The energy components of production costs : background material for estimating the impact of energy price increases

THE ENERGY COMPONENTS OF PRODUCTION COSTS

Background Material for Estimating the Impact of Energy Price Increases

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A. PURPOSE OF THE STUDY

Everybody concerned with the health of the regional economies senses that dramatic increases in energy prices will have an effect on each region's industrial development opportunities and constraints. The effect of a price increase for a particular energy commodity will differ among industries and among regions. The precise impact on a particular firm in a particular place will depend on a very complicated set of factors many of which are specific to the particular case. However, whatever else this impact depends on it will clearly depend on the fraction of production costs attributable to energy -- for the specific firm, for its competitors in the industry and for the producers of potential substitute products.

With this in mind, the primary purpose of this study is to provide background information on the fraction of input costs attributable to the various forms of energy for the various industrial sectors in the various regions of the country. It is hoped that this information can provide a starting point for DREE analysis of the energy components of particular RDIA cases and particular development opportunities. In addition, the information may be useful in helping to predict the industries in each region which are likely to suffer the worst problems in the transition to world energy prices.

B. ENERGY COMPONENTS OF PRODUCTION COST

Increases in the price of energy products (coal, oil, gas, electricity) affect the cost of production in three ways:

1.a directly through the increased cost of energy used in the production process (e.g., oil to fire the burners, electricity to run the motors and light the office space, gasoline and diesel oil to power the automotive equipment);

1.b directly through the increased cost of energy used as "materials" in the production process (e.g., natural gas used as a feed stock in chemical production or electricity for aluminum reduction). For most industries this contribution will usually be much smaller than 1.a.

2. indirectly through the increased cost of all other inputs (e.g., increased delivered prices of raw materials and products because of transportation fuel cost increases; higher prices for virtually all other input materials because of energy-induced increases in the cost of their production).

The competitive impact of the energy price increases may depend on whether the cost increases were induced directly or indirectly. For example, a firm's major competition might come from other firms with an equally energy-intensive production technology but who rely on other inputs which are affected to varying degrees by the price of energy. On the other hand, a firm may use the same inputs as its competition but rely on technology with different energy demands. For this reason it is useful to analyze both direct and indirect components of cost increases attributable to energy price increases.

C. DIRECT AND INDIRECT COMPONENTS: NATIONAL INPUT-OUTPUT RESULTS

Statistics Canada produces data on the direct energy contribution to production costs for each standard industry classification. These data are available by province and will be discussed in Section D. The total contribution (direct plus indirect) is more difficult to obtain since the indirect contributions depend on the whole interactive chain of production and transportation processes.

However, the data contained in the Statistics Canada National Input-Output model provides a way of estimating the indirect component. This model contains national data only, but does contain coal, oil, gas and electricity as input categories along with each of the other standard industrial products (outputs in some industries, inputs in others).

The model is not designed to answer the question: "What is the component of the cost of item X (e.g., oil) to the final production cost in industry Y (e.g., steel manufacturing)?" It is designed to answer questions of the type: "What will be the effect of a particular increase in the price of item X on prices of the products produced by industry Y?"1/

1/ Given all the standard assumptions for input-output models of this type: totally elastic market demand, fixed factor coefficients, no supply constraints and constant prices for factors of production.

However, it is clear that the answer to the first question will be very nearly the answer to the question "What will be the effect on the price of the product of industry Y produced by a 100 per cent increase (doubling) in the price of item X?"1/

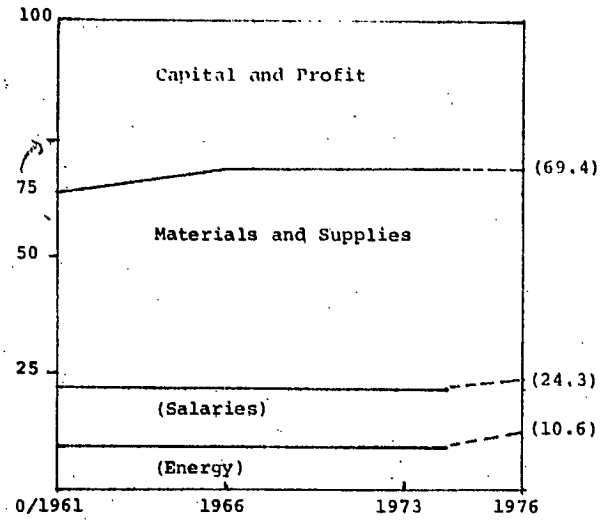
In posing this question to the model it is possible to separate out the direct effects (impact on final price due to a doubling of prices of energy inputs) and the indirect effects (impact on final price due to increases in the price of all the other inputs). Estimates of these impacts for coal, oil, gas and electricity are summarized in Appendix I. Of particular significance are the impacts on the manufacturers of industrial chemicals (total impact: 15.8 per cent) and the pulp and paper industry (total impact: 13.9 per cent).

It should be noted that the Statistics Canada model is based on 1966 (relative) prices and production technology. In most industries the technology has not changed dramatically in the last decade: approximately the same number of units of energy input are needed for each unit of output. Relative prices have changed somewhat. Unfortunately, data is not readily available for the period since 1974 when energy prices began to climb dramatically. Estimates have been made of the relative share of input costs for the various inputs in several industries. The cases of the pulp and paper and iron and steel industries are shown respectively on Charts I and II and on Charts III and IV below while a more complete list can be found in Appendix I.

1/ In this formulation the production costs are defined to be the sum of the revenues: profits are taken to be payments to another factor input, capital.

CHART I

PULP AND PAPER MILLS - COST PROFILE



SHARES (%)

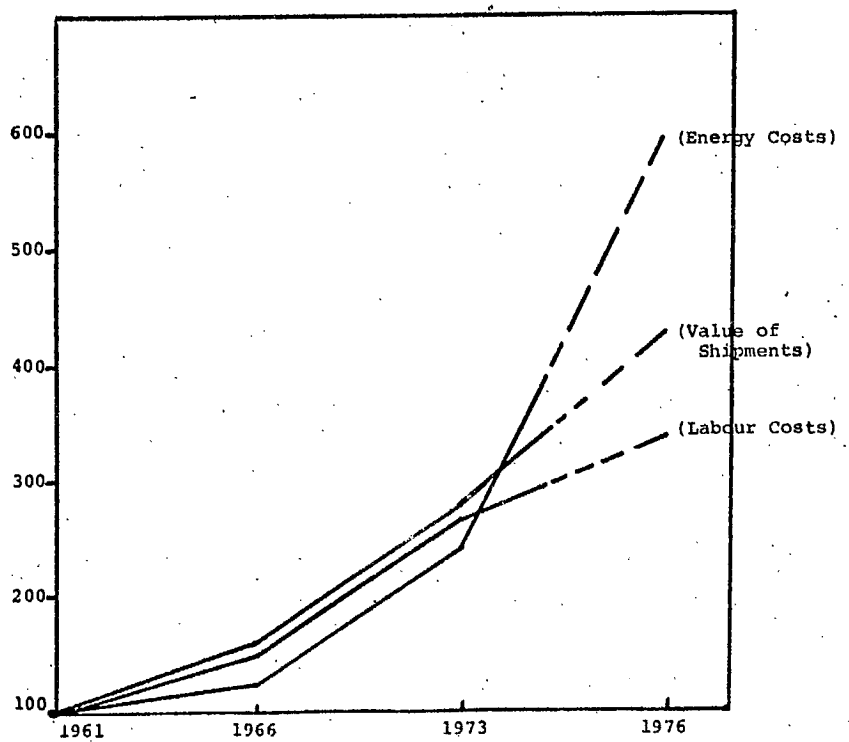
	Salaries	Materials/Supplies	Energy	Capital/Profit
1961	16.4	41.7	7.1	34.9
1966	17.0	45.4	7.1	30.5
1973	17.0	44.9	7.1	31.0
1976*	13.7	45.1	10.6	30.6

* (estimated base on assumption of constant productive capacity from 1973 to 1976).

CHART II

PULP AND PAPER MILLS, COST PROFILE*

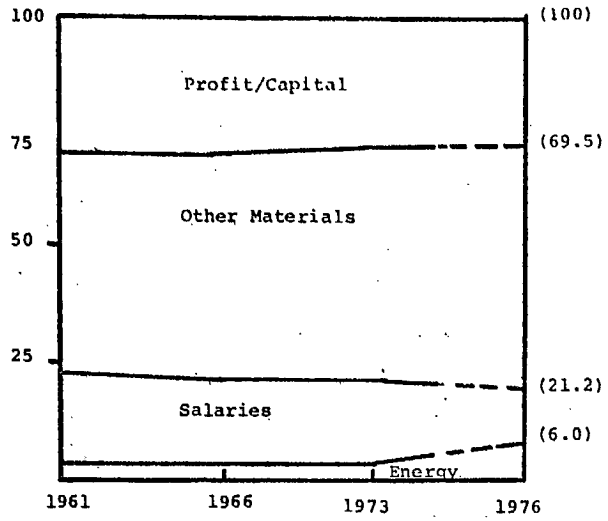
(1961 = 100)



*(See Table I at Appendix III for details of calculations)

CHART III

IRON AND STEEL MILLS - COST PROFILE



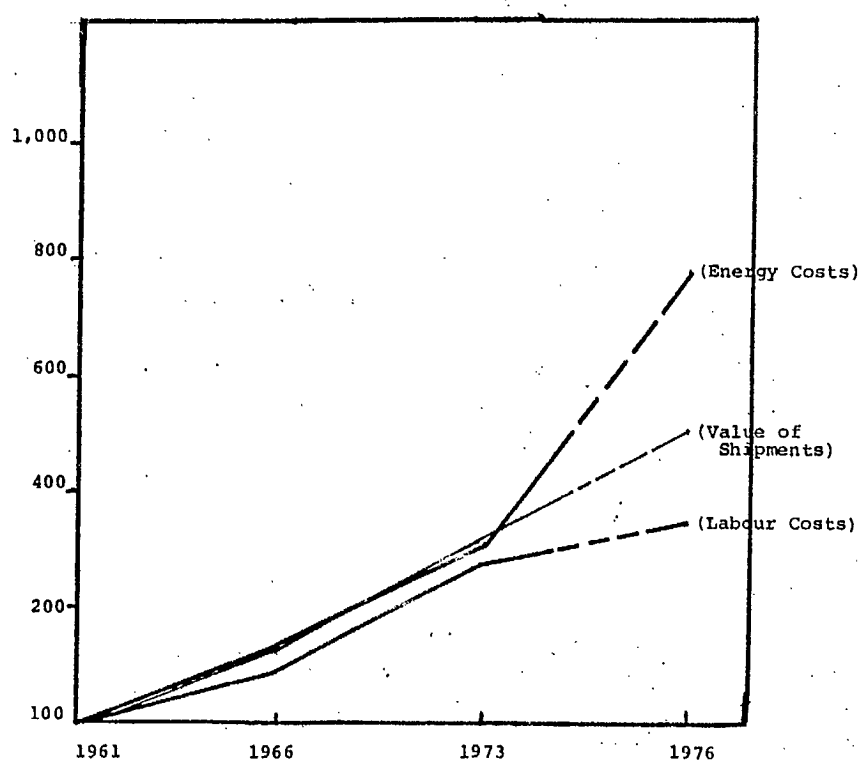
SHARES (%)

	Salaries	Energy	Other Materials	Capital/Profit
1961	19.7	3.8	45.3	31.6
1966	18.9	3.9	44.3	32.9
1973	18.9	3.9	46.5	30.8
1976	15.2	6.0	48.3	30.5

CHART IV

IRON/STEEL MILLS - COST PROFILE*

(1961 = 100)



*(See Table II at Appendix III for details of calculations)

Some broad conclusions about the use of the various sources of energy can be drawn from the national average figures displayed in Appendix I:

1. Electricity is the dominant direct source of industrial energy. Thus, for most industries the direct impact on costs will come from increases in electricity prices (which are, of course, influenced by the price of hydrocarbon fuels). Only a few major industries (e.g., ferro-alloy producers, cement manufacturing, road construction) together with the transportation sector and utility industries spend a higher fraction of production costs on direct coal, oil or gas purchases than on electricity purchases.

2. The energy intensity of Canadian industrial groups varies dramatically, from over 20 per cent (direct and indirect expenditures) for cement manufacturing to less than 1 per cent for some food processing industries and textile-related industries.

3. The most energy-intensive industries tend to be those engaged in primary processing (total energy costs in the range of 9 per cent to 18 per cent for pulp and paper, aluminum smelting, industrial chemicals) and the dominant form of energy is electricity.

4. Primary industry (as opposed to primary processing) including agriculture, forestry, fishing are of medium energy intensity (direct energy being 2 per cent to 7 per cent of production costs) and the dominant energy form is oil. Mining tends to be at the high end of the range and has more dependence on electricity.

5. Manufacturers of finished goods tend to have a smaller direct energy component than the primary or primary processing sectors. However, the indirect component (effect of higher prices for other inputs) may be greater. For example, the paper box and bag manufacturing industry devotes less than 1 per cent of its production costs to direct energy but the energy component of the costs of its other inputs (primarily paper) means that a doubling of energy prices would increase its total production costs by about 6 per cent.

The separation of direct and indirect energy costs in Appendix I complemented by a detailed business analysis should be useful for attempts to estimate what portion of energy-related cost increases an industry is able to pass on.

D. DIRECT COMPONENTS: INTERPROVINCIAL COMPARISONS

The results of the national input-output analysis in the previous section identified the industrial groups with the greatest overall dependence on energy. Although the national model does not permit the calculation of indirect components of production costs on a provincial basis, data is available on the provincial averages of the direct components. This section will make interprovincial comparisons of the importance of direct expenditures on energy for the high energy-using sectors.

The data in Appendix II are based on the 1961-1972 averages, 1972 being the last year for which data is available at the provincial level. In most industries the numbers were rather constant over the period. However, as suggested by Chart I in the preceding section, the share detained by energy in total productive costs for 1976 will increase by about 50 per cent as a result of the rise in relative energy prices since 1973.

It should be noted that the interprovincial differences can be due both to differences in technological process (the use of a different number of units of energy per unit of output) and also in differences in relative prices (which can be due to differences in absolute prices of energy and to differences in absolute prices of labour, materials and transportation costs, etc.). Before strong conclusions are drawn about particular cases, a more thorough business analysis of the various price changes would be required. However, some rather general conclusions will be drawn from these tables:

1. In employment terms, the most important industries with high energy costs are pulp and paper, industrial chemicals, smelting and refining and iron and steel mills. Together they account for about 11 per cent of the total Canadian manufacturing employment. The proportion is, however, much higher for the Atlantic Provinces (14 per cent).

2. Energy costs have been more important in the Atlantic Provinces than in Western Canada and Ontario. In the case of pulp and paper, for example, New Brunswick firms spend about 45 per cent more on energy than those in British Columbia in relation to the value of shipments.

3. Quebec appears to be in a relatively good position with its high energy-using industries being less or not more energy intensive than their Ontario counterparts. However,

a rapid rise in energy prices (especially electricity) could create problems for the aluminum industry which has to compete internationally.1/ As for the textile industry, though it is not a high energy user in any direct way, it could still be adversely affected as a result of increased prices (energy costs-induced) for chemical products used in the manufacturing of synthetic fibres.

E. IDENTIFICATION OF INDUSTRIAL CONSTRAINTS AND PROBLEM AREAS

The mere fact of increased energy costs does not necessarily lead to difficulty for a given industrial sector or a specific firm because in many cases it will be possible to pass on the increases without decreasing the demand for its product. In fact, if a particular firm faces cost increases that are significant but nevertheless smaller than its competitors, it might benefit from universal energy-price increases.

In general, a firm will only be adversely affected in the short run if one or more of the following conditions hold:

a. If it faces higher energy price increases than its competitors, due either to differences in energy mix or to regional differences in prices of energy supplies;

b. If its production process is more energy-intensive than its competitors (higher direct energy dependence);

c. If the cost of its input materials (including transportation) is more dependent on energy prices than that of its competitors (higher) indirect energy dependence);

d. If it has to transport its products farther to market, especially if the products and distances are such that transport is a significant fraction of costs;

e. If the demand for the product is highly sensitive to price so that the passing on of increased costs would lead to significant reduction in the volume of sales.

1/ Under present market conditions and at today's costs (1¢/Kw hr.) electricity currently accounts for about 20 per cent of total production costs.

On a national basis, Canada is in a relatively favourable position among the industrialized countries with regard to point a. Most Canadian export industries have competitors who have faced, or will shortly face, comparable increases in the price of their energy materials. However, exceptions exist. For example, some American competitors in the pulp and paper and petrochemicals industries still have access to lower cost natural gas energy.

With regard to points b and c, Canada's traditional access to cheap energy has in some industries led to firms being more energy-intensive than their foreign competitors. It appears to be the case for Eastern pulp and paper mills. Iron and steel mills in Quebec and Manitoba pay more for energy than their Ontario counterparts because of a different energy mix (electricity vs. coal and natural gas).

With regard to transportation, the peripheral regions of the country (B.C. and the Maritimes) may be better located for water transportation to international markets but worse placed for transportation to markets in central Canada.

F. IDENTIFICATION OF DEVELOPMENT OPPORTUNITIES

Higher energy prices represent an industrial opportunity if a firm can get on the right side of any or all of points a to e in Section E.

The insured supplies of hydro-electric power to be provided by James Bay and other major projects could lead to development opportunities to the extent that the energy produced is priced lower than other sources in other regions.

Possibilities of plant modernization and developing new more energy-efficient processes may constitute development opportunities if these can be achieved more cheaply than those of competitors. They may, of course, constitute a competitive necessity rather than an "opportunity" for some firms -- but, even then, the need for plant redesign produces opportunities for firms that will construct and supply the new technology.

The increased cost of world transportation could constitute a development opportunity for those areas of the country closer to the new market than their competitors -- presumably this applies to the Atlantic Provinces for the European market and to B.C. for the Pacific Rim market.

Finally, the increased investment in energy production will constitute an opportunity for firms that supply items such as equipment for oil and gas exploration and materials for pipeline, hydro-electric and nuclear construction.

APPENDIX I

TABULATION OF DIRECT AND INDIRECT ENERGY COMPONENTS FOR SELECTED INDUSTRIES BY ENERGY SOURCES

1. Note: These estimates are based on 1966 relative prices. The changes in relative prices in the last decade, mostly in the last two years, have tended to increase the energy components of production costs. A rough estimate is that for 1976 prices, each percentage in the tables should be increased by about 50 per cent for most cases. Thus 1.4 per cent in 1966 would increase to about 2.1 per cent in 1976.

2. Source: Statistics Canada - 1966 Input-Output "cost-push" price model. Analysis assumes doubling of prices for stated energy resources and summarizes resulting direct and indirect impacts. on prices of final products. The resulting percentages constitute a good approximation of the share detained by energy components (directly and indirectly) in the production process.

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

A. SELECTED INDUSTRIES RELATED TO AGRICULTURE AND FOOD

SECTORS	COAL		CRUDE OIL		NATURAL GAS		ELECTRIC POWER		TOTAL IMPACT		
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Total
Agriculture	.07	.03	2.0	1.2	.03	.04	1.1	.1	3.2	1.4	4.6
Slaughtering and Meat Packing	.03	.07	.1	2.4	.04	.06	.8	.4	1.0	2.9	3.9
Poultry Processors	.02	.08	.2	2.5	.04	.06	.9	.3	1.2	2.9	4.1
Dairy Factories	.09	.10	.7	2.4	.04	.06	1.0	.4	1.8	3.0	4.8
Process Cheese Manufacturing	.03	.17	.1	1.6	.05	.05	.5	.5	0.7	2.3	3.0
Fruit and Vegetable Canners	.10	.20	.3	1.3	.07	.03	.7	.4	1.2	1.9	3.1
Feed Manufacturers	.05	.05	.3	1.9	.04	.06	1.0	.2	1.4	2.2	3.6
Flour Mills	.04	.06	.1	2.5	-	-	1.0	.2	1.2	2.8	4.0
Breakfast Cereal Manufacturing	.28	.12	.3	1.3	.08	.02	.8	.4	1.5	1.8	3.3
Biscuit Manufacturing	.04	.16	.2	1.1	.01	.09	.5	.4	0.8	1.8	2.6
Bakeries	.03	.07	.9	.4	.09	.11	.9	.3	1.9	0.9	2.8
Confectionery Manufacturing	.07	.13	.1	2.0	.05	.05	.6	.3	0.8	2.5	3.3
Vegetable Oil Mills	-	-	.1	.9	-	-	.5	.1	0.6	1.0	1.6
Miscellaneous Food Industries	.04	.06	.2	.5	.09	.01	.5	.3	0.8	0.9	1.7
Soft Drink Manufacturing	.06	.14	.7	.6	.06	.04	.5	.3	1.3	1.1	2.4

A. SELECTED INDUSTRIES RELATED TO AGRICULTURE AND FOOD (Cont'd)

SECTORS (Per Cent Price Increase)	COAL		CRUDE OIL		NATURAL GAS		ELECTRIC POWER		TOTAL IMPACT		Total
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
Distilleries	.03	.07	.2	1.3	.06	.04	.4	.2	0.7	1.6	2.4
Breweries	.06	.14	.2	1.0	.05	.05	.8	.2	1.1	1.4	2.5
Wineries	.04	.06	.1	1.1	.09	.01	.6	.2	0.8	1.4	2.2
Leaf Tobacco Processing	.05	.15	.1	2.9	.02	.08	.8	.4	1.0	3.5	4.5
Agricultural Implement Industries	.10	.50	.1	.8	.07	.03	.5	.5	0.8	1.8	2.6
Manufacturing of Mixed Fertilizers	.40	.30	.1	2.1	.30	.20	1.6	.5	2.4	3.1	5.5

B. FISHING TRAPPING INDUSTRY

Industry Impact	COAL		CRUDE OIL		NATURAL GAS		ELECTRIC POWER		TOTAL IMPACT		Tota
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
	(% Price Increase in Selling Effects)										
Fishing, Trapping, Hunting	-	0.1	2.4	0.8	-	-	-	0.6	2.4	1.5	3.4
Fish Products Industry	-	0.2	0.4	1.8	-	-	-	1.3	0.4	2.1	2.5

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

C. SELECTED INDUSTRIES RELATED TO FORESTRY

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		Total
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
Forestry	.03	.17	1.2	.8	-	-	.3	.4	1.5	1.4	2.9
Sawmills	.04	.16	.4	1.2	-	-	1.1	.5	1.5	1.9	3.4
Veneer and Plywood Mills	.04	.16	.1	1.1	-	-	1.3	.4	1.4	1.7	3.1
Sash and Door and Planning Mills	.04	.26	.2	.9	-	-	.9	.6	1.1	1.8	2.9
Wooden Box Factories	.05	.15	.2	.8	-	-	.8	.5	1.1	1.5	2.6
Coffing and Casket Industry	.3	.2	.2	.6	-	-	.9	.4	1.4	1.2	2.6
Miscellaneous Wood Industries	.24	.36	.3	1.3	-	-	1.3	.6	1.8	2.3	4.1
Pulp and Paper	1.8	.7	1.2	1.1	.3	-	7.5	1.3	10.8	3.1	13.9
Wood Pulp	.8	.8	-	2.3	-	-	3.4	2.1	4.2	5.2	9.4
Paper Producing	.4	1.4	-	2.2	-	-	1.8	4.4	2.2	8.0	10.2
Paper Converting	.3	1.4	.3	2.2	-	-	1.4	4.4	2.0	8.0	10.0
Paper Box and Bag Manufacturing	.05	.85	.2	1.5	-	-	.5	2.8	0.8	5.2	6.0
Other Paper Converters	.08	.62	1.1	1.3	-	-	.6	2.0	1.8	3.9	5.7
Asphalt Roofing Manufacturing	.2	.5	4.6	2.3	.1	.1	1.3	1.5	6.1	4.4	10.5

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

D. SELECTED INDUSTRIES RELATED TO MINERALS

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		Total
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
A. Mining											
Base Metal and Other Metal Mines	.1	.3	.3	.7	.0	-	2.6	1.4	3.0	2.4	5.4
Uranium Mines	1.2	.7	.4	1.2	.0	-	2.7	1.2	4.3	3.1	7.1
Iron Mines	.1	.4	1.2	1.2	.3	.1	4.4	1.1	6.0	2.8	8.8
Gold Mines	.2	.4	.4	.8	.0	-	5.0	.5	5.6	1.7	7.3
Coal Mines	94.1	-	1.0	.8	.0	-	8.7	.7	103.8	1.5	105.3
Petroleum and Gas Wells	.0	.2	77.0	-	14.8	-	1.8	1.0	93.6	1.2	94.8
Asbestos Mines	.1	.3	1.1	1.5	.0	-	3.1	1.2	4.3	3.0	7.3
Gypsum Mines	.1	.2	1.0	1.1	.0	-	2.7	.9	3.8	2.2	6.0
Salt Mines	1.1	.4	.9	1.2	.2	.0	2.3	1.0	4.5	2.6	7.1
Other Non-Metal Mines	.2	.4	.5	1.1	.9	.2	3.1	1.6	4.7	3.3	8.0
Quarries and Sand Pits	.9	.4	2.0	1.5	.0	-	2.4	.8	5.3	2.7	8.0
Services Incidental to Mining	.0	.2	1.3	.9	.0	-	1.1	.5	2.4	1.6	4.0
B. Primary Metals											
Iron and Steel Industry	.4	.4	.8	1.0	.3	.1	3.7	.9	5.2	2.4	7.6
Coke Ovens	83.8	-	.0	.8	.0	-	1.2	.4	85.0	1.2	86.2
Sinter Plant and Blast Furnaces	8.3	.4	.1	1.6	.2	.0	2.1	1.5	10.7	3.5	14.2

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

D. SELECTED INDUSTRIES RELATED TO MINERALS (Cont'd)

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		Total
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
Steel Mills	.4	4.0	.0	1.5	.1	.1	1.1	2.5	1.6	8.1	9.7
Rolling Mills	.1	3.3	.0	1.6	.1	.1	.6	3.2	.8	8.2	9.0
Ferro Alloy Producers	5.0	.4	.2	1.5	.1	.1	1.9	1.8	7.2	3.8	11.0
Iron and Steel Other Activities	.2	.6	.0	1.7	.2	.1	4.5	2.0	4.9	4.4	9.3
Steel Pipe and Tube Mills	.1	2.0	.2	1.2	.1	.1	1.2	2.4	1.6	5.7	7.3
Iron Foundries	.4	.6	.3	.7	.1	.1	1.3	.7	2.1	2.1	4.2
Aluminum Smelting and Refining	1.2	.8	.7	.9	.0	-	4.5	.6	6.4	2.3	8.7
Other Smelting & Refining	.9	.4	.1	1.0	.1	.1	2.5	1.9	3.6	2.4	6.0
Aluminum Rolling and Extruding	.1	1.0	.3	1.1	.1	.1	1.6	.9	2.1	3.1	5.2
Copper and Alloy Rolling	.5	.5	.1	1.0	.1	.1	1.3	2.4	2.0	4.0	6.0
Metal Casting & Extruding	.1	.4	.2	.9	.1	.1	.8	1.0	1.2	2.4	3.6
C. Non-Metallic Minerals											
Cement Manufacturing	7.3	2.1	.9	1.5	.9	.2	6.1	2.2	15.2	6.0	21.2
Lime Manufacturing	7.8	.4	1.7	.9	.8	.1	2.8	.8	13.1	2.2	15.3
Gypsum Products Manufacturing	.1	.5	.7	1.5	.4	.1	2.0	1.7	3.2	3.8	7.0
Concrete Products Manufacturing	.6	1.0	.7	1.3	.2	.0	1.2	1.2	2.7	4.5	7.2
Ready-Mix Concrete Manufacturing	1.5	1.9	1.0	1.8	.2	.0	1.7	2.1	4.4	5.8	10.2

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

D. SELECTED INDUSTRIES RELATED TO MINERALS (Cont'd)

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		Total
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	
Clay Products Manufacturing	.9	.3	.7	.7	1.1	.0	2.0	.7	4.7	1.7	6.4
Refractories Manufacturing	1.2	.4	.3	.8	.2	-	.9	.9	2.6	2.1	4.7
Stone Products Manufacturing	.3	.3	.6	1.4	.0	-	1.4	.6	2.3	2.3	4.6
Mineral Wool Manufacturing	.1	.4	.9	1.3	.5	.1	1.6	1.1	3.1	2.9	6.0
Asbestos Products Manufacturing	.4	.3	.3	1.0	.2	.0	1.3	.9	2.2	2.2	4.4
Glass and Glass Products Manufacturing	.1	.3	.9	.4	.4	.0	1.4	.7	2.8	1.4	4.2
Abrasives Manufacturing	.7	.7	.2	.8	.1	-	11.5	.6	12.5	2.1	14.6
Other Non-Metallic Products Industries	.7	.4	.4	1.2	.3	.1	1.7	1.0	3.1	2.7	5.8
D. Petroleum and Coal Products											
Petroleum Refineries Products	.1	.2	66.3	-	.1	.1	1.3	1.5	67.8	1.8	69.6
Other Petroleum and Coal Producing Industries	9.7	.8	7.3	3.7	.1	.1	1.4	1.0	18.5	5.6	24.1
E. Chemicals and Chemical Products											
Explosives and Ammunition Manufacturing	.3	.5	.5	1.3	.1	.0	1.5	1.1	2.4	2.9	5.3

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

D. SELECTED INDUSTRIES RELATED TO MINERALS (Cont'd)

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Total
Manufacturing of Mixed Fertilizers	.4	.7	.1	2.1	.3	-	1.6	1.7	2.4	4.5	6.9
Manufacturing of Plastic and Synthetic Resins	.4	.7	1.3	2.2	.2	.0	2.2	1.5	4.1	4.4	8.5
Manufacturing of Pharmaceuticals and Medicines	.0	.3	.2	1.0	.0	-	.4	.8	.6	2.1	2.7
Paint and Varnish Manufacturing	.3	.5	1.1	1.6	.1	.0	.9	1.0	2.4	3.1	5.5
Manufacturing of Soap and Cleaning Compounds	.3	.4	.2	1.3	.1	.0	.7	1.0	1.3	2.7	4.0
Manufacturing of Toilet Preparations	.1	.2	.2	1.0	.0	-	.3	1.0	.6	2.2	2.8
Manufacturing of Industrial Chemicals	2.3	.8	2.7	2.5	.6	.1	5.3	1.5	10.9	4.9	15.8
Other Chemicals Industries	.5	.5	1.4	1.7	.1	.1	.8	1.1	2.8	4.4	7.2

DIRECT AND INDIRECT COMPONENTS OF PRODUCTION COSTS

E. SELECTED INDUSTRIES RELATED TO CONSTRUCTION AND SERVICE INDUSTRIES

	COAL		OIL		NATURAL GAS		ELECTRIC POWER		TOTAL SOURCES		
	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Direct %	Indirect %	Total
Road, Highway and Air-strip Construction	.3	.6	4.6	1.8	.0	-	.3	.9	5.2	3.3	8.5
Construction, Other Activities	.0	.2	2.6	1.7	.0	-	.7	.5	3.3	2.6	5.9
Air Transport	.0	.1	2.6	1.3	.0	-	.3	.4	2.9	1.8	4.7
Truck Transport	.0	.1	3.1	1.4	.0	-	.5	.4	3.6	1.9	5.5
Urban Transit Operations	.1	.0	1.8	.4	.0	-	2.2	.2	4.1	.6	4.7
Taxicab Operations	.0	.1	1.9	.8	.0	-	.6	.3	2.5	1.2	3.7
Meter and Other Utilities	.0	.2	8.4	2.5	.0	-	1.5	.7	9.9	3.4	13.3
Travel and Entertainment	.0	-	1.2	1.6	.0	-	.4	-	1.6	1.6	3.2
Pipeline Transport	.1	.5	.1	.7	.0	-	4.2	6.0	4.4	7.2	11.6
Hospital	.3	-	.3	.7	.3	-	2.0	.5	2.9	1.2	4.1
Other Recreational Services	.1	-	.2	.8	.0	-	2.4	.6	2.7	1.4	4.1
Electric Power	3.8	2.1	.4	.9	.3	-	98.0	-	102.5	3.0	105.5

APPENDIX II

TABULATION OF DIRECT COMPONENTS FOR SELECTED INDUSTRIES BY PROVINCES

Note: Energy costs are in terms of percentage of total value of shipments (industry average from 1961-1972). Employment data refers in most cases to year 1972.

Source: Statistics Canada - Census of Manufacturing

DIRECT COMPONENTS OF PRODUCTION COSTS:

A. FORESTRY SECTOR

Sectors	Nfld	PEI	N.B.	N.S.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Cda
1. Logging											
Energy Costs	4.8	-	2.3	1.3	3.0	2.7	2.7	4.0	2.2	1.4	2.0
Employees	3,000	-	5,000	3,000	19,000	10,000	1,000	1,000	2,000	27,000	71,000
2. Sawmills and Planing Mills											
Energy Costs	2.8	3.9	2.4	3.1	2.6	2.4	3.8	1.2	3.8	1.6	1.9
Employees	136	18	2,146	1,194	8,332	4,778	342	467	2,043	29,977	51,076
3. Veneer and Plywood mills											
Energy Costs	9.5	-	4.2	-	1.7	2.5	-	-	1.5	1.6	1.8
Employees	27	-	154	-	2,312	2,166	-	-	442	7,068	12,213
4. Pulp and Paper Mill											
Energy Costs	7.9	-	9.4	7.0	7.8	7.1	8.5	11.1	4.2	6.2	7.3
Employees	1972	-	4,124	1,716	22,885	16,970	529	320	490	1,934	60,940

B. MINING AND PROCESSING SECTOR

Sectors	Nfld	PEI	N.B.	N.S.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Cda.
I. Mining											
1. Metal other than coal											
Energy Costs	4.0	-	8.4	6.8	3.2	4.0	4.6	4.0	3.4	4.5	3.7
Employees	27	-	78	12	1,220	2,619	91	74	313	237	4,654
II. Processing											
1. Iron and Steel Mills											
Energy Costs	9.6	-	-	4.2	5.6	3.6	5.9	-	4.8	4.4	3.8
Employees	200	-	-	2,805	4,047	29,974	632	-	617	609	80,841
2. Smelting/ Refining											
Energy Costs	-	-	6.9	-	6.4	13.2	2.19	44.3	2.2	3.3	7.8
Employees	-	-	420	-	9,206	7,791	1,191	262	619	4,103	48,839
3. Aluminum Rolling Extruding											
Energy Costs	-	-	1.8	-	1.6	1.7	-	-	.6	1.3	1.6
Employees	-	-	3	-	1,059	3,279	-	-	590	137	4,585

C. FINISHED GOODS

Sectors	Nfld	PEI	N.B.	N.S.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Cda.
I. Textile Mills											
1. Wool, Yarn & Cloth											
Energy Costs	-	3.6	4.2	-	1.6	1.8	5.2	-	-	2.9	1.7
Employees	-	19	103	-	2,856	2,348	18	-	-	114	5,423
2. Cot, Yarn, Cloth Mills											
Energy Costs	-	-	2.8	3.7	1.8	1.8	-	-	-	-	1.8
Employees	-	-	299	423	6,433	2,956	-	-	-	-	10,114
3. Synthetic Text Mill											
Energy Costs	-	-	-	1.9	2.3	2.9	-	-	1.8	-	2.6
Employees	-	-	-	7.8	8,793	7,619	-	-	220	-	16,873
4. Other Knitting Mills											
Energy Costs	7.5	-	4.4	1.2	0.6	1.2	0.6	-	0.5	-	0.8
Employees											
II. Textile Products											
1. Men's Clothing											
Energy Costs	4.4	-	0.9	1.3	0.3	0.4	0.3	0.5	0.4	0.4	0.4
Employees	25	-	326	116	2,766	10,415	3,782	115	1,399	1,188	39,128
2. Women's Clothing											
Energy Costs	-	-	0.6	-	0.3	0.2	0.2	0.2	3.4	0.3	0.3
Employees	-	-	27	-	26,266	7,024	2,016	104	287	920	36,714
3. Carp, Mat, Rug, Ind.											
Energy Costs	-	-	-	1.8	1.0	1.4	1.0	-	-	1.2	1.2
Employees	-	-	-	287	2,436	1,987	18	-	-	64*	4,969
III. Motor Vehicles											
1. Motor Vehicles Mfgr											
Energy Costs	-	-	-	-	0.4	0.4	-	-	-	-	0.4
Employees	-	-	-	-	2,014	26,653	-	-	-	-	30,580
2. Motor Vehicles parts											
Energy Costs	-	-	-	-	1.5	1.1	-	-	-	-	1.1
Employees	-	-	-	-	689	36,632	-	-	-	-	37,951

D. OTHER INDUSTRIAL PRODUCTS

Sectors	Nfld	PEI	N.B.	N.S.	Que.	Ont.	Man.	Sask.	Alta	B.C.	Cda
1. Cement Mfgrs											
Energy Costs	14.6	-	19.2	14.0	16.2	22.5	11.4	7.5	8.7	15.0	14.8
Employees	76	-	89	76	825	294	148	43	264	294	2,742
2. Abrasive Mfgrs											
Energy Costs	-	-	-	-	22.1	8.8	-	-	-	-	10.9
Employees	-	-	-	-	329	1,434	-	-	-	-	1,763
3. Mixed Fertilizer											
Energy Costs	-	0.7	0.7	0.7	1.0	1.0	-	-	-	0.6	1.0
Employees	-	23	66	18	2.6	380	-	-	-	23	721
4. Industrial Chemicals											
Energy Costs	4.6	-	11.4	12.2	8.3	9.6	19.8	13.9	6.8	8.3	8.6
Employees	523	-	123	290	2,136	6,954	62	69	934	658	11,651

APPENDIX III

CALCULATIONS OF AVERAGE ENERGY COSTS

BY ENERGY SOURCES FOR SELECTED YEARS AND INDUSTRIES

TABLE I

AVERAGE COSTS BY ENERGY SOURCES

PULP AND PAPER MILLS

Energy Sources	% Share	1973 Average Costs (¢ MMBTU)	1976 Average Costs (¢ MMBTU) (2)
Coal	2.0	47	114
Oil (1)	34.9	58.9	142
Natural Gas	13.6	48.4	130 to 139
Electricity	49.4	168	395 to 875
TOTAL	100.0	111.11	-

NOTE: (1) 94% Heavy Fuel Oils

(2) Estimated: based on the following:

a) coal: thermal coal landed in Ontario at $32.00/ton

b) oil: heavy fuel oil (Toronto price) at $8.50/bbl.

c) natural gas: Toronto plant gate price:
$1.30 mcf - interruptible
$1.39 mcf - firm service

d) electricity: based on the following industrial power rates as of March 1976 (at 2,700 Kw load, 60% load factor):

	$/000 Kw hr.
Nfld.	22.54
N.S.	29.86
N.B.	18.05
Que.	13.50
Ont.	17.37

TABLE II

AVERAGE COSTS BY ENERGY SOURCES

IRON AND STEEL MILLS

Energy Sources	% Share	1973 Average Costs (¢ MMBTU)	1976 Average Costs (¢ MMBTU) (2)
Coal	2.4	46	114
Oil (1)	17.2	72.1	142
Natural Gas	28.9	56.5	130 to 139
Electricity	51.5	225	395 to 875
TOTAL	100.0	145.3	-

NOTE: (1) 75% Heavy Fuel Oils

(2) Estimated, based on the following:

a) coal: thermal coal landed in Ontario at $32.00/ton

b) oil: heavy fuel oil (Toronto price) at $8.50/bbl.

c) natural gas: Toronto plan gate price:
$1.30 mcf - interruptible
$1.39 mcf - firm service

d) electricity: based on the following industrial power rates as of March 1976 (at 2,700 Kw load, 60% load factor):

	$/000 Kw hr.
Nfld.	22.54
N.S.	29.86
N.B.	18.05
Que.	13.50
Ont.	17.37