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Royal Commission

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on Canada's Economic Prospects

The Nova Scotia Coal Industry

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by Urwick, Currie Limited



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THE NOVA SCOTIA COAL INDUSTRY

prepared by
URWICK, CURRIE LIMITED

JUNE 1956

While authorizing the publication of this study, which has been prepared at their request, the Commissioners do not necessarily accept responsibility for all the statements or opinions that may be found in it.

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INTRODUCTION

IN response to a request made on December 22, 1955, by Mr. W. L. Gordon, we undertook to carry out a study of that part of the Nova Scotia coal industry controlled by the Nova Scotia Steel & Coal Company Limited and Dominion Coal Company Limited. The coal operations of these companies, which are referred to in this report collectively as the DOSCO companies, account for over 90% of the total output of the industry in Nova Scotia.

Because any trends in DOSCO activities would be reflected immediately in the industry position, we have used published figures from the Dominion Bureau of Statistics for the industry as a whole when providing background information and trends. Those parts of the report dealing with mechanization and markets, however, are based on estimates provided by DOSCO and relate to their activities alone.

The sections of the report dealing with the anticipated effects of mechanization are intended to be illustrative and show the implications of operating at different levels of production. They provide an indication of the expected increase in productivity and of the displacement of mine workers which would result from closing high-cost mines. In making our calculations we have not examined the reasons which determine which mines should be closed and our selection therefore in no way implies what should be done; it does, however, give a sufficient indication of the *results* of closing mines.

In discussing the benefits which can be expected to result from the completion of the mechanization programme (outlined in Section II of this report), we have taken the increase in productivity in terms of tons per man-day as our main consideration because clearly it is in such terms that the more realistic estimates can be made. The relevant figures have been supplied by DOSCO. In addition, however, it was necessary to

assess the effect of increased productivity on production costs in order to arrive at an estimate of subvention costs during the next five years. We have therefore made the necessary calculations, including estimates of the effect of possible changes in wage rates, but excluding those of any other changes such as transportation costs. While we have no means of gauging the possibility of other changes, we believe that a change in wage rates is likely to occur in the next few years and that appropriate allowances should be made in assessing subvention costs.

In stating the market position we have attempted to give a realistic assessment.

We are particularly grateful to The Nova Scotia Research Foundation which arranged for a number of United States experts on gasification to attend a meeting in Ottawa in order to give us the benefit of their experience. A leading member of this group, Mr. L. L. Newman, of the Bureau of Mines, was good enough to read and comment on a draft of the gasification section of this report. We would like to express our thanks for the co-operation and help we received from the management of DOSCO, the executive of District 26 United Mine Workers of America, the Chairman and staff of the Dominion Coal Board, and members of the Economics Branch of the Department of Trade and Commerce.

COAL PRODUCTION AND MECHANIZATION

Historical Review

It is not proposed to review the history of the coal industry in Nova Scotia in detail as it applies to the period prior to 1946, in view of the completeness of the report of the Royal Commission on Coal, 1946. However, in order that current progress may be assessed, we give figures of output and output per man-day for the years 1921 - 46 in Appendix I to this report. It will be observed that production varied between four and seven million tons throughout this period and output per man-day, while varying within a narrow range, showed a steady decline from 1939 to 1946. At the latter date it was below the 1921 level.

The Royal Commission on Coal made extensive comments on mechanization, productivity and management-labour relations, all of which were regarded as being in need of improvement. All of these factors have improved since the date of the Royal Commission's report.

Arising from the Royal Commission report, a loan of \$7.5 million was authorized by the federal government to the Dominion Coal Company in 1950, to which the company added \$5.5 million, making a total of \$13 million to be used for mechanizing operations in the mines to reduce production costs. In addition, DOSCO was to provide \$5 million for the mechanization of Old Sydney Collieries from its own resources and by private borrowing.

Since the time of the Royal Commission report productivity has improved and in 1955 it was 47% above the level which prevailed in 1945, with output per man-day at 2.33 tons against 1.58 tons.

During the course of our study we met the top management of the coal company and the members of the executive of District 26, United Mine Workers of America. Both parties expressed the conviction that relations between them have improved greatly since the time of the Royal

Commission report and that they are now conducted on a basis of greater understanding and respect. In our contacts with them we have been greatly impressed by the improved attitude and by the responsible approach taken to the problems of the industry by both sides. Although there does still appear to be room for improvement in the relations between the lower levels of management and the miners themselves, this improvement should take place in time in view of the sincerity displayed at the top levels.

Progress of Mechanization Programme

The mechanization programme as conceived consisted of the designing and installing of suitable mining machines for cutting and loading, the installation of simple fast-moving conveyors, the replacing of small mine cars by large lightweight cars, the replacement of rope level haulage by Diesel locomotive haulage, the driving of strategically located tunnels to speed up and cheapen main-line transport and the building of preparation plants for the improving and grading of the product.

Up to December 31, 1955, the Dominion Coal Company had drawn \$4.6 million of the government loan and had installed 21 Continuous Miners, eight Joy Loader units, 21 Diesel locomotives and 905 large mine cars. It has also driven 15% of a tunnel in the Glace Bay area and has practically completed the design of a washplant capable of handling the entire output of the company. The design was based on the performance of the pilot washery built for the Old Sydney Collieries.

At Old Sydney Collieries a washplant capable of handling the output from that company's mines has been built and put into operation. A 3,445 ft. long tunnel has been driven from the washery to Princess Colliery in order to permit that colliery's output to be doubled and to deliver the coal to the washery without handling. This tunnel has greatly cheapened the handling of coal from the pit bottom to the washery and when full outputs are obtained from the colliery the savings from the tunnel drirage will be most substantial. Four Continuous Miners and one Joy Loader unit have been installed and are working satisfactorily.

No programme of mechanization has as yet been decided on for the mines of the Acadia Coal Company in Pictou or for those of the Cumberland Railway & Coal Company at Springhill. The physical conditions existing in these collieries are in many respects much more severe than the conditions obtaining in the Cape Breton mines. Because of this it was decided to develop mechanization plans for the mainland collieries only after sufficient experience had been gained by the use of the equipment developed for the Cape Breton mines.

To complete the Dominion programme an additional 27 Continuous Miners, 28 Diesel locomotives and 2,400 mine cars will be required. The tunnel being driven in the Glace Bay area was stopped because the output which would have been tributary to it is presently not required because

of the falling off of anticipated markets. This tunnel will not be restarted until market requirements call for it. The Dominion washplant will be started in the immediate future and should be completed late in 1957.

Although much of the programme has been completed, in no colliery has the full benefit of the work done been realized, nor will the full benefits be felt in any colliery until mechanization of that colliery is completed. This is due to a large extent to the difficulty experienced in obtaining a suitable face conveyor. It was little more than a year ago that a conveyor was obtained which had reasonable operational and maintenance costs and which could handle the surge loading from the DOSCO Miner. Such conveyors are now being installed as rapidly as they can be obtained.

The programme is now being implemented at an accelerated rate and will be largely completed by the end of 1958. However, the need to design and build a low-height mining machine will retard the completion of mechanization of No. 16 Colliery probably until 1959, and the completion of mechanization in No. 26 Colliery may also be delayed until that year.

Anticipated Effects Of Mechanization

The programme of mechanization was launched to provide coal at a lower cost. The implications of the resultant increase in productivity are either to produce more coal with the same number of men, or produce the same amount of coal with fewer men. The question of which alternative is the appropriate one can only be judged in relation to the market prospects. This is discussed later in this report.

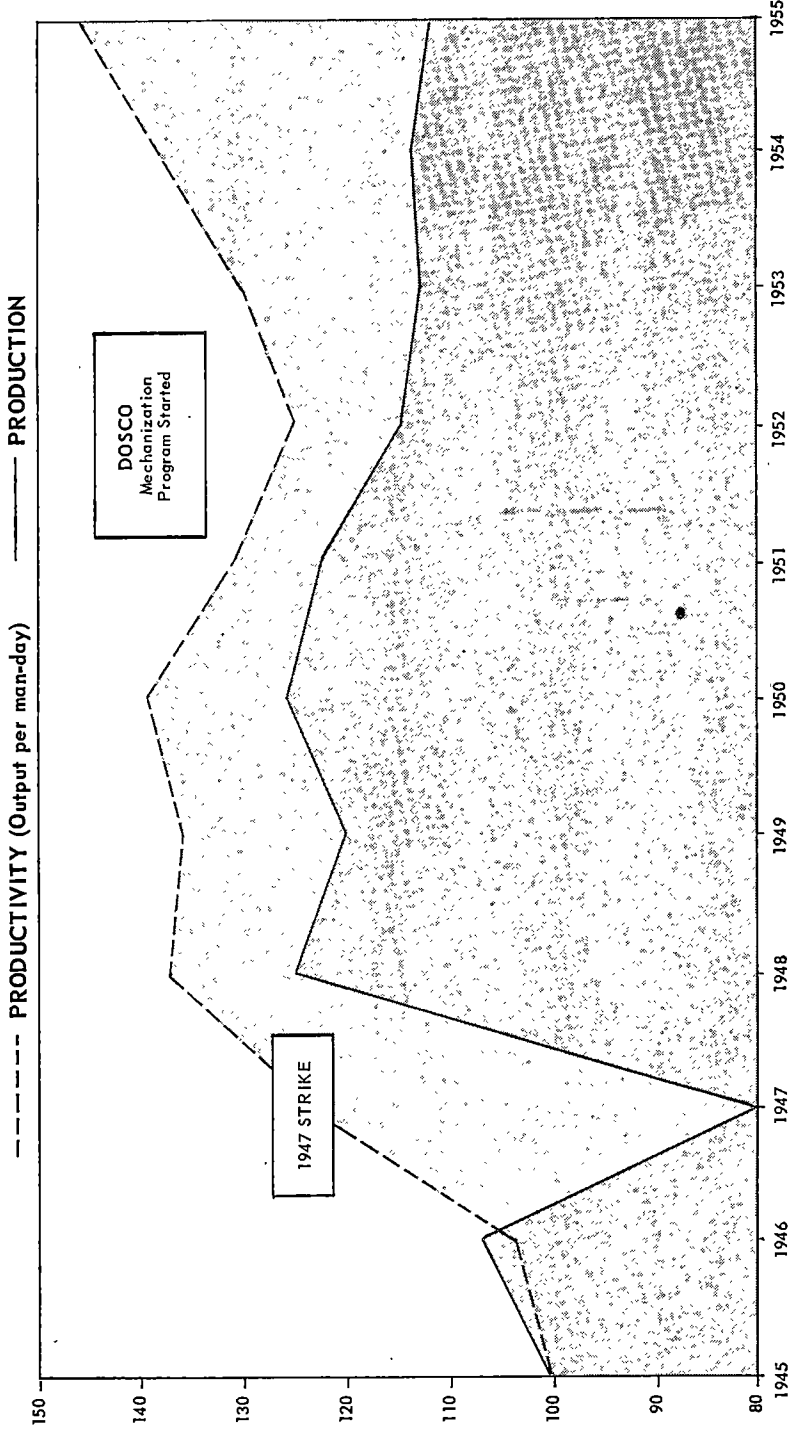
The coal companies feel that the programme at present being carried out represents the maximum that can be done in the mines and that on its completion the mines will be as efficient as mechanization can possibly make them.

The effect of mechanization is not completely felt in any given mine until all mechanization in that mine is completed. Moreover, the last stage has the greatest effect because it is essential if all other parts are to operate at peak efficiency. Apart from No. 25 Mine, where physical conditions have restricted the amount of mechanization that can be carried out, no mine has yet been completely mechanized and therefore there is no basis on which to prove conclusively what the effects of the programme will be.

Although the major results to be expected from mechanization have not yet been realized, a definite improvement in productivity has nevertheless occurred since 1952. In Chart 1, both production and productivity of Nova Scotia coal are shown in relation to the 1945 level. It will be observed that with the exception of 1947, which was an unusual year because of a major strike, output per man-day varied in direct relation to output up to 1952. When, for example, production dipped in 1949, rose again in 1950 and then fell by 10% in 1952, productivity changed at an

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1945 = 100



almost exactly corresponding rate. Between 1952 and 1955, however, productivity rose sharply without a corresponding rise in total output until in 1955 productivity was 2.3 tons per man-day, an increase of 47% above the 1945 level.

In order that the anticipated results of mechanization may be studied, we give a table in Appendix II to this report compiled from data supplied by DOSCO showing both for 1955 and at the completion of mechanization the production, productivity, average working force and estimated life for each colliery. The information is summarized for each company in Table 1.

Table I

**COMPARISON OF DOSCO 1955 PERFORMANCE
WITH
ANTICIPATED RESULTS AT COMPLETION OF MECHANIZATION**

	Available production		Tons per man-day	
	1955	End of mech.	1955	End of mech.
	(millions of net tons)			
Dominion Coal Co. Ltd.....	3.6	4.9	2.83	4.32
Cumberland Railway & Coal Co.....	.7	.6	2.47	2.30
Old Sydney Collieries Ltd.....	.7	1.2	2.51	3.87
Acadia Coal Co. Ltd.....	.3	.5	2.23	2.68
All DOSCO.....	5.3	7.2	2.70	3.79

The available production shown in Table I would be produced by a labour force that is comparable with the average for 1955. The tons per man-day produced, which on the basis of full production is 3.79 over-all, is some 40% above the 1955 level. Over-all costs should be correspondingly reduced.

The total available production can be expected to be some two million tons above the 1955 level and will, as we have stated above, be produced at a reduced cost per ton. An examination of Appendix II will show that the total tonnage is made up by production from mines which produce coal in varying quantities and at varying productive rates per man-day.

We were requested to study the implications of stabilizing production at the present level, which we have taken to be the 1955 output less the tonnage produced by Colliery I B, which was closed in mid-1955. It now appears that if the total production were to be stabilized at the 1955 level then there would be a surplus of some two million tons of coal with full production at the end of mechanization. It is uneconomic to operate a mine at less than full capacity and therefore if production were to be held at the 1955 level after mechanization were complete, it would then be necessary to close some high-cost producing mines. The effect of such action is indicated in Table II. It has been prepared on the assumption that mechanization takes effect in the year after it is scheduled for completion.

Table II

POSSIBLE EFFECT OF MAINTAINING PRODUCTION AT PRESENT LEVEL ^a

Year	Available production	Maintaining production at present level (millions of net tons)	Surplus if output maintained at present level	
			Production	Labour force
1955.....	5.3	5.3	—	—
1956.....	5.0	5.0	—	—
1957.....	5.5	5.0	.5	1,000
1958.....	6.0	5.0	1.0	1,900
1959.....	6.5	5.0	1.5	3,000
1960.....	7.2	5.0	2.2	4,000

a. Present production level is 1955 production less the output of Colliery I B, which was closed in mid-1955.

It will be seen that the stabilizing of the level of production could displace some 4,000 mine workers by 1960. Later in this report we discuss some of the social implications which could arise from such displacement.

With production stabilized at the present level the cost of coal per ton would drop substantially below the present costs as well as below the costs which would apply if all mines were kept in operation. Our calculations of these costs indicate that the elimination of the high-cost mines would make a significant contribution to the competitive position of the companies.

The increase in productivity and the corresponding reduction in the average cost per ton will be a progressive improvement because of differing completion dates for individual mines. The estimate of the movement in production per man-day is shown in Table III.

Table III

ESTIMATE OF AVERAGE PRODUCTION PER MAN-DAY

Year	At full production level (tons)	At present production level (tons)
1956.....	2.70	2.70
1957.....	2.99	3.05
1958.....	3.34	3.41
1959.....	3.58	4.08
1960.....	3.79	3.98

Note: The higher productivity at the present production level reflects the effects of closure of the lower productivity mines.

In order to give an indication of the effect of operating at an intermediate level of output we give an estimate of the output per man-day and changes from the present level of employment at differing levels of output after completion of mechanization.

Table IV

ESTIMATE OF EFFECT OF VARYING LEVELS OF OUTPUT
AFTER COMPLETION OF MECHANIZATION

	Millions of net tons	Output per man-day (tons)	Surplus, labour force
Present level	5.0	3.98	4,000
	5.6	3.96	2,900
	6.1	3.92	2,200
	6.7	3.84	1,200
Anticipated capacity . .	7.2	3.79	Nil

We have attempted to show in this section of the report that there are three alternative courses of action that can be considered, namely:

1. To operate the mines to capacity and produce a surplus of coal for which a market would have to be found.
2. To stabilize the output at the present level.
3. To operate the mines at an intermediate level.

The information we have used has been supplied by the coal company and the effects that have been indicated depend on whether the company's estimates are realized. The first opportunity of testing the validity of the estimates will occur by January, 1957, when Colliery No. 18 should be running smoothly on complete mechanization. We would emphasize that the estimates given are only intended to be illustrative and indicate the nature and possible extent of the problems which could arise. With an ever changing situation any major change in policy would have to be based on the actual position at the time any plans might be formulated.

MARKETS FOR NOVA SCOTIA COAL

Historical Review

Subvention Aid

The marketing of Nova Scotia coal has been governed over the years by its geographical position in relation to Canadian coal markets. Aid in the form of subventions has been given in varying degrees over the past 29 years. This aid has been given against the cost of transporting coal to the market in order that it might be competitive with imported coal from the United States. The amount of subvention required depends on three factors: the cost of coal landed at the market, the agreed price of comparable U.S. coal, and the tonnages sold in subvention areas. The tonnages moved under subvention, the subvention cost, and the cost per ton for the fiscal years 1928 - 29 to 1954 - 55 are shown in Appendix III.

It will be seen that the cost per ton of moving coal under subvention has increased steeply from 1950-51, when it was 80¢ per ton, up to 1954-55, when it was \$3.41. In 1955-56, however, because of increases in the price of U.S. coal, the cost was reduced to \$3.13 per ton. In recent years the subvention cost has increased sharply and the total payments made during the last 5 years more than equal the total payments for the preceding 23 years. The total subvention cost since 1945 has been as follows:

Table V

SUBVENTION COST—AND PERCENTAGE MOVED TO TOTAL NOVA SCOTIA OUTPUT

Fiscal year ended Mar. 31	Subvention cost (\$ millions)	Output moved percent
1946.....	0.8	9.0
1947.....	0.3	7.3
1948.....	0.2	7.0
1949.....	1.0	22.8
1950.....	2.7	23.5
1951.....	1.4	27.2
1952.....	3.3	28.5
1953.....	4.8	27.5
1954.....	7.1	36.9
1955.....	8.7	43.5
1956.....	8.4	45.7

Note: Figures for the fiscal year 1955-56 are provisional.

Disposition of Coal

In Appendix IV to this report we give a schedule showing the areas into which Nova Scotia coal was shipped during the calendar years 1946-55. An examination of the schedule reveals that from 1952 onwards sales have been remarkably constant, at about 5.8 million tons, but with the pattern of distribution reflecting a falling off in sales of railway coal and of sales to the Maritime Provinces. The loss of the railway market has been due to the dieselization programme and the losses in the Maritime market to increasing competition from imported residual oil. These losses have, however, been made good by additional sales to the Provinces of Quebec and Ontario with the help of the transportation subvention.

Transportation Costs

The 600-mile strip between Montreal and Windsor manufactures 75% of all Canadian iron and steel products and accounts for over 66% of this country's total coal consumption. DOSCO, which must haul its coal almost 1,000 miles to reach the most eastern end of this area, finds that with the maximum subvention it can barely compete with American coal as far as the Ottawa Valley. Virtually no coal at all is sold further west. Thus, because of the great distances DOSCO coal must be hauled, a vast market completely eludes the company. The following Table will give some indication as to the relative importance that freight costs would have to the final delivered cost throughout this area. For comparison purposes, competitive American coal at Cornwall and Toronto has an equivalent final cost of \$9.56 and \$8.33 respectively.

	Approx. mileage	Return to mine ^{a b}	Est. total freight cost ^b	Final cost ^b
<i>From Glace Bay</i>				
To Montreal by rail	1,000	8.91	4.93	13.84
by water		8.91	3.47	12.38
To Cornwall by rail	1,100	8.91	5.58	14.49
by water		8.91	6.10	15.01
To Toronto by rail	1,250	8.91	6.33	15.24
by water		8.91	7.55	16.46
To Windsor by rail	1,500	8.91	7.63	16.54

Although the above table demonstrates the exceptionally high cost of transportation in relation to the cost of coal, relative to the cost of shipping other commodities these distances, there appears to be little ground for considering these rates unreasonable, especially in view of

a. Return to mine is a representative figure based on average 1955 costs, selling and administrative expenses, and 25¢ profit per ton.

b. Per ton

coal's exemption since the war from the general pattern of horizontal percentage increases in freight rates. However, as in the near future the prosperity and indeed the survival of the Maritime coal industry may well rest with the markets to be found in the Atlantic Provinces, the effects of the transportation policy on the industrial economy of the Maritimes will have an indirect but material effect on coal.

The present rate structure is based primarily on a value of service principle, that is, on the value of the goods hauled, on the reasonable assumption that the more expensive goods can easily bear higher freight costs than can the less expensive goods. Secondary factors include transportation costs to the railroads, competition with other carriers, size, density and nature of the commodity, as well as influencing factors of geographic, political and historic origin.

Transportation rates based on the value of the commodity hauled have a strong tendency to persuade firms to locate their plants near the market for the finished goods rather than near the source of raw materials and supplies. This is simply because the cost of hauling finished products may be several times the cost of hauling the raw material used in producing those end products. The Maritimes, primarily an extractive industry area, suffers greatly from this situation as industry in general is very reluctant to locate its plants so far from the central Canadian markets, preferring to haul raw materials to manufacturing plants located close to the markets.

The result of this displacement of industry away from the source of raw material is first that more ton miles must be hauled to produce the same quantity of end products, thus increasing the over-all cost to the economy; and secondly that the raw materials hauled, as in the case of coal, can frequently be imported from nearby United States mines and plants at a lower cost to the manufacturer than would result from hauling the greater distances from Canadian extractive industry areas.

Another hypothesis has been voiced by a United States economist, the value of which we have not had opportunity to assess. His suggestion is that the most economic freight rate would be one which exactly equals the marginal cost to the carrier of hauling that freight. Such a system, he suggests, would greatly simplify rate setting, maximize the real benefit to the economy of hauling any article, encourage longer hauls and create new industries in extractive industry areas such as the Maritimes. Whatever the practicability of adopting such a scheme might be, we believe that further study should be carried out towards establishing which factor or factors should rightly dominate and control the determination of freight rates.

Except for three vessels in the fleet of the Dominion Shipping Co., a DOSCO subsidiary, the vessels used by the DOSCO companies are chartered on the open market. In recent years competitive bidding has become quite strong for the type of vessels used to carry coal, with the

result that water transportation costs have risen substantially. This trend is expected to continue over the next several years.

In 1955, 15 ships were under season charter and made an average of 15 trips each during the shipping season. An additional six ships were engaged on a single trip basis but accounted for only ten trips in total. The costs of hauling coal aboard these vessels varied to a remarkable degree, ranging on the trip to Montreal from \$1.00 per ton to \$3.50 per ton, depending on the charter price, the ship's capacity, its speed and the turn-around time. The average water freight cost to Montreal during 1955 was \$1.90 per ton, but because of increasing chartered boat rates, the 1956 cost is expected to be much higher and will likely exceed \$2.40 per ton. Certain vessels however, including the three DOSCO-owned ships, carried a substantial portion of the total tonnage hauled at a significantly lower cost than this average. For example, of all tonnage moved to Montreal in 1955, 40% was carried at an average cost of \$1.40, and over a third of this was carried by the single DOSCO-owned vessel, the *Louisburg*. If all shipments had been made at this rate, the subvention costs to the government would have been reduced by well over \$500.00.

In view of the importance of transportation to the over-all cost of coal, we believe that further study should be given to determine whether a considerably greater proportion of the coal could be carried on more suitable, low-cost ships.

Future Prospects

Our examination of the future prospects for sales of coal is restricted to the potential for DOSCO. We will not only be dealing with established markets but will take into account other possible uses for coal in spheres of electrification, gasification and the coal fired gas turbine. An examination of these uses is set out later in this report. These new potential uses for coal are not likely to make a contribution of any magnitude in the short-term future.

General

The size of the market for DOSCO coal depends on the number of available users, the extent of competition from U. S. coal, and the extent of losses to other sources of energy. In making our assessment we have been guided by studies prepared by officials of the Economics Branch of the Department of Trade and Commerce, and by officials of the Dominion Coal Board. In addition, the coal company has submitted estimates of expected sales under certain conditions. No studies have been prepared dealing specifically with Nova Scotia coal for any period beyond the early 1960's and any consideration of the size of the market has been restricted accordingly. There is evidence that energy demands in Ontario beyond the mid-1960's will be far heavier than could be met from the present available supply, but it is not felt that the gap will be filled by Nova Scotia

coal. Additional demands for energy will more likely be satisfied by increased supplies of oil, by coal from western Canada and the U.S., by natural gas, and by the development of atomic energy.

The short-term prospects are affected by the following factors:

1. The expectation of continuing competition from oil in the industrial and domestic fields.
2. The loss of the remaining market for railway coal.
3. The expected impact of natural gas in the eastern Ontario and Quebec markets after 1958.
4. The influence that may be felt after 1958 through the completion of the St. Lawrence Seaway.
5. The expected reduction in the cost of coal due to mechanization.

An underlying consideration affecting the market prospects is the extent of aid that may be granted by way of subvention. The anticipated effects of mechanization have already been discussed in this report, and in view of the close relationship between the cost per ton of coal, the tonnage produced, the subvention cost, and the competitive market position, it is proposed to examine these factors on three separate bases:

1. With output stabilized at about five million tons per year.
2. With full output after completion of mechanization.
3. With output related to market demand.

With Stabilized Output

In selecting a level which could represent a stabilized position we have been guided by output over recent years. From 1952 onwards DOSCO has found markets for about five million tons of coal a year, and that level has therefore been chosen. In Appendix V we submit a schedule showing outputs by both DOSCO and other producers for the period 1946 - 55.

Estimates from DOSCO which we have examined in relation to other market studies lead us to the opinion that markets for five million tons of coal can be found up to and including the year 1960.

At the present time no assistance is available to enable coal to compete with oil for industrial purposes. Assistance to enable sales to be made in the Maritime Provinces is less costly than the subvention assistance that would be required to sell the coal elsewhere. This assistance against oil should apply in particular to thermal power, which promises to become an expanding market in the area. It is a logical market for Nova Scotia coal and should be protected.

The maintenance of output at a five million ton level presupposes that the high-cost mines are closed as and when production would exceed requirements. The price of coal under these conditions is the lowest that

could be obtained under any of the three alternatives and the subvention cost would therefore be at a minimum. In estimating the subvention cost at this level of output two assumptions are made: (1) that wage rates and other elements of cost remain constant, and (2) that the average cost of coal reduces in accordance with the assumptions made above.

Under these conditions we would expect the subvention cost required with an output of five million tons a year to reduce to about \$4.4 million for 1957 and 1958, to about \$3.2 million in 1959, and to about \$2.1 million in 1960. The need for an oil subvention will probably disappear by 1960, as the price of coal reaches the minimum.

The progressive reduction in the cost of subvention which is likely to accrue under the stated conditions would represent a saving of over \$6 million a year compared with the 1956 position. It should be appreciated however that the amount of coal so moved is reduced by almost one million tons. If these conditions were to prevail, however, the implication arising from the displacement of some 4,000 mine workers would have to be considered.

With Anticipated Available Output

The completion of mechanization is likely to make coal available which may not be readily salable in established markets. This excess over the stabilized level, which has already been discussed, may be of the order of two million tons by 1960. The marketing of this coal can apparently only be accomplished in three ways:

1. By expanded sales in existing markets.
2. By a further westward movement into Ontario under subvention.
3. By sales in the export market.

The surplus of coal over the established demand is likely to reach sizable proportions in 1959, at a time when the impact of the St. Lawrence Seaway may begin to be felt and the Ontario and Quebec market can be expected to be receiving supplies of natural gas at highly competitive prices.

These factors will seriously reduce sales in Quebec. In the case of Ontario no market of any size is held at present, although coal consumption is some 16 million tons annually, virtually all of which is imported from the United States.

Whatever the inroads made by other sources of energy may be, a market of considerably more than two million tons per year will continue to exist for coal. Provided, therefore, that Nova Scotia coal is acceptable as to quality, the surplus quantity could theoretically be sold if it were competitive in price. Under present conditions it is likely that the subvention cost of selling the two million tons competitively in Ontario could possibly be \$14 - \$15 million per year, while by 1960 it might be between \$13 - \$14 million per year.

In view of the very high subvention cost of selling coal in Ontario, and because of the greater accessibility of other fuels, it appears uneconomical to attempt to sell the full extra available tonnage in that province.

A large potential market exists in Europe and particularly in the United Kingdom. In 1956 sales by DOSCO to Europe amounted to 235,000 tons. The export market could easily absorb two million tons a year, provided price and quality were acceptable. The requirements set by the United Kingdom, however, regarding the acceptable sulphur content of the coal, have already created a minor problem. Whether the question of price would outweigh considerations of quality has not yet been tested. However, the shipment in British vessels has a dollar earning attraction which might mean an advantageous freight cost. This possibility should be examined further.

The manner in which subventions are granted hampers trading in world markets because it makes it impossible to enter into long-term contracts with buyers. Subventions are granted on spot orders and the subvention applicable to current orders has been \$2.30 per ton. By 1960, assuming present wage rates, the subvention cost is likely to be well under \$1.00 per ton. The present cost of selling two million tons in the export market would therefore be about \$4.6 million and in 1960 it might be only one million dollars.

Although we see little possibility of selling the full two million tons in established markets, it could be sold between Ontario and the export market, but the subvention cost would be much higher than the rate applicable in established markets. If it is to be sold at the lowest possible subvention cost then DOSCO must be placed in the best possible position to make sales. The subvention regulations must be adjusted with that end in view.

Anticipated Market

The possibilities of selling either a fixed level of output or all available output have been examined and some of the factors influencing the market position have been reviewed. From estimates prepared by DOSCO, which we have examined in conjunction with other studies and which we have discussed with experts on the coal markets, we are of the opinion that the sales of DOSCO coal can be expected to be as follows:

Table VII

ESTIMATE OF DOSCO SALES, 1956-60

Year	Millions of net tons
1956.....	5.9
1957.....	5.8
1958.....	5.8
1959.....	5.5
1960.....	5.3

By the years 1959-60 three main factors will be felt, namely, the loss of the railway market, the loss of industrial markets in Quebec, and the expected gain of markets because of thermal power developments in New Brunswick. Together with a drop in the cost of coal these factors will have a marked effect on the required amount of subvention, since the losses will occur in subvention areas while the gains are expected to accrue at virtually no subvention cost in the Maritime Provinces.

The impact of natural gas arising in eastern Ontario and Quebec, although it is expected to hurt coal imports, is also estimated to lose DOSCO some 800,000 tons of coal sales a year. The pipeline which will carry the equivalent of eight million tons of coal a year will not merely service public utilities in the main centres. It is expected that industrial consumers, paper mills, cement plants, mines, will be prepared to pay equivalent prices on a contract basis. Many major DOSCO customers are within easy reach of the pipeline and it is felt that spur lines will be built by the pipeline operators to capture these markets. In fact two major customers have already been approached and in one case the building of a 60-mile spur has been proposed if a contract for the supply of gas can be agreed upon.

The St. Lawrence Seaway is expected to be in operation in 1959, and whether it will have an effect on the market price of coal will depend on whether the ore carriers will carry U.S. coal to eastern Ontario and Quebec on their return run down river. If they do this, then it has been estimated that the price of competitive U.S. coal will be lowered by at least \$1 per ton and the subvention cost under the conditions applying in 1960 would increase by some two million dollars a year.

It is not expected, however, that the large ore carriers will carry any appreciable tonnage of coal in the early years of the Seaway, because of lack of facilities for unloading large ships and because the expected demand for the ore will be so great that the need for the rapid return of ore carriers will outweigh the benefits of earning extra revenue by carrying coal. Accordingly no major provision has been made in the sales estimate for losses from this cause. After 1960, however, the cost of holding the Quebec markets may increase.

It is most important to realize that the sales estimate given will be subject to the same considerations that have been illustrated in discussing the maintenance of a stabilized coal output. To achieve the cost of coal required and the subvention costs indicated, mines would have to be closed somewhat in accordance with the position shown in Table II. This would mean that by 1960 some 4,000 miners would be displaced.

The coal costs shown reflect the improvements in mechanization but do not take account of any rise in wage rates, transportation costs or material costs. The miners have not had an increase in pay for the past four years and although we understand that agreement has been reached

that no increase will apply for another year, increases will nevertheless have to be given during the period to 1960. We have estimated that every one dollar a day granted will increase the price of coal at a five million ton output level in 1960 by 50¢ a ton. The subvention cost would increase by a corresponding amount on two million tons sold under subvention.

In estimating the probable subvention cost over the next five years some provision has to be made for: (1) possible loss of business to natural gas, (2) the effect of the St. Lawrence Seaway on the competitive position of U.S. coal, and (3) possible rises in wage rates and transport costs.

The calculated subvention costs referred to earlier, based on the sales tonnages given in Table VII and the expected coal production costs year by year, have therefore to be adjusted accordingly. After considering all the factors we have come to the conclusion that a reasonable estimate of the future subvention costs would be as follows:

Table VIII

ESTIMATE OF SUBVENTION COSTS
1956-61 INCLUSIVE

Year	Estimated sales (millions of net tons)	Estimated subvention costs (millions of dollars)
1956.....	5.9	8.5
1957.....	5.8	8.3
1958.....	5.8	8.3
1959.....	5.5	6.5
1960.....	5.3	4.0
1961.....	5.3	4.5

^{††} Note: In the year 1961 the sales are expected to be held at the previous year's figures but at increased cost because of the possible effect of the Seaway. Thus the year 1960 must be considered as the optimum at the present level of production as far as total subvention costs are concerned. Only a further closing down of pits is likely thereafter to reduce subvention costs.

EMPLOYMENT AND DEPENDENCE ON THE INDUSTRY

Employment

The total employment in the Nova Scotia coal mines during the period 1946-1955 has been as follows:

1946 — 13,231	1951 — 11,952
1947 — 10,045	1952 — 11,612
1948 — 12,044	1953 — 11,231
1949 — 11,785	1954 — 10,637
1950 — 11,712	1955 — 11,337

In the case of the DOSCO companies, who in 1955 employed 93% of the total, the numbers that will be employed in the future will, after allowing for increases in productivity, depend on the output of coal to be produced. After mechanization is completed we would expect employment by DOSCO to vary with output somewhat as follow:

Level of production (millions of net tons)	Estimated mine workers
5.0	5,200
5.6	6,200
6.1	6,800
6.7	7,900
7.2	8,800

The figures stated do not include auxiliary departments, piers, repair shops and the Sydney & Louisburg Railway, which could be expected to account for a further 1,500 - 2,000 personnel.

Dependence On The Industry

The coal industry in Nova Scotia is by far the largest single employer of labour in the province, accounting for some 12% of industrial employment. In the mining areas the towns are small and their dependence on the coal industry is virtually complete. The main centres of population and the DOSCO estimate of the extent of their dependence on the industry are shown in Appendix VI. Except as otherwise indicated DOSCO estimates the dependence to be complete, giving an estimated total impact on 120,000 persons for the industry as a whole. This represents an additional ten persons directly or indirectly dependent on one mine worker.

Studies that have been carried out on the implications of new projects in new areas suggest that between four and five additional people are dependent on one worker. In the Cape Breton area there is a considerable amount of unemployment and it is probable that previous mine closures have reduced the returns to the service trades to a point where any further displacement of miners would have maximum effects. For this reason it appears that the number of additional persons affected by any displaced miner would be higher and could be expected to be between six and seven, as opposed to DOSCO's estimate of ten. If the estimate of seven additional persons affected by the displacement of one miner is accepted, as seems to us reasonable, then the displacement of 4,000 miners would affect the livelihood of at least 30,000 persons.

NEW POTENTIAL USES FOR COAL

Electrification At The Mine

The question as to whether it is more economical to produce electricity at a mine or to carry the coal to thermal plants at load centres is determined by the relative cost of transporting equivalent amounts of energy. Studies have been conducted by the Economics Branch of the Department of Trade and Commerce which conclude that the transmission of electricity from thermal plants at the mines to load centres in the Maritimes would be the more costly method.

Although it would not appear to be economic to electrify coal at the mine and build a grid to various load centres, it might be possible to supply electricity from the mine area to a central grid if one existed. Reports have been prepared by Professor A. C. Christie on behalf of the Dominion Coal Board in respect of energy developments in the Maritime Provinces which emphasize the wide economic benefits that could accrue if a grid system were established. If participation in such a scheme could materialize, the cost would undoubtedly be less than finding other markets for the coal involved.

Gasification

The use of coal for the production of gas is not new, and coke ovens and water gas sets have been operated for this purpose for very many years. However, the process with which we are concerned, namely, continuous processes for gasifying coal without the production of coke, is of more recent origin. Two such processes attained commercial development in Germany during the decade preceding World War II: the Winkler process for gasifying granular sizes of coal in a fixed fluidized bed, and the Lurgi process for gasifying similar sizes in a fixed bed under pressure.

The Winkler process was first used on a small scale at Leuna in 1926 and the first large-scale generator making water gas was operated in 1930. When the programme of synthetic oil plants was begun in Germany in 1936, the Winkler process was adopted as the standard source of hydrogen at the Brabag Works. The first high-pressure gasification plant operating by the Lurgi process was put into operation for city gas production in 1936 and the company is currently installing and operating gasification plants in the Ruhr, Pakistan, South Africa and Australia. High-volatile bituminous coals cannot be successfully used in either the Winkler or Lurgi processes. Where non- or weakly-caking coals of granular size are available the Lurgi process is favoured. If the proportion of fines is too large, or if the coal is strongly caking, pulverized-coal gasification processes are preferred. Except for anthracite in Pennsylvania the coals mined east of the Mississippi are predominantly caking.

The methods of gasification of coal actively studied in the U.S. in the postwar period were principally concerned with pulverized coal. Gasification research in the U.S. is of increasing importance in the light of an expected shortage of fluid fuels after 1975. At that time, coal will be a vital source of primary energy, to be used for making up the demand for fluid fuels and gasification is almost certain to be carried out on a large scale. It is likely that by 1965 local conditions in the U.S. will permit economic gasification. In New England, for example, because of the distance from the source of natural gas, the gasification of oil may now be carried out competitively and the time has almost arrived when town gas from coal can be provided at competitive prices.

Development work in the United States has been carried out by the Bureau of Mines at Morgantown, West Virginia; the Institute of Gas Technology at Chicago, Illinois; and the Texaco Development Company at Montebello, California. Pilot plants have been operating at Morgantown since January, 1951, to produce synthesis gas by the reaction of coal with oxygen and steam in a continuous process. The present plant has a nominal rating of 500 lbs. of coal per hour, producing about 330,000 cu. ft. of carbon monoxide and hydrogen per 24-hour day. In order to avoid the limitations on the use of caking coals imposed by the Lurgi process the plant was designed for and operates on pulverized coals. This enables high-volatile bituminous coal to be used and the sulphur content of the coal has no effect on the process. Of specific importance is the fact that Cape Breton coal shipped by the Dominion Coal Company has been tested in Morgantown and has been found suitable for commercial applications.

The production of synthesis gas gives a mixture of carbon monoxide and hydrogen in varying proportions. It forms the basic raw material for ammonia, methanol, and many other chemicals, as well as for synthetic liquid fuels. The experiments at Morgantown have been directed towards the production of synthesis gas for synthetic liquid fuels and pipeline gas, but basically the processes are suitable for large-scale production of hydro-

gen. Hydrogen has an important potential use in steel making which will be discussed later in this section of the report.

There appear to be three spheres in which the gasification process can be considered in relation to Nova Scotia coal, namely:

1. To provide a gas to supplement or replace the public utility gas supply.
2. To provide basic chemicals.
3. To produce hydrogen for use in steel making.

With the exception of the gasifier, the unit processes required in the production of high B.T.U. gas for public utility distribution, basic chemicals, or hydrogen, have attained a considerable degree of development and are all subject to conventional engineering treatment. They present no major problems.

The application of gasification using coal has been demonstrated at Morgantown, but we know of only two commercial applications using coal on this continent. The E. I. duPont de Nemours Company has been operating a low-pressure pulverized coal gasifier at Belle, West Virginia, since January, 1955. This installation is gasifying high-volatile bituminous coal to produce synthetic ammonia which, in turn, is used to produce a variety of fertilizers at the Belle plant. This installation, consuming up to 18 tons of coal per hour, uses some 150,000 tons per annum in continuous operation and is part of a larger plant using conventional water-gas equipment. The Texaco Development Corporation has considerable experience with synthesis gas production. It has installed a number of commercial plants for synthesis gas and is engaged in constructing several more plants to gasify heavy fuel oil. It also has under construction a high-pressure unit for gasifying pulverized coal, using air, at the rate of 100 tons of coal a day. This unit would be able to handle as much as three times that quantity when using oxygen.

The potential use of gasification to produce hydrogen could assume great importance in view of the developments that are taking place in the application of hydrogen to steel making. A semi-commercial plant has been operating for two years at Trenton, N.J., as a joint project of Hydrocarbon Research Inc. and the Bethlehem Steel Co. This plant reduces the ore (iron oxide) to metallic iron in a single step using high-pressure hydrogen. The following advantages are claimed:

1. It eliminates the process of charging the blast furnace with limestone, coke and ore in successive layers.
2. The product produced is iron metal that is free of carbon and sulphur.
3. The process can produce a mixture of metallic ore and open hearth charge ore in the same package.
4. The metallic iron portion can reduce dependence on purchased scrap.

Against these advantages must be set the disadvantage that the process will not remove silica and phosphorus from ore that is high in these elements. We understand that the Wabana ore used by Dominion Iron & Steel Ltd. is high in both these elements.

At a meeting held in Ottawa on April 12th, 1956, a number of U.S. experts gave us the benefit of their experience with gasification and expressed some general views on its possible application in Nova Scotia. The following guides to the economic possibility of gasification were given:

1. If natural gas were to cost more than 65¢ per 1,000 cu. ft. in Montreal, then it would be feasible to pipe gas from Nova Scotia, if coal were available at a cost of \$4.00 per ton.
2. The hydrogen process for producing metallic iron could possibly save \$15.00 per ton on the price of purchased scrap.
3. The minimum size for an ammonia plant in North America would be one with a capacity of at least 100 tons of ammonia a day. Such a plant would consume two tons of coal for every ton of ammonia produced.

The capital costs of the plants necessary to gasify 250 tons of coal per day were given broadly as :

Gasifier Plant	\$1½ million
Purification Plant	\$2½ million
Conversion Plant	\$2 million
Hydrogen Steel-Making Process	Not available

An estimate of the capital cost of the Hydrogen Steel-Making Process cannot be provided at the present time. Such an estimate could only be provided by Hydrocarbon Research Inc. of New York, who have stated that they could not give it without having details relating to the steel company's operations. The cost of the plant would, however, be an addition to the estimated \$6 million set out above.

The general economic situation in the Maritime Provinces would indicate that the relative demand for the products of gasification in order of importance would likely be as follows:

1. The production of hydrogen for use in steel making.
2. The production of ammonia for fertilizer use.
3. The production of public utility gas. This is not likely to have any application until such time as it might be needed to boost supplies available from other sources.

It appears highly desirable that experts in the gasification process should be requested as a matter of urgency to undertake a detailed study of the cost and implications of applying gasification in Nova Scotia. It must be appreciated, however, that an initial installation of the type discussed would only demand something less than 90,000 tons of coal annually.

Coal-Fired Gas Turbine

The use of steam locomotives is declining rapidly through the diesellization programme of the railways and this market which once accounted for about one million tons of Nova Scotia coal a year will have virtually disappeared within five years. The building of a coal-fired gas turbine with an application for railway locomotive use is therefore of considerable interest.

With financial assistance from the federal government, development work on this project has been carried out over the past six years at McGill University under Professor D. L. Mordell. Both the Canadian National and Canadian Pacific Railways have stated that they would be interested in a coal-fired gas turbine locomotive when built and would be willing to test a prototype under operating conditions. It is likely, however, that the railways would only be able to use about 150 such locomotives, assuming that they were eventually built and approved. The use would be limited because the locomotives would have their greatest efficiency and most economic use on long hauls. The possible economy in cost over the life of a locomotive has been estimated by Professor Mordell at between \$20,000 and \$50,000, and the coal consumed by 150 such locomotives under operating conditions could be about 600,000 tons a year. Not all this coal, however, would be supplied from Nova Scotia mines; in fact, from geographical considerations probably less than half would be supplied from this source.

Apart from the possible application of Professor Mordell's work to locomotives it is also claimed that the coal-fired gas turbine is particularly suitable for the small-scale production of power and that it could also be used in conjunction with large steam generators. In considering the potential applications of the turbine it should be appreciated that it will operate equally efficiently on oil and should Bunker C oil be available more cheaply than coal then the turbine, if used, would probably be operated on oil and not on coal.

Work on the experimental unit is still being carried on and Professor Mordell is confident that solutions to the remaining problems will soon be found. However no prototype locomotive has yet been built. Indeed, the position at the time of writing is such that unless further funds are forthcoming to enable the work to continue, it will cease within the next two months. The work that has been done so far appears to be ahead of any comparable development in other parts of the world.

Any benefits that might accrue to the Nova Scotia coal industry from this work can only be regarded as minor and would only have any effect from a long-term point of view.

CONCLUSION

The main points arising from this report are as follows:

1. On the basis of information supplied, the results of mechanization will be to increase output to seven million tons a year and output per man-day to 3.79 tons by 1960. The cost of coal will be reduced, depending on the level of output maintained.
2. With full employment of the present labour force under present conditions and assuming the foreign market does not expand, the cost of subvention in 1960 can be expected to be up to \$16 million a year.
3. If output is kept down to the present market estimate of 5.3 million tons a year in 1960 the subvention cost would be between \$2 and \$3 million a year at present wage levels, or, taking all factors into account, between \$4 and \$5 million a year. Because of increased output per man-day it would be necessary to close high-cost mines and some 4,000 miners would be displaced.
4. If no subvention aid were payable, output in 1960 would have to be restricted to three million tons and some 5,800 miners would be displaced.
5. The main market must remain the Maritime Provinces and every effort should be made to retain and increase it; this would necessitate the granting of assistance against oil where required.
6. There is a potential export market in Europe of at least two million tons a year, provided price and quality could be agreed on. But this market has not yet been fully tested and might require an approach at government level in view of the dollar exchange angle.
7. The new possible uses for coal — electrification and gasification at the mine, and the coal-fired gas turbine — will not have any great effect on the size of the market in the immediate future. The most promising new use lies with gasification and it is desirable that experts in the process undertake a detailed study of the cost and implications as they might apply in Nova Scotia.

8. The effect of an increase in wage rates at a five million ton level of output would be to increase the price of coal by about 50¢ a ton for every \$1.00 a day granted. This would increase the subvention cost correspondingly on every ton sold under subvention.

The effects of maintaining output at any level which would require the closure of mines are twofold, namely, to cause unemployment and to incur heavy capital expenditure if the need to reopen mines arises at a later date. Because the multiplying effect of unemployed miners on the economy of the province would be so severe, we feel that the best way to deal with such a situation would be through the establishment of new industries within the area. We suggest that this is a major social problem which demands the attention of both the provincial and federal governments. We believe that the first practical step would be to examine what can be done to develop secondary industries in the area, since this would have the double effect of supplying alternative employment and further markets for coal. Once this survey has been made it will then be possible to assess the balance of unemployment and to consider what approach should be taken to meet it.

The basis on which rail transportation rates are calculated is against the establishment of new secondary industry and the need to re-examine the basis on which they are set may assume greater importance if industry is to be attracted to the province.

The maintenance of full employment will create the need to sell large tonnages of coal which will need assistance by way of subvention. Such aid will have to be regulated and administered in a flexible manner with the objective of placing DOSCO in a position to compete against oil and to take full advantage of the export market potential. It may also be necessary to permit the joining of water and rail subvention allowances in specific cases. In view of the importance of transportation costs on the laid-down price of coal the possibility of increasing the tonnage moved in low-cost boats justifies an intensive effort to reduce costs in that way.

**PRODUCTION AND OUTPUT PER MAN-DAY
ALL NOVA SCOTIA MINES**

1921-46

	Production (millions of tons)	Output per man-day (tons)		Production (millions of tons)	Output per man-day (tons)
1921.....	5.7	1.98	1934.....	6.3	2.26
1922.....	5.5	1.87	1935.....	5.8	2.12
1923.....	6.6	1.88	1936.....	6.6	2.28
1924.....	5.6	2.20	1937.....	7.3	2.21
1925.....	3.8	2.05	1938.....	6.2	2.24
1926.....	6.7	2.26	1939.....	7.1	2.34
1927.....	7.0	2.16	1940.....	7.8	2.30
1928.....	6.7	2.09	1941.....	7.4	2.05
1929.....	7.0	2.07	1942.....	7.2	2.08
1930.....	6.3	2.05	1943.....	6.1	1.84
1931.....	5.0	2.03	1944.....	5.7	1.65
1932.....	4.1	2.08	1945.....	5.1	1.58
1933.....	4.6	2.61	1946.....	5.5	1.65

ANTICIPATED RESULTS OF MECHANIZATION

	Production (net tons)		Tons per man-day		Average working force		Estimated reserves Years	Expected completion of mechanization
	1955	End of mech.	1955	End of mech.	1955	End of mech.		
Dominion Coal Co. Ltd.								
ALL COLLIERIES.....	3,562,653	4,892,400	2.83	4.32	5,540	5,245		
No. 1B.....	170,606		4.08		365		50	1958
No. 4.....	480,113	648,000	2.38	4.17	922	720	27	1956
No. 12.....	706,555	885,600	2.88	4.40	1,053	931	12	1959
No. 16.....	640,954	756,000	2.84	4.37	968	801	13	1956
No. 18.....	255,892	453,600	3.20	4.77	358	440	86	1958
No. 20.....	628,516	874,800	2.84	4.16	1,027	974	10	Complete
No. 25.....	206,582	194,400	2.77	2.73	325	330	10	1959
No. 26.....	473,435	1,080,000	3.91	4.77	522	1,049	116	
Cumberland Railway & Coal Co.								
ALL COLLIERIES.....	674,943	648,000	2.47	2.30	1,196	1,306	28	Indefinite
No. 2.....	409,397	388,800	2.54	2.36	713	764	8	Indefinite
No. 4.....	265,546	259,200	2.37	2.21	483	542		
Old Sydney Collieries Ltd.								
ALL COLLIERIES.....	729,729	1,209,600	2.51	3.87	1,253	1,448	34	1957
Princess.....	390,519	885,600	2.54	4.88	661	841	16	Indefinite
Florence.....	311,912	324,000	2.35	2.47	568	607		
No. 7 Lloyds.....	27,298		5.75		24			
Acadia Coal Company Ltd.								
ALL COLLIERIES.....	316,176	486,000	2.23	2.68	593	840	4	None contemplated
Albion.....	121,738	194,400	2.09	2.66	245	339	15	Indefinite
McBean.....	194,438	291,600	2.32	2.70	348	501		
All DOSCO.....	5,283,501	7,236,000	2.70	3.79	8,582	8,839		

Note: No programme of mechanization has as yet been decided on for the mines of Acadia Coal Company Ltd. and Cumberland Railway and Coal Co. The changes shown are the results of normal improvements in operation.

TONNAGES AND COSTS OF NOVA SCOTIA COAL MOVED UNDER SUBVENTION

Fiscal year ended Mar. 31	Tonnes moved (millions of net tons)	Total subvention cost (millions of dollars)	Cost per ton (dollars)
1929.....	.2	.2	0.86
1930.....	.3	.2	0.59
1931.....	.3	.2	0.59
1932.....	.4	.2	0.53
1933.....	.7	.6	0.78
1934.....	1.6	1.8	1.14
1935.....	1.7	1.5	0.87
1936.....	1.6	1.4	0.86
1937.....	1.7	1.6	0.95
1938.....	1.9	1.8	0.94
1939.....	1.3	1.2	0.93
1940.....	2.6	3.2	1.23
1941.....	1.8	2.5	1.39
1942.....	1.8	1.9	1.05
1943.....	1.8	3.4	1.90
1944.....	.6	1.6	2.77
1945.....	.8	2.0	2.41
1946.....	.5	.8	1.74
1947.....	.4	.3	0.93
1948.....	.4	.2	0.59
1949.....	1.4	1.0(a)	0.70
1950.....	2.1	2.7(a)	1.27
1951.....	1.7	1.4(a)	0.80
1952.....	1.8	3.3(a)	1.85
1953.....	1.6	4.8(a)	2.94
1954.....	2.1	7.1(a)	3.37
1955.....	2.6	8.7(a)	3.41
1956.....	2.7	8.4(a)	3.13
	38.5	64.0	1.66

a. Payments on water-borne coal during the past eight years were on an accountable advance basis. Included in the last five years figures are final payments in respect of prior years. Figures for the year ended March 31, 1956 are provisional.

**DISPOSITION OF NOVA SCOTIA COAL,
1946 TO 1955**
(in millions of tons)

Year	Total output	Company and employee use	Inventory change and waste	Bunker ^(a)	Locomotive	Nova Scotia	New Brunswick	Newfoundland	Prince Edward Island	Quebec	Ontario	Export (including St. Pierre)
1946	5.5	.5	.1	.1	.9	2.1	.9	.2	.1	.6	.0	.0
1947	4.1	.4	.1	.1	.5	1.7	.5	.2	.1	.5	.0	.0
1948	6.4	.5	(.2)	.1	.9	2.2	.7	.3	.1	1.7	.0	.1
1949	6.2	.4	.0	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
1950	6.5	.5	.0	.1	1.2	2.0	.6	.2	.1	1.8	.0	.0
1951	6.3	.5	.0	.1	1.0	1.9	.6	.2	.1	1.8	.0	.1
1952	5.9	.4	(.1)	.1	.8	2.0	.6	.2	.1	1.7	.0	.1
1953	5.8	.4	.1	.1	.8	1.7	.5	.2	.1	1.9	.0	.0
1954	5.8	.3	.1	.1	.5	1.7	.4	.2	.1	2.2	.2	.0
1955	5.7	.3	.0	.1	.5	1.8	.5	.2	.1	1.8	.2	.2

(a) A decline from 1946 to 1955 of some 60,000 tons of coal used in bunkering is not shown because of rounding.

(b) Figures not available.

**OUTPUT OF NOVA SCOTIA COAL,
DOSCO GROUP^(a)
AND OTHER OPERATORS**

	DOSCO group	Other operators ^(b)	Total Nova Scotia ^(b)	DOSCO group to total percent
1946.....	4.7	.8	5.5	85
1947.....	3.6	.5	4.1	88
1948.....	5.7	.7	6.4	89
1949.....	5.5	.7	6.2	89
1950.....	5.7	.8	6.5	88
1951.....	5.5	.8	6.3	87
1952.....	5.1	.8	5.9	86
1953.....	5.1	.7	5.8	88
1954.....	5.3	.5	5.8	91
1955.....	5.3	.4	5.7	93

(a) The DOSCO group consists of all collieries within Dominion Coal Company Limited, Old Sydney Collieries Limited, Cumberland Railway & Coal Company and Acadia Coal Company Limited.

(b) Millions of tons.

**DOSCO ESTIMATE OF
POPULATION OF NOVA SCOTIA WHOLLY DEPENDENT ON
THE COAL INDUSTRY OF THE PROVINCE**

MAIN COMMUNITIES

Glace Bay	25,500	
Dominion	3,000	
New Waterford	10,500	
Sydney Mines	8,400	
Florence — Bras d'Or	4,000	
Stellarton	2,700	— 50% of population
Westville	2,000	— 50% of population
Thorburn	2,500	
River Hebert	1,300	
Joggins	2,400	
Springhill	7,200	
Inverness	2,400	
Port Morien — Donkin — Birch Grove	2,600	
Reserve	3,000	
Sydney	17,500	— 50% of population
North Sydney	2,300	— 30% of population
New Glasgow	3,000	— 30% of population
Others engaged in transport, supplies, etc. throughout province	20,000	
Total	120,300	

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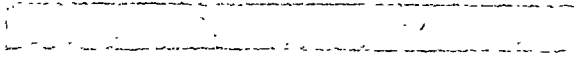
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¹—This is one of a series of three studies on Canadian international economic relations prepared under the direction of S. S. Reisman.

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