The Future of the Coal Industry in Nova Scotia

By A. E. Cameron

THE future of any industry depends upon three fundamental factors: (a) raw materials; (b) markets; (c) workmanship. Without these no industry can exist, be it a coal industry or a candy shop. Each supplements the other and, unless the industry is balanced on that three-legged stool, failure will result. All factors are relative only. We may have good or poor raw materials, great or small markets, good or poor workmanship. If we have good workmanship, many of the handicaps of poor raw materials or small markets can be overcome. The greatest of these three is workmanship. The product, no matter how good the raw materials, is no better than the workmanship put on it. The better the product, the greater the market.

The Nova Scotia coal industry is an old industry. The easily accessible and, therefore, relatively cheap coal has all been extracted. The future of the industry must depend to a greater extent than in the past upon workmanship. Engineering, management and labor, all must pull together for the future.

Present Conditions

Before we can envisage the future, we must discuss the facts of the present. The great majority of the coal production of Nova Scotia comes from large and extensive mining operations. Costs of upkeep of roadways and of transportation increase steadily with length and depth below surface.

Increasing time of movement of coal from coal face to surface requires more care in transit at a given time, if production is to be stable. This in turn means more costs in equipment and power to handle the same tonnage. Increases in distance from the surface means increased time getting workmen to and from work, thus shortening the working period. Obviously there is an economic limit beyond which profitable extraction is impossible. When that time is reached, the mine must die even though the coal is still of merchantable quality. Life of the mine can be extended only by increased efficiency in the workmanship put in it.

The importance of this from the Nova Scotia point of view is that, as has been said, the coal industry is an old industry. Virgin coal fields are not available for rapid development to production. Future coal supplies must come from extensions of the present workings, not from new fields. The very size and extent of the present workings require that the mines continue to operate. Once abandoned, the costs of rehabilitation delay, if they do not prohibit, access to the coal still left below. This factor has been very clearly shown at Mabou, Port Hood, Morien and Thorburn.[1] The possible coal to be recovered below existing, abandoned workings at these points is much closer to the surface and therefore more accessible than the coal below No. 1B, Princess or No. 12" [collieries would be if they closed tomorrow, be cause of getting out coal are not met by costs the returns obtained by its sale.

Industries Based on Coal

There are two major types of industrial development dependent upon the raw material, coal. These are the mining industry, which brings the coal to the surface, and the metallurgical, chemical or manufacturing industries, which utilize the coal. The primary one of these is the mining industry and is usually spoken of as the coal industry. The others all depend upon the utilization of the coal after it is dug from the ground and made available.

EDITOR'S NOTE: Dr. A. E. Cameron, former Professor of Geology at the University of Alberta, is Deputy Minister of Mines for Nova Scotia.

1. Collieries in Cape Breton Island, N. S.

Under our present scheme of civilization the others cannot exist without the first. It is reported that Russian experiments have indicated a way by which the coal can be utilized without first mining it beyond elementary development. This, however, is still an experiment and cannot be expected to supplement immediately the established methods of digging out, hoisting to the surface and preparing coal for present-day markets. For many generations to come man must continue to mine coal.

Other industries take the coal as mined and use it either directly as fuel or as a raw material for other products, power, coke, gas, tar, benzol and all the other products that are obtained from it. The ordinary manufacturing industries use it as fuel or as a source of power. The metallurgical and chemical industries use it for these other purposes.

There is a growing tendency today to look at the coal industry as including all of these others and to expect the possible profits from the chemical utilization of coal to enhance the value of coal at the pit head. The fundamental point is overlooked that the coal mining industry ends with a clean coal at the surface on cars for distribution. The finished product of that operation becomes a raw material for other industries, be they manufacturing or chemical. Those industries of necessity must go for their raw material to the point where they can get the best quality for the lowest cost. Invariably, also, the chemical industries need other raw materials than the coal. Development of the chemical industry requires a balance of all factors.

It is true that coal can be a basic raw material for a large number of products. After all coal is nothing but a natural combination of C and H[1] with undesirable substances and impurities such as S, N,[1] oxygen, and mineral matter. The modern chemical engineer can take the C and H[1] and rearrange them and add other elements to make complex substances from drugs and dyes, through waxes and plastics, to rubber and silk stockings.

1. C = carbon, H = hydrogen, S = sulphur, N = nitrogen.

These things are possible. The question for the individual case is "Is it practical?" The optimist will say that anything that is possible is practical. The pessimist will say that what is not practical, is worthless. The so-called professional pessimist will only say, "What is now possible, will some day be practical and we should prepare for that day."

So long as Nova Scotia can produce coal, it is possible that it can have chemical industries based upon coal. At least, it will be possible to supply raw materials or partly-processed materials for use in chemical industries elsewhere. It is doing so to-day and some expansion may be possible. They will be practical only as long as the coal mining industry produces the coal for the chemical industries at a cost that will allow the chemical industry to use it in preference to products from coal mining elsewhere. If the costs are high, or if the quality of the product is poor, the industries will not develop.

If new industries based upon coal are to develop in Nova Scotia, the coal mining industry must produce good quality product at a satisfactory cost. No large-scale mining industry can exist producing coal for a chemical industry only. A single mine may. A single industry may draw certain products from the production of a number of mines. The coal mining industry as a whole cannot exist solely to supply coal for chemical purposes. The great majority of the coal must find markets as fuel or power for manufacturing industries or in domestic consumption. Those markets will depend upon cost of production and costs of production in turn depend upon production per man.

Mining Costs and Revenue

Costs and revenue for mining operations are not available for the earlier years but the Dominion Fuel Board has published averaged costs and revenue for Nova Scotia coal mining since 1933. The following table summarizes the figures given by the Board.

TABLE SHOWING MINING COSTS AND REVENUE FOR TON OF COAL IN NOVA SCOTIA COAL MINES
1933-1943

DISTRIBUTION	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
	$	$	$	$	$	$	$	$	$	$	$
COSTS:											
Labor	2.09	2.10	2.19	2.10	2.28	2.27	2.23	2.30	2.61	2.89	3.40
Stores	.44	.50	.49	.44	.45	.44	.42	.42	.55	.55	.70
Power	.32	.26	.29	.25	.24	.28	.23	.26	.24	.28	.32
Depletion and Depreciation	.26	.20	.20	.26	.20	.18	.21	.18	.19	.19	.21
Admin., Taxes, etc.	.56	.45	.52	.55	.52	.56	.57	.50	.56	.57	.71
Sales, etc.	.54	.54	.52	.52	.51	.53	.54	.52	.53	.51	.44
Total costs	4.21	4.05	4.21	4.12	4.20	4.26	4.20	4.18	4.68	4.99	5.78
REVENUE:											
Coal sales, etc.	4.04	4.02	4.04	3.89	4.05	4.16	4.19	4.15	4.35	4.76	4.90
Other	.08	.09	.09	.08	.09	.04	.06	.09	.08	.12	.23
Total revenue	4.12	4.11	4.13	4.06	4.14	4.20	4.25	4.24	4.43	4.88	5.13
Profit and loss	.09	.06	.08	.06	.06	.06	.05	.06	.25	.11	.65
AVERAGE OUTPUT PER MAN-DAY IN TONS											
Tons	2.000	2.20	2.31	2.20	2.33	2.22	2.28	2.27	2.01	2.05	1.8

Allowing for annual fluctuation, the table shows that the costs of producing a ton of coal remained relatively constant, averaging $4.18 per ton mined for the eight year period, 1933 to 1940 inclusive. Labor costs showed a tendency to rise in 1937 and 1938 and made a definite rise in 1940. They have risen steadily since then, especially in 1943.

It is important to note that in the ten year period only three years: 1934, 1939 and 1940, showed profits on operations.

The table shows also that labor costs are slightly greater than 50% of total operating costs, including charges for depletion, depreciation, etc. For the eight year period, 1933-1940, losses on operation averaged $0.04 per ton. A reduction of 2% in labor costs would have changed this loss to a profit.

Since 1940 labor costs have increased rapidly with corresponding increased losses in operations. During the same period labour productivity, that is, the average output of a miner per working day, has steadily declined as can be seen from the last line of the table.

Engineering

Engineering and engineering design for coal production is the first fundamental factor in the problem. All mines die. New mines take their place. Lay-out of the new mine first has to be placed on the drafting board, just the same as new design in aircraft or a new house. Unlike these, however, the mine is a growing thing. Its workings extend further and further from the portal. In this respect it is more like a village growing to a town and then to a city. As it progresses the design changes in detail, although the main principles usually remain. Within limits set by the original layout, each mine is an experiment. If the reserves of coal for the mine are large enough, it may be that increasing production requires modification of the original layout. With a life of 20, 30 or 40 years, the mine changes its appearance and grows in size.

Any new mine is "blue printed" long before it is put into development. Equipment installed will be the most modern available of its kind. Design based upon the use of that equipment will not always be the best, because better equipment requiring a new design may be developed later Either the mine must continue to operate with its existing equipment or the costs of change must

be met by increased savings likely to be made possible by a change. New type of equipment can be put in new sections of a mine but the full value of it may be handicapped by older type of installation which still has to handle the output of the new equipment between the new section and the portal. Complete conversion from one mine design to another is not practical in one step. It may be done over a long period of time, providing costs can be met from the savings thereby made. It must always be remembered that the first cost of new equipment and new design must be recovered from the coal sold.

Engineering and mine design in Nova Scotia over the past thirty years has been good. Not perfect, perhaps, but good. Each new mine as it was developed, was as modern in equipment and mining principles as was known at the time. New principles have been adopted as rapidly as circumstances and costs allowed. Many new mining principles have been developed in the coal fields. New principles developed elsewhere have been modified to meet existing conditions. Experiment has been continuous and, if not always successful, has always been based on sound principles.

Much has been written in the current press regarding modernization of Nova Scotia mining. Actually it is as up-to-date as any coal field of comparable size and age. The use of electricity is widespread. Electric cap lamps have replaced the open lamp or the miner's safety lamps in practically all operations. Electric power for pumping has replaced steam and compressed air. Electric power is steadily replacing compressed air for haulage and hoisting underground wherever ventilation conditions can be arranged to permit. Cutting machines have replaced hand picks. Mechanical haulage—either air or electric—is replacing horse haulage. Horses used in mining decreased from 934 in 1913 to 374 in 1943. Longwall mining has done away with much of the labor of hand-pushing cars from the working place. Mechanical loading was proposed for a Cape Breton colliery in 1938 but was opposed by the workmen. It has since been established in one independent mine.

Nova Scotia engineers, through a long period of experiment, have developed the longwall system of mining to a high degree of proficiency from the points of view of both manual labor required and application of machinery. Conveyors handle the coal from the face to the coal car. Mechanical loading on to the conveyor has still to be established. Machines for this operation are not available, although one model is now being tested in England. Much experimental work remains to be done before a satisfactory mechanical loader can replace the pan shovel at the longwall face in the pitching seams of Nova Scotia. The theoretical working force and the theoretical time cycle of operations have been designed for maximum production per man-day.

The hazards of mining are generally well taken care of in the engineering and design. Ventilation and dust control are always questions of considerable importance. Gas analyses are taken regularly and ventilation adjustments made to conform to the information obtained. Rock-dusting to dilute the coal dust is a general practice. Safety devices to reduce mechanical hazards are installed in many places. Travelling roads are generally well located and reasonably satisfactory arrangements are made for the handling of men and materials.

In general, it can be said that Nova Scotia engineering and design has kept abreast of and, in places, led, modern practice in coal mining.

Management and Labor

The management, that is, the manager and officials, and the labor forces, are the two parties to the workmanship of coal mining that take over the engineering design and by it extract the coal and bring it to the surface for use elsewhere. The management may also be responsible for the engineering, although modern mining practice tends to separate

them, at least in part. Whether the engineering and management are combined or separate, management and labor can only be considered as one body of workmen whose united effort is responsible for efficient workmanship within the industry. Working together they can get the maximum amount of clean coal to the surface on each operating day.

Management has the additional burden of finding markets for the production. Markets are easier to find if the coal is always clean and if the cost of getting it and, therefore, the amount at which it can be sold, is low. Costs are the costs of labor, of materials, and of equipment. High cost coal means a limited market and idle days. Dirty coal means a limited market or lost time and increased cost cleaning it.

The present picture of the coal industry in Nova Scotia is tragic. Wages are higher than ever before, yet production is dwindling. The mining engineering has been good. The equipment was good, but responsibility for maintenance and operation must be taken by the machine operator himself. Every man operating a piece of machinery, be it winding engine at the surface or boring machine at the coal face, should take as great care of it as though it were his own. Only when the individual responsibility is taken, will the efficiency of machines really show in production of coal.

All mines are experiments. The conditions in no two mines are alike. Conditions from place to place in one mine will vary. Nature placed the coal in the seam and its condition is beyond human control. All that man can do is to try to win the coal as economically as possible. A low quality of coal, i.e., one with high ash, or high sulphur, or both, must be won at less cost than a high-grade coal. To meet a competitive market, the low quality coal has to either sell at a lower price, or it has to be beneficiated (washed, picked, etc.) to eliminate the impurities, and increase its quality. These operations increase the costs and these must be recovered in the sales price or the operation is a failure.

First essential in any coal mine operation is production of as clean coal as possible. Roof rock falls on the coal face, pavement rock lifts up from the floor. The coal tends to become contaminated by these materials. They should be kept out of the coal as loaded at the face and this can only be done by the miner himself. Every pound of rock shipped to the surface requires power and human effort. It means additional power, human effort and costs to take it out of the coal after the coal reaches the surface.

An important point in a miner's work is to see that only **coal** goes to the surface. If the coal itself is dirty, as it may be, then it will have to be cleaned, but the cost of cleaning is in proportion to the amount of dirt to be removed. Every pound of dirt that is left underground means a saving in costs. Many and many a tipple today has to be stopped while the pickers on picking belt sort out roof and pavement rock that should never have left the working face. Stoppage of the tipple often means stoppage of the hoisting rope and that means stoppage of work at the face and a loss of coal.

Safety is another factor in the joint relationship of management and labor. Engineering design always includes this factor but its application lies with the officials and the men; primarily with the men. The mine is only as safe as the least safe practice of the individual within it. Management can lay out travelling roads for safe movement of persons underground but many will disregard the rules and travel elsewhere. More individuals are hurt or killed on haulage ways travelling where they should not have been than in any other hazard of the mining operations. In Nova Scotia, Thirteen fatal accidents occurred in 1943 on haulage, most of them because the man had violated a rule of travelling underground. Men are injured or killed by falls of rock at points where safety practices, of which they were aware, would have protected

them. No one was injured or killed from the misuse of electricity or explosives.

These are cases where lack of safety has resulted in injury or death to the person taking the chance. One man smoking in a gaseous mine endangers the lives of all within the mine. Yet evidences of smoking in the mine or tipple are found only too frequently.

Lack of safety results in loss of coal as well as injury and death. All increase costs. The individual employee, official or miner, must always consider safety practices. Self-discipline and realization of personal responsibility are fundamental to good mine operation.

The Future

In 1940 it was estimated by competent authority[2] that, if the present mining capacity were kept up to production, the Cape Breton fields had an estimated life of 180 years. That capacity was then two million tons in excess of the normal annual production. Other districts of the province have a less assured life but, if full capacity were used so that advantage can be taken of technological improvements, there is every reason to believe that they could continue to produce economically for nearly as long a time. There is no real shortage of coal substance, though there may be a shortage of good grades of coal. The lower grades of coal can be processed if the costs thereof can be met.

The future of the coal mining industry lies in the matter of production costs. Engineering and design have been good. They can be bettered only if the difference between production costs and sales returns supply the necessary funds. Increased production and efficiency in the mines must depend upon able and efficient management and labor. The relationship between these two must be based upon mutual confidence and trust. Wages to-day are the highest they ever were in the industry. They can stay at that point only if the greater rewards of labor are repaid the industry by greater individual effort. Production per man-day must increase. The governing factor is the net return per ton of coal sold. A greater tonnage per man-day distributes the costs, costs of labor, cost of materials, cost of equipment, over a greater tonnage so that the costs per ton may be lowered until it is less than the return per ton. Today, in Nova Scotia, costs are excessively high and production per man-day dangerously low. Unless these conditions are reversed, the prospects for the mining industry of Nova Scotia, once the artificial conditions due to the war are removed, are very bleak indeed.

If we are to have a coal mining industry in the future, costs of production must decrease now. Mechanical loading at the coal face can come and emancipate the coal miner from the shovel; more modern equipment for hoisting and haulage of coal, men and materials can replace existing equipment; chemical industries to help utilize the coal at home can develop. These would help reduce production costs in time. They cannot do it right away.

It takes time to re-tool an industry, be it conversion of a peace-time industry for war purposes, or re-conversion of a war industry to peace-time production. It takes time to re-design a mine from one type of operation to another, be it room and pillar mining to longwall, or longwall to mechanical loading. The Nova Scotia coal industry was as ready as any other coal industry anywhere for war production. Capacity was there in excess of production. The tools were, perhaps, not the best, they were sufficient and modernization was well underway.

A complete re-toolingjob on this industry, or even on the principal producers in the industry will take many years to complete if better tools can be found. Mechanical loading at the coal face means a re-design of the coal face. That means new coal faces and new development. These take time.

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*. F. W. and R. H. Gray, "The Sydney Coal Field" Trans. C.I.M.M., Vol. XLIV, 1941.

Two men can be put at one development face but you cannot put twenty there and in that way increase the rate of re-tooling by ten times. There is no room for twenty to work at once.

In the meantime production has to continue with the existing design and equipment and using the same labor force. In the meantime costs of production must be met by the revenue from coal sold or by subsidy.

Costs of producing coal in Nova Scotia in 1942 were $4.997 per net ton and for 1943 (published August, 1944) $5.78 per net ton. Costs have risen steadily since then and present costs are in excess of $7.50.

In 1942 average revenue from coal on cars at the mine tipple was $4.88. The only increase since that time has been $0.95 allowed this year to pay for $1.00 a day increase in wages retroactive to part of 1943. Average sales revenue from coal, therefore, at present is not over $6.00 per net ton. The balance of costs is being met by direct Dominion Government subsidy because of war needs.

The future of the coal industry in Nova Scotia lies to a large extent in the hands of the workers in that industry and their workmanship. An immediate increase in the production per man will cause an immediate decrease in the costs per ton.

Planning Canada's Physical Assets

Reports of the Advisory Committee on Reconstruction

By D. P. Reay

The Advisory Committee on Reconstruction which was appointed by the Dominion Government at an early stage of the war has, after three years of extensive work, brought out a number of comprehensive reports dealing with the main phases of Canadian post-war organization. The following article attempts to evaluate some of the Committee's findings concerned with the development of Canada's physical assets. It is based on the reports of the sub-committees on Conservation and Development of Natural Resources, on Publicly Planned Reconstruction Projects, and on Housing and Community Planning.

THE three publications of the Advisory Committee on Reconstruction now under review are all intimately connected with planning in the physical sense and are consequently interrelated to a considerable degree. Together they cover a wide field and in the space of a short article it is possible to make only brief and over simplified comments on their general characteristics.

EDITOR'S NOTE: D. P. Reay is a graduate of Architecture of the University of Liverpool. As holder of a Commonwealth Fellowship he studied town planning at Columbia University. Since the outbreak of the war he has been attached to the R.C.A.F. and has assisted in the design of airdromes in many parts of the Dominion.

The terms of reference of the three committees are as follows:

The Conservation and Development of Natural Resources Committee was to "consider and recommend to the Committee on Reconstruction the policy and program appropriate to the most effective conservation and maximum future development of the natural resources of Canada, having regard to the importance of these resources as national assets and emphasizing the part which the proposed policies may play in promoting employment opportunities at the end of the present war."

The committee on Publicly Financed Construction Projects was "to study the extent