COAL AND PETROLEUM PRODUCTS COMMISSION
(BRITISH COLUMBIA)

Volume III.

Report of the Commissioner

The Honourable Mr. Justice M. A. Macdonald

relating to

Paragraph 3 of the Terms of the Commission

December 5th, 1938

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1938.

VICTORIA, B.C., December 5, 1938.

To His Honour the Lieutenant-Governor in Council:

MAY IT PLEASE YOUR HONOUR:

I, the undersigned Commissioner, appointed under Your Honour's Royal Commission, dated the 28th day of November, A.D. 1934, to cause inquiry to be made into and concerning the matters therein referred to, have the honour to submit my final report thereon.

In due course I will make return of the Evidence and the Exhibits filed in the Inquiry.

I have the honour to be,

Sir,

Your humble and obedient servant,

(Signed) M. A. MACDONALD.
Commissioner.

"PUBLIC INQUIRIES ACT."

His Honour the Lieutenant-Governor in Council has been pleased to appoint the Honourable Mr. Justice M. A. MACDONALD, one of His Majesty's Justices of Appeal of British Columbia, a sole Commissioner under the "Public Inquiries Act" to inquire into the following matters:—

1. The following matters respecting coal mined in or imported into British Columbia and used for fuel purposes in British Columbia:—

(*a.*) The cost of production:
(*b.*) The manner and cost of preparation for the wholesale and retail trades respectively:
(*c.*) The cost of transportation:
(*d.*) The cost to dealers in British Columbia:
(*e.*) The cost to consumers in British Columbia:
(*f.*) The profits made by persons or corporations owning or operating coal-mines in British Columbia:
(*g.*) The profits made by persons or corporations engaged in the business of buying and selling coal in British Columbia.

2. The following matters respecting petroleum products, that is to say, gasoline, fuel-oil, lubricating-oil, kerosene, and other petroleum products imported into or refined or produced in British Columbia and used or designed for use therein for fuel purposes, lighting purposes, or in the operation of internal-combustion engines:—

(*a.*) The cost of importation or production:
(*b.*) The cost of refining or preparation for use:
(*c.*) The cost of transportation:
(*d.*) The cost to dealers in British Columbia:
(*e.*) The cost to consumers in British Columbia:
(*f.*) The profits made by persons or corporations engaged in the importation of petroleum products into British Columbia, or in refining, producing, or supplying petroleum products for use in British Columbia.

3. Generally, all matters tending to show the comparative value of coal and petroleum products for economic use as aforesaid in British Columbia, and the value to the economic welfare of British Columbia of the development of industry based upon the production of the fuels enumerated, or tending to show whether or not the prices charged for coal and petroleum products respectively are unjust or unreasonable; and all such further matters as the Commissioner may consider to be incidental to any of the foregoing matters of inquiry.

A. W. GRAY,
Acting Provincial Secretary.

Provincial Secretary's Office,
November 29th, 1934.

PREFACE.

This is the final report based upon specific questions in respect to the Coal and Petroleum Industries: it is the necessary sequel to Volumes I. and II. where certain findings there made are now co-related and applied to the questions considered in this volume, viz., the comparative value of coal and petroleum products in their economic uses and in relation to public welfare (involving the relative position of two rival fuels—coal and fuel-oil). In Chapter IX. will be found a general review of the findings in the three volumes.

In Volume I. we were concerned with: (1) The British Columbia business operations of the oil companies; (2) Whether or not, having regard to a fair profit, gasoline as a separate commodity, regardless of the type of crude from which it was processed, was sold at excessive prices in British Columbia; (3) If other major products of crude, viz., fuel-oil (light and heavy) were sold at a just and reasonable price; (4) A similar inquiry in reference to other products of crude processed in British Columbia, e.g., kerosene and lubricants. All these products are manufactured in this Province from crude, an imported raw material.

A " just and reasonable price " in respect to gasoline had an important aspect, viz., the price to the consumer; that is so because it does not stand in a relationship to any other product, the subject of this Inquiry. There would be no point to a discussion of the comparative value of gasoline and coal. A " just and reasonable " price in respect to fuel-oil, however, has a duel aspect inasmuch as it is linked with a similar inquiry concerning coal. The dual aspect is (1) Price to the consumer, domestic or industrial—is it just and reasonable? and (2) Its relation to the selling-price of coal. Coal and fuel-oil should be placed on a footing of equality—both sold at just and reasonable prices. If these rival products are not sold at " just and reasonable " or as it is called in this report—" economic prices," meaning a price that bears a uniform relation to reasonable costs of production and distribution and which also includes a reasonable profit on a reasonable investment, one product might unfairly drive the other from the market. Again, apart from relative position, if either product, standing alone, is sold below cost some other product is unfairly burdened with the loss: hence the necessity of finding a just price for coal and a just price for gasoline and fuel-oil.

There is no doubt that in the public mind—it was so represented to me—the impression prevailed that not only was gasoline too dear but also, for reasons unknown, at that stage, domestic and industrial consumers were turning from coal, a local product, to fuel-oil, processed from an imported product. Whether this displacement of a local product was due, on the one hand, to the fault of the coal industry itself, coal prices too high, inefficient methods, inflated capital structures; or, on the other hand, due to similar conditions in respect to the British Columbia operations of the oil companies, was unknown at the outset of the Inquiry. The purpose was to find the facts and the object to place both fuels, as intimated, on a basis of equality; not penalizing fuel-oil because of its foreign origin or favouring coal as a local product because of its local origin.

Referring to both Volumes I. and II. we found that coal and heavy fuel-oil (there is no such finding in respect to light fuel-oil used in homes, etc.) were not sold at economic prices and were not therefore on a fair relative basis of equality. Reasons in respect to coal were: (1) Mining costs too high; (2) Inflated capital structure; (3) Financial methods; (4) Treatment of depreciation; and (5) Want of modernized mining methods and in respect to *heavy fuel-oil* that it is sold below cost.

The Inquiry concerned that part of the business of the oil companies carried on in British Columbia. Because, however, of the costing system followed by integrated oil companies it was necessary to explore many avenues to reach conclusions in respect to costs of production and distribution in this Province.

The ramifications of the Petroleum Industry apparently give rise to misconceptions as to the method of approach in determining whether or not petroleum products manufactured in this Province are sold at reasonable prices. I refer in this connection to a public statement, typical of others, in October, 1938. It reads as follows:—

> " One of the problems of price fixing is obvious in connection with the Petroleum Industry. The product to be regulated in price is to be extracted from raw materials of necessarily foreign origin. How could these primary costs be determined by an authority within this Province."

It can best be answered with an illustration. Let us assume cheese factories are located in this Province and the only place the companies could secure their raw material—viz., milk

—is from the State of Washington (crude comes from California, Peru, etc.); in other words, visualize a condition where no milk at all is produced in this Province. Let us assume that not only cheese, but butter, buttermilk and whey is manufactured or processed in British Columbia from the imported raw material (milk). The task is to find if the prices of these products to the consumer in British Columbia are just and reasonable. The starting point would be the laid-down cost of imported milk at the cheese-factory door. From that point we would find costs of manufacture, wholesale distribution, together with all necessary elements in respect to plant equipment, depreciation, etc. If these companies had other cheese factories all over the world we would not of course investigate prices to consumers elsewhere. If, too, books and records were kept relating to business activities in this Province no difficulty would be encountered. If, however, the Sales Realization System, as employed by the oil companies, should be used it would be necessary to recast their cost accounting for the purpose of allocating to each individual product manufactured in British Columbia the costs attributable to it. In the Petroleum Inquiry we were assisted in this task through the fact that leading executive officials from Toronto and California appeared and testified in this Province, and the further fact that our Chartered Accountants investigated the books of the companies in Ontario and California in respect to that part of the companies' activities relating to this Province. If they failed to convince us that we should adopt their system of cost accounting they did greatly assist in the difficult task of applying the evidence to British Columbia operations.

The illustration might be carried further to elucidate another aspect. Let us assume that the companies doing business in this Province and in other provinces and countries processing imported milk owned the dairy herds in Washington in addition to the factories in British Columbia, also owned pipe-lines or a fleet of trucks to transport the milk from the dairies to Seattle. Let us further assume that this integrated company owned tank steamers to transport its milk from Seattle to the factory or factories on Burrard Inlet; also that they owned and controlled, directly or indirectly, all distribution facilities in this Province. If we were asked to find whether or not these companies with world-wide operations in respect to their British Columbia business only, were selling butter and cheese, both manufactured in this Province, from an imported raw material (milk) at a fair price we would again start with the laid-down cost of milk at the cheese-factory door wholly unperturbed by the question as to how it got there, or the financial or other history prior thereto or the magnitude of the business outside this Province. Ramifications of the companies' activities do not add to or subtract from the price of the raw material in the form of milk required for that part of its business of manufacturing local products carried on in British Columbia. There is no need therefore for confusion of thought in approaching the problem.

We found in Volume I. that gasoline could be sold at a fair profit at 18 cents a gallon, or if the public want to tolerate the present system of retail distribution designed to maintain prices and prevent competition it could be sold for 23 cents. I refer to this further fact, only recently discovered as a result of information furnished by Mr. C. C. Labrie. I instructed A. W. Fisher, barrister, of Vancouver, to investigate through the Land Registry Office, etc., the statement made by Mr. Labrie that Imperial Oil, Limited, owned a lot of property in Vancouver and vicinity upon which no service-stations were erected, pursuant, in my opinion to the policy of maintaining prices and preventing competition. It was disclosed by this investigation that (with one exception) corner lots in Vancouver and vicinity amounting, according to transfer values, to nearly a quarter of a million of dollars were purchased in a period of four years (1927–1931). I have not delayed the report by making inquiries in other parts of the Province. This is enough, if more is needed to disclose the method followed. While I do not recall a specific question in respect to advance purchases of real estate by the oil companies certainly the information was not volunteered; a full statement of these purchases, together with transfer values and assessments before and after purchase, also certificates, will be found in Appendix 51.

The facts just referred to—one that has arisen since the taking of evidence ended—leads me to make another reference. Statements of alleged losses said to have been incurred by the oil companies in respect to that branch of their business carried on in this Province have also been made since the public sessions of the Inquiry were completed. Mr. R. M. Pidgeon, B.C. manager of Imperial Oil, as reported October 12th, 1938, stated that "evidence was presented

to Dr. Carrothers indicating that the industry is losing money in British Columbia." This is presumably apart from any proposed reductions in gasoline prices. It is not stated whether there was any diminution in the volume of sales—or if costs were higher. The purchase of the idle property referred to might possibly represent the "loss" or part of it. These purchases ought really to indicate a lucrative business in this Province.

I would not accept these statements of alleged losses for the following reasons. Certainly there was no evidence of it in the course of the Inquiry:—

(*a.*) No statement of losses based on the Sales Realization System can be accepted.

(*b.*) Local managers of oil companies took the position in evidence in the Inquiry that they had not (and it was true) separate books or records showing British Columbia costs.

(*c.*) Mr. Kenmuir, manager of Union (p. 4189), said "we are only the marketing end: we have no costs on commodities and even the freight paid here is calculated in the head office of the Company" (California).

(*d.*) To enable the Commission to determine these questions in respect to purely British Columbia business our Chartered Accountants had to, and did, pursue inquiries at head offices in Ontario and California.

It was also asserted that great loss will occur if gasoline prices should be reduced. There will be a reduction in revenue to the Oil Companies from gasoline sales, only however on the assumption that sales at reduced prices will not be increased. As often pointed out heavy fuel-oil is sold in this Province below cost. That fact has been found by this Commission, supported by the Tariff Board, and finally, if any further proof is needed, admitted by the Imperial Oil, Ltd., through its representative in a statement given to the Economic Council. All major companies now operating in British Columbia (Imperial, Union, Shell and Home—no reference here to Standard as it came into British Columbia later) sold to the people in 1934 a grand total of 39,734,326 gallons of gasoline and 116,168,762 gallons of heavy fuel-oil. In view of the fact that on the whole they sold and dealt with over five times as much heavy fuel-oil as gasoline (the former "regardless of cost") the reader may estimate what adjustment in prices would absorb any diminution of revenue consequent upon a reduction in gasoline prices. The foregoing statement is based on 1934 figures. There is no reason to assume that this general relation has not been virtually maintained in subsequent years.

The method followed in Volume II. is comparatively simple. Our findings principally relate to Canadian Collieries (Dunsmuir), Ltd. No substantial objection is taken to the set-up, financial or otherwise, or prices of any other, including the Crow's Nest Pass Coal Company in East Kootenay. We provided for a return of 8 per cent. on a capitalization of $5,000,000 and on that basis, with proper depreciation charges and all necessary allowances, found that all grades of coal could be sold to the consumer in Vancouver and Victoria at $8.10 per short ton and under other conditions at the prices outlined in Tables 77, 78, 79 and 80 in Chapter XI., Volume II., at $7.25, $6.50, and $6.00 a short ton. The reader will find therein reasons why we suggested coal distributing depots. It may be of interest to say that after making this suggestion in Volume II. we find from a report by Forster, Brown and Rees, Mining Engineers of Cardiff, Wales, only recently produced, that they made the same recommendation 28 years ago. Nor is our recommendation criticized by Canadian Collieries. Not only would it result in lower prices for the consumer; it would also enable coal (and this is the point I wish particularly to mention) to compete with heavy fuel-oil in many markets, that without it will be beyond its reach. It would result, too, in more production, more work for miners, and more labour in actual distribution to the consumer.

I invite the reader's attention to a perusal of Chapter X. containing our answer to a criticism of the Coal Report by the Canadian Collieries. The criticism is inserted in full as Appendix 49. I need not refer further to the contents of that chapter beyond directing attention to it. The reader will find in Section 10 of that chapter a useful discussion on reduction of mining costs through modernized methods where the views of Dr. Gray, of the Nova Scotia Dominion Coal Company, and Mr. G. W. Evans, Consulting Mining Engineer, are disclosed, together with reasons for my acceptance of the latter's views. Some interesting letters also are appended.

As stated, the basic principle in the three Reports is equality of treatment so far as coal and fuel-oil are concerned. That here has not been that equality in the past is obvious. There is no question either as to the consequences to the coal industry flowing from this inequality of treatment. I direct the reader's attention to the following statement made by Senator J. W. deB. Farris, K.C., in the course of the Inquiry (Counsel for Canadian Collieries (Dunsmuir), Ltd.), quoted in Chapter IX. It is not an exaggerated statement, except that I would not apply the word "foreign" to the Petroleum Industry if it carries the suggestion that it should be penalized on that account—

> ". . . where a foreign commodity is invading the field of fuel in the shape of fuel-oil and is threatening the complete destruction of the native industry and means the wiping out of some very prosperous cities and towns in this Province and I may add throwing hundreds of miners out of employment."

I was, in the course of the Inquiry, disturbed by the fact that domestic and industrial consumers of fuel in this Province discarded coal for fuel-oil either without tests or any adequate investigation, scientific or otherwise, into the question of suitability, cost, and use, or by enlisting the aid of combustion engineers. As an illustration—Pacific Mills, Limited, using from 60 to 70 thousand tons of coal a year, changed to the use of heavy fuel-oil without adequate investigation from the standpoint of cost and efficiency. If it procured heavy fuel-oil processed at the refineries in this Province some local employment would be given; instead, however, the coal was displaced by fuel-oil imported direct to the plant from California. The facts in this connection are given in Chapter V.

Railways in this Province use much heavy fuel-oil—including the P.G.E. and the E. & N. on the Island. One reason assigned is alleged fire-hazard. That need no longer prevent the use of coal although patrols, not required where oil is used, would be ordered on the same basis, however, as in Eastern Canada where coal is almost exclusively used. So, too, in Government institutions, schools, etc., fuel-oil is found. Chapter VII. is devoted to fire-hazards. It was read and approved by Mr. C. D. Orchard, of the Forestry Department. The conclusions will be found at the end of that chapter.

Having found just and reasonable prices for coal and heavy fuel-oil, or as we call it "economic prices," we proceeded to inquire into the value and efficiency of each fuel to the domestic and industrial consumer. It is obvious that one cannot by an inquiry, however scientific, tell the home-owner, apartment-house dweller, owners of power plants, industrial concerns, railways, etc., whether or not from the standpoint of cost and efficiency coal or heavy fuel-oil is superior if the price fluctuates from day to day. It is also clear that if they are to be treated as public utilities the price would necessarily be fixed on the basis already referred to. This fact is not altered by the circumstances that because heavy fuel-oil may be imported into this Province paying a 17½ cents a barrel customs duty its prices cannot in justice to local refineries manufacturing it in this Province be advanced—notwithstanding it is just that it should be advanced—until local authorities are protected by the knowledge that a dumping duty will be applied to the imported products. In our opinion the Dumping Act applies.

This Report on the whole is favourable to coal only because the facts warrant it. With abundant coal resources it is in the economic interests of the people of this Province to take every legitimate step to encourage its use and to place it on a footing of equality with heavy fuel-oil. It was suggested by Mr. L. C. McCloskey, of Imperial Oil, that coal is an out-moded fuel; that this is not so is clearly revealed in this Report. It is also in the interests of industry to have at its disposal two rival fuels. At present, as pointed out elsewhere, a private body or company controlling the price of gasoline (and consequently of heavy fuel-oil) can virtually destroy the coal industry. Regulation therefore by a public body is highly desirable in its interest and in the public interest.

Readers of the Report will observe our indebtedness to the Commercial Testing and Engineering Company of Chicago. This firm was highly commended to us by the American Institute of Mining and Metallurgical Engineers. The tests made by them, as outlined in Chapters IV. and V., were translated and applied to British Columbia coals. After this was done we submitted our conclusions in full with all supporting data to that firm of engineers and secured their approval.

As in the Coal and Petroleum Reports no findings were made nor any important decisions reached without the most exhaustive collaboration and assistance of the best technical and

professional advice procurable. I am greatly indebted to the following for assistance of this character: George Watkins Evans, Consulting Mining Engineer; D. O. Lewis, M.E.I.C., M.Inst. C.E.; Professor W. F. Seyer, Ph.D.; K. Moodie, M.E.I.C.; R. W. Hartley, LL.B.; R. Rolleston West, B.A., A.M.Inst. C.E.; H. J. McCreery, B.A.Sc.; Professor F. W. Vernon, B.Sc., A.M.I.Mech.E.; Messrs. J. Haydn Young, C.A.; H. G. Hinton, C.A.; G. W. Clarke, C.A.; H. B. Pratt, of George A. Touche & Co.; Commercial Testing and Engineering Company of Chicago; W. A. McAdam, Acting Agent-General for the Province of British Columbia; Officials of the Northern Pacific, Missouri Pacific, New York Central, Atcheson, Topeka & Santa Fe, Southern Pacific, Union Pacific, Chicago, Rock Island & Pacific Railways; Dr. Camsell, Deputy Minister of Mines and Resources and other members of his Department; C. C. Stibbard, Chief Operating Officer, Board of Transport Commissioners; Officials of the United States Department of Agriculture and of the United States Bureau of Mines; F. Hull, of the Vancouver General Hospital; W. N. Bee, of the University of British Columbia and Mr. Adamson of the British Columbia Sugar Refining Co. Ltd.

For convenience a general summary of the findings in the three volumes will be found in Chapter IX. and a summary of this volume at the first of the report.

M. A. MACDONALD,
Commissioner.

Victoria, B.C., December 5, 1938.

SUMMARY.

(These brief notes show in a general way the nature of the findings made in this Report. A better understanding thereof will be had by reading the portions of the Report relating thereto.)

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1. The Commission was directed to inquire into the cost of production and distribution of coal and petroleum products, principally coal, gasoline, heavy fuel-oil and light fuel-oils, in the light of their comparative value to the economic welfare of the Province, and the development of industry therein; also into the profits made by persons engaged therein; and finally to ascertain if the prices charged for such products were just and reasonable to the consumer.

2. The foregoing involved finding economic delivered prices (viz., just and reasonable prices) of each of these major products; as to coal and heavy fuel-oil, both used for similar purposes in many ways, it involved a comparison of their respective merits as fuels.

3. In the *Petroleum* and *Coal Reports* we found economic costs of production and distribution of coal, gasoline, and heavy fuel-oil and other less important petroleum products. Those findings, in so far as they affect coal and heavy fuel-oil, have been used in this Volume to arrive at their comparative value as economic fuels.

4. Economic delivered prices (viz., just and reasonable prices to the consumer) must include a reasonable profit upon the necessary capital invested in reasonable production and distribution services, without which the product cannot be produced and marketed. We have dealt in this Volume with *cost, selling price* and *profit.*

5. *Selling price* is the most certain and definite of the three, in that the price received is an actual fact and a thing certain; *profit* is described as the margin between *cost* and *selling price.* Reasonable cost must first be found in order to determine whether the selling price is just and reasonable; but whether it is just and reasonable is determined by the profit shown upon an invested capital found to be reasonably required.

6. To find economic costs, therefore, we were compelled to inquire into methods of costing, depreciation, distribution and capital structure, and as to coal, method of mining. As crude oil or petroleum (from which gasoline, heavy and light fuel-oils are processed in this Province) is not produced here we were not directly concerned with its cost of production; we accepted the oil companies' stated laid-down costs thereof in British Columbia as the basic figure upon which to commence the above-mentioned inquiries into the cost of production and distribution of gasoline and heavy fuel-oil.

7. With the economic costs as found in the *Coal* and *Petroleum Reports* and as supplemented in this Report we studied the comparative value of coal and heavy fuel-oil as economic fuels in this Province.

8. The relative merits of coal and heavy fuel-oil as fuels were judged by the evaporation results actually obtained under comparable operating conditions and related to the B.T.U. value of each fuel. The number of barrels of a designated heavy fuel-oil equivalent to one ton of a designated coal was determined therefrom, apart from any cost or price factor.

9. The respective values of coal and heavy fuel-oil as economic fuels were then obtained by applying their respective economic delivered prices as found, together with other comparative costs, such as labour, depreciation and maintenance charges.

10. No comparative tests between the two fuels as fuels were available in this Province.

11. Competitive prices could not be used because they bear no uniform relation to costs of production and distribution; furthermore, they may vary and fluctuate so much from month to month or from year to year that no reliable comparison could be obtained thereby within the terms of this Commission.

12. We found in general, in so far as their relative merits as fuels alone are concerned, apart from any cost or price factor, that:—

(*a.*) British Columbia coals are a suitable and convenient fuel adaptable to modern and efficient methods of use and consumption.

(*b.*) A coal of known physical and chemical properties selected by reason thereof for a specific use in a boiler-furnace designed and constructed for the specific use and for the consumption of a coal of such characteristics, and fired in a manner to develop the maximum combustion for the required operating conditions, is at least equal to a designated heavy fuel-oil similarly selected and utilized.

(*c.*) In general, about the same efficiency may be expected from either coal or heavy fuel-oil in stationary plants, provided design and operating conditions are equally superior. There are a few specialized uses for which the characteristics of one fuel or the other may be more suitable with present knowledge of fuel uses.

(*d.*) As crude oil (from which heavy fuel-oil is derived) is not produced in British Columbia while coal is produced and may be produced in much greater abundance, coal is the logical and economic fuel to be used in this Province, wherever it is at all suitable for use. It is good engineering and good economics to so design steam plants as to use the fuel nearest at hand.

(*e.*) On the question of flexibility (ability to raise steam rapidly) we believe the difference between coal and heavy fuel-oil is more a matter of convenience, especially in stationary plants.

13. We find in particular, taking into account both the relative merits of the two fuels as fuels and their economic delivered prices as found, that in building heating plants, such as office buildings, hotels, departmental stores, institutions and such like, coal can be used with a substantial annual saving.

14. The superiority of coal as a fuel in this respect was definitely established in the tests conducted by the *Commercial Testing & Engineering Company* in the Eastgate and St. Clair Hotels in Chicago; full details thereof will be found in Sections 1 and 2 of Chapter IV. hereof; and it is of interest to note that a check on the performance of the two hotels under several months' operating conditions showed greater savings in favour of coal than were shown in the actual tests.

15. The *Chicago tests* were made when the contentions of the *Chicago Coal Merchants' Association* as to the superiority of coal were challenged by a firm of Architects and Engineers; as a result of the tests the two hotels changed over from heavy fuel-oil to mechanically fired coal.

16. With the approval of the *Commercial Testing & Engineering Company* and our technical advisers in this Province, we have translated the results of these tests to British Columbia fuels and operating conditions, and have come to the approved conclusion that if similar tests were conducted in building heating plants in this Province the resulting coal superiority should be shown as not materially different.

17. In stationary and industrial power plants we find that substantial savings can be effected in the use of coal, whether pulverized or mechanically stoked. In plants of this nature, also, we were greatly assisted by various tests conducted by the *Commercial Testing & Engineering Company*, detail of which will be found in Chapter V. hereof.

18. Coal is chemically a very complicated substance; its chief constituent is carbon, but other elements are combined with the carbon, notably hydrogen and oxygen. Oil, on the other hand, is essentially a mixture of hydrocarbons, the result of chemical combinations of carbon and hydrogen.

19. This Report indicates the important place that properly qualified Engineers should occupy in the selection of coal and in advising upon the type of equipment most suitable to obtain the maximum combustion and efficiency under operating conditions in its various uses.

20. Until industrial and power plants and building heating plants as well as the domestic consumer are governed by the advice of competent and experienced Engineers, both as to the coal to be used and type of equipment suitable, it is not to be expected that the real value of coal as a fuel will be as generally recognized as it should be.

21. We have found in one instance, referred to in Chapter V. hereof, where a power plant using 60,000 to 70,000 tons of coal annually, changed over to heavy fuel-oil in circumstances where the use of coal should have been equal, if not superior, to the use of heavy fuel-oil. The change took place because this Company was able to buy cheap California fuel-oil and import it direct at "*dumping*" *prices.*

22. Instead of coal being a decadent fuel, as was suggested by the Building Owners and Managers Association of Vancouver, the experience in Great Britain, the United States and elsewhere shows that it presents one of the most fruitful fields for commercial research.

23. It is of importance that in British Columbia, possessing a great abundance and variety of coal, its scientific study should be encouraged. We see the necessity for co-operation in this respect between the coal companies, the Provincial Mines Department and the University of British Columbia.

24. Coal and heavy fuel-oil are not in competition in private dwelling-houses. Diesel or furnace oil is there used, which it is admitted does not compete in price with automatically fired coal even on to-day's competitive prices.

25. A large market has been lost to Vancouver Island coal because of its high cost of production and distribution. Alberta coals have made substantial inroads in Vancouver due to lower prices, despite the freight rate from Alberta. Thousands of sawdust burners in Vancouver and Victoria have also reduced Vancouver Island coal consumption for the same reason.

26. Reduced distribution charges to building heating plants in which the usual retail distribution charges apply, should not be made by "loading" all or some of these charges upon the domestic consumer and increasing his distribution charges thereby.

27. We have approached the domestic coal distribution problem on the premise that automatic coal-burning equipment sold at reasonable prices and on low monthly payments should supplant hand-fired furnaces because of the saving in fuel costs, elimination of physical labor and the convenience of automatic control.

28. Automatic coal-burning equipment should result in the preponderating use of pea and slack coal, creating a market therefor in place of the larger sized coals which can be and are now crushed into the smaller sizes. The domestic consumer, however, should be protected against increases in prices of pea and slack coal, by reason thereof, to the $10.50 and $10.75 prices we found to prevail for lump coal.

29. In Section 9 of Chapter IV. hereof we analyzed the prices of coal as found in the *Coal Report* in relation to the economic delivered price of heavy fuel-oil, with the resulting conclusion that the establishment of *central coal distributing depots,* or some modification of that principle, was the only effective way in which the present high distribution charges could be reduced to a point where coal could compete effectively in building heating plants with heavy fuel-oil, if the latter is sold at economic delivered prices as found.

30. We do not regard a delivered price of coal as economic which includes charges for a variety of retail services which we found can be dispensed with to the advantage of the community by the establishment of *central coal distributing depots.*

31. Both private dwelling-houses and building heating plants should be constructed so as to receive coal in bulk (unsacked) and to store it conveniently for use in automatic coal-burning equipment. We find that surprisingly little thought is given to these considerations in much of the construction now proceeding.

32. We find that buildings are constructed to burn heavy fuel-oil without either Architects or Engineers studying the advantages that may be obtained by burning coal. This merits emphatic public comment by reason of the great coal resources of this Province, and the successful manner in which coal can be burned as shown by tests conducted by the *Commercial Testing & Engineering Company* in Chicago.

33. The objects of these findings is not to favour coal as such, but rather to set out in concise form a general statement of the studied results of a comparison between coal and heavy fuel-oil. A purpose of the Commission was to determine the comparative value of the two fuels in terms of economic price relationship.

34. Once the merits of the fuels for a particular use are established by tests conducted by competent fuel-testing Engineers and the economic delivered prices of each fuel are found, the ensuing comparison should enable the prospective consumer to decide which fuel, with equal services, will cost him less at the end of the year.

35. In railway operation in British Columbia the use of coal and heavy fuel-oil is dictated, not by the merits of these fuels for locomotive use, but rather by their *competitive* prices. Heavy fuel-oil is purchased by the railways at prices much below the economic cost of production and economic delivered prices as found.

36. If heavy fuel-oil and coal were sold at economic delivered prices the use of coal in railway locomotives should result in substantial annual savings. In the year 1936, 44,057,660 gallons of heavy fuel-oil were consumed in railway locomotives in British Columbia, as compared with only 2,871,923 gallons in all the rest of Canada.

37. The railways advanced an argument that the use of heavy fuel-oil was required in railway locomotives in this Province because of its mountainous character as compared with the Prairies. This contention has been disposed of in a thorough analysis in Sections 3 to 6 of Chapter VI. hereof.

38. No objection would be raised by the Forestry Department or by the Board of Transport Commissioners to the use of coal in railway locomotives in this Province on the ground of fire-hazard: Patrols, however, would be ordered, but only on the same basis as in Eastern Canada, where coal is exclusively used.

39. No locomotive tests of coal and heavy fuel-oil have been made in this Province by either railway. Such a test was conducted by the *Canadian Pacific Railway* between Calgary and Red Deer, Alberta, in 1931. The results of the said test applied to British Columbia operating conditions in so far as they may be, without an actual locomotive test in this Province, would indicate no reason why coal cannot be as efficiently used in British Columbia railway locomotives as it is in fact by the *Northern Pacific* Railway.

40. We find that recent coal tests on locomotives made on the Mohawk Division of the *New York Central* Railway Company showing efficiencies from 70% to 85% within the operating range of the locomotive were obtained with one of the Company's latest design stoker-fired coal burning locomotives.

41. It is not possible to find in the evidence presented that coal as a fuel in logging operations is as safe as oil in respect to fire danger.

42. Notwithstanding the foregoing statement, coal appears to be safely used in logging operations in the State of Washington and on one part of Vancouver Island.

43. It should not be accepted as a final and settled fact that coal cannot be safely used in logging operations in this Province. An open mind should be maintained and exhaustive tests made to settle the question.

44. Through the good offices of *Mr. W. A. McAdam,* Acting Agent-General in London, we have been given considerable information, which is incorporated in Chapter VIII. hereof, regarding the successful use of mechanically coal-stoked passenger vessels in the coastal waters of Great Britain. Study thereof convinced us of the danger of coming to a conclusion without more authentic information.

45. The greater use of cargo space and the longer time required for refuelling were two of the main objections presented against the use of coal in British Columbia coastal waters. How good these objections are in the light of experience elsewhere is a subject for further inquiry. In view of the abundant supply of Vancouver Island coal, we remain to be convinced that heavy fuel-oil is a more economic fuel for this use until it is shown that mechanically coal-stoked passenger vessels cannot be operated in these coastal waters as successfully as in Great Britain.

46. While Diesel-engined tugs appear to have an advantage, a doubt exists as to whether coal or heavy fuel-oil is superior in coastal tugs. Evidence was presented in favour of each, but as pointed out during the hearings neither the tug companies, the coal companies nor the oil companies saw fit to present us with records of performance of either or both fuels under comparable operating conditions.

47. In our investigation of the cost of production and distribution of heavy fuel-oil we found that the oil companies used a method of apportioning the costs of the various products of crude petroleum, which admittedly did not show the actual costs of producing heavy fuel-oil. This method was rejected by the *Tariff Board of Canada* as well as by this Commission. In arriving at the costs of heavy fuel-oil we used the *Product Cost method* approved by *George A. Touche & Company,* internationally known chartered accountants.

48. In our investigation of depreciation and depletion charges, we found in the case of Canadian Collieries that depreciation was charged largely according to the discretion of the directors; in addition large sums were withdrawn from the Company's depreciation reserves and used for other purposes. We recast this method and treated the excessive depreciation charges as profit. We followed a method approved by leading Coal-Mining Engineers, Economists and Chartered Accountants, including *Price, Waterhouse & Company* and *George A. Touche & Company,* in British Columbia.

49. Our findings in respect to the capital structure, profit position and return upon investment of *Canadian Collieries* were likewise made in accordance with principles generally accepted by leading Coal-Mining Engineers, Economists and Chartered Accountants, including *Price, Waterhouse & Company* and *George A. Touche & Company,* in British Columbia.

50. Our findings in regard to reducing costs of mining coal on Vancouver Island were made after careful study by *Mr. George Watkin Evans,* internationally known Coal-Mining Engineer. In Section 10, Chapter X., hereof, it is shown that Mr. Evans has successfully reduced the cost of mining in other coal-mines. In the same section we published a letter from Mr. Evans, wherein he states that he is willing to advise ways and means for reducing cost of mining on Vancouver Island and to supervise the operation thereof, if requested so to do.

51. The excessive use of heavy fuel-oil in British Columbia indicates the existence of a unique condition in this Province; although it is a great coal-producing Province, more heavy fuel-oil is consumed as a substitute for coal than in any other Province of Canada; also, in addition to the heavy fuel-oil processed here, more heavy fuel-oil was imported into British Columbia in 1936 than into all the rest of Canada.

52. Despite our comparatively small population, the Province of British Columbia consumed in 1936 one-third of the heavy fuel-oil used in Canada. According to reported figures, British Columbia consumed in 1936:

17½ times as much as the *Irish Free State*;
nearly 4 times as much as *New Zealand* and *Belgium* respectively;
nearly 3 times as much as the Dominion of *South Africa*; and
nearly 1½ times as much as the Dominion of *Australia*.

53. The reported figures also disclose that in 1936 the Province of British Columbia alone consumed half as much heavy fuel-oil as *Italy*; three-tenths the consumption of *France*, *Germany* and *Japan* respectively and one-fifth the consumption of the *United Kingdom*. These extraordinary figures indicate that an economic condition exists in British Columbia that does not exist elsewhere in Canada.

54. Reference is made in Section 13 (*e*) of Chapter IX. to some incidental matters; these, and other matters, provide a fruitful field of study as occasion demands and as interest grows in the more economic and efficient use of fuels.

55. It is essential that provision should be made for the testing and grading of all petroleum products under a qualified supervisor, as pointed out at page 126 and elsewhere in the *Petroleum Report*. The Chemistry Department of the University of British Columbia presents an opportunity in this respect that we judge should be of advantage to the Province, the University, the industry and consumers alike.

56. It is contrary to the economic welfare of the Province that depreciation reserves should be withdrawn in cash from a company; as such reserves are created for the purpose of maintaining the equity of the original investment, these reserves should remain in the Province and in the company for that purpose.

57. The costs of production and distribution of coal have been found to be too high, with resulting uneconomic prices to consumers. The cost of production and distribution of heavy fuel-oil as stated by oil companies, on the contrary, has been found to be too low and not to reflect or represent the economic cost thereof, also with resulting uneconomic prices to consumers. The oil companies have been able to pursue this course by using a method of allocating costs whereunder the losses incurred in heavy fuel-oil have been "loaded" on to gasoline, thereby increasing its alleged costs of production.

M. A. MACDONALD,
Commissioner.

December 5th, 1938.

GENERAL INDEX.

PAGE.

CHAPTER I.—INTRODUCTORY CHAPTER RELATING TO SOME ASPECTS OF COAL AND PETROLEUM PRODUCTS TO BE CONSIDERED UNDER PARAGRAPH 3 OF THE COMMISSION 1

Sec. 1.—Terms of the Royal Commission 1
(a.) Summary of Commission Terms 1
(b.) Petroleum and Coal Reports already filed 1
(c.) Matters to be considered in this Volume 1
(d.) Outline of scope of Paragraph 3 of Commission Terms 1
Sec. 2.—Some Conditions existing in this Province which gave rise to the Questions in Paragraph 3 of the Commission Terms 3
(a.) Provincial Production of Coal and Heavy Fuel-oil 3
(b.) Decrease in British Columbia Coal Production 3
(c.) Legislation relating to Fuel-oil and Economic Council Hearings 3
Sec. 3.—The course the Inquiry has taken 4
(a.) Evidential Hearings 4
(b.) Original Plan of calling Evidence 4
(c.) Fuel-oil Consumption in British Columbia compared with the Rest of Canada 5
(d.) Some Conclusions in the Petroleum Report 6
(e.) Failure of Coal Companies to cross-examine Officials of Canadian Pacific and Canadian National Railways 7
Sec. 4.—Is Coal a Modern Economic Fuel as compared with Heavy Fuel-oil? 7
(a.) Imperial Oil Observations concerning Failure of Coal Industry to keep Abreast of Modern Fuel 7
(b.) Coal is not in fact a Decadent Fuel 7
Sec. 5.—Some Factors entering into a Comparison of the Relative Merits of Coal and Heavy Fuel-oil 8
(a.) Necessity of a Method of Comparison 8
(b.) Losses of Energy in a Fuel 8
(c.) Evaporation results reflect Energy actually obtained from each Fuel 8
(d.) Cost Factors in Fuel Comparisons 9
(e.) Laid-down Prices of Fuel to be studied in their Relation to Economic Costs 9
Sec. 6.—Nature of the Evidence adduced 9
(a.) Plants and Industries from which Evidence obtained 9
(b.) Classification thereof 10
(c.) Comparisons based upon the Money paid out for Fuels 10
(d.) Hand-fired Coal Plants do not provide a Reliable Comparison 11
Sec. 7.—The Evidence presented shows that the Advances made in the Use of Coal during the last Fifteen Years have not been given due Consideration 11
(a.) Observations concerning increased Efficiency obtained from Coal 11
(b.) Lack of Information concerning Coal due partly to lack of Technically Qualified Persons 12
(c.) Necessity for Coal Research-work 12
Sec. 8.—The problem of Change-over from Heavy Fuel-oil to Coal 12
(a.) Reasons that Change-over Costs not considered further 12
(b.) Limitations of Discussion 13
Sec. 9.—Fuel-oil and its Uses 13
(a.) Distillate Fuels 13
(b.) Certain Heavy Fuel-oil Characteristics 13
(c.) Furnace-oils 14
(d.) British Columbia Conditions 14
(e.) Other uses of Straight-run Heavy Fuel-oil 15
Sec. 10.—Coal and its Uses 15
(a.) B.T.U. Value 15
(b.) Automatic Coal-burning 16
(c.) Pulverized Coal 16

CHAPTER I.—*Continued.* PAGE.

Sec. 11.—Reference to Modern Methods of Production and Distribution of Coal with 1934–1936 Figures of Heavy Fuel-oil Use in British Columbia 17
(*a.*) Modern Coal Use Methods 17
(*b.*) Statistics of classified Heavy Fuel-oil used in British Columbia 17

CHAPTER II.—ANALYSIS OF THE EVIDENCE RELATING TO THE BURNING OF COAL AND OIL IN HEATING PLANTS IN PRIVATE DWELLING-HOUSES, HOTELS, OFFICE BUILDINGS, HOSPITALS, SCHOOLS, APARTMENT-HOUSES AND SUCH LIKE 19

Sec. 1.—Use of the Light Fuel-oils or Distillate Oils such as Diesel-oil, Furnace-oil, and Stove-oil in Relation to Coal 19
(*a.*) Furnace-oils 19
(*b.*) Good Combustion sacrificed in many Coal Furnaces 19
(*c.*) Evidence of saving in use of Coal compared with Furnace-oil 19
(*d.*) Further Evidence thereon 20
(*e.*) Janitor Problem in Apartment-houses 20
(*f.*) Greenhouse Evidence 20
(*g.*) Comparative Tables of Stoker Coal and Furnace-oil Costs 20
(*h.*) Further Tables thereon 21
Sec. 2.—Hospitals, Hotels and Institutions 22
(*a.*) Domestic and Building Heating Plants Fuel-oil Consumption 22
(*b.*) Vancouver General Hospital 22
(*c.*) Hotel Vancouver and Empress Hotel 23
(*d.*) Further Consideration thereof in relation to other Building Heating Plants 23
Sec. 3.—Departmental Stores 24
(*a.*) David Spencer, Limited, Vancouver and Victoria 24
(*b.*) Hudson's Bay Company, Vancouver and Victoria 25
Sec. 4.—Business Blocks 25
(*a.*) Building Owners and Managers' Association of Vancouver 25
(*b.*) Reference to Coal Costs and Prices 26
(*c.*) Advantages of Modern Coal-burning Equipment 27
(*d.*) Royal Trust Company Memorandum 27
Sec. 5.—Schools 28
(*a.*) Vancouver School Board 28
(*b.*) Cost variations in Schools 29
Sec. 6.—Summary of Automatically Fired Coal and Heavy Fuel-oil uses compared in this Chapter 29
(*a.*) Summary thereof 29
(*b.*) Short Analysis of such Evidence, generally Favourable to Coal Use 30
(*c.*) Authentic Evaporation Results Necessary to enable Comparison of Coal and Heavy Fuel-oil 30
Sec. 7.—Factors requiring Primary Consideration 31
(*a.*) Amount of Energy actually obtained and Economic Prices essential Elements of Comparison 31
(*b.*) Fuel Comparison Method explained 31
Sec. 8.—Some Illustrations of the Factors discussed in Section 7 31
(*a.*) Chemical Analysis of Fuels Indispensable 31
(*b.*) Competitive Prices do not assist in Real Comparison 32

CHAPTER III.—ECONOMIC DELIVERED PRICES OF COAL AND HEAVY FUEL-OIL IN BRITISH COLUMBIA 35

Sec. 1.—Cost of Production of Coals of varying B.T.U. Values from Separate Mines 35
(*a.*) Introductory Remarks 35
(*b.*) Separate Mine Costs 35
(*c.*) Weighted Average Mine Costs 36
(*d.*) Reasons for taking Weighted Average Mine Costs 36

CHAPTER III.—*Continued.* PAGE.

Sec. 2.—Comparison of Comox and Michel Mine Costs 37
(*a.*) Remarks thereon 37
(*b.*) Nanaimo, Comox and Wellington detailed Comparative Costs 37
(*c.*) Comox and Michel Comparative Detail Costs 41
(*d.*) Conclusions thereon 45

Sec. 3.—Economic costs of distribution of Coal to Building Heating Plants, Industrial and Power Plants Plants, Locomotives and Bunkers 45
(*a.*) Distribution Systems 45
(*b.*) Economic Price of Vancouver Island Coal delivered Vancouver Building Heating Plants, 1935 46
(*c.*) Retail Distribution Costs 47

Sec. 4.—Methods used in the Petroleum Report to arrive at an Economic Cost of Production of Heavy Fuel-oil 47
(*a.*) Introductory Remarks 47
(*b.*) Detail Vancouver Posted Price Heavy Fuel-oil, 1935 48
(*c.*) Cost of Production, Heavy Fuel-oil at Refinery 48
(*d.*) Method of bringing Fuel-oil Cost of Production up to date 48

Sec. 5.—California Dumping Prices dominate Heavy Fuel-oil Prices in British Columbia 48
(*a.*) Heavy Fuel-oil Prices not based on Cost of Production and Distribution 48
(*b.*) British Columbia Processed Heavy Fuel-oil has to compete with Imported California Fuel-oil 49

Sec. 6.—Imperial Oil Statements concerning effect of California Heavy Fuel-oil Dumping Prices 50
(*a.*) Heavy Fuel-oil imported from Seattle at less Price than Vancouver Posted Prices 50
(*b.*) Excerpts from Correspondence between Imperial Oil, Limited, Head Office and Vancouver Office relating to California Fuel-oil Competitive Prices 50

Sec. 7.—The Dumping Duty Provisions have not been enforced against Importations of California Heavy Fuel-oil 50
(*a.*) The 75-cent California Export Heavy Fuel-oil Price was a Dumping Price 50
(*b.*) The Dumping Duty was not enforced against California Fuel-oil 51
(*c.*) British Columbia Processed Fuel-oil unable to compete with California Dumping Prices 51
(*d.*) Continuation thereof 51

Sec. 8.—Comparison of Imperial Oil Heavy Fuel-oil Prices in Vancouver with Laid-down California Prices 52
(*a.*) Manner in which California Fuel-oil imported 52
(*b.*) Influence of California Fuel-oil Prices on British Columbia Industrial Prices 52
(*c.*) Average British Columbia Heavy Fuel-oil Prices, 1934–1935 53

Sec. 9.—Competition between British Columbia Processed Heavy Fuel-oil and imported California Heavy Fuel-oil 57
(*a.*) Imperial Oil Correspondence relating thereto 57
(*b.*) California and Washington Fuel-oil could be imported for Lower Price than Ioco Heavy Fuel-oil 58
(*c.*) Breakdown of imported California Fuel-oil Prices as laid down in Vancouver in 1935 59

Sec. 10.—Economic Heavy Fuel-oil Prices delivered at Consumer's Plant in Vancouver 59
(*a.*) Economic Delivered Price of Heavy Fuel-oil to Vancouver Building Heating Plant, 1935 59
(*b.*) British Columbia Costs of Heavy Fuel-oil accepted in preference to Imported Prices 60
(*c.*) Reasons therefor 61

PAGE.

CHAPTER IV.—THE TRUE COMPARISON OF COAL AND HEAVY FUEL-OIL CONSUMED IN BUILDING HEATING PLANTS OF THE NATURE DESCRIBED IN CHAPTER II. 63

Sec. 1.—Tests between Coal and Heavy Fuel-oil conducted in the Eastgate and St. Clair Hotels, Chicago, in November and December, 1930 63
(*a.*) Conditions under which the Tests arose 63
(*b.*) Detail of Chicago Tests 63
(*c.*) Analysis thereof in respect to Fuel Superiority 67
(*d.*) Detail of Actual Operation compared to Tests 67
(*e.*) Explanation thereof 71

Sec. 2.—Discussion of Costs arising from Labour and Ash Removal in the St. Clair Hotel since Installation of Coal-burning Plant 71
(*a.*) Ash Removal Costs 71
(*b.*) Extra Labour in Coal-burning Plants discussed 71

Sec. 3.—Remarks upon Chemical Analysis of Mid-western (U.S.) and Vancouver Island Coals 72
(*a.*) Introduction 72
(*b.*) Analyses of Nanaimo and Comox Coals 72

Sec. 4.—Discussion of the Methods adopted in applying the Results obtained in the Chicago Tests to Building Heating Plants in this Province 73
(*a.*) Description of Coals and Heavy Fuel-oils 73
(*b.*) Basis upon which Chicago Tests apply to British Columbia Building Heating Plants 73
(*c.*) Method of Application 74
(*d.*) Approval of Commercial Testing & Engineering Company and British Columbia Technical Advisers 74
(*e.*) Coal and Heavy Fuel-oil give more or less Equal Results 75

Sec. 5.—Reduction of Coal and Heavy Fuel-oil to Equivalent Quantities based on Evaporation Results related to B.T.U. Value 75
(*a.*) Method 75
(*b.*) Calculations pursuant to Method 75
(*c.*) Continuation thereof 76
(*d.*) Continuation thereof 76

Sec. 6.—Depreciation and Maintenance in Coal and Heavy Fuel-oil use in Building Heating Plants 77
(*a.*) Nature of Depreciation 77
(*b.*) Maintenance, Renewals and Replacements 77
(*c.*) Life of Coal Burning and Oil Burning Equipment 77

Sec. 7.—Depreciation and Maintenance as applied to Coal and Heavy Fuel-oil Burning Equipment in Building Heating Plants 78
(*a.*) Method 78
(*b.*) Comparative Capital and Operating Costs of fully mechanized Coal and Heavy Fuel-oil Burning Plants, comparable to Eastgate and St. Clair Hotels with Fuel Consumption equivalent to 500 Tons of Coal per Annum 78
(*c.*) Discussion thereof 79
(*d.*) Applied to British Columbia 79

Sec. 8.—Wherein we arrive at a Comparision of the Heat Value of a Designated Coal and a Designated Heavy Fuel-oil in Building Heating Plants 80
(*a.*) Detail thereof 80
(*b.*) Superiority of Coal as Fuel ascertained 80
(*c.*) Comparision of the two Fuels in Terms of Economic Prices 80
(*d.*) Conclusions that Nanaimo and Comox Coals are Superior to Heavy Fuel-oil 81
(*e.*) Remarks upon Results from above Comparisons 82
(*f.*) Results compared in terms of Economic Prices 82

CHAPTER IV.—*Continued.* PAGE.

Sec. 9.—Retail Distribution Charges of Coal must be substantially reduced if it is to compete with Heavy Fuel-oil sold at Economic Delivered Prices to Building Heating Plants 82
(*a.*) Different Types of Purchasers considered 82
(*b.*) Discussion of Retail Distribution Charges as affecting Economic Delivered Prices 83
(*c.*) Analysis thereof 84
(*d.*) Results flowing therefrom 84
(*e.*) Results show necessity for Central Coal Distributing Depots 85
(*f.*) Further remarks thereon 85
(*g.*) Continuation thereof 86
(*h.*) More or less similar Recommendation by Forster, Brown & Rees, Cardiff, Wales, Mining and Civil Engineers, in 1910 86
(*i.*) Conclusion 86

CHAPTER V.—ANALYSIS OF THE EVIDENCE TOGETHER WITH COST TABLES RELATING TO THE BURNING OF COAL AND HEAVY FUEL-OIL FOR INDUSTRIAL AND MANUFACTURERS' HEATING AND FOR POWER PURPOSES IN STATIONARY PLANTS 87

Sec. 1.—Nature and Extent of Comparative Use in this Province of Coal and Heavy Fuel-oil for Industrial and Manufacturers' Heating and for Power Purposes 87
(*a.*) Extent of Use 87
(*b.*) Pulp and Paper Mill Annual Consumption of Heavy Fuel-oil 87

Sec. 2.—Inquiry as to whether there was a Lack of Continuity of Coal Supply which caused the Pulp and Paper Companies to change from the use of Coal to Heavy Fuel-oil 88
(*a.*) Statement of issues raised by Pulp Companies 88
(*b.*) Powell River Company, Limited, 1921 Incident 88
(*c.*) B.C. Pulp and Paper Company, Limited, Port Alice Incident 89

Sec. 3.—Study of alleged Lack of Continuity of Coal Supply put forward by Pacific Mills, Limited 89
(*a.*) Pacific Mills incident 89
(*b.*) Result thereof 90

Sec. 4.—Discussion of the Evidence put forward by the Pulp and Paper Companies alleging that Coal as a Fuel was not as efficient as Heavy Fuel-oil 91
(*a.*) B.C. Pulp and Paper Company, Limited Statement analysed 91
(*b.*) Analysis Pacific Mills, Limited, Evaporation Results 91
(*c.*) Continuation thereof 92
(*d.*) Particulars of Chicago Power Plant and Industrial Tests 92
(*e.*) Analysis thereof 93
(*f.*) Conclusion relating to Coal and Heavy Fuel-oil compared as Fuels 94

Sec. 5.—Analysis of Evidence put forward by Pulp and Paper Companies that Coal costs more than Heavy Fuel-oil 94
(*a.*) Competitive prices 94
(*b.*) Breakdown Pacific Mills, Limited, Coal and Heavy Fuel-oil Delivered Prices 95

Sec. 6.—British Columbia Production Cost Figures as found in the Petroleum Report are accepted as Basis for Coal Comparision instead of Imported Heavy Fuel-oil Figures 96
(*a.*) Pacific Mills California Heavy Fuel-oil Price 96
(*b.*) Continuation thereof 96
(*c.*) Continuation thereof 97

Sec. 7.—Economic Delivered Prices of Heavy Fuel-oil and Vancouver Island Coals at Ocean Falls 97
(*a.*) Economic Delivered Prices of Coal and Heavy Fuel-oil at Ocean Falls, 1935 97
(*b.*) Distribution Charges of Heavy Fuel-oil delivered at Ocean Falls 98

CHAPTER V.—*Continued.* PAGE.

Sec. 8.—Ash Removal and Extra Coal Labour Costs considered 99
(*a.*) Pacific Mills Comparative Personnel in Coal and Heavy Fuel-oil use 99
(*b.*) Ash Removal Costs 99
Sec. 9.—Depreciation and Maintenance Cost Factors applicable to Fuel Comparisons in Industrial and Stationary Power Plants 100
(*a.*) Comparative Cost of Pulverized-fuel-fired, Stoker-fired and Oil-fired Boiler Units as supplied by Commercial Testing & Engineering Company 100
(*b.*) Depreciation and Maintenance Costs therein compared 101
Sec. 10.—Comparison of Coal and Heavy Fuel-oil in Industrial and Stationary Power Plants based on Analysis of Pacific Mills Statements 101
(*a.*) Discussion Economic Delivered Prices at Pacific Mills Plant of Coal and Heavy Fuel-oil 101
(*b.*) Comparison thereof in Terms of Economic Price Relationship 102
(*c.*) Savings in cost in use of Coal in Industrial and Stationary Power Plants where Delivery direct from Mine and Refinery to Plant 103
(*d.*) Results applied to Pacific Mills Example 103
(*e.*) Conclusions therefrom 104
(*f.*) Continuation thereof 104
Sec. 11.—Use of Pulverized Coal in Industrial and Power Plants as compared with Automatic Coal-firing and Heavy Fuel-oil 104
(*a.*) New construction favours Pulverized Coal Use 104
(*b.*) Discussion thereof 105
(*c.*) Some Advantages of Pulverized Fuel over Stoker-fired Coal 106
(*d.*) Fly-ash Disposal 106
(*e.*) B.C. Sugar Refinery, Limited 106
(*f.*) Advantages of Pulverized Coal in Out-of-town Power Plants 107

CHAPTER VI.—ANALYSIS OF THE EVIDENCE RELATING TO THE CONSUMPTION OF COALS AND HEAVY FUEL OILS IN RAILWAY LOCOMOTIVES IN BRITISH COLUMBIA 109

Sec. 1.—Consumption of Heavy Fuel-oils in Railway Locomotives in the Province in relation to Coal 109
(*a.*) Extent of Railway Locomotive Fuel-oil Consumption 109
(*b.*) Discussion as to why so much Heavy Fuel-oil used in Railway Locomotives in this Province 109
(*c.*) Number of Oil-burning and Coal-burning Railway Locomotives in the Province 110
(*d.*) Railway Locomotives Heavy Fuel-oil and Coal Consumption 110
Sec. 2.—Outline of Reasons given by Railway Officials for use of Heavy Fuel-oil in Locomotives in British Columbia 111
(*a.*) Witnesses 111
(*b.*) Arguments advanced in favour of Heavy Fuel-oil 112
(*c.*) Evidence relating to Preponderating use of Heavy Fuel-oil in British Columbia Railway Locomotives 112
Sec. 3.—Analysis of Canadian Pacific and Canadian National Railways' evidence relating to convenience for Faster and more Regular Service by the Use of Heavy Fuel-oil in Railway Locomotives in British Columbia 114
(*a.*) Analysis of evidence 114
(*b.*) Evidence of Northern Pacific Railway Official in reply thereto 115
(*c.*) Canadian Pacific Reasons founded on Competition with American Railroads 116
Sec. 4.—Study of the Physical Characteristics of British Columbia in relation to the Use of Coal and Heavy Fuel-oil in Railway Locomotives 116
(*a.*) Canadian Pacific Argument for Heavy Fuel-oil based on Mountainous Character of Province 116
(*b.*) Memorandum from Mr. D. O. Lewis comparing Railway Gradients in British Columbia with those in the Prairie Provinces 117

CHAPTER VI.—*Continued.*
Section 4—*Continued.* PAGE.
(*c.*) Analysis Canadian National Railway grades 123
(*d.*) Analysis Canadian Pacific Railway grades 123
(*e.*) Reference to Supplementary Memorandum on Statement of D. O. Lewis 123
(*f.*) Conclusions thereon 124
Sec. 5.—Study of the Physical Characteristics of the Country through which Canadian Railways operate as compared with the Northern Pacific 124
(*a.*) Comparison Northern Pacific Railway Profile with Profiles of Canadian Pacific and Canadian National 124
(*b.*) Comparative Passenger Train Schedules Canadian Pacific, Canadian National and Northern Pacific Railways 129
Sec. 6.—History of Coal and Heavy Fuel-oil use in Railway Locomotives in British Columbia 130
(*a.*) Canadian Pacific 130
(*b.*) Canadian National 131
(*c.*) Heavy Fuel-oil Prices at Material Times 131
Sec. 7.—No Comparative Tests of Coal and Heavy Fuel-oil in Railway Locomotives have been conducted in British Columbia 131
(*a.*) Analysis of Evidence thereon 131
(*b.*) Only tests were Amount paid out for Fuel at End of Year 132
(*c.*) Canadian National did not conduct any Tests in British Columbia 133
Sec. 8.—Analysis of Canadian Pacific Railway Tests in Alberta between Coal and Heavy Fuel-oil and application thereof to Comox Coal and British Columbia Heavy Fuel-oil 133
(*a.*) Description of Enman Tests 133
(*b.*) Conclusions therefrom 134
(*c.*) Applicability of Canadian Pacific Alberta Tests to British Columbia Operating Conditions 134
(*d.*) Continuation thereof 135
(*e.*) Northern Pacific Railway 1935 Tests 135
(*f.*) Missouri Pacific Lines Tests 136
Sec. 9.—Wherein we discuss Competitive Prices of Coal and Heavy Fuel-oil for Railway Locomotive Use and find the Economic Delivered Prices that should apply 136
(*a.*) Canadian Pacific Railway 1935 stated Laid Down Competitive Price at Vancouver of Coal and Heavy Fuel-oil 136
(*b.*) Economic Delivered Price of Comox Coal at Vancouver for Railway Locomotive Use in 1935 136
(*c.*) 1935 Economic Delivered Price of British Columbia Processed Heavy Fuel-oil at Vancouver for Railway Locomotive Use 137
Sec. 10.—Coal sold at Economic Delivered Prices costs less than Heavy Fuel-oil for Railway Locomotive Use in British Columbia 137
(*a.*) Saving shown in use of Coal if both Fuels sold at Economic Delivered prices 137
(*b.*) Saving shown on Coal consumed in Locomotives on Basis of Economic delivered Prices of both Fuels 138
Sec. 11.—Consideration of Canadian National Toronto-Sarnia Locomotive Fuel Tests 139
(*a.*) Canadian National Toronto-Sarnia Tests 139
(*b.*) Canadian National Tests not conclusive 139
Sec. 12.—Conclusion 139
(*a.*) Other Cost Factors to be considered 139
(*b.*) Final Conclusion 140

CHAPTER VII.—FIRE-HAZARDS 141
Sec. 1.—General Observations 141
Sec. 2.—Conflicting Opinions 142

CHAPTER VII.—*Continued.* PAGE.

Sec. 3.—Tests ... 142
Sec. 4.—Tests on American Railways ... 144
Sec. 5.—Fire-hazards in Fuel-Oil-burning Locomotives ... 145
Sec. 6.—Laboratory and Research Work ... 145
Sec. 7.—A General Survey of Evidence as to Fire-hazard from Coal-burning Locomotives ... 146
Sec. 8.—Evidence indicating that there is Little Danger of Fire from Stack of Coal-burning Locomotives properly equipped ... 146
Sec. 9.—Evidence indicating that there is Danger of Fire escaping from Stacks of Coal-burning Locomotives ... 149
Sec. 10.—Danger of Fire from Ash Pans in Coal-burning Locomotives ... 150
Sec. 11.—General ... 151
Sec. 12.—Logging Locomotives and Stationary Equipment in Logging Operations ... 152
Sec. 13.—Conclusions ... 155

CHAPTER VIII.—COMPARATIVE USE OF COAL AND HEAVY FUEL-OIL IN BRITISH COLUMBIA SHIPPING ... 157

Sec. 1.—Use of Heavy Fuel-oil in British Columbia Coastal Shipping ... 157
(*a.*) Vessels operated by Canadian Pacific ... 157
(*b.*) Vessels operated by Canadian National ... 157
(*c.*) Vessels operated by Union Steamships ... 158
(*d.*) Heavy Fuel-oil Consumption in Coastal Waters, 1934 ... 158
Sec. 2.—Reasons stated by Canadian Pacific Steamships in favour of Heavy Fuel-oil Consumption in Coastal Vessels ... 158
(*a.*) Time taken to fuel with Coal ... 159
(*b.*) Bunkering Coal would interfere with loading of Automobiles and Cargo ... 159
(*c.*) Cargo Space on Alaska Ships ... 159
(*d.*) Heavy Fuel-oil more Comfortable for Passengers ... 159
(*e.*) Other Reasons advanced ... 159
Sec. 3.—Reasons given by Canadian National and Union Steamships for burning Heavy Fuel-oil instead of Coal in Coastal Shipping ... 159
(*a.*) Canadian National could not maintain existing Services with coal Burners 159
(*b.*) Union Steamships advanced same Argument ... 159
Sec. 4.—Analysis of the Argument for use of Heavy Fuel-oil in Coastal Ships as set out in Sections 2 and 3, *supra* ... 160
(*a.*) Tacit Admission by General Manager, Canadian Collieries, of Shipping Viewpoint above outlined ... 160
(*b.*) Analysis of Arguments advanced in the Light of Experience of Mechanically Stoked Vessels in Great Britain ... 160
(*c.*) Reference to Mechanically Stoked "Duke of York," of Heysham-Belfast Service ... 161
Sec. 5.—Reference to Mechanically Stoked Coastal Vessels recently constructed in Great Britain ... 161
(*a.*) Description of "Duke of York" ... 161
(*b.*) Discussion of Cargo Space Argument ... 162
(*c.*) Summary of Shipping Statements obtained from Great Britain ... 163
(*d.*) Further Discussion thereof ... 163
Sec. 6.—Tugs and Towboats ... 164
(*a.*) Outline of Evidence ... 164
(*b.*) Opinion divided as to Comparative Merits of Heavy Fuel-oil and Hand-fired Coal ... 164
(*c.*) Conclusions ... 165
Sec. 7.—Use of Coal and Heavy Fuel-oil in Ocean-going Vessels ... 166
(*a.*) Coal-burning Cargo Vessels ... 166
(*b.*) "Empress of Asia" and "Empress of Russia" burn Coal ... 166
(*c.*) On the Atlantic ... 167

CHAPTER VIII.—*Continued.*
Section 7—*Continued.* PAGE.
(*d.*) Canadian National Australia and West Indies Services ... 167
(*e.*) As to reduction in Stokehold Personnel when Mechanical Stokers used ... 167
Sec. 8.—Use of Coal and Heavy Fuel-oil in Ferries and Fishing Vessels ... 167
(*a.*) Ferries ... 167
(*b.*) Fishing Vessels ... 168
Sec. 9.—Discussion of Comparative Economic Values of the Use of Coal and Heavy Fuel-oil in the British Columbia Coastal Service ... 168
(*a.*) Summary thereof ... 168
(*b.*) Conclusions ... 168

CHAPTER IX.—REVIEW SUMMARY AND CORRELATION OF FINDINGS ON THE EVIDENCE PRESENTED TO THE COAL AND PTROLEUM PRODUCTS COMMISSION ... 169
Sec. 1.—Preliminary Conclusions as to Suitability of British Columbia Coal for Modern Use ... 169
(*a.*) Thoroughness of Basic Cost Inquiries ... 169
(*b.*) British Columbia Coals Suitable and Convenient Fuels adaptable to Modern Uses ... 169
(*c.*) Coal and Heavy Fuel-oil are in general Equally Suitable, subject to Design and Operating Conditions ... 170
(*d.*) Advantage rests with Coal if both Fuels sold at Economic Delivered Prices 170
(*e.*) It is good Engineering and good Economics to design Steam Plants to use the Fuels nearest at hand ... 170
Sec. 2.—Necessity for Regulation of the Price of Gasoline on the basis of a uniform and adopted Costing Method if the Coal Mining Industry is to be saved from extinction ... 170
(*a.*) Introduction ... 170
(*b.*) Oil Companies have Coal Mining Industry virtually at their Mercy ... 171
(*c.*) Definition of Just and Reasonable Price ... 171
(*d.*) Explanation of Product Sales Method employed by Oil Companies ... 172
(*e.*) Explanation of Product Cost Method accepted by Commission ... 172
(*f.*) Economic Gasoline Prices as found in Petroleum Report ... 173
(*g.*) Application of Petroleum Report Cost Tables to Present Prices ... 173
(*h.*) Price Regulation to be based on Adopted Costing Method under which Prices will not be subject to expediency nor fixed in an Arbitrary Manner 174
(*i.*) Extent of Consumption of Heavy Fuel-oil in British Columbia, compared with other Portions of the World ... 174
Sec. 3.—Drastic Reduction of Gasoline Service-stations is an Important Element in the Reduction of Gasoline Prices and Consequent Preservation of the Coal-mining Industry ... 174
(*a.*) General Demand for Regulation of Gasoline as a Public Utility ... 174
(*b.*) Oil Companies control 93 per cent. of Service-stations and Gasoline Outlets 175
(*c.*) Service-station Dealers for the most part were making a Bare Existence even at the Excessive Spread (Retailer's Margin) existing all over the Province ... 176
(*d.*) No Real Loss of Employment need be expected from Drastic Curtailment of Service-stations ... 176
(*e.*) If the Price of Gasoline is reduced to the Extent it should be, Heavy Fuel-oil will be bearing its own Fair Share of Cost and compete with Coal on a Fair Comparative Costs basis ... 177
Sec. 4.—The Commission Terms are Premised on the Principal that Sales below Cost are Uneconomic—effect thereof on Costing method ... 178
(*a.*) The Price of Gasoline is now and has been fixed for many years by the Oil Companies, with no relation to Reasonable Costs of Production and Distribution ... 178

CHAPTER IX.—*Continued.*
Section 4—*Continued.* PAGE.
(*b.*) The Commission Terms are based on the Premise that Sales below Cost are contrary to Economic Welfare ... 178
(*c.*) Canadian Collieries are particularly associated with the Principal of Sales below Cost ... 178
Sec. 5.—Costing and Distribution Problems of Different Kinds exist in the Coal and Oil Industries ... 179
(*a.*) Remarks on Costing Methods ... 179
(*b.*) Remarks on Methods of Distribution ... 179
Sec. 6.—Depreciation Charges in the Coal-mining Industry ... 179
(*a.*) Canadian Collieries ... 179
(*b.*) Continuation thereof ... 179
(*c.*) Continuation thereof ... 180
Sec. 7.—Marketing and Distribution of Heavy Fuel-oil and Coal ... 180
(*a.*) Two classifications of Distribution ... 180
(*b.*) Where delivery is made direct to Consumer's Plant ... 181
Sec. 8.—Necessity for Reduction of Mining Costs in Vancouver Island Coal Mines ... 181
(*a.*) Problem originally presented ... 181
(*b.*) Report of George Watkin Evans ... 182
(*c.*) Some Conclusions therefrom ... 183
Sec. 9.—Canadian Collieries Coal Sales below Stated Cost at Mine—analysis thereof with some Conclusions ... 183
(*a.*) Canadian Collieries showed 50 per cent. of its Sales below Cost of Production ... 183
(*b.*) Domestic Consumer has Complaint ... 183
(*c.*) Continuation thereof ... 183
Sec. 10.—Importance of a Fair and Uniform Return upon Capital reasonably and necessarily invested in relation to Just and Reasonable Prices to the Consumer ... 184
(*a.*) Return on Investment is included in ascertainment of Reasonable Capitalization ... 184
(*b.*) Price Regulation in assuring Adequate Returns on Capital would be apt to attract Capital ... 184
Sec. 11.—Coal not sold at Economic Delivered Prices cannot compete in Building Heating Plants with heavy Fuel-oil sold at Economic Delivered Prices ... 185
(*a.*) Heavy Fuel-oil does not compete with Coal in Household Use ... 185
(*b.*) For Coal to compete with Heavy Fuel-oil in Building Heating Plants Reductions in Mining and in Distribution costs must take place ... 185
(*c.*) Present Coal Distribution Spreads assist in greater use of Furnace-oil and Heavy Fuel-oil ... 185
Sec. 12.—Coal Sales to Domestic Consumers—Economic Delivered Prices thereof related to Character of Distribution Service when compared with Building Heating Plant Deliveries ... 186
(*a.*) The Delivered Price to the Domestic Consumer should not be loaded with Charges attributable to Lower Delivered Prices to Larger Consumers ... 186
(*b.*) Reasons for High Coal Distribution Charges ... 186
(*c.*) Coal Problems approached on more General Use of Automatic Coal-burning Equipment ... 187
Sec. 13.—Application of the Conclusions reached in the Coal Report and in the Petroleum Report to the Comparision of Coal and Heavy Fuel-oil as Economic Fuels ... 187
(*a.*) Economic Prices and not Competitive Prices had to be used for Fuel Comparision ... 187
(*b.*) Fuel Comparision in Industrial and Stationary Power Plants and Railway Locomotives ... 187
(*c.*) Fuel Comparision in Coastal Vessels and Tugs ... 188

CHAPTER IX.—*Continued.*
Section 13—*Continued.* PAGE.
(*d.*) Difference in Coal and Heavy Fuel-oil flexibility is more a Matter of Convenience 188
(*e.*) Reference to other Incidental Matters 188
(*f.*) Necessity for Coal Research and Scientific Study 189

CHAPTER X.—ANSWER TO CIRCULATED STATEMENT OF CANADIAN COLLIERIES (DUNSMUIR) LIMITED OBJECTING TO CERTAIN FINDINGS IN THE COAL REPORT 191

Commissioner's Introductory Statement 191
Sec. 1.—Objections to Coal Report as contained in Reply received 20th October, 1938 from Canadian Collieries (Dunsmuir), Limited 193
(*a.*) Analysis of Coal Company's Main Objections 193
(*b.*) Study thereof does not alter any Conclusions in Coal Report 193
Sec. 2.—Further Discussion of the Objections to the Coal Report advanced by Canadian Colleries 194
(*a.*) Conclusions in Coal Report relating to Capital Structure, approved by Price, Waterhouse & Company and George A. Touche & Company 194
(*b.*) Conclusions in Coal Report relating to Depreciation and Profit Position approved by Price, Waterhouse & Company and George A. Touche & Company 194
(*c.*) Canadian Collieries' Reply not vouched for by Independent Chartered Accountants 195
(*d.*) Reference to some Secondary and Minor Objections made by Coal Company 195
Sec. 3.—Relating to Canadian Colleries' Contention that $11,000,000.00 was a Fair Purchase Price in 1910 and that accordingly the 1920 and Present Capital Structure is justified thereby 195
(*a.*) $8,000,000.00 paid for Coal Rights in 1910 195
(*b.*) This fact supports Coal Report Conclusions as no reasonable Expectation of Mining said Coal Rights for forty years in the Future 196
(*c.*) Alleged Tonnage covers Estimated Reserve for 625 Years in the Future 196
(*d.*) $8,000,000.00 was borrowed at 5 per cent. interest to pay for Coal Rights which could not reasonably be expected to be mined for Forty Years in the Future 197
Sec. 4.—The 1910 Coal Rights Valuation was in fact written off in 1920 198
(*a.*) This is shown by 1920 Records 198
(*b.*) Corresponding $8,000,000.00 Bond Liability raised to purchase these Coal Rights was not correspondingly written off 198
(*c.*) In the 1920 Reorganization the Bond-holders elected to remain as Mortgagees in Possession 198
Sec. 5.—The Valuation of the Coal Lands (as distinct from Coal Rights for which $8,000,000.00 was paid) as found in the Coal Report is strengthened by the Further Information submitted in Canadian Collieries' Reply 199
(*a.*) Coal Report and other References thereto 199
(*b.*) If Crow's Nest Pass Coal Company Capital Structure built on similar Principles, it would be $144,000,000.00 199
(*c.*) Analysis of Western Fuel Valuation by George Watkin Evans as stated in Canadian Collieries' Reply 199
Sec. 6.—Speculative Values of Intangible Assets should not be included in Capitalization of a Producing Coal Mining Company 200
(*a.*) Opinions of George Oliver May expressed before United States Federal Trade Commission thereon 200
(*b.*) Such Intangible Assets should be excluded from Capitalization 200
(*c.*) Purchase and Inclusion of these Intangible Assets in Capitalization increased Cost and Selling Price of Coal 201

CHAPTER X.—*Continued.* PAGE.

Sec. 7.—Depreciation Questions raised in Canadian Collieries' Reply ... 201
(*a.*) Statement of Coal Company's two Main Objections ... 201
(*b.*) Answer to Criticism of Method of Depreciation ... 201
(*c.*) Answer to Objection that no Accurate Estimates can be made of Coal Recoverable from any particular Mine Opening ... 202
Sec. 8.—Canadian Collieries' Objection to Profit Position as found in Coal Report ... 203
(*a.*) Statement of Coal Company's two Main Objections ... 203
(*b.*) Answer to Coal Company's Objection to inclusion of Bond Interest and Bond Redemption Payments in Profit Position ... 203
(*c.*) Continuation thereof ... 204
Sec. 9.—Canadian Colleries charged Excessive Depreciation and used it for Other Purposes ... 205
(*a.*) Analysis of Depreciation Reserves as charged compared with 1934 Value of Depreciating Assets ... 205
(*b.*) Large Depreciation Reserves forwarded in Cash to Montreal Office ... 205
(*c.*) Company's conduct showed that Depreciation Reserves allowed in Coal Report were not too Low when treated purely as Depreciation Reserves ... 205
Sec. 10.—Canadian Collieries have not substantiated their Objection to the Coal Report Finding, that Mining Costs can be reduced ... 206
(*a.*) Preliminary Remarks thereon ... 206
(*b.*) Dr. Gray does not assert that some Savings in Cost cannot be made ... 206
(*c.*) Explanation of Table 69 Roslyn and Comox Flow Sheets ... 208
(*d.*) Dr. Gray's Opinion is neither Specific nor Conclusive ... 208
(*e.*) Mr. G. W. Evans is prepared to outline Ways of reducing Costs at Comox and direct and supervise such a Programme, if requested ... 209
(*f.*) Letters from Austin Corbin, Paul Shoup, Col. Sherwood Lett, and George Watkin Evans ... 209
Sec. 11.—Reference to some Secondary Matters in Canadian Collieries' reply in addition to the Supplementary Memorandum ... 211
(*a.*) Answer to Canadian Collieries Objections to Coal Company's Costs per Ton as stated in Coal Report ... 211
(*b.*) Answer to Coal Company's Objection that Coal Rights under E. & N. Land Belt were an Asset of Wellington Colliery Co., Ltd. ... 211
(*c.*) Answer to Coal Company's objection to Coal Land Acreage at Nanaimo ... 212
Sec. 12.—Conclusion ... 212
(*a.*) Preliminary statement ... 212
(*b.*) Policy of Canadian Collieries' Bondholders to remain as Mortgagees in possession is a Source of Criticism ... 212
(*c.*) Failure of Canadian Colleries to produce 1910 reports of Forster, Brown & Rees, W. L. Coulson and Price, Waterhouse & Co., is a Source of Criticism 213
(*d.*) Canadian Collieries failed to re-act favourably to Carefully Considered suggestions regarding Reduced Costs of Mining ... 214
Supplementary Memorandum:
Answering in detail Specific Allegations of Error in Secondary Matters ... 215
Letter from George A. Touche & Company, 25th November, 1938, to effect that no Accounting Principles, Figures or other Data submitted in Canadain Collieries' reply in any Material Way refutes the Soundness of the Conclusions arrived at in the Coal Report and Chapter X., now concluded ... 220

APPENDICES ... 223

LIST OF EXHIBITS NOT LISTED IN COAL REPORT, VOLUME II. ... 481

INDEX TO TABLES IN VOLUME III.

Table Number.	Subject-matter.	Page.
1.	Fuel-oil Deliveries by Provinces, 1934–1936	5
2.	Importation of Light and Heavy Fuel-oil, 1934–1936	5
3.	Railway Locomotive Fuel-oil Consumption, 1934–1936	5
4.	Specific Uses of Fuel-oil in British Columbia, 1934–1936	17
5.	Specific Uses of Fuel-oil in British Columbia based on Deliveries and Consumption, 1934–1936	17
6.	Cost of Heating 100 Square Feet of Radiation during Season	21
7.	Table 6 adjusted to Recast Prices	21
8.	Comparative Furnace-oil, Stoker Coal and Hand-fired Coal Heating Costs	21
9.	Table 8 adjusted to Recast Prices	21
10.	Table 9 adjusted to Improved Combustion with Automatic Coal-firing	22
11.	Summary of Total Costs of Separate Mine Production per Short Ton Canadian Collieries, 1932–1936	35
12.	Summary of Nanaimo Wellington and Comox Coal Production available for sale per Short Ton, 1932–1936	39
13.	Comparison Comox and Michel Costs of Production, 1932–1936	43
14.	Economic Price of Vancouver Island Coal per Short Ton in 1935 delivered Building Heating Plants	47
15.	Comparison of Laid-Down Vancouver Imported Heavy Fuel-oil Prices with Imperial Oil Prices, 15th July, 1935	52
16.	Union Oil 1934 and 1935 Heavy Fuel-oil Prices at Vancouver	55
17.	Breakdown of Laid-Down Prices in Vancouver of imported California Heavy Fuel-oil in Cargo Lots, July, 1935	59
18.	Economic Price of Heavy Fuel-oil delivered to Building Heating Plants in Vancouver July, 1935, where Delivery could not be made direct from Refinery to Plant	60
19.	Comparative Tests of Coal and Heavy Fuel-oil conducted in the Eastgate and St. Clair Hotels, Chicago, by Commercial Testing & Engineering Company in November and December, 1930, and January, 1931	65
20.	Comparative Operating Results in the use of Coal and Heavy Fuel-oil as shown by the Eastgate and St. Clair Hotels, Chicago	69
21.	Average Analyses of Nanaimo Coals February 15th to March 15th, 1935	72
22.	Average Analyses of Samples of Comox Coals during the Month of February, 1935	73
22-A.	Comparative Capital and Operating Costs of fully Mechanized Coal and Heavy Fuel-oil Burning Plants, comparable to Eastgate and St. Clair Hotels with Fuel Consumption equivalent to 500 Tons of Coal per Annum	78–9
23.	Recapitulation Coal Delivered Prices 1936 basis, pages 294–301, Coal Report	83
24.	Fuel-oil Deliveries for Industrial and Manufacturers' Heating and for Power Purposes	87
25.	Comparative Merits of Coal and Heavy Fuel-oil as disclosed by Analyses of Pacific Mills Limited Evaporation Figures	92
26.	Comparative Merits of Coal and Heavy Fuel-oil as disclosed by Analyses of Evaporation in the Three Plant Tests conducted by Commercial Testing & Engineering Company in Chicago	93
27.	Pacific Mills Limited Breakdown of Heavy Fuel-oil Delivered Costs compared to Coal	95
28.	Recast of Table 27 with Economic Delivered Prices at Ocean Falls	97
29.	Gasoline Tanker Delivery Rates per Barrel ex Ioco	98
30.	Pacific Mills Comparative Personnel in Coal and Heavy Fuel-oil Use	99
31.	Comparative Cost of Pulverized-fuel-fired, Stoker-fired and Oil-fired Boiler Units	100
32.	Comparative Capital Costs and Operating Costs of the Plants referred to in Table 31	101
33.	Depreciation and Maintenance compared in Pulverized Coal, Stoker-fired and Heavy Fuel-oil Plants	101
34.	Method of finding equivalent number of Barrels of Heavy Fuel-oil of Designated B.T.U. Value per Short Ton of Coal of Designated B.T.U. Value on Premise that 1,000 B.T.U.'s of Heavy Fuel-oil and Coal give equal Evaporation Results	103

Table Number.	Subject-matter.	Page.
35.	Analysis of Number of Industrial Power Plants, Central Stations and Paper Manufacturing Companies which are mechanically stoked or burn Heavy Fuel-oil or Pulverized Coal respectively	105
36.	Heavy Fuel-oil consumed by Railway Locomotives in Canada, 1934–1936	109
37.	Railway Locomotives in use in British Columbia, 1935	110
38.	Railway Locomotive Consumption of Heavy Fuel-oil in British Columbia, 1934	111
39.	British Columbia Coal reported as purchased for Railway Locomotive Consumption, 1936	111
40.	Comparative Profiles of Canadian Northern, Canadian Pacific, Grand Trunk Pacific, Great Northern, Northern Pacific, Union Pacific, Chicago-Milwaukee and Santa Fe Railways	119
40A.	Map showing Portions of Western Canada and Western United States above and below 3,000 Feet Elevation, respectively	121
41.	Comparative Profiles of Canadian National, Canadian Pacific and Northern Pacific Railways	125
42.	Profile of Northern Pacific Railway superimposed on respective Profiles of Canadian National and Canadian Pacific Railways	127
42A.	Comparative Passenger Train Schedules, Canadian Pacific, Canadian National and Northern Pacific Railways	130
43.	Detail of Canadian Pacific Railway Locomotive Tests Calgary-Red Deer, May, 1931	134
44.	Canadian Pacific Calgary-Red Deer Locomotive Tests applied to Comox Coal and British Columbia Processed Straight-run Heavy Fuel-oil (Appendix 44 hereto)	433
45.	Extension of Table 44 (Appendix 44 hereto)	433
46.	Canadian Pacific Railway 1935 stated Laid-down Competitive Prices at Vancouver, of Comox Coal and Heavy Fuel-oil	136
47.	1935 Economic Delivered Price of Comox coal at Vancouver for Railway Locomotive use	137
48.	1935 Economic Delivered Price of British Columbia Processed Heavy Fuel-oil at Vancouver for Railway Locomotive Use	137
49.	Aproximate Comparison of Comox, Middlesboro, Coalmont, Coal Creek and Michel Estimated Costs with Heavy Fuel-oil for Railway Locomotive Use, based on Canadian Pacific Red Deer-Calgary Tests	138
50.	Detail of Northern Pacific Railway Coal and Heavy Fuel-oil Locomotive Tests (Appendix 45 hereto)	435
51.	Particulars of Missouri Pacific Lines Coal and Heavy Fuel-oil Locomotive Tests (Appendix 46 hereto)	437
52.	Extension of Table 51 (Appendix 46 hereto)	437
53.	General Summary of Canadian National Railway Toronto-Sarnia Locomotive Tests May–June, 1932 (Appendix 11 hereto)	265
54.	Canadian National Locomotive Tests in greater detail (Appendix 47 hereto)	439
55. 56. 57.	Table Numbers overlapped	
58.	Comparative Forested Mileage in relation to Special Fire Patrols Required by Provinces	142
59.	Related Particulars of Losses from Railway Fires	142
60.	Total Number of Steam Locomotives owned and Damage Claims paid for Fires along Rights of Way alleged to have been set by Steam Locomotives (Missouri Pacific Lines)	148
61.	New York Central Railroad Record of Fires 1924–1931	149
62.	Railway and Forested Mileage by Provinces 1930–1936	151
63.	Total Railway Fires in Canada with Related Particulars 1930–1936	151
64.	Canadian Pacific Coastal Vessels (British Columbia)	157
65.	Canadian National Vessels (British Columbia)	157
66.	Union Steamships, Limited, Coastal Vessels	158

Table Number.	Subject-matter.	Page.
67.	Canadian Pacific, Canadian National and Union Steamships Consumption of Heavy Fuel-oil in Coastal Waters, 1934	158
68.	Heavy Fuel-oil consumed in British Columbia for Bunkering 1934–1936	158
69.	Diagram of Flow Sheets of Coal from the Face of Workings in Roslyn and Comox Mines to the Railway Cars	207

INDEX TO APPENDICES IN VOLUME III.

Distinguishing Number.	Subject-matter.	PAGE.
1.	Statement from Chief Inspector of Mines relating to Output of Coal in B.C. Coal Mines, 1876–1934 (Exhibit 632)	223
2.	Summary of Representations made to Provincial Economic Council October, 1934 (Exhibit 783)	225
3.	Correspondence relating to Tariff Board Reference No. 84 respecting Petroleum and its Derivatives	237
4.	Transcript of Evidence, pages 6817 to 6831, relating to failure of Counsel for Canadian Collieries to Cross-examine Railway Witnesses	239
5.	Vancouver School Board Oil-burning and Coal-burning Statements (Exhibit 619)	245
6.	Memorandum from Chief Engineer, Vancouver School Board, regarding Fuel Comparisons (Exhibit 694)	247
7.	Fuel-oil Deliveries by Provinces (Exhibit 784)	251
8.	Table showing Comparison of Coal and Fuel-oil on Various Price Bases and Various Types and Sizes of Plants as presented by Canadian Collieries (Exhibit 703)	253
9.	Memoranda by Messrs. D. O. Lewis and K. Moodie on Canadian National Railway Toronto-Sarnia Locomotive Fuel Tests (Exhibits 805–807)	255
10.	Memorandum from David Spencer, Limited, Vancouver respecting Coal-burning Plant (Exhibit 704)	263
11.	Summary of Canadian National Locomotive Tests Toronto-Sarnia (Exhibit 595) (Table 53)	265
12.	Vancouver School Board Fuel Purchase Statement (Exhibits 617–618)	267
13.	Report of Commercial Testing & Engineering Company, Chicago, dated 22nd August, 1938, on Tests conducted in the Eastgate and St. Clair Hotels (Exhibit 788)	269
14.	Analyses of British Columbia Coals (Exhibit 786)	277
15.	Contract between Union Oil Company of California and Imperial Oil, Limited, dated 2nd January, 1932, with Supplementary Letters (Exhibit 358)	279
16.	Contract between Union Oil Company of Canada, Limited, and Canadian Pacific Railway, dated 27th December, 1934 (Exhibit 410)	289
17.	Imperial Oil Heavy Fuel-oil Cargo Prices from 1st January, 1930 (Exhibit 426)	295
18.	Report of Commercial Testing & Engineering Company, dated 22nd August, 1938, on Stationary Power Plants (Exhibit 788)	299
19.	Report of Commercial Testing & Engineering Company, dated 22nd August, 1938, on Pulverized Coal (Exhibit 788)	313
20.	Computation of Heavy Fuel-oil Equivalence with Nanaimo Coal on basis of Evaporation as referred to in Section 8 (*c*), Chapter IV.	317
21.	Computation showing Economic Factors included in difference in favour of Nanaimo Coal compared with Heavy Fuel-oil consumed in a Building Heating Plant and based on Economic Delivered Prices (refer Section 8 (*c*), Chapter IV.)	319
22.	Chemical Analyses of Comparative Coal and Fuel-oil Pacific Mills, Limited (Exhibit 790)	321
23.	Computation of Heavy Fuel-oil Equivalence and Coal based on Evaporation (refer Section 4 (*c*), Chapter V. hereof)	323
24.	Detail of Canadian Pacific Railway Calgary-Red Deer Tests (Exhibit 592)	325
25.	Proximate Analysis various Coals used in Canadian Pacific Railway Locomotives in British Columbia and Statement showing Fuel-oils used in its Locomotives in British Columbia (Exhibit 582)	329
26.	Canadian National Railway Comparison Laid-down Costs of Vancouver Island and Alberta Coals (Exhibit 593-A)	333
27.	Reprint from "Marine Engineer," July, 1935, relating to S.S. "Duke of York" (Exhibit 776-B)	335
28.	Correspondence with Agent-General's Office in London, relating to use of Coal by S.S. "Duke of York" (Exhibit 777)	341
29.	Photographs of Boiler House, Interior of Boiler House and Pneumatic Ash-ejector, University of British Columbia	345

Distinguishing Number.	Subject-matter.	PAGE.
30.	Correspondence relating to Northern Pacific Railway Locomotive Tests (Exhibits 798 and 799)	349
31.	Correspondence with Missouri Pacific Lines relating to comparison of Coals versus Oils for Locomotive Use (Exhibit 800)	351
32.	Analysis of Coals used on 20th Century Passenger Train between New York and Chicago, New York Central (Exhibit 772)	357
33.	Excerpts from Evidence relating to Known Coal Reserves of Canadian Collieries and Western Fuel with Acreage and opportunity of Mining same, etc.	359
34.	Extract from Pages 8024–8043 of Evidence of Roger Rolleston West, B.A., A.M.Inst. C.E., relating to Improvements in the Use of Coal	377
35.	Report of Smith, Emery & Company, San Francisco, 9th October, 1936, relating to Methods adopted in Recovery and Preparation of Crude oils, with particular reference to Natural Gasoline (Exhibit 752)	383
36.	Memorandum from Commercial Testing & Engineering Company, 3rd November, 1938, relating to Depreciation and Maintenance of various Types of Heating Plants (Exhibit 820)	393
37.	Supplementary Memoranda to Memorandum of D. O. Lewis, M.E.I.C., M.Inst. C.E., relating to Physical Characteristics of British Columbia Railroads (Exhibit 823)	401
38.	Correspondence with Commercial Testing & Engineering Company in respect to Depreciation and Maintenance Charges in Building Heating Plants (Exhibit 826)	409
39.	Memorandum relating to Standard Oil of British Columbia, November, 1938 (Exhibit 837)	411
40.	Detailed Chemical Analysis Comox Coal (refer Appendix 25) (Exhibit 846)	413
41.	" Coal Resources of Southern Vancouver Island," by J. D. Mackenzie, June 1st, 1923 (Exhibit 164)	415
42.	Proximate Analyses of 20 Samples of Vancouver Island Coals from September 1st, 1936, to October, 1938 (Exhibit 840)	429
43.	Carload Rate in Cents per Hundred Pounds of Coal in effect May, 1935 (Exhibit 344)	431
44.	Detail of Canadian Pacific Railway Tests as contained in Tables 44 and 45	433
45.	Northern Pacific Railway Tests as contained in Table 50	435
46.	Missouri Pacific Lines Locomotive Tests as determined by Standing Evaporation Tests, as contained in Tables 51 and 52	437
47.	Canadian National Railways, Toronto-Sarnia Locomotive Tests as contained in Table 54	439
48.	Comparison between Canadian National Railways Heavy Fuel Oil-burning Freight Locomotive Tests Nos. 10 and 11, and Canadian Pacific Railway Calgary-Red Deer Coal-burning Freight Locomotives (refer Appendix 47 and Table 43)	441
49.	Statement of Canadian Collieries (Dunsmuir), Limited, upon report of Coal and Petroleum Commission (Exhibit 814)	443
50.	Boiler-furnace Efficiency and Evaporation Curves from New York Central Railway (Exhibit 849)	463
51.	List of certain Vacant Properties in Greater Vancouver registered in name of Imperial Oil, Limited	471
52.	Copy of letter 27th July, 1938, from Commissioner to Mr. H. G. Hinton, Branch Manager Victoria, of George A. Touche & Company	479