415	534
Permitted	175	204	175	186	226	316
Non-permitted	12	17	108	154	189	218
ECL						
Total	8348	9005	9752	10317	11569	13928
Permitted	6825	7171	7479	7823	8269	10389
Non-permitted	1523	1834	2273	2494	3300	3539
BCCL						
Total	7135	7451	7977	8394	9051	15038
Permitted	5245	5522	5719	5905	6000	6923
Non-permitted	1890	1929	2258	2489	3051	8115

1	2	3	4	5	6	7
CCL						
Total	11142	11580	12848	15570	18691	32344
Permitted	2069	2213	2420	2686	2782	4011
Non-permitted	9173	9367	10928	12884	15909	28333
WCL						
Total	7908	8572	9278	10426	12127	19525
Permitted	5325	5623	5873	6016	6277	7785
Non-permitted	2583	2949	3405	4410	5850	11740
C I L						
Total	34720	36829	40138	45047	51853	81369
Permitted	19639	20733	21666	22616	23554	29424
Non-permitted	15181	16096	18972	22431	28299	51945
II. Explosive requirement by other industries	28200	30175	32285	34540	36960	48045
III. Total explosive requirement in the country	62920	67004	72423	79587	88813	129314
IV. Likely explosive production from different sources						
IEL	35000	35000	35000	35000	35000	35000
IDL	20000	20000	20000	20000	20000	20000
Narendra & Sons	5000	5000	6000	7000	8000	10000
IOL	2000	2000	2000	2000	2000	3000
Bhandara	5000	5000	5000	5000	5000	5000
Slurry Explosive	5000	7000	9000	10000	12000	15000
ANFO — FCI	3000	5000	5000	6000	8000	9000
IBP	5000	7000	10000	12000	14000	15000
Total	80000	86000	92000	97000	104000	122000

Rescue of Trapped Workers

5.13 Action for procurement of self rescuers, to be provided to individual workers in phases starting with highly gassy seams and mines where fire exists has already been taken up. Mobile winders, large diameter boring machines and high capacity high head submersible pumps shall be kept ready at different centres. 2 Nos. mobile winders and 36 Nos. submersible pump will be imported in early 1979-80. IIT Kanpur has been associated in the studies.

Miners Health

5.14 Analysis of health of miners and research is aimed at to find out the effect of dust concentration, e. g. pneumoconiosis and silicosis, inefficient lighting, nutritional deficiency, possible effect on hearing due to noise caused by mechanisation, hook worm diseases and effects due to working in hot and humid atmosphere. Emphasis will also be given to ensure that workers remain away from alcoholic drinks. R&D studies will be started gradually from 1979-80. With the introduction of shearers, effects of increased dust concentration on miners health will be studied.

Opencast

5.15 Thrust on opencast mining during the coming decade will be very high, with the opencast production rising from the level of 23.63 mt in 1977-78 to the level of 90.14 mt in 1987-88. Percentage of coal from opencast mines will rise from 26% at present to 45% by 1987-88. A few of the opencast mines at present are being worked manually but their contribution will reduce very much in the next 10 years.

The present system of excavation in the opencast mines is mainly by the deployment of shovel-dumper combination and draglines. By and large, this basic system will be continued during the coming decade, mainly on account of the fact that mining is to be done for a number of seams one above the other. The smaller shovels of bucket capacity of 2½/3Y³ will be deployed in small patches or isolated areas, where electric power supply in requisite amount will not be available.

In general, the size of the shovels being deployed in the opencast mines is 4.6 M^3 bucket. In some projects, there are even bigger capacity shovels of 6.3 and 8 M^3 bucket, which were imported. Usually, the 35 T rear dumper is used along with the 4.6 M^3 shovel and the 50 T rear dumper along with 6.3/8 M^3 shovels. In general it is economical to use higher capacity shovels, especially where the quantity of excavation is very high and the type of material to be excavated is very hard, creating big boulders during blasting. The size of excavators to be deployed in coal depends on the quantity of coal excavated, number of seams and thickness of seams. Generally 4.6/6.3 M^3 shovel will be used with matching dumper/coal haulers. The future technology is based on the above considerations.

Wherever the coal seams are flatter, draglines for side casting the overburden into the goaf have been introduced, depending upon the required output, as cost of overburden removal by draglines is much less than that by shovel dumper combination. In view of the low cost of excavation, even if the quarry conditions are not suitable for dragline application by single side casting, it is now-a-days the practice to deploy the draglines for further rehandling of the overburden spoil. The bucket capacity of the draglines now being deployed in the opencast mines vary from 6.12 M^3 to 29.82 M^3. Table 6.3 of Chapter 6 shows the anticipitated requirement of equipment during the next decade.

The question of reduction of the transport system to the minimum in opencast mines, has been under consideration for some time, in view of the high cost of dumpers and diesel oil to run them. For this purpose the rock-over quarry skip is being thought of for quarries which have achieved a depth of about 60 mtrs, wherever it can be suitably installed. The proposal to install the first quarry skip is for Manikpur opencast during the 6th plan period. Some details for the installation of such skip in the Kathara opencast are also being worked out. The slope will be as much as 22-40° to the horizontal. The skips will be of the double track type so that while the loaded skips go up, the empty skips come down. In this system, the skip size has to be more or less idential to that of the dumpers.

Wherever the site conditions do not permit proper installation of the skip system for coal, the system of crushing the coal within the pit and transporting the same through belt conveyors to the coal handling plant at the surface is advised in mines to eliminate the corresponding dumper transport. For this purpose, it would be necessary to have the crushers of the mobile type, so that it could be shifted along with the advance of the coal face. Such system are being planned for installation in the Bishrampur quarry at present. Scope for installation of such system exist in some more quarries like, Manikpur, Durgapur and Jhingurdah. This system is expected to be more economical than dumper transport. In order to avoid dumper for the transport of coal from the coal face shovel to the mobile crusher, which will not always be necessarily close to the shovel, tractor shovels could be deployed which could excavate the coal from the face and transport to the crushers which is normally within the economic distance of haul by the tractor shovels.

To avoid the necessity of crushing the coal before the same can be delivered on to the belt conveyor, experiments with drilling and blasting will be undertaken especially in thinner seams to get sufficient fragmentation of coal while blasting, which could be directly delivered on to the belt conveyor.

Lately, hydraulic excavators are replacing the conventional shovels in Europe and USA. In the hydraulic excavators, the power at the bucket depends purely on the developed hydraulic power. The hydraulic excavators give multi-directional digging action, powerful penetration precise operation and faster cycles. They have wrist action which enables it to use force in digging. These machines employing top dumping bucket can handle boulders bigger than the bucket in cable operated machines which employ bottom dumping. The hydrablic excavators can have shovel and backhoe attachment. The backhoe enables the hydraulic excavator to dig below its level. Such application may find frequent utilisation in our opencast mines, especially in digging bottom coal benches during rainy season, when water will be accumulated below the bench and also for making sumps in the quarry floor. Some calculations have shown that the hydraulic excavators are more economical. In view of this, there is a proposal to buy some hydraulic excavators of 3.2 M^3 capacity in place of the 4.6 M^3 conventional electric shovel. In some of the opencast projects, which are being planned now, hydraulic excavators are being provided, in view of the above conditions.

Hundreds of million tonnes of coking and medium coking coal is at present lying locked up in the underground workings of the Jharia Coalfield. Some areas are under fire and some are flooded. Methods of winning this coal economically with underground mining, are not in sight. In view of this, and the limited reserves of such coal in our country, quarrying this coal to greater depths and ratios are being considered seriously. A master plan for quarrying up to over 200 metres depth in the Jharia coalfield is under study. This scheme incorporates the application of walking draglines to the extent economically possible, in addition to the shovels, dumpers and scrapers.

Earlier opencast projects were planned to work in two shifts and 6 days a week except the draglines which are put on 3 shifts. In view of very large investment required for the opencast equipment, new projects are being planned to operate 7 days a week and 3 shifts a day including time required for the routine preventive maintenance and scheduled overhauls.

More emphasis will be paid on reclamation of land and afforestation of the area.

Work on suppression of dust on haul roads has already been taken in hand.

Chapter 6

Plant and Epuipment

Introduction

6.0 The investiment on plant & equipments constitutes the biggest chunk of the total capital outlay on mines and associated infrastructures. There is, therefore, a need for a realistic assessment of such equipment after striking a balance of the two views of increased production and cost reduction on the one hand and need for increased generation of employment on the other.

Methodology for Plant & Equipment Planning

6.1 This chapter deals with plant & machinery for :

(i) Mines both underground and opencast.

(ii) Coal handling plants.

(iii) Workshops.

The methodology followed has been that in case of mines for which project reports have been prepared, such reports have formed the basis. For all other mines for which project reports are yet to be made both for new mines as well as mines proposed for re-construction, the projected swing in mining technology & degree of mechanisation have formed the basis. For existing mines, the improvement in production, population of equipment, their present condition and effective utilisation have been the considerations for replacement requirement.

Underground Mines

6.2 Other criteria for assessment of underground equipment has been rise in production and the trend of application of new mining technologies in respect of requirement of specialised mining equipment like shearers, ploughs, flight loaders, powered supports, power packs, armoured face conveyors, hydraulic props & stage loaders etc. Similarly, the face operations & underground transport in bord and pillar system are proposed to be mechanised for increased productivity and to reduce human drudgery by using side loader, load haul dumpers, headers / dinters, scraper haulages, belt conveyors & scraper chain conveyors etc. It is expected that by 1987-88 about 50% of underground production will come from such mechanised faces. However, in the course of time, it is just likely that the technology may undergo further change and the estimate of P & M will also have to undergo change accordingly.

The details of each proposed new mining technology with their comparative cost analysis and extent of application is covered under the Chapter 5 on mining technology.

Opencast Mines

6.3 The production from opencast mines is proposed to be increased very rapidly. During the next ten years it will increase four folds. This necessitates the deployment of large capacity heavy earth moving equipment like big capacity shovels and draglines. While planning for heavy earth moving equipment the present system of shovel dumper combination or dragline has been retained to a fairly large extent. The use of diesel shovel is limited to small patches or isolated areas where electric power supply is not available.

The use of skips and belt conveyors has also been given due consideration.
In all these cases the suitability of the machines to our conditions has been duly considered.

Requirement of Plant and Equipment for Mines

6.4 The detailed assessment of equipment has been made collierywise. However, for the purpose of presentation, the total consolidated list of different types of equipment, yearwise for the first five years from 1978-79 to 1982-83 and on indicative basis for next 5 years from 1983-84 to 1987-88 is shown in Table 6.1 & 6.2 for underground and opencast mines respectively for Coal India. Similar information in respect of the subsidiary companies have been incorporated in their respective perspective plans.

TABLE 6.1

Anticipated Requirement of P&M for Underground Mines for Coal India from 1978-79 to 1987-88

Sl. No.	Equipment	1978-79	1979-80	1980-81	1981-82	1982-83	1983-88	Total
1	2	3	4	5	6	7	8	9
	FACE MACHINE							
1.	Coal cutting machine	78	102	118	108	94	210	710
2.	Gate end box for CCM	120	112	128	115	101	243	819
3.	Flight loader	8	11	17	14	13	56	119
4.	Shearer single/double drum	4	2	8	9	9	28	60
5.	Shearer/coal plough with SA support	1	3	1	3	2	18	28
6.	Coal plough	—	—	—	3	—	—	3
7.	Road header/dinters/ continuous miners	3	8	7	2	2	13	35
8.	Coal/stone drill	1243	1353	1382	1728	1714	7611	15031
9.	Drill panel	674	765	766	810	913	3328	7256
10.	Pneumatic drill	109	110	124	195	197	663	1398
11.	Exploder	837	968	1040	920	1032	4105	8902
	SUPPORT							
12.	Friction prop 40 Te.	4400	4900	4100	1000	3000	7000	24400
13.	Friction/hyd. 20 Te.	2400	4000	4000	1600	800	25600	38400
14.	Hydraulic prop 40 Te.	10825	9600	19800	12000	23000	129100	204325
15.	Link bars	14400	14850	22700	24810	32910	219390	329060
16.	Central power pack	20	14	28	30	46	184	322
17.	Hyd./mech. pushers	600	330	840	450	690	5160	8070
	TRANSPORT							
18.	Side loader	6	15	4	6	5	46	82
19.	LH dumper	8	11	14	9	10	45	97
20.	Scraper loader	62	96	109	98	120	260	745
21.	Front end loader	15	30	22	7	7	30	111

1	2	3	4	5	6	7	8	9
22.	Shuttle car	2	—	4	—	—	—	6
23.	AFC H/D & M/D	26	35	46	33	45	269	454
24.	Chain conveyor L/D	156	190	224	133	150	452	1305
25.	Stage loader	26	32	50	33	45	269	455
26.	Gate/trunk conveyor	72	79	94	184	116	353	898
27.	Locomtives	2	34	20	26	24	41	147
28.	Haulages	412	329	300	311	327	1054	2733
29.	Elect. winder	10	6	5	14	7	36	78
	OTHERS							
30.	Pumps	709	606	586	664	684	2457	5706
31.	Main fan	57	50	40	45	43	97	332
32.	Auxiliary fan	143	193	230	130	121	447	1264
33.	Man riding haulage	3	7	7	5	10	23	55
34.	Burn side boring machine	1	5	10	3	4	21	44
35.	Air compressor	30	26	31	21	22	84	214
36.	Transformers	644	474	473	432	434	1449	3900
37.	OCB/ACB, HT/LT	1499	1509	1504	1657	1755	5788	13712
38.	PVC belting, km.	120.4	144.0	154.6	186.9	196.3	1138.9	1941.1

TABLE 6.2

Anticipated Requirement of Opencast Equipment from 1978-79 to 1987-88 for Coal India Limited

Sl. No.	Year	1978-79	1979-80	1980-81	1981-82	1982-83	1983-88	Total
	Produciton m. - Te.	22.89	24.35	28.71	35.76	46.18	66.27	
	Equipment	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	
1.	5-35/45-90 Dragline	1	—	4	2	—	13	20
2.	6.3-8 cu.m. Elect. shovel	1	2	6	5	18	54	86
3.	3.2-4.6 cu.m. Elect. shovel	12	19	20	11	11	41	114
4.	2½-3 Y³ Diesel shovel	10	7	6	4	7	38	72
5.	1.91-6 m³ FE loader/ .9 Cum. hydraulic shovel	6	15	7	1	1	26	56
6.	50 T. rear dumper	22	36	31	40	116	547	792
7.	35 T. rear dumper	92	125	104	119	114	273	827
8.	25 T. rear dumper	30	48	43	27	35	334	517
9.	45 Te. coal hauler	—	—	5	22	22	3	52
10.	29 Te. coal hauler	6	6	29	31	42	118	232
11.	11.5 cu.m. scraper	28	18	16	14	8	65	149
12.	250-269 mm BH drill	8	17	11	7	19	60	122
13.	100-166 mm BH drill	19	18	19	21	16	67	160
14.	275-300 HP dozer	56	71	77	38	85	176	503
15.	Grader	8	11	6	—	4	13	42
16.	15-50 T. crane	9	13	4	2	4	21	53

The yearwise requirement shown above has taken care of the time required for erection and commissioning.

Coal Handling Plants

6.5.1 CHPs have been identified where the quantity of coal to be handled per year justifies the investment on a CHP. For such investment the minimum quantity to be handled is in the region of .4 to .5 mt/year or so.

The approximate saving per tonne on account of having a CHP as compared to manual operation is in the region of Rs 2.50 to Rs 3.50 per tonne. Apart from saving, another object of CHP is to ensure that the wagons are loaded within a permissible time allowed by railway authorities.

In large capacity CHP like that of Jayant, wagon loading arrangement involves sophisticated technology for which design expertise from foreign countries may have to be obtained.

Mini CHPs

6.5.2 For small projects where heavy investment for a CHP is difficult to justify, mini CHPs are envisaged. These are generally for projects whose rated output is in the region of 0.2 mt/year ± 0.15. Such mini CHPs involve only simple mechanisation comprising generally of a tippler, elevating conveyor, single deck screen if required and hoppers for loading of either wagons or trucks. The number of CHP and mini CHP have been identified. For the first 3 years the fulfledged CHPs and mini CHPs are identified in the basis of project reports already approved or under processing for approval or under preparation. For the balance period the number of CHPs and mini CHPs have been indentified on the basis of coal production. The anticipated requirement of CHP equipments have been indicated in Table 6.3. The requirement of mini CHPs and CHPs is indicated in Tables 6.4.

TABLE 6.3

Anticipated Requirement of Coal Handling Plant Equipment for Coal India Limited from 1978-79 to 1987-88

Sl. No.	Equipment	1978-79 Nos.	1979-80 Nos.	1980-81 Nos.	1981-82 Nos.	1982-83 Nos.	1983-88 Nos.	Total Nos.
1	2	3	4	5	6	7	8	9
1.	Crusher of different size & capacity	4	18	20	16	2	34	94
2.	Reciprocating feeder of different size and capacity	200	259	264	187	142	490	1542
3.	Vibrating screen of different size and capacity	36	51	51	32	17	74	261
4.	Conveyors of different width and capacity	11 KM	14 KM	22 KM	12 KM	8 KM	29 KM	96 KM
5.	Belting of different width & type	23.5 KM	30 KM	47.5 KM	26 KM	17 KM	62 KM	206 KM
6.	Wagon hauler of different size and capacity	11	18	21	11	9	27	97
7.	Rotary breaker of different size and capacity	—	—	1	1	—	—	2
8.	Feeder breaker, skid mounted	1	—	5	3	2	—	11

1	2	3	4	5	6	7	8	9
9.	Rock breaker, pedestal mounted	1	3	—	2	2	5	13
10.	Coal sampler, automatic	1	8	5	11	16	11	52
11.	Scraper bucket hauler of different capacity	—	—	1	2	4	1	8
12.	Motorised tipplers for coal tub/mine cars	10	3	7	10	10	6	46
13.	Sump pump of different capacity for use in bunker tunnels	12	29	17	34	16	22	130
14.	Loading chute, two way motorised	26	22	27	16	4	25	120
15.	Belt weighers	—	2	4	1	2	2	11
16.	Dust suppression/extraction units	8	24	22	11	9	26	100
17.	Front end loader	—	6	6	3	3	6	24
18.	Coal dozer	—	—	—	6	—	6	12
19.	Gravity tippler	28	—	—	—	—	—	28
	ELECTRICALS							
20.	Unitised sub-stations of different capacity with all necessary protection	10	13	18	12	11	17	81
21.	Motor control centre with all necessary protection	10	16	28	14	12	35	115
22.	Control desk	9	14	25	12	12	33	105
23.	Transformers of different capacity	6	6	27	11	1	26	77
24.	Air break switches	16	16	21	12	21	16	102
25.	Power cable of different sizes	19 KM	40 KM	39 KM	29 KM	23 KM	43 KM	193 KM
26.	Control cable of different sizes	17 KM	27 KM	32 KM	27 KM	41 KM	58 KM	202 KM
27.	Lighting cables of different sizes	14 KM	28 KM	26 KM	19 KM	19 KM	45 KM	151 KM
28.	Lightening arrestors	39	54	55	35	45	71	299
29.	Communication equipment set	9	9	16	12	14	22	82
30.	Contactor panels for cross country transport	—	—	20	4	—	28	52
31.	Power factor connectors of different rating	—	2	32	10	1	40	85
32.	Switch board, HT – 250MVA	—	—	2	—	—	4	6
33.	Illumination unit with light fittings	50	400	3000	1000	200	4000	8600
34.	ACSR conductor 'Mink' to 'DOG'	1 KM	40 KM	10 KM	10 KM	—	50 KM	110 KM
35.	Isolators of different ratings	4	10	5	5	—	15	29

TABLE 6.4

Anticipated Requirement of Coal Handling Plants (CHP) Mini CHP in Coal India Limited from 1978-79 to 1987-88

(Capital in Rupees Thousand)

Coal Company	1978-79			1979-80			1980-81			1981-82			1982-83			1983-87		
	CHP	Mini CHP	Capital Outlay	CHP	Mini CHP	Capital Outlay	CHP	Mini CHP	Capital Outlay	CHP	Mini CHP	Capital Outlay	CHP	Mini CHP	Capital Outlay	CHP	Mini CHP	Capital Outlay
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CCL	1	10	13000	2	5	18100	10	5	216300	6	5	60000	1	5	22000	6	—	120000
WCL	2	—	20145	4	2	39000	2	4	19300	2	3	33900	15	—	192580	13	—	104000
BCCL	3	4	25000	2	4	18000	—	3	3000	—	2	2000	1	3	10000	3	12	42000
ECL (including NECL)	2	9	45000	8	13	136000	8	—	160000	—	—	—	2	—	40000	20	10	420000
Total for CIL	8	23	103145	16	24	211100	19	12	398600	8	10	95900	19	8	264580	42	23	686000

Note : 1. Numbers against CHP/Mini CHP indicate the CHPs/Mini CHPs likely to be commissioned in the particular year.

2. Capital outlay indicates total expected expenditure of CHPs/Mini CHPs. However, this capital will have to be proportionately phased in preceeding years and in some cases also in the succeeding years as per construction programme.

Workshops

6.6 The high level of mechanisation both for underground and opencast mines will call for adequate workshop support. For this purpose a 3 tier workshop organisation consisting of unit workshops, regional workshops and central workshops is proposed. The Nos. of workshops required has been indicated in Table 6.5. While the unit workshops will cater to the need of repair and maintenance of equipment at the unit colliery level, the regional and central workshops will be utilised for overhauling and repair of major equipment and manufacture of such spare parts as are not available from ancilliary sector.

TABLE 6.5

Consolidated Statement of Workshops & Their Capital Outlay for Coal India Limited from 1978-79 to 1987-88

Name of Company	Category	No. of Workshops							Capital out-lay in Rs lakhs
		1978-79	1979-80	1980-81	1981-82	1982-83	1983-88	Total	
ECL	Unit	4	4	6	5	5	—	24	300
	Regional	1	1	1	1	1	—	5	400
	Central	—	—	—	—	—	—	—	—
BCCL	Unit	24	—	—	—	—	—	24	360
	Regional	2	2	2	2	—	—	8	640
	Central	—	1	—	—	—	—	1	600
CCL	Unit	16	—	—	4	2	5	27	417
	Regional	3	4	—	—	—	—	7	490
	Central	—	1	—	—	—	—	1	1750
WCL	Unit	5	4	2	—	—	15	26	286
	Regional	5	—	1	—	—	5	11	880
	Central	—	—	—	1	—	1	2	1800

Choice of Equipment

6.7 The assessment of plant & machinery is not only dependant on the degree of mechanisation but also on the "total system concept" considered while selecting a particular system of mechanisation. The choice of equipment should therefore, take into consideration the following factors :

(a) Matching in duty & charecteristics with other equipment working in a given system of mine mechanisation.

(b) Its realiability & maintainability to achieve maximum output.

(c) Inter changeability of spare parts and their adequate availability from indigenous source.

(d) Compatibility of design to suit our working conditions, geo-technical parameters and meeting safety standards.

(e) Indigenous availability as far as possible or development of indegineous spares for imported equipment and facility for its indigenous manufacture in due course.

Planned Maintenance

6.8 The major factors in achieving good performance of the maintenance functions will primarily depend on a well organised maintenance facility which includes the following basic elements :

(i) Maintenance organisation.

(ii) Planning and scheduling.

(iii) Maintenance materials.

(iv) Import substitution.

(v) Maintenance records.

(vi) Inspection.

(vii) Analysis of break-downs.

(viii) Quality of workmanship.

(ix) Liaison with equipment manufacturers.

(x) Workshops facility and reclamation of old spares.

(xi) Budgeting.

(xii) Good-house-keeping and safety.

Adequate Availability of Spares

6.9 To ensure timely availability of spare parts for imported equipment it is necessary that the suppliers/manufacturers should be asked spares for atleast two years along with the machines. For indigenous equipment, manufacturers should keep sufficient stock of spares with them so that the timely availability can be ensured.

Though indigenisation of equipment has taken very large strides in the recent years and much more progress is expected within the next 10 years, the indigenous manufacturers have not geared up their capacity to supply desired quality and quantity of spare parts in the given time. For the indigenous development of imported spare parts there should be a proper indigenous wing in each of the Company which will keep liaison with indigenous manufacturers and give them the sample, drawings and technical know-how so that the standard quality of spares can be developed.

Chapter 7

Mining Electronics & Telecommunication

Introduction

7.0 An Experts panel on mining electronics and telecommunications was constituted for the first time by the Electronics Commission, in June, 1976 to explore the scope of introduction of electronics in the Indian mining industry with the twin objectives of safety and productivity.

7.0.1 The panel identified the following broad application areas and submitted its report to the Electronics Commission in March, 1977.

(a) Mine safety & instrumentation.

(b) Control & industrial electronics.

(c) Communications & telecontrol.

(d) Computerisation.

7.0.2 The panel report was approved by the Electronics Commission in June. 1977.

Followup actions to Panel Recommendations are as follows :

Standing Implementation Committee

7.0.3 In order to oversee implementation of the panel recommendations, an Implementation Advisory Committee has been setup to provide broad policy directions to a Planning & System Engineering Cell (PSEC), for initiation of electronics in the mining sector in co-ordination with the users, manufacturers, research laboratories and educational institutions.

Planning & System Engineering Cell

7.0.4 The PSEC has been proposed to be set up at Ranchi as an integral part of the Electronics Wing of CMPDI. The necessary capital budget for the PSEC will be made available by the Electronics Commission, while the revenue expenditure is to be shared by both the coal and non-coal sectors of the public sector undertaking companies of the mining industry.

Mines Safety and Instrumentation

Environmental monitoring

7.1.1 The conditions to be monitored are :

(a) Air velocity

(b) Concentration of methane

(c) Concentration of carbon monoxide

Air velocity

7.1.2 The speed of air should be monitored in all districts. Besides continuous monitoring, the supervisory staff should periodically check air ventilation at places, not adequately covered by continuous monitoring.

Methane

7.1.3 In gassy mines methane must be continuously monitored. Routine examination and search for gas should be regularly carried out at such places not covered by continuous monitoring by portable methanometer.

Carbon monoxide

7.1.4 Carbon monoxide should be monitored to detect spontaneous combustion, particularly with mining technique of caving roof. In case of fiery coal mines and those believed to be emitting CO in the seams, monitoring of the gas must be continuous. The instrument must be capable of measuring small concentrations with a high degree of accuracy.

Monitoring of Strata Behaviour

7.2.1 Assessing the conditions of a newly exposed roof in a coal mine under induced stresses will continue to be a nagging question till development of electronic instruments for pre-monitoring of the strata. Mechanical instruments should meanwhile be used for measurement of rock-movement and rock pressure.

7.2.2 A long term study of underground media based on seismic noise for locating focii of possible seismic disturbances needs to be initiated. Techniques based on ultrasonics and infra-red should be investigated for prediction of impending roof falls.

Transport System Monitoring

Haulage rope

7.3.1 The highest priority should go for 'Defectoscope' for electromagnetic monitoring of defects in winder and haulage ropes. At least one 'Defectoscope' for each Area should be provided.

Tubs

7.3.2 Detection and alarm signalling system in the event of run-away tubs should be developed including diversion of the run-away tubs to sand buffers.

Automatic contrivance equipment

7.3.3 Development of a mine winder monitoring and protection system incorporating the following should be developed :

(a) Winding speed monitor.
(b) Cage position indicator.
(c) Overspeed limit protection.
(d) Over-winding limits protection.
(e) Electrical braking of the winder for (c) and (d) above.

Conveyor belt monitoring

7.3.4 In new mechanised mines using belt conveyors, monitoring should be done with a view to stop the conveyor in case of :

(a) Belt slip.
(b) Belt tear.
(c) Belt misalignment.
(d) Rise of belt temperature.
(e) Blocked chute.

Surveillance of Underground Electrical System

7.4 Basically, the following should be available :

(a) Insulation tester.
(b) Electrical lockout protection.
(c) Earth leakage protection.
(d) Earth continuity protection.

Prognosis of Inundation

7.5 Protection by electronic means against prognosis of inundation should be achieved by :

(a) Level measurement of mine sumps.
(b) Monitoring of levels in nearby rivers.
(c) Ranging of water logged barriers.

Grades of Monitoring System

7.6.1 Considering the wide variation in production, target and degree of gassiness, three grades of monitoring systems are envisaged. The system design must have, however, the inherent potential for expanding into multi parameter monitoring with telemetry interface, as and when conditions so dictate.

Grade 'A' monitoring

7.6.2 The system should aim at providing continuous watch over the crucial parameters from a central location, enabling control action to be intimated without delay.

Grade 'B' monitoring

7.6.3 In case of mines with relatively lower level of mechanisation, the basic requirements should be :

(a) Continuous monitoring of methane & air velocity at each working face.
(b) Measurement of water levels in sumps, nearby rivers (in exposed to danger of inundation).

Grade 'C' monitoring

7.6.4 In case of small mines portable methanometers at the minimum scale of one per overman will be needed.

Control and Industrial Electronics

Machinery controls

7.7.1 The control circuits of the face machinery should carry out the following functions :

(a) Pilot core continuity protection of trailing cable.
(b) Protection of the main contactor from voltage fluctuations (particularly from under voltage).
(c) Resistance monitoring of the earth.
(d) Preventing the contactor from reoperation till clearance of fault.
(e) Annunciation of faults.

System automation

7.7.2 System automation which could be introduced in the foreseeable future are :

(a) Remote operation of face machinery.
(b) On-line electronic weighing on conveyor belts.
(c) Automatic counting & weighing of coal tubs.
(d) Sequence control of conveyor belts.
(e) Sequence control of ventilation fans.
(f) Automatic personnel counter.
(g) On-stream coal-ash monitor.
(h) Tramp metal detector.

Tele-communications : Underground Mines

Telephone system

7.8.1 Each mine should have a despatcher exchange which should be also connected by a few tie lines to the surface auto communication system.

Sound powered telephone

7.8.2 Where only a few numbers of mining phones for small ranges are needed, sound powered telephones need be used.

Inter-communication system

7.8.3 The system is required to provide non-exchange voice communication.

(a) In a mine gallery/conveyor run.

(b) Between underground points.

(c) Between selected underground points and the surface.

Radio communication

7.8.4 Guide radio communication by leaky feeder may be planned for large mechanised mines for mobile communications to roving personnel.

Cage communication

7.8.5 Provision of continuous communications between cage winder and personnel in side the cage should be available during emergency or during maintenance operations in the shaft.

Face communications

7.8.6 Face communication and signalling should be available in longwall face.

Trapped miner — Location & communication

7.8.7 Emergency communications through the strata between miners trapped underground and the surface need to be developed for locating the miners with a view to rescue operation.

Haulage signalling

7.8.8 The system should provide multiple stage controls with facility for start, stop with latch in/out facility and position signalling. The above should have a backup of loud hailing communication system.

Shaft signalling system

7.8.9 The system should provide audio visual signalling amongst banksman, onsetters and the engine room operator. In case of manriding, electrical interlock for speed control should be incorporated.

Opencast Mine Communication

Wired connections

7.9.1 Communications within fixed points should be provided by conventional automatic exchanges.

Radio systems

7.9.2 Operational communications are best provided by radio since the working points keep on shifting and the movement of heavy earth moving machinery are likely to damage the network of wired communications.

Key personnel paging communication

7.9.3 Supervisory personnel may carry light weight sets, so as to be in contact with the despatcher control, while being in roving role.

Dumper control communication

7.9.4 In large opencast projects, a separate radio network with selective calling facility may be established for efficient control and utilisation of the fleet of dumpers.

Washery Communications

7.10 Besides normal administrative communications by means of conventional automatic exchange, a washery should need despatcher communication for operational control. The key points and various control locations will have amplified inter-communication facility. The despatcher operator should have the facility to make selective or collective calls to the terminal stations.

Communication for Exploration Teams

7.11.1 The geological drilling camps will need communications for :

(a) Control of drilling site.

(b) Control of siesmic exploration.

Drilling camp

7.11.2 A radio network should be established for each drilling camp with the base stations at the camp headquarter, which in turn, if feasible, will be connected to the nearest static exchange by portable 'Rumphone' type equipment, for access to the trunk system.

Seismic exploration

7.11.3 A number of light weight low-power radio sets with selective calling facility may be used for control of the 'Geo-phone' locations from the seismic control station.

Surface Communications

Scale of communications

7.12.1 The scale of communications as at Table 7.1 between two units at various levels should be provided on a progressive programme subject to constraints of system capabilities and actual engineering.

System profile

7.12.2 Each field unit/zone will have a private automatic exchange which will have interface for at least two links with the despatcher exchange so that underground communications can be integrated with the surface communications. A private automatic exchange will be installed at each administrative headquarter. These will be interlinked by means of automatic electronic switching unit for through dialling.

TABLE 7.1

Scale of Communication

From	To	Voice	G/Telex	Facsimele	Data	Remarks
Colliery	Sub-area/Area	2	—	—	—	—
Sub-area/Area HQ	Area HQ	2	1	—	—	—
Area HQ	Company HQ	4	1	1	1	—
Company HQ	CIL HQ	@	1*	1	1	@ Speech — By Tk. Calls through public network. * Tg — By telex or telegram through public network.
Company HQ	Sales Office	@	1*	—	1	@ Speech — By Tk calls through public network. * Tg — Sales Office to have telex also.
CIL HQ	Regional Office	@	1*	—	1	@ Speech — By Tk calls through public network. * Regional Office should have also telex system.
Washery HQ	Company	1	—	—	1	—
CE Washery. Coy	Washery	1	—	—	—	—
Compay HQ	Central Stores/ Workshops	1	1	—	1	—
CMPDI	Regional Institute	@	1*	—	—	@ Speech — By Tk calls through public network. * Through telex system.

7.12.3 A typical surface communication network for a company is shown in Diagram 7.1. Mines or collieries which can not be connected to the parent exchange directly through land lines should be connected small capacity duplex radio equipment, like Ruraphone. Links between the electronic line-of-light duplex system.

Security communication

7.12.4 A separate VHF net may be established for the purpose of security surveillance. The equipment should be of mobile type and have selective calling and/or patching interface unit for remote operation.

Flood warning radio network

7.12.5 A flood warning network should be installed during the monsoon months in each area, exposed to dangers from flood or inundation.

P & T backup communication

7.12.6 Backup communication at all levels should be arranged from the P&T for access to public communication grid.

Mining Electronics and Tele-communications

Reserch and development projects

7.13 The R & D projects listed at Appendix - A should be initiated.

Requirements of Major Mining Electronics and Tele-communication Systems

7.14 The approximate demand for mining electronics and tele-communication systems, envisaged at this stage are listed at Appendix - B.

Mis and Computerisation

7.15 The following 5 major areas were identified by experts panel for application of computer in various stages of mining process :

(a) **Pre-project formulation stage**

Mineral Exploration.
Mineral property appraisal and investment decision.

(b) **Project formulation and appraisal stage**

Mining economics.
Long range planning & production from several deposits.
System planning for underground mines.
Planning of open pit mines.
Mining system simulation.
Underground ventilation network.
Modular design from mine planning.

(c) **Project management**

Project control system.
Financial control system.
Budgetary control system.
Production control system..
Inventory control system.
Personnel control system.
Sales control system.

(d) **Special areas**

Safety management.
Maintenance management.
Despatch cost optimisation.
Sand transportation.
Optimisation of loading and seighing facility.

DIAGRAM 7.1

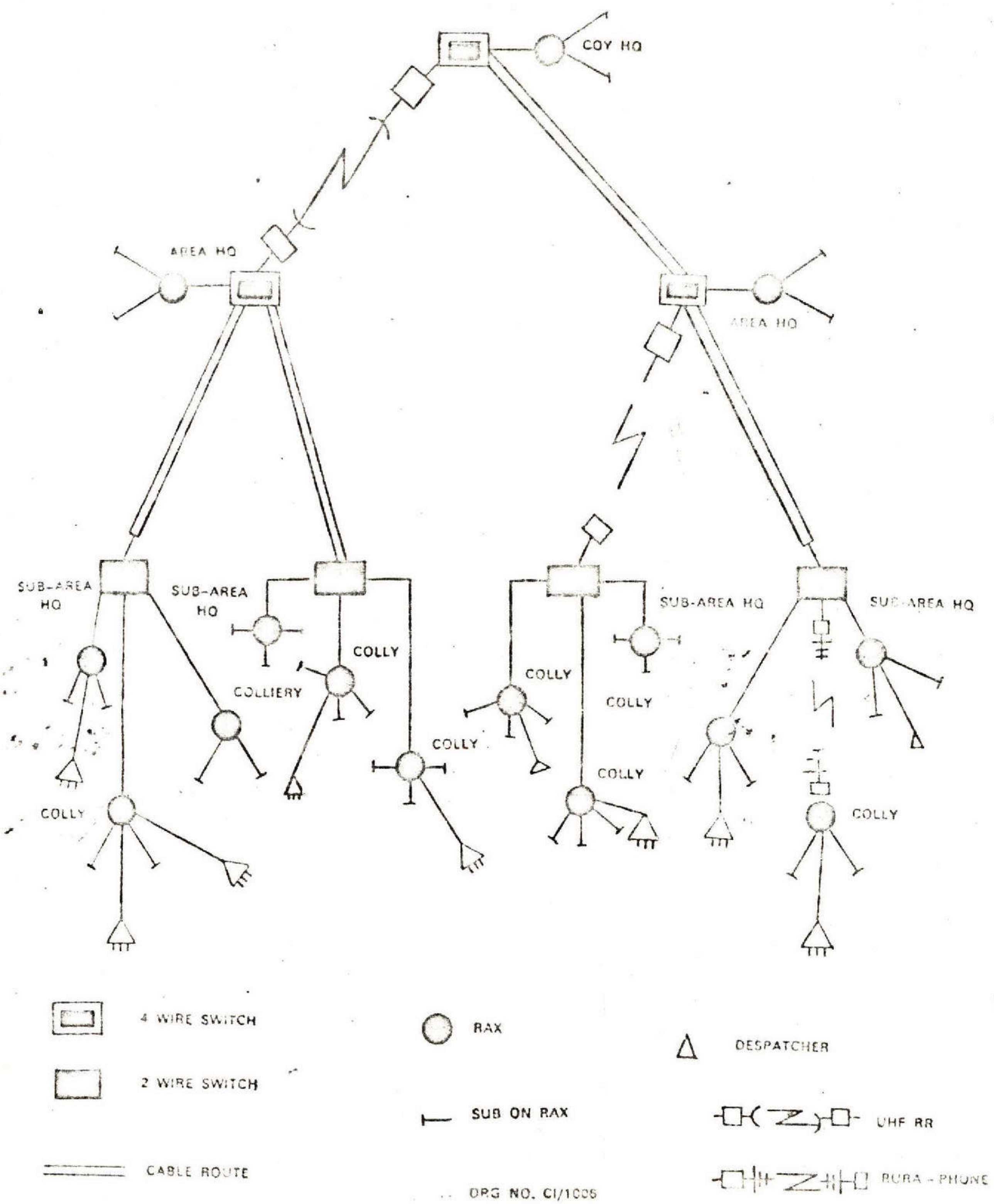
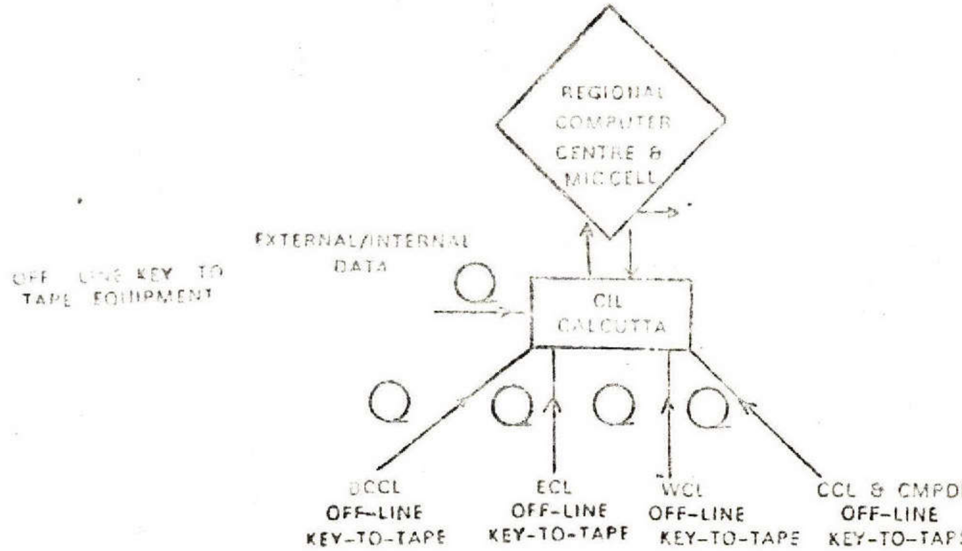

COY HQ
AREA HQ
AREA HQ
SUB-AREA HQ
SUB-AREA HQ
SUB-AREA HQ
SUB-AREA HQ
COLLY
COLLIERY
COLLY
COLLY
COLLY
COLLY
COLLY
COLLY
COLLY
4 WIRE SWITCH
2 WIRE SWITCH
CABLE ROUTE
RAX
SUB ON RAX
DESPATCHER
UHF RR
RURA - PHONE
DRG NO. CI/1005

DIAGRAM 7.2

CIL MIS NET WORK
(STAGE-1)



CIL MIS NET WORK
(STAGE - 2)

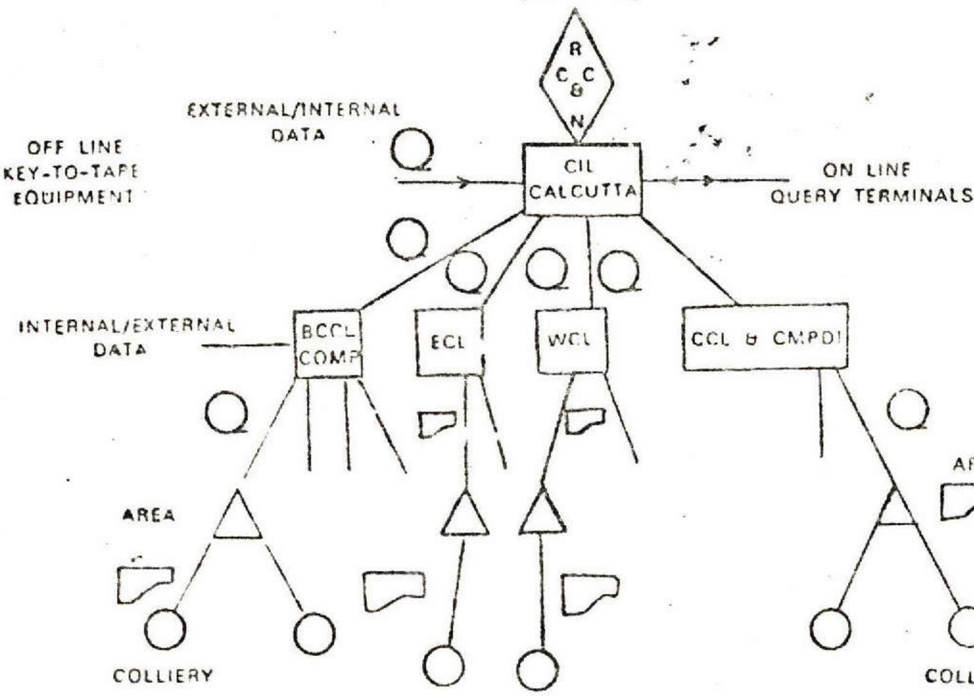
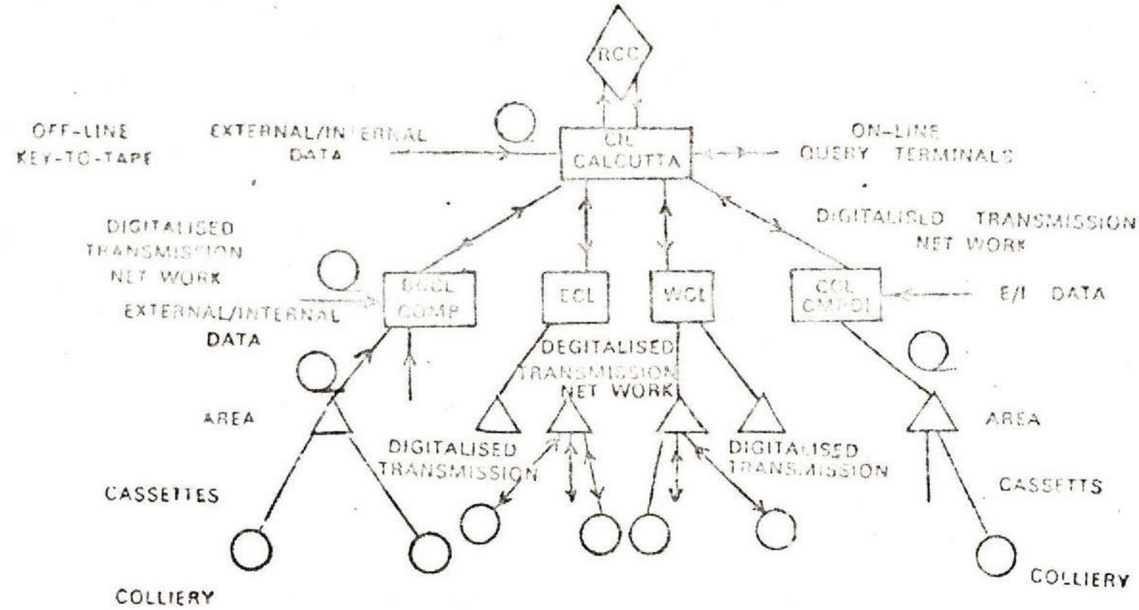


DIAGRAM 7.3

DIAGRAM 7.4

CIL
MIS NET WORK
(STAGE-3)



CIL
MIS NET WORK
(STAGE-4)

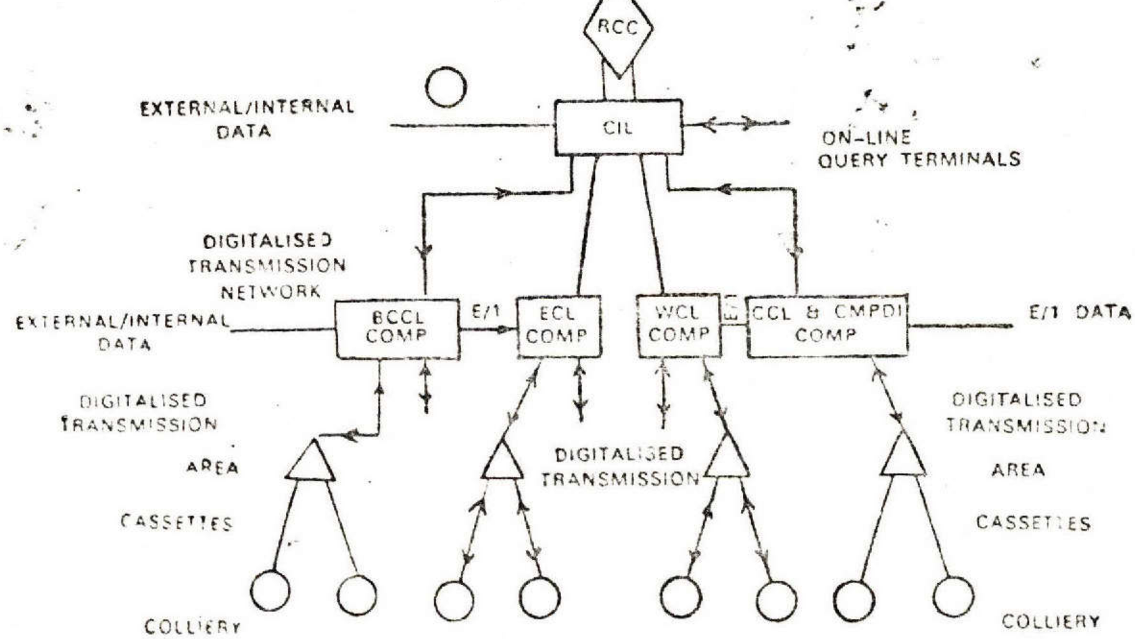


DIAGRAM 7.5

7.16.1 The experts panel has recommended four phased development of computerised system leading to an Integrated Management Information System, which are schematically shown in Diagram 7.2 to 7.5.

7.16.2 Stage I : comprises recruitment of computer specialists, orientation programme for computer specialists at collieries, orientation of coal personnel towards computer, data preparation organisation including equipment, development of corporate MIS at CIL, Calcutta, installation of computer facility at Calcutta, starting of work on MIS at company headquarter.

7.16.3 Stage II : entails repeat of the above steps for the subsidiary companies, establishment of computer at BCCL, characterisation of data collection procedures at colliery level, development of MIS for BCCL, initiation of data communication at ECL and WCL & CMPDI use of BCCL computer centre.

7.16.4 Stage III : entails recruitment and training of computer specialists, computer orientation programme for management at BCCL & CIL, training of personnel, establishment of data communication links between CIL, Calcutta and company headquarters, establishment at CCL & CMPDI computer centre, development of CCL, MIS system, mechanised data preparation at colliery level at BCCL & CCL, terminals from CIL, Calcutta to company headquarters, establishment of ECL, WCL data communication network, institution of BCCL, CCL data communication network.

7.16.5 Stage IV : entails MIS training of management personnel development of ECL & WCL, MIS system with in-house systems, on-line data preparation activities at ECL & WCL at all levels, off-line data preparation at colliery level in BCCL & CCL, on-line data transmission facilities from area to company headquarters at BCCL & CCL.

APPENDIX A

Mining Electronic Research and Development Projects

Sl. No.	Short title of the project	Brief application	Priority	status of development
1	2	3	4	5
1.	Sound powered despatcher Communication system	Despatcher communication in UG mines, with voice amplification facility in the surface exchange	I	Already developed and under production.
2.	Battery powered telephone communication system	Despatcher communication in large underground mines.	I	Prototype expected from Indian telephone industries, Bangalore, for trials in September, 1978.
3.	Sound powered point to point communication	Non-exchange point to point communication in small UG mines without voice amplification	I	Prototype under trails.
4.	Battery powered loud, hailers for UG mines.	Common bus party line communication on point to point basis.	I	Development in progress in ITI. Prototype expected in June, 1978.
5.	VHF intrinsically safe duplex Trans-receivers & leaky feeder system	Mobile radio communication in UG mines & radio paging	I I	Project planned to be intiated in 1978-79.

1	2	3	4	5
6.	Inductive type cage (shaft) communication	Continuous communication between cage & winding engine room	II	
7.	VLF/ELF communications through the-strata	Emergency communications with trapped miners	I	Project planned to be initiated in 1978-79.
8.	2 Wire/4 wire automatic switching unit	Direct dialling in tandem or selective discrimination in the surface communication network comprising SAX/RAX's	I	Being developed in ITI, Bangalore. Prototype expected by end 1978.
9.	Telemetry/telecontrol system for environmental and production monitoring	Real time transmission and collection of safety production data in large mechanised and/or gassy mines	I	Project planned to be initiated in 1978-79.
10.	Long wall face communications and control system	Intra-face crew communications and emergency stop control with pre-start signalling of the AFC	II	Project planned to be initiated in 1978-79.
11.	Loud speaking inter-communication system	Inter-communication with Signalling & Supervisory facility for washeries and CHP's	II	
12.	Radio wire integration unit	To link up any auto/CB/magneto subscriber with the VHF radio net in opencast mines	II	
13.	Shaft signalling system	Electronic signalling & visual display of status and instructions in respect of cage movement amongst winding operator, banksman and on-setters	II	Under development at ISM, Dhanbad.
14.	Roof fall detector (Portable)	To predict roof-fall either by IR or ultrasonic based devices	II	
15.	Defects scope	Checking of haulage and winder wire rope for broken strands and wear	I	In progress in ISM, Dhanbad.
16.	Safe meggar	Testing of cable insulation in underground mines	I	Nearing completion in BIT, Mesra.

1	2	3	4	5
17.	Remote flood level indicator	Indication of river water level from remote unmanned sensing points and radio telemetering the data to a central station for logging	I	Under development expected to be completed by 1978.
18.	Automatic contrivance equipment .	(a) Monitoring of cage speed and depth (b) Tripping of power supply in the event of over-speeding and over-winding (c) Electrical braking of the winder motor in case of overwinding	I	Projects planned to be initiated in 1978-79.
19.	Run-way coal tub warning system	To detect speed of run-way coal tub beyond 5 m/s and initiate alarm	I	Under development.
20.	Coal barrier thickness monitor	To measure thickness of coal face from water logged abandoned mine workings by VHF radar techniques	I	Project planned to be initiated in 1978-79.
21.	Goaf temperature monitoring system	To monitor rise in goaf temp. due to spontaneous heating of coal	I	Developed prototype under trails.
22.	Conveyor belt monitor	To stop the belt in case of (a) Belt slip (b) Belt tear (c) Belt misalignment (d) Rise of belt temp. (e) Blocked sohute (f) Detection of smoke	II	
23.	Automatic cage lockout	To ensure that winding motor will not start till screen door is replaced	III	
24.	Bearing temperature sensor	To provide early warning about insufficient lubrication of bearing of motor and trip power supply	II	
25.	Infra-red distantometer	To determine accurately distance in mine survey by infra-red device	III	—
26.	Laser beam alignment device	To align accurately drivages and ascertain the verticality of sunken shafts	III	—

1	2	3	4	5
27.	Ash monitor	On-stream monitoring of ash content in coal	I	Project planned to be initiated in 1978-79.
28.	Coal tub automatic identification, weigher and counting	Electronic weighing, counting of loaded coal tubs and totalising the data with display and recording. Project includes digital identification of tubs as well	I	Under development.
29.	Pipe-wall thickness monitor	To determine thickness of stowage pipes in order to avoid failure by ultra-sonic technique	II	—
30.	Thyristor control of slipring induction motors	To replace grid-resistance type of control thyristor device for speed control of induction motors	II	Investigative work on various principles are in progress in I.I.Sc, Bangalore, Calcutta University and BIT, Mesra.
31.	Thyristor control of DC motor	To replace existing resistance control of DC motor speed by thyristor devices	II	—
32.	Static power switch	To replace electro-mechanical power switches by solid-state devices	II	Under development in ISM, Dhanbad.
33.	Thyristor controlled chopper driven battery locomotives	Speed/torque control of battery operated DC motors through inverter/chopper control	II	—
34.	Thyristor controlled diesel electric locomotives	Speed/torque control of diesel-electric locomotives by thyristor devices	II	—
35.	Line drop indicator	To determine drop in voltage along the track in DC trolley type locomotives	II	—
36.	400 Hz handheld coal drill	Investigation on possible reduction of size and weight of drill using a 400 Hz motor powered from 50/400 Hz solid state converter	III	—
37.	Solid-state sequence control of (a) Ventilation fans (b) Conveyor belts	To replace electro-mechanical relays in the sequence control systems by solid state devices	III	—
38.	Metal flaw detector	To detect flaw in structural members of heavy machinery by ultrasonic device	III	—

APPENDIX B

Requirement of Major Mining Electronics Equipment

Sl. No.	Equipment	Application	Likely Demand 1978-81	Likely Demand 1981-88	Availability Prospects	Remarks
1	2	3	4	5	6	7
1.	Central despatcher system (I S)	Communication in underground mines	90	300	Indigenous production	(i) Sound powered system already under production. (ii) Battery powered system under development.
2.	Point to point wired communication system (I S)	Non-exchange communications in U G mines	70	200	Indingenous production	Under development.
3.	Continuous access guided communication system	Mobile radio communication in large/mechanised mines	XX	120	Indigenous production	Development project under initiation
4.	Cage communication system	Continuous communication between cage and winding engine operator	XX	100	Indigenous development	XX
5.	Longwall face communication & signalling system	Inter-phase crew communication & emergency stop control of AFC with pre-start signalling	24	80	Indigenous production	Development under progress.
6.	Shaft signalling system	Electronic signalling & audio-visual display of status & instructions on cage movement amongst winding engine operator, banksman & onesetters	XX	80	Indigenous development	-do-
7.	Haulage control & communication system	Emergency stoppage with pre-start alarm & communication along haulage road way	XX	100	Indigenous development	
8.	Conveyor control & monitoring system	Local & remote control of conveyor system including emergency stoppage & communication along conveyor runs	XX	150	Indigenous development	

1	2	3	4	5	6	7
9.	Inductive communication system	Mobile personnel & loco-communication in UG mines	XX	70	-do-	
10.	Emergency communication through strata	Locating and communication with trapped miners from the surface	XX	50	-do-	Project being initiated in '78-79.
11.	VHF selective calling system	Operational and administrative communications with mobile and semi-static stations in opencast mines	900	1000	-do-	Available off shelf.
12.	VHF paging system	Paging of key personnel in OC mining area	125	125	-do-	-do-
13.	PA system	Broadcast of important messages and instructions in OC mines, CHPs etc.	50	30	-do-	-do-
14.	Tele-briefing system	Public address system for playing pre-recorded instructions during shift change over	200	300	-do-	-do-
15.	Local automatic exchange (SAX/RAX)	Surface communication for colliery and administrative units at all levels	100	200	-do-	-do-
16.	Trunk switching unit	Inter and intra area automatic dialling	15	25	-do-	Under development.
17.	VHF net radio with selective calling	Mobile security communication	200	300	-do-	Available off the shelf.
18.	VHF Ruraphone system	Emergency radio communication providing direct dialling of PAX accross difficult terrain	16	50	-do-	-do-
19.	Radio remote control unit	Intergretation of VHF net radio with surface PAX	20	30	-do-	-do-
20.	Close circuit televesion	Remote visual monitoring and control communication in collieries / CHP / Workshops etc.	4	20	-do-	-do-

1	2	3	4	5	6	7
21.	UHF radio relay with ADM channelling equipment	Inter-area trunk multi channel radio communications	7	20	Indegenous development	Under development
22.	Facsimile system ·	Transmission of formatted data, documents, drawings, sketches etc. over voice communication channel	XX	80	Indigenous production	Under development.
23.	Telemetry/telecontrol system for environmental and production monitoring in UG mines	Real time transmission and analysis of safety and production data in large mechanised/actively gassy mines	21	XX	Import/ indegenous development	Telemetering system under development.
24.	Single point methane monitoring system	Monitoring methane in Degree-III gassy mines	117	XX	–do–	
25.	Portable methanometers	Spot monitoring of methane at discreet point	855	2100	–do–	
26.	Portable composite gas meter	Spot monitoring of Co/ Co_2/O_2	100	200	do–	
27.	High percentage methane drainage monitor (0 to 100%v)	For use in main return and for degassification projects	50	XX	–do–	
28.	Continuous methane monitor (0 — 5%)	Cyclic monitoring of methane for use with system at Sl. No. 23 above	400	XX	–do–	
29.	Carbon monoxide analyser 0 – 30 ppm	Multi point cyclic monitoring of carbon monoxide for use with system at Sl. 23 above	50	XX	–do–	
30.	Air velocity monitor	Cyclic monitoring of ventilation air velocity for use with system at Sl. 23 above	200	XX	–do–	
31.	Portable roof fall detector	To assess the roof condition in underground mines.	XX	700	–do–	
32.	Defectoscope	Non-destructive inspection of haulage mine winder and guide wire ropes for broken strands/wear	100	300	Indigenous development	Under development.
33.	Intrinsically safe megger	Testing of insulation/continuity of power cable in underground mines	200	500	–do–	

1	2	3	4	5	6	7
34.	Cable fault locator	To localise earth fault and interphase faults in power cables	200	500	Indigenous development	Under development
35.	Telemetry based remote flood level monitoring system	Radio telemetry of river level from remote unmanned sensing stations	1	XX	-do-	Project under development
36.	Automatic contrivence equipment	Monitoring of cage speed & depth with protection against over-winding and over speeding	XX	80	-do-	Project under initiation
37.	Run-away coal tub warning and protection system	To detect run-away condition and initiate alarm and protection system	30	70	-do-	Under development.
38.	Coal barrier thickness monitor	To determine barrier thickness from water logged zones	XX	40	-do-	Project under initiation
39.	Goaf temperature monitoring system	Remote measurement of temperature in goaf and coal dumps	50	450	-do-	Developed.
40.	Coal ash monitor	On stream monitoring of coal ash percentage by 'Nucleonie' device	10	100	Import/ indigenous development	Project under initiation
41.	Coal tub automatic identification, weighing & counting system	Production monitoring for UG mines	10	150	Indigenous development	Under development.
42.	Pipe wall thickness monitor	To determine the thickness of pipes and stowing range and washeries before failure	XX	50	Import/ indigenous development	-do-
43.	Line drop indicator	Continuously monitoring of the drop in voltage along the loco track in underground mines	XX	50	-do-	-do-
44.	Belt weighing system	Continuous weighing and totalising of coal in feeder conveyor belt and associate control system	30	120	Indigenous production	Available off shelf.
45.	Electronic wagon weigh bridge	Weighting loaded wagons at colliery sidings/RLBs of washeries	5	30	-do-	-do-

Chapter 8

Power Supply

Introduction

8.0 Electrical energy is one of the basic inputs for coal production for almost all the mines of CIL except for a few older mines where steam winders and winches are still employed in the process of coal production. The electrical energy is being supplied by State Electricity Boards and other power generating companies as shown in Table 8.3.

After nationalisation of coking & non-coking coal mines in recent past the need for reorganisation of mines as well as its power supply system was felt necessary and the efforts are being made in this direction.

The specific energy consumption per tonne of coal will rise sharply for next few years partly due to abandonment of old equipment powered by energy other than electricity and partly due to increased level of mechanisation & pumping to be employed for increased coal production to meet the growing demand of the country and same will become reasonably stabilised thereafter.

Status of Power Supply & Need for Re-organisation

8.1 Nearly 65% of coal production comes from the mines situated in the states of Bihar & West Bengal and controlled by ECL, BCCL & CCL. The accute power shortage and frequent interruption of power supply in these regions affects the coal production considerably and also endanger the safety.

8.2 With the committed increase in productivity and greater role assigned to Coal India for meeting the demands of coal, the basic energy source of the country, the problem of power supply has to be solved within foreseable future by re-organising and rationalising the power supply system to mines by the supply agencies as well as by CIL.

8.3 At present multi-point and multi-voltage supply exist in mines which is higly uneconomical. The study conducted in various coalfields shows that the distribution losses can be brought down from level of 10% to 4% by proper selection of load centre, sub-transmission and distribution voltages and distribution line constants. It also indicates that the investment made in re-organisation will be paid back within a short period by way of reduced distribution losses and reduced down time.

8.4 Action for economic aspect resulting from high power factor has been realised by the organisation, but the action for improvement of existing power factor could not be taken for all the taken-over mines.

8.5 Functionwise metering arrangement does not exist in mines which is essential for efficient and economic use of electrical energy. Hence energy/power consumption for each function such as CHP, pumping, ventilation, Colony, washery and production etc. should be recorded. This will be helpful in evaluating norms and standards for future power planning, for individual mines.

TABLE 8.1

Salient Feature of Existing Supply Arrangements

Sl. No.	Particulars	ECL	BCCL	CCL	WCL	CIL
1.	No. of Mines	112+5	92	56	73	338
2.	No. of supply Agencies	5	3	5	3	10
3.	No. of supply points	237	398	52	72	759
4.	No. of supply voltage	4	5	3	2	6
5.	No. of mines with different voltage of supply	—	6	1	—	7
6.	No. of mines with multi-point supply	—	>50	4	—	>54
7.	Distribution of supply points voltagewise :					
	(a) 33 KV	—	2	9	—	11
	(b) 11 KV	167	182	42	24	415
	(c) 6 KV	—	55	—	—	55
	(d) 3.3 KV	21	8	1	—	30
	(e) 550 V	7	—	—	—	7
	(f) 440 V	42	151	—	48	241
8.	Total installed capacity of main transformers, MVA.	130	163	165.42	120	578.42
9.	No. of types & size of main transformers	>30	>30	84	>20	>84

Trend for Power Demands

8.6 The Coal India's energy consumption is estimated to increase from 1561.39 million KWH in 1978-79 to 3462.18 million KWH. in 1987-88 corresponding to an increase from 15.58 KWH/ tonne to 17.24 KWH/tonne in the specific energy consumption. "The maximum demand is also estimated to increase from 349.59 MW in '78-79 to 822.22 MW in '87-88 corresponding to 3.49 MW/mt/Yr. and 4.10 MW/mt/Yr. respectively in specific maximum demand." This is not only due to increase in production but also is attributable to the major technological transformation in the coal industry and coal beneficiation. The increasing trend vis-a-vis increase in production are shown in Diagram 8.1 and 8.2 which also indicates the phased power & energy requirement of Coal India.

TABLE 8.2

Phased Power Requirement of Coal India upto 1987-88

Sl. No.	Particulars	Unit	Name of the Companies	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7	8	9	10
1.	Total annual production	mt per year	NEC	0.68	0.80	0.85	0.97	1.18	1.57
			ECL	28.31	30.15	32.07	33.74	36.82	45.20
			BCCL	23.00	24.11	25.42	26.52	27.86	40.11
			CCL	23.70	24.58	28.06	32.46	38.07	60.25
			WCL	24.50	26.09	27.99	30.27	33.75	49.64
			CIL	100.19	105.73	114.39	123.96	137.68	200.77

1	2	3	4	5	6	7	8	9	10
2.	Production from opencast mines	mt per year	NEC	0.02	0.03	0.19	0.27	0.33	0.38
			ECL	2.65	3.19	3.95	4.33	5.73	6.14
			BCCL	3.28	3.35	3.92	4.32	5.30	14.08
			CCL	15.92	16.26	18.96	22.36	27.61	49.17
			WCL	4.48	4.95	5.91	7.65	10.15	20.37
			CIL	26.35	27.78	32.93	38.93	49.12	90.14
3.	Energy consumption	Million KWH	NEC	9.00	10.70	11.40	13.00	16.00	20.00
			ECL	376.46	402.50	429.42	453.47	501.12	605.68
			ECCL	586.50	649.00	707.00	767.00	836.00	1233.50
			CCL	262.43	282.37	336.41	406.91	499.49	858.00
			WCL	327.00	348.56	374.00	406.00	463.00	695.00
			CIL	1561.39	1693.13	1853.23	2046.38	2315.61	3462.18
4.	Maximum demand	MW	NEC	2.70	3.30	3.70	4.30	5.00	7.00
			ECL	74.09	79.58	85.17	89.44	99.36	129.22
			BCCL	107.00	121.00	138.00	149.00	159.00	241.00
			CCL	85.80	92.40	109.00	127.49	152.69	263.00
			WCL	80.00	89.00	97.00	109.00	125.00	182.00
			CIL	349.59	385.28	432.87	479.73	541.73	822.22
5.	Specific energy	KWH per tonne	NEC	13.24	13.38	13.41	13.40	13.56	12.74
			ECL	13.30	13.35	13.39	13.44	13.61	13.40
			BCCL	25.05	26.92	27.81	28.92	30.01	32.00
			CCL	11.07	11.49	11.99	12.54	13.12	13.35
			WCL	13.35	13.36	13.36	13.41	13.72	14.00
			CIL	15.58	16.01	16.24	16.51	16.82	17.24
6.	Specific maximum demand	MW/mt per year	NEC	3.97	4.13	4.35	4.43	4.23	4.46
			ECL	2.62	2.64	2.66	2.65	2.70	2.86
			BCCL	4.65	5.02	5.43	5.62	5.71	6.01
			CCL	3.62	3.76	3.88	3.93	4.01	4.09
			WCL	3.27	3.41	3.47	3.60	3.70	3.67
			CIL	3.49	3.64	3.78	3.87	3.93	4.10

Power Sources

8.7 Coal India depends for power supply to various State Electricity Boards & other supply agencies with varied tariffs. However, the choice of supply source can be made to affect economy. The tentative power demand on different supply agencies have been given in Table 8.3.

DIAGRAM 8.1

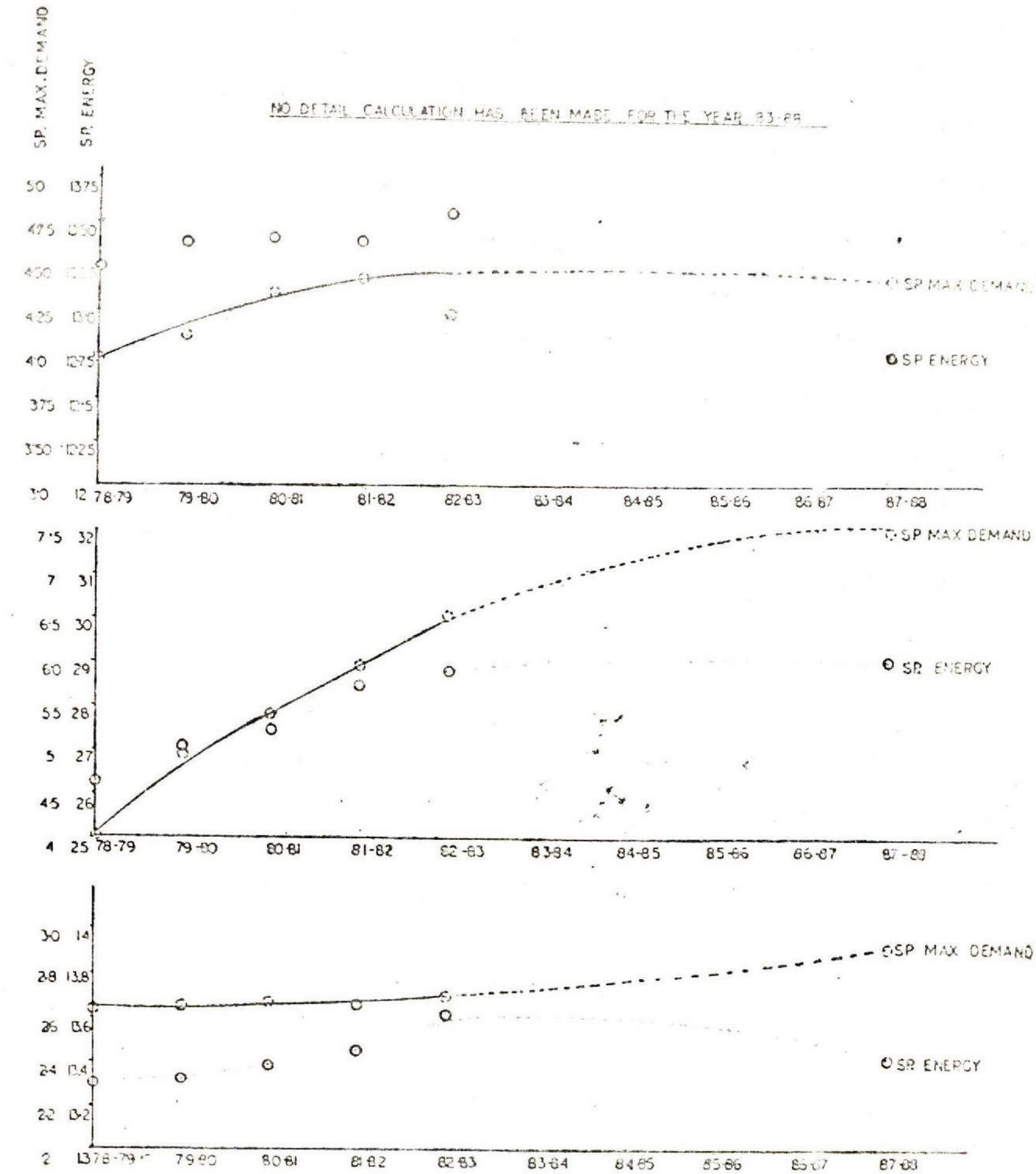

SP. MAX. DEMAND
SP. ENERGY
NO DETAIL CALCULATION HAS BEEN MADE FOR THE YEAR 83-88
78-79
79-80
80-81
81-82
82-83
83-84
84-85
85-86
86-87
87-88
SP MAX DEMAND
SP ENERGY

DIAGRAM 8.1

ANNUAL PRODUCTION MT PER YEAR
MAXIMUM DEMAND IN MW
ENERGY CONSUMPTION MILLION KW HRS

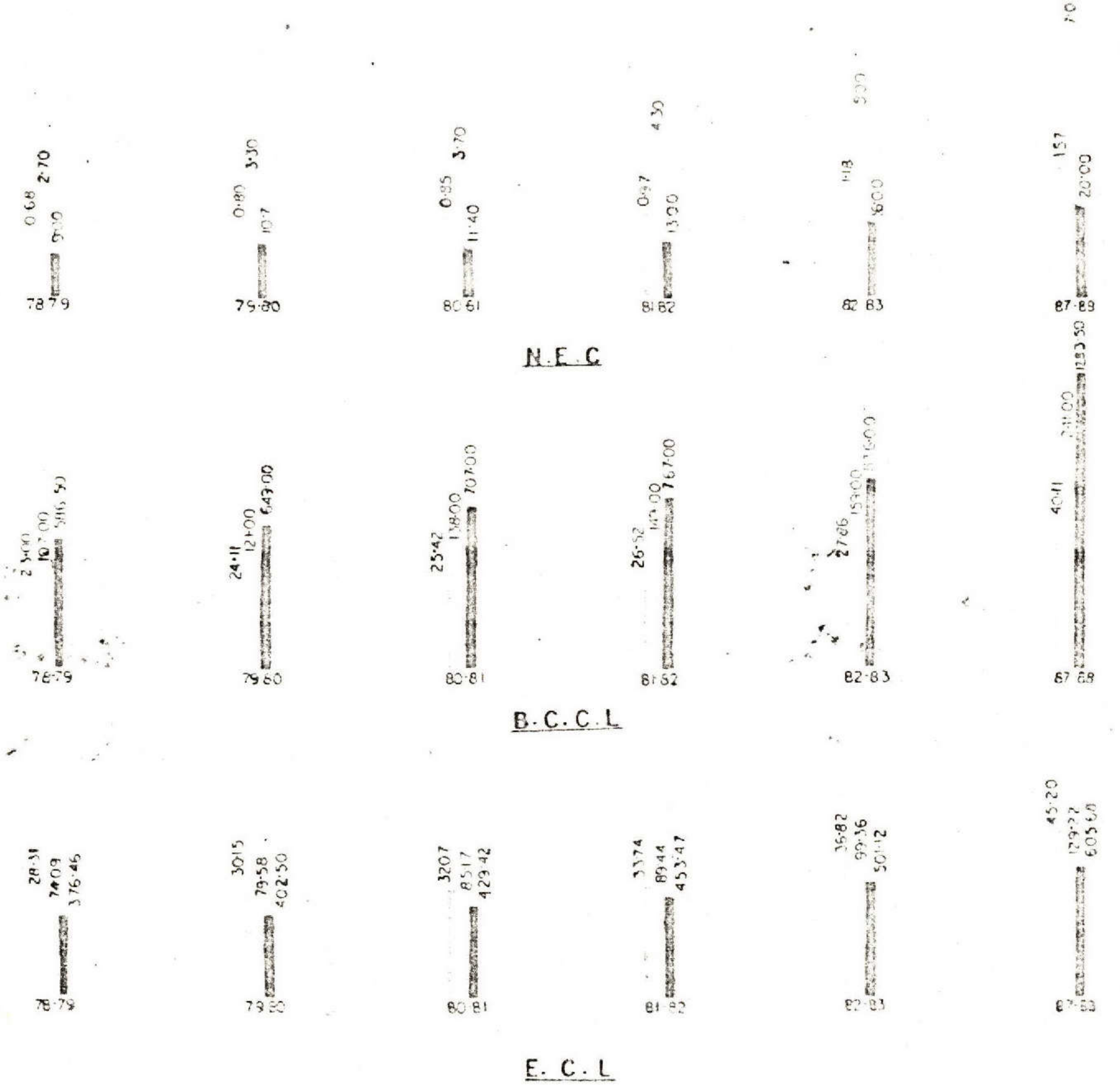


TABLE 8.3

Coal India's Power Demand on Different Supply Agencies upto 1987-88

Sl. No.	Name of the supply agencies	Name of the companies	Total MD in MW by					
			1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7	8	9
1.	Assam State Elec. Board	NEC	2.70	3.30	3.70	4.40	5.00	7.00
2.	West Bengal State Elec. Board/Durgapur Project Ltd.	ECL	14.00	14.00	16.00	17.00	20.00	30.00
		BCCL	2.36	2.36	2.36	2.40	2.45	2.62
		Total	16.36	16.36	18.36	19.40	22.45	32.62
3.	Associated Power Company	ECL	4	4	4	4	4	4
4.	Dishergarh Power Supply Co.	ECL	7	7	7	7	7	7
5.	Damodar Valley Corporation	ECL	44.09	49.58	52.17	55.44	60.36	78.22
		BCCL	16.00	30.00	47.00	61.60	72.00	158.00
		CCL	38.20	41.20	47.70	51.70	52.20	66.90
		Total	98.29	120.78	146.87	168.74	184.56	303.12
6.	Bihar State Elec. Board	ECL	5	5	6	6	8	10
		BCCL	88.64	88.64	88.64	85.00	84.55	80.38
		CCL	35.10	35.70	37.80	40.40	41.70	83.10
		Total	128.74	129.34	132.44	131.40	134.40	173.48
7.	Orissa State Elec. Board	CCL	6.00	7.50	8.50	10.00	20.00	25.00
		WCL	2	2	3	4	5	8
		Total	8	9.50	11.50	14.00	25.00	33.00
8.	Madhya Pradesh Electricity Board	CCL	5	6	10	17.10	28.00	50.00
		WCL	57	62	66	71.00	80.00	122.00
		Total	62	68	76	88.10	108.00	172.00
9.	Maharashtra State Electricity Board	WCL	21	25	28	34	40	52
10.	Uttar Pradesh State Elec. Board	CCL	1.5	2	5	8.29	10.79	38.00

Future Trend

8.8 Certain qualitative changes foreseen are as under :

8.8.1 Study has indicated that most economical voltage for sub-transmission is 6.6 KV.

Besides the study conducted also indicates that the supply to the mine should be at 33 KV (Regional sub-station for group of mines).

8.8.2 With the advent of larger shovels, draglines, winders etc the need for 6 KV motors above 100 KW is foreseen in place of 3.3 KV in bigger mines.

8.8.3 In mechanised longwall face due to concentration of load and use of bigger motors, 1000 volts supply is envisaged for motors above 100 KV.

8.8.4 Establishing of 132 KV sub-station near coalfields for stability of power supply.

8.8.5 Gradually a trend is evolving to have isolated neutral system in place of presently followed earthed neutral system. This needs changes in Indian Electricity Rules and Mines Rules.

8.8.6 Due to low power factor CIL has to pay considerable amount by way of charges levied on additional KVA consumed in mines. Besides it results in loss of electrical energy and higher capital cost, for electrical installations, such as transformers and cables etc. Hence it is envisaged necessary corrective action should be taken to improve the power factor in the mines. It is also envisaged to increase, present load factor of 50-60% to 75-80% to affect economy.

8.8.7 Necessary metering arrangements to record power/energy consumption for CHP, pumping, ventilation, colony, washery and production will be provided to assess the actual requirement and to minimise the loss of energy. This will help in evaluating norms and standards for planning of a mine as well as it will affect the economy of the mine.

8.8.8 Due to in-adequate and frequent interruption of power supply BCCL & ECL are establishing diesel generating stations to cater to the need for ventilation, pumping, men winding and other safety requirements. This provision will be extended to selected mines, specially gassy mines.

8.8.9 At present power generation particularly in Eastern India is far from satisfactory and as such it is envisaged to set up captive thermal power stations, coal grid exclusively to cater the need of power supply to the mines.

Tentative Requirement of Funds

8.9 Requirement of fund is catered in the capital estimate of the different projects. However, in addition to the investment in these projects, the expenditure to be incurred in re-organisation of power supply system, is estimated to be of the order of Rs. 45.1 crores. Break up is given as under.

(Rs in crores)

Companies	ECL	BCCL	WCL	CCL	CIL
Amount	10.10	20.00	5.00	10.00	45.10

Matters to be taken up with related agencies

8.10 Power supply interruption however small may affect the coal production seriously and endanger safety. The interruption is mainly due to the supply at 11KV and 440 V by rural feeders to most of the mines. These feeders have a large No. of other consumers connected to them. Supply agencies should be requested to provide independent feeders for the mines or group of mines.

8.11 As the stability of power supply to mines is linked in addition to production, with safety of men and material, serious thought is to be given to this problem by the concerned supply agencies and Central Electricity Authority. One of the probable solution can be, to have 132 KV 'Coal Grid' to connect the coal mines in contiguous areas. If it is not agreed upon an attempt should be made to provide power to receiving point in the coalfields by 132 KV lines and sub-stations.

8.12 Electric supply agencies and generating units, located in coalfields may be requested to give preference to coal industry over other consumers when there is a short fall in power generation.

8.13 The existing agreement between the supply agencies and the coal companies are one sided by providing penalty clause for not being able to use the energy on the part of the consumer but at the same time it is silent about the interruptions, voltage fluctuations and frequency variations. Efforts should be made to rationalise the agreement for mutual benefits.

8.14 In the areas where groups of mines are near to one another, a single point supply and subsequent distribution by internal transmission lines are envisaged. Supply agency concerned should be persuaded to agree to single point supply on the merits of the individual cases.

Chapter 9

Beneficiation

Introduction

9.0 The need for beneficiation of coal is two-fold. In case of coking coals, the need is technological and coal will have to be beneficiated irrespective of the cost. In case of non-coking coals, the issue is basically one of economics and beneficiation is resorted to mainly to reduce freight charges, ensure consistent quality and at the same time relieve the load on the railway transport system.

Coking Coal

9.1.1 Table 9.1 shows the forecast of total demand for coal as charged to ovens in respect of steel plants, Durgapur Coke Ovens Project and FCI, Sindri. The share of this demand that would have to be borne by Coal India is also indicated.

TABLE 9.1

Forecast of Coal Demand as Charged to Ovens

(In m t)

		1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
Total demand (as charged to ovens)	Prime	10.21	10.10	10.94	11.72	12.64	16.01
	Medium	5.94	5.89	6.49	6.98	7.54	11.22
	Semi-coking	1.43	1.28	1.33	1.36	1.43	1.85
	Total	17.58	17.27	18.76	20.06	21.61	29.08
Share of Coal India	Prime	7.19	6.93	7.65	8.38	9.09	12.42
	Medium	5.09	5.04	5.62	5.92	6.35	9.85
	Semi-coking	1.43	1.28	1.33	1.36	1.43	1.85
	Total	13.71	13.25	14.60	15.66	16.87	24.12

Existing Washery Capacity

9.1.2 Coal India at present operates the following washeries:

(A) Prime coking coal	Capacity (in m t)
1. Lodna	0.40
2. Dugda I	2.40
3. Bhojudih	2.00
4. Patherdih	2.00
5. Dugda II	2.40
	9.20

(B) Medium coking coal

1. Kargali	2.72	
2. Kathara	3.00	
3. Sawang	0.75	
4. Gidi	2.84	(Designed for non-coking coal)
	9.31	

Prime Coking Coal

9.1.3 Table 9.2 shows the demand for prime coking coal (as charged to ovens); the existing availability and the details of washeries proposed to meet the deficit in respect of the demand on Coal India Ltd Phased requirement of capital and other details of the proposed prime coking coal washeries are shown in Table 9.3.

TABLE 9.2

Demand and Availability of Washed Prime Coking Coal

(in m t)

Sl. No.	Items	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7	8
1.	Demand on Coal India	7.19	6.93	7.65	8.30	9.09	12.42
2.	Availability from the existing washeries	5.33	5.48	5.56	5.56	5.65	5.66
3.	Direct feed	1.60	1.21	0.93	0.58	0.88	—
4.	Total availability (2+3)	6.93	6.69	6.49	6.14	6.53	5.66
5.	Deficit (—) Surplus (+) (4—1)	(—)0.26	(—) 0.24	(—) 1.16	(—) 2.16	(—) 2.56	(—) 6.76
	Availability from the Proposed Washeries (BCCL)						
6.	Sudamdih	—	0.67	0.99	1.17	1.17	1.17
7.	Monidih	—	0.38	0.87	1.18	1.18	1.18
.	Barora	—	—	0.12	0.18	0.21	0.21
9.	Pootkee	—	—	—	—	—	1.20
10.	New washery	—	—	—	—	—	1.80
11.	Bulliary	—	—	—	—	—	1.20
12.	Total of 6 to 11	—	1.05	1.98	2.53	2.56	6.76
13.	Net deficit (—) Surplus (+)(5-12)	(—)0.26	(+)0.81	(+) 0.82	(+) 0.37	—	—
14.	Short term steps to meet deficit						
(a)	Additional yield from C C W O Washeries	0.09	—	—	—	—	—
(b)	Raw coal, BCCL	0.17	—	—	—	—	—
15.	Total of short term steps	0.26	—	—	—	—	—
16.	Net deficit (—) Surplus (+) (15+13)	—	(+) 0.81	(+) 0.82	(+) 0.37	—	—

TABLE 9.3

Details of the Proposed Washeries in Prime Coking Coal Sector

Sl. No.	Washery BCCL	Raw coal input capacity (mt/yr)	Type of the plant	Expected yield %		Expected year of commi-ssioning	Capital investment (million Rs.)				Remarks
				Clean	Middling		Total antici-pated	Total during 5th plan	Total during 1978-79 1982-83	Total during 1983-84 to 1987-88	
1.	Barora	0.48	B	50	25	1979-80	30	15	15	—	Type of plant
2.	Sudamdih	2.00	A	70	15	1979-80	330	290	40	—	A. Washery with raw coal input capacity of 1.0 mt/yr & above.
3.	Monidih	2.00	A	70	20	1979-80					
4.	Pootkee	1.80	A	67	16	1984-85	150	—	140	10	
5.	Bulliary	1.80	A	67	16	1984-85	150	—	140	10	B. Washery with annual raw coal input capacity of less than 1.0 mt.
6.	New washeries	2.60	A	70	15	1987-88	200	—	—	200	
	Total (1 to 6)	10.68					860	305	335	220	

TABLE 9.4

Demand and Availability of Washed Medium Coking Coal

(mt/yr)

Sl. No.	Items	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1	2	3	4	5	6	7	8
1.	Demand on Coal India	5.09	5.04	5.62	5.92	6.35	9.85
2.	Availability from the existing washeries of CCL	4.17	4.23	4.79	4.57	4.51	4.35
3.	Direct feed	1.30	0.89	0.25	—	—	0.32
4.	Total availability (2+3)	5.47	5.12	5.04	4.57	4.51	4.67

1	2	3	4	5	6	7	8
5.	Deficit (—1) Surplus (+) (4—1)	(+) 0.38	(+) 0.08	(—) 0.58	(—) 1.35	(—) 1.84	(—) 5.18
	Availability from the proposed washeries						
6.	Ramgarh (CCL)	—	—	—	0.58	1.15	1.65
7.	Nandan (WCL)	—	—	—	0.56	0.56	0.56
8.	Mohuda (BCCL)	—	—	0.40	0.40	0.40	0.40
9.	Junkundar (BCCL)	—	—	0.24	0.24	0.24	0.30
10.	Kedla (CCL)	—	—	—	—	—	1.25
11.	Parej (CCL)	—	—	—	—	—	1.37
12.	Total of 6 to 11	—	—	0.64	1.78	2.35	5.53
13.	Net deficit (—) Surplus (+) (5+12)	(+) 0.38	(+) 0.08	(+) 0.06	(+) 0.43	(+) 0.51	(—) 0.35

TABLE 9.5

Details of the Proposed Washeries in Medium Coking Coal Sector

Sl. No.	Washery	Raw coal input capacity (mt/yr)	Type of plant	Expected yield %		Expected year of commi-ssioning	Capital investment (Million Rs.)				Remarks
				Clean	Middling		Total antici-pated	Total during 5th plan	Total during 1978-79 1982-83	Total during 1983-84 1987-88	
1.	Jhunkundar (BCCL)	0.42	B	73	17	1980-81	20.00	4.00	16.00	—	Type of plant as mentioned in Table 9.3
2.	Mohuda (BCCL)	0.63	B	74	26	1980-81	28.00	8.00	20.00	—	
3.	Ramgarh, (CCL)	3.00	A	60	22	1981-82	257.70	—	257.70	—	
4.	Kedla, (CCL)	2.60	A	50	25	1983-84	253.10	—	200.00	53.10	
5.	Nandan, (WCL)	1.20	A	55	30	1981-82	100.90	—	100.90	—	
6.	Parej (CCL)	3.00	A	50	25	1985-86	300.00	—	50.00	250.00	
	Total (1 to 6)	10.85					959.70	12.00	644.60	303.10	

Medium Coking Coal

9.1.4 Table 9.4 shows the demand for medium coking coal (as charged to ovens), the existing availability and the details of washeries proposed to meet the deficit in respect of the demand on Coal India Ltd. The surplus availability projected would go to meet the deficit of semi-coking coal till 1982-83. Phased requirement of capital and other details of the proposed medium coking coal washeries are shown in Table 9.5.

Semi-Coking Coal

9.1.5 The demand for semi-coking coal till 1982-83 is in excess of the anticipated production/availability of the same. While high ash semi-coking coal is available, it may not be possible to set up plants for beneficiating the same before 1982-83. The deficit, therefore, is proposed to be met by planning for surplus production of medium coking coal till 1982-83.

Beyond 1982-83, beneficiation plant is expected to be in operation at Seetalpur/Sodepur (ECL) and the output from the plant, together with raw coal production would be sufficient to meet the demand. Phasad requirement of capital and other details for this plant are shown in Teble 9.6.

Quality Control

9.1.6 All future coking coal washeries will be three-product washeries yielding clean coal, middlings and rejects. It is planned that washeries will control the operations in such a way that, depending upon their design and raw coal parameters, the ash content in clean coal varies, from 16% to 19% and that in middlings will be maintained at a level of 32 ± 3%. It is also proposed, in view of the increasing proportion of fines in raw coal feed and increasing ash content in the fines, to make provision for upgradation of fines. Suitable provision is proposed to be made to dispose of the increasing percentage of rejects.

Tipong Washery

9.1.7 North Eastern Coalfields produce coal which is prime coking. However, at present, it has not been possible to use them in steel plants because of their high sulphur content. A washery has been proposed at Tipong to beneficiate this coal to decrease its ash content so that the same can be blended with high ash and low sulphur coals and used in steel plant. If this is not feasible, the coal could be exported. Phased requirement of capital and other details for this plant are shown in Table 9.6.

Non-Coking Coal

9.2 Beneficiation is proposed for power coal mainly to save on freight charges (including saving in capacity and operating costs of CHPs/ash handling plants and saving in handling and storage capacity of coal) and to reduce strains on the national transport system. Incidentally, this will also result in supply of consistent quality of coal resulting in increased efficiency of boilers and increased plant life. Beneficiation plants are also proposed for mines meeting the needs of export and the fertiliser plant at Talcher.

The details of the beneficiation plants are shown in Table 9.7.

Central Magnetite Plant

9.3 The existing washeries and proposed new washeries will be consuming a considerable amount of prepared magnetite. It is, therefore, proposed to instal a Central Magnetite Preparation Plant under Coal India in Daltonganj area where BCCL owns a magnetite mine.

Capital Investment

9.4 The estimated capital investment that would be required for installation of coking coal washeries and beneficiation plants for semi-coking coal and non coking coals is shown in Table 9.8.

TABLE 9.6

Details of Proposed Tipong & Seetalpur/Sodepur Washeries

Sl. No.	Name of the washery	Raw coal input capacity (mt/yr)	Yield %		Expected year of commissioning	Capital investment (Million Rs.)	
			Clean	Middling		Total anticipated	Total during 1978-79 to 1982-83
1.	Tipong (NEC)	0.47	64	16	1982-83	17.5	17.5
2.	Seetalpur	0.95	60	15	1982-83	55.3	55.3
	Sodepur (ECL)	1.42	—	—	—	55.3	55.3

TABLE 9.7

Details of the Proposed Beneficiation Plants for Non-Coking Coal

Company	Sl. No.	Beneficiation plant	Annual raw coal input capacity (mt/yr)	Type of the plant	Expected year of commissioning	Capital investment (Million Rs.)				Remarks
						Total estimated	Total during 5th plan	Total during 1978-79 to 1982-83	Total during 1983-84 to 1987-88	
ECL	1	Dhemo-main	0.45	D	1980-81	30	—	30	—	For export purpose
	2	Amritnagar	0.42	D	1984-85	30	—	—	30	-do-
	3	Ratibati	0.90	C	1984-85	30	—	—	30	-do-
Sub-total (1 to 3)			1.77			90	—	30	60	
CCL	4	Jhingurdah	3.0	C	1981-82	71	—	71	—	Type of the plant C : Simple de-shaling plant of raw coal input capacity above 0.6 mt/yr
	5	Bina	4.5	C	1983-84	100	—	100	—	
	6	South Balanda & Nandira	1.65	C	1983-84	47	—	47	—	
	7	Jagannath	1.00	C	1983-84	29	—	29	—	D : Simple deshaling plant of annual raw coal input capacity 0.6 mt & below.
Sub-total (4-07)			10.15	—	—	247	—	247	—	
Grand total (1 to 7)			11.92	—	—	337		277	60	

TABLE 9.8

Estimated Capital Investment on Proposed Washeries and Beneficiation Plants (Including C H P and Modifications in Existing Washeries)

(In million Rs)

Company	Washeries/beneficiation plants/modifications in existing washeries	Estimated capital investment during 5th plan	Estimated capital investment during 1978-79 to 1982-83	Estimated capital investment during 1983-84 to 1987-88	Total investment by 1987-88
ECL	Washeries (Tipong)	—	17.5	—	17.5
	Beneficiation plants (including semi-coking)	—	67.8	60	127.8
	Sub-total	—	85.3	60	145.3
BCCL	Modifications in existing washeries	—	96.4	4.4	100.8
	Washeries	317.0	371.0	220.0	903.0
	Magnetite plant	—	10.0	—	10.0
	Sub-total	317.0	477.4	224.4	1018.8
CCL	Modifications in existing washeries	—	87.8	60.0	147.8
	Washeries	—	507.7	303.1	810.8
	Beneficiation plants	—	161.0	86.0	247.0
	Sub-total	—	756.5	449.1	1205.6
WCL	Washeries	—	100.9	—	100.9
	Sub-total	—	100.9	—	100.9
	Grand total	317.0	1420.1	733.5	2470.6
	Plant & equipment	206.1	923.0	476.8	1605.9
	Others	110.9	497.1	256.7	864.7
	Total	317.0	1420.1	733.5	2470.6

Chapter 10

Transportation—Rail, Road Etc.

Introduction

10.0 This chapter deals with transport of coal by different modes and various steps taken, and to be taken, to build up the transport potential to the required level. An analysis of the coal transported in the last two years by different modes has been worked out along with the anticipated total requirement of transport by each mode upto 1987-88. The total figure has been in each case broken down so that a clear picture, of the extent to which the transport potential would have to be developed in each area, can be had. In the case of Rail-Transport, coalfieldwise and directionwise figures have also been provided.

Modewise Classification

10.1 While the bulk of coal transportation is by rail the other modes of transport have and will continue to play a significant role, as may be seen from the Table 10.1.

TABLE 10.1

(In m t CIL only)

Modes	1975-76		1976-77		1977-78		1982-83		1987-88	
	Tonnes	% of total	Tonnes	% of total	Tonnes	% of total	Total	% of total	Tonnes	% of total
By rail	59.81	77	61.48	77	62.94	74	115.86	75	139.82	75
By road	13.37	17	13.21	16	16.18	19	16.20	10	17.00	9
By other modes	4.81	6	5.51	7	5.55	7	23.03	15	29.85	16

Transport by Rail

10.2.1 Since about 75% of the transport of coal will be by the Indian Railways, this mode of transport has been given special attention.

Development of Rail Transport by Coal India

10.2.2 Reduction of the number of loading points from 699 to 296, extension of 143 sidings so that these can now accommodate full block rakes, mechanisation of 208 loading points and installation of 83 additional hundred tonne weigh-bridges (so that loading and weighment can be done simultaneously), are improving the potential for rail transport.

10.2.3 Table 10.2 gives the break up of the reduction in the number of sidings in Coal India Companies.

TABLE 10.2

Reduction in the Number of Sidings

Company	No. of sidings existing before the rationalisation scheme	No. of sidings at present
NEC	Not applicable	Not applicable
ECL	184	86
BCCL	383	123
CCL	68	35
WCL	64	52
Total	699	296

10.2.4 Table 10.3 below gives the progress in siding modification and the estimated expenditure.

TABLE 10.3

Progress in Siding Modification

Name of Company	No. of sidings taken up for modification	No. of sidings where work completed	No. of sidings where work are in progress	Rough estimated expenditures (Fig. in lakhs of Rs)
NEC	1	Nil	Nil	4.30
ECL	32	23	9	110.30
BCCL	67	29	38	341.84
CCL	22	7	15	235.09
WCL	21	5	16	176.79
Total CIL	143	64	78	868.32

10.2.5 Table 10.4 below gives the progress in installation of additional 100 tonne weigh-bridges and estimated expenditure thereon.

TABLE 10.4

Installation of Weigh-bridges

Company	Position as on 1.4.76	Additional W B's proposed	No. ordered	No. installed	No. under installation	Expenditure on the proposed installation in crores
NEC			Not applicable			
ECL	1 (6)*	33	9	6	7	1.65
BCCL	2 (9)*	6**	—	—	—	0.65
CCL	12 (2)*	24	4	1	3	1.20
WCL	13 (4)*	20	17	3	3	1.00

* The figure refers to Railway weighbridges.

** The figure refers to weight-o-meters.

10.2.6 The above measures have made it possible for despatches by rail to steadily increase as indicated in Table 10.5 below.

TABLE 10.5

Transport of Coal by Rail (In Terms of 4 Wheeler Wagons)

Year	Bengal-Bihar		Outlying		Total	
	CIL	Country	CIL	Country	CIL	Country
1973-74	—	5132	—	2266	—	7398
1974-75	5108	5603	2121	2788	7229	8391
1975-76	5704	6216	2253	3061	7957	9277
1976-77	5991	6400	2175	3046	8167	9447
1977-78	6105	6570	2275	3161	8380	9731

Estimation of the Future Requirement of Transportation by Rail

10.3 In order to laydown the extent of rail transport that would be required by the coal industry in general and Coal India in particular the following analysis has been made (Table 10.6). To the total anticipated production of coal, the production of hard coke, LTC coke, washed coal and middlings have been added. From this over all production figure the following quantities which would not require despatch were deducted :

(a) Colliery consumption ;
(b) Loss in washery-rejects ;
(c) Loss in production of soft-coke ; and
(d) Loss in production of hard coke.

The following items were deducted from the total estimated despatch :

(a) Raw coal to washery ;
(b) Washed coal to steel plants ;
(c) Hard coke ;
(d) Soft coke ;
(e) Raw coal to LTC plant ;
(f) LTC coke ;
(g) Fertilizer ;
(h) Power station ; and
(i) Others.

} To the extent these despatches will be by means other than rail.

The overall despatch by rail was thus obtained.

10.4.1 In order to facilitate estimation of the required section capacities, Table 10.7 gives a breakdown of the total movement by rail, coalfieldwise and directionwise. Diagram 10.1 also explains the directionwise movement and indicates the volume of traffic at present and in 1982-83 in each case.

TABLE. 10.6

Estimation of Future Requirement of Transportation by Rail

(in m.t)

	1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83	
	CIL	All India	CIL	All India	CIL	All India	CIL	All India	CIL	All India	CIL	All India	CIL	All India
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Total production														
(a) Coal	89.49	101.28	88.96	100.87	100.50	112.13	105.73	118.97	114.39	130.28	123.96	141.61	137.68	158.36
(b) Hard coke	0.75	0.75	0.67	0.67	1.19	1.19	1.22	1.22	1.25	1.25	1.27	1.27	1.30	1.30
(c) LTC coke	3.24	3.24	2.93	2.93	3.24	3.24	3.30	3.30	3.36	3.36	4.00	4.00	4.75	4.75
(d) Washed coal	8.93	10.45	8.79	10.29	9.62	12.35	9.70	11.55	12.14	14.41	12.62	15.67	14.48	17.58
(e) Middlings	3.01	3.41	3.84	4.24	3.45	3.89	3.26	4.34	4.85	5.43	6.15	6.88	6.88	7.76
	105.41	119.13	105.19	119.00	119.00	123.80	132.81	129.38	135.98	154.73	148.40	169.63	165.69	190.15
2. Quantity not requiring depatch														
(a) Colliery consumption	3.10	3.35	3.07	3.32	3.1	3.35	3.31	3.35	3.10	3.35	3.10	3.35	3.10	3.35
(b) Loss in washery rejects	1.29	1.53	1.29	1.53	1.29	1.53	1.36	1.60	1.69	2.61	1.41	1.81	2.18	2.66
(c) Loss in production of soft coke	1.26	1.26	1.26	1.26	1.26	1.26	1.70	1.70	1.91	1.91	2.20	2.20	2.45	2.25
(d) Loss in production of hard coke	0.32	0.32	0.32	0.32	0.32	0.32	0.52	0.52	0.53	0.53	0.54	0.54	0.55	0.55
	9.67*	11.96*	10.65*	9.15*										
Total	15.54	18.42	16.59	15.58	5.97	6.46	6.68	7.17	7.23	7.80	7.25	7.90	8.28	8.01
3. Total estimated despatch (1 minus 2)	89.77	100.71	88.60	103.42	113.05	126.34	117.13	132.21	128.75	146.73	141.15	161.73	156.81	181.14
4. Despatches by other than rail														
(a) Raw coal to washeries	9.11	9.11	9.51	9.51	9.44	9.44	8.90	8.90	10.54	10.54	14.28	14.29	15.42	15.42
(b) Washed coal to steel plant	0.66	0.66	0.75	0.75	1.19	1.19	1.21	1.21	1.22	1.22	1.23	1.23	1.24	1.24
(c) Hard coke	0.052	0.052	0.05	0.05	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
(d) Soft coke	1.74	1.74	1.80	1.80	1.64	1.64	1.51	1.51	1.67	1.47	1.60	1.60	2.12	2.12
(e) Raw coal to LTC	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(f) LTC coke	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(g) Power station	8.80	8.80	9.50	9.50	10.97	10.97	11.97	11.97	13.05	13.05	14.19	14.19	14.29	14.29
(h) Fertilizer	0.65	0.65	0.55	0.55	0.55	0.55	0.61	0.61	0.72	0.72	0.78	0.78	0.88	0.88
(i) Others	3.40	4.12	3.50	4.22	3.65	4.65	4.65	5.61	4.74	5.70	4.85	5.91	6.23	7.19
Total	24.412	25.132	25.66	26.38	27.54	28.54	29.95	29.91	31.99	32.85	[illegible]	38.24	[illegible]	41.18
5. Despatch by rail (3 minus 4)	65.35	75.51	62.94	77.04	85.51	97.94	87.18	102.30	96.76	113.98	103.87	123.49	116.56	139.95

*Other quantities not despatched such as increase in pit head stock etc.

[illegible] figures [illegible] after [illegible] of figures from SCCL [illegible] NCDC [illegible]

TABLE 10.7

TABLE 10.7

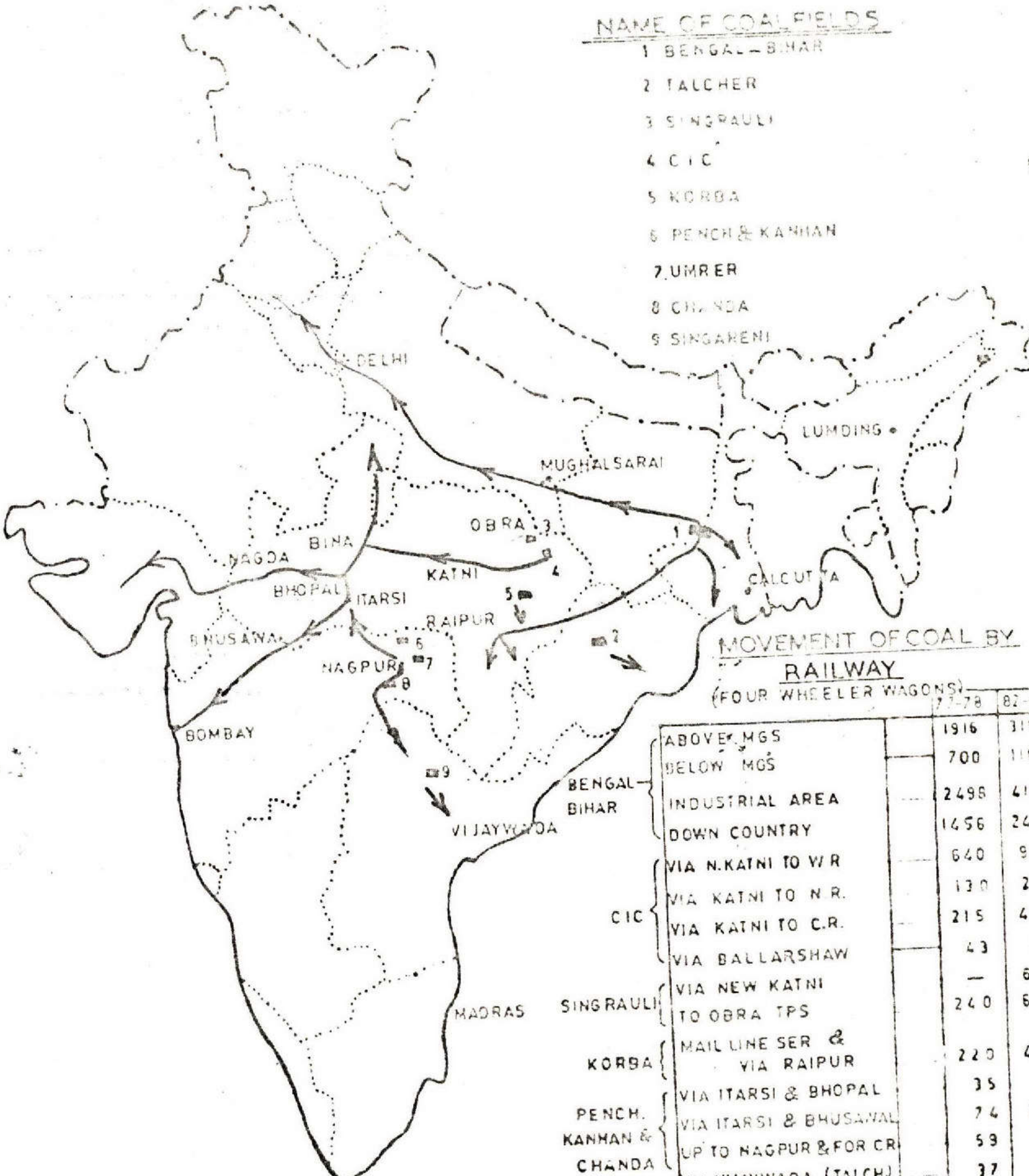
Coalfieldwise and Directionwise Breakup of Likely Rail Movement of Coal (Refer Diagram 10.1)

(In terms of four wheelers/per day)

Field	Direction	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
1	2	3	4	5	6	7	8	9
Bengal-Bihar	Above MGS	1867	1916	2373	2430	2596	2830	3193
	Below MGS	682	700	867	888	990	1033	1166
	Industrial area/ER	1058	1086	1345	1377	1493	1604	1809
	Industrial area/SER	1376	1412	1750	1791	1972	2085	2353
	Down country	1418	1456	1802	1845	1934	2113	2424
	Total	6401	6570	8137	8331	8960	9702	10946
Singrauli	Via New Katni	—	—	—	42	190	513	654
	To Obra TPS	261	240	391	372	478	583	644
	Total	261	240	391	414	668	1096	1298
C I C (i) Korea-Rewa	Via Katni to N R	130	130	170	186	228	227	231
	Via Katni to W R	644	640	852	942	923	969	958
	Via Katni to C R	215	215	285	313	321	341	418
	Via Ballarshaw	43	43	57	59	56	62	59
	Total	1032	1028	1364	1500	1538	1600	1666

1	2	3	4	5	6	7	8	9
(ii) Korba	Mail line SER & via Ripur	220	220	230	235	426	426	440
	Total	220	220	230	235	426	426	440
Pench, Kanhan Chanda & Umrer	Via Itarsi & Bhopal	30	35	43	40	67	51	62
	Via Itarsi & Bhusawal	62	74	92	84	119	97	110
	Up to Nagpur & for CR	50	59	74	73	86	77	73
	Others	410	493	603	688	696	817	898
	Total	552	661	812	885	959	1042	1144
Talcher	Via Vijaywada	36	37	47	47	52	81	93
	Others	32	32	45	45	48	48	48
	Total	68	69	92	92	102	129	141
Assam	Industries(Others	36	29	36	42	47	49	69
	Railways	35	28	35	35	35	35	36
	Total	71	57	71	77	82	84	105
Singareni	Via Vijaywada	842	886	181	190	252	302	325
	Others	—	—	961	1046	1192	1328	1555
	Total	842	886	1142	1236	1444	1630	1880
	Grand total	9447	9731	12239	12770	14208	15709	[illegible]

DIAGRAM 101



MOVEMENT OF COAL BY RAILWAY

(FOUR WHEELER WAGONS)

		77-78	82-83
BENGAL – BIHAR	ABOVE MGS	1916	3193
	BELOW MGS	700	1166
	INDUSTRIAL AREA	2498	4162
	DOWN COUNTRY	1456	2424
CIC	VIA N.KATNI TO W R	640	958
	VIA KATNI TO N.R.	130	231
	VIA KATNI TO C.R.	215	418
	VIA BALLARSHAW	43	59
SINGRAULI	VIA NEW KATNI	—	654
	TO OBRA TPS	240	644
KORBA	MAIL LINE SER & VIA RAIPUR	220	440
PENCH. KANHAN & CHANDA	VIA ITARSI & BHOPAL	35	62
	VIA ITARSI & BHUSAWAL	74	110
	UP TO NAGPUR & FOR CR	59	73
TALCHER	VIA VIJAYWADA (TALCH)	37	93
SINGARENI	DO (SINGR)	885	325

10.4.2 Analysis of the above tables reveals the following striking features :

(a) The percentage increase in the overall wagon requirement over 1977-78 as in follows

Year	Bengal - Bihar	Outlying	Total
1978-79	12%	22%	15%
1982-83	66%	118%	80%
1987-88	150%	147%	149%

(b) Of the total requirement of wagons by CIL about 2/3rd is concentrated in the Bengal-Bihar fields which indicates that greater attention has to be paid in augmenting the railway infrastructure of this area, i. e. loading facilities at sidings, pilot and yard facilities, line capacities etc.

(c) The rail facilities for carrying coal out of Bengal-Bihar area also may need to be augmented. The construction of the Raniganj-Bankura Branch Line would for instance enable more coal from this area to move to the South and East via Kharagpur (thus bye passing the already saturated routes). This line has already been surveyed at the instance of the West Bengal Government.

(d) There is a considerable amount of new coal traffic that will move from Singrauli, west-ward, this will require augmentation of capacity between Singrauli and Katni.

(e) Since the coal traffic from CIC via Katni junction will also be doubled by 1987-88, the facilities of Katni Junction would require to be further improved so that this yard can cater to the traffic received from Singrauli and CIC.

Development of Railway Infrastructure

10.5.1 The transportation of nearly 128 million tonnes of coal, washed coal, middlings etc., by rail in 1982-83 (as estimated in Para 10.2.21) would require further development of railway-infrastructure besides the steps already enumerated in 10.2.2 above.

New Branch Lines

10.5.2 A large number of new mines which have no rail facility at present are being developed to meet the growing demand. These would have to be connected to the railway network so that the coal produced can be moved to the demand points. The main new railway lines that would be required in this connection are as follows :

Kerela Road to Jayant

10.5.3 The railways have agreed to construct a line from the Kerela Road Station (on the Billi Junction-Singrauli Line) to Jayant as a branch line (i.e. at their own cost). The construction of this line commenced on 1st April '77 and the line would be completed in March, 1980. The 39 Km long line would cater to the Jayant, Dudhichua, Khedia, Marrak, Bina and Kakri blocks. Coal produced from this area would be despatched to Obra and consumers in the west as indicated below :

TABLE 10.8

Coal Linkages from Singrauli Coalfield

(In m t)

Sl. No.	Power House	1978-79	1980-81	1982-83	1987-88
1	2	3	4	5	6
1.	Bhusawal (Maharastra)	---	---	0.93	0.93
2.	Ukai (Gujrat)	---	0.60	1.00	1.00

1	2	3	4	5	6
3.	Wanakabari (Gujrat)	—	0.35	1.52	2.31
4.	Nasik (Maharastra)	—	0.50	1.20	1.20
5.	Kota (Rajasthan)	—	—	0.38	0.66
6.	Obra (UP)	2.75	3.82	5.15	5.51
7.	Singrauli (STPS)	—	—	1.42	2.31
8.	Renusagar (UP)	0.82	0.82	0.82	0.82
9.	Trombay, Tata (Maharastra)	—	—	—	1.60
10.	Pancha (UP)	—	—	0.17	0.90*
11.	Ukai (Gujrat) 2nd stage	—	—	0.15	0.62
	Total	3.57	6.09	12.79	17.91*

* This does not include linkages to power plants which will come up in the period beyond 1982-83.

Mael to Ramgarh Washery

10.5.4 The 10.4 Kms long line will serve the Ramgarh washery. It takes-off from the mid-section between Gola road and Mael station on the Muri-Barkakana of South Eastern Railway. The line has been surveyed and construction will start in 1978-79. The total despatches from Ramgarh washery would be about 2.7 million tonnes by 1982-83.

Danea Kedla Line

10.5.5 The 11 Km line would take-off from Danea railway station on the Chandrapura-Barkakana section of Eastern Railway. It would serve the Kedla washery. It would be despatching 1.92 million tonnes of clean coal and middlings by 1982-83. The survey of this line has been completed.

Hirdagarh Damua Line

10.5.6 This line takes-off from Hirdagarh railway station on the Amla Parasea section of Central Railway and will serve the Nandan washery. This washery would be despatching 1.04 million tonnes of washed coal and middlings by 1982-83 (the clean coal 0.72 m t would be despatched to Bhilai Steel Plant). The survey of this line has been completed.

Chainpur to Pindra

10.5.7 This 20 Km long railway line will serve Sarubera, Ara, Kuju and Topa areas. The production of these areas is given below in million tonnes :

	1978-79	1982-83	1987-88
Sarubera	0.30	0.15	0.15
Ara, Topa Kuju, Pindra	1.03	1.38	2.95

Khelari to Hesalong Block

10.5.8 This 5 Km long line will serve K.D. Expansion whose production is given below in million tonnes :

	1978-79	1982-83	1987-88
K.D. Expansion	0.65	1.55	3.85

Mohuamilan to Pinderkom Block

10.5.9 This 16 Km. long line will serve the Pinderkom and Badam blocks.

New Sidings

10.6.1 Details of the new sidings required are given in the respective parts of Companies. A summary is given in Table 10.9.

TABLE 10.9

Summarised Position and Cost of New Sidings Needed in 1978-79 to 1982-83

Company	No. of sidings	Approach length in Kms	Yard length in Km	Total cost in crores
NEC	Nil	Nil	Nil	Nil
ECL	24	105	57.6	24.39
BCCL	3	7.5	8.1	2.71
CCL	18	55	56	19.40
WCL	17	32.6	25.2	12.00

Transport by Road

10.6.2 Table 10.10 gives the break up of transport by road.

TABLE 10.10

Transport by Road

(In m.t for CIL)

Company	Actuals			Anticipated	
	1975-76	1976-77	1977-78	1982-83	1987-88
NEC	0.09	0.09	0.160	0.160	0.160
ECL	5.00	5.00	4.85	5.00	5.00
BCCL	3.79	4.00	4.73	4.73	4.84
CCL	2.50	2.12	3.90	3.90	4.00
WCL	2.00	2.00	2.44	2.44	3.00
Total	13.38	13.21	16.18	16.27	17.00

It will be noted that transport of coal by road would remain more or less at the 1977-78 level.

10.6.3 Internal transport (i.e. from pit head to railway loading points) will be as given in Table 10.11.

TABLE 10.11

Internal Transport of Coal by Road

(In m t)

Company	1977-78	1982-83	1987-88
NEC	Nil	Nil	Nil
ECL	1.66	2.4	3.4
BCCL	2.73	3.8	5.3
CCL	7.01	9.8	13.7
WCL	0.16	0.2	0.3
Total	11.56	16.20	22.7

•(Projected on the basis of demand of coal/actual internal transport of coal by road).

Transport by Other Modes

10.7 Table 10.12 gives details of transport of coal by other than rail and road.

TABLE 10.12

Transport by Other than Rail & Road

(In m t)

Company	Actual		Anticipated	
	1976-77	1977-78	1982-83	1987-88
NEC	Nil	Nil	Nil	Nil
ECL	Nil	Nil	Nil	Nil
BCCL	0.434	0.434	1.80	2.33
CCL	1.870	1.870	7.80	10.09
WCL	3.210	3.250	13.43	17.46
Total	5.514	5.554	23.03	29.88

Coastal shipping and reverine transport are being used for transporting relatively small quantities of coal.

Conclusion

10.8 In conclusion it may be said that the Indian Railways would have to bear the brunt of the increase in coal transport. The railway infrastructure that is being developed near the mines should be constant and in tune not only with changes in Coal India but also with changes in the Indian Railways. This has been kept in mind while planning the transportation of coal.

Chapter 11

Ancillary Activities on End-Use of Coal/Coal Products and Chemicals

Energy Crisis

11.0 Limited oil reserve and its sharp price rise in the international market has been causing concern among the energy planners of the country. As it stands now, from the points of view of cleanliness and ease of operation, priority of coal perhaps stands only next to oil. But reality of the situation prompts for more and more use of coal in every possible sector.

Approach to the Problem

11.1 Keeping the above in view, number of R & D schemes have been taken in hand with the sole object of boosting up the coal usage in the various industrial sectors. The socio-economic condition of the country and the quality of coal resources as indigenously available were kept in view in projecting various R & D proposals in coal utilisation area. While the main emphasis for selection of the various schemes in coal utilisation area for the next 10 years have been based primarily on the themes of conservation of coking coal, oil substitution, development of clean and cheap domestic fuel etc., no attempt has been made here to include even any well proven technology/process which is much capital intensive and perhaps holds less potentialities from that angle for immediate installation atleast within the next 10 years period.

Basis of Assessment

11.2 Of all the commercial fuels available today in the market, coal is the cheapest one and with adequate coal reserve being available in the country, its demand is likely to increase progressively not only for meeting the energy requirements but also as a feed stock for other coal products and chemicals. Due consideration has been given to the coal demand projections for the 5 year plan period to the sectorwise demand of existing coal consumers and their likely growth in future as also to the developmental potentialities of new technologies for consolidating the picture as presented in this report brining out the thrust areas. On assessment made in this connection, it appears that much of the future coal demand will arise from the conventional consumer sectors like power, steel, railway, cement, domestic and other industries. Keeping in view the development status of some of the established technologies as well as some of the new technologies that are currently under development, proposals have been included for setting up commercial scale low temperature carbonisation plants, coal-based producer gas plants, pressurised coal gasification plant etc., besides many other schemes as identified separately mainly under 3 different sectors viz. metallurgical, industrial and domestic. Particulars of all such schemes are given in Table 11.1, Table 11.2 and Table 11.3. Table 11.4 gives yearwise fund requirement for all such identified schemes.

TABLE 11.1

Metallurgical Sector

Sl. No.	Name of the Project	Implementing Agency/ Company	'77-78	'78-79	'79-80	'80-81	'81-82	'82-83	'83-84 to '87-88	Estimated cost, Rs in lakhs	Beneficiary	Objective
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Coal blend test programme	CMPDI HSL (R&D)	—	—	—	—	—	—	—		CIL SAIL	To identify new coal source for steel plant use.
2.	Talcher formed coke project (600 tpd coal throughput)	CMPDI	—	—	—	—	—	—		1400	SAIL CIL	To produce metallurgical grade hard coke out of non-caking coal.
3.	Hot briquetting of coal (BFL process for formed coke making) 600 tpd	CMPDI				—	—	—	—	2500	SAIL CIL	To set up a demonstration plant for the production of metallurgical grade formed coke utilising about 70% non-coking coal.
4.	Fluid-bed carbonisation pilot plant at CFRI, Dhanbad	CMPDI, CFRI, HSL(R&D)			—	—	—			24.5*	SAIL CIL	To produce char for formed coke making.

* Actual project cost is Rs 30.5 lakhs out of which HSL (R&D) is committed to provide Rs 6/- lakhs.

TABLE 11.2

Industrial Sector

Sl. No.	Name of the Project/Scheme	Implementing Agency/ Company	'77-78	'78-79	'79-80	'80-81	'81-82	'82-83	'83-84 to '87-88	Estimated cost Rs in lakhs	Beneficiary	Objective
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Conversion of Lancashire boiler to fluid-bed combustion system	CMPDI/ CMERI, Durgapur		—	—	—				6.50	CIL	To save good grade sized coal by replacing it by low grade slack coal.
2.	Desulphurisation of Assam coal by bacterial means	CMPDI	—	—	—					0.43	NEC	To remove and recover sulphur from Assam coal.
3.	Solvent refining of coal	CMPDI, CFRI					—	—	—	60	CIL	To produce ashless product out of coal.
4.	Demonstration plant for pressure gasification of coal	CMPDI, HSL(R&D)			—	—	—			60*	CIL/ HSL	To produce clean fuel gas out of coal.
5.	Carbon black from Assam coal (Demonstration plant of 3000 tes/yr capacity)	NEC, CMPDI			—	—	—			250	NEC	To produce carbon black directly from coal in replacement of coal tar & petroleum based feed stocks.
6.	R&D trial with low IDT coal in power house	CCL, CMPDI			—	—				50	CCL	To establish use of low IDT coal in power plant.
7.	Centralised producer gas plant at Nagpur/Nasik	WCL			—	—				200	WCL MIDC	To replace oil by coal based gas.
8.	Bee-hive coke ovens	WCL		—	—					5	WCL	To produce hard coke out of Damua coal till the washery is installed.

* Capital cost of plant Rs 10/- crore may come from S&T grant of steel sector.

TABLE 11.3

Domestic Sector

Sl. No.	Name of the Project/Scheme	Implementing Agency/ Company	'77-78	'78-79	'79-80	'80-81	'81-82	'82-83	'83-84 to '87-88	Estimated cost Rs in lakhs	Beneficiary	Objective
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	LTC plant											
1.1	Dankuni	CMPDI/ CIL	—	—	—	—	—			5000	CIL & W B Govt.	To supply gas and semi-coke and produce by-product tar.
1.2	Delhi	CMPDI/ CIL		—	—	—	—	—	—	6000	CIL & Delhi Admn.	-do-
2.	Domestic chullah	CMPDI	—	—	—					1	CIL	To use raw coal directly for domestic purpose.
3.	Domestic nodules from Assam coal (100 tpd)	NEC			—	—				50	NEC	To produce domestic fuel from Assam coal.
4.	Pellet coke plants											
(a)	At Salanpur sub-area (200 tpd)	ECL			—	—				137	ECL	To produce somkeless domestic fuel out of low grade caking coal.
(b)	At Mugma area (100 tpd)	ECL					—	—		80	ECL	-do-
5.	Domestic briquette plant											
(a)	At JK Nagar colliery (100 tpd)	ECL/ CMPDI		—	—	—				80	ECL	To produce smokeless domestic fuel out of non-caking coal fines.
(b)	At Kenda opencast project from Bogra seam coal (200 tpd)	ECL							—	140	ECL	-do-

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1	2	3	4	5	6	7	8	9	10	11	12	13
6.	Experimental mechanised soft coke plant	ECL/ CMPDI								30	ECL	To produce improved quality soft coke with minimum air pollution.
7.	Commercial mechanised soft coke plant (1000 tpd)	ECL								470	ECL	-do-
8.	Pellet coke plants (3 plants of 200 tpd each)	BCCL								410	BCCL,	To produce smokeless domestic fuel out of low grade caking coal.
9.	Briquetting plants (2 plants of 100 tpd each)	BCCL								160	BCCL	To produce smokeless domestic fuel out of non-caking coal fines.
10.	Experimental mechanised soft coke plant	BCCL								35	BCCL	To produce improved quality soft coke with minimum air pollution
11.	Pellet/briquette plants											
	(a) At Gidi (300 tpd)	CCL								180	CCL	To produce smokeless domestic fuel out of middlings/fines of washery.
	(b) At Giridih (100 tpd)	CCL								80	CCL	To produce smokeless domestic fuel by the partial use of high ash Giridih coal.
12.	Domestic briquette plant at Swang (Phase-I, 100 tpd, Phase-II, 250 tpd)	CCL								230		To produce smokeless domestic fuel out of Swang washery sink.
13.	Mechanised soft coke plant	CCL								20	CCL	To produce improved quality coke with minimum air pollution.
14.	Domestic briquette plant (150 tpd)	WCL								110	WCL	To produce smokeless domestic fuel from non-coking coal.

TABLE 11.4

Break-up of Investments on Coal Utilisation During Next 10 Years

(Rupees in lakh)

Sl. No.	Project/Scheme	Actual expenditure in 1977-78	Expenditure in VIth plan period 1978-79	1979-80	1980-81	1981-82	1982-83	Expenditure during the period 1983-84 to 1987-88	Total	Implementing Agency/ Company
1	2	3	4	5	6	7	8	9	10	11
1.	LTC plants									
1.1	Dankuni	7	1293	1100	1600	1000	—	—	5000	CMPDI/CIL
1.2	Delhi	—	3	—	—	100	100	5797	6000	CMPDI/CIL
2.	Demonstration plant for pressure gasification of coal	—	—	—	—	60	—	—	60	CMPDI* HSL (R&D)
3.	Talcher formed coke	1	60	420	420	280	219	—	1400	CMPDI
4.	Fluid-bed carboniser at CFRI	—	—	8.5	8	8	—	—	24.5	CMPDI,CFRI, HSL (R&D)
5.	Conversion of Lancashire boiler to fluid-bed combustion system	—	1	4	1.5	—	—	—	6.5	CMPDI, CMERI, Durgapur
6.	Desulphurisation of Assam coal by bacterial means	0.21	0.22	—	—	—	—	—	0.43	CMPDI
7.	Domestic chullah	—	0.6	0.4	—	—	—	—	1	CMPDI
8.	Solvent refining of coal	—	—	—	—	10	20	30	60	CMPDI & CFRI
9.	Hot briquetting of coal (BFL process for formed coke making) 600 tpd	—	—	—	800	700	500	500	2500	CMPDI
10.	Carbon black from Assam coal	—	—	177	73	—	—	—	250	CMPDI & NEC
11.	Domestic nodules from Assam coal (100 tpd)	—	—	30	20	—	—	—	50	NEC
12.	Pellet coke plant in Salanpur sub-area 200 tpd	—	—	100	37	--	—	—	137	ECL
13.	Pellet coke plant in Mugma area 100 tpd	—	—	—	—	50	30	—	80	ECL

1	2	3	4*	5	6	7	8	9	10	11
14.	Domestic briquette plant at JK Nagar 100 tpd	—	5	40	35	—	—	—	80	ECL
15.	Domestic briquette plant from Dobrana seam coal 200 tpd	—	—	—	—	—	—	140	140	ECL
16.	Mechanised soft coke plant (R & D) at Mugma	—	20	10	—	—	—	—	30	ECL, CMPDI
17.	Commercial mechanised soft coke plant 1000 tpd	—	—	—	—	—	—	470	470	ECL
18.	Three pellet coke plant each of 200 tpd in BCCL	—	—	—	120	17	—	273	410	BCCL
19.	Domestic briquette plant at BCCL, 2 plants of 100 tpd each	—	—	50	30	—	—	80	160	BCCL
20.	Mechanised soft coke plant (R&D) at BCCL	—	15	10	10	—	—	—	35	BCCL
21.	Domestic briquette plant at Swang (Phase-I, 100 tpd, Phase-II, 250 tpd)	—	50	30	—	—	—	150	230	CCL
22.	Pellet/briquette plant at Gidi 300 tpd	—	—	—	—	50	50	80	180	CCL
23.	Pellet/briquette plant at Giridih 100 tpd	—	—	—	50	30	—	—	80	CCL
24.	Mechanised soft coke making (R&D) at CCL	—	10	10	—	—	—	—	20	CCL
25.	Utilisation of low IDT coals in power plants	—	—	30	20	—	—	—	50	CCL, CMPDI
26.	Centralised producer gas plant at Nagpur/Nasik	0.875	0.875*	100	98.25	—	—	—	200	WCL
27.	Domestic briquette plant at WCL, 150 tpd	—	—	80	30	—	—	—	110	WCL
28.	Bee-hive coke oven at WCL	—	5	—	—	—	—	—	5	WCL
	Total	9.085	1463.695	2199.9	3352.75	2305	919	7520	17769.43	

* Capital cost of plant Rs 10 crore may come from S&T grant of steel sector.

Chapter 12

Manpower and Management Development

Indroduction

12.0 Coal India is the largest employer of all the public sector undertakings of Central Government. With about six lakhs persons, employed in three hundred and fourty mines scattered over seven States in India, it cannot survive without effective organisation and organisational development. It has taken due care of this need and chalked out perspective plan in respect of its requirement of manpower and training.

MANPOWER

Strategy

12.1 The 6 lakhs people on the rolls of Coal India constitutes almost 40% of the total work force of 16 lakhs employed in all the Central Government public sector undertakings. This in terms of investment gives very encouraging picture. Out of the total capital of 11,000 crores invested in these undertaking the investment in Coal India is less than 10%. As per the figures of Bureau of Public Enterprises the investment in coal industry for each job was about Rs 21000, against Rs 1.40 lakhs in steel, Rs 3.02 lakhs in chemicals and Rs 64000 in heavy engineering. The average for all the industries was also about Rs 70000. However, the picture is likely to undergo a drastic change during the next few years. Though philosophy during the next few years will be to achieve the objective of generating higher levels of employment in the industry, certain basic needs of mechanisation cannot be overlooked. The mechanisation that is proposed to be introduced will be based on intermediate technology suitable to the technological environment of the country and will be aimed at reducing human drudgery, to cope up with the reduced railway loading time, to ensure the quality of coal specially in respect of sizing, etc. Another factor which is likely to effect the employment potential is opening of large opencast mines which in any case have to be mechanised. During these few years distortions existing in the manpower employment in the coal industry before nationalisation will also get corrected; for example in BCCL alone the employment as on 1st April, 1976 was 1.88 lakhs which will be reduced to about 1.40 lakhs by 1987-88 when the production is likely to go up to more than 40 million tonnes from 20.68 million tonnes in 1976-77. Another change that is expected is in the mix of the manpower deployment in the industry, proportions of unskilled worker is likely to be reduced substantially. As a result of these factors, the increase in manpower will not be in the same proportion as increase in coal production.

Requirement

12.2 The manpower picture that is likely to emerge by the end of 1987-88 is as given in the Table 12.1. This means that Coal India Ltd and its subsidiaries will be able to absorb about 2,50,000 additional persons for its operations during next 10 years. Out of this about 1,21,000 additional jobs will be created and about 129000 persons will be absorbed against the natural wastage by death and retirement of the existing manpower. This natural wastage has been taken at 2% per year.

TABLE 12.1

Manpower Projection

Company	1977-78 (Actual)	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
NEC	4855	5200	5591	6011	6464	6950	8562
ECL	186243	186540	185540	188990	194050	201980	221110
BCCL	168434	165402	162425	159501	156630	153010	140451
CCL	112089	112000	112000	120000	129500	137500	176000
WCL	112800	121830	125500	128130	130390	137300	158080
CMPDI	2331	2450	2570	2705	2840	3000	3800
CIL	645	650	650	650	650	650	650
Total	587397	594072	595276	6[illegible]5972	620524	642190	708609

TRAINING

Objectives of Manpower Training & Development

12.3 Following objectives have been set forth for effective utilisation of existing manpower and also with a view to provide maximum job satisfaction and career development opportunities to the workmen deployed in coal industry :

(a) Ensuring that every single employee in the industry is given an exposure to basic training requirement in his/her present job.

(b) Ensuring that training for all non-managerial and key technical personnel is given in a manner such that the requirement of additional skilled personnel during this period can be met to the maximum possible extent by upgrading skills of existing personnel.

(c) Making available on a continuous basis an inventory of skilled and qualified technical supervisory personnel within the organisation, to meet the additional requirement of supervisory personnel, in the context of mechanisation, modernisation and expansion of our multifold activities.

(d) Preparing realistic managerial manpower succession and development plan, such that any additional requirement of technical and non-technical personnel is met primarily through requirement at the lowest intake level, except in highly functional and highly skilled personnel, who may not be readily available within the organisation.

(e) To provide maximum opportunity for self-development towards acquiring highly professional qualifications and competence through action learning and other processes.

(f) To impart training of safety on mines and machines.

(g) Training of fresh graduates, technicians and trade apprentices to fulfil the statutory requirement of Apprenticeship Act.

(h) To ensure containment of manpower particularly in companies having surplus manpower by imparting training to such personnel for their gainful utilisation.

Strategy for Training

12.4 With a view to formulate the strategy to achieve these objectives a committee headed by Shri R G Mahendru was appointed on 28.3.1975. The report submitted by the committee has emphasised the need for :

(a) A massive drive for training at all levels of the organisation primarily to bring about a sense of awareness in the organisation for necessity and usefulness of training both from the individual's and from the organisation's point of view because such awareness existed only marginally prior to nationalisation.

(b) To develop certain essential training facilities, such as the establishment of basic and refresher training centres both for meeting statutory as well as non-statutory need for training. This is to be achieved through revamping of the existing centres as well as through the establishment of new centres and through equipping of such centres with modern training aids relevant to the mining industry in India in general and specifically to the low level of literacy in coal industry.

Training Coverage

12.5.1 Training in Coal India Limited is divided into three groups :

12.5.2 Areas and coverage of training for workers :

— Initial training for newly recruited workers.

— Refresher training for the existing workers.

— Training for upgrading skills for upward mobility and redeployment.

— Training in mechanisation and new technology.

— Training for self-development.

12.5.3 Areas and coverage of training for supervisors :

— Company information.

— Leadership training.

— Methods improvement and cost control.

— Communication and instructional skills.

— Safety.

— Technical re-orientation.

12.5.4 Areas and coverage of training for executives :

— Training in all key areas of corporate management linked with career and succession planning for middle and senior level executives.

— Training in all functional areas that feature in a colliery system of management for all executives for increasing their effectiveness in their present job.

— Problems oriented training related to key problem areas in mine management and allied areas for middle and junior level executives.

— Training towards technical re-orientation for executives to cope with technical obsolescence.

Training Plans and Progress

12.6 A significant achievement in terms of the recommendations of the Mahendru Committee's Report has been made. Some deviations also had to be made to suit specific requirements of different companies. The companywise details of the training plans are shown in the Tables 12.2 to 12.6.

TABLE 12.2

Training Centres/Institutions of North Eastern Coalfields

(Capital in Rs lakhs)

Particulars	No. and Capital Outlay											
	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
1. Vestible training centres school & polytechnics	—	—	—	—	—	—	—	—	—	—	—	—
2. Group training centres	2	15.0	—	—	—	—	—	—	1	7.5	—	—
3. Unit training centres	1	3.5	—	—	—	—	—	—	2	7.0	—	—
4. Transport & hostel	—	1.2	—	—	—	—	—	—	—	2.5	—	—
Total	3	19.7	—	—	—	—	—	—	3	17.0	—	—

Number of Personnel to be Trained

Particulars	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1. Initial/refresher training	2400	2800	3300	3800	4300	2800
2. Upgrading of skill	240	280	330	380	430	280
3. Supervisory/managerial, technical	80	90	110	130	140	90
Total	2720	3170	3740	4310	4870	3170

TABLE 12.3

Training Centres/Institutions of Eastern Coalfields Limited

(Capital in Rs lakhs)

Particulars	No. and Capital Outlay											
	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
1. Group training centres	16	64	3	12	3	12	3	12	3	12	—	—
2. Unit training centres	1	3.5	1	3.5	1	3.5	—	—	—	—	—	—
3. Mining training centres Spill over		8.0	—	—	—	—	—	—	—	—	—	—
4. Hostel/transport	LS	3.5	LS	3.6	LS	3.6	LS	3.7	LS	3.8	LS	4.2
Total	17	79.0	4	19.1	4	19.1	3	15.7	3	15.8	—	4.2

Number of Personnel to be Trained

Particulars	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1. Initial/refresher training	24500	25300	25600	26300	27400	30000
2. Upgrading of skills	7500	7600	7700	7800	7900	8300
3. Supervisory/managerial/technical	2500	2500	2600	2000	2600	2800

TABLE 12.4

Training Centres/Institutions of Bharat Coking Coal Limited

(Capital in Rs lakhs)

Particulars	No. and Capital Outlay											
	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
1. Group training centres												
2. Unit training centres		40.00		25.65	—	—	—	—	—	—	—	—
3. Management development		0.75		—	—	—	—	—	—	—	—	—
4. Technical training institutes		9.70	—	—	—	—	—	—	—	—	—	—
5. Mining trades		47.14		25.85		17.85		12.00		17.00		8.00
6. Hostel/headquarters		10.00		12.00		2.00	—	—	—	—	—	—
Total		107.59		63.50		19.85		12.00		17.00		8.00

Number of Personnel to be Trained

Particulars	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1. Initial/refresher training	14703	24703	23678	23678	23678	23678
2. Upgrading of skills	5265	4480	4700	4125	4425	4850
3. Supervisory/managerial, technical	3565	3270	3140	3265	3285	3390

TABLE 12.5

Training Centres/Institutions of Central Coalfields Limited

(Capital in Rs lakhs)

Particulars	No. and Capital Outlay											
	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
1. Vocational training centres	1	6.00	—	—	1	7.50	—	—	1	7.50	2	10.00
2. Bhurkunda training institute	LS	1.80	LS	7.00	LS	5.00	LS	5.00	—	—	—	—
3. Excavation training centre, Singrauli	LS	7.30	LS	10.00	LS	10.00	LS	10.00	—	—	—	—
4. Washery training centre, Ramgarh	—	—	LS	2.00	LS	3.00	—	—	—	—	—	—
5. Artisan training centre, Bhurkunda	—	—	LS	2.00	LS	2.50	—	—	—	—	—	—
6. Management	—	—	LS	3.00	LS	3.00	LS	3.00	—	—	—	—
Total		15.10		24.00		31.00		18.00		7.50		10.00

Number of Personnel to be Trained

Particulars	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1. Initial/refresher training	17000	17000	18000	19000	20000	22000
2. Upgrading of skills	2000	2000	2500	3000	3500	4000
3. Supervisory/managerial/technical	1000	1000	1500	1500	1800	2000

TABLE 12.6

Training Centres/Institutions of Western Coalfields Limited

(Capital in Rs lakhs)

Particulars	No. and Capital Outlay											
	1978-79		1979-80		1980-81		1981-82		1982-83		1987-88	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
1. Vestibute training centres	—	—	—	—	—	—	—	—	—	—	—	—
2. Group training centres	10	40	4	16	4	16	AE	12	AE	10	—	—
3. Unit training centres	2	7	4	14	2	7	AE	8	AE	6	—	—
4. RTI (Tech. training institute set up by the company)	1	5.5	1	6	AE	10	AE	10	AE	5	—	—
5. Training mine	—	—	1	30	AE	30	—	—	—	—	—	—
6. Hostel/transport	—	18	—	20	—	15	—	10	—	6	—	6
7. MDI (Management development institute)	1	5	AE	3	AE	3	AE	—	—	—	—	—
Total		75.5		89		81		40		27		6

Note : A E — Additional expansion.
L S — Lump sum.

Number of Personnel to be Trained

Particulars	1978-79	1979-80	1980-81	1981-82	1982-83	1987-88
1. Initial/refresher training in V T Cs	26000	24000	25000	27000	30000	39000
2. Upgrading skills	1200	1500	1550	1600	1700	1800
3. Supervisory/managerial/technical	1000	1000	1200	1250	1350	1500

Training Facilities

12.7 To cope up with the above training, various types of training institutes/centres have been established in different companies and are proposed to be established as shown in the tables referred above.

Foreign Training

12.8 The foreign training being availed can be broadly covered under following five categories :

(i) Training which is provided as a part of outright grant/foreign aid.

(ii) Colombo plan and such other plans.

(iii) Training as part of the technical collaboration agreement with Poland, USSR etc.

(iv) Training in connection with supply of equipment.

(v) Training for applying new technology.

Foreign Aid for Training

12.9. Substantial aid is expected to be forthcoming from a number of countries for equipping our training centres with the latest tools and aids as well as for providing the training facilities on a continuous basis to different categories of training personnel. The significant areas of such aid are :

(a) Establishment of a training institute for trainers in our company.

(b) Establishment of a long-wall mechanisation training centre.

(c) Training to a group of 4 senior mine managers and 8 senior training officers in training methods and techniques in UK for a period of 6 weeks and 12 weeks respectively.

(d) Services of consultants from UK for a total period of 5 man-years for advising and assisting us in developing our training facilities and activities on the modern lines.

The above facilities are under the UK sectoral grant.

12.9.2 In addition to the above, based on an exercise carried out recently by a consultant deputed by ILO/UNDP substantial aid is expected to be forthcoming for developing training equipment and other facilities for providing basic and refresher training in different mining trades in the area of mechanisation.

12.9.3 Negotiations have also been carried out for assistance from France for providing both theoretical and practical training by French mining engineers on different mining problems such as fire damp, ventilation, spontaneous combustion, dust suppression, strata control etc., and other fields of safety engineering primarily concerned with the working of thick seams.

Captive Training Institutes

12.10 It is proposed to develop captive training centres in collaboration with the State Technical Education Departments. These centres will be ITI, MIT etc. The objective of such captive centres is two fold, (i) to arrange refresher training to our workers, and (ii) to modify the syllabus of these centres so as to meet our exact requirement.

Training Films

12.11 Training films are being procured by almost all the companies and ECL have taken a lead in this direction by setting up a fairly well equipped film library. In order to ensure equitable distribution of these training films presently held by the companies as well as the films available with the various professional institutes and agencies located in and around their areas which could be borrowed from time to time, a comprehensive list will be prepared. Based on this information, efforts would be made by CIL to obtain as many films as possible through the various foreign aid/grants etc.

Training Literature

12.12 Major emphasis in this regard naturally is being given to the development of training manuals for various types of trainings that are to be imparted in the organisation. Inspite of the various handicaps such as shortage of qualified staff, considerable amount of work has been done by the companies in this direction specially in the field of mining and non-mining technical training. The companies have agreed to circulate the complete details of such activities undertaken and completed by them to other companies.

Training Infrastructure

12.13 To develop the infrastructure required and to administer the training activities, a training board has been constituted with senior officers from CIL and subsidiary companies. It is felt that a large number of qualified training officers are required. A number of personnel will, therefore, have to be inducted in the organisation.

Self Development

12.14 To encourage the employees for self development through correspondence courses etc. a comprehensive scheme is being formulated under which employees will be offered incentives in various forms.

Departmental Examination

12.15 The system of departmental examination for the finance discipline in respect of newly-recruited management trainee (Finance) has been introduced, the scheme is proposed to cover also the non-executives of the Finance discipline. It is also proposed to evolve a scheme of departmental examination for non-executives belonging to all disciplines.

Hostel Facilities

12.16 CIL propose to utilise the capital assistance programme of the Ministry of Education, Govt. of India for building hostel accommodation in the coal mining areas for various categories of trainees. For this purpose specifications as received from the companies are under examination at CIL so that consolidated requirement can be worked out for taking it up with the Ministry of Education.

Chapter 13

Welfare Amenities & Social Benefits

Introduction

13.0 Earlier social obligations did not receive the attention it deserved. Nationalisation of coal industry has brought to focus inadequacies in housing, protected water supply, medical amenities, educational and recreational facilities etc. Unfortunately tempo of work has not been able to keep pace with the urgency of the problem. We can not afford to ignore this social obligation and will have to pool our resources for accelarating pace of achievement.

Housing — Overwiew of Present Housing Status

13.1.1 At the time of nationalisation there were 1,18,366 houses, including 30,000 dhowrahs in dilapidated condition. To this, 43629 houses have been added resulting in housing satisfaction of 27.5%.

Comparison with Other Sectors

13.1.2 There is no industry where shortage of housing is as acute as in coal industry. Housing satisfaction in some of the key sectors is indicated below :

Fertiliser	Range 60 to 85%
Steel	Range 51 to 68%
Oil	Around 68%
Other mining	Range 59 to 100%
Other industries	Range 60 to 76%

Even, according to B P E norms, for conditions relevant to coal industry, housing satisfaction has to be around 70%.

Housing Programme

13.1.3 After taking into account funds, capability and other relevant factors, ten year programme for housing entailing capital outlay of Rs 272.5 crores has been drawn up for subsidiaries of Coal India and the same is furnished in Diagram 13.1.

Impact of Housing Programme on Housing Satisfaction

13.1.4 This is indicated in Table 13.1.1

TABLE 13.1

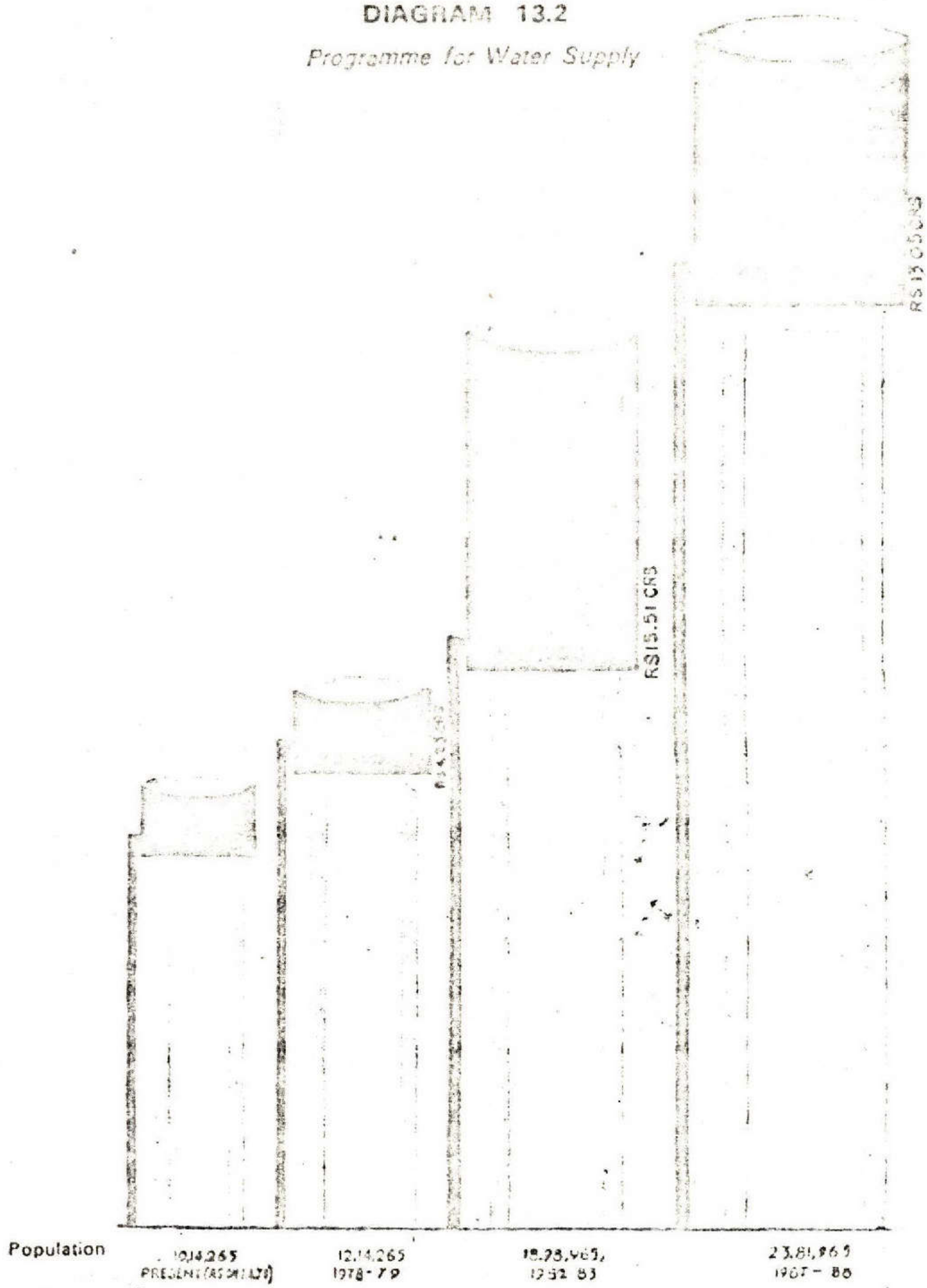
Impact of 10 Year Housing Programme on Housing Satisfaction

Period	Total employees	Total no. of houses	Housing satisfaction
1.4.78	587397	161995	27.57%
1978-79	594072	174920	29.44%
1982-83	642190	238200	37.09%
1987-88	708669	318900	44.99%*

* However effective housing satisfaction precluding 30,000 dhowrahs whose life would be over, would be 40%.

DIAGRAM 13.2

Programme for Water Supply



Showing additional population.

Per capita water supply proposed 135 Litres per day.

Strategy and Total Capital Outlay

13.3.3 First priority would be to establish above facilities where none exist. Second priority is accorded to shift creche, canteen, pit head bath etc. from their present substandard location to such buildings conforming to statute.

Implementation of above ten year programme for statutory welfare amenities would entail capital outlay of Rs 8.24 crores.

Medical Facilities — Medical Facilities Available in Subsidiaries of Coal India

13.4.1 In Coal India and its subsidiaries there are 44 hospitals with 1401 beds with resultant satisfaction of 2.40 beds per 1000 workers.

Medical Facilities Provided by Coal Mines Welfare Organisation

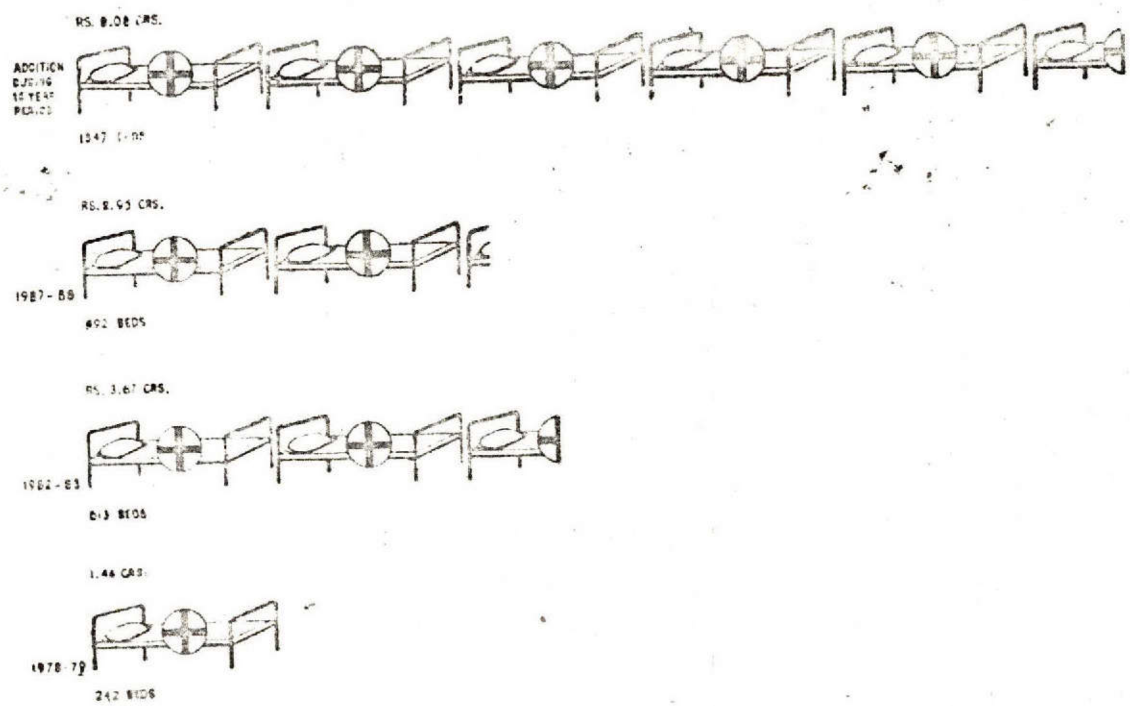
13.4.2 Coal Mines Welfare Organisation have three central hospitals viz. Dhanbad (300 beds), Kallu (Asansol) 350 beds and Manendragarh (100 beds). In addition they have six regional hospitals in Bihar (aggregate 236 beds), two in W Bengal (40 beds), three in MP (aggregate 110 beds) and one in Andhra Predesh. CMWO, either through their own hospitals or in arrangement with others have established 308 beds for treatment of TB, 46 beds for treatment of leprosy, 16 beds for treatment of mental cases. They have established 29 Anyurvedic dispensaries and 7 sub-units for malaria eradication. CMWO have established physio therapy centres, health promotion centres, rehabilitation cum convalescent homes and have arrangements for supply of artificial limbs and dentures.

Programme for Improving Medical Facilities

13.4.3 This is furnished in Diagram 13.3.

DIAGRAM 13.3

Programme for Improving Medical Facilities (Bed Strength)



It is proposed to achieve bed strength corresponding to 4 beds per 1000 workers. Recurring expenditure on account of provision of medical facilities to a satisfactory level is expected to be Rs 150 per worker per annum and the implication would be an annual expenditure of Rs 10.50 crores on account of medical facilities.

Comparison of Medical Amenities with Other Sectors

13.4.4 Programme for medical facilities is a humble beginning. Table 13.3 provides comparison with other sectors which would highlight inadequacies in this regard.

TABLE 13.3

Comparison of Medical Amenities with Other Sectors

Sector	No. of hospital beds per 1000 workers
Fertilizer	12 to 26
Neyveli lignite	8.5
Steel	16 to 18
Other industries	16 to 20
Coal	2.4 to be improved to 4.0

Occupational Health Centre

13.4.5 Pneumokoniosis, dermatitis, lumbago, hook worm etc. are diseases associated with coal mining industry. These diseases tend to undermine the health of the miners which Coal India can illafford. It is proposed to initiate action for setting up of Occupational Health Centre during 1983-84 1987-88 and provision of Rs 5 crores has been made on this account.

Family Welfare Planning

13.4.6 Coal India and its subsidiaries have established rapport with Commissioner of Family Planning, Government of India and Health Directorates of State Governments so that full facilities provided by these organisations on account of family welfare planning can be availed. While there would be no coercion or force, the workers and their families would be educated regarding benefits accuring from limited family.

Educational Facilities

13.5.1 Coal India can not ignore its social obligation for arranging proper eductional facilities for the benefit of wards of the workers. Due to geographical remoteness of collieries, State Governments and/or reputed educational institutions do not evince interest to run schools.

Strategy for Education

13.5.2 Following strategy is envisaged for providing educational facilities :

- (i) To construct school buildings and if unavoidable to equip them and handover to the State Governments and/or reputed educational institutions.
- (ii) To provide grants-in-aid to reputed educational institutions for operating schools in coal-field areas.
- (iii) To provide adequate fleet of school buses for facility of wards of workers.
- (iv) To persuade Ministry of Education to establish Central Schools in the areas covered by subsidiary companies of Coal India.

Programme for Providing Educational Facilities

13.5.3 Present status, ten year programme for providing educational facilities and capital outlay on each of such facilities is indicated in Table 13.4.

TABLE 13.4

10 Year Programme for Providing Educational Facilities

(Estimated cost in Rs lakhs)

Sl. No.	Particulars	Present status	Goal	1978-79	1982-83	1987-88	Addition during ten year period
1.	Primary school	255					
	No. to be added		one in each colly.	33	99	42	174
	Estimated cost			31.00	91.40	48.00	170.40
2.	Middle school	118					
	No. to be added		one in large colly. or sub-area	9	42	19	70
	Estimated cost			13.00	48.50	27.00	88.50
3	Central school	4					
	No. to be added		Three to four per company	1	11	6	18
	Estimated cost			5.00	100.00	50.00	155.00
4.	High school	72					
	No. to be added		one in each area	10	21	15	46
	Estimated cost			20.00	46.10	27.00	93.10
5.	College	13					
	No. to be added		one for each or two areas	1	9	Nil	10
	Estimated cost			10.00	85.00	Nil	95.00
6.	School bus	112					
	No. to be added		At least one per colliery	14	86	68	168
	Estimated cost			19.15	115.50	100.00	234.65
	Total capital outlay on educational facilities			98.15	486.50	252.00	836.65

Sports and Recreation

13.6.1 Due to geographical remoteness and lack of amenities in the collieries, recreational facilities need to be provided in the collieries with utmost expediency. It is proposed to provide workers institute/club, mobile cinema units, sports and playground, childrens park to improve recreational amenities in our collieries. To impart training in sewing, embroidery and other skills to the women folk, it is proposed to provide Mahila Kalyan Samiti in every colliery. For the benefit of employees of the coal industry, it is proposed to establish holiday homes in hill stations and/or other suitable places.

Present Status and Programme for Providing Recreational Amenities

13.6.2 This is furnished in Table 13.5.

TABLE 13.5

Ten Year Programme for Providing Recreational Amenities

(Estimated cost and capital outlay in Rs lakh)

Sl. No.	Particulars	Present status	1978-79	1982-83	1987-88	Addition during ten year period
1.	Workers' Institute	199				
	No. to be added		37	107	76	220
	Estimated cost		33.60	108.00	82.20	223.80
2.	Childrens' park	Nil				
	Capital outlay		0.55	10.45	11.30	22.30
3.	Mobile cinema	40				
	No. to be added		3	28	14	45
	Estimated cost		3.50	34.25	18.50	56.26
4.	Mahila Kalyan Samiti	89				
	No. to be added		23	67	15	105
	Estimated cost (including CCL)		3.45	10.20	2.25	15.90
5.	Sports	Nil				
	Capital outlay		18.75	85.50	50.30	154.55
6.	Holiday homes	Nil				
	No. to be added		1	4	Nil	5
	Estimated cost		4.00	16.00	Nil	20.00
	Total capital outlay on recreational amenities		63.85	264.40	164.55	492 80

Co-operatives and Banks — Co-operative Stores & Co-operative Credit Society

13.7.1 It is proposed to make available scarce and essential commodities at reasonable price through Co-operative Stores for which purpose it is proposed to provide building and managerial subsidy. To free employees from clutches of money lenders it is proposed to establish Co-operative Credit Society in each colliery. For two or more small collieries in contiguity one Co-operative Stores & Co-operative Credit Society would be established. The programme for establishing Co-operative Stores and Co-operative Credit Society is furnished in Table 13.6.

TABLE 13.6

Programme for Establishing Co-operative Consumer Stores & Co-operative Credit Society

(Estimated cost in Rs lakh)

Sl. No.	Particulars	Present status	1978-79	1982-83	1987-88	Addition during ten yr period
1.	Co-operative Stores	10 Central & 195 Primary units				
	No. to be added		27	65	71	163
	Estimated cost		17.05	42.10	37.50	96.65
2.	Co-operative Credit Society	112				
	No. to be added		30	62	27	119
	Estimated cost		19.80	32.14	22.83	74.77
	Total capital outlay on Co-operatives		36.85	74.24	60.33	171.42

Banks

13.7.2 It is proposed to ensure functioning of Bank branch in each sub-area and/or large colliery. Facilities of Bank extension counter is envisaged for each colliery.

It is proposed to privide on rental basis building with accommodation to Banks. Programme for ensuring functioning of Bank branches is given in Table 13.7.

TABLE 13.7

Ten Year Programme for Bank Branches

(Estimated cost in Rs lakh)

Sl. No.	Particulars	Present status	1978-79	1982-83	1987-88	Addition during ten yr pd
1.	Addn to Bank branches	105	11	34	13	58
	Estimated cost		15.50	64.80	32.40	112.70
	Total capital outlay on Co-operatives & Bank branches		52.35	139.04	284.12	475.51

Communications, Community & Area Development — Post Offices

13.8.1 Existing facilities in coalfield areas is not at all satisfactory. It is proposed to persuade P & T Department to establish Post Offices with telegraph facilities for speedy and effective communication.

It is proposed to provide building for housing Post Offices and also to provide accommodation to the Postmaster. Probable expenditure on this account is indicated in Table 13.8.

TABLE 13.8

Ten Year Programme for Providing Accomodation for Post Offices

Particulars	1978-79	1982-83	1987-88	Addn during ten yr pd
No. of Post Offices to be added	7	47	7	71
Estimated cost on building in Rs lakhs	2.80	27.00	18.50	48.30

Community & Area Development

13.8.2 This would cover dairy, poultry, pisciculture etc. It is proposed to encourage employees to grow kitchen garden for which purpose manure and seeds would be provided to them at subsidised rates. To restore ecological balance tree plantation would be undertaken in and around collieries. Rapport has been established with Forest Dept. of concerned State Govt. and also Forest Research Institute, Dehradun. Programme for community and area development is indicated in Table 13.9.

TABLE 13.9

Capital Outlay on Community & Area Development During Ten Year Period

Particulars	1978-79	1982-83	1987-88	Total capital outlay during ten year peroid
Capital outlay in Rs lakhs	19.25	100.00	97.00	216.25

Roads

13.8.3 One of the major constraints experienced by collieries is the absence of proper roads. State Govt. and Mines Board who are vested with the responsibility of providing proper road network have done practically nothing. Since road cess is collected by these organisations, it is proposed to persuade them to allow Coal India to construct and maintain roads on cost reimbursible basis.

Programme for Construction of Roads

13.8.4 Mostly approach roads would be constructed to link the colliery with trunk roads. Programme for construction of roads is given in Table 13.10.

TABLE 13.10

Ten Year Programme for Roads

Particulars	1978-79	1982-83	1987-88	Addition during ten year period
Length in kms to be added	131	577	600	1308
Estimated cost in Rs lakhs	265.00	1280.00	1367.00	2912.00

Capital Outlay on Social Obligations

13.9 Capital outlay on housing, protected water supply, medical facilities, educational and recreational facilities and other social obligations is indicated in Table 13.11.

TABLE 13.11

Capital Outlay on Welfare During Ten Year Period

Item	1978-79	1982-83	1987-88	Total capital outlay during ten year period
	(Capital outlay in Rs crores)			
(i) Housing	17.11	107.65	147.75	272.51
(ii) Water supply	4.23	15.51	13.05	32.79
(iii) In fulfilment of statutory obligations (includes) dispensaries & ambulances)	1.15	4.86	2.23	8.24
(iv) Medical facilities (hospitals)	1.45	3.07	2.95	8.03
Occupational health centre	—	—	5.00	5.00
(v) Educational facilities	0.98	4.86	2.52	8.36
(iv) Sports & recreational facilities	0.64	2.64	1.65	4.93
(vii) Co-operatives & Banks	0.52	1.39	2.84	4.75
(viii) Communications, community & area development	2.87	14.07	14.82	31.76
Total capital outlay on welfare	28.96	154.65	192.81	376.42

Allocation of Capital on Various Social Obligations

13.10.1 This is indicated in Diagram 13.4.

DIAGRAM 13.4

Allocation of Capital on Various Social Obligations
(Total capital outlay Rs 376.42 crores)

Conclusion

13.10.2 Coal India is alive to the problems concerning welfare of its employees and has adopted a progressive and positive policy to improve the living conditions in coalfield areas so that the morale of its employees is high and sense of belonging is inculcated in them.

Chapter 14

Research and Development

Introduction

14.0 Need for research in the mining industry in India was recognised in late 50's and to meet this end CMRS was established. Despite the good work done by CMRS in various fields, there could not be desired impact in practical areas due to lack of proper environments most of the industry was in private hands and sufficent resources were not available for applied research.

With the establishment of unified management under Coal India a balanced approach to R&D schemes in various disciplines on a long term basis has become possible. A number of schemes in various diverse fileds have already been identified in a 15 year plan of science and technology adopted by Govt. of India. Many of these schemes have already been taken up and in some cases actual field trials have commenced. The objective of these schemes is to introduce scientific mining, reduce cost, increase production, productivity, higher coal recovery etc. The two main examples of field trials in the sphere of mining technology are scraper mining and longwall mining.

The various research schemes have been allocated to different institutions like CMRS, ISM, IIT, Kharagpur etc. Coal India has identified the following six major areas for carrying out their R & D activities :

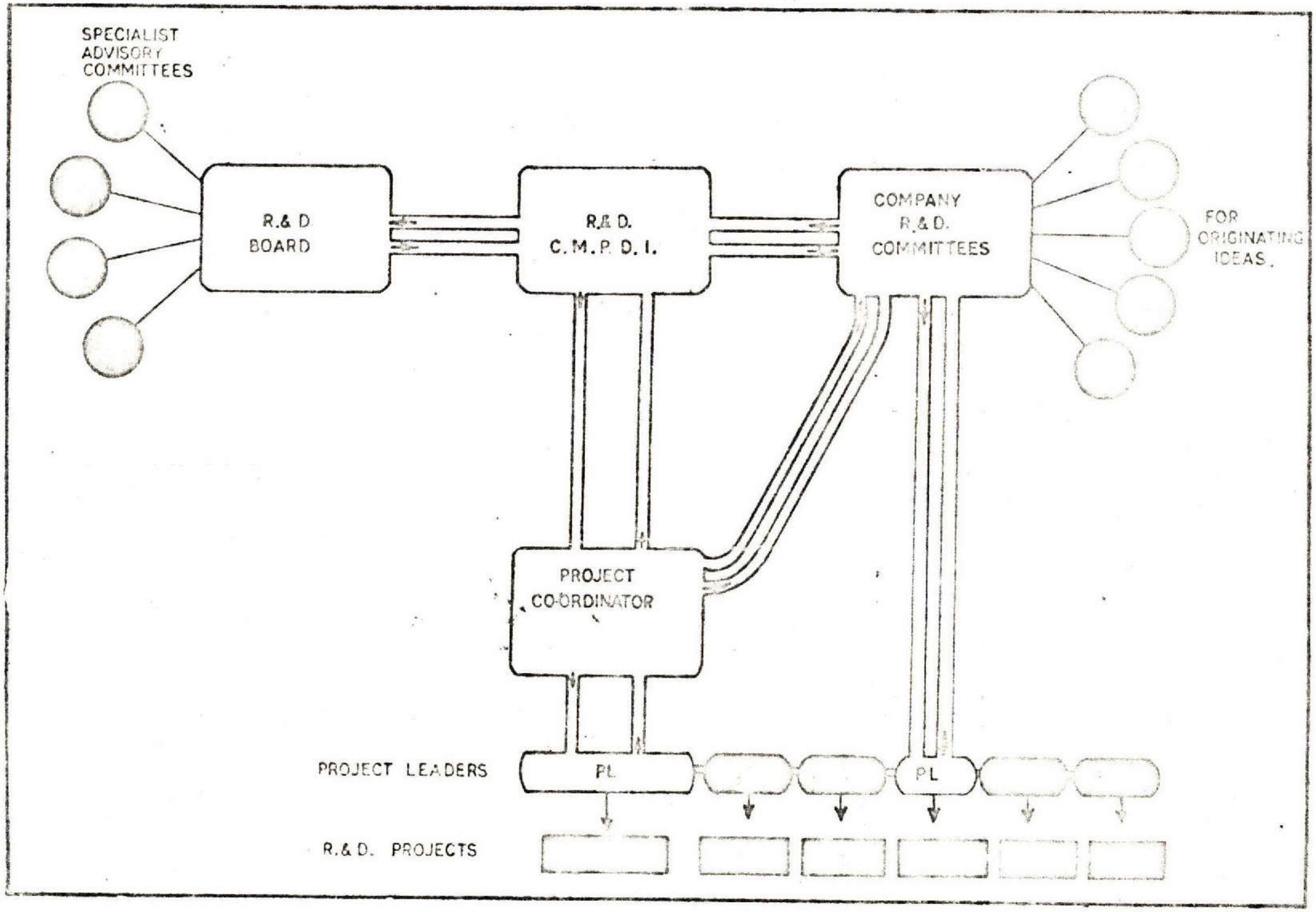
(a) Coal exploration;
(b) Mining technology;
(c) Engineering equipment and their development;
(d) Coal preparation/beneficiation;
(e) Telecommunication & electronics; and
(f) Coal utilisation.

Organisation of R & D Activities

14.1 In order to have a co-ordinated approach a 3-tier organisation comprising of company R&D Committees, R&D of CMPDI and R&D Board of CIL has been formed.

R & D Board of Coal India Limited (Diagram 14.1) identifies thrust areas, provides guidelines, indicates priorities and carries out budgeting and monitoring. (It has already recommended the funding procedure). It is composed of members from subsidiary companies, Apex, Ministry, DGMS Regional Institutes of CMPDI, Research Institutions, MECON, HEC & MAMC. Each coal company is having its own R&D committee having representation from each area, Regional Institute, CMPDI and a few specialist representations in different disciplines like Geology, Engineering, Washery etc. The committee's function is to identify the problem by discussions with various field and other executives and forward them to CMPDI, review and oversee R & D work being done in respective companies. There are a number of specialist advisory committees on different subjects which assist the R & D Board whenever specific problems are referred to them besides doing the technical audit of the various schemes under implementation. It is proposed to form trial teams in each subsidiary for introducing certain new mining methods. It is also proposed to supplement the work of the team by a Pit Committee in case of ordinary trials and a Steering Committee having representation from DGMS company headquarter and CMPDI in case of difficult trials.

DIAGRAM 14.1
Methodology of R & D Board



Funding of R & D Schemes

14.2 The R & D activities are being funded from two main sources, e.g. company R & D or trial funds and the Science & Technology (S & T) grants. The company R & D funds are primarily being used for undertaking trials of new mining methods and mining techniques.

It has also been envisaged that respective coal producing companies would introduce suitable mechanisms to deal with the disadvantage, which may arise by way of losses for undertaking the trials at a particular colliery. Under Science & Technology Grants of Govt. of India various schemes in the six areas of research are approved every year. In 1976-77, thirteen schemes in 1977-78, sixteen schemes and in 1978-79 fortytwo schemes were approved. The total approved cost of these schemes is of order of Rs 10 crores of which actual expenditure in 1976-77 was 1.29 crores and in 1977-78, 0.56 crores respectively. It is proposed to spend Rs 2.22 crores in 1978-79. These schemes cover mostly basic, R & D schemes and some experimental pilot plants. Out of these 70 schemes, 24 are in mining technology, 8 in allied engineering, 19 in coal exploration, 2 in coal preparation, 11 in telecommunication and electronics and 6 in coal utilisation.

An amount of Rs 40.00 crores has already been committed by 1978-79 from company R & D funds for the mining technology schemes given in Table 14.1 (A). In last two years equipment worth 15 crores have been purchased for the several trials. These include apart from the trials going to start shortly, the trials already in progress with scrapers and side loaders, longwall with solid blasting and with plough. During the next 3 years it is expected that further 25 crores worth of equipment will be purchased for conducting trials of four sub-level caving faces, four power support faces, two shearer faces, two load haul dumper development districts, three scraper depillaring districts and three road header districts etc.

Selection of Optimum Number of Trials

14.3 The number of schemes which have been included for R & D field trials are based on the consideration that a minimum number of mines shall be covered in each area and in each coalfield so as to have a proper acquaintance of various aspect of the new technology under different geological conditions and also to have a broader base for the comparision of new technology vis-a-vis the existing ones. A certain minimum number of trials are also considered necessary for proper dissemination of the technology; before wider use of the new technology is adopted and indigenous manufacture taken up. It is proposed to analyse the results from all these trial faces to arrive at a final choice of best methods of mining to be practised in any set of condition in the long run. However, the general attempt is to have the optimum number of trials (in a business like manner) i. e. not to have too-many or too less.

Coal Exploration

14.4.1 The need for R&D in coal exploration is mainly felt, firstly, because of the necessity to quicken the tempo of exploration, and secondly because of additional more reliable data needed for the highly mechanised mines being planned for a greater output. Thirdly, with the help of R&D programme better economy is proposed to be effected. The necessity for the development of new techniques of exploration to expedite the progress of investigation is, quite apparent. However, before these new techniques become routine, they have to be taken up as R & D projects to test their efficacy.

With the increase in mechanisation in practically every field of mining to achieve higher productivity, safety and conservation, it will be necessary to collect additional geological data which could not so far be collected by the conventional means in use. These data relate mostly to the engineering geology and hydrogeological properties of the coal measure strata. However, before these data are supplied, the R & D projects have to be taken up in the first instance to work out the methodology for the collection, interpretation and utilisation of such data.

R & D Schemes in Exploration

14.4.2 About the various schemes which have been taken up and also proposed to be undertaken subsequently, it may be stated that broadly speaking the new thrust in this direction would be channelised in following directions :

(a) Application of geophysical methods ;

(b) Application of computer for data processing & optimisation studies ;

(c) Engineering geology;

(d) Hydrogeology ;

(e) Coal analysis ; and·

(f) Coal geology.

At present 19 schemes have been either taken up or are being planned to be taken up during 1977-78 to 1980-81, with a total outlay of Rs 131 lakhs. Out of these, 10 schemes are based on geophysical investigations. The computer will play a vital role in one of these investigations as well as in four others beside making significant contribution in the case of most of the geophysical surveys, engineering geology and hydrogeological investigations. One scheme relate to R&D work to expedite chemical analysis of coal seams in boreholes. One scheme of geophysical investigations involves application of remote sensing to problems relating to coal mining.

Out of the above, 16 items were earlier included in the 'Project Black Diamond', published in 1976. Since then 3 more items have been considered. All the schemes are being funded by Ministry, S&T Grants. Out of the 19 schemes, work on one scheme regarding diagrams by electronic data plotter has been completed. In respect of hydrogeological investigations two models have been developed for quantifying make of water in caving conditions in Mahakali colliery. These will be tested in experimental depillaring operations. In case of another scheme on statistical analysis for optimisation of drilling, a model has been developed to reduce the work load of CFRI Laboratories.

New Schemes for the Period 1981-82 to 1987-88

14.4.3 In the previous paragraphs the areas where R&D work will be carried out during the period 1977-78 to 1980-81, have been enumerated. Many of the projects are likely to spill over to 1982-83, but new thrust areas are also likely to develop specially in satellite, imagery, drilling techniques, geophysics, computer etc. It may be mentioned that one of the important facilities required for the above work is the modern computer equipped with flat bed plotter, digitizer, display processor unit, etc. The new areas which will be taken up for investigation during 1981-82 to 1982-83 and beyond are satellite imagery, aerial photographs, aerial thermal imagery of Jharia coalfield, new drilling techniques, induced polarisation survey and other geophysical techniques, Laser studies, development of simulation models, a fully operating system of a geo data bank, geophysical survey of hidden coalfields and coal photography.

Mining Technology

14.5.1 In the field of mining technology, the research is directed toward systematic development of new methods of mining, applying the modern technology already proved in the advanced countries and application of new machines with a view to increase safety, efficiency, economy and percentage extraction.

In India, bord & pillar system of mining is the most prevalent method (97% of underground production) and is likely to remain so until 1500-2000 million tonnes of coal standing in pillars is mined out and alternative longwall mining system takes over. As such the thrust of mining technology research is towards improving this method so as to achieve objective mention in Para 14.0 and wherever possible its replacement by longwall system of mining to increase safety, economy, efficiency and percentage of extraction.

14.5.2 The mining conditions vary widely from one case to the other, the various trials have to be done in the mines, rather than in the laboratories. For this, various types of mining methods and equipment, to evaluate their suitability under different sets of conditions and their techno-economics are to be made before undertaking indigenous manufacture and large scale application for better environmental conditions and greater safety in mines. For example, trials with scrapers, side loaders and load haul dumpers are envisaged in bord & pillar mining. Scrapers have been used at Toposi, Kumardihi, Murlidih 20/21 pits, Kessergarh, Saunda 'D' & Patherkhera. The results of trials in many cases have already proved to be suitable for our mining conditions. Flight loaders, shearers along with hydraulic and friction props and self advancing supports in longwall faces are proposed to be introduced shortly. Longwall caving trials with solid blasting are going on at Ningah and Moonidih. Longwall caving with plough is being practised at East Katras. Use of Augar mining and Hydraulic mining is also foreseen. Application of continuous miner for extraction of pillars is under examination. As the introduction of a new technology would involve changes with regard to training, infrastructure, manufacture of equipment etc. it is necessary to conduct experimental trials to ascertain their suitability before making a large scale application. R&D activities are also needed in various other fields to economise on cost of production, conservation and safety. Such areas are, transportation of coal and material, manriding, sinking, drifting and construction, environmental conditions in mines and mining areas, existing mine and coalfield fires, spontaneous heating, strata control, rock mechanics and mine support, rescue work, stowing, explosive, opencast mining and development of equipment.

14.5.3 There shall be a wing under CMPDI for analysing accidents in coal mines. It may ultimately take the form of a National Accident Research Institute.

14.6 A R&D laboratory at Ranchi within CMPDI is coming up. The laboratory is expected to start functioning by 1978. The construction of building is over, equipments have started arriving and necessary manpower is being recruited. The laboratory will have three wings e.g. mining, exploration and coal beneficiation. Subsequently the laboratory facilities may also come up in the Regional Institutes by the later years. The R&D laboratory at Ranchi will be complementary to CMRS and other research institutions. Initially about half of the personnel will be recruitted. The work programme will become double by 1980-81, after the full contingent of personnel and instrument is made available.

A list of R&D projects already taken up and are either in progress or likely to commence soon are.

TABLE 14.1

	Name of Scheme	No. of Faces/Panels	Company
1	2	3	4
A.	Schemes as per Earlier Coal Plan		
1.	Single slice LW caving with friction/hydraulic props using shearer/plough/solid blasting	9	All four
2.	Single slice longwall with self advancing supports	6	ECL, BCCL, WCL
3.	Descending slice/sub-level caving	5	BCCL, CCL
4.	Modified LW/modified sub-level caving	4	BCCL, ECL, WCL
5.	Development using scrapers	5	BCCL, ECL, CCL
6.	Depillaring with scrapers	1	ECL
7.	Development with side loaders	10	ECL, BCCL, CCL, WCL

Civil Engineering

14.7 The civil engineering group proposes to undertake the following time bound experimental programmes. The scheme are basically aimed at (i) cost reduction technique, (ii) better use of locally available materials, and (iii) innovative use of constructional materials to save time, labour and scarce materials. The details of the schemes are given in Table 14.2.

TABLE 14.2

Sl. No.	Name of R&D Project	Target Date	Remarks
1.	Experimental construction of economic miners quarters	In progress since October, 1975	4 units of such miners quarters have already been constructed at Kargali.
2.	Precast prestressed concrete element as mine roof support	In progress since April, 1977	Work progressing as per schedule.
3.	Innovative use of materials for stoppings and stowing	1980	Necessary details on the subject are being collected.

Engineering Equipment

Programme for 1978-79 to 1980-81

14.8.1 This programme is based mainly on equipment development covering mechanical, electrical and industrial electronics. The total estimated capital need for the period upto 1980-81, is Rs 67.75 lakhs. Some of the projects are trolley mounted portable crusher, emergency escape hoist system, pedestal type rock breaker, aluminium alloy body dumpers, mobile coal sampling and testing, wagon hauler for 30 box wagons, mobile 3 m^3 bucket loaders and scraper bucket haulers of 4 m^3 capacity. The use of these equipment, apart from giving obvious advantages over conventional systems is likely to be economical as well.

Programme for the Period 1981-82 to 1987-88

14.8.2 This has been elaborated under the following main four headings :

(a) *Equipment Development*

(i) Equipment development basically with mechanical engineering background. This covers projects like trolley wire dumper, centralised belt reconditioning plant and wagon loading at 4000 tph. The main objectives are to reduce fuel cost of dumpers in open-cast mines, capital & replacement cost of conveyor belts and wagon loading time respectively.

(ii) Equipment development basically with electrical engineering background. This includes projects like 3.3 KV & 6.6 KV FLP switch gear, 250 & 315 KVA flame proof dry type transformer for meeting large requirement of mines and solid state thyristor controlled starter for squirrel cage 100/150 HP motor to substitute expensive DC motors and slipring AC motors. Their use is likely to reduce the present cost.

(b) *Bulk Material Handling*

This includes projects like unit train loading system for coal transport between captive mine and thermal power station, high capacity screening plant upto 600 tph for bigger capacity CHP, high capacity primary crusher complex for opencast CHPs and large ground stock system with mechanised building up & reclamation upto 600 tph to balance the fluctuating plant production & off take of coal. The advantages will be faster rate of loading, reduced operation cost and reduced plant stoppages even in case of no off take for longer period *(c) Coal Transport*

Coal transport needs during the year 1981-82 to 1987-88, is likely to include systems like belt conveyors above 4000-tph capacity (of 20 mm size), high capacity aerial ropeways, coal slurry pipe lines transport, vertical hydraulic transport, transport by sea (for coal export), river transport, loco transport and skip transport in opencast mines. The use of these will permit the transport of coal between captive mine and thermal power station, in undulating terrain, high capacity transport under specific conditions, watery mines for vertical transport encouraging indigenous development of ship/barge loading equipment, encourage loco transport upto 30 km in remote areas and to transport material from quarry floor to surface. All these projects are likely to be more economical also.

(d) Safety

This includes projects like automatic fire detection system with solid state circuitry, portable coal dust sampler, combustible gas sensor, remote type detector and portable breathing apparatus are to be taken up during 1979-83. The main objectives for taking up these projects are, to get an early fire alarm, for reducing health hazards, to get remote indication of combustible gas and for rescue or fire fighting operations respectively. These will ensure a high standard of safety and efficiency of rescue operations.

Beneficiation Activities in Coal Preparation

14.9.1 Though different types and capacities of crushers and some main washing equipment are being indigenously manufactured, it is high time that some simple washing jigs of the standard types and capacities are developed in the country.

14.9.2 Washery Department of CMPDI has a programme to undertake the following schemes under Research & Development :

(a) Better recovery of fines from coal washeries and reuse of water;
(b) Dewatering and filtering of fine coal;
(c) Development of coal preparation process and equipment;
(d) Development of substitutions for imported equipment in the field of coal preparation;
(e) Standardisation of main equipment & spare parts; and
(f) Utilisation of rejection from coal washeries.

14.9.3 For the purpose of testing and investigation of coal and development of process and equipment of spare parts for coal washing as mentioned above, a R&D laboratory is being set up by CMPDI. After establishing this laboratory it would be possible to develop process and equipment to suit our conditions and try them before exploitation on commercial scale in the field. In fact the Dutch State mines are working on this line and it is well known that today they are erecting a number of plants in this field all over the world.

Orders for the various equipment of the laboratory have already been placed and the same started coming in stages. The order is likely to be completed in the next few months.

R&D on Telecommunication and Electronics

14.10 The R&D projects on telecommunication and mining electronics have been discussed in detail in Chapter 7.

R&D on Coal Utilisation

14.11 The R&D projects on coal utilisation have been discussed in detail in Chapter 11.

Chapter 15

Safety, Conservation and Ecology

Introduction

15.0 Safety and conservation are an integral part of the production programme of CIL. A total systems concept regarding safety has been adopted with a target of achieving the stage of zero accident potential.

Safety at Planning Stage

15.1 CMPDI has advised all its planning engineers to take safety into consideration while planning for a new mine or re-organization of an existing one. While deciding the method of mining, system of transport and other related matters, all aspects of safety are considered at depth.

Methods of Mining

15.2 In our country, bord and pillar system of mining has been followed due to certain historical reasons and physical constraints. The world over, the mining community has accepted that longwall system of mining is a safer system, as compared to bord and pillar. Since we can not change the technology in a day, CIL has planned out to introduce longwall system in a phased manner. The Table 5.4 of Chapter 5 gives the number of longwall faces planned in next 10 years time and the percentage of underground production expected from them.

Safety Organization

15.3 In order to keep an internal vigil on the safety conciousness each subsidiary of Coal India has got an Internal Safety Wing. Their job is to an extent of technical audit in respect of safety. Some new concepts have also been introduced like safety clearance system by the Internal Safety Wing before starting extraction in a new panel or commencement of any dangerous operation. Every mine has been advised to maintain breakdown register and safety instructions register in order to keep a track on day to day operations.

Safety Propaganda Drives

15.4 Various safety propaganda drives are undertaken by the subsidiary companies according to their convenience with a view to educate the workers regarding safety measures and make them more safety concious. By 1979-80, every coal mine under CIL will be provided with a loudspeaker with pre-recorded safety message to be delivered to the workers during the shift beginnings. In addition, necessary safety instructions regarding day to day operations in the mine will also be communicated to the workers by competent persons through these loudspeakers. The programme has already started and the loudspeaker and tape recorders are being supplied from 1977-78, so as to cover at least 30% of the mines in each year.

Supports Underground

15.5 With the view to improve the quality of supports in the underground mines, the subsidiary companies have been advised to purchase their timber requirements only from the State Forest

Corporations concerned. In order to further improve on the situation, it has been decided to replace timber supports by steel supports as far as possible. A rate of replacement of 10% per year has been suggested. In addition to this, the new mines are being planned only with the help of steel supports, like friction and hydraulic props and also with self-advancing supports. It is expected that by 1986-87 only the bare essential quantity of timber will be used as support underground.

Standard of Haulage Tracks

15.6 Since haulage constitutes the second largest cause of accident underground, next to roof fall, therefore, considerable attention is being paid to the maintenance of track and rolling stock in the haulage system. It has been proposed to replace all the lower section rails by 15 kg sections (30 lbs rails). Since the total change will involve a huge capital, it is proposed that each subsidiary company should do this replacement in a phased manner so as to cover at least 10% of the mines every year.

Standard of Mine Plans

15.7 In order to improve the standard of mine plans quality survey equipment are being provided in each mine, in a phased manner. Training of survey staff and posting of qualified survey personnel in mines is an integral part of this drive.

Safety Equipment

15.8 In order to avoid the chances of human failure and error of judgement, sophisticated safety equipment are being provided in all gassy mines for the detection and measurement of methane in the gassy mines. Similarly CO detectors/monitors are being provided in the mines where chances of spontaneous heating and fire is there. The Table 15.1 to 15.8 give companywise phased requirement of methanometers, flame safety lamps, methane monitors/recorders, and CO detectors in the mines in the next 10 years time.

TABLE 15.1

Requirement of Top Feed Flame Safety Lamps (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	100	150	200
ECL	5000	6000	7000
BCCL	5000	6000	7000
CCL	1000	1500	3000
WCL	1000	1500	3000
Total CIL	12100	15150	20200

TABLE 15.2

Requirement of Methanometers (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	30	60	100
ECL	268	875	1175
BCCL	378	850	1100
CCL	150	283	353
WCL	29	390	539
Total CIL	855	2458	3267

TABLE 15.3

Requirement of Multi Point Mathane Monitoring System for Degree III Mines (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
ECL	4	8	19
BCCL	4	8	16
CCL	2	4	5
Total CIL	10	20	40

TABLE 15.4

Requirement of Single Point Methane Monitoring System for Degree II Mines (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	2	8	8
ECL	10	50	100
BCCL	6	30	60
CCL	6	25	50
WCL	1	4	8
Total CIL	25	117	226

TABLE 15.5

Requirement of Co-detectors (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	10	20	40
ECL	255	405	505
BCCL	200	350	500
CCL	50	70	100
WCL	50	100	200
Total CIL	565	945	1345

TABLE 15.6

Requirement of Burnside Boring Machine (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	1	3	5
ECL	8	18	24
BCCL	8	16	30
CCL	8	16	24
WCL	24	37	50
Total CIL	49	90	133

TABLE 15.7

Requirement of Underground Telephonic Communication System
(Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	2	3	3
ECL	8	40	50
BCCL	6	30	60
CCL	5	25	50
WCL	—	15	40
Total CIL	21	113	203

Self Rescuer

15.9 It has been decided to provide self rescuers to all the mine workers in Degree III and Degree II gassy mines. The companywise phased requirements of the self rescuers are given in Table 15.8.

TABLE 15.8

Requirement of Self Rescuers (Nos. proposed to be in use)

Subsidiary	1978-79	1982-83	1987-88
NEC	3000	6000	10000
ECL	20650	35000	49650
BCCL	20000	40000	50000
CCL	7600	25000	50000
WCL	5800	17132	65732
Total CIL	57050	123132	224382

Emergency Rescue Equipment

15.10 Six stations are being proposed on the basis of one in each coalfield for housing emergency heavy rescue equipment for helping the rescue operations in case of big disasters. They will include, a large diameter boring machines, large capacity high head pumps, portable winders and diesel generating sets for the same. Their phased requirement has been shown in the Table 15.9.

TABLE 15.9

Requirement of Emergency Rescue Equipment
Proposed Centres — Sodhpur (ECL), Sudamdih (BCCL), Barkakana & Talcher (CCL), Silewara & Korba (WCL)

Equipment	1978-79	1982-83	1987-88
1. Mobile winders	2	4	6
2. Large diameter boring machine	3	6	6
3. Submersible pumps (High head, high capacity)	16	36	48

Alternative Source of Power

15.11 Alternative source of power for running the main mechanical ventilators and winders is essential in case of Degree II and Degree III gassy mines. It is proposed that all such mines will be provided with alternative source of power by the year 1979-80.

Safety Devices in Winding System

15.12 In Jharia and Raniganj coalfields majority of the mines are being worked through shafts. Large number of them are not fitted with adequate number of safety devices. It is proposed that in a phased manner covering at least 30% of such shafts every year, all such shafts will be provided with quality suspension gears, power brakes, speed indicators, depth indicators, automatic speed controllers and overwinding preventors, by the year 1979-80.

Training

15.13 Training is an essential element in arousing the safety conciousness amongst the workers. Imparting skill with knowledge should be the basic aim of all vocational training. CIL has taken up training of manpower at all levels in a big way.

Conservation

15.14.1 Coal, being the prime source of energy in our country, is one of the most important natural resources. Therefore, its conservation has to be given due importance. A large amount of coal is wasted every year due to fire. Similarly huge amount of coal is locked up due to fires in underground workings, in standing pillars which can not be extracted due to non-availability of stowing material and under the built up areas. Recovery of this locked up coal is a national problem and has to be tackled on two levels. Technological and legislative. Technologically coal has to be recovered from locked up pillers by introducing such methods of mining that no stowing is required and by quenching the fires where necessary. On the legislative front, the Government has to inact law to prohibit further construction on the coal bearing areas and also to assist the coal companies in shifting the townships and villages from the coal bearing areas, where necessary.

Fires

15.14.2 Mine fires have assumed disastrous proportion in the Jharia coalfield. Till today there are 110 fires reported, out of which 70 are in active state. On a broad estimate, about 34 m t of coking coal has been lost and about 46 m t of coal is locked up due to these fires. Considerable portion of which can be recovered by successfully dealing these fires. The BCCL has prepared a programme to deal with the fire problem on a systematic and phased manner. In order to deal with these fires the entire coalfield has been broadly devided into four parts, namely — Rajapur fire area, Lodna fire area, Jogta fire area and Sudamdih fire area. Various methods like sand blanketing, covering with over-burden dumps, water spraying, water injection and CO_2 injection are being tried. Even digging out the fire physically with the help of HEM equipment is being considered. In the Raniganj coalfield 11 cases of fire are on record, resulting in a loss of about 0.02 m t of coal and locking up of 0.2 m t of coal. Programmes have been chalked out to deal with this fire effectively in next two years time.

Stowing

15.14.3 In order to protect the surface structures, roads, railway lines, rivers, overlying seams, or overlying water logged and fire workings, a sizeable proportion of coal from underground mines has to be extracted every year with the help of hydraulic sand stowing. The prime source of sand for stowing has been Damodar river, which has been depleated year after year. Alternative source of supply like the dredged material from Maithon Dam and Durgapur Barrage are under consideration. Plans have already been prepared for the above schemes by BCCL. Crushed stone stowing system is also being experimented and the use of quarry debris as an alternative stowing material will depend largely on the success of these experiments.

Shifting of townships

15.14.4 Shifting of townships like Jharia, Raniganj, Barakar etc., and prohibiting the future inhabitation on the coal bearing area is under active consideration of the Government. The Committee on Safety in coal mines consituted by the Government of India is already studying this problem.

Ecology.

15.15.1 Opencast mining as well as underground caving spoil the surface area rendering it useless for future agricultural use. The Table 15.10 gives the companywise break-up of area already covered under the opencast mining and overburden heaps, and subsidence area due to mining. Table 15.11 gives the companywise future land area likely to fall under opencast mining. The total area given in these two tables is a staggering one. Therefore, more awareness is developing towards the reclamation of the ground to the original condition after mining as far as possible, so that posterity may use it for agricultural purposes. This will, however, mean extra cost, which so far is not provided in the cost structure of coal production.

TABLE 15.10

(Area in hectares)

Company	Existing area under opencast mining and O B heaps	Existing subsided area due to U G mining	Total
ECL	1054	7076	8489
BCCL	1025	3123	4148
CCL	1241	811	2052
WCL	615	246	861
CIL	4294	11256	15550

TABLE 15.11

(Area in hectares)

Company	Additional excavated surface area		
	1978-79	1982-83	1987-88
ECL	54	70	89
BCCL	52	81	81
CCL	65	68	90
WCL	61	105	126
CIL	232	324	386

15.15.2 Smokes and fumes resulting due to soft coke making are the major source of pollution in the coalfield. At the same time, valuable volatible constituents of coal are lost which could be converted into coaltar, distilation of which may yield Naptha, Parafins and Benjols. Some proposals have been put forward to develop suitable low cost mechanical soft coke plants. The first experimental plant is proposed to be installed at Mugma. Its adoption in other areas will depend on the success of this experimental plant.

Chapter 16

Capital Outlay

Introduction

16.0 Since the publication of Coal India's 10-Year Coal Plan (Project Black Diamond) in November, 1976, coal industry in India has witnessed two significant developments having bearing on company's policies on creation of additional coal production capacity :

(a) Stagnation in demand for coal during 1976-77 and part of 1977-78.

(b) Govt. of India's decision to establish coal based super thermal power stations linked to different coalfields in the country.

These two developments have, on the one hand, raised the degree of caution among coal producting companies in creation of additional production capacity in mines not specifically tied to the consumers and on the other, there is relatively increased confidence among companies on development of coal projects linked to the super thermal power stations like projects in Singrauli coalfield, Korba coalfield and Rajmahal coalfield. Pace of development of coal projects in future years has been reviewed in the light of the above and projection of capital outlay has also been reviewed on this basis. The revised 10-year projection of capital outlay for Coal India for the period 1978-88 has been estimated as Rs 3280.84 crores. This includes outlay on exploration and design, infra-structural developments, R & D and other projects. Five-yearly break-up of the projected outlay is Rs 1693.97 crores for the period 1978-83 and Rs 1586 87 crores for the period 1983-88.

Outlay Break-up at a Glance

16.1 A summary of the companywise total capital outlay under major groups is given in the Table 16.1.

TABLE 16.1

Summary of Capital Outlay

(Rs crores)

	Investment upto '77-78	Outlay '78-83	Outlay '83-88	Total outlay '78-88	Projected investment upto '87-88
1	2	3	4	5	6
1. ECL					
Mines	132.39	330.07	201.46	531.53	663.92
Washeries	—	6.78	6.00	12.78	12.78
Exploration & design	6.51	7.50	8.06	15.56	22.07
Infrastructure		11.76	9.32	21.08	21.08
Others	—	11.96	1.42	13.38	13.38
Total	138.90	363.07	226.26	594.33	733 23

1	2	3	4	5	6
2. BCCL					
Mines	137.62	251.54	451.12	702.66	840.28
Washeries	14.68	47.74	22.44	70.18	84.86
Exploration & design	5.10	15.64	7.05	22.69	27.79
Infrastructure	29.72	60.60	43.40	104.00	133.72
Others	—	40.32	13.04	53.36	53.36
Total	187.12	415.84	537.05	952.89	1140.01
3. CCL					
Mines	246.27	363.03	333.89	696.92	943.19
Washeries	40.35	75.65	44.91	120.56	160.91
Exploration & design	7.51	9.03	6.81	15.84	23.35
Infrastructure	—	21.25	15.87	37.12	37.12
Others	—	2.36	2.37	4.73	4.73
Total	294.13	471.32	403.85	875.17	1169.30
4. WCL					
Mines	202.27	299.06	343.83	642.89	845.16
Washeries	—	10.09	—	10.09	10.09
Exploration & design	5.04	9.49	5.86	15.35	20.39
Infrastructure		8.39	9.33	17.72	17.72
Others	4.13	16.59	23.70	40.29	44.42
Total	211.44	343.62	382.72	726.34	937.78
5. NEC					
Mines	3.95	17.64	2.47	20.11	24.06
Washeries	—	1.75	—	1.75	1.75
Exploration & design	—	1.49	0.90	2.39	2.39
Infrastructure	—	—	—	—	—
Others	0.71	1.77	1.78	3.55	4.26
Total	4.66	22.65	5.15	27.80	32.46
6. CMPDI					
Infrastructure (Equipment & building)	6.40	7.38	0.64	8.02	14.42
R & D	1.89	18.09	20.60	38.69	40.58
Others (Coal utilisation)	—	47.00	10.60	57.60	57.60
Total	8.29	72.47	31.84	104.31	112.60
7. CIL					
Mines	722.50	1261.34	1332.77	2594.11	3316.61
Washeries	55.03	142.01	73.35	215.36	270.39
Exploration & design	24.16	43.15	28.68	71.83	95.99
Infrastructure	36.12	109.38	78.56	187.94	224.06
R & D	1.89	18.09	20.60	38.69	40.58
Others	4.84	120.00	52.91	172.91	177.75
Total	844.54	1693.97	1586.87	3280.84	4125.38

16.2 Besides developments mentioned in the synopsis above, some developments have also taken place at the national level in the planning process itself. One such development is the termination of Fifth Plan with the close of the year 1977-78 and onset of a new rolling plan of five years starting from the year 1978-79. In course of finalising the plan for the period 1978-79 the Planning Commission set up a Working Group on Coal among other such Working Groups for other major sectors of the conomy. The Working Group on coal has published its interim report in February, 1978 which presents ot only a review of coal demand and production potential from various coalfields but also a projection f capital outlay for Coal India and SCCL for the five-year period 1978-83. Publication of the interim report of Planning Commission's Working Group on coal is another development since the publication of original "Project Black Diamond".

16.3 The projection of capital requirement for the five-year period (1978-83) covered by the Working Group was Rs 2094 crores (All India including Rs. 1955 crores for Coal India). The Planning Commission in its subsequent deliberations on the interim report of the Working Group made a tentative allocation of only Rs 1655 crores (All India including Rs 1525 crores for Coal India). The present exercise, however, has worked out the total requirement of capital outlay for Coal India as Rs 1694 croes for the five years period (1978-83) which is marginally higher than the allocation made by the Planning Commission. This variation has arisen mainly due to fresh review of individual schemes with a view to accelerate the pace of development in areas where necessary.

Outlay in Mines

16.4 As brought out in the summary above, more than 80% of the projected investment is directly in mines. In the respective company sections of the coal plan projectwise outlay in different years of the plan has been indicated. During the first five year period of 1978-83 nearly two-third of the investment is on projects for which project reports are available or marginal schemes have been approved. The replacement capital for existing mines at the accepted rates has also been projected on the basis of production level of such mines in different years of the plan. Projection of capital outlay for mines identified for major development but project reports for which are yet to be prepared is problematic. During this period (1978-83) projected outlay in this category of mines works out to Rs 458.80 crores. However, during the subsequent five year period of 1983-88 projected outlay on such projects amounts to Rs 902.12 crores which constitutes nearly 70% of the projected outlay in mines during the said period.

16.5 Although project reports are yet to be prepared for this group of mines, identification of projects and tentative estimate of the target production from these mines have been made, based on target production and nature of the projects namely reconstruction or new projects, opencast or undergound mines, etc. A broad estimate of the total cost of each project has been made on the basis of the capital cost per tonne of target production in comparable projects recently prepared.

16.6 Projection of capital outlay for different groups of mining projects is based on the projection of coal production levels dealt with earlier in Chapter 4 of the coal plan dealing with production potentials from different coalfields. In Table below 16.2 relationship between the level of coal production capacity and investment level in different groups of mines at three-time horizons — 1977-78 (actuals), 1982-83 (projected) and 1987-88 (projected) has been shown.

TABLE 16.2

Group of mining Projects	1977-78		1982-83		1987-88	
	Prodn level (m t)	Capital investment (Rs crores)	Prodn level (m t)	Capital investment (Rs crores)	Prodn level (m t)	Capital investment (Rs crores)
	2	3	4	5	6	7
. Existing mines requiring no major reconstruction but including marginal schemes, if any.						
CL	14.53	96.83	14.75	147.33	12.29	165.88
SCCL	17.68	10.33	17.24	62.48	12.16	102.23
CCL	3.94	42.79	3.34	55.50	2.80	66.60
WCL	8.84	90.41	6.53	126.44	5.25	155.44
NEC	0.16	0.78	0.08	1.06	0.03	1.18
Total CIL	45.16	241.14	41.94	392.83	32.53	491.33

1	2	3	4	5	6	7
2. Sanctioned projects at various stages of development						
ECL	3.94	32.80	7.22	84.48	6.71	90.63
BCCL	1.52	121.54	6.37	168.16	6.11	163.16
CCL	8.11	164.16	17.87	285.57	21.58	322.38
WCL	9.08	105.02	15.80	218.42	16.41	293.58
NEC	0.46	3.17	0.51	8.83	0.51	10.02
Total CIL	22.31	426.69	47.77	765.46	51.32	881.82
3. Mines for which P Rs have been prepared but are in the process of being sanctioned						
ECL	1.17	2.76	3.59	83.60	7.84	117.58
BCCL	0.67	5.75	1.21	71.61	4.32	111.08
CCL	2.02	11.88	6.52	80.31	9.32	145.81
WCL	1.65	6.84	7.30	103.79	11.59	177.63
NEC	—	—	—	—	—	—
Total CIL	5.51	27.23	18.62	339.31	33.07	552.10
4. Identified mines for which P Rs are yet to be prepared						
ECL	6.83	—	11.26	147.05	18.36	289.78
BCCL	0.35	—	3.03	86.91	17.94	452.81
CCL	7.12	27.44	10.35	187.92	30.55	408.40
WCL	2.01	—	4.12	52.68	16.39	218.51
NEC	—	—	0.59	11.68	0.69	12.86
Total CIL	16.31	27.44	29.35	486.24	83.93	1388.36
Grand total						
ECL	26.47	132.39	36.82	462.46	45.20	663.92
BCCL	20.22	137.62	27.86	389.16	40.53	840.28
CCL	21.19	246.27	38.07	609.30	64.25	943.19
WCL	21.59	202.27	33.75	501.33	49.64	845.16
NEC	0.62	3.95	1.18	21.59	1.23	24.06
CIL	90.09	722.50	137.68	1983.84	200.85	3316.61

Outlay Production Level Relationship

16.7 Present level of capital investment per tonne of production level in CIL is around Rs 80/-. With the projected outlay of capital this index is likely to increase to Rs 144/- by 1982-83 and to Rs 165/- by 1987-88. Companywise figures of investment per tonne of production level at these time horizons are furnished in Table 16.3

TABLE 16.3

	1977-78 (Rs)	1982-83 (Rs)	1987-88 (Rs)
ECL	50.02	125.60	146.88
BCCL	68.06	139.68	207.32
CCL	116.22	160.05	146.80
WCL	93.69	148.54	170.26
NEC	63.71	182.97	1[illegible].61
CIL	80.20	144.09	165.13

Outlay on Washery Projects

16.8 Coal India's coal beneficiation policy is by and large for washing of entire coking coal supplies to steel plants. Direct feed coal is going to gradually reduce and finally eliminated. As regards beneficiation only when concerned consumer is ready to bear the extra cost involved. Washing projects for which capital has been provided are as in Table 16.4.

TABLE 16.4

Projects	Input capacity (m t)	Estimated capital cost (In Rs crores)	Expected year of commissioning
1	2	3	4
(a) Projects under construction			
Sudamdih	2.00	33.00	1979-80
Moonidih	2.00		1979-80
(b) Projects formulated and to be taken up			
Barora	0.48	3.00	1979-80
Putki	1.80	15.00	1984-85
Balliari	1.80	15.00	1984-85
Ramgarh	3.00	26.00	1980-81
Kedla	2.60	23.00	1983-84
Nandan	1.20	10.08	1980-81
c) Washery projects for which project reports are yet to be prepared			
New washeries (Prime) (In BCCL area to be identified)	2.60	20.00	1987-88
Parej	3.00	24.00	1987-88
Jhunkundar	0.42	2.00	1980-81
Mahuda	0.63	2.80	1980-81

Outlay on Exploration Programmes and Planning & Design Work

16.9 The exploration programme has been drawn up for meeting the net additional requirement of 22.84 million tonnes of production from areas yet to be drilled in 1982-83, 23.89 million tonnes in 1987-88 and 38.90 million tonnes in 1992-93. For this a total of 14,81,152 metres of drilling is required.

The entire exploration programme has been divided into two phases viz., Phase I for terminal year 1982-83 and 1987-88 and Phase II covering the terminal year 1992-93.

16.10 The summarised position of the quantum of drilling for meeting the demand and for the creation of shelf of reports is given in Table 16.5.

TABLE 16.5

Drilling Programme

(Metres)

Company	Phase I	Phase II	Total
1. ECL	183,808	136,000	319,808
2. BCCL	206,444	69,230	275,674
3. CCL	215,720	205,000	420,720
4. WCL	291,200	142,000	433,200
5. NEC	26,750	5,000	31,750
Total	923,922	557,230	1481,152

16.11 The entire exploration programme as outlined above is expected to be executed by January, 1986. The drilling for Phase I would be completed by October, 1982. Nearly 50% of exploration work for meeting the demand by 1982-83 has already been completed and balance is scheduled to be completed by March '79. The drilling for Phase II will be from November '82 and completed by September, 1985. The work programme thereafter is yet to be charted out.

16.12 For execution of this programme 158 drills of different agencies will be in operation which should on the average drill 1,90,000 metres per annum. Annual expenditure for this programme has been estimated as Rs 6.23 crores per annum (i.e. Rs 328 per metre including documentation).

Planning and Design Cost

16.13 The present rate of expenditure on planning & design function is Rs 2.40 crores per annum. Keeping in view the increase in volume of work for preparation of feasibility reports, revised project reports and working drawings and other incidental functions for scientific development of coal industry, the annual rate of expenditure is expected to increase to Rs 2.70 crores by 1981-82. The detailed working has been furnished for CMPDI section of the coal plan.

Infrastructure Development

16.14 Various schemes identified for infrastructural development along with phased yearwise expenditure on them have been listed in the respective company plans. Types of schemes covered are as follows :

1. Power sub-station;
2. Telecommunication;
3. Workshop;
4. Central stores;
5. Training & manpower development;
6. Reorganization of railway siding;
7. Administrative building;
8. Safety equipment;
9. Consultancy;
10. D&F ropeways;
11. Central housing; and
12. Water supply.

Outlay on R&D Schemes

16.15 Outlay projected here covers all schemes approved under Energy (Coal) R&D grant. There are 64 Nos. of such schemes in progress at present with estimated cost of Rs 9.20 crores. Projection of outlay on these schemes for next three years are available which gives an annual rate of R&D expenditure of the order of Rs 3.43 crores. With the various agencies engaged on implementation stabilising and setting in motion, R&D expenditure is likely to substantially in years to come. Projection of capital outlay on R&D schemes has been done on this basis.

16.16 Details of schemes in progress at present have been furnished in CMPDI section of coal plan.

Outlay on Other Projects

16.17 Schemes covered under this group are as under :

1. Bhandara explosive factory (WCL);
2. Dankuni LTC plant (CMPDI);
3. Talcher formed coke plant (CMPDI);
4. Coke plant (BCCL); and
5. Fire fighting project (BCCL).

16.18 Project reports are available for LTC plant, formed coke plant and some fire fighting schemes of BCCL also. Estimates for LTC plant and formed coke plant have been materially revised recently. The revised estimates and yearwise phasing of expenditure on these schemes have been furnished in respective company plans.

Reference Date of Estimates

16.19 These estimates of capital outlay are based on price level prevailing on 1.4.78. Any future revision of estimates will be done taking this date for reference of price index.

Errata

Page	Para	Line	Read	For
1	2	3	4	5
1	1.2.1	7	United States	United State
1	1.2.1	10	European Economic Community	European economic community
3	1.5	1	The objectives	The objective
10	3.2.1(c)	1	heterogeneity	heterogenity
20	3.2.1 (d)	3	blocks areas	blocks areas
	3.2.1 (e)	2	net	not
		9	1992-93	1992-33
21	3.4.1	3	another	ar other
28	4.3	30	rise	mark
28	4.3	34	additional	and additional
31		2	view to home	view
43	5.5	3	mines over	mines or over
46	5.5.2	2	28.4	284
48	5.9.1	13	2	Blank
57	Table 6.2/column 7	1	22	20
57	Table 6.2/column 9	1	Correctors	Connectors
59	Sl. No. 31			
60	Table 6.4	—	Coal Handling Plants (CHP) & Mini CHPs in the heading of Table 6.4	
66	7.12.3	4	connected by small capacity	connected small capacity
			duplex..........	duplex......
68	7.12.3	last line	Weighing facility	Seighing facility
71	Diagram 7.4	under ECL Block	Cassettes	Cassetts
73	14		Infra Red	IR
74	23		Winding Engine Motor or Winder Motor	Winding Motor
74	23		Pit top door	Screen Door
78	21,23		Indigenous	Indegenous
78	25		discrete	discreet
79	40		Nuclonic	Nucleonic
79	45		Weighing	Weighting
81	8.0	6	is	was
83	Table 8.2, Sl. No. 3, column 4		BCCL	ECL
89	8.8.3	1	1000/1100	1000
89	8.8.3	2	100 KW	100 KV
92	Table 9.2	Under 1981-82	8.33	8.30
		Sl. No. 1	(−) 2.24	2.16
		Sl. No. 5	(−) 0.29	0.37
		Sl. No. 13	(+) 0.29	0.37
		Sl. No. 16	(—)	(—1)
93	Sl. No. 5			
96	Table 9.6 column 7	Sl. No. 2 } Sl. No. 3 }	37.8	55.3 } 55.3 }
96	Table 9.5 column 8	Sl. No. 2 } Sl. No. 3 }	37.8	55.3 } 55.3 }

1	2	3	4	5
100	10.2.5 Table 10.4	3	in crores of Rupees	in crores
102	Table 10.6 column 7	11	132.80	123.80
102	Table 10.6 column 8	11	123.80	132.80
103	Table 10.7 column 9	9	2149	2119
104	Table 10.7	3	Raipur	Ripur
106	10.5.1	1	116	128
108	Table 10.9	3	Crores rupees	Crores
113	Footnote asterik (*)	last line	*Balance of capital cost	*capital cost of....
114	Sl. No. 3	Column 11	67	50
116	Sl. No. 1	Column 5	40	30
		Column 6	27	20
		Column 10	67	50
117	Footnote asterik (*)	last line	Balance of capital cost of Plant..	Capital cost of plant....
117	Sl. No.	Column 2	"Bogra"	"Dobrana"
117	Last line (Total figure)	Columan 5	2209.9	2199.9
		Column 6	3359.75	3352.75
		Column 10	17786.43	17769.43
122	Table 12.2, Item 1		Vestibule	Vestibile
124	Table 12.6, Item 1		Vestibule	Vestibute
128	Diagram 13.1	2	147.75	1475
130	Diagram 13.2	4th column	13.05	1305
135	13.7.2	3	Provide	Privide
139	14.0	3	environment	environments most
139	14.1	7	Regional Institute of CMPDI	Regional Institutes, CMPDI
141	14.4.1	2	additional and more	additional more
142	14.5.1	8	mentioned	mention
146	14.8.2 (c)	6	for vertical transport in watery mines.	watery mine for vertical transport
146	14.8.2 (d)	3	apparatus, which are	apparatus are
148	15.8	4	Tables	Table
151	15.14.2	3	these fires	this fire come up
151	15.14.2	6	divide	devide
156	16.8	2	regards non-coking beneficiation	regards beneficiation
158	16.15	5	to increase substantially	to substantially

Objectives of Coal India

1. To promote the development and utilisation of coal reserves in the country for meeting the present and likely future requirement of the national economy with due regard to the need for conservation of non-renewable resources and safety of mine workers.

2. To raise the productivity of coal mining and related activities through introduction of improved technology, streamlining of organisation and management, and improving the skills and motivation of the work-force.

3. To generate surpluses by optimum utilisation of productive capacity, improving efficiency of operations, and adopting appropriate cost reduction and cost control methods.

4. To make efficient arrangement for marketing and supply of coal so that coal, coke and other similar derivatives are available to consumers throughout the country conveniently and at reasonable prices.

5. To promote research and development activities on a continuing basis in the areas of coal mining, beneficiation, development of new coal-based products or by-products, fuel technology or any other area having a bearing on conservation; development or utilisation of coal reserves of the country.

6. To provide suitable facilities for training with a view to up-grading the knowledge and skills of employees in different categories and enabling them to make full use of their capabilities.

7. To look after the welfare of the employees and to promote the establishment and maintenance of healthy relations between management and workers, and foster a sense of fellowship and belonging to the company among personnel at all levels.

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RETURN TO NDO

2.5

REPORT

OF THE WORKING GROUP ON COAL & LIGNITE

SET UP BY

THE PLANNING COMMISSION

FOR THE SIX YEAR PERIOD

1978 — 84

PART—I (COAL)

OCTOBER 1978

FOR OFFICIAL USE ONLY

REPORT
OF
THE WORKING GROUP ON COAL & LIGNITE
SET UP BY
PLANNING COMMISSION
FOR THE
SIX YEAR PERIOD.
1978 - 1984 (PART-I: COAL)

OCTOBER - 1978.

REPORT OF

[illegible]

[illegible]

THE SIX YEAR [illegible]

PART-I [illegible]

C O N T E N T S

...

REPORT OF THE WORKING GROUP ON COAL AND LIGNITE
[illegible]

CHAPTER - I

INTRODUCTION

To formulate the programme for the development of Coal and Lignite for the period 1978-83, the Planning Commission set up a Working Group on Coal & Lignite in September,1977. During two meetings, this group deliberated upon various materials submitted to it by Central Mine Planning & Design Institute and Singareni Collieries Company Limited and an interim report was brought out in February,1978. This was subsequently discussed in the Planning Commission on 14th February,1978 and it was decided to constitute a larger Working Group on Coal & Lignite under the Chairmanship of Secretary(Coal), Department of Coal with wider and enlarged terms of reference. The relevant Office Memorandum No.1-19(1)/78-P&E dated 4.5.1978 on the composition and terms of reference is given in Annexure-I.

1.2 On the basis of this wider terms of reference, Coal India Ltd., Central Mine Planning & Design Institute Ltd. & Singareni Collieries Company Ltd. were requested to prepare jointly a preliminary draft on Coal Sector and Department of Coal to prepare draft material on Lignite in consultation with Neyveli Lignite Corporation, for consideration and finalisation of the Report. The Tata Iron & Steel Company Limited and Indian Iron & Steel Company Limited were also requested to furnish relevant information on the terms of reference for incorporation in the final report.

1.3 No information was sent in by TISCO & IISCO within the scheduled time nor was any material available from SCCL for a joint draft report. Therefore, the draft submitted by CMPDIL and CIL in June'78 mostly concerned Coal India. Subsequently, SCCL submitted a separate draft regarding their company and a draft was also put up by the Department of Coal & Lignite. In these

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draft reports the terms of reference were regrouped and dealt with under the following chapters:-

CHAPTERS		TERMS OF REFERENCE
I.	INTRODUCTION	
II.	REVIEW OF PERFORMANCE DURING FIFTH PLAN:	
	(i)	To review the performance during the Fifth Plan Period, to identify areas in which the policies, planning and implementation machinery require to be modified/improved;
	(ii)	To compare estimates of demand, production and capacity realised by the end of 1977-78 to what was anticipated in this year in the Draft Fifth Plan, to analyse the causes of major deviation and suggest remedial action in the appropriate areas;
III.	DEMAND PROJECTIONS	
	(iii)	To make an estimate of indigenous demand of coal and lignite for the period 1978-79 to 1982-83, 1983-84 and 1987-88, taking into account the projected pattern of growth in the consuming sector and the potential for substitution of petroleum by coal;
IV.	PRODUCTION PLANNING	
	(v)	To recommend a policy for conservation of coal taking into account the long terms requirements of the steel industry and the optimal end uses of non-coking coal both in the short and long terms, including identifications of those qualities which could be used for gasification and conversion to oil;
	(vi)	To suggest yearwise capacity and production targets that will need to be set for coal and lignite for 1978-83 and 1983-84 having regard to the demand and the long-term perspective set out as above;
	(vii)	To assess the requirement of washery capacity for the steel industry and examine the feasibility of beneficiation of non-coking coal for power generation and other selected industries;
	(viii)	To suggest the most economically advantageous way of securing the above objectives, whether in terms of expansion of existing facilities

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or through establishment of new facility adopting such things in technologies as would promote larger manpower utilisation;

V. COAL RESERVES & EXPLORATION

(iv) To make a quantitative and qualitative evaluation of the different categories of recoverable reserves of coal and lignite in the different regions indicating the basis of estimates as well as a review of work done in the Fifth Plan period(1974-78);

(xi) To recommend a programme of exploration consistent with long term perspective of the needs of coal as set out above and also to meet the requirements upto next fifteen years.

VI. PLANT & EQUIPMENT & ANCILLARIES

(xiv) To assess the requirements of equipment for coal and lignite sector and review the position regarding manufacturing facilities;

(xxi) To identify products and supplies of ancillaries from small scale sector;

VII. MANPOWER EMPLOYMENT POTENTIAL & TRAINING

(xii) To assess the employment potential likely to be provided by Coal and Lignite sector during 1978-83 and 1983-84 and to work out manpower requirements in different categories drawing attention to any significant gaps in such requirement and related training facilities;

VIII. COAL MARKETING, STOCKING POLICIES & INTERFUEL SUBSTITUTION

(ix) To recommend distribution and marketing policy for coal including a stocking policy for pitheads and for major consumers taking into account the financial implications;

(xv) To recommend a strategy for replacing conventional fuels such as kerosene and wood particularly in rural areas, by coal/coal based products;

IX. COAL TRANSPORTATION

(xviii) To estimate the infrastructural requirements of the coal and lignite sector in terms of electricity and transport

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facilities, namely road, rail, port
and other transport systems;

X. PLANNING, DESIGN, MONITORING & R&D

(xiii) To make a comprehensive review of the current status of design, engineering and consultancy facilities in the country and to recommend specific measures for strengthening such facilities consistent with programme of production;

(xvi) To assess current status of research and development activities in the coal and lignite sector and to formulate [illegible] and programmes for research and development necessary to support and aid in continuing growth of these industries; to [illegible] existing mechanism for implementation of the various programmes and recommend measures for strengthening the same by way of linkages with user industries;

(xvii) To review the existing planning and monitoring mechanism at the project, corporate and Central Ministry levels and to recommend measures for their improvement;

XI. INFRASTRUCTURE:

(xviii) To estimate the infrastructural requirements of the coal and lignite sector in terms of electricity and transport facilities, namely road, rail, port and other transport systems;

XII. SAFETY

(xix) To review the present status of mine safety measures and suggest further measures to be taken for ensuring safety in mining;

XIII. SUBSIDIES

(xx) To suggest the manner in which subsidies, if any, may be eliminated;

XIV. ENVIRONMENTAL CONTROL

(xxii) To make such other recommendations as may be appropriate covering inter-alia, the aspects relating to environmental pollution;

XV. INVESTMENT PROGRAMME:

(x) To make an assessment of the year-wise investment necessary both in the public

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and private sectors, for achieving the above production targets in total and in terms of foreign exchange indicating separately investment required in respect of major programme and projects;

XVI. POLICY FRAME

(xxiii) To suggest a policy frame consistent with the objectives set out above.

1.5 The members of the Working Group studied these reports and the drafts were taken up for detailed consideration in the four meetings of the Working Group held under the Chairmanship of Secretary(Coal) on 21.8.78, 23.8.78 [illegible].78 and 13.9.1978. The minutes of these discussions and list of participants are enclosed as Annexure 2 & 2A.

1.6 No discussions could take place on the coal production programmes and perspective plans of TISCO & IISCO as no information was forthcoming from these companies. Only ad-hoc provisions could be made where possible in finalising the various projections such as transport capacities, power and explosive requirements, subsidies and so on.

1.7 The final report of the Working Group given herein is based on the draft material submitted by CMPDIL, CIL and SCCL suitably modified in accordance with the views expressed and decisions taken during the meetings of Working Group.

CHAPTER - II

REVIEW OF PERFORMANCE DURING THE FIFTH FIVE YEAR PLAN (1973-74 to 1977-78)

.....

BACKGROUND:

2.1 Till the year 1963-64, the domestic consumption of coal had been steadily rising at an average rate of about 6.5%. From a level of about 38 million tonnes in 1955-56, consumption rose to about 63 million tonnes in 1963-64, Thereafter, the growth rate slumped and till 1971-72 consumption grew at the rate of only 2.2%. Consumption rose appreciably in the year 1972-73 by about 5.5% but the rate of growth could not be maintained during the year 1973-74, the first year after nationalisation of non-coking coal mines. This was caused mainly by the world-wide power and oil crisis and the industrial unrest in the Indian Railways culminating in the Railway Strike of May, 1974.

FIFTH PLAN:

2.2 (a) Projections of demand: The draft Fifth Plan (published in 1974) envisaged a demand level of 135 million tonnes for the year 1978-79. This implied an increase of about 57 million tonnes over the production level of 78 million tonnes in 1973-74 or a growth rate of 11.6% during the plan period. The year-wise breakup of the demand alongwith subsequent revisions and actuals [illegible]

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materialisation are given below:

(Million tonnes)

	M/M	1974-75	1975-76	1976-77	1977-78	1978-79	Source documents
						118 112	
Projections of demand:	78.3	83.00	98.00	111.50	122.7@	135.00	Performance Budget, Dept. of Coal 75-76. (@) Interpolated between 76-77 & 78-79.
Prod	81.9	88.4	99.7	101.0	101.0	101.9	
			93.00	108.00	–	135.00	Annual Plan Dept. of Coal '76-77.
				99.10	108.60	123.90	Annual Plan Dept. of Coal '77-78.
					106.82	114.57	Annual Plan Dept. of Coal '78-79.
Coal Controllers' Projections:		–	99.24	114.24	126.33	141.39	Annual Plan, Dept. of Coal '76-77.
Actual Materialisation	78.3	87.1	94.4	99.8	103.7(*)	..(*)	The level of demand was a little higher, the despatches having been affected by transport difficulties, consumption fell short of demand.
Prod							
Rate of growth over last year		11.7% (**)	8.4%	5.7%	3.9%	(**)	This high rise is partly due to carry-over from '73-74, when supplies fell short of requirements.

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ACTUAL MATERIALISATION:

2.3 As would be observed from the foregoing table, the actual materialisation in the first two years of the Plan fell short of the projected demand. The coal producing companies, however, had geared themselves up for meeting the projected demand. The resultant excess production led to accumulation of Pit-head stock, which grew to a level of 11.85 million tonnes by the end of 1975-76.

In the light of this development, the Government undertook a review in June'76, and brought down the target for 1978-79 from 135 million tonnes to 124 million tonnes. The heavy accretion of coal stock, at pitheads gave rise to criticism from various quarters and the production programme for 1976-77 was adjusted with reference to the demand assessed. The production during 1976-77 was, therefore, only 1.3 million tonnes more than that in 1975-76. This notwithstanding the pithead stocks increased further and reached at all time high of 14.47 million tonnes by the end of the year 1976-77.

The planned level of production for the year 1977-78 was, therefore, pegged at 2.5 million tonnes below the expected demand level of 106.5 million tonnes, with the intention of liquidating 2.5 million tonnes of the pit head stocks.

The year 1977-78 was unfortunately beset with serious problems on the production front. The Coal Industry was affected by serious power and explosives shortages and by industrial unrest. As the production fell short of the requirements, it was supplemented by coal from the pithead

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stocks which dwindled to a level of about 9 million tonnes in November,1977. The production, however, started picking up thereafter. The rail transport facilities, however, did not keep pace with the improvement in production. This led to a spurt in road movement which registered an increase of 22% during 1977-78 compared to 1976-77. Despite this spurt, a large part of the additional production went into pithead stocks which rose again to 12.3 million tonnes by the end of the year. The total consumption during the year was 103.7 million tonnes. It was, however, estimated that about 2.3 million tonnes of demand went unsatisfied.

The actual consumption, production and closing pithead stocks are given below:-

Transport-

(Million tonnes)

	73-74	74-75	75-76	76-77	77-78	Remarks
Actual demand		87.1	94.4	99.8	106.0*	*Actual consumption 103.7
Production	77.[illegible]	88.41	99.69	101.03	100.86	Unsatisfied demand 2.3
Pithead(Closing)Stocks	6.65	7.58	11.85	14.47	12.78	Total:106.0 14.74
		87.68	95.42	98.45		

2.4 (C) SECTORWISE REVIEW

2.4.1 Coking & Blendable Coals(Steel/Hard coke):

	73-74	74-75	75-76	76-77	77-78	78-79	Source Document
Demand	-	20.5	25.5	--	-	34.0	Performance Budget Dept.of Coal '75-76.
Projections			22.0	29.10	-	34.1	Annual Plan. Dept.of Coal 1976-77.
			20.5	25.20	25.20	28.7	Annual Plan, Dept.of Coal 1977-78
				22.00	24.80	25.4	Annual Plan, Dept.of Coal 1978-79
Actual materialisation	13.78	18.51	20.93	22.30	23.10	..	

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According to projections originally made for the year 1978-79, the growth rate proposed for this sector comes to about 19%. The actual coal consumption grew at about 13.5% per year between 1973-74 and 1977-78(i.e. at the rate of 7.4% during 1974-75 to 1977-78). The growth during the year 1976-77 was 6.5% over 1975-76 and only 2.9% in 1977-78 over 1976-77. The rates of growth during the earlier years were relatively high partly due to (i) variation in different sources from which data were compiled (ii) accretions to stocks at the steel plants of raw coal and of pig-iron, ingots, finished steels etc, which reportedly increased during the first few years and (iii) substantial increase in exports by the year 1976-77.

2.4.2 Power Sector: (million tonnes)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Demand	-	20.00	23.00	-	-	43.00	Performance budget,75-76 Dept.of Coal
Projections	-	-	27.00	30.00	-	42.50	Annual Plan, Deptt.of Coal 1976-77.
			27.00	26.50	29.00	33.50	Annual Plan, Dept.of Coal 1977-78
					29.50	33.50	Annual Plan, Deptt.of Coal, 1978-79
Actuals	16.43	20.04	23.44	27.70	28.83	32	36
Rate of growth over previous year	-	22%	17%	18%	4%		

The raw coal consumption of this sector was stated to have grown at the rate of 21% from 16.43 million tonnes in 1973-74 to 43.00 million tonnes in 1978-79. During successive reviews, however, the growth rate was brought down as slippages became evident. The actual consumption during the first 4 years increased at rates varying from 32% to 4%. This large variations could have been partly due to inaccuracies in data; thermal power generation has actually been growing at rates varying from 12% to 17% with an average of 15%.

2.4.3. Railways: (million tonnes)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Demand	-	14.5	14.5	-	-	13.00	Performance Budget '75-76 Dept.of Coal
Projections			14.4	14.4	-	14.40	Annual Plan, Dept.of Coal 1976-77.
			14.4	13.9	13.60	13.50	Annual Plan, Dept.of Coal 1977-78
					13.40	13.40	Annual Plan, Dept.of Coal 1978-79
Actuals	13.32	13.31	14.30	13.30	13.34	..	

The consumption of coal by Railways was expected to go down progressively due to increased dieselisation and electrification. Excepting a spurt in the year 1975-76, the consumption, however, remained static at the level of 13.3 million tonnes.

2.4.4 CEMENT (million tonnes)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Demand		5.50	6.00	-	-	7.00	Performance Budget Dept. of Coal '75-76.
Projections			5.50	6.00	-	7.00	Annual Plan Dept. of Coal 1976-77.
			5.50	4.70	4.90	5.10	Annual Plan Dept. of Coal 1977-78
					5.10	5.25	Annual Plan Dept. of Coal '78-79
Actuals	3.65	3.62	4.44	4.70	5.14	-	

The consumption was anticipated to increase at the annual rate of 14% from 3.65 million tonnes in 1973-74 to 7.00 million tonnes in 1978-79. This was brought down to more realistic level of 5.25 million tonnes in 1978-79, during successive reviews. The average growth in coal consumption during the first four years was about 9%.

2.4.5 EXPORT (million tonnes)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Export projections		0.80	1.00	-	-	1.00	Performance budget, Dept. of Coal '75-76
			0.80	1.00	-	1.50	Annual Plan Dept. of Coal 1976-77.
			0.80	1.00	1.80	2.50	Annual plan Dept. of Coal '77-78
					0.80	1.30	Annual Plan Dept. of Coal 1978-79.
Actuals	0.52	0.51	0.44	0.62	0.66	-	

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India's export has been traditionally to the neighbouring countries of Bangladesh, Burma, Pakistan and Ceylone. However, with the emergence of oil crisis and surplus coal production upto 1975-76, India started looking for export of non-coking coal with promising results. To start with, port capacities were proving to be a bottlenech which was solved to a large extent with the commissioning of the Haldia port. Unfortunately, coal shortages developed in 1977-78 leading to restrictions of export. The growth achieved in the year 1976-77 has, therefore, been halted.

2.4.6 Soft Coke:

(million tonnes-raw-coal equivalent)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Demand projections		5.50	5.50	-	-	9.00	Performance budget, Dept. of Coal '75-76
			5.00	6.00	-	8.00	Annual Plan, Dept. of Coal, 1976-77
			5.00	5.00	5.30	5.00	Annual Plan, Dept. of Coal, 1977-78
					4.70 -	5.10	Annual Plan, Dept. of Coal, 1978-79.
Actuals	3.80	3.72	3.64	4.30	3.91		

Considering the need to replace non-commercial fuels, a target of 9.0 million tonnes was set for 1978-79 representing an annual growth rate of 19%. This also included setting up of two LTC Plants, one at Ramakrishnapur (Andhra) and the other at Dankuni (W.Bengal). Of these two projects, the Dankuni project where the technology was re-examined, is now expected to come up in the current plan period The Ramakrishnapur project is at an advance stage and is expected to come up in 78-79.

The progress in expanding soft coke market has been tardy because of its poor competitiveness in the undeveloped markets and Railways unwillingness to undertake increased piecemeal movements. Some results were achieved in 1976-77 which could not be sustained as the production of soft coke declined during subsequent years.

Alternative coal-based fuels are under development, but it would take some time before their impact would be evident.

2.4.7 Other Industries, brick-kilns, fertilizers and Colliery consumption:

(million tonnes)

	73-74	74-75	75-76	76-77	77-78	78-79	Source document
Demand projections		21.20	22.50	-	-	28.00	Performance Budget, Dept of Coal, 1975-76
			23.30	25.00	-	27.00	Annual Plan Dept.ofCoal 1976-77.
			24.80	26.00	28.80	33.60	Annual Plan Dept.ofCoal 1977-78.
					28.12	30.12	Annual Plan, Dept.of Coal 1978-79
Actuals	26.10	27.40	27.21	26.90	23.94	-	

Note:- The consumers falling under this sector had to be clubbed for review due to non-availability of reliable data for each component subsectors, e.g. BRK, Fertilizer, etc are not available.

2.5 This is one sector where, it would be evident, demand projections have been on the low side. This probably is due to inaccuracies in past data on which projections had to be based. Leakage of coal from other

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sectors to this sector in the past cannot also be ruled out. Some coal from unreported production of collieries before nationalisation and from private mines after nationalisation also must have moved to this sector. The subsector 'fertilizer' was expected to consume about 3.1 million tonnes in the year 1978-79. This included two coal-based fertilizer plants one each at Ramagundam and Talcher. There has been slippages in their execution and the revised estimate of demand for 1978-79 for fertilizer plants stands at 2.30 million tonnes(Annual Plan, Department of Coal 78-79), The actual growth during the first four years has been as follows:-

(in mt.)

Year	74-75	75-76	76-77	77-78
Qty.consumed	0.95	0.93	0.70	1.20

To sum up, it can be seen that the bulk of the slippages in demand materialisation has been in the power and steel sectors which together account for half of the total coal consumption in the country. The projected rates of growth in other sectors being higher than what was actually achieved, the original estimates of demand proved to be on the higher side. In the year 1977-78, extraneous constraints on production and transport prevented fuller manifestation of potential demand. As the things stand at the time of review, the likely demand during the current year i.e. 1978-79 appears to be around 109 to 110 million tonnes.

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PRODUCTION PROGRAMME

2.6 At the end of the Fourth Five Year Plan(i.e.1973-74), coal production reached a level of 79.0 million tonnes. Since between 1971 and 1973, the process of nationalisation was over, the bulk of the production came from the nationalised sector(Coal Mines Authority Limited, Bharat Coking Coal Limited, Singareni Collieries Co.Limited and Neyveli Lignite Corporation Ltd.). In the Draft Fifth Five Year Plan, an increase of 56 million tonnes to an annual production of 135 million tonnes of Coal by 1978-79 was envisaged.

2.6.1 The Draft Fifth Plan did not provide any yearwise break up for the inter-mediate years. The expected consumption levels for the intermediate years worked out on the assumption of uniform rate of growth and the actual consumption levels are compared below:-

Year	Actual Production	Actual Consumption	Draft Fifth Plan Projections
1974-75	87.14	85.6	86.4
1975-76	99.7	92.8	96.1
1976-77	101.3	99.2	107.2
1977-78	100.9	103.7	120.1

2.6.2 By 1976-77, however, it became evident that although coal companies were increasing the capacity, the demand was not rising at the rate projected in the Draft Plan. The final Fifth Plan document, therefore, substantially

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scaled down the target of production for 1978-79 to 124.0 million tonnes. So far demand for coal, however, failed to grow even at the revised slower rate and a production level of 108-110 million tonnes is likely to satisfy the expected demand in 1978-79. Thus in retrospect the performance was impressive during the first two years of the Fifth Five Year Plan(1974-75 and 1975-76) the average increase in annual production being over 10 million tonnes per year, while for the next two years production stagnated at around 100 million tonnes.

2.6.3 The year 1977-78 was beset with serious problems on the production front. The coal industry was gripped by serious power and explosive shortages and by industrial unrest. The situation improved by the end of 1977 and the production started picking up thereafter. Unfortunately, the rail transport facilities did not keep pace with the improvement in production and a large part of the additional production went into pithead stocks instead of going to the consumers, despite a spurt in road movement.(The road movement of coal registered an increase of 22% in the year in the year 1977-78), The pithead stocks which stood at 14.5 million tonnes at the beginning of the year had dropped to the level of about 9 million tonnes, by October/November,1977, but rose again to 12.3 million tonnes by the end of the year as rail-transport lagged behind. The actual consumption level of 103.6 million tonnes during the year 1977-78 therefore does not reflect the real demand which is estimated to be somewhat greater

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than this level. Though stocks accumulated in the previous years helped to avert a crisis situation, it was evident that for meeting in full the demand for all grades and sizes and in different seasons at distant consuming centres, both production and transportation capacities needed enough cushion with matching power and explosives supply capacities to overcome the impact of any unforeseen sudden spurt in demand or bottlenecks affecting production in mines.

2.6.4 Productivity performance:

The impact of the behaviour of production during the four years of the FifthPlan was felt on productivity (output per manshift), technology, investment etc. The output per manshift increased from 0.59 in 1974-75 to 0.65 in 1975-76 in the mines of Coal India Limited which account for the bulk of coal production in the country. But with the subsequent slower increase in the rate of production the scope for increasing productivity (without any reduction in the existing employment) reduced. Thus the OMS rose to only 0.68 by 1977-78. In SCCL, in as much as their share in coal demand is small compared to CIL, growth of production was affected less and the OMS increased consistently from 0.65 tonnes in 1974-75 to 0.72 tonnes in 1977-78.

2.7 Technological performance:

The slump in demand affected the introduction of new technology which had to slower than what was originally envisaged. However, considerable progress has still been achieved in the field of mechanised opencast mining and a number of large opencast mines are under development. Equipment utilisation efficiency has been increasing, though it is yet to reach the desirable limits.

2.8 Export & Import Substitution:

The Fifth Plan projected exports of Rs.76 crores (Draft Plan provision being Rs.40 crores). Actual exports during the four years of the plan period however could not be as high. During the period about 2.2 million tonnes of coal were exported to about a dozen of countries including some non-traditional importing countries.

9. The indigeneous component of investments on plant and equipment in the coal sector has been increased from 70% to 90% through greater reliance on indigenous manufacturers of equipments.

10. Substantial progress in the substitution of fuel oil by coal in thermal power stations and industries was achieved. During the four year period a large number of units were pursuaded to switch over from furnace oil to coal, As a result of this, there will be savings in fuel oil consumption per year to the extent of about 0.8 mt. (valued at Rs.42 crores c.i.f.). However, further conversions would be faced with various constraints including those relating to finance needed for procuring costly equipment.

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2.9 Investment performance:

The Draft Fifth Plan outlay was Rs.787.4 crores for the five year period by the end of which production was expected to rise to 135 million tonnes. Although in the Final Plan the target of production was scaled down to 124 million tonnes, the investment outlay was increased to Rs.1147.6 crores. The increase in outlay was because of a sharp rise in prices during 1973-74 and 1974-75 By 1977-78, coal production reached a level of 100 million tonnes. A rough proportionate allocation would have meant an investment outlay of Rs.920 crores for this level of output. As against this, actual investments during the four years period from 1974-75 to 1977-78 were Rs.718.41 crores. While further price escalations have led to a rise in actual investment costs deferring of projects consequent upon production outstriping demand resulted in slower investment as compared to outlays.

In this context it may be mention that considering the period of time that elapses between project conception and projected approval and the time-lag involved in the procurement of plant and machinery advance actions taken under OM-1 and OM-2 to purchase plant and machinery master over Rs.260 crores in 1977-78 and 1978-79 turned out to be the right course of action taken but for which it would have been difficult for the industry to increase production by about 20 million tonnes within a couple of years and to maintain it over the subsequent 2/3 years.

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2.10 In the Final version of the Fifth Five Year Plan an allocation of Rs.1147.58 crores was made for the coal sector. The actual plan expenditure upto 1977-78 in relation to the allocation upto 1978-79 was as follows:-

	Revised Fifth Plan allocation upto 78-79	Estimated expenditure upto 1977-78	Total of 4 years Annual Budget allocation upto 1977-78
1. Coal India Ltd. Total:	966.14	655.00*	696.20
a) Investment on mines & infrastructure including mines safety, sand stowing power supply, welfare etc.	793.65	581.83	
b) New Washeries (Sudamdih Monidih & Others)	45.83	21.00	
c) CMPDI and others	12.30	13.00	
d) Dankuni LTC Plant	11.00	0.43	
e) Bhandra Explosive plant	6.70	3.74	
f) Others (including SWT wining engg, and coal controllers Orgn.)	10.31	-	
g) Exploration including advance action	32.85	14.00	
2. Singareni Collieries Co. Limited:	59.19	63.41	67.49
of which			
a) Investment on mines and advance action	48.00	58.44	
b) Ramakrishnapuram LTC Plant	11.19	4.97	
3 Neyveli Lignite Corporation Limited	122.25	-	
	1147.58	718.41	

* Total of (a) to (g) under (1) adds to less than Rs.655 crores because an amount of about Rs.21 crores is yet to be allocated among different heads.

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It is apparent that the actual investments were proportionately much less under major heads for Coal India upto 1977-78 compared to the Plan projections upto 1978-79. In the case of SCCL, the actuals were, however, higher. As noted earlier, the actual investments fell short of projections, because of slippages in demand and consequent deferment of mining projects. The LTC plants have also lagged original schedule.

2.11 Any analysis of investment in relation to production is complicated because of the following factors:-

a) time-lag between cash outflows and receipt of machinery,

b) time-lag between receipt of machinery and its utilisation for production,

c) impact of inflation on investment costs particularly since 1975-76 when prices of many equipments rose to 2 to 3 times the original cost estimates;

d) depletion of capacity of production in existing mines;

e) long gestation period of investments in mines as a result of which a considerable portion of investments are always in the nature of advance action.

2.12 Subject to these limitation, however, an attempt has been made to correlate production and investment in Coal India Ltd. The distribution of the total investment

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on mines was as follows:

	Estimated Investment (Rs. crores) 1974-75 to 1977-78	Increase in Production(M.t) 1974-75 to 1977-78
a) New Mines	55	4.13
b) Takenover Mines including re-organised mines.	273*	9.97
c) Spillover IV Plan projects(excluding Sudamdih & Monidih)	56	3.99
Total (a+b+c)	384	18.09
d) Sudamdih & Monidih	48	0.43
e) Advance investment against projects which will yield production in 1978-79 and beyond	52	-
All mines	484	18.52

* The entire investment, however, should not be related to increased production capacity but also to the maintenance of depleted capacity production(as explained in the para below).

It may be noted that investments under (e) as well as (d) are in the nature of advance investments the results of which will start flowing in 1978-79 and thereafter. Thus, an investment of Rs384 crores was needed for the current level of production of about 89 million tonnes. There was a production increase of 18.09 million tonnes during the four years. This production increase is net of continuous depletion of capacity of existing mines, the annual rate of which varies from 1 m. tonnes to 4 million tonnes, Assuming an average of 2 m.t. capacity depletion per year, the increase in the capacity works out to about 26 million tonnes. For this the investments were of the order of Rs. 190 crores (Rs. 55 crores on new mines, Rs. 56 crores on spill-over 4th Plan projects and about Rs. 76 crores on capacity increase through re-organisation and marginal schemes), Another Rs. 195 crores or so were invested for replacement of equipment in existing mines to maintain the depleted capacity of about 60 million tonnes for the four year period. In other words, on an average Rs. 50 crores of investment was needed to maintain the production at the depleted capacity of existing mines. It must be admitted, however, that the figures used in this analysis are broad approximate estimates primarily indicative in nature.

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2.13 The year-wise investments under different heads in CIL in relation to the annual budgets were as follows:-

(Rs. in crores)

	1974-75		1975-76		1976-77		1977-78	
	B	A	B	A	B	A	B	A
Plant & machinery	92.5	84.5	N.A.	136.0	117.4	132.1	105.0	--
Welfare	13.7	6.0	N.A.	11.5	21.8	19.7	26.0	--
Development & Exploration.	22.5	19.2	N.A.	21.7	27.7	25.6	28.6	--
Others	4.7	4.3	N.A.	11.0	26.0	14.8	14.1	--
Total	132.9	114.0	196.7	180.2	192.9	192.2	173.7	158.60

A: Actual B: Budget

2.14 The investments in SCCL amounted to Rs. 63.41 crores during 1974-75 and 1977-78. The production increased from 6.2 m.t. in 1974-75 to 8.9 m.t. in 1977-78.

The yearwise investments under different heads in SCCL in relation to annual budget were as follows:-

(Rs. in crores)

	1974-75		1975-76		1976-77		1977-78	
	B	A	B	A	B	A	B	A
Plant & machinery	4.4	4.15	14.54	14.69	8.98	8.45	5.33	6.23
Welfare	0.57	0.25	1.22	1.02	2.00	2.20	2.49	2.46
Development	2.91	2.53	3.90	3.39	4.07	4.92	4.53	4.43
Exploration	0.73	0.99	0.72	0.66	1.12	0.65	0.42	0.49
Others	0.02	0.52	0.06	0.04	0.05	0.08	0.05	0.09
LTC plant		0.34	2.58	0.40	1.30	0.97	5.50	3.36
Total	8.63	8.78	23.02	20.40	17.92	17.27	18.32	16.95

2.15 Conclusion & Recommendations:

The review of the performance of the coal sector

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during the four years of the Fifth Five Year Plan (1973-74 to 1977-78) reveals that a number of policies and measures need to be adopted so as to ensure that the coal sector is not constrained to make the desired contribution to the national economy in the coming years. Such policies and measures would include the following:-

(a) A clearer concept of the capacity of the coal mines needs to be evolved and a system of collection of relevant information needs to be designed so that evaluation of capacity utilisation, performance and investment effectiveness could be made in a much more meaningful manner than is possible now.

(b) Measures should be taken to eliminate the continuing imbalance between gradewise production planned (which is to some extent influenced by the objective of conservation of better quality coals) and the actual demand of consumers (which is considerably influenced by the economic advantage in the use of superior quality coals over inferior quality coals at the present price and freight rate structures). This may require not only a revision of the price and freight rate structures but also positive steps to ensure that the consumers actually shift away from superior quality coal-based technologies to inferior quality coal based technologies.

(c) In view of the recurring slippages in the coal requirements indicated by the major consumers, the present method of forecasting demand to the extent it is based on indications of coal requirements from such consumers should be reviewed. In particular for large and tied projects, coal demand and production plans wherever possible should be preceded by contractual agreements imposing penalty for slippages on the part of any of the parties - producers or consumers of coal.

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(d) There is also a need to provide for a cushion while planning capacity expansion for coal. The planning preparedness for coal production should be set at a level of around 10% more than the forecast demand. At the same time, in the growth of production a degree of stability needs to be imparted. In coal industry deliberate variation in production in accordance with short term demand fluctuations are costly in terms of resource mobilisation and utilisation. A more or less uniform rate of growth of production may be pursued allowing a well-conceived policy of stock adjustments to absorb the impact of demand fluctuations.

(e) For the purpose of planning, it is necessary that the time-lags between projects conception and project report preparation, between project report preparation and project sanction, between project selection and project implementation (till projects reach revenue production stage) and among purchase order for equipments, equipment delivery and utilisation, need to be carefully assessed. While efforts should be to bring down the time-lags, planning should be based on such estimates of time-lag as are realistic even if they appear to be higher than what one would have wished. In particular, for projecting production targets from projects, adequate allowance should be given for the relatively greater time generally required in firmly establishing new technologies that are being introduced. At the same time, measures such as advance action in respect of purchase of standard machinery/equipments as well as incline drivages, shaft sinking and construction of essential buildings even before the projects are formally sanctioned would help in reducing the overall time-lags. However, this will call for a closer co-ordination of the activities in the absence of which reduction in time-lags may result in idling of equipments buildings and capacity.

(f) There is also a need on the part of coal companies to pay much greater attention on the utilisation of equipments/machinery. This will not only help reduction in investments costs but also help in achieving higher labour productivity.

(g) A reassessment of the present mix of capacity expansion investments between marginal schemes/ reorganised mines and new mines needs to be made from the point of view of optimal resources

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utilisation and stable qualitative growth in the human resources of the industry.

(h) An indepth study of the organisation capabilities and efficiency in project execution should be studied and such steps including effective monitoring of project implementation should be taken to ensure that execution of projects are in accordance with the plans.

(i) From the point of view of ensuring smooth supply of coal to consumers particularly in times of sudden shortfall in coal production or in coal demand or constraints on wagon availability, it is necessary that there is a greater degree of co-ordination between coal producers and coal transport agencies.

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CHAPTER III

ASSESSMENT OF DEMAND

DEMAND PROJECTIONS - 1978-79 to 1983-84 & 1987-88

Forecast of coal demand is an uncertain area in as much as it is linked with the growth of the consuming sectors. More interaction is going on between coal industry and various consuming industries. Machineries have developed for regular review of the requirement in major consuming sectors like Cement, Power, Railways etc. The analytical approach adopted during the last couple of years and the rapport established with 6 steel plants, 60 thermal power stations, the Railways, 54 cement plants and various small consuming industries through their sponsoring authorities have led to a greater accuracy in demand forecast. Consequently, during the last couple of years the process of long term coal demand has been considerably improved despite the inherent uncertainties of estimating the requirements of an energy source which is dependent on the actual growth of the consuming sectors. The Fuel Policy Committee in 1974 had assessed the demand taking 6% growth of the Indian Economy as the basic premise. It had envisaged a demand level of 135 million tonnes by 1978-79. However, due to various reasons, the growth of the economy has been slower and as a result the demand of coal is likely to end at 110/113 mt. in the year 1978-79.

11.5%

3.2 The assessment of coal demand in India requires and analysis of the growth of a number of different sectors of which four principal sectors viz. Steel, Power, Cement and Railways account for about 70% of the total Demand. The balance of 30% is accounted for by nearly 20,000 industrial units, numerous brick kilns and 6 million domestic consumers (using soft coke). While the demand for the major sectors is assessed on the basis of their planned levels of future consumption, for the remaining consumers, appropriate growth rates are assumed. With the establishment of a system of closer scrutiny of developments in major consuming sectors and the collections of more detailed information in regard to their coal consumption it has been possible to improve the accuracy of demand forecasting in the intermediate term.

3.3 Based on a recent exercise Table 3.1 gives the assessment of coal demand for the year 1978-79 to 1983-84 and 1987- 88. It also shows the actual coal consumption during the last five years, the yearly increase in coal consumption during the last five years, and the projected increase in the ten year period. The magnitude of the yearly variation has not been regular in the past. It is obvious that this follows the trend in the economic growth and other related factors. As for the projected increase, the yearly increments are governed by the projections in the consuming sectors as given in the remark column.

This shows that the Steel and Power sectors account for nearly 50% of the coal demand at present and will progressively

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increases to 60% in 1982-83. By 1987-88 they are likely to go up to 67%. The requirement of these two sectors therefore, of special significance. The requirement of coal for the Railways is on the decline. The brick manufacturers are the fourth largest consumers of coal followed by cement and domestic sector etc. The sector 'Other Industries' is a conglomeration of miscellaneous industries for which individual data are not readily available. Their total consumption is estimated as the balance after the consumption of all other sectors has been deducted from the total.

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Assessment of All India Coal Demand
(without import of Coking Coal)

Table -3.1

(In million tonnes)

Sl.No.	Sector	ACTUAL CONSUMPTION					ASSESSED DEMAND							Remarks.
		73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88	
1.	Steel	13.78	18.51	20.93	22.30	23.10	23.79	26.30	29.14	31.44	33.70	35.20	42.10	By proposed steel/Hot metal programme.
2.	Power	16.43	20.04	23.44	27.70	28.80	32.62	36.40	42.60 (3.50)	47.90 (3.80)	54.00 (4.00)	60.00 (5.00)	84.00 (6.00)	By power programme.
3.	Railways	13.92	13.31	14.30	13 30	13.30	13.10	12.80	12.50	12.20	11.80	11.50	10.20	Railway corporate plan.
4.	Cement	3.65	3.62	4.44	4.70	5.10	5.72	6.00	6.50	6.70	7.20	7.60	9.60	By cement production prog.
5.	Fertilizer	*	0.95	0.93	0.70	1.20	1.60	2.40	4.20	4.50	4.70	4.90	6.20	By fertiliser prog. till 82-83.
6.	Export	0.62	0.54	0.44	0.60	0.65	0.60	0.60	0.50	0.60	0.60	1.00	1.00	Estimated.
7.	Soft coke/LTC	3.80	3.72	3.64	4.30	3.91	3.44	4.80	5.90	6.50	6.50	7.00	10.20	Estimated.
8.	BRK	**	**	**	**	**	**	**	6.70	7.00	7.00	7.50	8.30	
9.	Textile	1.78	***	***	***	***	2.69	2.70						
10.	Others	24.32	24.19 (0.30)	23.82 (0.39)	22.80 (0.62)	24.34 (0.91)	22.48	23.50	19.80 (0.60)	20.10 (0.70)	21.56 (0.80)	21.75 (0.80)	26.70 (0.90)	Growth rate
11.	Colliery Consumption.	*	2.26	2.46	3.40	3.30	3.38	3.40	3.40	3.42	3.44	3.65	3.70	
	Total	78.30	87.14	94.40	99.80	103.70	109.22	118.90	131.34	140.36	150.50	160.10	208.00	
	Increase		8.84	7.26	5.40	3.90	9.85	7.20	10.59	9.02	10.14	9.60	47.90	

Note(*) In 1973-74. fertilizer and colliery consumption are included in others.
(**) From 1973-74 to 79-80 'BRK' is included in 'Others'.
(***) Beyond 1973-74 till R.E. 1978-79 'Textile' is included in 'Others'.

3.4 For each sector, the consumption has been worked out with reference to the past performance of the particular industry, the current situation and future prospects. In certain industries, the effort was directed at finding out what the economy can absorb after 5 years or 10 years, what capacities are required for this and the consequent repurcussions on coal demand.

3.5 While making use of past data, reliance has been placed on the immediate past say 7 to 10 years. For the various industries different time period data has been used. The necessity to use such data was influenced by the non-availability of data for all the industries for the desired time period and also the difficulty in comparing data f for different years due to changes in the statistical reporting system.

The demand forecast for years upto 1983-84 and 1987-88 and its sectorwise allocation to different companies is indicated in Annexure-III. The following paragraphs mention in brief some of the salient features considered for the estimation of demand in various sectors:-

STEEL: The demand for coking coal has been calculated based on the information in respect of hot metal production and consequent clean coal requirement as charged to ovens which have been furnished by SAIL and Planning Commission (Annexure-IV). This also indicates the blend ratio of various types of coal as adopted by SAIL. The requirements of coking coal relates to actually to the utilisation of cokeries capacity and the programme of oven puching which also take into consideration the future additions in blast furnace capacity according to the expansion programme of various steel plants.

The Coking Coal Sector also has to meet the requirement of merchant coke ovens and of DCOP and FCI. This has been included here while arriving at the final requirement of various types of Coking Coal. In this connection, it has been suggested by the Planning Commission that in the overall economic interest of the Country it has become necessary to import 1 mt. of prime Coking Coal, notwithstanding the adequate production capacity available in our own coal industry to meet such demand. It may further be noted that even if at a later date it is decided not to import any coking coal, the production potential created in this Country will be able to meet this demand. The details calculations leading to the estimate of various types of Coking Coals can be seen in Annexure-V .

POWER: The actual coal based thermal power generation achieved during 1976-77 was 44 b. units. The power generation during 1977-78 is estimated to have registered a rise of 12 per cent over the previous year. The same trend is likely to continue in the next five years period also.

The total energy generation by 1982-83 has been estimated by the Planning Commission to be of the order of 165 b.units. Allowing for the generation from other sources, like hydro-electricity, nuclear, oil and gas etc. coal based thermal generation is estimated to be 95 b.units. This works out to a growth rate of 12.7% in power generation by coal based power stations during the time horizon 1978-79 to 1982-83. Taking a norm of 0.62 Kg. of coal per unit of power generation and off setting a likely availability of 4 mt. of washery middlings, the coal demand by 1982-83 worked out to 54.0 mt. Since this level of require-ment relate to the sets sanctioned so far, no more clearance except an odd-one here and there is envisaged.

CEA felt that the power sector coal demand in 1982-83 will be of the order of 65 mt. But as it was not in line with the Planning Commission's Model, a figure of 58 mt. (5444 mt) has been retained. Since it has not been possible to obtain unitwise coal demand break-up of power stations relating to 58 mt., the allocation between companies during the different years have been done on ad-hoc basis judiciously.

RAILWAYS: Railways demand was taken from their Corporate Plan. According to this, the demand decreases from 13.1 mt. in 1978-79 to 11.8 mt. in 1982-83 due to progressive dieselisation/electrification.

CEMENT: Based on the various building construction activities going to be generated within the country as considered by the Planning Commission, requirement level of 31 mt. of cement is expected to be reached by 1982-83. Off-setting an import of 2 mt. of cement the indigenous production capacity is to be built up for 29 mt. against a likely achievement level of 19.5 mt by 1978-79. This means a growth in production capacity by 7.6% and a 9.0% of growth rate in its demand. A substantial part of this additional capacity has already been licenced. All the new cement plants will have a relatively smaller norm of coal consumption because of their being based on dry process. The coal requirement thus rise from the level of 5.75 mt in 1978-79 (0.5 mt. especially provided for in this year) to 7.2 mt. by 1982-83.

FERTILIZER: In this sector, the percentage of growth is of no relevance as the indigenous production has increased 4 fold during the last 10 years. This does not offer a very meaningful indication for the future consumption of coal by this sector. The requirements of individual plants proposed and sanctioned have been considered to arrive at the total requirement of coal. The demand of two coal based plants has been taken in full and for the other coal required for steam generation only has been taken into account.

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EXPORT: In this sector, an export level of 0.6 mt has been assumed through out till 1982-83 and 1.0 mt. thereafter.

SOFT COKE & LTC. - The 1977-78, consumption of soft coke is about 2.8 mt. (raw coal equivalent to 3.9 mt) per annum. Although soft coke sector is not developing as desired, the present level does not reflect the potential market for soft coke. Quite a large potential exists in Southern and Western India markets. Government is, keen to popularise this source of domestic fuel to replace kerosene.

However, the Railway accord lowest priority in the allotment of Wagons for the movement of Soft Coke and the producers too, find its un-remunerative to convert coal into Soft Coke. As for LTC only two plants, namely Dankuni and Ramagundam are provided. Dankuni will not require any coal during the period upto 1982-83 where as Ramagundam will start requiring coal from 1978-79 onwards. The requirement of this has been taken as 0.3 m.t. by 1982-83. In the light of above, taking Soft Coke and LTC together a requirement of 6.5 m.t. by 1982-83 has been estimated. Thus the rate of growth in Soft Coke sector works out to be 10.7 percent.

BRICK-BURNING: The consumption statistics in this sector have not been very reliable in the past. In recent past rate of growth in this sector has been only of the order of 1.5 per cent. Considering, however, that industrial activity in the country will stimulate and other building/construction activities will also get stepped up, higher rate of growth is envisaged in this sector. Accordingly, a demand level of 7.0 m.t. by 1982-83 has been provided which meant a growth rate of 3.9%.

OTHER INDUSTRIES: This sector includes thousands of units covering over 30 different industries. It has been difficult to identify their individual requirement. Judging the various circumstances involved, a growth rate of 5.0 percent has been applied in this sector. This cuts the requirement of at 21.56 m.t. by 1982-83, inclusive of that for textiles.

COLLIERY CONSUMPTION: The level of colliery consumption is expected to remain almost same as the present one of about 3 mt. per year. This is because although the population of workers may increase, the consumption by colliery boilers is expected to come down gradually due to the replacement of Steam operated machines by electricity operated machines.

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CHAPTER IV

PRODUCTION PLANNING

4.1 Having fixed up the demand as contained in Chapter-III and having split up the same companywise, sectorwise and qualitywise, production planning has been done to meet the same.

As far as time horizon 1982-83 is concerned preparedness-both from planning and production angle has been aimed at 160 m.t. The figures appearing herein in all the statements relate to that. However, actual production availability that will be ensured will be only 153 m.t. This does not leave much cushion vis-a-vis the expected level of demand of 150.50 m.t. which is considered very necessary in order:-

(a) To cater to the sizewise and gradewise difference/imbalance in the demand vis-a-vis the optimal grade of production including requirement of Steam Coal for making soft coke;

(b) To off-set the inter-regional balances and as also seasonal variations between demand and availability;

(c) To be able to augment the supply from different regions in the event of slippages in the production/transport capacity in a specific region.

Although investment in this time horizon may be confined to the level of 153 m.t., other infrastructure support, by way of advance action have to be given to the level of 160. m.t.

For the time horizon 1987-88 also the planning

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preparedness has been worked out for nearly 240 m.t. against a projected demand level of 208 m.t. With haziness and lack of clarity persisting about the expected performance of various consuming sectors at that time horizons, planning preparedness has got to be kept with sufficient cushion. Besides, planning being a continuous process, this cushion will give an opportunity to build up the infrastructure in advance. In this case it works out to about 5/6 m.t. of cushion per company. As the demand of the various sectors will get firmed up in the future years, the clarity and firmness will also be reflected in the production planning as well.

STRATEGY(BASED ON CLASS OF MINES)

4.2 The strategy adopted has been to maximise the production from the on-going/existing mines and mines sanctioned so far. This has been done to minimise the capital requirement and increase capital utilisation. The remaining gap between demand and availability has been sought to be met from incremental output from reconstruction of some of the existing mines as the capital investment on a reconstruction mine is less than that on a new mine. Only the remaining gap has been proposed to be met from new mines. In choosing the existing mines for reconstruction, the gestation period as well as the resultant requirement in the plan period

1983-88 has also been kept in view. In practice the gestation period is found to be longer than what is worked cut in the construction schedule/bar-charts. Therefore, phasing of production has been done in the present exercise keeping this factor in view.

STRATEGY (TECHNOLOGY)

4.3 The strategy adopted has been mechanisation only when absolutely essential. Intermediate technology has been preferred to give rise to and promote employment potential as also larger manpower utilisation by suitable re-deployment of the existing manpower. Sophistication has been and is to be avoided.

COAL INDIA

4.4.1(a) UNDERGROUND

Bord & Pillar mining has been our predominent method since the beginning of coal mining in India. This method was adopted due to several advantages like low capital, quick production etc. Roof & floor, shallow reserves, simplicity of methods as also historical factors were responsible for its large scale adoption in Indian Mines. The conditions are now changing. The production has to be increased; the cost of mining has to be contained within limits; deeper seams/reserves have to be worked and good quality coking coal has to be conserved. All these call for reconstruction of smaller units into bigger ones and construction of newer necessarily larger units. This in turn is tending to lead to work concentration. This also means reconstruction of existing methods of mining.

During the year 1977-78 about 98% production was through bord and pillar method of mining. The percentage of bord and pillar method will decrease slowly in future

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CHAPTER -IV.

PRODUCTION ANALYSIS TECHNOLOGYWISE

TABLE - 4.1

SL. No.	Method	1977-78 *	1978-79	1979-80	1980-81	1981-82	82-83	83-84	87-88	Remarks
1.	LONGWALL:									
	(a) Caving	0.40	1.8	4.8	8.3	11.9	15.0	18.3	31.5	*1977-78 Break-up not available. Figures taken on percentage basis
	(b) Stowing	0.20	0.7	1.5	2.2	2.9	4.0	4.3	5.2	
	TOTAL LONGWALL	0.60	2.5	6.3	10.5	14.8	19.0	22.6	36.7	
2.	BORD & PILLAR:									
	(a) Mechanised	0.8	2.3	5.7	9.0	11.8	14.4	15.5	19.4	
	(b) Manual	63.9	70.9	67.9	63.4	60.4	55.9	56.6	54.8	
	(c) Others	-	-	-	-	0.1	0.2	0.3	0.7	
	TOTAL BORD & PILLAR	63.7	73.2	73.6	72.4	72.3	70.5	72.4	74.9	
3.	Share of Stowing in B & P	9.1	9.4	9.9	11.1	11.7	11.8	12.3	12.9	
	Total underground (CIL)	65.4	75.7	79.9	82.9	87.1	89.5	95.0	111.6	
	Total Opencast (CIL)	23.6	26.0	28.3	33.7	39.3	48.9	57.3	93.3	
	Total CIL(OC& UG)	89.0	101.7	108.2	116.6	126.4	138.4	152.3	204.9	
4.	SCCL	8.90	11.0	12.0	13.8	15.3	16.5	19.0	30.0	
	TISCO	3.00	2.9	3.1	3.3	4.6	5.3	5.2	5.0	
	Total(All India)	100.90	115.6	123.3	133.7	146.3	160.2	176.5	239.9	

Note:- Production Programme for 1978-79 & 1979-80 has been assessed during Annual Plan 1979-80 as 1978-79: 108 m.t., 1979-80: 117.89 m.t.

years for the reasons given above. The directional swing in the adoption of technology in underground mining may be some what on the following lines:-

(i) The intermediate technology such as scraper Mining, loading coal with side loaders, load haul dumpers will be used to the maximum extent.

(ii) In deeper mines and in mines where conservation of coal is important, long-wall mining will be introduced. The longwall mining will have mostly simple mechanisation. Shearers and powered support combination will be limited to very few faces due to requirements of high capacity. The other longwall faces will either solid blasting, hand loading or flight loading or shearer faces with individual props. The table 4.1 reflects the role of various technology only dimensionally.

OPENCAST

4.4.2(b) The contribution from OCP mines is going to increase substantially in the coming years. The share of the opencast in total production today being of the order of about 25% may rise to 50% in 1987-88. It may more than quadruple by end of century. The present system of excavation in OCP mines is mainly deployment of shovel, dumper and draglines. By and large this basic system will be continued during the next decade mainly on account of mining being done for a number of seams one above the other. Smaller shovel of bucket capacity of 2 $\frac{1}{2}$/3 cub.yd. ... will be deployed in small patches or isolated areas where electric power supply in requisite amount will not be available.

In general the size of the shovels being deployed in the opencast mines is 4.6 cub. metre bucket. In some projects, even bigger capacity shovels of upto 8 cub.metres are proposed which are imported ones. It is economical to use higher capacity shovels specially where the quantity of excavation is very high.

The question of reduction of transport system to the minimum in opencast mines has been underconsideration for some time, in view of the high cost of dumpers and diesel oil to run them. For this purpose the rock-over quarry skip is being thought of for quarries which have achieved a depth of 60 metres and wherever it can be suitably installed. It is proposed to try one at Manikpur opencast in the current plan.

Lately due to obvious advantages, hydraulic excavators

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are also being thought of to replace the conventional shovels, as in Europe and USA. It gives a multi directional digging action, powerful penetration and faster cycles.

Earlier opencast projects were planned to work in two shifts and 6 days a week except the draglines which are put on 3 shifts. In view of the very large investment required for the opencast equipment, new projects are being planned to operate 7 days a week and 3 shifts a day including the time required for the routine preventive maintenance and scheduled overhauls.

The size of the mine is also expected to rise to 10 m.t. annual capacity. The OCP technology is expected to absorb all the developments that are going to take place in indigenous development of the equipments.

A significant development in opencast technology is going to be in Jharia Coalfields. The reserve on the outskirts of the coalfield is going to be mined by opencast method to a depth of 300/350 metres.

STRATEGY (SCCL)

4.5 The following steps are envisaged to create the additional capacity:

(i) To introduce intermediate technology such as scraper mining, loading coal with side dumpers, load-haul-dumpers, long-wall mining with friction/hydraulic props, longwall mining with plough in conjunction with hydraulic stowing in a few mines where mining conditions are favourable.

(ii) In the existing mines to stick to the conventional method of mining which otherwise require major reconstruction for introducing mechanisation.

(iii) In new mines where the mining conditions are not favourable to continue with the conventional system of mining to create employment potential in economically backward areas.

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(iv) To work 10 to 12 longwall faces.

(v) To introduce opencast mining wherever the conditions are favourable.

(vi) To introduce experimental mechanised faces with self advancing support, to keep our workers and engineers abreast of the latest mining techniques and layout of the new mines in such a way that they are suitable for intensive mechanisation without much alteration.

(vii) To open mines in areas in such a way that these can be brought in production in about 2 years time for quick exploitation of proved reserves.

Mechanisation may have to be introduced in stages with the availability of indigenous equipment and trained manpower. In the tables appearing hereafter, the planned production has been analysed from various angles.

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4.6 The yearwise break-up of production from various category of mines are shown in table 4.2 below

TABLE 4.2

PRODUCTION PLANNING

(in mt)

Classification	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1987-88
TOTAL DEMAND(ALL INDIA)	103.70	118.55	120.75	130.54	140.36	150.50	160.10	208.00
1. Availability from exsting & sanctioned mines(All India)	100.87	109.25	110.92	114.54	116.87	116.67	115.06	106.12
Proposed Reconstruction Projects of OPENCAST(a)*	-	2.72	3.27	4.03	5.50	7.04	8.25*	11.35
Proposed Reconstruction Projects UNDERGROUND(b)*	-	0.83	2.36	4.04	6.23	9.99	14.22*	27.50
2. Total incremental availability from proposed Reconstruction Mines(a+b)	-	3.55	5.63	8.07	11.73	17.03	22.47	38.85
Proposed New Mines OPENCAST(c)	-	1.57	3.87	7.03	12.01	19.50	29.90	70.83
Proposed New Mines UNDERGROUND(d)	-	1.24	2.85	4.01	5.58	6.85	9.11	24.02
3. Total additional Availability from proposed new mines(c+d)	-	2.81	6.72	11.04	17.59	26.35	39.01	94.85
Total production availability (ALL INDIA)	100.87	115.[illegible]	123.27	133.65	146.19	160.05	176.54	239.81

*Assumed/Estimated,

Demand and Production for 1978-79 has been assessed as

	1978-79	1979-80
Demand	109.22 m.t.	118.90 m.t.
Production	106.38 m.t.	117.89 m.t.

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4.7 For the task ahead various project reports have been prepared and others are under preparation. Our preparedness from planning angle may be seen from Table 4.3 below. This is geared to the agreed level of demand, providing for a little cushion in the time horizon 1987-88.

Table - 4.3
PLANNING PREPAREDNESS (In mt.)

Sl. No.	Classification	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1987-88
1.	Total demand without providing for import	103.7	113.[illegible]	120.75	131.34	140.36	150.50	160.10	203.00
2.	Production availability from existing & sanctioned projects.	100.87	109.25	110.92	114.54	116.87	116.67	115.06	106.12
3.	Deficit to be met	2.83	4.30	9.83	16.80	23.49	33.83	45.04	101.88
4.	Production availability from projects which have already been formulated	-	5.86	8.76	11.62	15.81	21.96	27.09	38.85
5.	Deficit to be met from projects yet to be formulated	-	(+) 1.56	1.07	5.18	7.68	11.87	17.95	63.03
6.	Production availability from from projects identified but yet to be formulated	-	0.50	3.59	7.49	13.51	21.42	34.39	94.85
7.	Surplus(+)/Deficit(-)	(-)2.83	(+)2.06	(+)2.52	(+)2.31	(+)5.83	(+)9.55	(+)16.44	(+)31.81

Note: Demand for 1978-79 and 1979-80 as assessed during Annual Plan, is estimated :

	1978-79	1979-80
Demand	108.22 m.t.	118.90 m.t.

4.8 Table 4.4 below shows the qualitywise demand and production of coal for the different time - horizons

TABLE 4.4

ALL INDIA DEMAND AND PRODUCTION PROGRAMME

Quality	1977-78 Demand	1977-78 Prodn.	1978-79 Demand	1978-79 Production	1979-80 Demand	1979-80 Production	1980-81 Demand	1980-81 Production
Prime Coking	14.17	14.43	16.26	16.25	16.55	17.71	18.06	18.57
Medium coking	8.39	7.76	9.32	9.69	9.19	9.70	10.19	10.82
Semi-coking	1.02	1.43	1.32	1.26	1.31	1.2[illegible]	1.39	1.10
Total coking	23.58	23.67	26.90	27.20	27.05	28.74	29.64	30.49
Total non-coking	80.12	77.20	86.65	88.41	93.70	94.53	101.70	103.16
Grand Total	103.70	100.87	113.55	115.61	120.75	123.27	131.34	133.65

QUALITY	1981-82 Demand	1981-82 Prodn	1982-83 Demand	1982-83 Production	1983-84 Demand	1983-84 Prodn.	1987-88 Demand	1987-88 Production.
Prime Coking	19.32	21.09	20.16	22.07	21.36	22.70	26.06	21.05
Medium Coking	11.20	11.51	12.65	12.59	14.15	16.33	20.14	19.33
Semi.Coking	1.42	1.13	1.46	1.28	1.62	1.38	2.33	2.22
Total Coking	31.94	33.73	34.27	35.94	37.13	40.46	48.50	52.60
Total Non Coking	108.42	112.41	116.23	124.11	122.97	136.08	159.41	187.21
Grand Total	140.36	146.19	150.50	160.05	160.10	176.54	208.00	239.81

Note:- All India Demand & Production Programme have been assessed for 1978-79 & 1979-80 during Annual Plan 1979-80 discussion and estimated as -

	1978-79	1979-80
Demand	109.22 m.t.	118.90 m.t.
Production	106.38 m.t.	117.89 m.t.

The Planned production stands analysed, based on quality & company. This can be seen from Table 4.5 below

TABLE - 4.5

COMPANYWISE & QUALITY WISE PRODUCTION PROGRAMME OF C.I.L & ALL INDIA

Year	Quality	NEC	ECL	BCCL	CCL	WCL	CIL	SCCL	IISCO & TISCO	ALL India	Remarks
1977-78	Prime Coking	-	-	11.43	-	-	11.43	-	3.00	14.43	
	Medium Coking	-	-	1.23	6.18	0.30	7.76	-	-	7.76	
	Semi Coking	-	1.06	-	-	0.42	1.48	-	-	1.48	
	Superior	0.62	17.53	0.25	6.50	14.15	39.10	-	-	-	
	Lower	-	6.62	7.26	8.51	6.80	29.19	--			
	TOTAL	0.62	25.26	20.22	21.19	21.67	88.96	8.91	3.00	100.87	
1978-79	Prime Coking	-	-	13.35	-	-	13.35	-	2.90	16.25	
	Medium Coking	-	-	1.65	7.25	0.79	9.69	-	-	9.69	
	Semi Coking	-	1.25	-	-	-	1.26	-	-	1.26	
	Superior	0.68	18.62	0.15	7.16	14.85	41.46	-			
	Lower	-	8.45	7.92	9.67	9.91	35.95				
	TOTAL	0.68	28.33	23.07	24.08	25.55	101.71	11.00	2.90	115.61	
1979-80	Prime Coking	-	-	14.59	-	-	14.59	-	3.12	17.71	
	Medium Coking	-	-	1.70	7.21	0.79	9.70	-	-	9.70	
	Semi Coking	-	1.33	-	-	-	1.33	-	-	1.33	
	Superior	0.80	18.63	0.15	7.18	15.41	42.17	-			
	Lower	-	10.30	8.45	10.43	11.18	40.36	-			
	TOTAL	0.80	30.36	24.39	24.82	27.38	108.15	12.00	3.00	123.27	
1980-81	Prime Coking	-	-	15.30	-	-	15.30	-	3.27	18.57	
	Medium Coking	-	-	1.63	8.31	0.83	10.82	-	-	10.82	
	Semi Coking	-	1.10	-	-	-	1.10	-	-	1.10	
	Superior	0.85	19.10	0.15	7.39	16.06	43.55	-			
	Lower	-	11.23	8.93	12.52	13.08	45.31				
	TOTAL	0.85	31.48	26.06	28.22	29.07	116.53	13.80	3.27	133.65	

Year	Quality	NEC	ECL	BCCL	CCL	WCL	CIL	SCCL	TISCO& IISCO	ALL INDIA	REMARKS
1981-82	Prime Coking	-	-	16.54	-	-	16.54	-	8.55	21.09	
	Medium Coking	-	-	1.79	8.79	0.93	11.51	-	-	11.51	
	Semi-Coking	-	1.18	-	-	-	1.18	-	-	1.13	
	Superior	0.97	19.43	0.15	7.79	16.41	44.75				
	Lower	-	12.61	9.47	15.77	14.59	52.44				
	Total:	0.97	33.22	27.95	32.35	31.93	126.42	15.22	4.55	146.19	
1982-83	Prime Coking	-	-	16.82	-	-	16.82	-	5.25	22.07	
	Medium Coking	-	-	1.82	9.78	0.99	12.59	-	-	12.59	
	Semi-Coking	-	1.28	-	-	-	1.28	-	-	1,28	
	Superior	1.18	19.60	0.09	8.00	17.24	46.11				
	Lower	-	14.56	9.89	20.69	16.37	61.51				
	Total:	1.18	35.44	28.62	38.47	34.60	138.31	16.49	5.25	160.05	
1983-84	Prime Coking	-	-	17.50	-	-	17.50	-	5.20	22.70	
	Medium Coking	-	-	1.85	13.53	1.00	16.38	-	-	16.38	
	Semi-Coking	-	1.38	-	-	-	1.38	-	-	1.38	
	Superior	1.26	20.00	0.08	8.04	18.20	47.58				
	Lower	-	16.03	11.82	23.04	18.57	69.46				
	Total:	1.26	37.41	21.25	44.61	37.77	152.30	19.04	5.20	176.54	
1987-88	Prime Coking	-	-	26.10	-	-	26.10	-	4.95	31.05	
	Medium Coking	-	-	2.51	15.72	1.10	19.33	-	-	19,33	
	Semi-Coking	-	1.92	-	-	0.30	2.22	-	-	2.22	
	Superior	1.57	23.28	0.05	8.67	20.56	54.13				
	Lower	-	21.01	13.12	40.61	28.34	103.08				
	Total:	1.57	46.21	41.78	65.00	50.30	204.86	30.00	4.95	239.81	

Analysing the production on the basis of Underground and Opencast the table 4.6 below shows the position company-wise and year-wise.

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Table-4.6

Company-wise production programme U/G & O/C. (in million tonnes)

S.No.	Company	U/G/O.C.	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88
1.	N.E.C.	U.G.	0.62	0.66	0.77	0.66	0.70	0.85	0.91	1.19
		O.C.	-	0.02	0.03	0.19	0.27	0.33	0.35	0.38
	Total:		0.62	0.68	0.80	0.85	0.97	1.18	1.26	1.57
2.	E.C.L.	U.G.	21.78	25.68	26.97	27.53	28.89	29.71	31.60	38.98
		O.C.	3.48	2.65	3.29	3.95	4.33	5.73	5.81	7.23
	Total		25.26	28.33	30.26	31.48	33.22	35.44	37.41	46.21
3.	B.C.C.L.	U.G.	18.14	20.40	21.27	21.86	23.31	23.84	25.75	25.08
		O.C.	2.08	2.67	3.62	4.20	4.64	4.78	5.50	16.70
	Total:		20.22	23.07	24.89	26.06	27.95	28.62	31.25	41.78
4.	C.C.L.	U.G.	7.22	7.88	8.42	9.12	10.00	10.66	11.61	15.22
		O.C.	13.97	16.20	16.40	19.10	22.35	27.81	33.00	49.67
5.	W.C.L.	U.G.	17.57	21.08	22.46	23.73	24.23	24.40	25.17	31.00
		O.C.	4.10	4.47	4.92	6.24	7.70	10.20	12.60	19.30
	Total:		21.67	25.55	27.38	29.97	31.93	34.60	37.77	50.30
6.	C.I.L.	U.G.	65.33	75.70	79.89	82.90	87.13	89.46	95.04	111.58
		O.C.	23.63	26.01	28.26	33.68	39.29	48.85	57.26	93.28
	Total:		88.96	101.71	108.15	116.58	126.42	138.31	152.30	204.86
7.	S.C.C.L.	U.G.	8.91	10.53	11.20	11.79	12.93	13.19	14.44	22.00*
		O.C.	-	0.47	0.80	2.01	2.29	3.30	4.60	8.00*
	Total;		8.91	11.00	12.00	13.80	15.22	16.49	19.04	30.00
8.	TISCO/IISCO	U.G.	3.00	2.90	3.12	3.27	4.55	5.25	5.20	4.95*
		O.C.	-	-	-	-	-	-	-	-
	Total:		3.00	2.90	3.12	3.27	4.55	5.25	5.20	4.95 *
All India:		U.G.	77.24	89.13	94.21	97.96	104.61	107.90	114.68	133.53
		O.C.	23.63	26.48	29.06	35.69	41.58	52.15	61.86	101.28
	Grand total:		100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81

Note:- Production for 78-79 and 79-80 as assessed during Annual Plan 79-80 is:- 78-79: 106.38 m.t. 79-80: 117.09 m.t.

(*) Date not available. Assumed.

4.11 Various other details of the production planning can be seen from the following Annexures.

(i) Categorywise, companywise and project State-wise production programme ... ... Annexure-VI

(ii) Coalfieldwise production .... Annexure-VII

(iii) Statewise production .... Annexure-VIII

(iv) Companwise production .... Annexure-IX.

4.12.1 North Eastern Coalfield:

N.E.C. proposes to raise its production from the present level of 0.62 m.t. in 1977-78 to 1.18m.t. in 1982-83 and further to 1.57 m.t. in 1987-88. Highlight of production programme is to introduce hydraulic mining to reduce occurence of fire and make mining more safe and also to increase percentage of extraction. The area proposes to reconstruct one existing mines and opening of four new mines.

4.12.2 Eastern Coalfields Limited:

The company proposes to raise its production level from 25.26 m.t. in 1977-78 to 28.33 m.t. in 1978-79 to 35.44 m.t. in 1982-83 and 46.21 m.t. in 1987-88. The salient features of the production planning in this company is that Raniganj being a coalfield over hundred years old, many operating mines are more than 50 years old. The shallow depth reserves in most of them, therefore, stands already exhausted. The main rise is in the production lower grade coal which is proposed to be met apart from reorganisation of existing mines, by expediting underground reserves by opening 16 new mines. As reorganisation of 28 more existing mines are proposed apart from those, already sanctioned and under implementation- they will yield an additional production of 3.35 m.t. by 1982-83. In the interest of ensuring the required production from this coalfield, the proposed reconstruction schemes must be taken up with no loss of time so that the working depth increases further and the expansion of mines in vertical direction becomes possible. This is more so as this field has to rely mostly on underground reserve since quarry potentiality is very limited. A study conducted in the Mugma/Salanpur coalfield recently suggests that all the reserves stand to be taken into consideration in production planning as far as time horizon 1987-88 is concerned, reserves in fact do exist under depth but a direction to work the lower grade coal by deep underground methods in the absence of exploration data has to wait for the time being.

BHARAT COKING COAL LIMITED.

4.12.3 The company meets the entire demand of prime coking coal and a part of medium coking coal. The ratio between non-coking coal and coking coal production is roughly 1:2. The company proposes to raise the coking coal production from the present level of 12.71 m.t. in 1977-78 to 15.00 m.t. in 1978-79 and 18.64 m.t. in 1982-83 and further to 28.61 m.t. in 1987-88. Coking coal reserves in Jharia coalfield are presently being exploited from a large number of small mines. The production of non-coking coal in most of the cases is incidental to the production of coking coal because of the geological sequence of deposits. It is also mined due to inherent property of its forming good quality soft coke for domestic consumption. The contribution of reconstruction mines amount to 2.46 m.t. in 1982-83. More than this a substantial increase is to come from opening of new mines which amounts to 4.16 m.t.

A highlight of production programme in BCCL is an inclusion of three major opencast blocks apart from overall Jharia Reconstruction scheme. The peripherial reserves in Jharia coalfield are proposed to be mined by opencast methods. Three such blocks namely, Block-2,4 & 6 have been considered.

CENTRAL COALFIELDS LIMITED.

4.12.4 CCL has planned to raise its level of production from 21.19 m.t. in 1977-78 to 24.08 m.t. in 1978-79 and 38.47 m.t. in 1982-83 and further to 65.00 m.t. by 1987-88. A major part of the production is expected

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from Opencast Mines. There has been delay in the construction of the Singrauli Coalfield which is to contribute significantly to the large increase in the production. The construction of Ramgarh Washery has to be expedited, and that of Kedla Washery taken up so that they are able to receive coal latest by 1982-83 and 1983-84 respectively to meet the medium coking coal demand. To cater for continuity, an additional washery at Parej and associated mine capacity are to be built in the West Bokaro Coalfield. For this, advance action is envisaged before 1982-83 itself.

The main spurt in demand is noticed in lower grade of coal because of opening of many power stations. This is specially so in case of Singrauli Coalfield. Due to the advantageous location of this coalfield, the coal demand will always be increasing. As such, the infrastructural development in this coalfield should be expedited and made to precede the production.

WESTERN COALFIELDS LIMITED.

4.12.5 This company produces coal from a number of coalfields spread over three different states of Maharashtra, Madhya Pradesh and Orissa.

It is proposed to raise its production from the present level of 21.67 m.t. in 1977-78 to 25.55 m.t. in 1978-79, to 34.60 m.t. in 1982-83 and further to 50.30 mt in 1987-88.

A Coalfieldwise analysis reveals that principal centres of production rise are Korba, Chanda and Sohagpur coalfields. There are proposal for increase of medium coking goal from Kanhan coalfield. The main increase in production, however, is in lower grades which nearly doubles from 6.8 mt in 1977-8 to

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16.37 mt. in 1982-83, and further to 28.34 mt. in 1987-88 - four fold increase.

Superior grade production registers a rise from the present level of 14.15 mt. in 1977-78 to 17.24 mt. in 1982-83 and then to 20.56 mt. in 1987-88.

Most of the production increase as mentioned above comes from opencast mines to be opened at Kusmunda, Durgapur etc. which will be conveniently situated near the principal load centres like STPS in Korba and TPS in Chandrapur.

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CHAPTER - V.

COAL RESERVES & EXPLORATION

INTRODUCTION :

5.1.1 The exploration programme has been drawn up keeping in view the anticipated demand levels in the terminal years 1982-83 and 1987-88 and tentative projection of the demand for the terminal year 1992-93. Thus, the exploration programme has been drawn up for meeting the demand over a period of 15 years. Further, while drawing up the exploration programme, the gestation period involved for the development of a project has also been considered. However, it may be mentioned that the exploration programme in the past had to be tailored according to the fluctuation in the demand and as such the desired lead time for the development of a project could not be obtained. Further, the exploration had to be cut down drastically with the scaling down of the demand in the past. In view of this, if the desired lead time has to be maintained the exploration programme need not sympathetically fluctuate with the demand. The exploration programme, therefore, should be so drawn up that it meets both the short term and long term requirements of the industry and also provide for flexibility for adjustments, if needed. This would only be possible if there is a provision in the exploration programme for the creation of 'shelf of reports' not only to facilitate a choice of the blocks but also to meet sudden spurt in the demand. In other words, such an approach would provide better planning preparedness.

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5.1.2 Keeping the above in view, the exploration programme that was drawn up some time back (Feb'78) has not been changed with the marginal revision in the demand pattern. This approach has purposely been adopted so that the exploration needs are not arithmatically linked with demand-of course within bounds. This programme would only need marginal adjustment on an annual basis to suit the planning requirements exactly in tune with the requirement of rolling plan concept.

REVIEW OF THE FIFTH PLAN WORK (1974-75 to 1977-78)

5.2.1 The exploration programme that was drawn up for meeting the demand for the Vth plan requirements envisaged a total drilling of 1,55,291 metres in the various areas, and this programme was to be completed by December, 1976 in three Companies viz. ECL, CCL and WCL and by July'77 in the case of BCCL. The programme was initiated during 1973-74 itself. The entire work was completed as per the schedule and against a target of 1,55,291 metres, a total of 1,69,369 metres were drilled during the period 1973-74 to 1976-77 (upto December 76 for ECL, CCL, and WCL and upto July'77 in case of BCCL). It would thus be apparent that though extra meterage had to be drilled on local geological considerations in certain areas, the work could be completed well within the time schedule.

5.2.2. Based on the execution of above programme of work, a total of 4937 million tonnes of coal reserves of various types/grades were estimated. Of this, about 2400 m.t. fall under the 'proved' category. Further, of the proved reserves, about 1300 million tonnes constitute quarriable reserves. In total, 56 geological reports were prepared, based on the above performance.

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ADVANCE ACTION FOR SIXTH PLAN :

5.3.1 Simultaneously with the exploration programme for fifth plan, proving of areas earmarked for development during sixth Plan were also taken up as advance action because those involved long gestation period for development, and the priorities then visualised. That the action for proving areas was initiated sufficiently well in advance proved beneficial insofar as project planning for current plan period is concerned. This has also helped in creating a shelf of reports in certain cases which have proved handy now.

5.3.2 A total of 3,03,604 metres were drilled during the period 1973-74 to 1977-78 (upto December 77) against a target of 2,93,449 metres. Against this, a total of 6301 million tonnes of coal reserves of various grades and types were estimated and 72 geological reports were prepared.

FUTURE PROGRAMME :

5.4.1 The future exploration programme has been drawn up on the basis of the following:

a) The qualitywise and companywise additional requirements of coal to meet the demand in the various terminal years has been identified on the basis of the production levels likely to be obtained from 1977-78 (Previous Plan) projects vis-a-vis demand, at any point of time.

b) Based on the additional qualitywise requirement, appropriate blocks have been selected. Further, in selecting the blocks preference has been given to the quarriable areas (requiring shorter gestation periods) over the underground projects particularly for the lower grade coals which are required in large quantities for the power sector.

areas where exploration has already been carried out have been given preference over the virgin new areas.

c) The quantum of drilling for each of the blocks has been assessed based on the available geological knowledge about the deposit that has accrued as a result of regional drilling/mapping carried out by the G.S.I. or State Governments, or existing working, if any. The reserves thus envisaged to be proved would not only meet the demand in the various terminal years but would also prove adequate resources to meet the marginal extra production, wherever planned. In this context, it may be mentioned that there could be no correlation between the meterage drilled and the reserves proved, because the reserves in any area are directly linked with the vertical density of seams. Similarly, direct correlation cannot be established between the [illegible] required to be proved in an area matching with the grade and those not required because in the process of proving the desired type of coal reserves the associated reserves of different type and grade also get automatically proved on account of their vertical heterogeneity and proximate occurrence.

d) Provision has been made to provide production support drilling to the continuing scheme either for sustaining the existing production or to achieve increased production.

It may be mentioned that efforts have been made to identify the blocks/areas which would require production support drilling but where this was not possible an ad hoc provision has been made to take care of the situation in the future.

e) Provision has also been made to create a shelf of reports. For this, blocks/areas have been selected based on the quality-wise net additional requirement for each coal company in the various terminal years. Shelf has been provided to the tune of nearly 50%(on an average) of the net additional requirements. The shelf created for one terminal year (1982-83) has been drawn upon in the next terminal year (1987-88) for attaining the desired production level and the remaining shelf freshly enriched and supplemented for 1987-88 terminal year. Similar approach has been adopted for the terminal year 1992-93. It may be mentioned that in respect of BCCL in particular, as against shelf of reports, additional areas have been identified for exploration in 1982-83 and 1987-88 to yield production in 1987-88 and 1992-93 respectively for which advance action has to be taken in the previous terminal year.

f) It is proposed to introduce geophysical techniques on a largescale involving both well logging and surface geophysical surveys. Towards this, non-coring drilling coupled with well logging are proposed to be introduced to accelerate the progress of exploration and effect economy in the operation. Surface geophysical techniques

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viz. resistivity, seismic refraction and reflection techniques and high resolution shallow seismic refraction surveys will be introduced to unravel the geological structure, basin geometry, estimation of overburden thickness and its characteristics. With the successful implementation of the above mentioned R & D efforts it is expected that a total saving of Rs. 105 lakhs will be effected in CIL alone.

5.4.2 Keeping the above in view, the total quantum of drilling required to meet the demand in the various terminal years, for production support as well as for the creation of shelf of reports has been worked out. For proving the necessary resources for meeting the net additional requirements in the various terminal years a total of 14,81,152 metres of drilling is envisaged. The entire exploration programme has been divided into two phases, viz. Phase I covering the terminal year 1982-83 and 1987-88 and Phase II covering the terminal year 1992-93. The summarised position of the quantum of drilling companywise and terminal yearwise is given in the table below:

TABLE 5.1

PHASE - I (Jan'78 to Oct'82)

Item	NEC	ECL	BCCL	CCL	WCL	TOTAL
1. Meterage to be drilled for meeting the demand in 1982-83	-	46,685	52,422		23,350	1,27,457
2. Meterage to be drilled for production support.	10,750	15,736	16,607	66,020	36,900	1,43,063

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Item	NEC	ECL	BCCL	CCL	WCL	TOTAL
3. Meterage to be drilled for creation of shelf of reports/as advance action taken.	-	40,837	40,415	45,200	22,450	1,48,902
SUB. TOTAL	10,750	1,03,308	109,441	111,220	87,700	4,22,423
4. Meterage to be drilled for meeting the demand in 1987-88	3,000	25,000	37,600	-	1,03,500	1,69,100
5. Meterage to be drilled for production support	5,000	25,000	29,210	33,00	30,000	1,22,210
6. Meterage to be drilled for shelf of reports/as advance action.	8,000	30,500	30,190	71,500	70,000	2,10,190
SUB. TOTAL	16,000	80,500	97,000	101,500	203,500	5,01,500
TOTAL FOR PHASE I :	26,750	183,808	206,444	215,720	291,200	9,23,922
		PHASE - II (Nov'82 to Jan'86)				
7. Meterage to be drilled for meeting the demand in 1992-93	-	35,000	10,200	133,000	95,000	273,200
8. Meterage to be drilled for production support	5,000	25,000	20,000	20,000	12,000	82,000
9. Meterage to be drilled for creation of shelf of reports.	-	76,000	39,030	52,000	35,000	202,030
TOTAL FOR PHASE II	5,000	1,36,00	69,230	2,05,000	1,42,000	5,57,230
GRAND TOTAL	31,750	3,19,808	2,75,574	4,20,720	4,33,200	1,481,152

5.4.3. The entire exploration programme (Phase I and Phase II) as outlined above will be executed during the period from Jan'78 to Jan.86 (i.e. 8 years) including documentation. The drilling for Phase I would be completed by Oct'82 and the documentation would be available by Feb'83. It may, however, be mentioned that nearly 50% of the exploration work (including documentation) for meeting the demand by 1982-83 has already been completed and the balance work is scheduled to be completed by March'79. The drilling for Phase II would be taken up in Nov'82 and completed by Sep'85 and the geological reports would be available by Jan.86

5.4.4. From what has been indicated above, it will be seen that while the exploration work including the submission of geological reports will be completed about 4 years ahead in respect of the 1982-83 and 1987-88 projects, the same will be completed about 7 years ahead of production schedule in respect of projects for 1992-93.

COAL RESERVES TO BE PROVED :

5.5.1 With the completion of the above programme, a total of 16,903 million tonnes of coal reserves of various types/grades are likely to be proved. This is composed of 3241 million tonnes of prime coking, 2943 million tonnes of medium coking, 140 million tonnes of blendable, 3363 million tonnes of superior grade and 7216 million tonnes of lower grade non-coking coals. Of the total Coal reserves to be proved 6[illegible]3 million tonnes are expected to be quarriable reserves of various types and grades. All these reserves are insitu gross geological reserves based on the seam thickness and area involved. It may be mentioned that the above quoted reserves are to be proved in course of detailed drilling investigations and represent the total reserves to be proved. Such reserves include the reserves already estimated by the G.S.I. under the 'Proved' category apart from bringing the 'Indicated' and 'Inferred' categories under the 'Proved' category. Reserves estimated under the 'Proved' category by the G.S.I. are not suitable for mine planning, as such reserves may be in detached patches and not necessarily continuous.

It is rather difficult to quantify the recoverable reserves likely to be available because the recovery of coal is influenced by many factors, viz. methods/of mining(i.e. opencast and underground), mining technology adopted, recovery percentage on beneficiation, geological consideration, i.e. burning, highly faulted ground, etc. However, on a broader consideration about 60% of the gross insitu reserves are considered as mineable. Further, losses on beneficiation and geological considerations would also have to be considered to arrive at the net recoverable saleable produce.

RESOURCES :

Drilling

5.6.1 Currently 50 drills of CMPDI, 78 drills of M.E.C., 16 drills of State Governments of M.P. and Orissa and 14 drills of private contractors (i.e. a total of 158 drills) are deployed. The M.E.C. has been requested to increase their strength by another 10 drills in the ECL. However, it is proposed to deploy on an average about 158 drills over the entire period of exploration for the programme outlined above and drill on an

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average @ 1,90,000 metres per annum. The allocation of drills to the individual areas would entirely depend upon the quantum of work involved and their priority.

FINANCIAL INVOLVEMENT :

5.6.2 The total financial involvement for executing the exploration programme as outlined earlier would be about Rs.51.5 crores.

CHAPTER - [illegible]

PLANT AND EQUIPMENT

6.1 During the period from 1978-79 to 1982-83 production of coal is to increase from the present level of about 115 m.t to 160 m.t. This increase in production has to come from the existing as well as new opencast and underground mines. However, the major increase has been planned from Opencast mines to quickly meet the requirement of new power stations.

6.2 With the growing need of increased production, safety, conservation, higher productivity and effective employment; suitable systems of mechanisation have to be adopted to suit our working conditions in the mines. Technology mix and their methodology for achieving these objectives have been dealt with elsewhere in the chapter on Production planning.

6.3 The Methodology followed for assessment of requirement of Plant & Machinery has been that in case of mines for which Project Reports have been prepared, such Reports have formed the basis. For all other mines, for which project Reports are yet to be made, both for new mines as well as mines proposed for re-construction, the Projected swing in mining technology and desired/expected degree of mechanisation have formed the basis. For existing mines, the improvement in production, population of equipment, their present conditions and effective utilisation have been the considerations for replacement requirement.

6.4 With the concerted drive for increased productivity, safety and cost reduction through higher mechanisation, planning for and optimum utilisation of plant and equipment, proposed for deployment in future, is to be realised. It is with this basis that requirement of plant and machinery for

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TABLE I

ANTICIPATED GROSS REQUIREMENT OF P & M FOR UNDERGROUND MINES FOR COAL INDIA AND SINGARENI COALFIELDS LTD. FROM 1978-79 to 1982-83.

SL. No.	Equipment	78-79	79-80	80-81	81-82	82-83	Total	83-88 [illegible] only
1.	Coal cutting machine	78	102	118	108	94	500	210
2.	Gate End Box for CCM	120	112	128	115	101	[illegible]	243
3.	Flight Loader	8	11	17	14	13	63	56
4.	Shearer Single /Double Drum	4	2	8	9	9	32	28
5.	Shearer/Coal plough with S.A. Support	1	3	2	3	3	12	18
6.	Coal Plough	0	0	0	3	-	3	-
7.	Road Header/ Binters/continuous Miners	5	8	7	2	2	24	13
8.	Coal/stone drill	1563	1713	1772	2248	2224	9520	7611
9.	Drill Panel	714	810	816	835	973	4178	3328
10.	Pneumatic Drill	117	118	132	203	205	775	663
11.	Exploder	882	1013	1090	960	1092	5057	4105
	SUPPORT							
12.	Friction Prop 40T	5900	5400	5600	2580	4500	24900	7000
13.	Friction/Hyd Prop 20 T	3400	5500	6000	3600	2800	21300	25600
14.	Hyd. Prop. 40T	10825	11100	21300	13500	24500	81225	129100
15.	Link Bars	16900	19350	27700	29810	27910	131670	219390
16.	Central Power pack	20	16	30	32	48	146	184
17.	Hyd./Mech. Pushers	600	330	840	450	690	2910	5160
	TRANSPORT.							
18.	Side Loader	10	21	12	16	17	76	46

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Sl. No.	Equipment	78-79	79-80	80-81	81-82	82-83	Total	85-88
19.	L.H.Dumper	12	15	20	17	20	84	45
20.	Scraper Loader	64	100	115	104	126	509	260
21.	Front endLoader	17	32	24	9	9	91	30
22.	Shuttle car	2	0	4	0	0	6	-
23.	AFC HD/MD	27	27	48	35	47	194	269
24.	Chain Conveyor light Duty.	160	196	232	143	162	893	452
25.	Stage Loader	27	34	52	35	47	195	259
26.	Gate & Trunk Conve.	76	85	102	192	130	587	353
27.	Locomotives	2	34	20	26	24	106	41
28.	Haulages	462	379	350	361	377	1929	1054
29.	Ele. Winder	10	6	5	14	9	44	36
	OTHERS.							
30.	Pumps	769	666	661	789	734	3619	2457
31.	Main Fan	62	55	45	50	48	260	97
32.	Auxiliary Fan	168	218	255	155	145	945	447
33.	Man Riding Haulages	3	7	7	8	10	35	23
34.	Burn Side Boring Machine	2	5	11	3	5	26	21
35.	Air Compressor	32	27	33	23	24	140	94
36.	Transformers	659	494	493	452	459	2557	1449
37.	OCB/ACB HT/LT	1689	1759	1754	1907	2015	9124	5788
38.	PVC Belting KM	122.4	146.5	157.1	189.4	198.8	814.2	1138.9

Note: Details regarding TISCO and IISCO are not available.

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TABLE 5

ANTICIPATED REQUIREMENT OF OPENCAST EQUIPMENT FROM 1978-79 TO 1982-83 FOR COAL INDIA & SINGARENI COLLIERIES LTD.

SL. No.	Equipment	78-79	79-80	80-81	81-82	82-83	Total	83-85 CIL
1.	5-35/45-90 Dragline	1	1	5	2	2	11	24
2.	6.3-8 Cu.m Ele. Shovels	1	3	9	6	18	37	54
3.	3.2-4.3 Cu.m. Ele. Shovels	12	19	20	11	11	73	41
4.	2 1/2-3 Y. Diesel shovels	10	7	8	4	7	36	38
5.	1.91-6 Cu.m. FE Loaders	6	15	7	1	1	30	25
6.	0.9 Cu.m. Hyd. Shovels 6.50 T. Rear Dumpers	22	36	31	40	116	245	547
7.	35T Rear Dumpers	92	125	116	119	114	566	273
8.	25 T Rear dumpers	30	48	43	27	35	183	334
9.	45T coal Haulers	-	-	5	22	22	49	3
10.	29 T. Coal Haulers	6	8	34	34	45	127	118
11.	1.5 cu.m. scraper	28	18	21	14	9	90	65
12.	250-269 mm BH Drill	8	19	12	8	20	67	60
13.	100-166mm BH Drill.	19	18	19	21	16	93	67
14.	275-300 HP Dozer	56	73	81	38	86	334	176
15.	Grader	8	14	6	-	4	32	13
16.	15-50 T. Crane	9	14	6	2	4	35	21
17.	Ripper/attachment	-	-	5	-	-	5	20

Note- Details regarding TISCO & IISCO are not available.

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TABLE - 2.

INDICATIVE LIST OF ITEMS TO BE IMPORTED WITH THEIR APPROXIMATE VALUE FOR COAL INDIA & SINGARENI COALFIELDS LTD.

Sl. No.	Description	78-81 3 yrs.	81-83 2 yrs.	Value in Rs. lakhs 78-81	81-83
*	Integrated longwall face with power support shearer, AFC, stage loader, Gate belt conveyor with suitable transfer points including electricals.	4	-	920	-
2.	Shearer, Single ended ranging shearer	9	3	153	51
3.	Heavy duty AFC 500 TPH	12	3	131	46
4.	Stage loader with crushers	16	3	58	11
5.	Side discharge loader	25	10	65	25
6.	LHD Capacity 0.6 cu.m.	46	15	165	66
7.	Shuttle Car 6 T capacity	2	2	12	12
8.	Central power pack	52	24	107	50
9.	Road headers/Dinters	20	4	468	85
10.	Man Riding Haulage	4	-	36	-
11.	T/W Loco-10/15 Te	27	5	172	32
12.	FLP Diesel Locomotive 8T	6	3	14	7
13.	Safety Boring machine capable of Boring 19" & depth 850 ft.	=	1	=	100
14.	Steel Cord belting	4 km	4 km	40	40
15.	Submersible Pumps 500 M head 40 LPS	2	-	12	-
16.	-do- 500M head 80 LPS	2	2	12	12
17.	High tensile pipes for submersible pumps capacity 80 LPS head 500 M to carry a static load of 65-67 Te	2 km	2km	10	10
18.	Walking Dragline 15/25 Cu.m and 80/90 m.t. Boom.	6	-	1700	-
19.	Walking Dragline 10/70 A	1	-	120	-
20.	Shovel 6.3/8 Cu.mt.	9	-	350	-
21.	Blast hole drills	54	2	810	30

In addition to the above 15% of value of spares would be imported for initial set of items.

Details regarding TISCO, IISCO are not available.

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ANCILLARY ACTIVITIES OF COAL COMPANIES

6.8 Government appointed an Expert Committee in July 1975 to go into the question of taking up ancillary activities by different coal companies. On the recommendation of the Expert Committee which in its 22nd report on the NCDC observed that the Corporation should be made a permanent viable wing and they should not remain a "HEWER OF COAL" only. This was subsequently reiterated by the Committee on Public undertakings in its 7th report dividing ancillary activities into two parts with phase.I & Phase.II. Phase I covers the development of ancilliaries for providing essential inputs for the Coal mining industry and Phase-II Covers coal utilisation and processing industries.

6.9 Both the groups have done a lot of useful work on ancilliary activities which has been circulated to the Members from the Ministry of Finance, Coal India Ltd, and other concerned committees. An ancillary development Wing (ADW) has also been set up in CMPDI to co-ordinate developmental activities with subsidiaries, devise the lines of future growth in consonance with the future plans of in-take of plant and equipment. Efforts for publicity on dessiminating information on ancillary development including assistance available from various agencies of the Government have also been made by organising periodical seminars-cum-exhibitions etc.

6.10 As a result of these efforts a number of R & D and other engineering activities have been taken-up by CMPDI for the development of mining equipment and spare parts for imported machinery. A good number of equipment have also been developed by Ancillary Development Wing, in CMPDI in collaboration with Research Organisations like CMRS, CFRI, SFRDO, NIFFT, SSI Units and coal companies.

6.11 Such activities as have been initiated and followed so far should be pursued more vigorously in future to sustain a self supporting and efficient system and thereby help achieve optimum utilisation of equipment.

CHAPTER VII

EMPLOYMENT POTENTIAL

MANPOWER & TRAINING

Manpower:

7.1 The mining in general and coal mining in particular is a labour intensive industry. Presently more than six and half lakhs workers are employed in this industry. There is no denying that even today the coal mining is carried predominantly manually. The fact that the industry was mainly in the un-organised private sector and collieries were owned by private owners had neither the financial capacity nor the know-how nor the will to keep pace with the trend and tempo of mechanisation has contributed to the present situation. As a result not only there is a wide gap in the technology as applied to the coal mining in this country and elsewhere but even the hazardous operations which adversely affect the safety of the miner have greater manual content in itself. Similarly, the operations which cause lot of drudgery to the workers are continued to be carried manually. As a result the industry which employes more than 40% of the work force employed in the "public sector undertakings" of Central Government has only 10% of the total investment in these public sector undertakings. Even in the current year more than 72% of the coal is likely to come from the conventional bord and pillar method of the mining and only about 28% will be coming from the mechanised mines. Out of this 28% also 23% is expected from the mechanised open cast mines i.e.

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only 5% or so of the total coal production in the country is likely to come from the underground mechanized mines. This, of course, has helped in achieving a very important objective of providing employment at the least capital cost. Against an average investment of Rs.71,000 in public undertakings for each job in 1976-77, coal industry had an an investment of only Rs.21,000 for each man employed by it.

7.2 However, the situation is likely to undergo drastic change when the future decade will witness the introduction of mechanisation to a considerable extent. The circumstances which may necessitate rather force adoption of mechanised working are indicated below:-

(1) Deeper mines where the need for better strata control requires the use of heavy and costly support system and higher strata temperature limit the deployment of a large number of men.

(2) Big and deep mines where large capital is required for development work requiring a greater degree of concentration than hitherto of workings so as to keep them economically viable.

(3) Quick increase in production from existing or new mines. Large mechanised opencast mines are particularly amenable to this.

(4) Mechanisation of wagon loading operation in order to deal with higher production from re-organised bigger mines and re-organised loading points and also to ensure proper sizing and quality control. Restrictions imposed by railways for block rake

loading as well as shorter hours allowed for the same along with stricter quality requirements necessitate the mechanisation of even existing loading arrangements in a phased manner.

In addition mechanisation is absolutely essential in circumstancesto ensure better safety for the working men and reduce their drudgery and also to achieve greater conservation of this non-replenishable source of energy. In view of this the share of coal from the mechanised mines is likely to increase and by the year 1982-83 the production from conventional bord and pillar method is not likely to be more than 42% of the total production as will be seen from the Table I below:-

Table I

Likely production of coal by use of different Technologies (%)

	1978-79	1979-80	1980-81	1981-82	1982-83
Opencast	22.9	23.6	26.6	28.5	32.5
U.G.					
1. Longwall	2.5	6.0	9.3	12.1	14.3
2. Bord & Pillar					
(a) Conventional	72.2	64.9	56.1	49.7	42.3
(b) Mechanised	2.4	5.5	8.0	9.7	10.9
Total	100	100	100	100	100

In general the level of mining technology in Coal India and other companies is at the same level of development as such it has been assumed that availability of coal for India as a whole with different U.G. technologies will be same as for Coal India. This percentages are shown in Table-I. The likely production based on these percentages is shown in Table-2 below:-

Table-2
Likely production available from use of different Technologies (All India)

(Million tonnes)

	1978-79	1979-80	1980-81	1981-82	1982-83
Opencast	26.5	29.1	35.7	41.6	52.25
U.G.					
1. Longwall	3.0	7.4	12.4	17.7	22.9
(a) Conventional	83.4	80.0	75.2	72.6	67.7
(b) Mechanised	2.7	6.7	10.7	14.2	17.4
	115.6	123.2	134.0	146.1	160.2

7.5 Having worked out the likely contribution of different technologies to the total coal production in country, the OMS included in the articles "Coal Industry Future Trends" published in Khan Mandeer of May, 1978, has been taken for different technologies for the terminal years. The O.M.S. figures for the years 1979-80, 1980-81 and 1981-82 have been interpolated. Accordingly the O.M.S. figures used to work out the manpower are shown in Table-3 below:

Table 3

	1978-79	1979-80	1980-81	1981-82	1982-83
1. Opencast	1.20	1.25	1.30	1.35	1.40
2. Longwall	1.00	1.02	1.04	1.07	1.10
3. Board & Pillar:					
(a) Conventional	0.60	0.61	0.62	0.63	0.65
(b) Mechanised	0.80	0.82	0.84	0.87	0.90
Overall O.M.S.	0.71	0.74	0.78	0.83	0.90

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Employment Potential:

To arrive at the manpower the following assumptions have been made.

1. Absenteeism = 15%

2. Closed days
   Sundays = 52

   N.C.W.A.Holidays = 7

   Others = 2

   61

3. Working days = 365-61 = 304

4. No. of Personnel working in Area office, Company H.Q., workshop dispensaries, hospital etc, is to be added separately.

Accordingly the manpower requirement for mines and others may work out as in the table 4 below:

Table 4

Estimates of Manpower requirement

(Fig. in lakhs)

Requirement of Manpower	1978-79	1979-80	1980-81	1981-82	1982-83
1. Opencast	0.85	0.75	1.06	1.19	1.44
2. Longwall	0.11	0.28	0.47	0.64	0.81
3. Board & Pillar					
(a) Conventional	5.38	5.08	4.69	4.46	4.03
(b) Mechanised	0.13	0.32	0.49	0.63	0.75
4. Offices, workshops & dispensaries/ Hospitals	0.45	0.46	0.46	0.46	0.47
Total	6.93	6.89	7.17	7.38	7.50

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Training

The expansion of the coal industry's operations during the next decade will not only require an increase in the labour force, albeit at a slower rate compared to production, but also would call for a significant qualitative transformation of the human resources of the industry, with the changing technology-wise production mix that is being planned, newer skills and aptitudes would be necessary from coal industry's workforce. The growing emphasis on large mechanised open-cast mining and different variants of longwall mining would imply that both the fresh recruits as well as the existing personnel would have to be trained in the new tehhnologies sought to be established.

The magnitude of the tasks involved for meeting the training needs would be considerable not only because of the rate and nature of expansion of the industry's activities that have been planned, but also because of the initial conditions the industry inherited from the pre-nationalised era. In the first place, there was a considerable backlog in respect of even the statutory training for underground works. Secondly, the training facilities and infrastructure (centres, equipments and trained trainers) were extremely inadequate. Considerable progress has been made in reducing the backlog in statutory training as also in expanding the training facilities and infrastracture since then, But the leeway to be made up yet is substantial. Thirdly, so far as the workers are concerned, the very high rate of illiteracy is a major constraint that has to be overcome before the employees could be exposed to training in the new mechanized and more scientific methods of mining operations. Finally, with nearly 85% of this widely scattered industry having been brought under a single large organization, Coal India Limited the management training and development needs have increased significantly in both quantitiative and qualitative terms.

For an appreciation of the needs and their priorities, the different training areas may be classified into the following:-

(a) training of workers, supervisors and subordinate technical personnel;

(b) training of fresh entrants to the junior executive and Management cadres and

(c) training of Managerial personnel.

(a) Training of workers, supervisors and subordinate technical personnel;

In view of the statutory provisions and the heavy back-log in this respect, the first priority would go to (i) vocational training for the existing workers as well as new recruits and (ii) the training of surplus workers in such skills and trades where shortage of personnel is being felt. In particular, the literate section of existing workers can be trainined to enable them to switch over to semi-skilled jobs.

The training of the technicians dealing with repair and maintenance of sophisticated machinery is an important area. Yet another priority area would be training of operators of different types of mining equipment and in particular the operators of heavy earth moving machinery. When a new type of equipment is introduced arrangements for training of its operators and repair and maintenance personnel with the assistance of the representatives of the manufacturers/suppliers of the equipment, will have to be made.

At the same time, there is a considerable gap that has to be met in respect of the training needs of supervisory and subordinate technical personnel for the development of supervisory skills as well as technical competence for greater effectiveness on their present jobs as also for undertaking higher responsibilities on promotion.

(b) Training of Junior Executive Trainees (JETs) and Management Trainees (JETs):

In view of its large and growing size, the industry's requirements for recruiting fresh Graduate Engineers as Junior Executive Trainees in all the technical disciplines is considerably high and this would continue to be so during the next decade. Also fresh graduates are also to be recruited, although at a much smaller scale, for filling up managerial positions in the non-technical disciplines such as, Sales, Purchase, Personnel, General Administration, Accounts etc.

An organised training activity has, therefore, to be undertaken for these trainees over a period of time on a full-time basis comprising (a) mining-oriented technical knowledge, (b) orientation to the organisation and its various activities and (c) Managerial skills and abilities.

(c) Management Development/Training of Management Personnel:

In the area of management training the nationalized

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coal industry's inheritance of executives primarily comprised engineers and technical personnel who had gathered rich experience in mining and allied activities but were required, for greater effectiveness, to be turned into professional managers for the running of the large number of interconnected operating profit/cost centres in the fields, the development of professional managers had, therefore, to be taken on a war footing. Some measure of success had been achieved in this area but considerable efforts are required to be made to meet the requirements of the industry through re-orientation of existing executive manpower as also development of fresh management executives required to be inducted.

An assessment of the magnitude of efforts to be made in the above priority areas of training and the likely capital requirement for establishment of training institutes and procurement of necessary training equipments have been made. The existing capacity as well the required increase in the capacity for training for the next five years have been worked out for various categories of personnel in the executive and non-executive cadres (vide Annexure-X). It will be seen that considering the estimated number of non-executive personnel to be trained at the pre- entry and post-entry stages, the capacity of existing facilities is small. In the case of both executives and non-executives, in some of the areas of training the facilities just do not exist. The required increase in various types of training centres that would meet the gap between estimated training need and present capacity has also been worked out (vide Annexure-XI). There are about 125 training centres currently operated by by the industry. The number of training centres would have to be nearly doubled in the next five years.

In many of the areas of training, particularly technical, techno-management and management it would be necessary to utilize, as far as possible, the available assistance offered by foreign countries. In some other areas, foreign assistance in the form of grant of equipments/aids and training of Indian personnel abroad would be required to be sought. At the same time, in the supply contracts of machinery and equipments purchased by coal industry, provisions should be made to make it obligatory on the part of the suppliers (indigenous as well as foreign) to extend training facilities available to personnel of the coal industry in the use and maintenance of machinery and equipments procured from such suppliers.

While large industries in the organized sector like coal have to develop their own systems of training and network of training centres (class-room as well as on the job e.g., training coal faces), in as much as the industry draws considerably on the technical manpower resources of the country, a close degree of formal collaboration and co-ordination is necessary between the coal industry and the Directorate of Technical Education in different States. These state level agencies are in overall charge of the development of technical education and training in the country. At present, the links between industry and education is weak and haphazard. It is necessary that more direct and formal links between coal industry and education authorities are worked out, established and strengthened so that ..

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integrated schemes of education and training can be evolved and implemented. For this purpose it is felt necessary to set up joint advisory committees on coal company, state or institutional basis as may be appropriate, with representatives from company Training Departments, State Directorates of Technical Education and Educational institutions. At local levels also joint councils should be set up with principals of educational institutions, heads of mining departments, companies, area training officers, chief engineers, mechanisation officers, colliery managers, etc. These committees and councils should determine the number of persons to be educated/trained (categorywise), educational needs of various categories, and the curricula and syllabi for these categories as also work out arrangements for loan of equipment for training and interchange of personnel between industry's operations and teaching.

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CHAPTER - VIII

MARKETING & DISTRIBUTION STOCKING POLICY AND INTERFUEL SUBSTITUTION :

8.1 This chapter deals with the following subjects:

(A) Marketing and Distribution Policy for coal ⟩ Vide item No. (ix) of the terms of reference.

(B) National Stocking Policy for coal ⟩

(C) Strategy of replacement of Kerosene and fire-wood by coal/coal based products particularly in rural areas.

(A) Marketing & Distribution Policy for Coal:

8.2 The total coal requirments of the country are met by the following three producer Groups:

(i)	Coal India	about 88%
(ii)	Singareni Collieries Ltd.	about 9 %
(iii)	Others (TISCO, IISCO & DVC)	about 3%

8.3 The mines belonging to producers group 'Others' captive and the total coal produced is consumed by the producers themselves. No Marketing is, therefore, involved.

Marketing of Coal from SCCL

8.4 The Singareni Collieries generally cater to the requirments of the Southern part of the country. Since the demand for coal in SCCL's command areas has all along been more than the production the company has been able to achieve steady growth in their production programme and had no particular difficulty in marketing their coal. Some of the consumers still continue to approach for Bengal/Bihar coal, presumably on grounds of quality. In the national interest, therefore, three points need special attention:

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(i) Singareni's production to be geared up to progressively meet the total requirement of its expanding natural market. Only the balance of requirement which cannot be met by SCCL be supplied from CIL.

(ii) Necessary transport facilities to be built up for coal movement from SCCL collieries to the South and West.

(iii) All new consumers in South India to be advised to design their equipment suitably for using Singareni coal. All licensing authorities(State Directorate of Industries, DGTD etc.) and consumers to be suitably advised. The existing consumers may also be advised to change over to Singareni coal in a phased manner as far as practicable.

8.5 This will keep down the investments required for transporting Bengal/Bihar Chanda coal to South. As a corollary, SCCL will need to develop greater marketing and technical services in South to meet the above objectives and to promote the use of coal.

8.6 SCCL have also set up a LTC Plant. The success of this Plant would also determine the possibilities of meeting the domestic fuel requirements in the South with Singareni Coal. Studies are being undertaken at RRL Hyderabad regarding coal gasification possibilities from the high volatile coals of Manuguru field. These may have good potential for diversified usage in and around Visakapatnam, Vijayawada & Hyderabad. This needs to be explored further.

8.7 Movement of Singareni coal by rail does not require any sponsoring. As Singareni is to be given the responsibility of meeting the requirements of South, this policy should be continued.

Marketing of CIL Coal

8.8 Coal India's primary products are Non-coking coal, Coking Coal, Soft Coke and Hard Coke. These products are being dealt in the order of increasing volume:

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Hard coke

8.9 While the demand for superior quality By-product Hard Coke has always been adequate to ensure regular off-take the manufacturing capacities and production of ordinary quality Bee-hive hard coke had been more than its demand and/or offtake. During the last couple of years of the Fifth Plan, production of B.H. Coke had been curtailed to liquidate accumulated stocks which have since been brought down.

8.10 Besides the Coal producer Companies, a large number of Private Collieries in and around the Coking Coalfields also manufacture Hard Coke and market it. Any marginal shortage of Hard Coke of Bee-hive variety is primarily due to movement difficulties as the stocks at Pitheads are still very large. The marketing strategies for Hard Coke would consist of -

(i) Periodic Review of coke production programme of coal producers and the licenced capacities of merchant cokeries and regulation of coking coal supplies to them so as to evently match overall production with anticipated demand.

(ii) Provision of adequate wagon supplies particularly in piece-meal to move requisite quantities of ordinary quality Hard Coke to distant consumption centres to control its end-prices within reasonable limits.

(iii) Promotion of locally manufactured LTC Coke pellets & briquettes made out of non-coking coal to help gradually replace the small quantities Hard Coke used by non-metallurgical users like Halwais & Domestic(house-hold) consumers at distant points.

Soft Coke

8.11 The entire quantity of Soke Coke produced in the country is from CIL Subsidiaries. Its distribution is controlled by the State and the Railways. Coal India has no control on distribution of Soft Coke, excepting the distribution of Soft Coke in Delhi and the Hill districts of U.P. where the respective State authorities have delegated the functions to Coal India.

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8.12 Throughput 1977-78 and the current year, production of soft coke has been trailing behind demand, but during 1975-76 & 1976-77, Soft Coke production was satisfactory and efforts were launched by Coal India to increase its production and market as desired by the Government, though the current Pithead price of Rs.86/- per tonne does not cover production costs of Soft coke and results in heavy losses to Coal India not only in producing the raw coal for Soft Coke but also in converting the raw into Soft Coke. Even with this indirect subsidy to the consumers, its share of the domestic(house-hold) fuel market is not more than 17.5% in the Urban sector and 0.4% in the Rural sector in the Northern States where logistics of movement are better. In the Southern States, Soft Coke is practically unknown. Some recent attempts at introducing it in the Southern Urban centres have met with some success. When the Semi Coke from Singareni Collieries becomes available, the share of coal in domestic fuel in the South could be increased.

8.13 Similarly when the LTC Project at Dankuni starts production the growing fuel requirements of both gas and domestic coke in and around Greater Calcutta region will be met.

8.14 In general, the stake burning of coal to produce soft coke (leading to wastage of valuable by-products and adding to atmospheric pollution) has to be gradually replaced by by-product processes, besides promoting the use of low grade slack and middlings in the form of pellets, briquettes etc. with suitably designed and mass produced domestic ovens.

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Coking Coal

8.15 TISCO, IISCO & Coal India produce the entire quantity of Coking Coal required by the metallurgical and the office of Coal Controller statutorily controls coking coal distribution in the country.

8.16 The main objective of Marketing Coking Coal is to meet the growing requirements of Steel Plants and conserve our scarce reserves of coking coal for metallurgical purposes. Of equal importance is the strategy to use as much of more abundant non-coking coal as possible to replace or supplement coking coal supplies. The generally poor quality of Indian Coking Coals and the limited reserves of prime coking coals make it imperative to use medium and semi coking coals in appropriate blends and also increasingly take resort to coal washing to improve quality. The associated problems of marketing middlings, finding newer sources for coal blends or otherwise and arranging for suitable transport by rail and road between the collieries, washeries and the Steel Plants have also to be attended to

8.17 The policy being followed currently is:

(i) To wash more and more raw coal to bring down ash content and adopt three stage washing to make middlings suitable for Power Houses;

(ii) to improve washing methods/develop new methods through research to use more inferior qualities for metallurgical purposes and also to improve yield of clean coal;

(iii) to develop alternatives, e.g. formed coke etc.

(iv) to try out new sources of blendable/Coking coals.

8.18 In these efforts, the following stand out at the moment as promising and are being pursued actively:

(i) Formed coke - a Pilot Plant being set up at Talcher;

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(ii) Oil agglomeration - a Pilot Plant is in operation;

(iii) Assam coal - picked out low ash coal has been found to be acceptable to the Steel Plants, proposal to set up a washery is under process.

(iv) Injection of coal dust in the blast furnaces for reducing coke consumption. Some Steel Plants are making necessary arrangements for trying out the same.

8.19 It would be necessary that the production from TISCO and IISCO mines is increased substantially to make them self sufficient in the shortest possible time. TISCO have large lease holds of good quality coking coals and to the extent they step up their production meeting the growing requirements of other Steel Plants will be facilitated.

8.20 In general the marketing approach for the Coking Coal Sector would need positive steps for increased production, beneficiation, transportation and research for using new sources with a view to meet growing requirements and conserving the limited reserves which are expected to last for only 40 odd years unless imports are resorted to.

8.21 Of late, Steel Plants have been pressing for importing better quality coals and the Government has cleared import of one million tonnes of low ash coking coals commencing from November'78. Steel Plants have also been pointing out their need for a reduction in the ash content of washed coal being supplied. In this context, an objective study of the optimum ash content required by the steel plants is required. While some data have been collected, a regular and conclusive study is yet to be undertaken. The results of using the low ash imported coal would also need to be carefully assessed regarding technological as well as economic aspects of such imports for an objective evaluation of desirability to import after considering costs and savings associated with import and the conservation needs.

Non-coking Coal

8.22 While the country has plentiful reserves of non coking coal in general, the reserves of better quality coal are limited. The current pricing structure also makes it more economic to use better grade coals. The other aspect that needs to be considered is the geographical concentration of most of the good quality coals in one area, namely, Raniganj, on which field the demand continues to grow while it is becoming increasingly difficult to even maintain the existing level of production of better quality coals. It is therefore, necessary to bring about a bias in the consumption pattern towards the lower grades of coal. Simultaneously the rising trend in the demand for steam-size coal needs to be curbed. It is necessary that all concerned agencies lend their support in achieving this main mitigating objective of bringing about a bias towards lower grade coals and help strike a balance between steam/slack availability and their respective demands.

8.23 The following steps are suggested:

(i) all licensing authorities e.g. Director of Industries, DGTD and all consumers be advised by the Government to ensure that wherever feasible new units are designed to burn low grade slack coal;

(ii) all boiler-designers/Furnaces designers should be advised by the Government to develop equipment for small boilers for burning low grade slack coal. CFRI has made considerable progress in the utilisation techniques of low grade slack coal in small boilers and such research efforts should be intensified by other Research Organisations like CMERI Durgapur, RRLs, etc.

(iii) Some high temperature technologies e.g. refractories may still need better quality coals. Research in this sector is also called for developing suitable technology which can utilise low grade coals in these sectors.

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(iv) the pricing pattern needs modification to remove present imbalances resulting in disproportionately higher demand for better grade coals and steam size coal particularly in the high volatile better grade coals from Raniganj coalfield.

8.24. A possible supplement to the proposed shifts to lower grades would be to beneficiate the lower grade coals to improve their qualities before use. While this possibility along with the other alternative of blending better grade coals to reduce ash content has been debated subjectively quite often, no objective assessment has been made so far. These questions need to be quickly resolved and should be studies in depth. Prime facie it appears that a beginning could be made by studying the cost-benefits in the case of Singrauli coal linked to pithead as well as distant power houses and undertaking simple beneficiation wherever the consumer is agreeable to meet the additional costs of beneficiation.

8.25 The modern Power House, being very large, have to be fed with coal from a number of sources, resulting in variations in coal quality. Some of the larger seams reserved for Power (e.g. Singrauli) have varying quality of coal. The aforesaid group of experts could also examine the desirability of setting up blending plants at Power Houses for evening out these quality variations.

8.26 Yet another alternative is to develop the technology of burning high ash coal efficiently. Fluid-bed combustion offers promise in this field and the efforts being made by the Research Organisations, CFRI & Manufacturers like BHEL are in the right direction.

8.27 The relative share of power sector in the additional requirement of coal will increase over the years. In fact, the the Power Sector will consume about 70% of the additional coal

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production during the next 5 years. Because of the long gestation period of a colliery, power houses have to be designed on the basis of quality data obtained by analysis of borehole cores. It is common experience that, the actual quality of coal varies substantially from the Coal-Core data, creating subsequent difficulties in the operation of Power Houses. It is very necessary to establish reliable relationship between the quality of coal obtained from coal exploration data and the quality of coal as mined. It should be possible to predict the quality and its variation both in the short-term and the long-term after considerin the plan of working the lease-hold, the disposition and planned progress of benches and the variations in quality of the seam from one coal bench/lift to the other and the relative production from these benches/lifts.

8.28 The demand preference for high grade coals also brings abou a distortion between the qualitywise consumption pattern and the qualitywise distribution of pithead stocks in times when coal availability improves. This cannot be controlled unless distribution is regulated centrally with laid-down objectives and stocking policies.

Distribution Policies.

8.29 Coal being a bulky material, transport requirements and costs are very heavy. Distribution of coal, therefore, is primarily dictated by transport requirement and follows and pattern of movement evolved by the Railways over the years. The Railways, therefore, play the most vital role in coal transport and have the greatest control on it. Within this pattern evolved by the Railway the next in importance are the Sponsoring authorities. Approximately 70% of the total movements are sponsored by Central agenci

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while the balance 30% is sponsored by the States. Coking coal distribution is staturorily controlled. The producers do not have any significant role in the whole scheme. This proves to be very disadvantageous for the producers at times particularly for market promotion and/or equitable distribution to suit their own production programmes. The authority to sponsor Rail movement, over and above the normal sponsoring by other agencies, should also be vested with the producers wherever such a measure clearly seems to be in the overall national interest.

8.30 Singareni Collieries are, however, free from any handicap in this regard as movement from their collieries are not required to be sponsored.

8.31 The present role of Railways in the distribution of coal is, it is argued, justified in view of the large investments needed in this sector. Certain amount of monitoring is, however, necessary in the national interest, particularly in respect of Railways' preparedness to transport the coal that is planned to be moved by Rail and its information be made available by the Producers. The loading programme/pattern is often determined by the Railways to suit their operational needs without considering the operational needs of the coal producers and this may not always be in the overall interest of equitable distribution of particular grades and sizes of coal. Expansion of Soft Coke market would also require larger movement in piecemeal although the same is not in the interest of the Railways. It is, therefore, suggested that a national Forum comprising of Railway Board, Coal India, Planning Commission and Ministry of Energy be set up to monitor Railways preparedness and to review the extent coal distribution rules and to clear new ones before they are implemented.

Another aspect that could also be dealt with by this Forum is the development of transport infrastructure(e.g. Branch lines) for new coalfields.

8.32 In the chain of distribution, coal loading arrangements at the colliery siding is the starting point. After nationalisation of coal industry and increase in coal production, the Railways have been insisting on the rationalisation of loading points for enabling them to move larger quantities of coal. This necessitates transport of coal by road to common loading points and mechanisation of loading arrangements. The desirability of such costly steps need be studied objectively and a clear policy be evolved. The national forum suggested for deciding issues relating to coal transport by rail, could take a view on this issue also.

8.33 As transport is crucial in the coal sector and the gestation period for developing transport is as long as that for coal, this need to be planned well in advance, keeping in view the overall interests of the nation. This, therefore, needs closer co-ordination and Control.

8.34 Another aspect in distribution of coal which needs to be dealt with is the seasonal variations in coal demand. Coal consumption by certain Sectors e.g. Brick Kilns, Rice-Husking, Room-heating and power are subject to seasonal variations. Availability of rail transport as also coal productions are similarly subject to certain known pattern of seasonal variations. These create temporary imbalances in coal availability. A well-designed stocking policy can take care of these fluctuations. This has been dealt with separately.

(B) NATIONAL STOCKING POLICY FOR COAL

8.35 Coal being a vital basic raw material for the economy the importance of ensuring uninterrupted coal supplies under all conditions needs no reiteration. It is in this perspective that a well defined national policy has to be laid down for stocking of coal and favourable conditions are created for its implementation.

8.36 Stocks of coal have to be maintained at three different places namely, (i) Pit-heads (ii) consumer ends and (iii) intermediate places (Dumps). The functions that stocks at these three different places can discharge are somewhat different and are discussed in detail which would also bring out the necessity for having a national coal stocking policy:-

8.37 . <u>At the Pit-head</u>: In the normal course, stocks at the pithead are accumulated due to multiplicity of reasons. The more important ones are:-

(i) Seasonal variation in coal production - Coal production undergoes seasonal variations over the year in a set pattern dictated by weather conditions and absenteeism contingent on sowing/harvesting/marriage, seasons.

(ii) Seasonal variation in coal demand - Demand from certain sectors are subject to pronounced seasonal variations e.g. brick kilns, domestic users in the foothills of Himalayas and other cold regions, power houses, seasonal industries like tea, tobacco etc.

(iii) Day to day variations in transport availability -

Wagons are not made available at the pitheads in a continuous stream but in discrete lots (Rakes/hooks) representing generally a few days' production in the case of small collieries. Further almost all collieries load two sizes so that while, one size of coal is

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being loaded, the other accumulates. Some collieries also load more than one quality. The interval between two supplies of wagons at any particular colliery is also not constant but is subject to rather large variations. Combination of all these factors make it necessary for the colliery to maintain stocks.

(iv) Inadequate overall demand - When coal production exceeds the demand, the excess production accumulates at pithead. Usually, the collieries producing the poorer QUALITY, accumulate large stocks because due to economic reasons, the demand shifts to collieries producing better quality coals. This has happened on a number of occasions.

8.38 As would be evident, the accumulation arising out of items (i (ii) & (iii), above are of operational nature so that over the year there is no cumulative effect. An average level of stocks however, has to be maintained in the interest of smooth operation. A colliery wise assessment undertaken by Coal India showed that an average inventory of 5% of the total annual production has to be maintained from these considerations alone. This figure of 5% is however, not uniformly applicable to all the collieries but is an average of all the collieries. It varies from colliery to colliery depending on products, grades, sizes, loading arrangements(manual)/mechanical and the lot size (Rake/Split) in which coal is loaded. The production pattern and the type of colliery (Quarry/Underground) also play their parts. Generally speaking, the operational stock is directly proportional to lot size, number of sizes loaded and grades loaded (unless more than one grade/size are loaded in the same rake/hook. On this has to be superimposed the effects of any special feature of the colliery (e.g. out of the common producing pattern as in scraper mining, production of other products such as hard coke/soft coke), to arrive at the optimum operational stock. The overall figure of 5% mentioned earlier has been arrived at on a colliery to

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colliery analysis on these lines. This is also an average over the year and may vary from 3% in the busy season to 7% in the slack season due to seasonal variation. In the case of individual collieries, the variations may be more.

8.39. The operation stock has to be maintained almost wholly at the colliery. A part of it, arising out of seasonal variation in demand can however, be shifted to the consumer end (e.g. seasonal variations in power) or to the intermediate point (e.g. Dump for soft coke brick burning coal and other state.

8.40 This stock to the extent it is operational, has no role to play as a reserve of energy. It cannot be drawn upon except at prohibitive costs to the nation in the event of any calamity. The costs of maintaining such stocks are also a legitimate operating expense of the coal producers.

8.41 The stocks accumulating at the pit head due to lagging demand (item iv), is however, of a different nature and can play the role of reserve energy in exigencies. This stock can be accumulated at any of the three locations depending on the policy adopted. When these stocks accumulate at the colliery, they usually cause adverse criticism in absence of any laid down stocking policy.

8.42 No forecast of coal requirement can be precise and is always subject to errors. Apart from normal forecasting errors, deviations in the projections made in the national plans also contribute to a large extent to this gap between demand forecasts and actuals. Since production planning is based on the projected demand, large gaps result whenever the targets of economic growth remain unrealised. Whatever revisions are undertaken subsequently, the extent of adjustments possible cannot fully undo the impact on the efficient functioning of coal producing companies.

8.43 On the other hand, planning for coal production perforce, has to be on the basis of formal targets as no risks can be taken, and there are slippages on the coal production side also, though to a much lesser degree. This is probably justifiable as the investment on the consuming sector is much more compared to the investment on coal and, therefore, under utilisation in the coal consuming industries would be rather costly. The accumulations at the pithead are, therefore, in the nature of insurance against shortage of coal. Its carrying costs can therefore, be treated as a legitimate charge to the national economy and subsidised by the Govt. The additional expenses would comprise interest burden on the cost of production, costs of handling and rehandling and additional transport to and from stock-yards and losses due to fire, deterioration and size degradation.

8.44 These stocks when accumulated deliberately as a matter of policy, can discharge the following functions -

(i) Act as a reserve in the event of any dislocation in production system.

(ii) Act as a stabliser for market prices which shoot up whenever there are shortages.

(iii) Can permit more realistic production planning. Once stocks have been accumulated, production planning can be done on the basis of realistic demand assessments and not on the basis of highest possible growth rates as these stocks can bridge the gap should the 'ambitious' targets for the consuming industries, materialise. This should result in substantial savings in investment because a tonne of coal in the stocks would cost about Rs.75/- while an annual production capacity of one tonne costs around Rs. 250/-

8.45 These stocks, however, cannot perform these functions in the event of (i) any disruption in the transport system and (ii) unless the quality and size of the stocks are maintained to conform to the pattern of consumption.

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8.46 These stocks, if accumulated at the other two locations, namely intermediate or at consumer end, can discharge all the functions even when there is any dislocation in transport, or when the transport system becomes strained due to underseen developments, e.g. war efforts, national calamities, import of cement, foodgrains movement etc. This is a very important advantage.

8.47 Intermediate Locations (dumps)

The consumers falling under the so called 'State Priorities' are numerous, small in size and a large number of them are of seasonal nature. These consumers occupy the lowest rungs in the ladder of priority for rail movement and become a prey to high prices whenever availability of coal becomes low either due to insufficient transport or restricted coal availability. As their requirements reach a very pronounced peak during the 'busy season' of the Railways, the Railways are severely strained. A few dumps if maintained by the State Govts. or their Agencies, or the consumers' own cooperatives at nodal points of distribution net-work, can take the strain off from the whole system, stabilise prices and ensure uniform traffic throughout the year for the Railways and uniform outlet for the coal producers.

8.48. At consumer ends:

While stocks maintained at the consumer ends have all the functional characteristics of the stocks at intermediate points, it has the additional advantage that multiple handling and subsequent costly transport (by road) from the dump is avoided. This can, however, be considered for large consumers only (e.g. Power Houses, Steel Plants, Cement Plants, Fertilizer Plants and other large industrial units) as it is not practicable to monitor an unusually large number of points.

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8.49 The costs and benefits of executing a national stocking policy are not easy to estimate. While the standard inventory model with appropriate modifications can probably represent the coal stocking situation adequately, the parametres are difficult, though not impossible, to estimate. The more important of the various elements that would go into a quantitative analysis to arrive at the optimum levels of stocks to be maintained are -

(i) Pattern of seasonal variation in coal demand and production
(ii) Pattern of variations in rail transport availability,
(iii) Costs of idling capacity in the transport system and in collieries,
(iv) Costs of creating new capacities in coal mines and transport system,
(v) Variable costs in the transport system,
(vi) Costs of stock-out to the national economy,
(vii) Inventory carring costs for the stock at various locations,
(viii) Current capacities of the producers/transport system, the future projected capacities and a realistic assessment of the actual requirement,
(ix) Geographical distribution of production and consumption, and
(x) Location of intermediate stocks/dumps.

8.50 The Coal Producers, major Consumer Sectors, Department of Coal and the Planning Commission should be in a position to pool necessary data on the above points. The stocks at the consumer ends should also be dependent on the distance from the production centres because the longer the distance the greater are the chances and extent of disruption. The Railways may be in a position to provide data on the extent to which this argument is valid.

8.51 As an alternative approach to rigourous quantitative

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analysis is also possible. The steps involved would be as follows:-

(i) Enumerate the points at which stocks are to be maintained, i.e.

(a) Collieries (location and numbers are already known)

(b) Dumps - Nodal points (can be ascertained from current traffic pattern for state priorities),

(c) Major consumers - Power Houses, Cement Plants, Fertilizer Plants, large industrial units.

(ii) Estimate consumption (qualitywise and sizewise) to be linked to those stocks and the seasonal variations and approximate distance from the production centres,

(iii) Lay down the levels of stocks to be maintained at these points as follows:-

(a) At collieries : Operational stocks (already estimated by CIL) + Reserve equal to 10% of annual production,

(b) At dumps and consumer ends) Quantity required to even out seasonal variation + 'D' days consumption, where D is the distance in KMS.

(quantity required to even out variation can be easily computed from the pattern of variations)

According to this formula, the stock levels at dumps and consumer ends work out to about 33 days for a distance of 1000 KMS and 45 days from a distance of 2000 Kms.

8.52 The Working Group recommends that in view of the importance of a well laid down Stocking Policy, a small Task Force be constituted forthwith with representatives from Planning Commission, Deptt. of Coal, Coal Producing Companies, Railways, Steel Authority of India and CEA. This Task Force will collect and collate data on the lines suggested at Para 8.51 and examine the approach suggested in greater detail.

8.53 Once this is done, the other elements of the Stocking Policy as enumerated in the earlier paras can be specified.

below fuel-wise:-

8.56 i) Kerosene - 98% of the Kerosene is utilised for lighting and therefore cannot be replaced by coal/coal products. The balance 2% utilised for heating would correspond to roughly 4000 tonnes of soft coke per month. Whether this quantity can be replaced by soft coke is contingent on the factors that have led to the adoption of Kerosene as a heating fuel in the few households in the rural sector where this is being so used. The likely reasons could be convenience and/or economics. Since by the time soft coke reaches the outlying rural areas, it would have added to it a substantial amount of transportation costs thereby making soft coke no more competitive. However, the quantity of Kerosene involved is so small (about 23 K.L) that it may not be worthwhile pursuing it.

8.57 ii) Electricity. Electricity in the rural household is utilised entirely for lighting and cannot be replaced.

8.58 iii) Firewood, Dung & other Non-commercial fuels:-

These are utilised in the rural sector entirely on economic grounds. So long as the rural population has the time to spare to collect these, all available non-commercial fuel would be utilised first and for all practical purpose cannot be replaced by coal/coal products. Commercial fuels would find usage in the rural areas only as and when the availability of non-commercial fuels fall short, either due to depletion of resources or growth of rural population. As and when this happens, coal/coal products may make in-roads depending on its competitiveness, which currently is poor due to heavy transportation costs.

8.59 In short it can be seen that the rural sector provides scope for replacement of other fuels by coal/coal products only to the extent other non-commerical sources are scarcer and to the extent the demand and purchasing power grows.

Urban Sector :

8.60 In the Urban Sector, the coal/coke products which would be considered for the near future are:-

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1) Soft Coke
2) Gas
3) Briquettes, Pellets, Semi-coke (LTC Coke)

8.61 Soft Coke : The most important factor in this sector is availability followed by economics. This is also confirmed by the NCAER study referred to earlier. The first step in this sector is to increase availability. NCAER estimated that regular availability could ensure an additional consumption of 1.2 million tonnes of soft coke/year in the Northern Sector studied. An additional market of 22,000 to 1,20,000 tonnes per month could be ensured if prices could be brought down by 20% to 40%.

Increasing availability of soft coke would necessitate increasing production. The producers will have to be compensated adequately for the same as they lose heavily in manufacturing soft coke at current pit-head prices. It would also be necessary to improve movement of soft coke. Penetration of the smaller urban centres would necessarily require movements in piecemeal, which the Railways find it difficult to undertake in any large measure. It would also be necessary to permit states to sponsor soft coke movements freely.

For making soft coke competitive it may also be necessary to modify its freight structure suitably.

8.62 Gas : As this product is costlier than soft coke, it can be utilised to replace such fuels as Kerosene, LPG & Electricity as it can compete with these in matters of convenience also. Distribution of gas, however, is very costly and can be considered only for densely populated localities. The proposed LTC Plant at Dankuni would feed gas into the existing net work at Calcutta. The desirability of setting up of more such plants can be assessed on the results achieved by this Plant. Feasibility studies for Delhi are in hand. Decision on this location would depend on the feasibility study and results of Dankuni Plant.

8.63 Briquettes, Pellets, etc. : These solid fuels derived from coal are only improved versions of soft coke, being relatively clearner and are desirable substitutes for soft coke for urban centres from considerations of environmental pollution. These are costlier than soft coke.

CHAPTER - IX

COAL TRANSPORTATION

INTRODUCTION:

9.1. Judging from the past trends the maximum infrastructural requirements required for the transport of Raw Coal, Washed Coal, Middlings, Hard Coke and L.T.C. Coke would be in transport by Indian Railways as may be seen from the table below:

	76-77		77-78		82-83		83-84	
	M.T	%	M.T	%	M.T	%	M.T	%
By Rail	75.50	69.20	77.00	67.75	112.64	66.0	117.70	63.67
By other Modes	33.60	30.80	36.65	32.25	60.65	35.0	67.17	36.33
Total	109.10		113.65		173.29		184.87	

The estimated demand of Raw Coal and Washed Coal in 87-88 are 208.00 m.t. and 22.27 m.t. respectively. We may, therefore, expect about 150 m.t. to move by rail in 87-88 on a proportionate basis.

9.2. It is expected that the quantum of Coal moving by road would if at all, increase only very nominally over the 77-78 figure of about 17 m.t. The increase in Coal traffic by road in some cases being compensated by a decrease in others, as and when the necessary railway lines and sidings are built (e.g. coal moving to Gidi'A' washery by road would move by rail when the Chainpur-Pindra line is built; the Hirdagarh-Damua line would do away with the present movement of coal to Hirdagarh by road). Movement to pit head thermal and fertilizer plants is being planned with the help of captive railway, conveyor or ropeway systems. This can be seen by the sizeable increase in the movement of other modes. Since these systems are of a wide variety and are tailormade to suit specific situations they do not come under the purview of this study. While Haldia is being developed to despatch coal we do not yet have suitable unloading facilities at other Indian Ports. An indication of the extent to which such facilities should be developed has been given. The Indian Railways would, however, be able to bear the burden of ....

ocal transport to these points during the Five Year Plan period 78-83 should the development of these ports be delayed. Studies of riverine transport are in their initial stages and could not be made use of since for the present, (i.e. during the Five Year Plan 78-83) capacity can be developed in alternate modes of transport which do not require investment of additional loading and unloading points.

2. Indian Railways:

9.3. The following steps to facilitate movement by rail are in various stages of completion:

(a) Reduction of the number of loading points from 699 to 296 (completed vide table.I).

(b) Extension of 143 sidings so that these can accommodate full block rakes (vide table.II).

(c) Mechanisation of 208 railway loading points.

(d) Installation of 83 additional hundred tonne weighbridges (vide table -III).

TABLE -I.

Reduction in the Number of Sidings

Company	No of sidings existing before the rationalisation scheme	No of operating sidings at present.
N.E.C.	Not applicable	Not applicable
E.C.L.	184	86
C.C.L.	68	35
W.C.L.	64	52
B.C.C.L.	383	123
Total	699	296

TABLE - II

Progress of Siding Modification

Name of Company	No of sidings taken up for modification	No of sidings completed	No of sidings where work is in progress	Rough estimated expenditure (Fig. in lakhs)
N.E.C.	1	Nil	Nil	4.30
E.C.L.	32	23	9	110.30
B.C.C.L.	67	29	38	341.84
C.C.L.	22	7	15	235.09
W.C.L.	21	5	16	176.79
Total.	143	64	78	868.32

TABLE, III

Installation of Weighbridges

Company	Position as on 1.4.76	Add'l. W.B's proposed.	No ordered	No Installed	No. under installation	Expenditure on the proposed installation in Crores.
N.E.C.	Not Applicable.					
E.C.L.	1(6)*	33	12	6	7	1.65
B.C.C.L	2(9)*	6**	-	-	-	0.65
C.C.L.	12(6)*	24	4	1	3	1.20
W.C.L.	13(4)*	20	17	3	3	1.00
Total CIL	21(21)*	83	33	10	13	4.50

* Indicates Railway Weighbridges
** Indicates Weight-o-metres.

Estimation of the future requirement of Transportation by Rail:

9.4 In order to lay down the extent of rail transport that would be required by the Coal Industry in general and Coal India in particular the following analysis has been made (Table-4). To the total anticipated production of coal, the production of hard coke, LTC coke, Washed Coal and Middlings have been added. From this over all production figure the following quantities which would not require despatch are deducted:

(a) Colliery consumption
(b) Loss in Washery Rejects.
(c) Loss in Production of Soft Coke and
(d) Loss in Production of Hard Coke.

From the total estimated despatch, the despatches to the following sectors that will be made by means other than rail, were deducted.

(a) Raw Coal to Washery (b) Washed Coal to Steel Plants
(c) Hard Coke (d) Soft Coke
(e) Raw Coal to LTC Plant (f) LTC Coke
(g) Fertilizer (h) Power Station
(i) Others.

The overall despatch by rail was thus obtained.

9.5 Table 5(below) shows this over all figures of despatch by rail further broken down coalfieldwise. Table 6(below) shows a coalfieldwise and directionwise breakup of Rail Movement of Coal in terms of F.W./day.

TABLE - 4

Estimation of future requirement of transportation by Rail

BASED ON ACTUAL PRODUCTION BASED ON ESTIMATED DEMAND (Figures in Mill.tonnes)

	1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		[illegible]		1983-84	
	CIL	A.IND	CIL	A.IND	CIL	A.IND	CIL	A.IND	CIL	A.IND	CIL	A.IND	CIL	A.Ind	CIL	A.Ind
1.	2	3	4	5	6	7	8	9	10	11	12	13	[illegible]	15	16	17
1. Total Production.																
a) Coal	89.40	101.28	88.96	100.87	100.43	113.55	105.63	120.75	114.02	131.34	112.96	140.36	128.20	150.50	134.80	160.10
b) Hard Coke	0.75	0.75	0.67	0.67	1.19	1.19	1.22	1.22	1.25	1.25	1.27	1.27	1.30	1.30	1.33.	1.33
c) L.T.C. Coke	3.24	3.24	2.93	2.93	3.24	3.24	3.30	3.30	3.36	3.36	4.20	4.20	4.75	4.75	4.75	4.75
d) Washed Coal	8.93	10.45	8.79	10.29	9.67	12.35	9.70	12.35	12.14	14.41	12.82	15.67	14.48	17.98	16.45	19.95
e) Middlings	3.01	3.41	3.84	4.24	3.45	3.89	3.26	4.14	4.85	5.43	6.15	6.88	6.88	7.75	7.1[illegible]	8.03
Total	105.41	119.13	105.19	119.0	118.0	134.22	123.11	141.76	135.62	155.79	144.40	168.38	1[illegible]5.61	182.29	164.4[illegible]	194.16
2. Quantity not requiring despatch:-																
a) Colliery consumption.	3.10	3.35	3.07	3.32	3.10	3.35	3.01	3.35	3.10	3.35	3.10	3.35	3.10	3.35	3.10.	3.35
b) Loss in Washery Reject.	1.29	1.53	1.29	1.53	1.29	1.53	1.36	1.60	1.69	2.01	1.41	1.81	2.18	2.66	2.41	2.89
c) Loss in Prodn of soft coke	1.26	1.26	1.26	1.26	1.26	1.26	1.70	1.70	1.91	1.91	2.20	2.20	2.45	2.45	2.45	2.45
d) Loss in Prodn of Hard coke.	0.32	0.32	0.32	0.32	0.32	0.32	0.52	0.52	0.53	0.53	0.54	0.54	0.55	0.55	0.60	0.60
e) Increase decrease	0.81(M) 2.49(R)	0.81(M) 2.76(R)	+1.13(M) -2.70(R)	+1.13(M) -2.21(R)	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	9.27	10.03	4.37	5.35	5.97	6.48	6.49	7.17	7.23	7.80	7.25	7.90	8.28	9.00	8.56	9.29

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3. Total estimated despatch 1 minus 2 including internal despatch.	98.14	109.10	100.82	113.05	122.03	127.76	116.22	134.79	128.39	147.99	141.15	160.48	147.33	173.29	155.02	184.87
4. Despatches by Other than Rail																
(a) Raw Coal to Washeries.	10.22	10.22	11.50	11.50	12.0	13.0	12.72	12.72	14.40	14.40	17.50	17.50	20.00	20.0	21.50	21.50
b) Hard Coke	0.052	0.052	0.05	0.05	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
c) Soft coke.	1.74	1.74	1.80	1.80	1.64	1.64	1.51	1.51	1.67	1.67	1.80	1.80	2.12	2.12	2.42	2.42
d) Washed coal to SteelPlants	0.66	0.66	0.75	0.75	1.19	1.19	1.21	1.21	1.22	1.22	1.23	1.23	1.24	1.24	1.24	1.24
e) Raw Coal to LTC./SC	4.50	4.50	4.19	4.19	4.50	4.50	5.00	5.00	5.27	5.27	6.40	6.40	7.20	7.20	7.20	7.20
f) LTC Coke	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g) Power Stations	8.80	8.80	10.82	10.82	11.38	11.38	12.24	12.24	13.20	13.20	16.0	16.0	18.0	20.0	21.00	23.50
h) Fertilizers.	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.72	0.72	0.78	0.78	0.78	0.78	0.78	1.0
i) Others	6.26	6.98	6.23	6.89	6.78	7.50	7.28	8.0	7.58	.50	8.0	9.26	8.0	9.26	8.00	10.26
Total	32.88	33.60	36.04	36.64	38.21	39.96	40.71	41.43	44.11	45.03	51.76	53.02	57.39	60.65	62.19	67.17
5. Despatches	63.26	[illegible]	64.78	77.00	73.79	87.8[illegible]	75.51	[illegible]	84.28	[illegible]	89.39	[illegible]	89.94	[illegible]	93.73	[illegible]

N.B. Transport of Imported Coking Coal has been excluded from the above figures.

TABLE - 5

Forecast of Production and Likely Rail Movement Coalfieldwise

(Figures in Million tonnes)

Coal FIELD	DIVISION	ACTUAL PRODUCTION 1976-77 Prod	Desp	1977-78 Prod	Desp	ESTIMATED DEMAND 1978-79 Demand	Desp	1979-80 Demand	Desp	1980-81 Demand	Desp	1981-82 Demand	Desp	1982-83 Demand	Desp	1983-84 Demand	Desp
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A- BENGAL -BIHAR																	
1.Rani Ganj	(a)Asansol	25.52	17.16	24.27	17.11	26.64	17.82	29.50	19.45	30.87	19.92	32.51	20.50	33.40	21.[illegible]	34.40	22.50
	Adra	1.70	1.62	1.70	1.43	1.81	1.65	1.90	1.72	2.03	1.72	2.14	1.80	2.26	1.80	2.26	1.80
2.Jharia																	
a)E.Rly	Dhanbad	22.32	13.87	22.10	15.65	25.56	17.15	26.33	16.95	27.60	18.00	29.61	17.53	29.61	18.03	30.61	19.03
b)S.E.Rly	Adra.	(12.66)*	(8.95)*	(13.41)*	(9.00)*	(14.36)*	(9.75)*	(14.93)*	(11.91)*	(16.60)*	(13.12)*	(18.6[illegible])*	(14.57)*	(20.86)*	(16.28)*	(21.32)*	(17.00)*
3.Karan Pura	(Dhanbad)	16.92	7.98	17.0	7.61	19.42	10.00	19.51	10.03	21.58	10.80	21.52	10.56	24.23	10.66	25.52	11.50
		(1.19)*	(0.75)*	(1.33)*	(0.73)*	(1.85)*	(1.41)*	(1.75)*	(1.41)*	(3.04)*	(2.53)*	(2.36)*	(3.25)*	(4.38)*	(4.33)*	([illegible].0)*	(3.60)*
B.SINGRAULI	Dhanbad	3.36	2.12	3.37	1.95	3.43	2.72	4.20	2.88	5.35	4.60	7.40	5.50	10.40	6.78	13.43	6.78
C.C.I.C.																	
1.Korea-Rewa	Bilaspur	9.54	8.66	9.81	8.66	10.91	9.48	12.02	10.0	12.49	10.30	13.07	10.46	13.73	10.46	15.33	10.46
2.Korba	Bilaspur.	3.77	1.67	4.00	1.68	3.77	1.60	3.83	1.64	4.51	2.0	5.34	2.0	5.43	2.00	6.18	2.00
D.																	
1.Pench-Kanhan.	(a)C.Rly	5.53	2.49	5.41	2.50	6.74	3.35	7.14	3.70	7.55	4.50	7.16	3.80	7.17	3.39	[illegible]	[illegible]

....2

(Fig. in Mill. tonnes)

1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18.
b) S.E.Rly NG			0.20		024		.20		.20		.20		.20		.20		.20
2. Chanda Nagpur		1.59	0.98	1.65	0.98	1.87	1.21	2.05	1.37	2.50	1.63	2.09	2.17	3.90	2.17	4.43	2.17
3. Umrer Nagpur		0.86	0.82	0.81	0.81	1.00	1.00	1.02	1.02	1.05	1.05	1.05	1.05	1.05	1.01	1.16	1.01
E. SINGARENI		8.27	7.31	8.91	8.22	10.0	9.14	10.85	9.69	12.70	11.40	14.0	12.00	15.45	12.60	17.0	14.08
F. TALCHER		1.32	0.55	1.26	0.56	1.70	0.75	1.65	0.75	2.25	0.82	2.65	1.01	2.92	1.01	1.02	1.01
G. ASSAM		0.57	0.44	0.62	0.46	0.70	0.57	0.75	0.62	0.80	0.67	0.82	0.70	0.95	0.70	1.00	0.70
Total.		101.27	65.87	100.87	67.87	113.55	76.64	120.75	80.02	131.34	87.11	140.36	89.24	150.50	91.78	160.10	96.60
		(13.84)*	(9.70)*	(14.74)*	(9.73)*	(16.20)*	(11.16)*	(16.68)*	(13.32)*	(19.84)*	(15.84)*	(22.54)*	(18.22)*	(25.74)*	(20.86)*	(27.98)*	(21.10)*
GRAND TOTAL		115.42	(75.57)	115.68	77.60	129.75	87.80	137.43	93.36	151.18	102.95	162.90	107.46	176.24	112.64	188.08	117.70

(Raw Coal, Washed Coal & Middlings).

N.B. Transport of Imported Coking Coal has been excluded from the above figures.

TABLE - 6

Coalfieldwise and Directionwise Breakup of Likely Rail Movement of Coal.

Field	Direction	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	198[illegible]-84
1	2	3	4	5	6	7	8	9	1[illegible]
Bengal-Bihar	Above MGS /	1867	1916	2107	2240	2388	2494	2590	275[illegible]
	Below MGS /	682	700	770	820	902	910	957	100[illegible]
	Industrial Area/E.R.	1058	1086	1194	1270	1373	1414	1484	155[illegible]
	Industrial Area/S.E.R.	1376	1412	1553	1651	1772	1839	1930	202[illegible]
	Down Country	1118	1456	1598	1700	1824	1867	1990	208[illegible]
	Total	6401	6570	7222	7683	8261	8526	8981	942[illegible]
Singrauli	Via New Katni				36	160	164	203	269
	To Obra TPS	261	240	340	324	415	523	644	57[illegible]
	Total:	261	240	340	360	575	686	847	84[illegible]
C.I.C. (i) Korea-Rewa									
	Via Katni to NR	130	130	148	155	188	188	188	18[illegible]
	Via Katni to WR	644	640	740	785	785	792	792	79[illegible]
	Via Katni to CR	215	215	248	261	261	278	278	278
	Via Ballarshah	43	43	50	50	50	50	50	5[illegible]
	TOTAL	1032	1028	1185	1250	1288	1307	1307	1307
(ii) Korba	Main Line & Via Raipur	220	220	200	205	250	250	250	26[illegible]
	Total.	220	220	200	205	250	250	250	250

1	2	3	4	5	6	7	8	9	10
Pench, Kanhan, Chanda & Umrer	Via Itarsi & Bhopal	30	35	38	40	62	48	44	44
	Via Itarsi & Bhuswal	62	74	82	82	109	90	84	84
	Via Nagpur& for C.R.	50	59	66	66	79	71	67	67
	Others.	410	493	534	598	635	742	712	712
	Total	552	661	720	786	885	952	908	908
Talcher	Via Vijay wada	36	37	48	48	54	77	77	77
	Others.	32	32	46	46	48	49	49	49
	Total	68	69	94	94	102	126	126	126
Assam	Industries /Others.	36	27	36	43	49	53	53	53
	Railways	35	30	35	35	35	35	35	35
	Total	71	57	71	78	84	88	88	88
Singareni	Via Vijaywada	842	886	181	184	247	280	293	328
	Others.	–	–	961	1025	1177	1220	1282	1432
	Total	842	886	1142	1211	1425	1500	1575	1760
	Grand Total	9447	9731	10974	11687	12870	13435	13982	14714

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Development of Railway Infrastructure Near New Collieries.

9.6 The transportation of nearly 113 m.t. of Coal, Washed Coal Middling etc., by rail in 1983-84 (as estimated above) would require further development of railway infrastructure near new collieries, besides the steps already enumerated in 9.3 above.

A large number of new mines which are not linked to the Railway net work at present are being developed to meet the growing demand. These would have to be connected by rail so that the coal produced can be moved to the consumption points.

In fact the production programme of Coal India pre-supposes that the railway lines listed below will be constructed. A decision regarding financing these lines should be taken immediately so that both Coal India and the Railways can in-corporate the expenditure of these lines in their programme.

(a) Karela Road to Jayant:

The railways have agreed to construct the line from the Karela Road Station (on the Billi Junction Singrauli Line) to Jayant as a branch line. The construction of this line commenced on 1st April, 1977 and the line would be completed in March, 1980. The 39 km. long line would cater to the Jayant, Dudhichua, Khedia, Bina and Ka blocks. Coal produced from this would be despatched to Singrauli STPS. OBRA TPS and consumers in the West as indicated below: (Table-7).

TABLE 7
Coal Linkages of Thermal Power Station from
Singrauli Coalfields

	78-79	79-80	80-81	81-82	82-83	83-84	84-85	87-88
1. Obra T P S & Renusagar	3.43	3.87	4.30	5.26	5.89	6.11	6.27	6.27
2. Singrauli STPS	-	-	-	-	0.71	1.91	2.30	2.31
3. Ukai Extension	-	0.14	0.36	0.88	0.91	1.06	1.06	1.06
4. Nasik	--	0.04	0.33	0.84	1.03	1.23	1.23	1.23
5. Manek Bori	-	-	0.11	0.60	1.10	1.77	2.07	2.07
6. Trombay	-	-	-	-	0.42	0.30	1.30	1.30
7. Kota	-	-	-	0.18	0.35	0.50	0.35	0.30
TOTAL	3.43	4.05	5.35	7.60	10.40	13.43	15.04	15.30

b) Meal to Ramgarh Washery:

The 10.4 kms. long line will serve the Ramgarh Washery. It takes off from the mid section between Gola Road and Meal Station on the Muri-Barkakana Station of South Eastern Railway. The line has been surveyed and construction will start in 78-79. The total despatches from Ramgarh would be about 2.7 million tonnes by 1982-83

c) Danea-Kedla Line:

The 11Km. line would take-off from Danea Railway Station on the Chandrapura-Barkakana section of Eastern Railway. It would serve the Kedla Washery which would be despatching 1.92 million tonnes of clean coal and middlings by 1982-83. The survey of this line has been completed.

d) Chainpur to Pindra:

This 20 km. long Railway line will serve Sarubera, Ara, Kuju and Chainpur Areas. The production of these areas is given below:-

	78-79	82-83	87-88 (In m.t.)
Sarubera	0.30	0.15	0.15
Ara, Kuju, Chainpur	-	1.30	1.30

e) Khelari to Hesalong Block.

This 5km long line will serve K.D. Expansion whose production is given below:-

	78-79	82-83	87-88 (In m.t.)
K.D. Expansion	0.65	1.55	2.85

f) Mohuamillan to Pinderkom Block :

This 16 km. long line will serve the Pinderkom and Badam Block.

g) Hirdagarh-Demua Line:

. The 16 km. long line takes-off from Hirdagarh Railway Station on the Amla-Parasea section of Central Railway and it will also serve the Nandan Washery. This washery would be despatching 1.04 million tonnes of Washed Coal and Middlings by 1982-83 (the Clean Coal 0.72 m.t. would be despatched to Bhilai Steel Plant). The survey of this line has been completed.

h) Korba Railway Station to Rajgamar:

The 14km long line takes-off from Korba on the Champa Gevra Road section of south Eastern railway. It will serve the new Rajgamar block which will despatch 0.50 m.t. of coal by 82-83. The survey of this line has been completed.

i) Karonji Station to Bhatgaon:

This line links Karonji Station on the Anuppur-Bisrampur section of South Eastern Railway with Bhatgaon. The 14 km. long line is expected to carry .55 m.t. by 82-83. The survey of this line has been completed.

j) Katora Station to Bhadkarpan:

The 20 km. long line will take-off at Katora Station on the Anuppur-Bisrampur Line .55 m.t. of Coal will move on this line in 82-83.

k) Ukhra Railway Station to Jhanjhra I & II:

This 7 km. long line will serve Jhanjhra I & II and Nakrakonda collieries. It will carry .44 m.t. in 82-83 and 4.22 m.t. in 87-88.

L) Linking Mejhia Coalfield:

The Coalfield can be linked either by a railway line to Madhukunda Railway Station on the Adra-Asansol Railway line (21 Km) or by a railway line to Bankura Railway Station on the Adra-Kharagpur Railway line (40km). The latter alignment has already been surveyed by the Railways at the instance of the West Bengal Government.

m) Pirpaiti Railway Station to (Lalmatia) Hura Block:

The Lalmatia Open Cast Project is expected to produce 0.25 million tonnes in 82-83 and 2.25 million tonnes in 87-88 and 3.5 million tonnes 92-93. The Railway line from Lalmatia to Railway Station (28km) would thus bring this important Rajmahal area on the Railway map.

Coastal Shipping:

9.7 In order to encourage coastal shipping a subsidy related to the difference in freight cost between coal movement by sea-cum-rail route and all railway route is being drawn by the Railways on coal moved by the sea-cum-rail route to the South. This subsidy is being drawn for a long time from the funds raised through a specific excise duty on coal under the Coal Mines (Conservation & Development) Rules. As a result the funds available for disbursement against stowing and protective measures and other conservation and development efforts undertaken by mines get reduced.

It is necessary to develop Coastal Shipping so that, the subsidy on the Sea-cum-Rail route is not necessary.

At present besides the 1.5 million tonnes of coal moved from Calcutta Port to the South Haldia Port has a capacity to export 3.5 m.t. Of this capacity it is expected that 1.m. t. will be utilised for export to Europe etc. About 2.5 m.t. of coal will/be transported by Coastal Shipping, to Tuticorin where a mechanical conveying system capable of handling 2.5 m.t. will be ready in about two years.

It is desirable that Madras Port also has a mechanical un-loading facility with a capacity of about 1.61 m.t. to meet the requirements of Ennore and Basin Bridge Power Houses (at present the coal is being un-loaded on the ground and is then loaded into railway wagons).

9.8. About 75% of the Coal produced would be moved by the Indian Railways. Development of Railway infrastructure adjoining collieries is, therefore, important. A study of the levels of production and the directions in which the distribution of coal would take place enables us to assess the quantum of increase in coal traffic at the various potential railway bottlenecks. While developing the Railway infrastructure necessary, various problems and constraints are likely to encountered. It is desirable that there is a High Level Committee comprising of representatives of the Railways and Coal India which can carry out this review generally and can also examine individual cases brought upto the Committee either by the Railways or Coal India.

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CHAPTER - X

PLANNING, DESIGN, MONITORING & R&D

THE CURRENT STATUS OF PLANNING & DESIGN PROCESS IN COAL INDUSTRY

To be able to appreciate the existing systems for carrying out planning & design functions in the coal sector, it would be proper to retrace the nearest part of the history of the Industry.

Until 1971, there were only two Coal Companies namely NCDC Ltd., & Singreni Coalfields Ltd., in the Public Sector.

A total of about 300 Coal Mines which were producing about 90% of the national production, operated in the private sector following different management styles. The Industry by and large had no uniform planning philosophy either with regard to economics or to technology or to safety or to conservation of resources. The Mines in the Private Sector were almost starving for inputs and although, production continued to come from these mines, the means adopted by the private owners utterly lacked eithical & scientific considerations.

The NCDC Ltd. did, however, maintain a planning & development department which had limited capacity for carrying out exploratory drilling as well as for preparation of Project Reports and for preparation of detailed designs.

When the Industry was nationalised (in the year 1971 in respect of Coking Coal Mines & in 1973 for Non-Coking Coal Mines) the planning & design function of Management assumed high degree of importance and was naturally given greater attention then ever before.

Little was known about the design & consultancy orgnisations operating in the country, whether in the private sector or in the public sector, which had specialisations in mining & related technology Some of the consultancy organisations like soffremines, Mcneilly Bharat etc. in the private sector had limited capacities for handling only some aspects of a mining system. Similar was the position of even large

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organisations like NIDC, Engineers India or Engineering Projects India Limited, in the Public Sector.

It was for this reason that design and consultancy jobs were given to foreign agencies in Poland and in Russia for planning of total development of large scale deep mines in the erstwhile NCDC.

With the ambitious Coal Plans ahead, need was felt for creating a centralised organisation to act as a THINK TANK for the Coal Industry as a whole and to develop self reliant expertise for dealing with all planning & design aspects related to Coal Mining Systems. And it was in this context that the Central Mine Planning & Design Institute was formed in the year 1974 on basis of report prepared by Polish Experts. Naturally, the planning & development wing of the erstwhile NCDC Ltd. formed the nucleus for the growth of this organisation.

CMPDI has following main objectives to pursue :-

(i) To accomplish the task of planning & design for modernisation, construction and reconstruction of mines in the nationalised Coal Industry.

(ii) To act as the premier Research & Development Organisation in respect of mining methods & technology, safety and environments for the entire Coal Industry.

(iii) To provide technical advice/services for promotion of efficient use of coal in industry and domestic sector.

(iv) To disseminate information for improvement and guidance of all engaged in Coal Industry through different publications.

(v) To form a body of experts in all disciplines by providing, where need be, suitable facilities for training, both in-country and abroad.

(vi) To establish and maintain an environment of mutual understanding between the management and the workers and bring forth a sense of fellow-feeling amongst all employees irrespective of rank and file through close association and participant in various functions of the company and thereby develop a socio-industrial culture.

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(vii) To establish a healthy society of its own by providing necessary amenities besides adopting concrete measures for the welfare of its employees and their family members.

Planned to have an ultimate manpower of [illegible] persons (excluding man-power required for exploration activities). CMPDI is today largest custodian of Planners & Designers in the field of mining engineering and the only one in Coal Sector. Expertise, however, is a gradual process and in spite of existence of CMPDI during the last few years, the country has until recently sought assistance from the Russian Experts in drawal of Integrated Coalfield Plans both in deep mining and in Opencast Mining from USSR. This collaboration has given sufficient opportunity to the Engineers in CMPDI to get on-Job Training for preparation of Schemes of large magnitude and it may be hoped that in some years to come, full expertise would be available within CMPDI itself.

Other institutions in this field are too insignificant to merit mention.

As such, the current status of planning & design process in the Coal Mining Industry is reflected in the working of the Central Mine Planning & Design Institute.

Forecast of demand on coal in forseeable future-which forms the basis for all subsequent planning and design efforts, is done at the national level by the Planning Commission through Fuel Policy Committee, Tasks Force etc. in which CMPDI actively associates but is not fully equipped to deal with assessment of coal demand in the total national economic model, independently.

CMPDI does maintain an Economic Research Group and a Market Intelligence Group, but these are still in nascent states and have to be suitably strengthened before they can be more effective in maintaining the integration & forecasting mechanism.

For formulation of broad based strategies, CMPDI maintains a Perspective Planning Group.

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This group maintains all relevant data on the existing capacities of mines and on coal deposits in various geographical parts, apart from continuously analysing and monitoring the future coal demands, in close coordination with the Marketing Division of Coal India Limited & in close association with various departments and Ministries of the Government and under the direct guidance of Department of Coal.

The dossier captioned "Action Plan for Mines of CMAL", prepared by this group in the year 1974 was the first corporate effort on delineating broad based strategies for meeting the national coal demand during the fourth plan. However rudimentary it may appear today in retrospect. With passage of time, more and more perfection got into the system and the last exercise captioned "Project Black Diamond" was brought out by this group in the year 1976. This document was a land mark in the planning process and attempted to forsee all aspects of a coal mining system not only on output side but also on process and input side. It enunciated in the context of foreseen demands, broad based strategies, on technology for future, manpower & skills; plant & equipment, Information System, Tele-communication and in fact the entire gamut of activities relevant for sustaining continued growth of the Coal Industry. This exercise is currently being updated and will be updated periodically on roll-on basis. It may be worth-while mentioning here that the recent recommendations of Baveja Committee on Working of Coal Industry and as accepted by the Government, calls for shifting the Perspective Planning function to CIL Headquarters. It is, however, strongly felt that this shift will entail requirement of a large inter-disciplinary group to be posted at Calcutta which in any case, will not have the advantage of close interaction with the Specialists in CMPDI Headquarters and its Regional Institutes.

Emanating from the broad based strategies enunciated by the Perspective Planning Group are exploratory & investigative drilling operations, feasibility report preparation, preparation of construction reports and advance action on related fronts.

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These tasks are performed at the Regional Institutes of CMPDI which are located at Asansol, Dhanbad, Ranchi and Nagpur adjacent to the four coal producing companies of Coal India Limited and are fully equipped for the purpose.

Uniformity in Planning approach by all these Regional Institutes is ensured by Centralised Project Scrutiny Group located at the Head-quarters of theCompany who in turn take advice on every project report from concerned specialists within or outside CMPDI.

Since its inception and despite shortage of men, CMPDI has until 1977 prepared 83 Project Reports, catering for investment of Rs. 863 Crores for creating an additional capacity of production of 75 MT/YR.

In conformity with the Government Policy in the management of a public Enterprise, as circulated by the Bureau of Public Enterprises, CMPDI prepares and submits Feasibility Reports on selected alternatives for every project for purpose of approval by CIL Board and for appraisal by Planning Commission, Ministry of Finance and Department of Coal, and for final investment decision, by the Public Investment Board. The Feasibility Reports/Project Reports prepared by CMPDI are not only enough for investment decision to be taken, but also they are adequate to start the construction of mines. Detailed working drawings of various systems, Sub-systems and items of work and equipment are fed to the project as a continuous process, covering almost entire construction phase. This process does not hinder the progress of construction work and in fact, it brings about optimal utilisation of resources, both in planning and design as well as in construction. Preparation of detailed project reports for coal mining projects will, therefore, serve no useful purpose. Discussions have been held on this subject with various experts coming to CMPDI from advanced countries like Poland, U.K., Germany & USSR who have categorically expressed their opinion on adequacy and high standard of project reports prepared in CMPDI. Besides covering the technological decisions, the project reports include cost estimates in their fullest details including DCF analysis.

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It may be mentioned that the current practice in USSR is that the Feasibility Reports should be prepared in more details and these should be followed by working drawings for the construction phase. Thus cutting out the Detailed Project Report which requires 14 to 16 months' time. CMPDI is also following the same lines which is appropriate.

There is no denial of the fact that with growing experience and expertise, CMPDI is showing signs of continuous improvement in the quality of planning and design.

Apart from attending to day to day planning tasks CMPDI is also semi-equipped to carry out effort directed towards bringing in improvement in quality of planning and designs as well as towards bringing in improvement in the working of Coal Mining Industry as a whole.

These efforts are mostly carried out at their Ranchi Headquarters. The Headquarter set-up at Ranchi is trying to develop self-reliant specialisation in the area of Coal preparation and Beneficiation, Coal Utilisation, Coke Ovens, Shaft Design, Application of Electronics in Mining, MIS related to Mining Industry, Corporate Transport Planning, Civil & Structural Engineering, related to Mining System, Opencast and Underground Mining Technology and in mine Mechanisation.

Towards long range goals of the Coal Industry, the Institute publishes technical bulletines and journals and carrys out training and development in the Industry through a Staff College. Also the Headquarters set-up of the Institute is engaged on creation and maintenance of a data base and also on generation of norms and standards in every field of mining activity.

Research and Development entailing conception of off-beat concepts, experimentation and field trials, interpretation of experimental results and development of code of practice for new concepts is another major area of thrust for CMPDI which has been discussed separately.

CMPDI also provides services to Coal India by keeping them informed on the progress made by Capital Projects in various Companies.

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RECOMMENDATIONS

With ambitious coal production plans ahead, the Coal Industry has to gear up for meeting new challenges in scale and complexity of Mining Operations.

It is obvious that much of the direction will be shown by CMPDI. In the coming few years, this Institute has to deal with about 100 construction and re-construction projects right from conception to monitoring.

There is imminent need, therefore, for CMPDI to assume greater importance both in the eyes of Industry as well as in those of the Government. For this purpose, CMPDI should introduce scientific systems for planning, design & monitoring of coal projects.

Attention has to be paid to the following specially at CMPDI Headquarters:-

(a) Creation & maintenance of wide data base covering all aspects of mining systems.

(b) Creation and maintenance of design modules.

(c) Standardisation & Typification.

(d) Gradual introduction of planning techniques in day to day working.

(e) Preparation of reports in greater details to facilitate continuous monitoring.

Apart from the above, there is need for revamping centralised functions in CMPDI headquarters and generation of self-reliant specialisations.

MONITORING SYSTEM
THE CURRENT STATUS

A Monitoring system entails preparation of an implementation plan, implementation based on plan, and regular feed-back during implementation in relation to plan to enable decision making.

The effectiveness of monitoring system quite obvicusely depends upon the following:-

(a) Existence of sufficient detailed implementation plans.

(b) Existence of proper organisation, procedures and authority for implementation.

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(c) Competence of the managers and their ability to react to the information provided by the monitoring mechanism.

(d) Timely flow of accurate information.

(e) Managers' awareness about need for receipt and transmission of information required.

(f) The will of the people concerned.

Until nationalisation, there was hardly any existence of monitoring system except for those generated by reporting systems of the DGMS and other Government agencies.

The nationalised industry has devised a large number of reporting formats for reporting on the performance of mines in all their phases which are dovetailed to the requirements of the Ministry and of the Planning Commission etc. Also well laid procedures exist for management & control of Projects.

The systems designed are adequate and phased implementation is envisaged, which is being carried out.

RECOMMENDATIONS

The systems conceived are adequate and the industry has to make them more effective by focussing attention on all the aspects elaborated earlier.

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Science & Technology

Science & Technology is considered as a very important element in the growth and development of the sector of coal & lignite industry. It is recognised that implementation of Science & Technology programme, followed by fruitful application of the results of Science & Technology, would lead to better and faster economic development in coal and lignite. Since about 1975 special emphasis on the S & T component for coal development plans was introduced in the formulation of annual plans as also in projecting perspective views for future development. The Department of Coal had prepared a [illegible]-year perspective plan (1976-90), covering S&T inputs for (a) in proving of coal resources (b) in optimising coal production, better mining technological methods, better safety and better allied engineering developments and (c) in areas of better utilisation, beneficiation & transportation of coal. From year to year, since 1975-76, annual plans under sector of S&T for coal are being prepared and included for planned development.

At the end of the Plan period 1978-83 an annual production of 153 million tonnes of coal with incremental production of 10 million tonnes is targetted at. In order to achieve this, tremendous mining, design and use of mining machinery, conservation, transportation, preparation, utilisation etc. Further, in order to keep abreast with the modern developments in the industry it is necessary to promote research and development efforts on a continuing basis.

Institutional set up and the Status of R&D Work so far

Since independence of the country the need for research and development programme in various fields including mining industry was recognised, which led to the setting up of the National Laboratories. Though these laboratories developed the know-how the progress in practical field was not properly tried and established owing to the absence of the desire on the part of the industry to profit by the results of R&D and also due to lack of capital fund, essentially needed for any development. Then, the public sector company National Coal Development Corporation was set up in 1956. The Central Mining Research Station was started in 1958 to carry out research and testing in the fields of mining and safety. The setting up of these institutions by itself did not lead to the appreciation of the need of science and technology, since the industry was divided into numerous private commercial mining enterprises working in comparative easier mining conditions with plenty of cheap labour. Besides there was absence of extension services on the part of research and educational institutions and absence in the country of consultancy firms and technology development enterprises.

In recognition of the key role coal has to play in the energy needs of the country, the industry was nationalised in two stages - coking coal mines in 1971 non-coking coal mines in 1973. With the creation of Department of Coal in the Ministry of Energy in October, 1974 policy and direction planning exclusively for the subject of coal and lignite was ensured. The creation of Coal India Ltd., with Central Mine Planning and Design Institute Ltd. as one of its subsidiaries, gave the necessary structural set up to the coal industry. There exists an R&D Board in the Institute, on behalf of the Coal India Ltd., industry oriented body for providing the guidelines and thrust for planning of R&D.

In June, 1976, the Department of Coal prepared a comprehensive booklet on research and development entitled 'Perspective R&D activities in Coal for 1976-1990'. This booklet identifies the areas of R&D, the activities to be undertaken, implementing agencies, their objectives and priority etc.

At the national level the adoption of Science and Technology in the Plan of 1974-79 was a major step in the organised promotion of research and development efforts. However in the Department of Coal, the Science and Technology programme was promoted and funded in an organised fashion, as compared to the isolated efforts and schemes in the past, only in 1975-76 in a small way (Rs. 7.07 lakhs).

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In the next year (1976-77) the programme was augmented and the expenditure was stepped upto Rs. 150 lakhs. During the year 1977-78 the programme and expenditure was maintained at the same key and level. In the current year 1978-79 the programme has been on a still higher level and the expenditure on the ongoing and new schemes is expected to be around Rs. 223 lakhs.

As the basic design and planning body of the industry, the Central Mine Planning & Design Institute has been identified as the two way link between the industry and research/educational institutions that is to say as the nodal point for the various science and technology programmes funded and promoted by the Department. Accordingly the Institute has been entrusted with the job of identification of the areas of R&D activities in coal, formulation of project reports, selection of appropriate implementing agency (agencies), monitoring and appraisal of the results of the experiments and feed back for implementation in the coal mining and utilisation industry, Apart from the Coal S&T grants, Coal India identifies mining and utilisation projects for development of new techniques or methods and provides fund of their capital investment under normal annual plan investments, while the uncertain and S&T components of these projects are placed for support under coal S&T plan. In those identified mining R&D projects, investments of the order of Rs. 40 crores is envisaged by Coal India and committed as such before 1978-79.

Programme

Coal S&T programme under Department of Coal is divided into the following 5 heads, (a) Coal Exploration, (b) Mining Technology (c) Allied Engineering (d) Coal Preparation/Beneficiation and (e) Coal Utilisation. The total cost of 5 schemes approved in 1975-76, 13 schemes in 1976-77, 16 schemes in 1977-78 and 49 schemes in 1978-79 is of the tune of Rs. 10 crores, against which the actual expenditure was Rs. 7.07 lakhs in 1975-76, Rs. 125 lakhs in 1976-77, Rs. 150 lakhs in 1977-78 and it is proposed to spend about Rs. 223 lakhs in 1978-79.

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Out of these 70 schemes, 24 are in Mining Technology, 8 in Allied Engineering, 20 in Coal exploration, 2 in Coal Preparation and 6 in Coal Utilisation. All the schemes which have been approved till now are expected to be completed by the end of another 3-4 years. In the coming five year period, the endevour of R&D would be not only to successfully implement the positive results of these R&D schemes so that R&D work is on a continuing basis, also fruitfully improve upon the results of previous research with change in technology by taking up new schemes. It is intended to plan for next five year plan of coal (R&D), area wise :-

(a) COAL EXPLORATION

Main thrust of the schemes already approved under this head is on (i) application of geophysical methods in coal exploration (ii) application of computer for data processing and optimal studies (iii) engineering geology (iv) hydrology (v) coal analysis and (vi) coal geology. At present 20 schemes have been either taken up or are being planned to be taken up during 1977-78 to 1980-81 with a total outlay of Rs. 131 lakhs, out of these, 10 schemes are based upon geophysical investigations, five schemes will utlise computer in a big way in geophysical surveys and building up of geodata bank, another scheme relates to R&D work to expedite chemical analysis of coal seams in boreholes and schemes relate to remote sensing of coal mining problems.

New thrust fields which are foreseen for R&D work in this area in next five years may be :-

1. Drilling techniques and various areas of machine and applications.
2. Aerial thermal imagery of Jharia coalfield.
3. Induced polarisation survey.
4. Design of drilling bits and equipments.

It is important to mention that research would be directed for obtaining quicker results of exploratory methods at less cost, higher speed, additional data needed for highly productive, safe &

economio mines of the future and for design of optimum mine layouts.

(b) MINING TECHNOLOGY

About 1500-2000 million tonnes of coal, mainly coking in nature, is standing on pillars. Bord & Pillar method still accounts for 97% of our underground coal production. As such, R&D work in this field is directed towards systematic development of new methods of mining applying the modern proved mining technology already established abroad for better safety, efficiency, economy and percentage extraction in our coal mines. As the mining conditions vary widely from one colliery to the other, various experiments are to be conducted in the mines. Mine environmental engineering is foreseen as a major field which would receive great thrust. Experimentation with scrapers, & side loaders has already yielded valuable results. Load haul dumpers are also going to be tried. Flight loaders, shearers a longwith hydraulic and friction props and self advancing supports, in longwall faces are proposed to be introduced shortly. Longwall caving trials with solid blasting are going on at Ningah & Moonidih, Longwall caving with plough is being practised at East Katras. Use of Hydraulic Mining is also foreseen. Application of continious miners for exploration of pillars is under examination. As the introduction of new technology would involve changes with regard to training, infrastructure, manufacture of equipment etc., it is necessary to conduct experimental trials to ascertain their suitability before making a large scale application. These trails are foreseen as focal point of R&D activity in coming five years. R&D activity is also needed in various other fields to economice on cost of production, conservation and safety, such areas are:-

Transportation of coal & material e.g. coal tubs with hinged body at one end, G. hauls, Bunker conveyors, tub marshalling devices at loading point under belt conveyors, modification of existing cages and pit top and pit bottom layout, Feeder crusher/Impact crusher and manriding.

Sinking, Drifiting and construction of ingress & cutgress of mines.

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Environmental conditions in mine like control & monitoring of poison, noxious and inflammable gases in mines, methods to combat them, design of ventilation systems, control and monitoring of heat & humidity in mines, coal dust and underground mine lighting.

Drilling & blasting e.g. central large diameter drilling, selection of proper drill bits, blasting pattern and optimisation of opencast.

Control & combatment of existing surface & underground fires in coal mines and adjoining areas, spontaneous heating.

Rock mechanics & mine support – e.g. use of soft wood, roof bolting in depillaring, strata control investigations in chamber blasting harmonic and semi harmonic extraction.

Rescue work.

Explosives

Back filling systems of goaf

Opencast mining system and allied problem.

Development of safety & rescue equipments.

Method of works – e.g. fragmentation of sublevel coal.

Strengthening system design of longwall face, a wing of R&D Laboratory in CMPDI for analysing accidents in coal mines in CMPDI and finally strengthening the infrastructure at mining educational institutes, research laboratories, equipment manufacturing concerns are some other areas foreseen for next five years.

(c) ALLIED ENGINEERING

R&D programme under this head is based mainly on equipment development e.g. mechanical, electrical and application of industrial electronics to mining. The total estimated capital need for period upto 1980-81 is Rs. 67.75 lakhs. Some of the projects in hand are trolley mounted portable crusher, emergency escape hoist system, pedestal type rock breaker, aluminium alloy body dumpers, mobile coal sampling & testing facility, wagon hauler for 30 wagons, Mobile 3 M^3 bucket loader and scraper bucket, haulers of $4M^3$ capacity. The future programme in next five years can be elaborated as follows:-

(i) Equipment development:

(a) Trolley wire dumper

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(b) Centralised belt reconditioning plant & wagon loading at 400 tph.

(c) Reduction in cost of fuel for dumpers, capital & replacement cost of conveyors, and wagon loading time.

(ii) Bulk Material handling

(a) Unit train loading system for coal transport between mines and thermal power stations.

(b) High capacity screening plant upto 600 tph for bigger CHP's.

(c) High capacity primary crusher complex for O/C CHP's.

(d) Large ground stock system with mechanised building up and reclamation upto 800 tph to balance the fluctuating plant production & off take of coal.

Main direction of R&D is towards faster rates of loading, reduced operation cost, and reduced plant stoppages even in case of no off-take for larger periods.

(iii) Coal Transport:

R&D under this head for coming five years is likely to include projects like belt conveyors above coal slurry pipe line transport, vertical hydraulic transport, transport by sea, river transport, loco transport in o/c mines. The use of these will permit the transport of coal between mine and thermal power station, in undulting terrain, high capacity transport under specific conditions, watery mines for vertical transport encouraging indigenous development of skips loading equipment, encourage loco transport upto 30 km in remote areas and to transport material from quarry floor to surface.

(iv) Safety

This includes projects like automatic fire detection system with solid state circuitary, portable dust sampler gas sensor, remote detectors, portable breathing apparatus, application of unit gas for fire extinguishing, objectives of taking up these projects are:-

to get an early fire alarm
Reduced health hazards

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Remote indication of inflammable gas

Rescue & fire fighting system & equipments.

Quick quenching of mine firs

(d) COAL PREPARATION

Future projects (coming five year may be) :

1. Standardised simple washing jig.
2. Development of optimal system for recovery of fines from coal washeries & re-use of water.
3. Dewatering & filtering of fine coal.
4. Development of coal preparation process and equipment.
5. Development of substitutes for imported equipment in the field of coal preparation.
6. Standardisation of main equipment and spare parts.
7. Utilisation of washery rejects and Middlings.
8. Batao jig application for looking facility.
9. Use of dry deshaller.
10. To find out a suitable subsitute for magnatite for use in coal washeries.
11. Design of a suitable screen for testing out finer sizes (say upto 5 mm) from the raw coal.
12. Design of a suitable mobile jig.

(e) COAL UTILISATION

R&D work would be directed towards development of suitable systems, equipment and process to utilise high ash coal e.g.

1. Utilisation of inferior grade coal in power houses without washing.
2. Formed coke technology, for the production of metallurgical grade formed coke utilising mainly non-coking coal.
3. Chemical demineralisation of coal for the production of low ash coke out of high ash coals.
4. Solvent extraction of coal for the production of ashless coal.
5. Vapour phase extraction of coal for the production of ash-less product.
6. Nodules from Assam coal.

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An average expenditure of Rs. 3 crores is estimated for the remaining four year of the plan period 1978-83, totalling to an expenditure of Rs. 14 crores.

CENTRAL FUEL RESEARCH INSTITUTE

A major development in the history of Science and Technology of coal is the transfer of the Central Fuel Research Institute under the administrative control of the Department of Coal with effect from 1.4.1978. The transfer of the Institute is intended to provide a closer and more purposive relationship between the Institute and the coal industry so that the programmes reflect the needs and the viewpoint of the users and the research product is more cost effective and result oriented. A good linkage/support between the Institute and the industry has already been established.

The Central Fuel Research Institute since its inception has been mainly concerned with the science and technology of coal utilisation. In this task it has acquired considerable expertise right from resources quality assessment, preparation and other technological applications and science relating to coal in general and Indian coals in particular Rs. 5 crores.

A write-up on the programmes and plans of the Institute for the Plan period 1978-83 is given in the Table I, It may be seen therefrom the Plan expenditure is expected to be of the order of Rs. 14.73 crores.

Constraints and problems faced in the S&T programme

(1) Development of effective management for R&D programmes. As it calls for a change in the technology involved, attitude towards R&D projects need undergo change in the effective management of the projects. This essentially requires a 'climate of growth' as a carefully planned approach is likely to yield rich dividends.

(2) Training of personnel involved in the technology proposed to be introduced/promoted - a conscientious decision to impart such training and to incur expenditure in this regard is required.

(3) In order to keep abreast with the modern developments and technology it is necessary to have improved interaction between research organisations and industry.

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[illegible]

1. [illegible]

1.1. Research on fuels, [illegible] coal, was initiated in the late thirties and [illegible] by pioneers like Dr. N.K.Sen ([illegible]), Dr. [illegible] ([illegible]), Dr. Forrester (Dhanbad), Dr. [illegible] ([illegible]) and also Dr. [illegible] of TISCO in coal [illegible]. While these attempts [illegible] on specific subjects and not inter-connected, [illegible] on coal and its utilisation began with the establishment of the CFRI in 1947 which is [illegible] under the aegis of the Ministry of [illegible], Department of Coal, Govt. of India. Over the past nearly 30 years, considerable knowledge has been acquired on the nature of coal resources in the country and on methods of their more effective and profitable handling and utilisation. The findings of the CFRI have been in use by the various coal consuming organisations with advantage.

1.2 During the decade 1950-60, coal formed the major source of energy for industrial development of the country. The first two five year plans envisaged considerable expansion of thermal power generation, iron and steel production, railways and cement and other industries. Correspondingly, the CFRI made very substantial contributions on the principles and practice of washing of Indian coals, on the properties of different grades of coking and caking coals in India and methods for blending them with the object of conserving coking coal; on the methods for rational use and efficient combustion of high ash coals, particularly in power stations and through electrification of railways. Studies on briquetting, carbonisation, gasifications, synthetic liquid fuels, by product processing etc., have been initiated. During this first decade the Institute, being new, had shown great enthusiasm in undertaking studies over a wide spectrum

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of coal processing and utilisation technologies and had made particularly original contributions in the field of coal science which have earned it an international reputation. With a view to rendering direct service to industry two pilot plants for washing of coal and high temperature carbonisation were established. It also developed a very strong base for coal and coke analysis and testing through its net-work of coal survey laboratories.

1.3 During the next decade, 1960-70, the CFRI continued its research efforts and technical advice to Government and industry. It established pilot plants on low temperature carbonisation and coal gasification and tested several coals in them. It also conducted programmes and provided facilities for training personnel from industry. During the decade, however, the CFRI had started to face problems, primarily because of the relative stagnancy in the demand for coal due to declining prices of imported petroleum whose share in the energy mix of the country had increased considerably. Coal processing industries, except mainly in steel plants, did not develop as anticipated. This situation has continued till about 1973 end when the international petroleum crisis developed. Since about 1974, due to deepening energy crisis and total nationalisation of coal industry there has been revival of the coal industry. The Government has also now decided as a policy to depend on coal as the major source of energy in India.

2. <u>Foreseen National needs in the coal sector.</u>

In the new context of the revival of the coal industry, the work load of CFRI has already considerably increased during the past five years. Enquiries from user industries and sponsorship of investigations have rapidly grown during the past few years. Activity has increased to render technical assistance to industries, particularly through in-plant studies for improving plant performance. Some

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of the processes developed at CFRI have also been commercialised. The Scientists of CFRI have continued to actively participate in many decision-making committees. The future programme of the CFRI would therefore have to be closely linked to the current and future needs of the whole coal sector-producers, users and Government.

2.1 <u>Needs in the next five years (1978-83)</u>

The following needs of the coal-sector (excluding mining as such) are foreseen in the immediate future or next five years:

2.1.1 Exploration for coal is planned to be intensified. Work on borehole core analysis will therefore increase considerably. Due to increasing coal production, the need for survey of quality of coal from working mines will also increase.

2.1.2 Increasing mechanisation and opencast mining are expected to increase the mineral matter content in coal to be produced in future. More and more coal washeries and dry deshaling units, are expected to be established. Work on coal beneficiation and improvement of technologies has to be intensified.

2.1.3 Conservation of coking coals is an accepted policy of the Govt. Reorganisation of mining in Jharia coalfields is being planned in this context. The importance of utilisation of lower seam coals in Jharia field is being stressed. New coking coals are being discovered in Western and Central Coalfields. These developments indicate the need for more intensive studies on utilisation of different grades of coking coals and maximise the use of substandard coking coals by blending them suitably to meet the requirements of the steel industry. In this context, technology for production of formed coke from non-coking coals to meet the requirements of blast furnaces has to be developed and commercialised.

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RETURN TO NDO

2.5

2.1.4 Utilisation of washery middlings, lower grade coals, and coke breeze acquire importance, Suitable agglomeration (briquetting etc.) techniques have to be developed leading to commercialisation.

2.1.5 Solid smokeless fuel continues to be a major need of the community. Proper and scientifically organised industry for this purpose has not yet been established although projects are under consideration, More L.T.C. plants are expected to be established for this purpose. Briquetting and pelletisation techniques to produce domestic fuels have to be commercialised.

2.1.6 Improvement of efficiency of coal combustion in different industrial applications is an urgent necessity and continuing activity, if the substitution of fuel oil has to be successful. Also, processes for combustion of lower grade coals, washery middlings and even rejects slacks etc. for power and steam need improvement. In this connection, development of package coal fired boiler based on the fluid bed combustion technique will be required, besides the development of pressurised fluid bed combustion systems. Problems of coal based power plants would need special attention, Establishment of gasification plants may also materialise.

2.1.7 Demand is expected to rise for demineralised coal, with very low ash contents for special carbon products, such as for electrometallurgical industries.

2.1.8 Demand for conventional and newer fertilizers based on coal is expected to rise. There will be need to simplify technology for coal based fertilizers.

2.1.9 Utilisation of by-products and waste materials from coal consuming plants is expected to increase. By-product tar and chemical recovery from steel plant coke ovens in particular is planned to be intensified. Many entrepreneurs are interested in further processing of these raw products to purer chemicals. There is already a keen

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interest in the use of fly ash from power plants for production of building bricks.

2.1.13 As a result of increasing coal production and utilisation, there will be need for more intensive technical service and advice to the industry and the Government, particularly Department of Coal. Emphasis is expected to be laid on the use of coal and its products in the rural sector.

2.2 Needs for subsequent 5-10 years (1983-1993)

Coal is expected to continue to be the major source of energy in India during the decade 1983-93 also. The needs of the coal sector listed above are expected to continue by and large. To the extent technologies will be developed and commercialised during the next five years the later needs of the industry would be mainly on improvement of process efficiency and trouble shooting. To the extent technological gaps exist, they have to be filled by process development and adequate engineering inputs. However, more sophisticated methods of coal utilisation, such as combined cycle power systems, MHD, Coal liquefaction, special carbon products etc. are expected to come into practice. Expansion of coal production and utilisation will also necessitate measures for environmental protection. These are likely to be inter-agency activities and projects and would much depend on future policies of the Government and relative economics of coal utilisation.

3. Future programme of the CFRI

3.1 Next Five Years (1978-83)

The future programme of the CFRI would be closely linked to the national needs enumerated above, The CFRI is already engaged on all the subjects listed above and will orient its work in each area depending on specific needs and priorities. Past experience has shown that all the areas listed in section 2.1 have parallel priorities and have to be simultaneously tackled. This has

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increase the load on the Institute very substantially. also been found during the past five years that the main need of the industry is adequately proven processes which can be commercialised. There is, therefore, a need for more intensive chemical and other engineering efforts for scale up and design, either within the Institute or in collaboration with outside design and consultancy organisations, even manufacturing establishments.

It is also necessary to emphasise the importance of intensifying application-oriented basis scientific investigations (for example in the fields of coal science, Catalysts, Chemical Engg., Instrumental Analysis, etc.) which gave a vital support to the applied work directly concerning the industrial needs. These should not be misinterpreted as 'pure research'. The quality of applied work is bound to suffer if the supporting basic investigations lag behind. Considering the above, the programme on hand at the end of March, 1978 will be continued. The anticipated programme during the next five years has been presented in the Sixth Plan (1978-83) document of the CFRI.

3.2 Later 5-10 years (1983-onwards)

The programme would have to be constantly reviewed considering the needs of the industry. Several of the current programmes are likely to change in their character from R&D effort to 'after-sales customer service'. At this stage many of the current individual programmes may have to be dropped or deferred. Work would have to be intensified on improvement of process efficiencies, new and more economic processes and more so-phisticated process technologies.

4. Future Organisation of CFRI.

Considering the anticipated needs of the coal sector of the country and the programme of the Institute, several changes in the structural organisation of the Institute are likely

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to become necessary in due course to ensure the best interest of coal producing and consuming sectors. Of course, adequate funds have to be provided for the full development of the Institute, including staff amenities.

Besides, strengthening of capacities of universities and technical institutions and other research organisations to handle basic research in relation to coal utilisation technologies will be a compelling need from various angles such as generation of a technical cadre of fuel science specialists, erection of new knowledge with wide scope of applications.

5. Finance

During the Sixth Plan period (1979-83), the financial requirements of CFRI have estimated at Rs. 18.06 crores (with a plan component of Rs. 8.27 crores), However, on specific suggestions from CSIR, the estimate has been pruned to Rs. 14.73 crores by curtailing some of the plan activities aimed at serving the specific needs of the coal industry for the present. The details are given in the Table-I.

A tentative projection of the estimate for R&D activities of CFRI during the Seventh Plan period (1983-88), when large emphasis will be on engineering and large scale proving of developed technologies, has indicated a requirement of Rs. 25.30 crores. However, this projection has necessarily to be worked out in detail about the middle of the present Plan period.

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CENTRAL FUEL RESEARCH INSTITUTE

Requirement for Sixth Five Year Plan (1978-83) as originally asked for and as recast if reduction is inevitable

TABLE-I

(Rs. in lakhs)

	Requirement as given in budget estimates of sixth plan document (Ref. Table No.1)			Requirement after reduction, if inevitable		
	Non-Plan	Plan	Total	Non-Plan	Plan	Total
1. Salaries	722.138	115.376	837.514	722.138	40.000	762.138
2. Equipment& Machinery	67.601	179.900	247.501	50.000	150.000	200.000
3. Chemical & Apparatus	32.837	55.099	87.936	32.837	30.000	62.837
4. Land	–	4.000	4.000	–	4.000	4.000
5. Contingencies	89.552	50.596	140.148	89.552	30.000	119.552
6. Maintenance	8.275	6.202	14.477	8.275	4.000	12.275
7. New Inst. Project	–	100.000	100.000	–	40.000	40.000
8. Staff amenities	–	194.500	194.000	–	120.000	120.000
9. Library Books	–	11.210	11.210	11.210	–	11.210
10. Works & Services	–	75.810	75.810	–	60.000	60.000
11. Furniture etc.	–	3.000	3.000	–	8.000	8.000
12. Vehicles	15.000	8.200	23.200	15.000	2.000	17.000
13. Computer time & T.A. for Symposia etc.	–	9.850	9.850	–	7.500	7.500
14. Allowances (not included in salaries)	43.781	13.330	57.111	43.781	4.500	48.281
Total :	979.184	827.073	1806.257	972.793	500.000	1472.793

CHAPTER -XI

INFRASTRUCTURE

11.1 For meeting the task outlined to satisfy the projected demand/requirement of coal during the next decade, certain infrastructural development is called for. The related areas are Tele-communication/Electronics, Workshop, Coal Handling Plants, Power Supply Systems, House Building, Sand Provisioning Beneficiation, etc.etc.

11.2 This Chapter deals with the following six prominent areas;

(1) Power Supply; (2) Workshop; (3) Coal Handling Plants; (4) Beneficiation; (5) Electronics & (6) Explosives.

I. POWER SUPPLY

11.3 Power supply has to play a major role being the basic input to coal production. Inadequate power supply and a recurrent power interuptions are the major constraints, resulting in low capacity utilisation and inefficient working of plants and machinery which adversely affects the production and jeopardises the safety.

Coalmines loads are mainly supplied from the power systems of the eastern regional grid. At present the Bihar system is operating in parallel with the Orissa and rest of the Eastern Region. In DVC system collieries get the highest priority next to traction and supply to coalfields is regulated according to the generation available as per table below:-

Generation (MW)	-	800	750	700	650	600	550
Coal loads(%)	-	100	100	90	80	70	70

With assistance from Bihar and Orissa it is expected that DVC will be able to meet the colliery loads satisfactorily. MP and Maharashtra are also deficient in power to certain extent and marginal power cut is now in force.

11.4 It may be seen from Table 11.1 that collieries are given power supply at a very large number of points. The voltage of supply also varies from low tension 440V. to 33 KV and total demand of collieries is about 350 MW in

1978-79 going upto 822 MW by 1987-88. The number of supply agencies are 11 Electricity Boards/Power Supply Licencees who are supplying power to the collieries. The Board/Licences will take into account the requirement of power for coal sector in the planning of their power systems. While the power requirement for 1987-88 for collieries is quite small in systems like, Assam, Associated Power Company etc. the same in DVC system is high being the order of 300 MW. In Bihar system and in M.P. system it is 173 MW & 172 MW respectively. These loads will again be distributed at various points at different voltages of supply in various states. At present, power supply to collieries has suffered due to two reasons (a) inadequate of power availability (b) interruptions due to inadequate transmission and distribution systems.

Almost all the States have now planned for stronger power net work with a greater degree of integration and the supply to collieries from the power grid can be considered reliable. However, interruptions in supply to collieries due to break downs of transmission and distributions lines etc. cannot be ruled out and the SEBS/Licencees should make every effort to maintain the distribution networks feeding colliery loads in an efficient manner so as to ensure reliability of supply to the collieries. It has since been decided to form a Task Force which will review the implementation of various recommendations which have been made from time to time to improve the distribution system in the coal mining area as well as the generation from Patratu Thermal Power Station as well as Thermal Power Stations of DVC. For this purpose the task force may have representatives from CEA, BSEB, DVC, OSEB and EREB and Deptt.of Power.

11.5 Due to nature of ownership during the pre-nationalisation period of industry, the main supply network could not develop in a planned manner. Now in the changed circumstances, the most economical distribution system is to be developed for power supply to the mines. It is felt that distribution losses can be minimised by proper selection of load centres, sub-transmission and distribution voltages and distribution line constants. Studies conducted earlier in Jharia coalfield have indicated that the entire system should be re-organised with 5 to 8 "source" sub-stations receiving power at 132 KV and transmitting it to colliery substations at 33 KV. From the overall economic point of view, the best utilisation voltage emerging out of the studies is 6.6.KV. To blend the design features into operations procedures, it is desirable to have good instrumentation, communication, protection, monitoring and control facilities to be installed in the distribution system. Table 11.1 shows the salient features of existing supply arrangements to the mines:-

Table 11.1

SALIENT FEATURES OF EXISTING SUPPLY ARRANGEMENTS

S.No.	Particulars	ECL	BCCL	CCL	WCL	SCCL
1.	No. of mines	117	92	56	73	52
2.	No. of supply agencies	5	3	5	3	2
3.	No. of supply points	237	398	52	72	NA
4.	No. of supply voltage	4	5	3	2	NA
5.	No. of mines with different voltage of supply.	-	6	1	-	NA
6.	No.of mines with multi-point supply.	-	50	4	-	N.A.
7.	Distribution of supply points voltagewise.					
	(a) 33 KV	-	2	9	-	10
	(b) 11 KV	167	182	42	24	3
	(c) 6.6 KV	-	55	-	-	1
	(d) 3.3 KV	21	8	1	-	53
	(e) 550 V	7	-	-	-	-
	(f) 440 V	42	151	-	48	-
	Total installed capacity of main transformers, MVA.	130	163	165.2	120	55

11.6 Though the prespective supply agencies in Eastern India are taking remedial measures to ensure uninterrupted supply to coalmines yet there are various influencing factors to achieve meeting full demand of power by supply agencies/licencees, It is, therefore, suggested that Captive Thermal Power Station may be set up exclusively to cater the need of coalmines.

11.7 For the expansion programme of SCCL during plan period, no power shortage has been experience as the power

CHAPTER XV

INVESTMENT PROGRAMME

This chapter is yet to be finalised in consultation with the Planning Commission and Ministry of Finance.

requirement was supplemented by their captive power station. However, another captive power station of 30 MW capacity is being envisaged to cater the need for their increased power requirement in future.

Table-11.2 shows the phased power requirement of coal indutry.

TABLE -11.2

Phased Power requirement upto 1987-88

S.No.	Particulars	Unit	Name of the Coal	78-79	79-80	80-81	81-82	82-83	87-88
*1.	Total annual production	mt/year	NECL	0.70	0.75	0.85	0.97	1.18	1.57
			ECL	23.00	26.94	32.07	33.24	36.82	45.20
			BCCL	21.00	23.00	25.42	26.72	27.85	40.11
			CCL	23.70	24.82	28.06	32.46	38.07	60.25
			WCL	25.00	27.38	27.99	30.27	33.75	49.64
			SCCL	10.18	12.00	12.70	14.00	15.40	19.06
2.	Energy consumption	Million Kwh.	NEC	9.00	10.70	11.40	13.00	16.00	20.00
			ECL	376.46	402.50	429.42	453.47	501.12	605.68
			BCCL	586.50	649.00	707.00	767.00	836.00	1283.50
			CCL	262.43	282.37	336.41	406.91	499.49	858.00
			WCL	327.00	348.56	374.00	406.00	463.00	695.00
			SCCL	257.4	283.20	324.60	337.80	379.80	448.20
3.	Max. demand	MW	NEC	2.70	3.30	3.70	4.30	5.00	7.00
			ECL	74.09	79.58	85.17	89.44	99.36	129.22
			BCCL	107.00	121.00	138.00	149.00	1[illegible]9.00	241.00
			CCL	85.80	92.40	109.00	127.49	152.69	263.00
			WCL	80.00	89.00	97.00	109.00	125.00	182.00
			SCCL	34.32	37.76	43.28	47.04	53.04	59.76
4.	Specific Energy.	Kwh/tonne	NEC	13.24	13.38	13.41	13.40	13.56	12.74
			ECL	13.30	13.35	13.39	13.44	13.61	13.40
			BCCL	25.05	26.92	27.81	28.91	30.01	32.00
			CCL	11.07	11.49	11.99	12.54	13.12	13.35
			WCL	13.35	13.36	13.36	13.41	13.72	14.00
			SCCL	25.74	26.10	25.55	24.12	24.36	24.90

Note:(*) For 78-79 and 79-80 -company-wise production figures given in accordance with assessment made during Annual Plan discussions for 79-80.

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1	2	3	4	5	6	7	8	9	10
5.	Specific max. demand	MW/mt. per yr.	NEC	3.97	4.13	4.35	4.43	4.23	4.46
			ECL	2.62	2.64	2.66	2.65	2.70	2.86
			BCCL	4.65	5.02	5.43	5.62	5.71	6.01
			CCL	3.62	3.76	3.88	3.93	4.01	4.09
			WCL	3.27	3.41	3.47	3.60	3.70	3.67
			SCCL	3.43	3.48	3.55	3.36	3.44	3.31

N.B. TISCO/IISCO figures are not available.

11.8 As interruption of supply to the ventilation, pumping and men-winding would jeopardise the safety of the operating personnel and the equipment as well, the collieries may have to plan for the installation of their own captive diesel generating plants to meet their essential loads. This facility may be extended mainly to degree 3 gassy mines.

Table 11.3 Shows the power demand on different supply agencies during next ten years.

TABLE-11.3

ASSESSED POWER DEMAND ON DIFFERENT SUPPLY AGENCIES UPTO 1987-88

Sl. No	Name of the supply agencies	Name of the beneficiary company	TOTAL MD in MW by 78-79	79-80	80-81	81-82	82-83	87-88
1.	Assam State Elec. Board	NEC	2.70	3.30	3.70	4.40	5.00	7.00
2.	West Bengal State Elect. Board/Durgapur Project Ltd.	ECL	14.00	14.00	16.00	17.00	20.00	30.00
		BCCL	2.36	2.36	2.36	2.40	2.45	2.62
3.	Associated Power Company	ECL	4	4	4	4	4	4
4.	Dishergarh Power Supply Co.	ECL	7	7	7	7	7	7
5.	DVC	ECL	44.09	49.58	52.17	55.44	60.36	78.22
		BCCL	16.00	30.00	47.00	61.60	72.00	58.00
		CCL	38.20	41.20	47.70	51.70	52.20	66.90
6.	Bihar State Elect. Board	ECL	5	5	6	6	8	10
		BCCL	88.64	88.64	88.64	85.00	84.55	80.38
		CCL	35.10	35.70	37.80	40.40	41.70	83.10
7.	Orissa State Elect. Board	CCL	6.00	7.50	8.50	10.00	20.00	25.00
		WCL	2	2	3	4	5	8
8.	M.P. State Elect. Board	CCL	5	6	10	17.10	28.00	50.00
		WCL	57	62	66	71.00	80.00	122.00
9.	Maharashtra State El.Board	WCL	21	25	28	34	40	52
10.	U.P. State Elect.Board	CCL	1.5	2	5	8.29	10.79	38.00
11.	Andhra Pradesh State Elect. Board	SCCL	18.16	21.60	27.12	30.38	36.88	43.50
12.	SCCL own generation	SCCL	16.16	16.16	16.16	16.16	16.16	16.16

II. WORKSHOPS

11.9 To meet increased demand of coal during the period 1978-79 to 1987-88 the concerted drive is for increased productivety, safety and cost reduction through higher mechanisation. With heavy deployment of some imported equipment and other capital intensive equipment envisaged, it is necessary to create facilities for planned preventive maintenance which offers best means of achieving high equipment availability and maximise productivity with greater savings towards maintenance cost. Development of Workshops has therefore, been considered as one of the most essential support to achieve the objectives and for indigenisation of spare parts for imported equipment.

11.10 With these objectives in view, a three tier system of workshops organisation has been proposed which covers (1) Colliery workshop (2) Regional Workshop (3) Central Workshop. The unit workshop will be set-up at the colliery level for a group of collieries having a minimum of 0.5 mt/year production for day today repair and maintenance jobs. Regional Workshop will be set-up one in each area having an ultimate production of 4 to 6 mt/ year for carrying out periodical overhauling and repair of equipment and complete sub assemblies. Central Workshop will be set-up at a strategic location so as to cater to a group of 4 to 5 areas having an ultimate production of 10 mt/year or so. These workshops will undertake mass production of spare parts particularly for imported machinery heavy repairs and overhauling of major equipment, R & D activities for development of new equipment and specialised jobs connected to the mine mechanisation.

11.11. The existing facilities available in the various coalfields which includes Two Central Workshops set up by N.C.D.C. Ltd. at Barkakana and Korba and a few Workshops owned by the then private coal companies in the Eastern Region and also facilities available with small scale industrial units are for too inadequate to meet the requirements of coal industry for increased production through higher mechanisation.

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11.12 Keeping in view the existing workshop facilities and the increased need of workshop supports for coal industry, the planning of workshops has been made for next 10 years period. The companywise and yearwise requirement of workshops has been indicated in table 11.4. More number of collieries workshops have been provided which serves the purpose of day-to-day repairs and routine maintenance jobs. It is therefore now renamed as colliery workshop instead of Unit Workshop.

TABLE- 11.4

ANTICIPATED PROGRAMME FOR CONSTRUCTION OF WORKSHOPS IN COAL INDIA LTD AND SINGARENI.

Name of Company	Category of Workshops	1978-79 Nos	1979-80 Nos	1980-81 Nos	1981-82 Nos	1982-83 Nos	1983-88 Nos	Total Nos	Remarks
E.C.L.	Colliery	4	4	6	5	5	-	24	Nos not known for 1983-88
	Regional	1	1	1	1	1	-	1	
	Central								
B.C.C.L.	Colliery	24	-	-	-	-	-	24	
	Regional	2	2	2	2	-	-	8	
	Central	-	1	-	-	-	-	1	
C.C.L.	Colliery	16	-	-	4	2	5	27	
	Regional	3	4	-	-	-	-	7	
	Central	1+½*	-	-	-	-	-	1+½*	*Expansion of Central Workshop Barkakana.
W.C.L.	Colliery	5	4	2	-	-	15	26	
	Regional	5	-	-	-	-	5	10	
	Central	-	-	-	1	-	-	1	
SINGARENI	DIVISIONAL	-	1	1	-	1	NA	3	

Note: Details regarding TISCO & IISCO are not available

III COAL HANDLING PLANTS

11.13. CHPs have been identified where the quantity of coal to be handled per year justifies the investment on a full-fledged CHP. Minimum investment on a full-fledged CHP is in the region ofRs.50.00 lakhs or so. For such investment the minimum quantity to be handled is in the region of 0.4 to 0.5 m.t./year or so. Some of the reasons calling for a CHP are as follows:-

To satisfy the consumer with their specific requirement in respect of coal quality.

To cope up the demand for higher quantity of coal by way of increasing rate of loading which would have been otherwise impossible by manual loading.

Optimising the wagon utility by loading in minimum permissible time.

Reduce the cost of loading compared to manual loading for the quantity also possible by manual loading.

MINI CHP

For small projects where CHP is difficult to justify,Mini-CHPs are envisaged. These are generally for a capacity of 0.20 + .15 mt year or so. Such mini-CHPs only involve simple mechanisation comprising generally of a tippler, elevating conveyor, single deck screen and hoppers for loading of either wagon or trucks.

The number of fullfledged CHPs and Mini CHPs that have been identified are given in the table below:

Companies	Type of Plants	78-79	79-80	80-81	81-82	82-83	83-84
COAL INDIA	CHP	8	16	20	8	19	42
	M/CHP	23	24	12	10	8	23
SINGRANI	CHP	-	2	1	- -	1	-
	M/CHP	-	-	-	-	-	-

Note: Details regarding TISCO &IISSO are not available.

IV BENEFICIATION

DEMAND AND AVAILABILITY OF PRIME COKING COAL

11.14 The following table shows the demand for prime coking coal and the details of washeries proposed to meet the deficit in respect of the demand on Coal India Ltd. The capacities and the year of commissioning has been whown in table No.11.5 and 11.6.

SL. No.	Items	1978-79	79-80	80-81	81-82	1982-83	7-88
1	2	3	4	5	6	7	8
1.	Total Demand (ALL India)	10.24	10.11	11.01	11.78	12.58	16.02
2.	Availability from						
	a) existing washeries (ALL INDIA)	8.30	8.52	8.70	8.90	8.90	8.90
	b) Sanctioned Washeries	Nil	-	-	-	-	2.35
	c) Proposed new washeries	Nil	-	-	-	-	6.72
3.	Direct feed (ALL INDIA)	1.94	1.48	0.72	0.92	1.33	0.87
4.	Total availability 2 + 3	10.24	10.67	11.28	12.17	12.58	18.84
5.	Surplus.	Nil	+ 0.56	+ 0.27	+ 0.19	nil	+ 2.82
	Availability from the proposed washeries.						
6.	Sudamdih	-	0.67	0.99	1.17	1.17	1.17
7.	Moonidih	-	-	0.87	1.18	1.18	1.18
8.	Barora Prime	-	-	-	-	-	0.92
9.	Pootkee-Bulliary	-	-	-	-	-	2.16
10.	Bhalgora	-	-	-	-	-	1.80
11.	Dharmaband	-	-	-	-	-	1.84
12.	Total of 6 to 11	-	0.67	1.86	2.3	2.35	9.07
13.	Net deficit (-) Surplus (+) (5-12)	(-)0.26	(+)0.81	0.82	(+)0.29	Nil	Nil

TABLE - 11.5

PRIME COKING COAL

Sl. No.	Name of Washery	Date of Commissioning	Capacity in m/t
(a) EXISTING WASHERIES			
1.	Dugda I (BCCL)		2.40
2.	Dugda II(BCCL)		2.40
3.	Patherdih (BCCL)		2.00
4.	Bhojudih (BCCL)		2.00
5.	Lodna (BCCL)		0.40
6.	Jamadoba (TISCO)		1.44
7.	Chasnala (IISCO)		2.00
8.	Durgapur (DPL)		1.35
9.	Durgapur (HSL)		1.50
			15.49
(b) UNDER CONSTRUCTION			
1.	Sudamdih (BCCL)	1979-80	2.00
2.	Monidih (BCCL)	1980-81	2.00
			4.00
(c) PROPOSED WASHERIES			
1	Barora I (BCCL)	1983-84	1.80
2.	Bhalgora (BCCL)	1983-84	4.20
3.	Pootkee-Balliharí(BCCL)	1984-85	3.60
4.	Dhamaband(BCCL)	1986-87	3.60
			13.20

TABLE - 11.6

MEDIUM COKING COAL

(a) EXISTING WASHERIES

Sl. no	Name of Washery		Date of Commisioning	Capacity in m/t
	(a) EXISTING WASHERIES			
1.	West Bokaro	(TISCO)		0.57
2.	Kargali	(CCL)		2.72
3.	Kathara	(CCL)		3.00
4.	Gidi	(CCL)		2.84
5.	Sawang	(CCL)		0.75
				9.88
	(b) UNDER CONSTRUCTION			NIL
	(c) PROPOSED WASHERIES			
1.	Jhunkundar	(BCCL)	1980-81	0.42
2.	Mohuda	(BCCL)	1980-81	0.63
3.	Ramgarh	(CCL)	1982-83	3.00
4.	Kedla	(CCL)	1982-83	2.60
5.	Nandan	(WCL)	1982-83	1.20
6.	Parora	(BCCL)	1979-80	0.48
7.	Shampur	(ECL)	1982-83	0.80
8.	Paroj	(CCL)	1985-86	3.00
				12.13

Demand and Availability of medium coking coal

11.15 The following table shows the demand for medium coking coal (as charged to ovens), the existing availability and the and the details of washeries proposed to meet the deficit in respect of demand on medium coking coal.

Sl. No.	Items	1978-79	1979-80	1980-81	1981-82	1982-83	87-88
1.	Estimated quantity of medium coking coal chargeable to coke oven.	5.94	5.88	6.51	6.99	7.43	11.19
2.	Estimated availability of medium coking coal from existing sources(washed and raw) chargeable to coke ovens.	5.88	5.89	6.46	7.03	8.36	12.02
3.	Estimated availability of medium coking coal from the proposed washeries.						
	CIL.						
	(a) Barora (BCCL)	-	-	0.12	0.18	0.21	0.21
	(b) Jhunkundar(BCCL	-	-	0.15	0.24	0.24	0.24
	(c) Mohuda (BCCL)	-	-	0.20	0.40	0.40	0.40
	(d) Nandan ((WCL)		-	-	-	0.30	0.56
	(e) Ramgarh (CCL)	-	-	-	-	0.60	1.43
	(f) Kedla (CCL)	-	-	-	-	0.30	1.10
	(g) Shampur (ECL)	-	-	-	-	0.10	0.38
	(h) Parej (CCL)	-	-	-	-	-	1.27
	Total of 3	-	-	0.47	0.82	2.15	5.66
	West Bokaro	-	-	-	0.39	0.64	0.64
	Total availability	-	-	-	1.21	2.69	6.30
4.	Direct feed	1.34	1.43	1.45	1.18	0.90	0.95
5.	Net Deficit(-) Surplus(+) (3+4)	(-)0.06	(+)0.01	(-)0.05	(-)0.04	(+)0.93	(+)0.83

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Blendable Coal:

11.16 North Eastern Coalfields produce coal which is prime coking. However at present, it has not been possible to use them in steel plants because of their high sulphur content. A washery has been proposed at Tipong to beneficiate this coal to decrease its ash content so that the same can be blended with high ash coal and low sulphur coals and used in steel plants.

Another beneficiation plant for blendable coal is expected to be in operation at Sitalpur/Sodepur (ECL) and the output from the plant together with raw coal production would be sufficient to meet the demand.

Beneficiation Plant	Annual raw coal input capacity (m.t./year)	Expected year of commissioning
a) Sodepur/Seetalpur(ECL)	0.95	1982-83
b) Tipong (NEC)	0.47	1982-83

Non-coking coal (power coal)

11.17 Beneficiation is proposed for power coal mainly to ensure the supply of consistent quality of coal resulting in increased efficiency of boilers and longer plant life. The beneficiation also saves freight charges (including saving in capacity and saving in handling and storage capaiity). It will be seen that it also reduces strain on the national transport system.

Benefits due to use of beneficiated coal

11.18 Benefits at consumer's end.

(a) Direct benefits.

(i) Supply of consistent quality of coal.

(ii) Saving in transport cost.

(iii) Saving in capacity and operating costs of coal handling plants/ash handling plants at the consumers' end.

(iv) Saving due to use of beneficiated coal with increased heat value.

(v) Saving in handling and storage capacity of

(b) Indirect benefit.

(i) Increase in efficiency of boilers on account of consistent quality of coal.

(ii) Increase in plant-life.

11.19 Benefits at National level

(a) By application of beneficiation, it is possible to mine low grade coal reserves and supply to different consumers and conserve superior grades. The beneficiation gives a long term benefit so far as exploitation and utilisation of low grade coals are concerned, thus ensuring conservation of this wasting asset.

(b) The Railways will not be required to transport dirt, shale, stone coming with coal over a long distance as a result of elimination in the beneficiation plant at the mine heads and in this way, there will be a saving of Railway transport capacity which can be utilised for transportation of other goods.

11.20 Cost of beneficiated coals

General practice has been to supply raw coal for power plant use in the past. Recently, it has been possible to make power plants namely Obra and Tata Electric Co. Bombay agree to accept washed coal and this has been achieved after lot of persuation.

Detailed design of the washeries:

11.21 All the washeries in India in the past have been installed by Foreign Firms alongwith detailed design and drawing of the same. Recently two washeries (Sudamdih & Moonidih) have been taken up by Indian Firms, While the detailed design of the washery at Sudamdih is being done by M/s Mcnally Bharat Engineering themselves, the detailed design of the washery for Moonidih is being done by

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M/s MAMC in collaboration with Polish Experts. Although some beginning has been made in this direction, much ground still remains to be covered. Many washeries/ beneficiation plants are proposed for installation in the sixth and seventh five year plan. This shows there is lot of scope for detailed design work in this field and the same should be developed at some institutes like CMPDI which would be most appropriate for this job. If it is considered necessary, know-how and experise in the line may be availed of from experienced countries and utilised at these institutes.

Imported coal:

11.22 Steel sector is proposing to import low ash metallurgical coal. The cost of the imported coal of 10% ash will be about Rs.800 per tonne (FOR). The imported coal is planned to be blended with washed coal of 20% ash and the blended coal is proposed to be used in steel plants. This proposal is blessing in disguise for the washing of coking coals in our country. Even after adopting the most up-to-date washing system and crushing down raw coals to a very fine size so as to ensure maximum recovery of clean coal, the cost of washed coal from our washeries is expected to be much lower than that of coals proposed to be imported. Against the above background, the possibility of re-washing of middlings and washing of high ash coal has to be explored mainly from the point of view of conservation of metallurgical coal. CFRI is engaged on this problem and if this comes through, washed coal availability will increase substantially from existing washeries. Although import of coking coal is being resorted to, future washing capacity has been worked out without taking into consideration any import of coking coal.

V. ELECTRONICS FOR MINING

11.23 With the advent of nationalisation of coal mines in Indian, it has become imperative for the adoption of modern mining techniques ensuring increased safety of personnel, optimum machine utilisation and precise management of the industry for economic viability. One of the most vital aspects in modernisation of coal industry is the need for improvement in communication and application of electronics

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and safety of operations.

11.24 Presently considerable gap exists between the advanced nations and India in the application of machinery and equipment involving automation by way of deployment of electronics in coal mining industry.

11.25 A Panel on Mining Electronics and Communication was constituted by the Chairman, Electronics Commission in June 1976 to study in depth the electronics requirements of the coal industry to promote its planned growth, with emphasis on self- sufficiency. The report of the Panel was accepted by the Commission in June 1977.

APPLICATIONS IN THE FIELD OF COMMUNICATIONS:

11.26 (a) For underground Mines:

The immediate need for bridging the gap for communication in mines would be by wired telephone communications backed up by point to point loud hailing system and mobile radio communications by leakly feeder. In order to improve productivity by mechanised coal winning, efficient communication signalling in the face and cage movement in the shaft will be imperative. During emergency conditions involving trapping of miners, through the strata coded communications from the surface to underground and vice-versa will be essential to locate trapped miners and effective rescue measure.

11.27 (b) For Opencast mines: Radio communication with selective calling would be essential for opencase mines.

COMMUNICATION IN CHP'S WASHERIES & BENEFICIATION PLANTS:

11.28 For catering to the need of the process plants like CHP's, Washeries and Coal Beneficiation Plants, it would be necessary to incorporate wired communications and loud speaking intercom system.

SURFACE COMMUNICATIONS

11.29 To ensure smooth and effective communication from the administrative headquarters at all levels down to the field units it would be necessary to have surface automatic exchange alowing direct dial through facilities.

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11.30 For access to P & T network, it will be necessary to equip selected subscribers with P & T telephones, To transmit messages and formatted data, telex/PT teleprinters will also be needed.

ELECTRONICS IN THE FIELD OF SAFETY APPLICATION :

11.31 Environmental Monitoring: Underground mining being effected by explosive and poisonous gases, environmental monitoring by electronic means of methane and carbon dioxide concentration as well as air velocity needs to be carried out to improve the safety standards.

11.32 Monitoring of Strata Behaviour: With a view to detect the strata behaviour and predict roof falls it will be necessary to harness electronics meansfor monitoring strata condition, barrier deflection, Hydraulic sures which might act on account of nearby water logged areas.

11.33 Besides the above, electronics could be introduced in mining for the following:

(i) Warning and protection against run-way coal tubs.
(ii) Monitoring of temperature in goaf to predict on set of spontaneous fire.
(iii) Warning system against inundations by nearby flooded river and other water sources.

INDUSTRIAL ELECTRONICS:

11.34 With the advancement of solid state devices, control circuits hitherto employing magnetic / electromagnetic devices could be replaced by solid state logic for greater relibility and efficiency. Besides, there are a number of areas such as production monitoring, mine winder control, ash-monitoring of coal etc. where electronics will contribute to better productivity coupled with safety.

VI EXPLOSIVES

11.35 The demand of explosive in the last decade has increased mainfold due to the following reasons:

(a) Previously non-permitted explosive was being used in non gassy underground coal mines. After categorisation of all coal mines (U/g) into gassy, only permitted explosives is to be used. Permitted explosives being weaker in strength compared to non-permitted larger quantity of explosive is required for the same coal production.

(b) Adoption of the technique of the Solid Blasting(BOS) the consumption of explosive has increased due to low yield of coal per unit weight of the explosive.

(c) Due to coming up of more mechanised opencast and also the increase in OB coal ratio has resulted into the increased consumption of explosive.

(d) Due to increasing production of coal the demand of explosive is also steadily increasing.

11.36 On the basis of estimates of the future production, the requirement of explosive have been worked out and given in table-1. In working out the requirements of the explosive an average consumption rate of one Kg.per 3.75 tonne of coal in case of underground workings. The same in opencast workings has been taken as 8 tonne for coal and $5m^3$ for overburden rocks.

11.37 The manufacturing capacity in the explosive have been given in the table-2 based on the licenced capacity of the various manufactures and their likely production programme in the future years.

11.38 As regards the adequacy of the existing capacities to meet the explosives requirements, it would be necessary to scertain the demand pattern of non-coal mining sectors which has not been possible to be included in the present studies.

A LONG TERM REVIEW OF DEMAND AND SUPPLY OF EXPLOSIVES AND ACCESSORIES

1978-79 - 1983-84

1.0 A review of the demand and supply of explosives and accessories for the Sixth Five Year Plan period has been made. This exercise has been based on planned mineral targets for the period as per draft Sixth Plan document. The demand from non-mining sector has been estimated on the basis of the outlay of funds to major/minor irrigation projects, hydro-electric projects and Roads/Railways construction.

2.0 SIXTH PLAN TARGETS:

Sector		Fund Allocation 1978-79 to 1982-83 (Rs crore	Mineral Production Target(*) 1977-78	78-79	82-83	83-84
A. MINING						
Coal	MT	1850	103.2	113.0	149.0	158.0
Lignite	"		3.7	4.5	8.8	10.0
Iron Ore	"	528	43.0	48	65.0	73.0
Magnanese	"		1.8	2.0	2.0	2.0
Non-Ferrous Metals						
Copper Metal	'000t	427.6	23.0	N/A	40.0	45.0
Copper Ore	MT		3.1	3.7	N/A	8.5
Lead Metal	'000t		N/A	N/A	15.0	17.0
Zinc Metal	"		43.0	N/A	75.0	84.0
Lead/Zinc	MT		1.0	1.6	N/A	3.4
Cement	"	187.0	19.2	N/A	30.0	33.0
Limestone/ Dolomite	"		33.0	35.0	51.0	57.0

* Estimated targets

B. NON-MINING		
Major Irrigation	7250	
Hydel Project	4000	(estimated at 40% of total allocation for power sector)
Minor Irrigation	1725	
Roads & Railways	5333	

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3.0 EXPLOSIVES & ACCESSORIES DEMAND:

3.1 In the case of coal targets for the plan period, we have obtained the break-up of production for both underground and opencast mining operations. Production from underground mines has been analysed according to the degree of mechanisation for calculating 'Blasting Ratios' for each application. For example an average blasting ratio of 500 tes of explosives per million tonne of coal when blasting coal off-the-solid in development operations has been assumed, and 250 tes per million tonne of coal when blasting in cut faces.

3.2 The methodology adopted for other minerals is based on past performance as well as on assessment of blasting ratios based on current experience.

3.3. For the non-mining sector, a uniform blasting ratio is not practicable and the estimates of demand for explosives in this sector are based on past offtakes related to blasting work carried out at each of the major consuming centres.

3.4. A summary of industrywise demand for explosives is given in Table III. These are conservative estimates and are likely to be much higher if all the mineral production targets are met.

3.5 In Table II, demand for accessories viz Safety Fuse, Detonators and Detonating Fuse, has been compiled for the corresponding supply of explosives. This shows that the market for Safety Fuse and Plain Detonators is expected to remain stabilised at the current levels although demand for electric detonators is increasing rapidly.

4.04.0 ANALYSIS OF DEMAND & SUPPLY:

4.1 An assessment of the supply from various manufacturers has been made with the latest information on the progress made by them. The demand and supply position appears in Table 7, which is summarised below:

In 1000 tes.

	1978-79	1980-81	1982-83	1983-84
Demand	74.7	90.5	106.4	114.5
Supply	72.5	84.3	96.0	102.0
Shortfall	2.2	6.2	10.4	12.5

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4.2. It is apparent from these figures that the shortfall will continue to increase throughout the Sixth Plan period unless the supply of the right types explosives is supplemented through additional capacity/ imports. Our demand estimates are very conservative and if the mineral production targets are met, the actual demand from various sectors are likely to be much higher than anticipated.

4.3. A closer look at the gap in supply vis-a-vis demand for explosives of various product types, shown in Table VI, indicates that the shortfall will be very acute in small diameter non-permitted. This is mainly so because of varied conditions of usage in this market area where slurry type of explosives are yet to be established.

TABLE - I

PERSPECTIVE REQUIREMENT OF EXPLOSIVE (PERMITTED /NON-PERMITTED)

Sl. No	Company	Permitted/ Non permitted	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85
1.	N.E.C.	Permitted	165	176	205	176	187	227	243	317
		Non-permitted	–	11	16	91	142	173	184	277
	Total	Permitted & Non-permitted	165	187	221	267	329	400	427	549
2.	E.C.L.	Permitted	5808	6848	7192	7341	7704	7923	8427	10395
		Non permitted	1827	1391	1727	2074	2273	3008	3050	3796
	Total	Permitted & Non permitted	7635	8239	8919	9445	9977	10931	11477	14191
3.	B.C.C.L.	Permitted	4837	5440	5672	5829	6216	6357	6867	6688
		Non permitted	1092	1402	1901	2205	2436	2510	2888	8768
	Total	Permitted & Non permitted.	5929	6842	7573	8034	8652	8867	9755	15536
4.	C.C.L.	Permitted	1925	2101	2245	2432	2668	2843	3096	4088
		Non permitted.	7334	8505	8610	10028	11734	14600	17325	26877
	Total	Permitted & Non permitted	9259	10606	10855	12460	14402	17443	20421	30165
5.	W.C.L.	Permitted	4685	5621	5989	6328	6461	6507	6712	8267
		Non-permitted.	2153	2347	2283	3276	4043	5355	6615	10133
	Total	Permitted & Non permitted.	6838	7968	8272	9604	10504	11862	13327	18400
6.	C.I.L.	Permitted & Non permitted.	29827	33842	36138	39789	43862	49502	55406	78727

Sl. No.	Company	Permitted / Non permitted	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85
7.	S.C.C.L.	Permitted	2376	2808	2987	3144	3448	3517	3851	–
		Non permitted	–	247	420	1055	1202	1733	2415	–
	Total	Permitted & Non permitted	2376	3055	3407	4199	4650	5250	6366	–
8.	TISCO IISCO	Permitted	712	755	821	963	1197	1440	1467	1467
	Total	Permitted	712	7755	821	963	1197	1440	1467	1467
9.	All India	Permitted	20509	23749	25112	26213	27880	28813	30661	–
		Non Permitted	9747	13902	15257	18737	21830	27379	32477	
	Total		30256	37651	40369	44950	49710	56192	63138	–

TABLE - II

THE SUPPLY POSITION OF THE EXPLOSIVES DURING THIS PERIOD IS LIKELY TO BE AS FOLLOWS:

	1978-79 (Tonne)	1983-84 (Tonne)	Installed/ required capacity (Tonne)
I.E.L.	30,000	36,000	30,000
I.D.L.	28,000	30,000	37,000
Narendra & Sons	-	5,000	10,000
I.D.L.	2,000	3,000	3,000
BHANDARA	--	5,000	5,000
F.C.I. (ANFO & SLURRIES)	11,000	15,000	15,000
I.B.P.	2,000	18,000	25,000
Chowgule & Co.	-	10,000	15,000
	73,000	122,000	146,000

EXPLOSIVES DEMAND- SIXTH PLAN PERIOD
In Tonnes

TABLE [illegible]

Sector	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
Coal	37850	41500	45000	48600	53200	55300
Lignite	850	1200	1600	2000	2300	2700
Iron Ore/Manganese Ore	7000	7900	8800	9700	10600	11500
Copper	3200	4300	5500	6700	7800	9000
Lead/Zinc	1200	1400	1600	1900	2100	2300
Lime Stone/ Dolomite	6000	6500	7000	7400	7900	8400
Others	2300	2300	2400	2500	2500	2600
Total; Mining	58400	65100	71900	78800	85400	92300
Roads/Rlys	2900	3100	3399	3600	3200	4000
Major Irrigation Hydro Electric projects	6800	7100	7200	7600	7800	8000
Minor Irrigation	6000	6600	7200	7800	8400	9000
Others	500	600	800	800	1000	1200
GTotal Non-mining	16300	17400	18600	19800	21000	22200
Grand Total:	74700	82300	90500	98600	106400	114500

SUMMARY OF EXPLOSIVES AND ACCESSORIES DEMAND 1978-79 to 1983-84

TABLE- 6

A. EXPLOSIVES (In tonnes)	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
Small Diameter Permitted	26600	27700	28700	29600	30600	32300
Small Diameter Non Permitted.	26800	29600	32300	35200	37400	40900
Large Diameter	31300	25200	29500	33300	38400	41300
Total:-	74700	82500	90500	98300	106400	114500
B. DETONATORS (In million Nos.)						
Plain	59.0	61.3	58.4	60.3	60.3	60.3
Aluminium Electric/Delays	45.3	52.3	56.5	64.0	71.4	78.7
Copper Electric/Carricks	79.0	82.0	84.3	87.7	90.3	93.3
Total:	103.3	195.6	199.2	212.0	222.0	232.3
C. SAFETY FUSE (In Million mtrs.)	90.0	92.8	89.0	90.0	90.0	90.0
D. DETONATING FUSE (In Mill. metres)	10.6	11.5	14.3	16.5	18.0	21.0

PROJECTED SUPPLY VERSUS DEMAND OF EXPLOSIVES

TABLE - V.

	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
DEMAND.	74700	82500	90500	98600	106400	114500
SUPPLY						
IEL	36000	36000	36000	36000	36000	36000
IDL CL	23000	26000	28000	30000	30000	30000
IEP	2500	4000	5300	7500	10000	12500
FCI	7000	7500	7500	7500	7500	7500
IIL	3000	3000	3000	3000	3000	3000
Bhandara	-	500	1000	1500	2000	2000
Narendra	-	500	500	500	500	1000
Choygules	-	-	2000	4000	6000	8000
Gunpowder (High Explosive equivalent)	1000	1000	1000	1000	1000	1000
Total supply:	72500	78500	84300	91000	96000	102000
SHORT FALL:	2200	4000	6200	7600	10400	12500

TABLE .VI

DETAILED ANALYSIS OF SUPPLY VERSUS DEMAND OF EXPLOSIVES
(in Tonnes)

	1978-79				1980-81				1982-83				1983-84			
	SDP	SDDP	LD	Total	SDP	SDDP	LD	Total	SDP	SDDP	LD	Total	SDP	SDDP	LD	Total
SUPPLY																
IEL	16000	16000	4000	36000	16000	16000	4000	36000	16000	16000	4000	36000	16000	16000	4000	36000
IDLCL	9800	3600	9600	23000	10500	4000	13500	28000	11000	5000	14000	30000	11000	5000	14000	30000
IBP	300	-	1700	2500	1400	600	3300	5300	2100	1200	6700	10000	2500	1600	8400	12500
FCI	-	3700	3300	7000	-	4000	3500	7500	-	4000	3500	7500	-	3300	3700	7500
IDL	-	300	2700	3000	-	300	2700	3000	-	300	2700	3000	-	300	2700	3000
BHANDARA	--	-	-	-	500	-	500	1000	1000	-	1000	2000	1000	-	2000	3000
NARENDRA	--	-	-	-	-	500	-	500	-	500	-	500	-	1000	-	1000
CHOWGULES	-	-	-	-	-	200	2000	3000	-	1200	4800	6000	-	1500	6500	8000
GUNPOWDER (High Explosive equivalent)	-	1000	-	1000	-	1000	-	1000	--	1000	-	1000	-	1000	-	1000
Total Supply	26600	24600	21300	72500	28400	26400	29500	84300	30100	29200	36700	96000	30500	30200	41300	10200
Demand.	26600	26800	21300	74700	28700	32300	29500	90500	30600	37400	38400	106400	32300	40900	41300	114500
SHORTFALL	-	2200	-	2200	300	5900	-	6200	500	8200	1700	10400	1800	10700	-	12500

EXPLOSIVES REQUIREMENT FOR MINING OF COAL AND LIGNITE

Coal Production - Mil Ts
Explosives - Ts

	1978-79		1983-84	
	Production	Explosives	Production	Explosives
Pick Mining	-	-	-	-
Depillaring by blasting	39.0	11100	48.0	13000
Machine Cutting and Blasting	26.0	6500	29.0	7300
BOS(development)	18.0	9000	26.0	13000
Complete Mechanisation	0.5	-	5.0	-
TOTAL UNDERGROUND	83.5	26600	103.0	32300
SURFACE COAL	28.5	11250	50.0	23500
TOTAL COAL	112.0	37850	153.0	55800
LIGNITE	4.5	850	10.0	2700
GRAND TOTAL		58700		53500

CHAPTER-XII

MINE SAFETY

12.0 Mining through ages has been recognised as one of the most hazardous profession. Hazards in Coal Mining arise due to:-

1. Strata movement-fall of roof,sides etc.
2. Noxious and inflammable gases-explosions.
3. Coal dust.
4. Use of machinery.
5. Inundation - from surface and underground sources of water.
6. Mine fires.
7. Health hazards due to dust, noxious gases, poor lighting, uncongenial working environment.

12.1.0 A total systems approach:

Realisation of the professional hazards has led Coal India to adopt a total systems approach towards safety, and it is no longer considered as an isolated action confined to the enforcement of safety regulations along, but is made to permeate the entire gamut of mining activities, right from the planning stage. Some of the areas where greater emphasis is being given include.

1. Introducing modern and safer methods of extraction of coal.
2. Introducing new mining techniques and technical innovations.
3. Improving the maintenance and checking facilities.
4. Improvement in ventilation.

5. Providing suitable and adequate safety equipment, safety devices and materials.

6. Improved communication systems.

7. Providing comprehensive arrangement for training.

8. Encouraging workers' participation in safety efforts.

9. Humanisation of working conditions and living environment.

12.2.0 Review of safety performance and out look:

The number of casulaities (both serious and fatal) has been an important yardstick to judge the performance in the field of safety. Table-1 gives the year-wise casulaities for Coal India mines from 1973 to 1977 and the rate based on production and employment.

Table – 1

Casualties 1973 to 1977 in Coal India Mines.

Year	No. of persons killed in mine accidents in the year.	Total of of persons seriously injured in mine accidents in the year.	Total Casualty (Fatal & Serious) in mine accidents during the year.	Rate: Per million tonne of output: Fatalities.	Seriously injured cases	Total	Per 300,000 manshifts worked: Fatalities.	Seriously injured cases	Total Casualty.
1973	165	1345	1510	2.37	19.49	21.69	0.36	2.93	3.29
1974	192	1442	1634	2.62	19.34	22.18	0.42	3.17	3.59
1975	233	1496	1729	2.72	17.53	20.21	0.47	3.02	3.50
1976	237	1130	1367	2.64	12.22	15.24	0.54	2.56	3.10
1977	186	1004	1190	2.10	11.65	13.45	0.44	2.39	2.83

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It is apparent from the above that the various efforts put in (as detailed later on) towards improving safety in mines have borne fruit and the mine accidants have shown a definite downward trend.

12.2.1 Stage reduction of accidents:

Long term aid of Coal India is to attain the stage of zero accident potentiality. Achievement of this has to be in stages aiming a gradual reduction of fatalities and bringing it to less than 0.3 per 300,000 manshifts worked by 1987-88 from a level of 0.44 in 1977.

12.3.0 Status of various measures to improve safety and programme for next 10 years.

Various measures for improvement of safety and the programme for next 10 years, like introduction of safer mining technology, electronics for safety, training etc., are being detailed in subsequent pages.

12.3.1 Introduction of Safer Mining Methods:

Introduction of longwall Mining, adoption of opencast mining in preference to underground workings, enhanced stowing arrangements to extract thicker seams are some of the techniques being adopted to achieve improved built in safety.

12.3.2 Introduction of Longwall Mining:

Longwall faces with individual steel supports (hydraulic or friction) have been introduced at Ningha Sudamdih and East Katras in B.C.C.L., Gidi and Saunda 'D' collieries in C.C.L., Banko and Surakachar Collieries in W.C.L. Equipment for longwall mining with self-advancing supports and shearer has been installed at Moonidih Colliery and for longwall mining with coal plough at East Katras Colliery. Plans have been made

The Singareni Collieries Company Limited.

Regd. Office :
KOTHAGUDEM COLLIERIES - 507101
Bhadrachalam Road Station,
S. C. Rly.

Grams : MANAGER

Phones -

Chairman & M. D.		1
General Manager		2
Addl. General Manager	301 Extn.	1
Chief - P & R	,,	10
Chief-Purchase & Stores	,,	17
Chief-Finance & Accounts	,,	19
Chief Engineer	,,	16
Secretary	,,	20
AO. Coal A/Cs.	,,	15
C. O. S.	,,	8

Ref. No. SO/SC/79-80/780

Date. 19. 6. 1979

MSG FROM SHRI M K V SUBBAIAH GM(HQ) SCC LTD. KGM.

MSG FOR SHRI R P KHOSLA, ADDL. SECY., DEPT OF COAL, NEW DELHI.

REFERENCE YOUR MSG NO.22014/2/79-CPD, DATED 15TH JUNE 79, PLEASE FIND HEREUNDER THE MONTH-WISE TARGET OF COAL PRODUCTION OF SCC FOR THE YEAR 1979-80(.)

MONTH	TARGET (IN LAKH TONNES)
APRIL 1979	8.23
MAY	8.80
JUNE	8.76
JULY	9.20
AUGUST	9.21
SEPTEMBER	9.00
OCTOBER	9.32
NOVEMBER	9.62
DECEMBER	10.24
JANUARY 1980	10.22
FEBRUARY	9.35
MARCH	10.05
TOTAL	112.00

21/6

GENERAL MANAGER(HQ).

Confirmation copy by post to

Shri R.P. Khosla,
Addl. Secretary,
Dept. of coal,
NEW DELHI.

GENERAL MANAGER(HQ).

to introduce 277 longwall faces in next 10 years both with individual supports and with powered supports. The number of longwall faces by the end of 1978-79 is likely to be 35; 159 by 82-83 and 277 by 87-88. They will provide 3.4% 21.3.% and 33.0 % of the total underground production respectively.

12.3.3 Opencast Mines:

The opencast production which was 20.77 m.t. (26.3%) in 1974-75 increased to 25.60 m.t. (28.8%) and is planned to increase it to 90.14 m.t. (44.8%) by 1987-88.

A large part of the Jharia Coalfield upto a depth of about 200 metres towards the outcrop and Gidi Colliery in C.C.L. have been identified for change over to opencast mining in preference to the underground. Project Reports are under preparation.

12.3.4 Stowing:

For extraction of thicker seams specially the coking coals in Jharia Coalfield, increased quantity of sand or other packing materials will be needed. The requirement of stowing material in C.I.L. mines which is about 10.0 million m^3 to-day is likely to increase to 15.81 million m^3 by 82-83 and 18.08 million m^3 by 87-88. One R&D plant for experimenting hydraulic stowing of crushed debries at Kankanee Colliery in B.C.C.L. is under implementation, and one at Bhurkunda in C.C.L. is under planning. Project reports have been formulated for long distance transport of sand from Maithon Tail End and Durgapur Barrage and the schemes are under consideration of various approving authorities.

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12.4.0 Introduction of New Mining Techniques and Technical Innovations:

12.4.1 Hydraulic Mining:

Hydraulic extraction of coal has been tried in Canada, Japan, USSR, West Germany and China and gives much better standard of safety compared to the conventional systems provided the geological conditions are of the right type. A draft project report has been prepared for R&D trail of hydraulic mining at Baragolai Colliery in NECL? which is likely to cost about 146 lakhs.

12.5.0 Introduction of Electronics for improved Safety.

12.5.1 Central Despatch System:

Use of the Central Despatch Systems for improving communication between a central control room on the surface and various critical points of activity underground, is being considered for all mines of C.I.L.

One such experimental system has already been installed at Moire Colliery in E.C.L. It is proposed to cover the 21 degree III gassy mines during 1978-79 and rest of the mines in next 10 years time. The commulative investment on this is estimated at Rs. 52.5 lakhs in 1978-79, Rs. 452.5 lakhs by 82-83 and Rs. 900.00 lakhs by 1987-88

12.5.2 Multi-point Monitoring Systems:

Multi-point Monitoring System for a continuous monitoring and record of methance and Co content of the air as well as the air velocity and other parameters at critical points in the mine, is being planned. One 40-point Methane, Co and Air

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servicing station may be able to look after the independently

The above facilities may be developed as a nucleous on a smaller scale during 1978-79 and may be gradually expanded into full_fledged servicing station by 1982-83.

12.6.6. Testing Facilities for mining equipment:

Coal companies purchase a large number of equipment bearing CMRSor DGMS approval or ISI marks for their quality and standard to meet certain specifications. But the manufacturers after getting the above certification do not maintain the quality of their products resulting in wasteful expenditure on the part of consumer organisation.

The above mentioned Central Servicing Stations may be equipped and enlarged to take up the job of sample/batch testing of such equipment, supplied by the manufacturers at a time. This will help the coal companies in keeping a close watch with a view to quality control, resulting in savings on the cost of sub_standard meterials and improved safety. This will also help them in developing their own standards and specification.

12.7.0 Preventive measures against inundation:

12.7.1 Inundation from surface water:

As recommended by the Committee on Safety in Coal Mines, all mines where dangers of inrush of water from Rivers, Nalas etc., is anticipated have been provided with warning systems.

Use of Radio Controlled electronic warning system to monitor the floods in Damodar river is also under contemplation, as mentioned earlier.

12.6.3 Carbon-monoxide detectors:

Almost very mine has been provided with a Carbon-monoxide detector for an on the spot detection of carbon-monoxide, and more will have to be provided in next 10 years. The investment on this account is estimated at Rs. 2.5 lakhs in 1978-79, Rs. 6.0 lakhs by 82-83 and Rs. 9.0 lakhs by 87-88.

12.6.4 Area Laboratories:

Most of the areas have been provided with central laboratories for quick analysis of mine air samples and coal dust samples on regular basis. Those not covered so far will be covered in next two years time.

12.6.5 Safety Equipment Servicing Facilities:

With the changed outlook on safety a large number of various safety equipment are likely to be introduced in the coal mines. They will need regular servicing, maintenance and calibration for standardisation so as to keep them in working order. Therefore, it is suggested that in each subsidiary company a central servicing station should be set up for equipment like methanometers, gas detectors, velometers, anemometers and pressure gauges etc.

Similarly, it is suggested to set up a cell consisting of qualified and well trained Electronic Engineerings, electricians in CMPDI for the servicing and maintenance of sophisticated electronic equipment like the multi-point and single point methane monioring devices, control despatch systems etc. They will also train people from subsidiary companies for similar jobs so that with the increasing number of such electronic devices in use the above mentioned central

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Velocity Monitoring System is in the process of procurement for Moonidih Collier in B.C.C.L. It is proposed to install 10 such units at a cost of Rs. 50 lakhs during 1978-79. The number of such units is likely to go upto 40 by 1982-83 and 80 by 87-88, at an estimated capital outlay of Rs. 200 and 400 lakhs respectively.

12.5.3 <u>Single-Point Methane Monitoring System:</u>

Single-point Methane Monitoring Systems are initially proposed to be provided at each longwall face. Gradually these may be provided in other extraction areas also. It is proposed to install 25 such units during 1978-79, 117 by 82-83 and 226 by 1987-88 each costing about a lakh of rupees.

12.6.0 <u>Environmental Conditions Underground:</u>

12.6.1 <u>Mechanical Ventilators:</u>

In order to improve the environmental conditions underground, all mines are now provided with a mechanical ventilator or replaced by a larger one where necessary. For development areas auxiliary fans are also being provided. Capital outlay on this account is likely to be about Rs. 1[illegible]2 lakhs during 1978-79, another Rs. 440 lakhs by 82-83 and Rs. 888 lakhs by 1987-88.

12.6.2 <u>Methanometers:</u>

Regular checking of the underground atmosphere for methane is important for the safety of workers. Nearly 750 Methanometers have already been procured and distributed to varous mines and another 855 are likely to be distributed during 1978-79. The number will go up to 2050 by 82-83 and 3550 by 87-88. The capital on this account is estimated at Rs. 25.65 lakhs in 1978-79, Rs 61.50 lakhs by 82-83 and Rs.106.5 lakhs by 87-88.

This working group feels that use of quarry detries for making embankments between the mine workings and water courses should be avoided. The embankments where necessary should be properly designed and constructed.

In order to implement the recommendations of the above Committee on Safety in Coal Mines a cell has been created in each subsidiary companies to monitor the progress in this field.

12.7.2. Inundation from Underground Workings:

Danger arises when present workings approach water bodies in old workings and suddely puncture into it. So to safeguard against this burnside boring machines are being provided to delineate such water bodies and dewater them in advance of workings. There are 30 such machines already in use. It is proposed to provide another 39 during 1978-79, 90 by 82-83 and 139 by 87-88 at a cost approximately one lakh each.

12.8.0 Alternative source of electric supply for emergency:

Dangerous situation may arise due to stoppage of the main mechanical ventilator in highly gassy mines, in case of power failutures. Therefore, alternative source of electric supply has already been provided in 5 collieries in E.C.L., 3 in B.C.C.L. and 4 in C.C.L.

Diesel generating sets are being provided at the 9 remaining Degree III gassy mines, during 1978-79 at a cost of Rs. 45 lakhs. Another 45 mines will be covered by 1982-83 and 126 by 87-88 so as to cover all degree II mines also. The capital outlay is estimated to be Rs. 340 by 82-83 and Rs. 630 lakhs by 87-88.

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12.9.0 Underground Supports:

The roof and side falls due to strata movement during extraction of coal has been one of the major causes of accidents in mines. Therefore, in addition to technological improvements and introduction of solf advancing powered supports, hydraulic and friction props, action has been initiated for purchase of better quality of timber directly from the State Governments rather than through middlemen and also for gradual replacement of timber support by steel supports.

Roof and side belting and stitching with various materials like steel rods, wire ropes, etc., are also under trial in many mines and their use is likely to increase further.

It is proposed to reduce the requirement of timber to the barest minimum by 1987-88. Investment on steel supports is likely to be Rs. 675 lakhs during 1978-79, Rs. 6225 lakhs by 82-83 and Rs.12400 lakhs by 87-88.

12.10. Protective equipment:

12.10.1 Hats and Footwears:

Each and every underground worker is now provided with protective footwear, helmets, etc. This has holped in substantial reduction in the number of injuries to the miners.

12.10.2 Self-Rescuers:

All the 18500 workers in Degree III gassy mines and some in degree II mines have now been provided with Self-Rescuers for use in emergency to protect them from carbon-monoxide poisoning in case of an explosion in a mine. It is proposed to provide Self-Rescuers to all the underground workers in next 10 years. Investment

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[illegible]
on this account is is lik[illegible] to be Rs. 1250 lakhs by 82-83 and Rs. 2500 lakhs by 87-88.

12.11.0 <u>Emergency Rescue Equipment:</u>

Emergency heavy rescue equipment like the emergency/mobile winders escapehoists, Large diameter boring machines and submersible pumps are not being maintained by the present rescue stations. It is proposed to provide such equipment for use during emergency at six centres to cover all the coalfields in the country-

<u>Proposed Stations are:</u>

1. Sodepur (ECL)
2. Sudamdih (BCCL)
3. Barkakana (CCL)
4. Talcher(CCL)
5. Silewara (WCL)
6. Korba (WCL)

Investment on this account is likely to be Rs.100 lakhs during 1978-79, Rs. 213 lakhs by 82-83 and Rs. 288 lakhs by 87-88.

12.12.0 <u>Transport system:</u>

Next to roo and side falls, haulage is the second major cause of accidents in mines, mainly due to derailments and breakage of the ropes.

12.12.1 <u>Replacement of lighter section rails:</u>

Lighter section rails used earlier which are found unsuitable for the one-tonne tube now being used are being replaced by 30 lbs. rails. The action has been started and no lighter section rails are now being purchased.

12.12.2 <u>Other measures:</u>

To reduce accidents because of the haulage rope in motion, safety devices in the new haulages under manufacture, blinking lights for warning, and better illumination of haulage roads, etc. are being introduced.

12.12.3 Manriding arrangements:

With the increasing size of mines the distance covered by underground workmen to reach his place of work will gradually increase. This will not only cause strain on the workmen thereby reducing his productivity but also make him susceptible to more accidents due to fatigue. Manriding haulages are being planned for Girimint, Swang, Banki, Eklehra, South Jhagrakhand and Bargolai collieries. The number is likely to increase further on success of the trails at above mines.

12.13.0 Coal dust Treatment:

• Coal dust produced during extraction of coal causes health-hazard to the workers and may also cause an explosion in the mine. Large quantity of lime stone dust is regularly dusted and water spraying done in all the underground mines to make the coal dust harmless. Investment towards water spraying to be done is likely to be Rs. 17.0 lakhs during 1978-79, Rs. 59.0 lakhs by 1982-83 and Rs. 106.lakhs by 87-88.

12.14.0 Other Safety Measures:

12.14.1 Lighting:

There is a total absence of natural light in underground workings and flame-proof or intrinsically safe artificial lighting has to be used underground for illumination. Due to constant advance of the extraction areas, the lighting arrangement has to be portable or transportable.

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12.14.2 Cap Lamps:

Each and every worker working underground is now provided with an electric cap lamp. Additional cap lamps will be required for nearly 1½ lakhs more workers to be employed in next 10 years underground, needing a total investment of nearly 5 crores.

12.14.3 Bulkhead light fittings:

Bulkhead light fittings are now being introduced for lighting of places like the pit-bottoms, haulage roads, travelling roads, transfer points, etc. Rs. 200 lakhs will be needed for this during next 10 years.

12.14.4 Safety Organisation:

In order to keep an internal vigil on safety conciousness, Safety Organisations in each Company Headquarters, Area Offices and Collieries have been established in all the producing companies. In some of the companies these organisations function independent of the production personnel while in other they function as part of the production set-up. These Safety Organisations not only formulate and advise on safety plans and programmes but also investigate the various eccidents and carry out mine inspections and internal audit on safety.

12.15.0 Workers' participation and Workmen Inspectors:

For increased workers' participation in safety, the following actions have been taken:-

i) Formation of Safety Committees in all mines.

ii) Appointment of Workmen's Inspectors.

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(iii) Publicity to educate workers on safety to win their willing co-operation in implementation of safety measures.

(iv) Organization of Safety Weeks and Fortnights.

(v) Use of public address systems with pre-recorded safety instructions at pit heads.

12.16.0 Training:

Attitude and skill of the workmen while at work is most important for accident prevention and this can be developed only by training. Vocational Training Institutes are now functioning in almost all the Sub-Areas and a programme to train each and every worker in a mine has been drawn up. It is proposed that all the workers will be trained by March, 1982 in the V.T.C. and retrained thereafter once in every 5 years.

In addition to vocational training, special training institutes are being established for imparting training in advanced technologies at Longwall Training Institute at Moonidih and Opencast Training Institute at Singrauli. These institutes will impart especialised training in operation and maintenance of sophisticated equipment.

12.17.0 Safety Publications:

A programme of publishing Manuals in English and Hindi for various trades, have been undertaken. So far four manuals have been published and another 11 are under publication.

12.18.0 Emergency Organisation:

Adequate Organisation is needed to deal with emergencies which may arise due to serious accidents. Draft Emergency Organisation has been drawn up and is likely to be finalised and put into effect soon.

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12.19.0 Post-accident Care:

In order to avoid minor injuries developing into serious injuries and serious ones into fatel, a large number of supervisors and workers are being trained in first-aid in addition to the provision of first-aid room, first-aid Kits, etc. The aim is to render the First aid or medical help at the earliest instan

12.20.0 Conservation of Coal:

Coal being a valuable natural resources has to be conserved judiciously. A large amount of coal is lost due to fire every year. Similarly huge amount is locked up in various fire areas, under railway lines, roads, rivers, townships and other structures. The various action being taken for conservation include:-

i) Control of the fires from extension and measures to contain them.

ii) Stowing below built-up areas, railway lines and roads.

iii) Diversion of roads, railway lines and rivers, wherever economically possible.

On the recommendation of the Committee on Safety in Coal Mines, Government of India is also considering making legislation to prohibit further inhibitation on the coal bearing areas; and also shifting of townships like Jharia, Raniganj, Barakar etc.

12.21.0 CONCLUSION:

It will thus be seen that inspite of the best efforts having been made to improve the safety standards in the mines, a lot of more is still to be done, and will always be needed to be done since safety is not an onetime affairs but it needs constant review and action. We have to plan for gradual reduction of the mine accidents so as to approach the stage of Zero Accident potential. The major thrust areas for safety will be:-

1) Total systems approach so as to integrate safety as a part of mining operation right from the planning stage.
2) Instroduction of safer mining methods like longwall and Opencast Mining on a larger scale
3) Greater stress on training and re-training of each and every worker employed in the mine.
4) Introduction of electronics in the mining to reduce dependence on human judgement and to safeguard against human failures.
5) Rigid check for quality control of safety and other mining equipment to improve the safety Standards, reduction in cost and better utilization of the equipment.

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SUBSIDIES IN COAL INDUSTRY

Chapter Coverage:

This chapter covers the terms of reference (**)

To suggest the manner in which the subsides if any may be eliminated.

13.1 The two subsidies in force in the Coal Industry are assistance/subsidies for conservation and development and for housing for the coal miners. It must be realized, however, that these subsidies to the coal companies are not, unlike in the case of normal subsidies, financed from general revenues of the Government. Net proceeds from collection of specific excise duties or cesses paid by the coal consumers for each tonne of coal purchased ~~paid by the coal consumers for each tonne of coal purchased~~ from the funds from which assistance is granted to individual units in the Coal Industry. Such assistance is given against actual cost incurred on conservation and development and housing.

Conservation and Development Assistance.

13.2 Primarily with a view to ensuring conservation of the extremely limited reserves of coal of superior quality in particular, the coal Mines (Conservation, Safety and Development) Act, 1952 was enacted. The act among other things authorised the Government to levey a duty of excise on coal and coke and provided for the utilisation of its proceeds for conservation, safety and development measures in coal mines. Except for the portion of the funds collected through this duty, which was earmarked for financing the subsidy scheme for the movement of coal by rail-cum-sea route which was

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administered by the Coal Controller, the fund was operated by the coal Board. Under a new Act entitled 'the Coal Mines (Conservation and Development) Act, 1974, the Coal Board was abolished and the operation of the fund was taken over by the Department of Coal.

13.3 Mining of coal from underground may be done by caving method which means allowing the roof to subside because of the vacuum caused by extraction of coal. Such caving methods may lead to loss of coal reserves in the upper seams and/or damage to buildings and properties on the surface due to subsistance. Where such possibilities of subsistence and damage to coal reserves and/or properties arise, the collieries are required under the law to fill up the vacuum created by coal extraction with sand or other stowing materials. Inasmuch as such stowing is done in the national interests of conservation, safety and protection of surface properties and since sand stowing or allied activities foe conservation, safety and development imply additional costs, the collieries are given subsidy by the Govt. on the actual amount of stowing done and other operations connected with conservation and development of coal mines.

13.4 As at present the rates of excise duty are as follow:-

Coal/Coke	Rs.per tonne.
Non-coking coal(raw& washed)	1.65
Soft Coke	1.65
Coking Coal(raw,washed clean,middlings and rejects).	2.40
Hard Coke	3.60

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13.5 The excise duty is shown separately in coal sale bills and collected by the collieries/companies concerned and deposited with Coal Controller Calcutta. In each financial year, a sum not exceeding the net proceeds (total collections less refunds and expenses of collection and administration) during the preceding financial years are to be disbursed by the Central Government to the collieries claiming grant of financial assistance under the Act as per the recommendations of the Coal Conservation and Development Advisory Committee. The purposes for which assistance may be given by the Government include all operations of collieries connected with conservation of coal, development of coal mines, stowing and other allied operations connected with safety, research work connected with conservation and utilisation of coal as also transportation or distribution of coal. However, since traditionally stowing has been a major conservation operation, the excise duty under rule 12 of the Coal Mines (Conservation & Development) Rules, 1975 has come to be generally referred to as stowing excise and the assistance under the Rule as stowing subsidy.

13.6 Proposals for assistance are submitted to Director, Department of Coal Ministry of Energy in the prescribed forms giving details of work to be undertaken for the year. At the close of the year, a consolidated statement is to be submitted. The amount collected as excise duty currently is about Rs. 20 crores per annum. In 1975-76, an amount of Rs. 16.40 crores was claimed by Coal India based on actual expenditure incurred, of which stowing alone

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accounted for Rs. 11.81 crores. The Government assistance, however, was only to the extent of Rs. 11.81 crores (against the expenditure of Rs. 16.40 crores).

23.7 The disbursements of financial assistance under the Act is done mainly for the following purposes (a) stowing in mines (b) adverse factores affecting specific collieries (c) protective works (against fire, inundation etc.) and (d) operation and maintenance or ropeways for transportation of sand for stowing in the Bengal Bihar Coalfields. The disbursements of funds under the Act during the last five years were as indicated below:

Purpose	Disbursements (Rs. crores)				
	1973-74	1974-75	1975-76	1976-77	1977-78
Stowing subsidy	4.01	4.25			
Special assistance for adverse factors	1.00	2.00	11.38	5.20	12.46
Protective Works subsidy	0.09	0.06			
Refund of Excise duty (due to double incidence etc.).	0.52	0.59	0.33	0.47	0.10
Central Ropeway (Capital Expenditure.)	3.23	3.21	3.17	0.55	3.36
Administrative Expenditure.	0.49	0.61	0.06	0.02	-
Others	0.16	0.09	0.06	-	-
Total	9.50	10.81	15.00	0.24	15.92

23.8 Since nationalisation the conservation operations other than stowing are increasingly becoming important. The expenditure on stowing is also expected to increase fast. It has been estimated that the expenditure under various heads admissible for assistance (Subsidy) as per

Coal Mines (Conservation & Development) Rules 1975 would be of the order of Rs. 67 crores in 1978-79 and Rs. 12.05 for 1983-84. Based on past trends and programmes proposed and likely to be taken up under various conservation and development. heads the cost per tonne for stowing operations (including BCCL's schemes) and protective works alone it has been estimated would be about Rs. 4.50 per tonne in 1978-79 and will be about Rs. 9.00 per tonne by 1983-84. As against this, the present rates of excise duty varies from Rs. 1.65 per tonne to Rs. 3.60 per tonne only. If however, the expenditure on scientific development of mines coal utilization projects and research and Development on Coal transportation, sand transportation, coal utilization, ventilation and environmental conditions monitoring, etc, the cost on account of all such expenditure would workout to Rs. 6.76 per tonne of coal production in 1978-79 and Rs. 12.05 per tonne in 1983-84. The rise in costs are primarily because of back long in conservation efforts invented from the past including fire fighting worker and operation of BCCL's scheme for long distance recovery and transportation of sand that have to be taken up in view ofdepletion of nearby sources of sand. It follows therefore, that the rate of excise duty needs to be raised substantially. The existing rules provide for enhancement of the duties upto Rs. 10/- per tonne.

13.9 In this connection, it may also be noted that at present the coal companies collect the excise realizations and deposit them to the exchequer and than apply for reimbursements. As a result the time-lag between actual expenditure and reimbursement is considerably entailing higher interest incidence on coal companies. Besides, some amount of administrative expenses into the disbursable funds.

3.10. As indicated earlier part of the net proceeds is also utilised for the payment of Rail-cum sea Route subsidy. In 1961, in view of the difficult rail transport situation at that time, the Government of India decided to move 2 million tonnes moving at that time. Since freight charges by coastal shipping route were higher than by the all rail route, it was considered that the coal transported sea route should be made available to the consumers at almost the same price as coal moved by all rail route. It was therefore, decided that the consumers of seaborne coal should receive as subsidy an amount about equal to the difference between the actual freight by rail-cum-sea route and the all-rail route. The drawing of sea-cum-rail subsidy from the same poor results in reduction in the funds available for conservation and development subsidy of coal was as follows:-

Year	Amount of Subsidy (Rs. crores)		
	Railways	Other consumers	Total
1971-72	1.37	0.12	1.49
1972-73	1.80	0.40	2.20
1973-74	1.48	0.82	2.30
1974-75	1.35	0.23	1.62
1975-76	3.24	0.26	3.50
1976-77	1.27	0.73	2.00
1977-78	3.39	0.46	3.85
1978-79*			5.66

* Budget Provision.

13.11 Coal mines are situated in geographically remote areas with the result that the mine workers are deprived of even the basic amentities of life like decent house protected watersupply medical aid education for their children etc. Provision of housing to the workers in coal mines is not only a social obligation butthe same contributes to substantial improvement in attendance and productivity of the workers. Reckoning the crying need for housing and necessity for improving welfare amenities in coal mines coal mines Labour Welfare Organisation was set up under the Coal Mines Labour Welfare Fund Act. 1947.

13.12 The Coal Mines Labour Welfare Cess levied @ 75 paise per metric tonne from 17th January 1973 is apportioned between the Housing Account and General Welfare Account of the Fund in the ratio of 2:3. The annual receipt of cess is presently of the order of Rs. 6 crores out of which Rs. 2.4 crores is earmarked for the Housing Account. The erstwhile colliery owners did not give due attention to the welfare of the employees in spite of facilities available to them for construction of houses under the Coal Mines Labour Welfare Fund Scheme. This has resulted in accumulation of nearly Rs. 13 crores in the Housing Account of the Fund.

13.13 The situation at the time of takeover of coal mines was one of serious backlog of fulfilment of basis welfare needs and housing constituted most pressing need of the workers. The status of housing at the time of nationalisation was hardly 116356 houses out of which more than 30000 accounted for dhowrahs in dilapidated condition. The

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resultant poor housing satisfaction of 20% posed major challenge to the nationalised coal industry. In spite of constraints like buildable land scarcity of construction materials like cement and steel funds etc. the effort of the nationalised coal industry have culminated in the improvement in the housing satisfaction to the level of 28% as at present. Comparsion of housing satisfaction available to the workers in the other industries like steel oil fertiliser and other mining industries would indicate that there is no industry where shortage of housing is as acute as in the coal industry. Even according to the guidlines of Bureau of Public Enterprises and for conditions relevant to coal industry the housing satisfaction has to be in the range of 55 to 70%. Such stupandous task cannot be achieved in a short time and would call for meticulous planning both long term and short term planning which have not only to identify the likely constraints but should evolve strategies for over coming such constraints. While constraints in other areas relevant to housing can be examined in depth and coresctive measure planned in advance we should not lose sight of ensuring adequate each flow to sustain such massive housing programme. In this context the role of Coal Mines Labour Welfare Fund and subsidy forthcoming from this organisation assumes paramount importance.

13.14. Under the Coal Mines Labour Welfare Fund broadly speaking at present there are two kinds of houses which have been approved by the Fund. The first category known as Type-I Houses (plinth area 354 sft and floor area 269.3 sft) are covered by Low Cost Housing scheme and other

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category known as Type-II Houses (plinth area 451 sft. and floor area 352 sft) are covered by New Housing scheme. Coal Mines Labour Welfare Fund subsidies housing under these approved schemes and the quantum of subsidy for Type I houses under Low Cost Housing Scheme is 75% of actual cost of construction or 75% of unit cost taken as Rs. 6825 for ordinary soil and unit cost of Rs.7925 for black cotten soil conditions whichever is less. Subsidy for Type-II houses under New Housing scheme is 75% of actual cost of construction or 75% of unit cost taken as Rs. 11325 for ordinary soil and Rs. 13425 for black cotton soil conditions whichever is less

13.5. There is already an awareness of the fact that the funds available ander housing account are totally inadequate to sustain massive housing programme required to be undertaken. by nationalised coal industry. Reportedly the Coal Mines Labour Welfare Fund Advisory Committee has recommended enhancement of the welfare cess from the present level of 75 paise to Rs. 5 per tonne. It is doubtful whether even such an escalation in the cess would be adequate to sustain the housing programme of the order as envisaged. Ironically even the procedure for claiming the subsidy from Coal Mines Labour Welfare Fund for construction of houses is so tedious and time consuming that the deficiencies in the procedure have a significant contribution in the slippages of housing construction. Unless the procedures are simplified and funds are made available to the coal producing companies at the beginning of the year itself no improvement in housing stock can be expected.

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13.15 Ten years Perspective Plan 1978-79 to 1987-88 for Welfare Amenities and Social Benefits has been drawn up by Coal India. The welfare plan envisages total capital investment of Rs. 376 crores during the ten year period and of this Rs. 2725 crores is earmarked for housing.

13.16 Salient features of the housing programme are given below:

Period	Addl. houses to be built.	Total houses at the end of the period.	Capital outlay in Rs. crores.	Housing Satisfaction.
1.4.78		161995		27.57%
1978-79	12925	174920	17.11	29.44%
1982-83	63280	238200	107.65	37.09%
1987-88	80700	318500	147.75	45.00%

13.17 The Singareni Collieries Co. Ltd. have incurred an expenditure of Rs. 2.20 crores on welfare during 76-77 and Rs. 2.46 crores during 77-78 and have a budgetory allocation of Rs. 2.75 crores during the current year. The company envisages increase in manpower from the level of 60000 for 78-79 to the level of one lakh envisaged during 1987-88. Assuming similar pattern of growth in the field of welfare as envisaged for CIL capital investment of welfare during the ten year period is expected to be around Rs. 50 crores of which allocation on housing would be of the order of Rs. 30 to 35 crores.

Thus capital investment on housing by Coal India and SCCL during the ten year period is expected to be around Rs. 425 crores out of which appx. Rs.300 crores would account for housing. It is high time that

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that due thought is given regarding the continuance or otherwise of Coal Mines Welfare Organisation as a separate entity. In the context of the entire coal industry being in the nationalised sector the objective and the purpose in setting up the Coal Mines Welfare Organisation would appear to be not relevant in the present context. Even if Coal Mines Welfare Organisation is to exist in present form to keep watch over the welfare amenities being provided by nationalised coal industry major reorganisation and rethinking in its functioning consistent with the role it has to play in sustaining the massive welfare programme would be necessary.

CHAPTER - XIV

ENVIRONMENTAL CONTROL

INTRODUCTORY:

14.1 Activities associated with coal mining pose multifaceted environmental pollution problems. The impact of environmental pollution brought about by mining of coal and lignite has not yet been seriously felt due to the fact that such mines are scattered and scale of opencast mining so far has been limited.

ENVIRONMENTAL PROBLEM DUE TO MINING & MINING ACTIVITIES IN THE COMING YEARS:

14.2.1 In the coming years picture would rapidly change. The contribution of coal from open cast mines would increase from the present level of about 24 mt (27% of total coal production) to cover 90 mt. (45% of total coal production) by 1987-88. Reconstruction of Jharia coalfield in collaboration with Poland envisages opening of large mines some of which would be opencast mines.

14.2.2 In addition to the existing 14 Coal Washeries 30 new coal washeries are envisaged in the next ten years period. In Singaranli Coalfield several giant coal mining projects situated contiguous to each other would be developed. With the setting up of pit head Super Thermal Power Stations and coal-based fertiliser complex in the heart of the coalfield the dimension of mining environmental problem in the coming years would be both complex as well as collosal.

ENVIRONMENTAL POLLUTION & STATUTE:

14.3.1 It would therefore be prudent to identify spcific environmental pollution areas and evolve proper environmental control strategy so that the damage function is minimised.

14.3.2 Certain statutes like Water Pollution Act are already in force and other statutes covering air pollution and environmental control are in the offing while such statutes were earlier non-existent. This indicates the awareness of the nation to the problem of environmental pollution and necessity to quickly implement environmental control measures. For developing countries like India which is industrially in infant stage such awareness is a good augery.

14.3.3 ISI has already drawn up tolerance limits for industrial effluents of various industries discharged into (i) inland surface water (IS 2490) (ii) marine coastal areas (IS 7968) (iii) public sewers (IS 3306) (iv) land for irrigation purposes (IS 3307) etc.

14.3.4 ISI is presently engaged in working out ambient air quality standards and standards relating to air pollution emission standards for Thermal Power Stations Chemical Fertiliser & Petroleum industry etc.

14.3.5 Environmental control measures should aim to satisfy the provisions of statute apart from improving the environment in and around coalfields.

LAND DAMAGE DUE TO MINING

LAND DAMAGE DUE TO OPENCAST MINING:

14.4.1 Opencast mining operation necessarily entails clearance of vegetation removal of soil and rocks. This results in open pits and overburden dumps being left disfiguring the landscape. The rock wastes are usually devoid of nutrients and soil bacteria and poor water retainers and many a time contain toxic concentrations of chemicals harmful to plant life. It is this realisation and precisely for these very reasons the environmental lobbyists the world over are mobilising public opinion to force mine owners to reclaim the land and restore it to original condition. National Coal Board UK Legislation of British, Columbia, Canada, USA, etc. make it incumbent on the mine owners to reclaim the worked out land and restore it to original condition.

14.4.2 The most common reclamation method is to grade the waste rock dump fill the pit first with large rock material then cover with smaller pieces of rock and then with top soil and finally plant in the area.

14.4.3 While all these measures mean cost it is estimated that for our conditions reclamation of land higherto mined by open cast method would result in increasing production cost of coal to the tune of Rs.8 to Rs.10 per tonne. Paradoxically this element is totally absent at present. Hence such measures will have to be introduced with caution and only when the nation can bear this burden of increased cost of coal.

LAND DAMAGE DUE TO UNDERGROUND MINING:

14.4.2 It is well known that underground mining operations particularly depillaring or caving in operations result in ground movement and subsidence of surface area. This poses problems regarding safety of structures on the surface like buildings roads, railway line etc. Cracks in the subsided area pose drainage problems. Remedial measures for subsidence have already been taken by UK and other countries.

In India there has been greater awareness of subsidence in Jharia Coalfield. Further research on stowing and partial extraction would be desirable to determine optimum extraction of coal. Though control of subsidence through harmonic and semi-harmonic mining is practised in deep mines in Germany the same would not be feasible for Indian conditions.

LAND DAMAGE DUE TO MINE FIRES

14.4.3 Spontaneous ignition of coal seams in outcrop or goaved areas underground pose elusive problem. Total number of notable existing fires in all India coalfields are 158 of which 96 are in Jharia and 35 in Raniganj coalfields. Dormant and active fires in Jharia coalfields account for loss of 39 million tonnes of precious coking coal. Control measures are adoption of better extraction methods less prone to fires early detection of fire and fire fighting. Underground fires can be controlled by sealing them against air from surface. Clay or sand blanketting and poughing the surface in stages to create a seal of pulverised earth upto 3m. deep are effective in controlling mine fires. It is high time that systematic studies and strategy to effectively combat mine fires particularly in Jharia-Raniganj coalfields are evolved.

WATER POLLUTION DUE TO MINING

ACID MINE DRAINAGE:

14.5.1 Pyritic nodules of sulfureous materials present in or associated with the coal seam in contact with air and water causes formation of acid mine water. The chemical reaction produces sulfuric acid and ferrous sulphates. The ferous sulphate can undergo further reaction with air & water to form ferric hydroxide which imparts yellow orange colour to water. The problem of acid mine drainage is most acute in mines in Assam Pench and Chirimiri coalfields. Acid mine drainage is causing havoc to pumps pipelines and underground equipment. While some work on 'treatment on the spot' was initiated by National Environmental Engineering Research Institute this has to be taken up as fullfledged research project in collaboration with NML and Pump Manufacturers Association of India.

EFFLUENT FROM COAL WASHERIES
FORMED COKE PLANT ETC:

14.5.2 Effluent from coal washery formed coke plant etc. also need to be treated. There is scope for considerable research work including determination of coagulent aids synthetic or natural. Most of the coal washeries are on closed water circuit and even in the case of washeries action would need to be taken to convert them into closed water circuit.

MINE WATER PUMPED OUT FROM PITS:

14.5.3 Water pumped out from mines has generally PH ranging from 7.0 to 8.0 but they sometimes contain large quantities of suspended fire coal particles which pose problem to water treatment plants located down below the point where the mine water joint natural stream or river. This also adversely affects fish life. Damodar River is a pointer. It would be necessary to evolve measures to control this pollution so that provisions of tolerance limits as spelt out by ISI are not violated.

NOISE DUE TO MINING OPERATIONS:

14.6 One of the hazards associated with mining activities is the problem of noise. Blasting extraction and handling of coal loading of coal noise caused by constant plying of trucks dumpers & HEM transportation of coal by rail etc. substantially increase the noise level. Noise produces disagreeable effects on hearing thresholds speech intelligibility interferences changes in psychological and physiological state including annoyance and sleep interruptions. Though noise is considered as occupational hazard it is time that measures for abatement of noise are evolved by providing suitable inbuilt mechanism in equipment and also by undertaking systematic studies on noise due to mining activities. While acceptable indoor noise levels varies from 30 to 50 DBA recommended levels of exposure to industrial noise is in the range of 105 to 115 dBA (OSHA Standards).

AIR POLLUTION DUE TO MINING ACTIVITIES:

14.7 Air pollution due to mining and ancillary activities of late is causing grave concern. Manufacture of hard coke in beehive coke ovens and of soft coke in open stacks contribute to a large volume of atmospheric pollutants. Thermal inversions and smog are a recurring problem in Jharia Raniganj coalfields with attendant traffic safety problems. Dust due to drilling blasting handling and transportation of coal washeries and other ancillary mining activities poses serious threat in coalfield areas.

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In Jharia & Raniganj coalfields other than coal mining activity there are other industries like fertilizer chemicals etc. which cumulatively cause considerable air pollution. The magnitude are diversity of air pollution problem was high-lighted in the 'All India Seminar on Atmospheric Pollution in Jharia Coalfield' (Aug 10 & 11 74) sponsored by the Institution of Engineers India.

In the coming years the air pollution problem would be further aggravated due to pithead Super Thermal Power Stations and coal based fertilizer plants being located in the heatt of coalfield. Emissions from such giant thermal power stations and emissions from fertilizer complexes etc. would be of grave concern. The environmental hazards of such type are of recent origin. Since we are yet to embark on a major industrial venture we are relatively in advantageous position. Reportedly the problem of air pollution in an around coalfield areas has already attracted the attention of the authorities. Pollution in coal mining areas is being taken up by NEERI in collaboration with CIL and possibly CFRI. Air pollution Bill is expected to be enacted shortly and standards for emissions from various industries are also expected to be finalised shortly. We should ensure that environmental control strategy and measures substantially combat the problem.

OCCUPATIONAL HEALTH HAZARDS
DUE TO MINING ACTIVITIES

14.8 It is a well known fact that pneumokoniosis dermatitis nystagmus hook work dysentry are caused due to the environmental changes brought about by mining activities. These diseases are of grave concern to the mining industry because of their adverse effect on the health of the miners and loss of miners and loss of working hours effecting coal production. While improved illumination in working area dust supression by water spraying etc. help in minimising the hazard there is considerable scope for research. It should be appropriate that fulfledged Occupational Health Centre for mining industry be set up to effectively tackle the occupational diseases associated with mining industry.

THE EFFECT ON ECOSYSTEMS:

14.9 The diverse activities of mining industry has direct adverse effect on the ecological balance of plant and animal life. Disposal methods for liquid airborne and solid wastes by mining industry should be harmonised with an aim to protect plant and animal life to restore ecological balances. Reclamation of mined/worked out land minimising coal dust particles in water discharged in natural streams and planting of trees in and around coalfield are steps in the right direction to safeguard ecological balance.

CONCLUSION

14.10 While mining of coal and lignite for use as prime source of energy is in the best interest of the nation we whould not overlook diverse environmental problems posed by mining activities.

Following measures for control of environmental are recommended:

14.10.1 Reclamation of worked out open cast mines should be done to ensure proper land use and restore ecological balance.

14.10.2 Remedial measures for control of subsidence and further research on stowing and partial extraction should be undertaken.

14.10.3 Adoption of mining extraction methods less prone to fire early detection of fire and fire fighting. It would be necessary to tackle mine fires particularly in Jharia Raniganj coalfields in a comprehensive and systematic manner.

14.10.4 Further research should be undertaken for control of acid mine drainage.

14.10.5 Coal washeries should be planned on 'closed water circuit' and even in the case of existing coal washeries the switchover to 'closed water circuit' should be done with utmost expediency.

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14.10.6 Further research on treatment of effluents from coal washeries coke over plants etc. is a necessity. Similarly further studies on coagulent aids/flocculant aids for effluent treatment should be undertaken.

14.10.7 Treatment of pit water and other effluents discharged into nalas or streams so that the same conform to tolerance limits for effluents.

14.10.8 Measures for abatement of industrial noise due to various mining activities should be adopted.

14.10.9 Control of atmospheric pollution in coalfield areas and air quality survelillance in Jharia Raniganj and similar coalfields should be undertaken. Thermal power stations Fertiliser Chemical and other industries located in coalfields should also adopt measures to control emissions so that they are within emission standards and the ambient air quality standards is also maintained.

14.10.10 Low temperature Carbonisation Plants should ultimately replace traditional soft coke making in small dumps which cumulatively cause more serious air pollution.

14. 10.11 Occupational Health Research Cent-re for mining industry should be immediately set up and major thrust provided for control of occupational diseases. Measures like better illumination of working area dust supression by water spraying etc, which minimise occupational hazards should be compulsorily adopted in all mines.

14.10.12 Plantation in and around coal mines and disposal methods for liquid air borne and solid wastes aimed at protection of ecosystems should be adopted.

Essential measures for environemtnal control is to be reckoned as an integral part of mining activities and cost thereof has to be absored as basic and essential component of production cost of coal/lignite.

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CHAPTER - XV

INVESTMENT PROGRAMME

The Investment programme is at present under consideration of the Sub-Committee constituted under the Chairmanship of Financial Adviser of the Department of Coal, and will be submitted separately.

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ANNEXURE I

THE COMPOSITION AND TERMS OF REFERENCE

Composition

1.	Secretary, Department of Coal	Chairman
2.	Representative of Department of Coal	Member
3.	Representative of Deptt of Steel	Member
4.	Representative of Deptt. of Power	Member
5.	Representative of Deptt. of Railways	Member
6.	Representative of Deptt. of Heavy Industry.	Member
7.	Representative of Ministry of Finance(Plan Finance)	Member
8.	Representative of Ministry of Labour(Dte.Gen. of Mines Safety)	Member
9.	Representative of Deptt. of Science & Technology.	Member
10.	Two representative of Planning Commission(Perspective Planning & Energy Division).	Member
11.	Representative of CFRI	Member
12.	Representative of G.S.I.	Member
13.	Representative of CMRS	Member
14.	Chairman/Managing Director, Coal India Ltd. or his representative	Member
15.	Chairman/Managing Director, Singareni Collieries Co. Ltd. or his representative.	Member.

Terms of reference.

i) To review the performance during the Fifth Plan period, to identify areas in which the policies, planning and implementation machinery require to be modified/improved;

ii) To compare estimates of demand, production and capacity realised by the end of 1977-78 to what was anticipated in this year in the Draft Fifth Plan; to analyse the causes of major deviation and suggest remedial action in the appropriate areas;

iii) To make an estimate of indigenous demand of coal and lignite for the period 1978-79 to 1982-83, 1983-84 and 1987-88, taking into account the projected pattern of growth in the consuming sector and the potential for substitution of petroleum by coal;

iv) To make a quantitative and qualitative evaluation of the different categories of recoverable resources of coal and lignite in the different regions indicating the basis of estimates as well as a review of work done in the Fifth Plan period (1974-77);

v) To recommend a policy for conservation of coal taking into account the long-term requirements of the steel industry

xvi) To assesses current status of research and development activities in the coal and lignite sector and to formulate schemes and programmes for research and development necessary to support and sustain continuing growth of these industries; assess existing mechanism for implementation of the various programmes and recommend measures for strengthening the same by way of linkages with user industries;

xvii) To review the existing planning and monitoring mechanism at the project, corporate and Central Ministry levels and to recommend measures for their improvement;

xviii) To estimate the infrastructural requirements of the coal and lignite sector in terms of Electricity and transport facilities, namely, road, rail, port and other transport systems;

xix) To review the present status of mine safety measures and suggest further measures to be taken for ensuring safety in mining;

xx) To suggest the manner in which subsidies, if any, may be eliminated;

xxi) To identify products and supplies of ancillaries from small scale sector;

xxii) To make such other recommendations as may be appropriate covering inter-alia, the aspects relating to environmental pollution;

xxiii) To suggest a policy frame consistent with the objectives set out above.

Note:- 1. The Chairman of the Working Group may, if deemed necessary, constitute Sub-Groups and also co-opt more members.

2. The expenditure of members on TA/DA in connection with the meetings of the Working Group will be borne by the parent Department/Ministry/Organisation

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ANNEXURE-II

Record note of the meeting of the Working Group on Coal & Lignite held under the Chairmanship of Shri S.C. Varma, Secretary, Department of Coal on 21.8.1978 & 23.8.1978.

The list of the members present is annexed.

The Working Group on Coal and Lignite as reconstituted by the Planning Commission vide its Office Memo.No.1-19(1)78.P&E dated 6.5.1978, met on 21.5.1978 and 23.8.1978 to consider the two basic documents on Coal covering the terms of reference indicated by the Planning Commission, prepared by Coal India Limited, and Singareni Collieries Co. Limited.

Demand

While considering the demand for coal in 1978-79 and 1982-83, it was decided that the demand as assessed finally in the Planning Commission's draft Five Year Plan document for 1978-1983 should be taken as the latest assessment. It was noted that the demand for 1978-79 has been assessed at 111.9 million tonnes and for 1982-83 at 149.00 million tonnes by the Planning Commission. However, it was recognised, as emphasised by the Secretary(Coal), that this figure may need to be re-examined in view of the higher demand indicated by consumer sectors e.g., Power Sector. It was also decided that the chapter on demand should indicate the shortfall between demand and the actual consumption in 1976-77 and 1977-78 highlighting the reasons and constraints for the same. In this connection, the mid-term appraisal of the 5th Plan and the decisions arrived at, at that time should also be taken into consideration. It was noted that the demand as assessed by the Planning Commission for 1978-1983 includes a content of import of coking coal of 1 million tonne per year during this period. However, it was decided to plan the production programme for coal vis-a-vis demand of 150.5 million tonnes i.e. excluding this import content of 1 million tonne.

It was accepted by all members that production should be so planned as to leave sufficient cushion between the demand and availability of coal. It was finally decided that for meeting the demand in 1982-83, a production of 158 million tonnes should be targetted at. This cushion was considered necessary in order to:-

(a) cater to size-wise and gradewise differential in the demand vis-a-vis the optimal grade mix of the production including requirement of steam coal for making soft-coke.

(b) off-set the inter-regional imbalances and seasonal variations between the demand and availability.

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(c) be able to augment supplies from different regions in the event of slippages in the production/transport capacity in a specific region.

5. While reviewing the past production performance, it was decided that an analysis of the investment made in the coal industry with particular emphasis on investment made on Plant and Machinery should be included in this chapter. It was also decided that the sector-wise demand, projections and the comparative figures of consumption for the last 4 years should be indicated.

6. While discussing the sector-wise demand of 1978-79, a representative of the Power sector stated that the demand for coal for the Power Sector is expected to increase during the current year and indicated that against the present assessment of 36.74 million tonnes, the demand is expected to be 37.2 million tonnes. For the year 1982-83 the requirement of the Power Sector was stated to be 65 mt. whereas the provision made in the Plan document is only for 58 million tonnes.

7. The representative of the railways agreed with the requirement of loco coal as assessed in the document; however, he indicated that the question of deterioration in the quality of coal had not been taken into consideration while working out the requirement. Secretary(Coal) emphasised the need to evaluate the demand after taking into consideration the inevitable deterioration in the quality of the steam coal supplied to the railways.

8. It was decided to reduce the assessment of export to 0.6 m.t. It was further decided to recheck with the fertilizer sector as to their export requirement of coal.

9. It was decided that any deviation in the demand assessed for 1978-79 for operational purposes, will not have any effect on the demand assessed for 1982-83.

Production Planning

10. It was agreed to include in this chapter an introductory paragraph on the method of planning proposed elaborating the reasons for the same, especially, the reasons for recommending particular methods of mining. It was decided after discussions that the targetted production programme for CIL for 1982-83 would remain at 138 mt. In this context Secretary(Coal) pointed out the various imponderables in coal production arising out of labour unrest, strike in the explosives factory, interrupted power supply, etc. The investment required for a slightly higher production programme as compared to the demand assessed will need to be justified against this background. The representatives of the Planning Commission emphasised the

need to review the various gestation periods for projects presumed in the report in the light of the past experience. The representative of Department of Expenditure(Plan Finance Division) suggested that the break up of continuing projects and sanctioned projects should be classified into the different plan periods.

Exploration

11. The representative of the Geological Survey of India pointed out that the quantity of prime coking coal likely to be explored appears to be on the high side. The known reserves of this quality of coal are 5400 million tonnes, of which more than 3000 million tonnes have already been proved. As such the quantities further likely to be proved as mentioned need to be rechecked. It was also pointed out by him that the provision of metreage for the production support in the second phase(November,1980 to January,1986) appears to be on the lower side as compared to the production support drilling provided for in the earlier yearsfor a much lower rate of production. It was decided to recheck these projections.

Plant & Equipment

12. It was decided to exclude the names of the various manufacturers. It was further decided that the proposed policy on mechanisation should be indicated and the reasons for the deployment of such equipment as suggested may be elaborated. It was desired that the projections given in the report should be tallied with those in the report of the Association of Industrial manufacturers.

Manpower and Training

13. It was suggested that the training facilities already available should be elaborated and their quality analysed. The need for training of ground level people should be highlighted and the need for specialisation courses should also be mentioned.

14. It was further suggested that the question of productivity should be discussed in detail bringing out the implications/improvements resulting out of introduction of new technologies and mechanisation in the industry. Its impact on the employment potential must also be clearly brought out.

23.8.1978

Marketing and Stocking Policy

15. The need for an elaborated and comprehensive coal stocking policy at the pit-heads, nodal points(dumps)

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and at the consumers' ends as an integral part of production planning was discussed in detail. The Planning Commission's representative suggested that the details of the quantity to be stocked, modality thereof and financial implications thereof could be considered by a small group whose recommendations could be taken into account by this working group.

Demand of soft coke

16. It was felt that the view taken in the Coal India Limited draft report on the basis of a small survey conducted by the NCAER, may not be representative of the real demand for soft coke in the rural or the urban sector. A more comprehensive study regarding the demand pattern of domestic fuels is necessary which, it was pointed out is being carried out by the Committee on Energy Policy. As such, one group noted that this issue could be left to be decided upon by the said Committee. It was pointed out by the representative of Central Fuel Research Institute and also other members, that the future policies regarding conservation of coking coal should be carefully evaluated with a view to making the best use of available resources taking consideration the cost of import. The need to explore new beneficiation techniques to minimise middling generation and also to wash inferior qualities of coking coal was noted.

Utilisation of lower grade non-coking coal

17. It was recognised that there is an urgent need for a phased shift towards efficient utilisation of the lower grade non-coking coals and also to remove the present imbalances in steam/slack production against their respective demand. In this connection, the representative of CFRIpointed out that research has already been conducted on burning of lower grade slack coal in the small sector units and results thereof could be taken up for further promotion, with commercial manufacturers. It was pointed out that the promotion of soft coke to replace non-commercial sources of energy would very much depend upon the increase in peacemeal loading and terminal distribution by rail as a conscious policy because the production of soft coke is done by and large at a large number of small sidings and its sale is also channalised through a large number of retailers at numerous consumer centres whose individual requirements are only a few wagons or even less.

Need for new branch lines/sidings

18. As regards the criterial for new branch lines and or sidings for coal transportation, it was opined that a fresh look is necessary in this matter taking into consideration past practices of treating these developments as exclusive schemes for coal transportation to be finalised by the coal sector rather than as an intergral part of development of the area where the mine is situated. Some other issues regarding the Railways rules and procedures prevailing need to be modified in the overall interest of optimisation of the transport

capacity as well as utilisation of the loading facilities and wagons loaders at the railway sidings. As some of these issues are already under reference to the National Transport Policy Committee and Rail Tarriff Committee, the Working Group may need to indicate only the broad outlines and leave the detailed examination to these Expert Committees on the subject.

Planning, Design, Monitoring and R&D

19. The representative of the Planning Commission explained that in view of the importance of the R&D activities in the development of various sectors, the sectoral working groups are also being requested to review the progress of R&D schemes already taken in hand and also lay down broad outlines for future schemes. The detailed examination of R&D activities, their financial implications and requirement of funds will however be dealt with by the concerned R&D sub-group nominated for the purpose. The recommendations of this sub-group will be incorporated in the Working Group reports. Shri S.K.Bose, Incharge of R&D in the Department, agreed to take further action on these lines and submit the necessary report to the Working Group.

Coal Transportation

20. Some anomalies were pointed out in the computation and presentation of figures of production, total transport requirement and the rail component thereof. It was decided to rectify these and to make the presentation uniform for all the years under consideration. The representative of the railway requested that the transport requirement for the year 1983-84 may also be included. He pointed out that the despatches by rail for the year 1978-79 have been projected too high at 97.94 million tonnes while the provision made by the Planning Commission for railways traffic programme for 1978-79 is for 88 million tonnes. He also pointed out that in the terminal year of the Five Year Plan for 1978 to 1983 the provision made for coal movement is only 112 million tonnes, against 140 million tonnes projected in the draft report under consideration. It was decided to rework these figures after re-examining the quantities which do not need movement and quantities which are to be moved by means other than rail. The representative of the railways also pointed out that transport envisaged for the ~~import of~~ coking coal as well as the coastal movement should be spelt out and the component of rail movement specified. Planning Commission was requested to take necessary action in the matter.

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(Smt.S.Kandpal)
Deputy Secretary to the Govt. of India

LIST OF OFFICERS WHO ATTENDED THE MEETING OF THE WORKING GROUP ON COAL AND LIGNITE HELD UNDER THE CHAIRMANSHIP OF SHRI S.C.VARMA, SECRETARY DEPARTMENT OF COAL ON 21.8.1978 and 23.8.1978

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Ministry of Energy-Department of Coal

1. Shri S. C. Varma, Secretary

2. Shri S.P. Gugnani, Joint Secretary & F.A.(only on 23.8.78

3. Shri R.P. Khosla, Joint Secretary

4. Shri S.K. Bose, Joint Secretary

5. Shri S.Chattopadhya, Officer on Special Duty,

6. Smt. S. Kandpal, Deputy Secretary

Ministry of Energy- Department of Power

7. Shri B. Sinha, Joint Secretary

8. Shri S.K. Aggarwal, Director.

Ministry of Finance-Department of Expenditure(Plan Finance)

9 Shri D. Sankaraguruswamy, Joint Secretary

Planning Commission.

10. Shri T.Satishchandran, Adviser(Energy)-(only on 23.8.78)

11. Shri V.V.S.R Hanumantha Rao, Joint Adviser(Coal).

12. Shri T.K. Ghosh, Senior Research Officer(PPD),

13. Shri R.K. Das, Research Officer.

Department of Heavy Industry

14. Shri T.S. Sambaji- Director(Technical)

Central Electricity Authority, R.K.Puram,New Delhi

15. Shri B.N. Mukherjee,Director(PIM),

16. Shri P.C. Angirish,Dy. Director(PIM)

Steel Authority of India Ltd-Kasturba Gandhi Marg,New Delhi.

17. Shri A.N. Dharmapuri, Senior Manager.

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Ministry of Railways - Railway Board, New Delhi.

18. Shri K. Bikram Singh, Joint Director (T.P.)

19. Shri Chatterjee, Joint Director(Traffic)

Gological Survey of India, Calcutta.

20. Shri N.D. Mitra, Geologist(Sr.)-(only on 21.8.78)

Central Fuel Research Institute, Dhanbad.

21. Shri S. Ranga Raja Rao, Scientist(E)

Director General of Mines Safety, Ghaziabad

22. Shri S.Kumar, Deputy Director.

Coal India Limited, Calcutta

23. Shri M.S. Nagar, Dy. C.M.E.

Central Mine Planning & Design Institute, Ranchi.

24. Shri S.N. Prasad, Addl. C.M.E.

Singareni Collieries Co. Ltd. Kothagudem.

25. Shri T. Prasad - Chief Planning & Research.

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ANNEXURE III

RECORD NOTE ON THE MEETINGS OF THE WORKING GROUP ON COAL AND LIGNITE HELD ON 12.9.78 AND 13.9.1978.

The list of members present on the two days is annexed.

2. The Working Group on Coal and Lignite resumed discussion on the draft reports prepared by the Coal India Ltd., and the Singareni Collieries Co. Ltd. on 12.9.1978.

INFRASTRUCTURE

3. It was noted that a Task Force has been set up to review the proposal for power distribution system in the Jharia Coalfields. It was decided to incorporate the recommendations of this Task Force as finally accepted and the salient features of the schemes in the final report of the Working Group. The Working Group took note of the projections of requirement of power by CIL, in the coming years. The Group desired that these projections may be indicated coalfield-wise. It was further noted that if the existing sources of power generation were not able to meet this requirement, the need for the captive power stations for the coal mines would have to be examined. The Working Group recommended that stand-by generating sets should, however, be provided for at least for degree 3 gassy mine.

WORKSHOPS

4. While it was recognised that repair workshop facilities should be provided commensurate with the deployment of plant and equipment which are located in isolated places of mines, their numbers and locations should be carefully evaluated taking into account the facilities that are already existing either within the industry or in the nearby industrial areas. The utilisation of these facilities should also be taken into account while going in for more such units. The unit workshop which really serves the purpose of day-to-day repairs and routine maintenance job could be more appropriately renamed.

EXPLOSIVES

5. It was decided to include a write-up on the requirement of explosives of different types and the projected manufacturing capacities, in the final report.

BENEFICIATION

6. The Group observed that the washing capacity should also provide for adequate cushion to cater for the inevitable

12.9.1978

10. The group deliberated on the Report prepared by the Singareni Collieries Co. Ltd. on the demand, production and investment programme of the company.

DEMAND

11. It was noted that the demand projected by the SCCL for the company in 1982-83 is 17 million tonnes which includes a quantum of 1 m.t. for export. It was also noted that this demand assessed did not include the probable additional demand from power stations in the Western Division.

12. It was indicated by the representatives of SCCL that Bellampalli and Ramagundem areas of the company would be able to meet the said additional demand. It was finally decided that the total demand on SCCL in 1982-83 may be assessed at 17 million tonnes, however, no provision for export would be necessary.

13. It was also noted that the demand for coal by the railways on SCCL is gradually increasing during the period 1978-79 to 1982-83. It was decided that to this extent the load of loco-coal on CIL mines would be reduced. The Group also recommended that efforts should be made to shift the entire load of demand for coal in southern region to SCCL, except when that was not possible due to quality considerations.

14. Secretary(Coal) noted that SCCL would need to chalk out a production programme to meet the additional demand of 7 million tonnes by 1982-83 for which purpose the organisation for the preparation of project reports in the company should be further strengthened, if necessary. The group recommended that the possibility of introducing increased mechanisation as well as forming larger mines should be examined by the company.

15. It was pointed out by FA., Department of Coal, that in the Plan a marked increase in manpower is noticed along with an equally steep increase in the investment on plant and machinery.

TRANSPORTATION

16. A sharp increase in road transportation was noted.

SAFETY

17. It was pointed out by Shri R.P. Khosla, Joint Secretary in the Department of Coal, that the rate of accidents in SCCL is very high.

deterioration in the quality of coal. It was further decided that the washing capacity should be worked out without taking into account any import of coking coal. It was pointed out by the representatives of the steel sector that the proposed expansion of DSP washeries may also be taken into account. They also pointed out that the washing technology should also be updated commensurate with the growth in the washing capacity to provide washed coal of requisite quality to the steel plants without undue losses of coking coal in the shape of larger quantities of middlings.

NON-COKING COAL WASHERY

7. The group was of the view that an evaluation of the benefits of washing non-coking coal, taking into account the increase in the production capacity and cost of beneficiation, loss of energy in rejects, vis-a-vis the benefits of such washing viz. reduced cost of generation and coal transportation may be carried out. It was accepted that the coal from the Singrauli coalfield for the STPS in the area as well as for power houses in the Western India Power Houses would justify beneficiation. The Group was of the view that beneficiation of non-coking coal may be restricted to supplies to power houses.

SUBSIDIES

8. The Group desired that the expenditure on various measures relating to safety and conservation, scientific development of mines and coal utilisation for which the coal mines are entitled for subsidies may be indicated with adequate justification in each case. It was not considered necessary to indicate in the report, the modality of collections and disbursement of excess of levies. Only the quantum of collections and disbursement may be indicated.

HOUSING

9. More details regarding the number of houses to be built and the per centage satisfaction to be achieved at different time horizons should be indicated along with proposed expenditure thereon.

INVESTMENT

18. It was decided that after the draft Report have been finalised a small task force would analyse the issue relating to investment required for the two companies. It was noted that the funding pattern for SCCL would be discussed and decided shortly.

19. It was also desired that an analysis of investment required for existing mines and reconstruction of projects should be carried out. It was recognised that the design of capital investment in an extractive industry, like coal mining different from that for other industrial activities. Here, even to maintain the production programme, capital investment is called for year after year.

DEMAND

20. Shri Satish Chandran, Adviser(Energy), of the Planning Commission, pointed out that the total demand for coal is assessed at 149 million tonnes in 1982-83 against which a production programme of 153 m.t. should be planned. Secretary(Coal) pointed out that the plan should be to ensure availability of 153. m.t. of coal to meet the demand of 149 m.t. in 1982-83 for which purpose it may be necessary to have a planning preparedness by way of geological reports, feasibility reports and investment proposals for production level of 158 m.t. However, the investment would be confined to a level of production of 153 m.t.

LIGNITE

21. It was decided that a note on the demand and the production programme for lignite would be prepared and circulated among the members which would thereafter be added to the Working Group Report.

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LIST OF OFFICERS WHO ATTENDED THE MEETING OF THE WORKING GROUP ON COAL AND LIGNITE HELD UNDER THE CHAIRMANSHIP OF SHRI S.C. VARMA, SECRETARY, DEPARTMENT OF COAL ON 12.9.1978, and 13.9.1978.

PRESENT

Ministry of Energy-Department of Coal.

1. Shri S.C. Varma- Secretary.
2. Shri S.P. Gugnani -Joint Secretary & F.A.
3. Shri R.P. Khosla -Joint Secretary.
4. Smt. S.Kandpal - Deputy Secretary.

Ministry of Energy-Department of Power.

5. Shri S.K. Aggarwal - Director.

Ministry of Finance - Department of Expenditure

6. Shri D. Sankaraguruswamy - Joint Secretary.

Planning Commission, New Delhi.

7. Shri T. Satishchandran - Adviser(E)
8. Shri V.V.S.R. Hanumantha Rao -Joint Adviser(Coal)
9. Shri T.K. Ghosh - Senior Research Officer(PPD)
10. Shri R.K. Das - - Research Officer.

Department of Heavy Industry, New Delhi.

11. Shri T.S. Sambaji --- Director(Technical).

Central Electricity Authority - R.K. Puram, New Delhi.

12. Shri S.K. Mukerjee ... Director(RCP)
13. Shri K. Krishnaswamy Rao .. Director(COT)
14. Shri B.N. Mukherjee ... Director(FIM)
15. Shri P.C. Angirish ... Dy. Director(FIM)
16. Shri M.S. Bhalla --- Dy. Director.
17. Shri V.V. Rao .. Chief Engineer.

Steel Authority of India Ltd., Kasturba Gandhi Marg, New Delhi.

18. Shri A.N. Dharmapuri .. Senior Manager.
19. Shri R.N. Kaul ... Adviser(Coal)

Ministry of Railways, New Delhi.

20. Shri M.L. Chatterjee- Joint Director.
21. Shri R. Dayal -- Joint Director.

Department of Science & Technology, Mehrauli Rd. New Delhi.

22. Dr. J. Gururaja ... Director.

Coal India Limited, Calcutta.

23. Shri M.S. Nagar ..... Dy. CME.

Singareni Collieries Co. Ltd., Kothagudem.

24. Shri T. Prasad - Chief Planning & Research.

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ASSESSMENT OF COAL DEMAND
(WITHOUT IMPORT)

(Annexure-III-Oct.78)

Company	Steel	Power	Railways	Cement	Fertilizer	Export	Soft Coke & L.T.C.	BRK	Others including Textiles	Colly. Consump.	Total	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13
					YEAR - 1977-78							
NEC	–	–	0.32	0.01	–	–	–	–	0.29	–	0.62	
ECL	0.98	5.84	5.42	0.95	0.21	0.62	1.67	0.69	8.07	1.13	25.58	
BCCL	12.16	2.15	0.55	–	0.58	0.02	1.52	1.98	1.50	0.84	31.30	
CCL	6.56	6.41	2.24	0.74	0.24	0.01	0.70	0.58	3.25	0.48	21.21	
WCL	0.40	9.84	3.35	1.94	1.17	–	0.02	0.18	6.12	0.62	22.64	
CIL	20.10	24.24	11.88	3.64	1.20	0.65	3.43	3.91	19.23	3.07	91.35 + 0.99	depletion at consumers' end
SCCL	–	3.69	1.43	1.42	0.03	–	–	–	1.66	0.23	8.46	
TISCO/IISCO OTHERS	2.67	0.22	–	–	–	–	–	–	–	–	2.89	
TOTAL	22.77 (+)0.31	23.15 + 0.63	13.31 + 0.01	5.06 + 0.04	1.23	0.65	3.43	3.91	20.39	3.30	102.70 + + 0.99	(Actual Consumption on.
					YEAR - 1978-79							
NEC	–	–	0.30	0.10	–	–	–	–	0.30	–	0.70	
ECL	1.26	6.30	4.64	0.90	0.36	0.60	1.86	2.70	8.00	1.20	27.82	
BCCL	14.65	3.00	0.70	–	0.36	–	1.90	1.80	0.10	0.70	23.21	
CCL	7.19	7.50	2.30	0.95	0.58	–	1.00	1.70	1.65	0.60	23.47	
WCL	0.40	12.60	3.60	1.93	0.20	–	–	0.10	5.82	0.60	25.25	
CIL	23.50	29.40	11.54	3.33	1.50	0.60	4.76	6.30	15.87	3.10	100.45	
SCCL	–	4.30	1.56	1.87	0.10	–	0.09	–	1.90	0.28	10.10	
TISCO/IISCO OTHERS	2.90	0.10	–	–	–	–	–	–	–	–	3.00	
TOTAL	26.40	33.80 (2.7)	13.10	5.75	1.60	0.60	4.85	6.30	17.77 (0.50)	3.38	113.55	
Latest Operational Assessment.	23.79	32.62 (1.83)	13.10	5.72	1.60	0.60	3.44	6.30	18.67	3.38	109.22	

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1	2	3	4	5	6	7	8	9	10	11	12
							YEAR - 1979-80				
NEC	-	-	0.30	0.10	-	-	-		0.30	-	0.70
ECL	1.31	7.00	4.60	1.00	0.36	0.60	2.00	2.70	8.25	1.20	29.02
BCCL	14.74	3.00	0.60	-	0.36	-	2.00	1.90	0.10	0.70	23.40
CCL	7.18	3.35	2.20	1.10	0.78	-	1.00	1.80	1.80	0.60	24.81
WCL	0.20	14.36	3.50	2.30	0.30	-	-	0.10	6.34	0.60	27.79
CIL	23.43	32.71	11.20	4.50	1.80	0.60	5.00	6.50	16.79	3.10	105.63
SCCL	-	5.09	1.60	1.80	0.60	-	0.30	-	2.21	0.30	11.90
TISCO/IISCO											
OTHERS	3.12	0.10	...	-	-	-	-	-	-	-	3.22
TOTAL	26.55	37.90 (3.0)	12.80	6.30	2.40	0.60	5.30	6.50	19.00 (0.60)	3.40	120.75
Latest Operational Assessment.	26.30	36.40 (2.6)	12.80	6.00	2.40	0.60	4.80	6.50	19.70	3.40	118.90
							YEAR - 1980-81				
NEC	-	-	0.30	0.10	-	-	-	-	0.30	-	0.70
ECL	1.39	7.65	4.60	1.00	0.44	0.60	2.20	2.80	8.65	1.20	30.53
BCCL	16.82	3.00	0.50	-	0.36	-	2.20	2.00	0.10	0.70	25.68
CCL	7.40	10.15	2.20	1.10	1.73	-	1.20	1.80	1.90	0.60	28.08
WCL	0.26	15.26	3.30	2.40	0.65	-	-	0.10	6.46	0.60	29.03
CIL	25.87	36.06	10.90	4.60	3.18	0.60	5.60	6.70	17.41	3.10	114.02
SCCL	-	6.44	1.60	1.90	1.02	-	0.30	-	2.39	0.30	13.95
TISCO/IISCO											
OTHERS	3.27	0.10		-	-	-	-	-	-	-	3.37
TOTAL	29.14	42.60 (3.50)	12.50	6.50	4.20	0.60	5.90	6.70	19.00 (0.60)	3.40	131.34

Contd.... Annex. III

YEAR- 1981-82

1	2	3	4	5	6	7	8	9	10	11	12	13
NEC	-	-	0.30	0.10	-	-	-	-	0.30	-	0.70	
ECL	1.42	8.56	4.50	1.00	0.46	0.60	2.40	2.90	8.70	1.20	31.74	
BCCL	17.73	3.00	0.50	-	0.36	-	2.40	2.00	0.10	0.70	19.79	
CCL	7.53	13.40	2.10	1.10	1.75	-	1.30	2.00	1.90	0.60	31.68	
WCL	0.21	15.26	3.15	2.50	0.73	-	-	0.10	6.50	0.60	29.05	
CIL	26.89	40.22	10.55	4.70	3.30	0.60	6.10	7.00	17.50	3.10	119.96	
SCCL	-	7.58	1.65	2.00	1.20	-	0.40	-	2.60	0.32	15.75	
TISCO/IISCO			-									
OTHERS	4.55	0.10	-	-	-	-	-	-	-	-	4.65	
TOTAL	31.44	47.90 (3.80)	12.20	6.70	4.50	0.60	6.50	7.00	20.10 (0.70)	3.42	140.36	

YEAR - 1982-83

1	2	3	4	5	6	7	8	9	10	11	12	13
NCL												
NEC	-	-	0.30	0.10	-	-	-	-	0.40	-	0.80	
ECL	1.63	10.00	4.30	1.00	0.56	0.60	2.40	2.90	9.12	1.20	35.77	
BCCL	17.73	3.55	0.50	-	0.36	-	2.40	2.00	-	0.70	27.24	
CCL	8.64	16.16	2.00	1.20	1.81	-	1.20	2.00	2.00	0.60	35.61	
WCL	0.50	15.80	3.00	2.80	0.77	-	-	0.10	7.21	0.60	30.78	
CIL	28.50	45.51	10.10	5.10	3.50	0.60	6.00	7.00	18.79	3.10	128.20	
SCCL	-	8.39	1.70	2.10	1.20	-	0.50	-	2.77	0.34	17.00	
TISCO/IISCO			-									
OTHERS.	5.20	0.10	-	-	-	-	-	-	-	-	5.30	
TOTAL	33.70	54.00 (4.00)	11.80	7.20	4.70	0.60	6.50	7.00	21.56 (0.30)	3.44	140.50	

1	2	3	4	5	6	7	8	9	10	11	12	13
							YEAR - 1983-84					
NEC	-	-	0.30	0.10	-	-	-	-	0.40	-	0.80	
ECL	1.70	10.50	4.30	1.00	0.56	1.00	2.60	3.00	9.25	1.20	35.21	
BCCL	18.50	4.00	0.40	-	0.36	-	2.50	2.20	-	0.70	28.66	
CCL	9.20	18.30	1.90	1.20	1.91	-	1.30	2.20	2.00	0.60	38.61	
WCL	0.60	16.50	2.85	3.00	0.77	-	-	[illegible]	[illegible]	0.60	31.52	
CIL	30.00	49.30	9.75	5.40	3.60	1.00	6.40	7.50	18.75	3.10	134.80	
SCCL	-	10.60	1.75	2.20	1.30	-	0.60	-	3.00	0.55	20.00	
TISCO/IISCO OTHERS	5.20	0.10	-	-	-	-	-	-	-	-	5.30	
TOTAL	35.20	60.00 (5.00)	11.50	7.60	4.90	1.00	7.00	7.50	21.75 ([illegible])	3.65	160.10	
							YEAR - 1987-88					
NEC	0.35	-	0.20	0.20	-	-	-	0.10	0.60	-	1.45	
ECL	2.74	13.50	3.80	1.10	0.40	1.00	4.50	3.50	11.50	1.20	43.24	
BCCL	23.94	6.00	0.30	-	0.70	-	2.90	2.30	-	0.70	36.84	
CCL	15.19	25.45	1.50	2.00	2.30	-	1.70	2.30	2.30	0.60	[illegible]	
WCL	0.93	20.23	2.30	3.80	1.42	-	0.20	0.10	8.25	0.60	33.03	
CIL	43.15	65.18	8.20	7.10	4.82	1.00	9.30	8.30	22.85	3.10	173.00	
SCCL	-	18.72	2.00	2.50	1.38	-	0.90	-	3.85	0.60	29.95	
TISCO/IISCO OTHERS	4.95	0.10	-	-	-	-	-	-	-	-	5.05	
TOTAL	48.10	84.00 (6.00)	10.20	9.60	6.20	1.00	10.20	8.30	[illegible].70 (0.90)	3.70	208.00	

NOTE: The coal requirement for steel sector is based on information furnished by Deptt. of Coal and Planning Commission. The coal requirement for power sector & Railways are based on estimates/ information furnished by Planning Commission/ Railways respectively. Figures in brackets indicate Washery middlings. Figures for 1977-78 are actual off-take.

ANNEXURE- IV

Requirement of Coking Coal(as Charged) at Steel Plants 1978-79 to 1982-83)

(In '000 tonnes)

Year	Particulars	BSP	DSP	RSP	BSL	TISCO	IISCO	TOTAL	Blend
1	2	3	4	5	6	7	8	9	10
	Blend-(PMB)	58:35 7	70:20 10	50:40 10	55:45	60:30 10	65:25 10		
1978-79	Hot Metal								
Coal Requirement	PCC	2800	1350	1370	2666	1850	920	10956	
	MCC	2440	1522	1197	1923	1578	1146	9806	58.8
	SCC	1470	444	957	1547	739	438	5645	33.8
	Total:-	290	264	239	–	263	176	1232	7.4
		4200	2230	2323	3470	2630	1760	16683	100.0
1979-80	Hot Metal	2810	1550	1370	2775	1900	1000	11405	–
Coal requirement	PCC	2376	1483	1200	2020	1620	1077	9776	58.7
	MCC	1434	425	959	1650	810	414	5692	34.2
	SCC	287	215	240	–	270	166	1178	7.1
	Total:-	4097	2123	2399	3670	2700	1657	16646	100.0
1980-81	Hot Metal	2910	1550	1500	3700	1900	925	12435	–
Coal requirement	PCC	2402	1433	1294	2530	20	1273	10607	58.[illegible]
	MCC	1449	425	1054	2070	810	492	6230	34.[illegible]
	SCC	290	215	259	–	270	196	1230	6.[illegible]
	Total:-	4141	2123	2587	4600	2700	1966	18117	100.[illegible]
1981-82	Hot Metal	2950	1550	1550	4985	1900	1010	13645	–
Coal Requirement	PCC	2428	1593	1280	302	1620	1432	11378	58.6
	MCC	1465	140	1019	2475	810	551	6760	34.8
	SCC	293	220	260	–	270	220	1263	6.6
	Total:-	4186	2253	2559	5500	2700	2203	19401	100.0
1982-83	Hot Metal	3120	1600	1600	4625	1900	1155	14000	–
Coal Requirement	PCC	2654	1753	1260	3355	1620	1540	12182	59.00
	MCC	1602	460	1000	2740	310	590	7202	35.00
	SCC	320	230	250	–	270	320	1300	6.00
	Total:-	4576	2443	2510	6095	2700	2360	20684	100.0

The hot metal production programme for 1983-84 and 1987-83 have not been furnished by SAIL.

ANNEXURE-IV

P. - Prime : M - Medium; S-Semi Coking C. Coking Coal

N.B : (i) Blends of Prime, Medium and Semi Coking coals have been adopted, as indicated by the steel plants.

(ii) Coal requirements have been adopted, based on the schedule of repairs of the coke ovens, commissioning of new batteries and the coke requirements at plants.

Furnished by SAIL & PLANNING COMMISSION FOR :

Working Group on Coal
1978-79 - 1982-83

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ANNEXURE -7

COKING COAL REQUIREMENT

1978-79

(in m.t.)

A. Plantwise Requirement :

Steel Plant	Hot Metal	Prime	Medium	Semi-coking	Total
Bhilai	2.80	2.44	1.47	0.29	4.20
Durgapur	1.35	1.52	0.45	0.26	2.23
Rourkela	1.37	1.20	0.96	0.23	2.39
Bokaro	2.67	1.92	1.55	-	3.47
TISCO	1.85	1.58	0.79	0.26	2.63
IISCO	0.92	1.15	0.43	0.18	1.76
Total Steel Plants:	10.96	9.81	5.65	1.22	16.68
DCOP		0.33	0.19	0.13	0.65
FCI (Sindri)		0.10	0.10	0.06	0.26
Total		10.24	5.94	1.41	17.59

B. Gradewise/Sourcewise Requirement :

Quality	Washery	As charged to Ovens	Eqvt. Raw coal	Company
Prime	Dugda-I	1.14	1.80)	
	Dugda-II	1.16	2.04)	
	Bhojudih	1.66	2.10)	BCCL
	Patherdih	1.16	1.70)	
	Lodna	0.20	0.33)	
	Chasnalla	0.96	0.50	IISCO
			0.70	BCCL
	Jamadoba	1.00	1.40	TISCO
	DSP	0.76	1.16	BCCL
	DCOP	0.26	0.43	BCCL
	Direct Feed	1.94	1.70	BCCL
			0.24	TISCO
		10.24	14.15	
Hard coke Manufacture			1.70	BCCL
			15.85	
Medium	Kargali	1.62	2.45)	
	Kathara	1.18	2.15)	CCL
	Swang	0.46	0.70)	
	Gidi	0.84	1.68)	
	West Bokaro	0.36	0.57	TISCO
	DSP	0.08	0.12	BCCL
	Direct Feed	1.40	0.16	CCL
			0.80	BCCL
			0.33	WCL
			0.20	IISCO
		6.03	9.16	
			0.05	CCL
			9.21	

ANNEXURE - V (Contd)

Semi-coking	Direct Feed	1.32	1.26 0.06	ECL WCL
	Total :	17.59	26.38	

SUMMARY

Quality	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	-	13.71	-	-	13.73	2.13	15.86
Medium	-	0.92	7.19	0.34	8.45	0.77	9.72
Semi-coking	1.26	-	-	0.06	1.32	-	1.32
	1.26	14.63	7.19	0.40	23.50	2.90	26.40

ANNEXURE - V

COKING COAL REQUIREMENT

1979-80

(In m, t.)

A. Plantwise Requirement :

Steel Plant	Hotmetal	Prime	Medium	Semi-coking	Total
Bhilai	3,81	2.38	1.43	0.29	4.10
Durgapur	1.55	1.48	0.43	0.21	2,12
Rourkela	1.37	1,20	0.96	0.24	2.40
Bokaro	2,73	2.02	1,65	-	3.67
TISCO	1.90	1.62	0.81	0.27	2,70
IISCO	1,00	1.08	0.41	0.17	1.66
Total SteelPlants	11.41	9.78	5,69	1.18	16.65
DCOP		0.33	0.19	0.13	0.65
Total:		10.11	5.83	1.31	17.30

B. Gradewise/Sourcewise Requirement :

Quality	Washery	as charged to ovens	Eqvt. Raw Coal	Company
Prime	Dugda-I	1.21	1.92)	
	Dugda-II	1.23	2.16)	
	Bhojudih	1.66	2.10)	BCCL
	Patherdih	1.16	1.70)	
	Lodna	0.20	0.33)	
	Chasnalla	0.96	0.60	IISCO
			0.60	BCCL
	Jamadoba	1.00	1.40	TISCO
	DCOP	0,26	0.48)	
	DSP	0.84	1.30)	BCCL
	Sudamdih	0.67	0.90)	
	Direct Feed	0.92	0,62	BCCL
			0.30	TISCO
		10.11	14.41	
	Hard coke manufacture		1.74	BCCL
			16.15	
Medium	Kathara	1.18	2.22)	
	Swang	0.46	0.70)	CCL
	Kargali	1.62	2.41)	
	Gidi	0.84	1,68)	
	West Bokaro	0.36	0.57	TISCO
	Direct Feed	1.42	0.25	IISCO
			0,08	CCL
			0.20	WCL
			0.83	BCCL
		5.88	9.04	

...contd...

ANNEXURE - V (Contd)

Hard coke			0.05	CCL
			9.05	
Semi-coking	Direct Feed	1.31	1.31	ECL
		1.31	1.31	
Total:		17.30	23.55	

S U M M A R Y

Quality	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	-	13.85	-	-	13.35	2.80	16.15
Medium	-	0.89	7.18	0.20	8.27	0.32	9.09
Semi-coking	1.31	-	-	-	1.31	-	1.31
	1.31	14.74	7.18	0.20	23.43	3.12	26.55

ANNEXURE - V

COKING COAL REQUIREMENT

1980 - 81

(m.t.)

A. Plantwise Requirement :

Steel Plant	Hotmetal	Prime	Medium	Semi-coking	TOTAL
1. Bhilai	2.91	2.40	1.45	0.29	4.14
2. Durgapur	1.55	1.43	0.43	0.22	2.12
3. Rourkela	1.50	1.80	1.03	0.26	2.59
4. B.S.L	3.70	2.53	2.07	–	4.60
5. TISCO.	1.90	1.62	0.81	0.27	2.70
6. IISCO	0.93	1.23	0.49	0.19	1.97
Total:	12.49	10.61	6.28	1.23	18.12
7. D.C.O.P		0.40	0.23	0.16	0.79
Total:	12.49	11.01	6.51	1.39	18.91

B. Gradewise/Sourcewise Requirement :

Quality	Washery	As charged to ovens	Raw coal Equivalent	Company
1. Prime	CCW & Lodna	5.54	8.33	BCCL
	DCOP	0.32	0.58	BCCL
	DSP	0.84	1.30	BCCL
	Chasnalla	1.00	0.50	IISCO
	Jamadoba	1.00	1.40	TISCO
	Sudamdih	0.99	1.32	BCCL
	Monidih	0.37	1.25	BCCL
	Direct Feed	0.45	0.15	BCCL
			0.20	TISCO
		11.01	15.88	
	Hard coke	–	1.78	BCCL
		11.01	17.60	
2. Medium	Kathara	1.25	2.41	CCL
	Swang	0.46	0.70	CCL
	Kargali	1.62	2.45	CCL
	Gidi	0.85	1.70	CCL
	West Bokaro	0.36	0.57	TISCO
	Barora	0.12	0.24	BCCL
	Mahuda	0.20	0.23	BCCL
	Jhamkundar	0.15	0.24	BCCL
	Direct Feed	1.50	0.25	IISCO
			0.35	BCCL
			0.26	WCL
			0.14	CCL
		6.51	10.09	
3. Semi-coking	Direct Feed	1.39	1.39	ECL
	Total:	18.91	29.14	

....contd...

ANNEXURE - V (Contd)

SUMMARY

Quality	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	-	15.21	-	-	15.21	2.45	17.66
Medium	-	1.61	7.40	0.26	9.27	0.82	10.09
Semi-coking	1.39	-	-	-	1.39	-	1.39
	1.39	16.82	7.40	0.26	25.87	3.27	29.14

ANNEXURE - V

COKING COAL REQUIREMENT

1981 - 82

(M.T)

A. Plantwise Requirement:

	Steel Plant	Hotmetal	Prime	Medium	Semi-coking	Total
1.	Bhilai	2.95	2.43	1.47	0.29	4.19
2.	Durgapur	1.55	1.59	0.44	0.22	2.25
3.	Rourkela	1.55	1.28	1.08	0.23	2.56
4.	B.S.L.	4.59	3.03	2.47	-	5.50
5.	TISCO	1.90	1.62	0.81	0.27	2.70
6.	IISCO	1.01	1.43	0.55	0.22	2.20
--	Total:	13.55	11.38	6.76	1.26	19.40
7.	D.C.O.P		0.40	0.23	0.16	0.79
-	Total:		11.78	6.99	1.42	20.19

B. Gradewise/Sourcewise Requirement:

Quality	Washery	As charged to Ovens	Raw coal Equivalent	Company
1. Prime	CCWO & Lodna	5.54	8.33	BCCL
	DCOP	0.32	0.58	BCCL
	DSP	0.84	1.30	BCCL
	Chasnalla	1.20	0.30	IISCO
	Jamadoba	1.00	1.40	TISCO
	Sudamdih	1.17	1.56	BCCL
	Monidih	1.18	1.70	BCCL
	Direct Feed	0.53	0.23	BCCL
			0.30	TISCO
		11.78	17.10	
	Hard coke	-	1.82	BCCL
		11.78	18.92	
2. Medium	Kathara	1.27	2.50)	
	Sawang	0.46	0.70)	CCL
	Kargali	1.70	2.57)	
	Gidi	0.85	1.70)	
	West Bokaro	0.75	1.20	TISCO
	Barora	0.18	0.36)	
	Mahuda	0.40	0.55)	BCCL
	Jhunkunder	0.24	0.38)	
	Direct Feed	1.14	0.62	BCCL
			0.06	CCL
			0.21	WCL
			0.25	IISCO
		6.99	11.10	
3. Semi-Coking	Direct Feed	1.42	1.42	ECL
	Total:	20.19	31.44	

...contd.....

ANNEXURE-V (Contd).

SUMMARY

Quality	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	-	15.82	-	-	15.82	3.10	18.92
Medium	-	1.91	7.53	0.21	9.65	1.45	11.10
Semi-coking	1.42	-	-	-	1.42	-	1.42
	1.42	17.73	7.53	0.21	26.89	4.55	31.44

COKING COAL REQUIREMENTS 1982-83 — **ANNEXURE - V**

A. Plantwise Requirement :

Steel Plant	HotMetal	Prime	Medium	Semi-coking	Total
Bhilai	3.12	2.65	1.60	0.32	4.57
Durgapur	1.60	1.75	0.46	0.23	2.44
Rourkela	1.60	1.26	1.00	0.25	2.51
Bokaro	4.63	3.36	2.74	–	6.10
TISCO	1.90	1.33	0.31	0.27	2.70
IISCO	1.15	1.54	0.59	0.23	2.36
Total:	14.00	12.18	7.20	1.30	20.68
DCOP		0.40	0.23	0.16	0.79
Total:		12.58	7.43	1.46	21.47

B. Gradewise/Sourcewise Requirement:

Quality	Washery	As charged to Ovens	Eqvt. Raw Coal	Company
Prime-I	Dugda-I	1.30	2.04)	
	Dugda-II	1.23	2.16)	
	Bhojudih	1.66	2.10)	
	Patherdih	1.16	1.70)	BCCL
	Lodna	0.20	0.33)	
	Sudamdih	1.17	1.56)	
	Monidih	1.18	1.70)	
	DSP	0.84	1.30)	
	DCOP	0.32	0.53)	
	Jamadoba	1.00	1.40	TISCO
	Chasnalla	1.20	1.70	IISCO
	Direct Feed	1.33	1.03	BCCL
			0.30	TISCO
		12.58	17.90	
	Hard Coke Manufacture		1.86	BCCL
			19.76	
Medium	Kathara	1.30	2.60)	
	Sawang	0.46	0.70)	
	Gidi	0.65	1.70)	CCL
	Kargali	0.70	2.57)	
	Ramgarh	0.60	1.03)	
	Nandan	0.30	0.50	WCL
	Junkundar	0.24	0.33)	
	Mohuda	0.40	0.55)	BCCL
	Barora	0.21	0.43)	
	Shampur	0.10	0.18	ECL
	West Bokaro	1.00	1.60	TISCO
	Direct Feed	0.27	0.25	IISCO
			0.02	BCCL
		7.43	12.55	
Semi-coking	Direct Feed	1.46	1.46	
		1.46	1.46	
		21.47	33.77	

....Contd.....

ANNEXURE (Contd)

SUMMARY

Quality	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	–	16.36	–	–	16.36	3.40	19.76
Medium	0.18	1.37	8.65	0.50	10.70	1.85	12.55
Semi-coking	1.46	–	–	–	1.46	–	1.46
	1.64	17.73	8.65	0.50	28.52	5.25	33.77

ANNEXURE - V

COKING COAL REQUIREMENT

1987 - 88

(in m. t.)

A. Plant-wise Requirement :

Steel Plant	Hot Metal	Prime	Medium	Semi-coking	Total
Bhilai	4.[illegible]3	3.58	2.48	0.46	6.52
Durgapur	1.70	1.59	0.81	0.26	2.66
Rourkela	1.65	1.30	1.04	0.26	2.[illegible]9
Bokaro	6.00	4.36	3.56	-	7.92
TISCO	1.90	1.10	1.03	0.27	2.70
IISCO	1.15	1.54	8.59	0.23	2.36
New Steel Plants	3.03	1.60	1.50	0.35	3.55
Total Steel Plants	20.26	15.37	11.11	1.83	28.31
DCOP		8.40	0.23	0.16	0.79
Total:-		15.77	11.34	1.99	29.10

B. Grade-wise/Source-wise Requirement :

Quality	Washery	As charged to Ovens	Eqvt. Raw Coal	Company
Prime	Dugda - I	1.29	2.04)	
	Dugda - II	1.23	2.16)	
	Bhojudih	1.66	2.10)	
	Patherdih	1.16	1.70)	BCCL
	Lodna	0.20	0.33)	
	Sudamdih	1.17	1.56)	
	Monidih	1.12	1.70)	
	DSP	0.84	1.30)	
	DCOP	0.32	0.53)	
	Chasnalla	1.20	1.70	IISCO
	Jamadoba	1.00	1.40	TISCO
	Pootkee-Sulliery	2.16	3.06)	
	Barora II	0.92	1.53)	BCCL
	Bhalgora	1.44	2.40)	
		15.77	23.56	
Hard Coke Manufacture			- 2.10 -	BCCL
			25.66	

ANNEXURE - V

	Washery	As charged to Ovens	Eqvt. Raw Coal	Company
Medium	Kathara	1.35	2.70	CCL
	Sawang	0.50	0.70	
	Gidi	0.85	1.70	
	Kargali	1.78	2.72	
	Ramgarh	1.43	2.55	
	Kedla	1.10	2.21	
	Parej	1.27	2.55	
	Nandan	0.56	0.93	WCL
	Shampur	0.38	0.70	ECL
	Jugjundar	0.24	0.33	BCCL
	Mohuda	0.40	0.55	
	Barora	0.21	0.42	
	West Bokaro	1.00	1.60	TISCO
	Direct Feed	0.27	0.25	BCCL
		11.34	20.04	
Semi-coking	Seetalpur	1.40	0.67	ECL
	Sodepur			
	Tipong	0.22	0.35	NEC
	Direct Feed	1.37	1.37	ECL
		1.99	2.39	
	Total:	29.10	48.09	

SUMMARY

	NEC	ECL	BCCL	CCL	WCL	CIL	Others	Total
Prime	-	-	22.56	-	-	22.56	3.10	25.66
Medium	-	0.70	1.37	15.19	0.93	18.19	1.85	20.04
Semi-coking	0.35	2.04	-	-	-	2.39	-	2.39
	0.35	2.74	23.93	15.19	0.93	43.14	4.95	48.09

Sl.No	Category		Company	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88
II	Production from Sanctioned Mines.	(a) Reconstruction Mines.	NEC	0.46	0.50	0.56	0.48	0.43	0.51	0.58	0.85
			ECL	2.00	2.80	3.48	4.00	4.44	5.04	5.50	6.32
			BCCL	–	–	–	–	–	–	–	–
			CCL	3.57	4.01	3.79	4.04	4.57	5.08	5.15	5.47
			WCL	3.35	3.86	4.09	4.19	4.56	4.24	4.10	3.54
			CIL	9.38	11.17	11.92	12.71	13.85	14.87	15.15	16.18
			SCCL								
			Sub-Total								
		(b) New Mines.	NEC	–	–	–	–	–	–	–	–
			ECL	1.58	2.27	2.57	2.48	2.38	2.24	2.02	1.18
			BCCL	–	0.23	0.23	0.23	0.23	0.23	0.18	–
			CCL	0.56	1.27	1.87	4.11	5.67	6.69	8.30	8.90
			WCL	0.53	1.79	2.58	3.38	4.12	4.46	4.57	4.93
			CIL	2.67	5.56	7.25	10.20	12.40	13.62	15.07	15.66
			SCCL								
			Sub-total								
	CIL			12.05	16.73	19.17	22.91	26.25	28.49	30.20	31.24
	SCCL										
	All India										
Total production from Existing & Sanctioned Mines.			CIL	88.95	97.07	98.55	102.02	103.22	102.48	101.63	92.67
			SCCL	8.91	9.28	9.25	9.25	9.10	8.94	8.83	8.50*
			Others	3.00	2.90	3.12	3.27	4.55	5.25	5.20	4.95
			All India.	100.86	109.25	110.92	114.54	116.87	116.67	115.06	106.12

* Estimated.

A N N E X U R E . VI.

PRODUCTION PROGRAMME

(In M. tonnes)

Sl. No.	Category		Company	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88
I	Production from Existing Mines	(a) Continuing Schemes.	NEC	-	-	-	-	-	-	-	-
			ECL	-	-	-	-	-	-	-	-
			BCCL	1.52	2.03	2.65	3.46	4.31	4.52	4.46	4.33
			CCL	3.99	4.74	4.71	5.05	5.25	5.30	5.50	5.53
			WCL	5.20	6.05	6.37	6.72	6.97	7.20	7.34	7.89
			CIL	10.71	12.87	13.73	15.23	16.53	17.02	17.32	17.75
			SCCL								
			Others								
			Sub Total								
		(b) Existing Mines	NEC	0.26	0.16	0.08	0.08	0.02	0.03	0.07	0.03
			ECL	21.67	23.17	22.70	22.52	21.61	20.49	19.83	17.46
			BCCL	18.70	20.16	20.30	19.35	18.35	17.25	16.23	12.16
			CCL	13.08	12.42	11.37	10.84	10.30	9.04	7.48	5.20
			WCL	12.53	11.56	11.20	11.09	10.10	10.11	9.85	8.83
			CIL	66.19	67.47	65.65	63.88	60.44	56.97	53.51	43.68
			SCCL								
			Others								
			Sub.total								
	CIL			76.90	80.34	79.38	79.11	76.97	73.99	70.83	61.43
	SCCL										
	Others										
	All India										

Sl.No.	Category		Company	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88
	Incremental production from Mines proposed for reconstruction.	(a) Project Report already prepared.	NEC	–	–	–	–	–	–	–	–
			ECL	–	–	0.13	0.43	1.01	1.53	1.84	3.08
			BCCL	–	–	0.08	0.21	0.47	0.71	1.18	3.06
			CCL	–	1.64	2.29	2.57	3.20	3.95	4.38	4.75
			WCL	–	1.56	1.59	1.71	1.88	2.06	2.25	2.97
			CIL	–	3.20	4.09	4.92	6.56	8.25	9.65	13.86
			SCCL								
			Sub-total		3.20	4.09	4.92	6.56	8.25	9.65	13.86
		(b) Project Report yet to be prepared.	NEC	–	0.02	0.04	0.07	0.07	0.13	0.14	0.18
			ECL	–	–	0.09	0.23	0.50	0.96	1.51	4.63
			BCCL	–	–	0.04	0.48	1.16	1.75	2.62	6.07
			CCL	–	–	0.75	1.40	2.18	4.40	6.85	11.80
			WCL	–	0.33	0.62	0.97	1.26	1.54	1.70	2.31
			CIL	–	0.35	1.54	3.15	5.17	8.78	12.82	24.99
			SCCL								
			Sub-total		0.35	1.54	3.15	5.17	8.78	12.82	24.99
	CIL			–	3.55	5.63	8.07	11.73	17.03	22.47	38.85
	SCCL			–	–	–	–	–	–	–	–
	All India.			–	3.55	5.63	8.07	11.73	17.03	22.47	38.85

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Sl.No.	Category		Company	77-78	78-79	79-80	80-81	81-82	82-83	83-84	87-88
IX.	Production from new mines proposed for construction.	(a) Project Reports already prepared but yet to be approved.	NEC	-	-	-	-	-	-	-	-
			ECL	-	0.09	0.78	0.78	0.86	0.98	1.59	4.03
			BCCL	-	0.60	0.60	0.85	0.85	0.85	0.85	0.85
			CCL	-	-	0.04	0.15	1.00	3.62	5.60	6.45
			WCL	0.01	0.25	0.50	0.86	1.69	2.94	3.77	7.06
			CIL	0.01	0.94	1.92	2.64	4.48	8.39	11.81	18.39
			SCCL	-	1.72	2.75	4.06	4.83	5.32	5.63	6.60 *
			Sub-total	0.01	2.66	4.67	5.70	9.25	13.71	17.44	24.99
		(b) Project Reports yet to be prepared.	NEC	-	-	0.12	0.22	0.34	0.46	0.47	0.51
			ECL	-	-	0.51	1.04	2.40	4.20	5.27	9.51
			BCCL	-	-	0.99	1.48	2.58	3.31	5.71	15.32
			CCL	-	-	-	0.06	0.18	0.39	1.35	16.90
			WCL	-	0.15	0.43	1.05	1.55	2.05	4.19	12.72
			CIL	-	0.15	2.05	3.35	7.05	10.41	16.99	54.96
			SCCL	-	-	-	0.49	1.29	2.23	4.58	[illegible] *
			Sub-total	-	0.15	2.05	4.34	8.34	12.64	21.57	69.86
	CIL			0.01	1.09	3.97	6.49	11.47	18.80	28.80	73.35
	SCCL			-	1.72	2.75	4.55	6.12	7.55	10.21	21.50 *
	ALL INDIA			0.01	2.81	6.72	11.04	17.59	26.35	39.01	94.85
	TOTAL PRODUCTION AVAILABILITY.										
	CIL.			88.96	101.71	108.15	116.58	126.42	138.31	152.30	204.86
	SCCL/Others.			11.91	13.90	15.12	17.07	19.77	21.74	24.24	34.95
				100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81

*Estimated.

Noted:- Production programme for 78-79 and 79-80 has been assessed during Annual Plan 79-80 discussions, and estimated at.-
78-79: 106.38 m.t. 79-80: 117.89 m.t.

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ANNEXURE VII

COALFIELDWISE PRODUCTION PROGRAMME.

SL.No.	Coalfield	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1987-88
1	Makum	0.62	0.68	0.80	0.85	0.97	1.18	1.25	1.57
2.	Rajmahal	0.20	0.20	0.23	0.23	0.23	0.45	1.20	4.30
3.	Raniganj	22.78	24.76	26.34	27.53	28.55	29.60	30.96	36.89
4.	Salanpur	*	1.28	1.37	1.58	1.90	2.50	2.44	2.13
5.	Mugma	2.73	3.21	3.51	3.59	4.02	4.36	4.30	4.20
6.	Jharia	22.76	24.25	26.22	27.28	29.82	30.80	33.36	43.82
7.	Giridih	0.20	0.35	0.33	0.33	0.34	0.46	0.57	0.71
8.	East Bokaro	6.04	6.61	6.73	7.21	7.37	7.82	8.27	8.73
9.	West Bokaro	2.44	3.39	3.55	3.96	5.17	[illegible].20	6.83	[illegible].06
10.	Ramgarh	0.22	0.26	0.18	0.90	1.00	1.85	2.55	2.55
11.	South Karanpura	5.57	5.84	5.85	5.90	6.21	6.39	6.52	6.82
12.	North Karanpura	1.93	2.31	2.71	2.80	3.13	4.15	4.82	6.41
13.	Daltonganj	0.10	0.05	0.06	0.06	0.05	0.04	–	–
14.	[illegible]ar	0.06	0.12	0.06	0.06	0.08	0.10	0.10	0.12
15.	Singrauli	3.37	4.00	4.05	5.35	7.60	10.40	13.30	27.30
16.	Talcher	1.26	1.75	1.90	2.25	2.60	2.97	3.25	3.90
17.	IB River	0.90	1.10	1.22	1.36	1.48	1.55	1.69	2.16
18.	CIL (Chrimiri Sohagpur Korea Rewa etc	10.65	11.87	12.74	13.69	14.40	15.28	16.25	19.71
19.	Korba	2.22	3.51	3.63	4.20	4.81	5.[illegible]	7.05	13.96
20.	Pench Kanhan	3.30	3.50	3.48	3.48	2.85	2.80	2.50	2.15
21.	Kamptee	1.05	1.32	1.43	1.61	1.92	2.12	2.44	2.86
22.	Tawa River	1.03	1.22	1.45	1.57	1.73	1.92	1.97	2.37
23.	Umrer	0.86	1.11	1.22	1.30	1.35	1.45	1.43	1.37
24.	Wardha Valley	1.67	1.92	2.21	2.76	3.39	3.93	4.44	5.72
25.	Godavari Valley	8.91	11.00	12.00	13.80	15.22	16.49	19.04	30.00
	Total:	100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81

Note:- Production programme for 78-79 and 79-80 has been assessed during Annual Plan 79-80 and estimated at : 78-79: 106.38 m + 79-80: [illegible]

ANNEXURE-VIII

STATEWISE PRODUCTION PROGRAMME

(in million tonnes)

SL. No.	State	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1987-88
1.	Andhra Pradesh	8.91	11.00	12.00	13.80	15.22	16.49	19.04	30.00
2.	Assam	0.62	0.68	0.60	0.85	0.97	1.18	1.26	1.57
3.	Bihar	39.25	47.04	49.89	52.78	57.88	62.77	68.98	88.17
4.	West Bengal	22.78	25.59	27.25	28.65	29.99	31.64	32.94	38.57
5.	Orissa	2.16	2.95	3.12	3.61	4.08	4.52	5.02	6.06
6.	Madhya Pradesh	20.57	23.85	24.85	27.29	29.39	33.45	36.02	54.59
7.	Uttar Pradesh	–	0.25	0.50	1.00	2.00	2.50	3.90	10.90
8	Maharashtra	3.58	4.35	4.86	5.67	6.66	7.50	9.38	9.95
	Total	100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81

Note:- Programme for Production has been reassessed for 78-79 and 79-80 at the time of Annual Plan 79-80, and estimated at:-

78-79... 106.38 m.t. 79-80...117.89 m.t.

ANNEXURE-IX

PRODUCTION BREAK-UP BASED ON OPENCAST & U/G

(In m.t.)

	1977-78	78-79	79-80	80-81	81-82	82-83	83-84	1987-88
ncast	23.63	26.43	29.06	35.69	41.58	52.15	61.86	101.28
derground	77.24	89.13	94.21	97.96	104.61	107.90	114.68	138.53
Total	100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81

PRODUCTION BREAK-UP COMPANYWISE

	1977-78	78-79	79-80	80-81	81-82	82-83	83-84	1987-88
.C	0.62	0.68	0.80	0.85	0.97	1.18	1.26	1.57
C.L.	25.26	28.33	30.26	31.48	33.22	35.44	37.41	46.21
.C.C.L.	20.22	23.07	24.89	26.06	27.95	28.62	31.25	41.78
.C.L.	21.19	24.08	24.82	28.22	32.35	38.47	44.61	65.00
C.L.	21.67	25.55	27.38	29.97	31.93	34.60	37.77	50.30
I.L.	86.96	101.71	108.15	116.58	126.42	138.31	152.30	204.86
SCO/IISCO/OTHERS	11.91	13.90	15.12	17.07	19.77	21.44	24.24	34.95
Total	100.87	115.61	123.27	133.65	146.19	160.05	176.54	239.81
king	23.67	27.20	28.74	30.49	33.78	36.04	40.46	53.60
n-Coking	77.20	88.41	94.43	103.16	112.41	124.01	136.08	186.21
Total	100.87	115.61	123.17	133.65	146.19	160.05	176.54	239.81

Note:- Production programme for 78-79 and 79-80 has been assessed during Annual Plan 79-80 and estimated at.- 78-79: 106.38 m.t. 79-80: 117.89 m.t.

	78-79	&79-80
Coking	25.11	28.07
Non-Coking.	81.27	89.82
	106.38	117.89

EXISTING AND ESTIMATED ADDITIONS REQUIRED FOR THE NEXT FIVE YEARS: ANNEXURE-X

CAPACITY FOR TRAINING DIFFERENT CATEGORIES OF PERSONNEL:

Area of Training & Category of Personnel	No of Persons to be trained by 1983-84			No of persons which can be trained per year with existing facilities.			Existing number of training centres (mostly equipped only marginally)			Required, Increase in the number of Training Centres.		
	SCCL	CIL	Total	CIL	SCCL	Total	CIL	SCCL	Total	CIL	SCCL	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
NON-EXECUTIVES												
COVERED SO FAR												
(i) Pre-entry Trades: Electrician Elec. Fitters Mechnisis Welders	1500	22000	23500	Nil	100	100	Nil	1	1	20	4	24
To be covered: Shot Fiter, Mine Mechanics, Mine Electricians, Diesel Mechanics, HEMM Operators.												
(ii) Post entry Initial & Refresher Training according to Statutory Safety Training Rules.: Timber man Track layer Trammer Mine loader Haulage, Winding & Conveyor Khalasis (pump) & Compressor Khalasis Lamp Fitters CCM Driver Logi Drivers	65000	374500	459500	52000	10000	62000	1027	7	109	56	7	63

Contd...

*1.		2	3	4	5	6	7	8	9	10	11	12	13
(iii) Refresher (for skill upgradation and multiple skill development.	Covered so far Mining Sardar and shot firers Overman Electricians Fitters Multi-skilled Face Workers Foreman & Chargeman(M) Foreman & Chargeman(E)	10000	183000	193000	17700	800	18500	11	-	11	3	17	20
	To be covered: HEMM Mechanics HEMM Electricians Washery Operating Personnel Shaft Sinking												
For Individual and Mechnised Long-Wall Face	Supportmen and conveyors Movers Shearer Operators and Assistants Check Maintenance Men Face Mechanics and Face Electricians face Supervisors.												
(iv) Trainers	Areas covered so Far. Engineering Mining HEMM New Technology including Mechanisation Washeries Supervisory Management.	100	1200	1300	Nil	Nil	Nil	Nil	Nil	Nil	1	1	2

Contd. ANNEXURE X

1	~	2	3	4	5	6	7	8	10	10	11	12	13

To be covered:

CIL:
Plus training in NCB-UK Training establishment for 50 instructors for a total of 150 man-months (this number is likely to increase as a result of the recommendations of the UK Consultants).

SCCL: Facility of training in UK etc under foreign aid may be extended to cover SCCL.

EXECUTIVES

1	~	2	3	4	5	6	7	8	10	10	11	12	13
1.Technical Skills *For other technical Areas the training facilities withinCIL and external agencies in the country are adequate. (Only for CIL as this is not applicable to SCCL)	* Washery Operations System of transport Underground includingman-riding arrangements and materials supply Rapid Sinking and Deepening of shafts, High speed Drifting including detailed designing for head frames, winding gear skips, skip pockets etc., Dry mechanical stowing, Equipment Planning, Installation, Operation and maintenance of Longwall equipment, Major Mine construction, Equipment Planning, Standardisation and Control Design of New Mine Installations Firedamp, Ventilation, Spontaneous Combustion, Dust & Strata Control	475			Nil		Nil				Training abroad throu[illegible] first hand exposure tothes[illegible] adoption of relevant technology in the countries concerred.		

1		2	3	4	5	6	7	8	9	10	11	12	13
II Management Skills.	ALL functional areas of Management relevant to Coal Mining.	10000	1100	11100	2300	--	2300	3	..	3	6	1	7
	Techno-Management Areas: Washery and Coal Beneficiation, plant Management, Planning Design & Management Mechanised Mines, Coal Movement by Railway Transportation, Management of large Open Cast Projects.	85	34	199	Nil (to be read with Cols. 7 &6)					Facilities for on-the job training-cum-guided study tours to advanced mining countries.			
III. Training Skills	Management of Training Executive and Supervisory Development Management of Training Institutes Trainer-Instructional skills.	320	25	345	Nil		Nil			1 to be covered under II		1	Covered under Trainers' for Non-Executive for Trainer-Instructional Skill. For Others, Training in UK as per UK consultants recommendations

ESTIMATES OF REQUIRED INCREASE IN NO OF VARIOUS TYPES OF TRAINING CENTRES AND LIKELY CAPITAL OUTLAY.

ANNEXURE -XI

Type of Training Institutions	Category of Personnel Trained.	Existing Number of units (marginally equipped)			Required increase in the number of units			Required capital outlay on equipments (Rs Crores)			Items for which assistant or aid is available or required from various sources.
		CIL	SCCL	Total	CIL	SCCL	Total	CIL	SCCL	Total	
1	2	3			4			5			6
1. Vocational Training Centres.	Timberman, Track Layer, Trammer, Mine Loader, Haulage, Winding & Conveyor Khalasis, Pump and Compressor Khalasis Lamp Fitters, OCM Driver, Loco Driver	102	7	109	56	7	63	3.10	1.21	4.31	Equipment for 22 Training Galleries & Audiovisual Aids for VT Centres. From UK Coal Sector Grant.
2. Basic Engineering Training Centres.	Electricians Elec. Fitters Mechinists Welders	Nil	1	1	20	4	24	1.59	1.40	2.99	ILO/UNDP Aid
3. Technical/ Mining Regional Training Institute for Supervisors.	Refresher Training for Technical-Supervisors	6	1	7	11	2	13	0.42	0.08	0.50	Teaching Aid from UK under Technical Cooperation programme.
4. *Mechanisation Training Centre	Mechanised Equipment and Face Workers.	1	-	1	1	1	2	1.60	1.60	3.20	ILO/UNDP Aid
5. Advanced Supervisory Training Instt.	Selected Supervisers with potential for Advancement	1	-	1	-	1	1	0.12	0.08	0.20	Training Aids from UK under Tech.Co-operation Programme
6. *Central Excavation Training School	HEMM Operators and Maintenance Personnel	1	-	1	1 For addl. equipment only	-	1	0.32	-	0.32	ILO/NUNDP Aid

 Contd. Annexure XI

1	2	3 CIL	3 SCCL	3 TOTAL	4 CIL	4 SCCL	4 TOTAL	5 CIL	5 SCCL	5 TOTAL	6
7. *Longwall Mechanisa-tion Training Instt.	Supportmen and Conveyor Movers Shearer Operators and Assistants, Chock Maintenances Men Face Electricians Face Supervisors.	1	-	1	1 to existing Instts.	-	1	0.80	-	0.80	Surface training Gallery Underground Training Face and Instructional Aids from U.K.
8. *Washery Training	Washery Operating Personnel	Nil	1	1	1	-	1	0.42	-	0.42	ILO/UNDP Aid
9. Central Training Instt. for Trainers	Training Instructors.	Nil	-	-	1	1	2	0.18	0.18	0.36	Training Equipment from UK and Technical Cooperation Project.
10. Management Training Instt.	Executive	3	-	3	6	1	7	0.36	0.21	0.57	Training Aids from under Technical Cooperation Projects