7

MANUFACTURING INDUSTRY

NATURAL RESOURCES AND LOCATION

Natural resources

Victoria's temperate climate and its rainfall, soil, and water resources have been used to develop the production of wool, grains, fruit, dairy products, and timber. On these the State's early secondary industries were based. There are extensive fuel resources of brown coal in the La Trobe valley, oil and natural gas fields in Bass Strait, and clay, limestone, stone and gravel, gold, gypsum, salt, and forests.

The La Trobe valley brown coal deposits are the most important mineral deposits in Victoria. The open cuts of the Yallourn–Morwell area produce about 22 million tons of brown coal annually for briquette making and electricity generation.

Clay deposits for brick, tile, and pottery industries are worked east of Melbourne and near Ballarat, Bendigo, Colac, Shepparton, and Wangaratta, and at other locations throughout the State. Sand, for the concrete and glass industries and for use in foundries, is obtained in the Port Phillip and west Gippsland areas. Stone and gravel quarries are worked in many parts of the State. The main market for quarry products is the metropolitan area and as these products are bulky and expensive to transport, most quarrying is located within a 50 mile radius of the capital. Local limestone deposits attracted the establishment of cement works at Geelong and Traralgon while the Lilydale limestones are used in the manufacture of agricultural lime.

Other mineral resources of Victoria include gold mined in the Castlemaine, Gaffneys Creek, and Harrietville areas ; salt produced from deposits of the Mallee and Wimmera lakes and from solar evaporating pans on the western shores of Port Phillip ; and gypsum in the north-western Mallee. For more detailed information on mining activity in Victoria see pages 373–89.

The forests of Gippsland and the Central Highlands form the basis of important forestry activities, especially in Gippsland where paper is produced at Maryvale. Victorian forests provide approximately one quarter of Australia's timber.

Water, needed in large quantities for industry, is available throughout much of the State from the dams and storages in the catchment areas of the main rivers (see map on page 478 of *Victorian Year Book* 1966). In most

years Melbourne is well supplied with water from the storages to the north and north-east of the City in the Plenty, Upper Yarra, Maroondah, and O'Shannassy river catchments. However, severe water restrictions were imposed during the 1967–68 and 1972–73 summers due to State-wide drought conditions. To meet future requirements, construction works for extending the water supply are in progress.

Power supplies are essential for industrial development. The lack of black coal once necessitated significant imports from New South Wales. For a number of years the State Electricity Commission has generated practically all of Victoria's electricity available for public supply, mostly from steam plants fired by brown coal or briquettes in the La Trobe valley (see page 423) ; the balance is purchased interstate. Electricity is now transmitted throughout the State by the high voltage grid network shown on the map on page 429.

The discovery in February 1965 and subsequent development of large offshore reserves of oil and natural gas in the Gippsland basin has increased Victoria's power and chemical resources. In March 1969 natural gas for commercial use flowed from the Barracouta field and on 14 April 1969 natural gas was made available to the first domestic consumer in Victoria, at Carrum. This was supplemented in January 1970 with gas from the Marlin field. Natural gas is now brought by pipeline from Longford to Melbourne and thence to Geelong, Ballarat, and Bendigo. Oil in commercial quantities became available from the Barracouta field in October 1969, from the Halibut field in March 1970, and from the Kingfish field in April 1971. In addition, there are petroleum products from refineries at Altona, Geelong, and Crib Point, and the fractionation plant at Long Island Point.

Location

The early concentration of industry in Melbourne has continued although power supplies now come largely from the La Trobe valley. At 30 June 1972, 83 per cent of Victoria's 11,408 manufacturing establishments were located in the Melbourne Statistical Division as were 85 per cent of the persons employed in such establishments. They contributed 85 per cent to the value added in manufacture. This concentration of manufacturing in the metropolitan area is partly due to the fact that Melbourne is Victoria's main port and the hub of the transport network. It is also the largest market in the State and the centre of commerce and finance ; it has a large labour force; and it is the administrative and educational centre of Victoria.

Many types of secondary industry are well represented in Melbourne. There are particularly high concentrations of the State's chemical, metal processing, textile, paper, furniture, food, and building materials industries in the capital. In terms of numbers employed, the engineering and metal processing industry is the major industry of Melbourne. Initially, industries developed in the inner areas of Port Melbourne, South Melbourne, Richmond, Collingwood, Spotswood, Fitzroy, and Footscray. The more recently established industries such as the motor vehicle, chemical, rubber, and refining industries, have taken up land in the outer industrial areas of Altona, Broadmeadows, Moorabbin, Oakleigh, and Dandenong, where considerable areas of flat land are available for future expansion.

Outside the metropolitan area, Geelong is the most important industrial

centre, with port facilities, close proximity to the Melbourne market, and rich surrounding rural areas. Industries established in the area include petroleum refining, and the manufacture of agricultural machinery, motor vehicles, aluminium ingots and extruded products, textiles, chemical fertilisers, glass, clothing, carpets, foodstuffs, cement, fertilisers, and sporting ammunition.

The other country urban areas in which more than 1,000 persons are employed in manufacturing establishments (ranked in order of the number of persons employed in factories) are the Ballarat urban area, Bendigo urban area, La Trobe valley, Wangaratta City, Shepparton City, Warrnambool City, Maryborough City, Castlemaine City, Portland Town, and Wodonga City. The factory population in country areas is engaged in the production of food and textiles from locally produced raw materials, in clothing, and in engineering plants, which sometimes had their origin in the gold mining era of the nineteenth century, and more recently in decentralised plants with defence significance. In addition, approximately 4,200 persons are engaged by the State Electricity Commission in power generation and ancillary activities. These are not taken into account in the foregoing ranking.

MANUFACTURING ACTIVITY

At the Australian level of aggregation information on the subjects dealt with in this section of the *Year Book* is contained in the annual *Manufacturing Establishments* and *Manufacturing Commodities—Principal Articles Produced* and *Principal Materials Used* issued by the Central Office of the Bureau. At the Victorian level of aggregation the annual publications issued by the Deputy Commonwealth Statistician, Melbourne, are *Manufacturing Establishments: Summary of Operations by Industry Class, Manufacturing Establishments: Details of Operations by Industry Class, Manufacturing Establishments: Small Area Statistics, Manufacturing Establishments: Usage of Electricity and Fuels, Manufacturing Establishments: Selected Items of Data Classified by Industry and Employment Size* (available for 1968–69 only). Current information on factory products is available in the *Victorian monthly statistical review* and the monthly Victorian publication *Secondary Production.*

In addition to the above-mentioned publications there is also a series of fifty-two *Monthly Production Summaries,* each relating to the production of a particular commodity or group of commodities at the Australian level of aggregation.

In respect of the year 1968–69 the Australian Bureau of Statistics conducted the annual census of manufacturing industry as part of a programme of fully integrated economic censuses covering manufacturing, mining, retail, wholesale and electricity and gas establishments. For a detailed description of the purposes served by this project, and of the new concepts and methods adopted, the reader is referred to the special article on these censuses on pages 368–89 of the *Victorian Year Book* 1971. A more detailed version of this article appears as Chapter 31 of the *Commonwealth Year Book* 1970.

The integrated economic censuses have been a major undertaking involving the development of new concepts, definitions, and procedures,

and, inevitably, there were considerable delays in finalising the results of the 1968–69 and 1969–70 censuses, so much so in fact that the 1970–71 census of manufacturing establishments was abandoned. However, the 1971–72 census of manufacturing establishments was completed close to timetables realised in respect of 1967–68 and previous years, and, so far as possible, 1971–72 data appears in this part.

Manufacturing developments during 1971 and 1972

Victoria's manufacturing industries continued to expand during 1971 and 1972. Developments in food processing industries included the completion of a new fruit juice and fruit paste concentrate plant at Mooroopna at a cost of $1.5m and the construction of a $3m gouda cheese factory in Cobram. An automated stockfeed mill, reported to be the first of its type in Australia, was constructed at Pakenham at a cost of $1m. Construction of a new meat processing complex on a 64 acre site at north Laverton was commenced, at an estimated cost of $10m, and at Seymour a winery was commenced which was expected to be operative for the 1973 vintage. This project is to include a restaurant seating 150 people and the total cost will be $1m.

The textiles and apparel industries will have a second Victorian supplier of nylon and polyester yarn following a major development at Thomastown. The plant, with three units, will produce fine denier nylon and polyester filament yarns for the yarn throwing, texturising, and warp knitting industries. A leading manufacturer of worsted wool, weaving, machine, and handknitting yarn was undertaking a major expansion programme of handknitting yarn manufacture at Benalla. A policy of re-locating all manufacturing activities in rural areas was being undertaken by this company.

Developments in the building materials industry in 1972 included the commencement of construction at Dandenong of Australia's first float glass manufacturing plant. Expected cost at completion in 1974 was $25m. A new particle board plant established in 1970 at Ballarat at a cost of $1.2m was being extended to include the manufacture of melamine impregnated paper. The paper and packaging industry continued to develop with plans for a softwood pulp mill at Myrtleford by a major tissue paper manufacturer at a cost of about $2m. A packaging factory estimated to cost nearly $1m was planned for Wodonga, and a new $11m paper machine for manufacturing machine glazed wrapping and bag papers began operating at Maryvale in 1972.

The current phase of development of the Western Port steel works was completed in April 1973 when the temper mill was commissioned. This followed completion of the galvanising line, finishing section, and warehouse in November 1972; the cold reduction mill in December 1972; coil annealling furnace in January 1973; and pickle line in February 1973. The ultimate capacity of coated and uncoated steel sheet and coil in a wide variety of qualities and sizes is 1.5 million tons per annum. At north Sunshine, a $7m integrated tube mill commenced production in 1972. Its anticipated annual production is 50,000 tons, consisting of industrial and structural pipe, and special pipe for gas pipelines.

Developments in the automotive industry in Victoria included the

construction of a $4m plant at Campbellfield for the production of plastic automotive components, and the construction of a new $2.5m factory to manufacture truck and transmission assemblies and components at Clayton for the trucking and heavy equipment industries. A $1m aluminium and rolling plant for the production of aluminium cables was completed at Tottenham.

Among the important developments in Victoria's chemicals industry in 1972 was the completion of a $10m plant at Altona for the production of high density polypropylene. A propylene glycol and polypropylene glycol ether plant was also completed at Altona at a cost of about $4m. Construction of a polybutadiene latex plant costing approximately $1m was completed at Dandenong, and at Huntingdale new machinery installations were made to double capacity in the manufacture of soft gelatin capsules; this latter project cost about $1m. An expansion programme to increase polymerisation capacity for high-density polyethylene to 42,000 tons per annum was completed at Altona at a cost of $15m to $16m.

Government activities

Industrial legislation

The *Labour and Industry Act* 1958 represents the development and consolidation of industrial legislation which had its beginnings in 1873. Among other matters, the Act deals with the registration and inspection of factories, guarding of machinery, and conditions of employment. It also provides for the appointment of Wages Boards and the Industrial Appeals Court. Further information on these matters may be found on pages 166–201.

Child labour in factories

The Labour and Industry Act of Victoria debars employment in factories of children under the age of fifteen years, and the Victorian Education Act makes daily attendance at school compulsory between the ages of six and fifteen years.

Some children under fifteen may work in a shop or office if they are exempted under the Education Act, but the general effect of the two statutes contributes to the very low incidence of child labour in this State.

Division of Industrial Development
Department of State Development
Decentralisation of Manufacturing Industries

Decentralisation of industry has been a policy objective of the Victorian Government for three decades, and until 1970 the administration of decentralisation of industry came under the control of the Premier's Department. A separate Department of State Development was established under the *State Development Act* 1970, the functions of the Department being to promote activities leading to the full and proper development of the State. The Division of Industrial Development of the Department is responsible for the decentralisation of industry.

In September 1972 a plan was adopted to achieve decentralisation. Its features included the regionalisation of State Government administration;

provision of direct financial incentives ; co-operation with adjoining States and the Australian Government in the development of new cities ; development of all services in major country centres, including education, recreation, and the arts ; encouragement of tourism and tourist facilities necessary for the development of the area ; establishment of a new development corporation to assist financially in non-metropolitan development schemes ; and assistance with housing for employees and executives of country industries.

To implement those sections of the plan relating to decentralisation of industry, the Victorian Government announced a re-organisation in the Division of Industrial Development of the Department of State Development.

In addition, the incentives given to approved decentralised secondary industries have been expanded and many new concessions or incentives introduced. Those currently available include finance at favourable interest rates and for longer periods than is available through normal banking channels. A rebate of pay-roll tax was paid commencing with 1972–73. There are also grants of $100 for the transfer of personnel leaving the Melbourne metropolitan area to take up employment with approved decentralised secondary industries and training allowances of up to $100 for employees being trained in the particular requirements of a country industry. Special assistance in housing arrangements is available for employees of country industry. Reimbursement of the cost of transporting plant and machinery for decentralising industries or established country industries involved in an expansion programme is also given. Significant railway concessions on raw materials and finished products are granted to industries with a two-way freighting disability. In addition an automatic rebate of approximately 10 per cent is available to all approved industries using rail instead of road. Declared industries preferring to use road transport receive " As of Right " licences. Other concessions are given in the fields of power, construction of access roads to industrial estates, and transport of employees. Local municipalities are also empowered to give significant assistance to industry. Concessions currently being introduced include a rebate of land tax paid by country industry and a 5 per cent preference on tendering for government contracts.

The Victorian Government has joined with the New South Wales and Australian Governments in the joint development of the Albury–Wodonga complex. In addition the Victorian Government gives special attention to the accelerated development of the growth centres of Ballarat, Bendigo, the La Trobe valley, and Portland.

Further reference, 1968

Australian Department of Overseas Trade

The functions of this Department relate chiefly to the formulation of international trade policy for the Australian Government and the development, maintenance, and diversification of export markets for primary and manufactured products through international trade agreements.

Australian Department of Secondary Industry

The functions of this Department are the formulation of policy proposals designed to encourage and promote the development and efficiency of

Australian secondary industry and to promote research into the special problems of small industries, the location of industry, and the efficiency of industry.

Protection of industry

The established policy of the Australian Government is to accord adequate and reasonable protection against import competition to economic and efficient industry. The Government seeks the advice of the Tariff Board on questions of protection for individual industries. The Board holds public inquiries into and reports on questions referred to it by the Minister. In cases of urgency, temporary protection may be accorded on the recommendation of a special advisory authority pending review by the Tariff Board.

The Customs Tariff is the accepted and normal instrument of protection to Australian industry. However, for some industries in special circumstances, assistance is accorded by means of bounties on local production. As a last resort, when other methods are inadequate, quantitative restrictions on imports are applied.

The Department of Customs and Excise administers the Customs Tariff and also operates the by-law system, under which plant and materials normally subject to protective duty may be admitted at concessional rates if no suitably equivalent products are reasonably available from local sources.

Scientific research and standardisation

Commonwealth Scientific and Industrial Research Organization

The C.S.I.R.O. is a statutory body established by the *Science and Industry Research Act* 1949. Its principal functions under the Act are the carrying out of scientific research in connection with primary and secondary industries of Australia; the maintenance of the national standards of measurement; the publication and dissemination of scientific and technical information; and to act for Australia in liaison with other countries in matters of scientific research.

Standards Association of Australia

This Association is the national standardising organisation of Australia and issues standard specifications for materials and codes of practice. Specifications and codes are prepared and revised periodically in accordance with the needs of the community; standards are evolved and accepted by general consent. It is the Australian member body of the International Organisation of Standardisation and of the International Electrotechnical Commission.

National Association of Testing Authorities

This is the Australian organisation for approval of testing laboratories. The Association registers laboratories of governmental and industrial testing authorities, thereby organising a national testing service. Registration of laboratories is voluntary. Owners of registered laboratories are members of the Association. They have the right to endorse their test documents in the name of the Association, to indicate their technical and managerial competence.

Industrial Design Council of Australia

The Industrial Design Council of Australia was established in June 1958 for the purpose of encouraging better design in Australian-made goods and fostering an appreciation of good design throughout the community. The Council is fully representative of industry, commerce and government, together with designers and educationists. Its activities are financed by donations from industry and commerce, and by Australian and State Government grants. I.D.C.A. has established Australian design centres in Adelaide and Melbourne and offices in Brisbane and Sydney. The centres display Australian products of approved design and present changing exhibitions relating to design in manufactured articles. I.D.C.A. is also responsible for the Australian Design Index, which provides a detailed, illustrated record of well-designed Australian products, and has teams of field officers who visit industries in four States.

The design delegate scheme enables regular contact to be maintained with senior executives of manufacturing companies, departmental officers, and designers wishing to participate actively in I.D.C.A.'s programme of lectures, information, and guidance on all aspects of industrial design. Services to design delegates are administered by I.D.C.A. through its design centres and State offices.

A record of designers has been set up to register information about industrial designers and their work. The Council, which has its headquarters in Melbourne, is also concerned with raising the standard of training in industrial design in co-operation with education authorities.

Manufacturing industry statistics

From 1901 to 1967–68

A series of substantially uniform statistics exists from 1901 to 1967–68 when the framework within which manufacturing statistics were collected was changed. The table on page 401 contains a summary of statistics on manufacturing activities in Victoria over that period. More detailed manufacturing statistics in respect of this period have been included in previous editions of the *Victorian Year Book*.

Since 1968–69

As from the year ended June 1969 the Censuses of Manufacturing, Electricity and Gas have been conducted within the framework of the integrated economic censuses, which include the Censuses of Mining, Retail Trade and Selected Services, and Wholesale Trade. As a result, manufacturing industry statistics for 1968–69 and subsequent years are not directly comparable with previous years. The electricity and gas industries, which were previously included in the annual Factory Census, were the subject of separate censuses. The integration of these economic censuses was designed to increase substantially the usefulness and comparability of economic statistics collected and published by the Bureau and to form a basis for the sample surveys which supply current economic statistics from quarter to quarter, particularly those which provide data for the quarterly national income and expenditure estimates.

The economic censuses of Manufacturing, Mining and Retail Trade

previously conducted in Australia were originally designed and subsequently developed primarily to provide statistics for particular industries on a basis which would best suit the requirements of users interested in statistics of those industries. More recently there has been a growth of interest in statistics describing activity in the economy as a whole—reflected, for example, in the development of employment and earnings statistics, surveys of capital expenditure and stocks, and the whole field of national accounts statistics. For such purposes statistics derived from economic censuses in the past have had serious limitations despite the fact that they covered a broad area of the whole economy. Because of the special requirements of each of the censuses, there were no common definitions of data, there was no common system of reporting units, and, as a standard industrial classification was not used for these censuses, industry boundaries were not defined in ways which would avoid overlapping or gaps occurring between the industrial sectors covered. For these reasons, direct aggregation and comparison of statistics from different censuses were not possible.

The integration of these economic censuses meant that for the first time they were being collected on the basis of a common framework of reporting units and data concepts and in accordance with a standard industrial classification. As a result, the statistics for the industries covered by the censuses are now provided with no overlapping or gaps in scope, and in such a way that aggregates for certain important economic data such as value added, employment, wages and salaries, fixed capital expenditure, and stocks can be obtained on a consistent basis for all sectors of the economy covered by the censuses.

For a more detailed description of the Integrated Economic Censuses reference should be made to pages 368–89 of the *Victorian Year Book* 1971.

Summary of factory statistics

Factory statistics compiled for 1967–68 were the last of the old series, and definitions used in the 1967–68 and previous factory censuses were published in the *Victorian Year Book* 1971, pages 394–7. The first publication of statistics from the 1968–69 Economic Censuses, *Manufacturing Establishments and Electricity and Gas Establishments: Preliminary Statement,* was issued in January 1971 and contained information in respect of ten industry sub-divisions permitting comparisons to be made between States, but did not permit comparisons to be made between 1968–69 and previous years because of the changes in the definition of the establishment, bases of classification, and forms.

The four metal products sub-divisions, namely, Basic metal products (sub-division 29), Fabricated metal products (sub-division 31), Transport equipment (sub-division 32), and Other machinery and equipment (sub-division 33), with 175,755 persons or 39.2 per cent of the total employment in manufacturing establishments in 1971–72, employed considerably more persons than any other part of manufacturing industry. Next in order of employment was Food, beverages, and tobacco (sub-division 21–22), with 62,805 or 14.0 per cent, followed by Clothing and footwear (sub-division 24) and Paper, paper products, and printing (sub-division 26) with 61,772 and 34,866, respectively, or 13.7 per cent and 8.1 per cent of the total.

The following table shows, at intervals between 1901 and 1967–68 and 1968–69, 1969–70, and 1971–72, the development of manufacturing activity in Victoria:

VICTORIA—DEVELOPMENT OF MANUFACTURING ACTIVITY

Year	Manufacturing establishments	Employment (*a*)	Wages and salaries paid (*b*)	Value of—			
				Materials and fuel used	Value added	Output	Land, buildings, plant and machinery
	number	number	$m	$m	$m	$m	$m
1901	3,249	66,529	n.a.	n.a.	n.a.	n.a.	25
1911	5,126	111,948	18	51	32	84	28
1920–21	6,532	140,743	43	135	77	212	71
1932–33	8,612	144,428	42	122	82	204	136
1940–41	9,121	237,636	105	241	178	419	184
1946–47	10,949	265,757	156	368	263	631	244
1953–54	15,533	331,277	472	1,154	817	1,971	679
1960–61	17,173	388,050	776	1,914	1,418	3,332	1,642
1965–66	17,980	439,149	1,077	2,597	2,028	4,625	2,386
1966–67	18,054	445,557	1,168	2,814	2,236	5,051	2,617
1967–68	18,030	449,945	1,244	2,957	2,395	5,351	2,685
1968–69	(*c*)11,563	431,651	1,342	(*d*)3,861	2,542	(*e*)6,336	(*f*)278
1969–70	(*c*)11,393	445,663	1,497	(*d*)4,307	2,799	(*e*)6,998	(*f*)300
1971–72	(*c*)11,408	450,339	1,802	(*d*)4,810	3,328	(*e*)8,051	(*f*)374

(*a*) Average over whole year, including working proprietors.
(*b*) Excludes drawings of working proprietors.
(*c*) Number of establishments operating at 30 June.
(*d*) Purchases, transfers in, and selected expenses.
(*e*) Turnover.
(*f*) Fixed capital expenditure.
NOTE. A line drawn across a column between the figures indicates a break in continuity in the series. No census of manufacturing establishments was conducted for the year ending 30 June 1971.

A comparison between manufacturing activity in Victoria and the other States is shown in the following table:

AUSTRALIA—MANUFACTURING ESTABLISHMENTS, 1971–72

State or Territory	Establishments (*c*)	Employment (*a*)	Wages and salaries paid (*b*)	Purchases, transfers in, and selected expenses	Value added	Turnover	Fixed capital expenditure
	number	number	$m	$m	$m	$m	$m
New South Wales	13,883	517,038	2,166	5,454	3,947	9,293	449
Victoria	**11,408**	**450,339**	**1,802**	**4,810**	**3,328**	**8,051**	**374**
Queensland	4,001	114,368	426	1,584	871	2,433	144
South Australia	2,979	121,637	470	1,169	803	1,942	88
Western Australia	2,727	64,074	255	777	472	1,240	172
Tasmania	933	30,931	119	359	245	596	26
Northern Territory	80	1,194	6	18	11	29	42
Australian Capital Territory	135	3,333	15	25	26	50	5
Total	36,146	1,302,914	5,259	14,196	9,703	23,634	1,298

For footnotes see previous table.

The total value added in 1971–72 was $3,328m. Of this amount the Metals products sub-divisions contributed $1,305m which represented 39.7 per cent of the total. The Food sub-division followed with $583m or 17.5 per cent, and the next in order were the Clothing and footwear sub-division with $289m, 8.7 per cent, and the Paper, paper products, and printing sub-division with $269m, 8.1 per cent.

The following table contains a summary of manufacturing establishments by sub-division of industry in Victoria during the year 1971–72:

VICTORIA—MANUFACTURING ESTABLISHMENTS BY SUB-DIVISIONS OF INDUSTRY, 1971–72

ASIC code	Industry sub-division	Establishments	Employment (*a*)	Wages and salaries paid (*b*)	Purchases, transfers in, and selected expenses	Value added	Turnover	Fixed capital expenditure
		number	number	$m	$m	$m	$m	$m
21–2	Food, beverages, and tobacco	1,197	62,805	255	1,302	583	1,869	53
23	Textiles	384	28,587	100	266	173	432	14
24	Clothing and footwear	1,606	61,772	177	350	289	637	12
25	Wood, wood products, and furniture	1,473	20,315	72	155	121	273	4
26	Paper, paper products, and printing	1,156	34,866	146	280	269	548	42
27	Chemical, petroleum, and coal products	357	22,638	107	321	244	564	39
28	Non-metallic mineral products	446	13,649	63	133	127	256	10
29	Basic metal products	203	11,680	58	184	100	280	54
31	Fabricated metal products	1,477	38,436	155	311	271	572	26
32	Transport equipment	451	59,579	271	702	478	1,147	59
33	Other machinery and equipment	1,651	66,060	281	525	456	981	37
34	Miscellaneous manufacturing	1,007	29,952	118	282	216	492	24
	Total	11,408	450,339	1,802	4,810	3,328	8,051	374

For footnotes see page 401.

The following table shows the number of manufacturing establishments operating in Victoria at 30 June 1969, 1970, and 1972, classified according to sub-division of industry :

VICTORIA—NUMBER OF MANUFACTURING ESTABLISHMENTS IN SUB-DIVISIONS OF INDUSTRY AT 30 JUNE

ASIC code	Industry sub-division	1969	1970	1972
21–2	Food, beverages, and tobacco	1,351	1,290	1,197
23	Textiles	376	371	384
24	Clothing and footwear	1,691	1,634	1,606
25	Wood, wood products, and furniture	1,531	1,478	1,473
26	Paper, paper products, and printing	1,145	1,145	1,156
27	Chemical, petroleum, and coal products	363	362	357
28	Non-metallic mineral products	434	449	446
29	Basic metal products	218	210	203
31	Fabricated metal products	1,499	1,496	1,477
32	Transport equipment	444	438	451
33	Other machinery and equipment	1,524	1,538	1,651
34	Miscellaneous manufacturing	987	983	1,007
	Total	11,563	11,394	11,408

The size classification of manufacturing establishments is based on the number of persons employed at 30 June 1969 (including working proprietors). The following table shows the number of manufacturing establishments classified according to the number of persons employed :

VICTORIA—MANUFACTURING ESTABLISHMENTS CLASSIFIED ACCORDING TO NUMBER OF PERSONS EMPLOYED (INCLUDING WORKING PROPRIETORS) (*a*) AT 30 JUNE 1969

Manufacturing establishments employing persons numbering	Number of establishments	Number of persons employed (*a*)
Less than 5	3,696	9,598
5 to 9	2,464	17,623
10 to 19	2,079	29,874
20 to 49	1,684	53,142
50 to 99	758	53,599
100 to 199	486	69,484
200 to 499	295	88,326
500 to 999	66	42,759
1,000 and over	35	61,925
Total	11,563	426,330

(*a*) Includes persons employed in separately located administrative offices or ancillary units serving the establishment.

The relative importance of large and small manufacturing establishments is illustrated in the preceding table. At 30 June 1969, 3,696 such establishments employing less than five employees had a total employment of 9,598 persons. 32.0 per cent of manufacturing establishments—those employing less than five persons—employed 2.3 per cent of the persons engaged. The most numerous of the establishments with less than five persons were printing, stationery and bookbinding, furniture (excluding sheet metal), joinery and wooden structured fittings, and industrial machinery and equipment, not elsewhere classified.

A general indication of the geographical distribution of manufacturing establishments in Victoria as at 30 June 1972 is shown in the following table where they are classified according to statistical divisions :

VICTORIA—MANUFACTURING ESTABLISHMENTS IN STATISTICAL DIVISIONS, 1971–72

Statistical division	Establishments (*c*)	Employment (*a*)	Wages and salaries paid (*b*)	Purchases, transfers in, and selected expenses	Value added	Turnover	Fixed capital expenditure
	number	number	$m	$m	$m	$m	$m
Melbourne	9,432	384,507	1,550	3,939	2,812	6,685	299
West Central	332	20,118	89	235	170	394	32
North Central	158	4,090	13	26	22	49	1
Western	381	14,091	50	185	100	281	9
Wimmera	111	1,453	4	11	8	19	..
Mallee	101	1,010	3	11	6	18	1
Northern	306	10,593	39	187	90	274	9
North Eastern	196	5,056	18	61	41	101	4
Gippsland	299	7,576	30	124	65	188	17
East Central	92	1,845	6	31	12	43	2
Total	11,408	450,339	1,802	4,810	3,328	8,051	374

For footnotes see page 401.

Manufacturing establishments in the Melbourne Statistical Division constituted 82.7 per cent of the total number in Victoria at 30 June 1972, 85.4 per cent of the persons employed, and 84.5 per cent of the value added.

The number of manufacturing establishments and persons employed therein, classified according to statistical division, is shown in the table on page 405.

It should be noted that Geelong is located in the West Central Statistical Division, Castlemaine and Maryborough in the North Central Statistical Division, Ballarat and Warrnambool in the Western Statistical Division, Bendigo and Shepparton in the Northern Statistical Division, Wangaratta in the North Eastern Statistical Division, and Morwell and Yallourn in the Gippsland Statistical Division.

Employment, wages, and salaries

Employment

From 1968–69 all persons employed in a manufacturing establishment and separately located administrative offices and ancillary units serving the establishment (including proprietors working in their own businesses) are included as persons employed. The grouping of occupations comprises (i) working proprietors; (ii) administrative, office, sales, and distribution employees; and (iii) production and all other employees.

The figures showing employment in manufacturing establishments represent either the average number of persons employed, including working proprietors, over a full year, or the number of persons employed at June each year.

The following two tables show the average number of persons employed in each industrial sub-division in Victoria in the years 1968–69 to 1971–71; and for each statistical division during 1971–72:

VICTORIA—PERSONS EMPLOYED IN MANUFACTURING ESTABLISHMENTS, 1968–69 TO 1971–72

ASIC code	Industry sub-division	1968–69	1969–70	1971-72		
				Males	Females	Persons
21–2	Food, beverages, and tobacco	57,134	60,125	45,602	17,203	62,805
23	Textiles	28,559	28,999	16,456	12,131	28,587
24	Clothing and footwear	63,998	64,258	14,423	47,349	61,772
25	Wood, wood products, and furniture	19,801	19,612	17,655	2,660	20,315
26	Paper, paper products, and printing	33,582	34,361	25,628	9,238	34,866
27	Chemical, petroleum, and coal products	21,944	22,862	16,723	5,915	22,638
28	Non-metallic mineral products	13,868	14,022	11,947	1,702	13,649
29	Basic metal products	10,807	11,332	10,463	1,217	11,680
31	Fabricated metal products	36,745	38,969	31,163	7,273	38,436
32	Transport equipment	53,274	56,237	51,200	8,379	59,579
33	Other machinery and equipment	63,528	65,906	49,891	16,169	66,060
34	Miscellaneous manufacturing	28,411	28,980	19,853	10,099	29,952
	Total	431,651	445,663	311,004	139,335	450,339

The dominance of the metal fabricating sub-divisions (29–33) (including transport equipment, machinery, and other equipment), food, beverages, and tobacco sub-division (21–2), and clothing and footwear sub-division (24) should be noted. Female workers in manufacturing establishments at 30 June 1972 were 30.8 per cent of the total. Females exceeded males

VICTORIA—NUMBER OF MANUFACTURING ESTABLISHMENTS AND PERSONS EMPLOYED (*a*) IN EACH STATISTICAL DIVISION, CLASSIFIED ACCORDING TO STATISTICAL DIVISION AND INDUSTRY SUB-DIVISION, 1971–72

ASIC code	Industry sub-division	Statistical division										
		Melbourne	West Central	North Central	Western	Wimmera	Mallee	Northern	North Eastern	Gipps-land	East Central	Total
		NUMBER OF MANUFACTURING ESTABLISHMENTS (*a*)										
21–2	Food, beverages, and tobacco	661	53	41	95	33	49	103	55	84	23	1,197
23	Textiles	327	26	6	7	3	..	7	4	3	1	384
24	Clothing and footwear	1,538	10	11	13	2	2	10	3	13	4	1,606
25	Wood, wood products, and furniture	1,017	58	37	78	17	10	42	68	107	39	1,473
26	Paper, paper products, and printing	976	22	17	37	14	12	30	15	25	8	1,156
27	Chemical, petroleum, and coal products	332	14	2	3	..	..	3	1	1	1	357
28	Non-metallic mineral products	274	23	13	40	14	10	33	18	18	3	446
29	Basic metal products	182	7	3	7	..	..	1	2	1	..	203
31	Fabricated metal products	1,281	46	8	44	15	6	34	19	21	3	1,477
32	Transport equipment	383	21	5	17	1	5	12	2	5	..	451
33	Other machinery and equipment	1,488	39	12	35	10	7	29	7	15	9	1,651
34	Miscellaneous manufacturing	973	13	3	5	2	..	2	2	6	1	1,007
	Total	9,432	332	158	381	111	101	306	196	299	92	11,408
		NUMBER OF PERSONS EMPLOYED (*a*)										
21–2	Food, beverages, and tobacco	44,061	1,815	522	4,394	502	572	5,697	1,488	2,217	937	62,805
23	Textiles	21,115	3,000	497	1,032	274	..	782	1,536	308	43	28,587
24	Clothing and footwear	56,289	1,137	762	1,755	137	26	756	126	622	162	61,772
25	Wood, wood products, and furniture	14,988	665	456	899	72	53	264	998	1,652	268	20,315
26	Paper, paper products, and printing	31,279	292	324	711	101	139	304	227	1,345	144	34,866
27	Chemical, petroleum, and coal products	21,051	1,223	31	259	..	..	7	14	50	3	22,638
28	Non-metallic mineral products	10,929	1,093	84	742	84	96	231	152	223	15	13,649
29	Basic metal products	8,471	2,118	51	848	..	..	21	165	6	..	11,680
31	Fabricated metal products	34,843	787	111	880	63	53	1,077	132	331	159	38,436
32	Transport equipment	51,662	5,452	70	1,598	3	10	656	6	28	94	59,579
33	Other machinery and equipment	59,894	2,248	1,161	948	165	61	718	189	657	19	66,060
34	Miscellaneous manufacturing	29,325	288	21	25	52	..	80	23	137	1	29,952
	Total	384,507	20,118	4,090	14,091	1,453	1,010	10,593	5,056	7,576	1,845	450,339

(*a*) See footnotes on page 401.

in the clothing and footwear sub-division (24) where they accounted for 76.5 per cent of the sub-division total. Of the total females employed 33.8 per cent were in sub-division 24 ; 11.6 per cent were in sub-division 33 ; and 11.9 per cent were in sub-division 21–2.

In the following table the number of persons employed in manufacturing establishments in Victoria is classified according to the nature of their employment at the end of June for 1969, 1970, and 1972 :

VICTORIA—MANUFACTURING ESTABLISHMENTS: TYPE OF EMPLOYMENT

At 30 June–	Working proprietors	Administrative, office, sales, and distribution employees	Production and all other employees	Total
1969	7,005	100,545	332,686	440,236
1970	6,904	102,053	341,395	450,352
1972	6,734	104,024	341,998	452,756

The following table shows the nature of employment in manufacturing establishments in 1971–72 classified according to industry sub-division :

VICTORIA—MANUFACTURING ESTABLISHMENTS: TYPE OF EMPLOYMENT BY INDUSTRY SUB-DIVISION AT 30 JUNE 1972

ASIC code	Industry sub-division	Working proprietors	Administrative, office, sales, and distribution employees	Production and all other employees	Total
21–2	Food, beverages, and tobacco	825	16,087	45,172	62,084
23	Textiles	142	4,940	23,364	28,446
24	Clothing and footwear	1,056	6,464	54,127	61,647
25	Wood, wood products, and furniture	1,159	3,506	16,348	21,013
26	Paper, paper products, and printing	677	10,311	24,313	35,301
27	Chemical, petroleum, and coal products	108	9,355	13,166	22,629
28	Non-metallic mineral products	187	3,312	10,505	14,004
29	Basic metal products	82	3,802	7,922	11.806
31	Fabricated metal products	900	8,359	29,287	38,546
32	Transport equipment	258	13,276	47,202	60,736
33	Other machinery and equipment	685	17.731	47,630	66,046
34	Miscellaneous manufacturing	655	6,881	22,962	30,498
	Total	6,734	104,024	341,998	452,756

Although " production and all other workers " constitute 75.5 per cent of the total number employed in manufacturing establishments, the percentage varies from 87.8 per cent in sub-division 24 to 58.2 per cent in sub-division 27. Sub-division 27 also has the highest percentage of administrative, office, sales, and distribution employees, 41.3 per cent, compared with the Victorian average of 23.0 per cent.

Where small establishments predominate there is usually a higher proportion of working proprietors than on the average and a smaller than average managerial and clerical staff. This is particularly evident in sub-division 25 where working proprietors comprise 5.5 per cent of the total number employed.

VICTORIA—MANUFACTURING ESTABLISHMENTS: FEMALE EMPLOYMENT AT 30 JUNE

ASIC code	Industry sub-division	Number		
		1969	1970	1972
21–2	Food, beverages, and tobacco—			
211	Meat products	2,634	2,743	3,675
213	Fruit and vegetable products	1,993	2,141	1,814
216	Bread, cakes, and biscuits	3,349	3,613	3,373
217–8	Sugar and other food products	3,081	2,938	3,352
	Other	4,339	4,496	4,358
	Total	15,396	15,931	16,572
23	Textiles—			
231–2	Textiles, yarns, and woven fabrics	9,484	9,512	9,008
	Other	2,766	2,775	3,088
	Total	12,250	12,287	12,096
24	Clothing and footwear—			
241	Knitting mills	9,823	10,522	10,028
242	Clothing	31,781	31,103	30,207
243	Footwear	7,634	7,685	6,902
	Total	49,238	49,310	47,137
25	Wood, wood products, and furniture	2,483	2,622	2,833
26	Paper, paper products, and printing	9,281	9,545	9,484
27	Chemical, petroleum, and coal products	5,948	6,295	5,892
28	Non-metallic mineral products	1,830	1,832	1,821
29	Basic metal products	1,285	1,162	1,257
31	Fabricated metal products	6,903	7,498	7,362
32	Transport equipment	7,310	8,154	8,583
33	Other machinery and equipment			
332	Appliances and electrical equipment	10,039	10,656	10,665
333	Industrial machinery and equipment	3,839	3,944	3,725
	Other	1,547	1,532	1,761
	Total	15,425	16,132	16,151
34	Miscellaneous manufacturing	9,602	9,692	10,390
	Total	136,951	140,460	139,578

VICTORIA—MANUFACTURING ESTABLISHMENTS: EMPLOYMENT (*a*) OF MALES AND FEMALES

Year	Males		Females		Total	
	Number	Average per 10,000 of male population	Number	Average per 10,000 of female population	Number	Average per 10,000 of total population
1901	47,059	778	19,470	325	66,529	553
1911	73,573	1,118	38,375	579	111,948	848
1920–21	96,379	1,283	44,364	574	140,743	923
1932–33	91,899	1,020	52,529	575	144,428	796
1940–41	161,880	1,708	75,756	782	237,636	1,240
1946–47	188,758	1,876	76,999	745	265,757	1,303
1953–54	240,698	1,979	90,579	751	331,277	1,367
1960–61	280,207	1,925	107,843	750	388,050	1,341
1965–66	310,303	1,937	128,846	809	439,149	1,375
1967–68	316,108	1,912	133,837	812	449,945	1,362
1968–69	297,411	1,771	134,240	800	431,651	1,286
1969–70	306,917	1,794	138,746	812	445,663	1,303
1971–72	311,004	1,761	139,335	787	450,339	1,274

(*a*) Yearly average, including working proprietors.

In sub-division 29, Basic metal products, the proportion of females to total persons employed is at its lowest, 10.6 per cent. In sub-division 24, Clothing and footwear, females predominate and comprise 76.5 per cent of the total number of persons employed; within this sub-division in the Clothing group, 242, 82.9 per cent of the total employed are females.

The numbers of males and females employed in manufacturing establishments, and the proportions of the average male and female population working in these establishments in 1971–72 and earlier years are shown in the previous table.

Wages and salaries

The next table gives details of wages paid in the various classes of industry in Victoria in 1971–72. Amounts paid to administrative, office, sales, and distribution employees are shown separately from those paid to production and all other workers. It should be noted that in all tables of salaries and wages paid the amounts drawn by working proprietors are excluded.

VICTORIA—MANUFACTURING ESTABLISHMENTS: WAGES AND SALARIES PAID, 1971–72

($m)

ASIC code	Industry sub-division	Paid to—		
		Administrative, office, sales, and distribution employees	Production and all other workers	All employees
21–2	Food, beverages, and tobacco	79	176	255
23	Textiles	22	78	100
24	Clothing and footwear	30	147	177
25	Wood, wood products, and furniture	16	56	72
26	Paper, paper products, and printing	48	97	146
27	Chemical, petroleum, and coal products	52	55	107
28	Non-metallic mineral products	17	46	63
29	Basic metal products	23	35	58
31	Fabricated metal products	43	112	155
32	Transport equipment	79	191	271
33	Other machinery and equipment	92	189	281
34	Miscellaneous manufacturing	33	84	118
	Total	536	1,265	1,802

Of the total amount of wages and salaries paid in Victoria in 1971–72—$1,802m—the metal fabricating sub-divisions, 29–33 (including transport equipment and other machinery and equipment), were responsible for $765m or 42.4 per cent; Food, beverages, and tobacco $255m or 14.1 per cent; Clothing and footwear, $177m or 9.8 per cent; and Paper, paper products, and printing, $146m or 8.1 per cent.

Turnover

The following table shows the value of turnover of manufacturing establishments. The figures include sales of goods whether produced by this establishment or not, transfers out of goods to other establishments of the same enterprise, bounties and subsidies on production, plus all other operating revenue from outside the enterprise, such as commission, repair and service revenue, and the value of capital work done on own account. Rents, leasing revenue, interest (other than hire purchase), royalties, and receipts from the sale of fixed tangible assets are excluded.

VICTORIA—MANUFACTURING ESTABLISHMENTS: TURNOVER BY INDUSTRY SUB-DIVISION

ASIC code	Industry sub-division	1968–69	1969–70	1971–72	
				Value	Percentage of total turnover
		$m	$m	$m	
21–2	Food, beverages, and tobacco	1,406	1,598	1,869	23.2
23	Textiles	380	392	432	5.4
24	Clothing and footwear	529	565	637	7.9
25	Wood, wood products, and furniture	227	242	273	3.4
26	Paper, paper products, and printing	434	472	548	6.8
27	Chemical, petroleum, and coal products	454	469	564	7.0
28	Non-metallic mineral products	209	222	256	3.1
29	Basic metal products	227	274	280	3.5
31	Fabricated metal products	462	505	572	7.1
32	Transport equipment	833	945	1,147	14.3
33	Other machinery and equipment	795	887	981	12.2
34	Miscellaneous manufacturing	382	423	492	6.1
	Total	6,336	6,995	8,051	100.0

Purchases, transfers in, and selected items of expense

In the following table the figures include purchases of materials, fuel, power, containers, etc., plus transfers in of goods from other establishments of the enterprise, plus charges for commission and sub-contract work, repair and maintenance expenses, outward freight and cartage, motor vehicle running expenses, and sales commission payments :

VICTORIA—MANUFACTURING ESTABLISHMENTS: PURCHASES AND SELECTED ITEMS OF EXPENSE BY INDUSTRY SUB-DIVISION

ASIC code	Industry sub-division	1968–69	1969–70	1971–72	
				Value	Percentage of total purchases
		$m	$m	$m	
21–2	Food, beverages, and tobacco	1,018	1,166	1,302	27.0
23	Textiles	224	236	266	5.5
24	Clothing and footwear	308	322	350	7.3
25	Wood, wood products, and furniture	127	137	155	3.2
26	Paper, paper products, and printing	230	249	280	5.8
27	Chemical, petroleum, and coal products	260	265	321	6.7
28	Non-metallic mineral products	110	119	133	2.8
29	Basic metal products	157	195	184	3.8
31	Fabricated metal products	255	287	311	6.5
32	Transport equipment	503	573	702	14.6
33	Other machinery and equipment	443	506	525	10.9
34	Miscellaneous manufacturing	222	253	282	5.9
	Total	3,860	4,307	4,810	100.0

Stocks

The figures in these tables include all stocks of materials, fuels, etc., finished goods and work-in-progress whether located at the establishment or elsewhere :

VICTORIA—MANUFACTURING ESTABLISHMENTS : STOCKS BY INDUSTRY SUB-DIVISION

ASIC code	Industry sub-division	1968–69	1969–70	1971–72	
				Value	Percentage of total opening stocks
		$m	$m	$m	
		OPENING			
21–2	Food, beverages, and tobacco	194	209	237	16.9
23	Textiles	75	76	89	6.3
24	Clothing and footwear	82	89	99	7.1
25	Wood, wood products, and furniture	32	32	37	2.6
26	Paper, paper products, and printing	61	63	79	5.6
27	Chemical, petroleum, and coal products	90	92	106	7.6
28	Non-metallic mineral products	26	26	32	2.3
29	Basic metal products	36	40	51	3.6
31	Fabricated metal products	84	90	106	7.6
32	Transport equipment	167	171	200	14.2
33	Other machinery and equipment	212	233	287	20.5
34	Miscellaneous manufacturing	66	72	80	5.7
	Total	1,126	1,193	1,403	100.0

VICTORIA—MANUFACTURING ESTABLISHMENTS:
STOCKS BY INDUSTRY SUB-DIVISION—*continued*

ASIC code	Industry sub-division	1968-69	1969-70	1971-72 Value	1971-72 Percentage of total opening stocks
	CLOSING				
21–2	Food, beverages, and tobacco	205	225	253	17.0
23	Textiles	75	80	95	6.4
24	Clothing and footwear	89	96	102	6.8
25	Wood, wood products, and furniture	33	33	40	2.7
26	Paper, paper products, and printing	64	73	81	5.4
27	Chemical, petroleum, and coal products	89	99	107	7.2
28	Non-metallic mineral products	26	28	36	2.4
29	Basic metal products	40	42	55	3.7
31	Fabricated metal products	89	99	116	7.8
32	Transport equipment	175	188	232	15.6
33	Other machinery and equipment	233	261	286	19.2
34	Miscellaneous manufacturing	73	78	86	5.8
	Total	1,192	1,301	1,489	100.0

Value added

Statistics on value added in the following table have been calculated by adding to turnover the increase (or deducting the decrease) in value of stocks and deducting the value of purchases and selected items of expense :

VICTORIA—MANUFACTURING ESTABLISHMENTS :
VALUE ADDED BY INDUSTRY SUB-DIVISION

ASIC code	Industry sub-division	1968–69	1969–70	1971–72 Value added	1971–72 Percentage of total value added
		$m	$m	$m	
21–2	Food, beverages, and tobacco	398	447	583	17.5
23	Textiles	157	161	173	5.2
24	Clothing and footwear	227	250	289	8.7
25	Wood, wood products, and furniture	101	106	121	3.6
26	Paper, paper products, and printing	207	232	269	8.1
27	Chemical, petroleum, and coal products	193	211	244	7.3
28	Non-metallic mineral products	99	105	127	3.8
29	Basic metal products	73	81	100	3.0
31	Fabricated metal products	211	226	271	8.2
32	Transport equipment	337	389	478	14.4
33	Other machinery and equipment	372	409	456	13.7
34	Miscellaneous manufacturing	167	177	216	6.5
	Total	2,541	2,796	3,328	100.0

Relation of costs to turnover and value added

Certain costs of production, the value of turnover, movement in stocks, and the balance available for profit, interest, rent, taxation, depreciation, etc. in each sub-division of manufacturing industry during 1971–72 are given in the following tables :

VICTORIA—MANUFACTURING ESTABLISHMENTS : COSTS AND TURNOVER, 1971–72

($m)

ASIC code	Industry sub-division	Cost of—		Movement in stocks	Balance between turnover, stocks, and costs (a)	Turnover
		Purchases and selected items of expense	Wages and salaries			
21–2	Food, beverages, and tobacco	1,302	255	+ 16	329	1,869
23	Textiles	266	100	+ 6	73	432
24	Clothing and footwear	350	177	+ 3	113	637
25	Wood, wood products, and furniture	155	72	+ 2	48	273
26	Paper, paper products, and printing	280	146	+ 1	123	548
27	Chemical, petroleum, and coal products	321	107	+ 1	137	564
28	Non-metallic mineral products	133	63	+ 4	65	256
29	Basic metal products	184	58	+ 4	42	280
31	Fabricated metal products	311	155	+ 10	116	572
32	Transport equipment	702	271	+ 33	208	1,147
33	Other machinery and equipment	525	281	..	175	981
34	Miscellaneous manufacturing	282	118	+ 6	98	492
	Total	4,810	1,802	+ 86	1,526	8,051

(a) Balance available to provide for all other costs and overhead expenses such as rent, interest, insurance, pay-roll tax, income tax, depreciation, etc., as well as drawings by working proprietors and profit.

VICTORIA—MANUFACTURING ESTABLISHMENTS: PERCENTAGE OF SPECIFIED COSTS TO TURNOVER, 1971–72

(per cent)

ASIC code	Industry sub-division	Cost of—		Movement in stocks	Balance between turnover, stocks, and costs (a)	Turnover
		Purchases and selected items of expense	Wages and salaries			
21–2	Food, beverages, and tobacco	69.6	13.6	+ 0.9	17.6	100.0
23	Textiles	61.4	23.1	+ 1.4	16.9	100.0
24	Clothing and footwear	55.0	27.8	+ 0.4	17.7	100.0
25	Wood, wood products, and furniture	56.7	26.5	+ 0.8	17.6	100.0
26	Paper, paper products, and printing	51.1	26.7	+ 0.3	22.4	100.0
27	Chemical, petroleum, and coal products	57.0	18.9	+ 0.2	24.3	100.0
28	Non-metallic mineral products	52.0	24.5	+ 1.6	25.2	100.0
29	Basic metal products	65.8	20.7	+ 1.6	15.0	100.0
31	Fabricated metal products	54.3	27.2	+ 1.6	20.3	100.0
32	Transport equipment	61.2	23.6	+ 2.9	18.1	100.0
33	Other machinery and equipment	53.5	28.6	− 0.1	17.8	100.0
34	Miscellaneous manufacturing	57.3	23.9	+ 1.2	20.0	100.0
	Total	59.7	22.4	+ 1.1	19.0	100.0

(a) Balance available to provide for all other costs and overhead expenses such as rent, insurance, pay-roll tax, income tax, depreciation, etc., as well as drawings by working proprietors and profit.

There are considerable variations in the proportions which purchases and selected items of expenditure, and wages and salaries, bear to the turnover in the different sub-divisions. These are, of course, due to the difference in the treatment required to convert materials to their final

form. Thus in sub-division 24 the sum paid in wages represents 27.8 per cent and the purchases and selected items of expense 55.0 per cent of the values of the finished articles, while in sub-division 21–2 the expenditure on wages amounts to 13.6 per cent and that on purchases, etc., to 69.6 per cent of the value of turnover.

In the following table specified costs of production, the value of turnover of manufacturing establishments, and the balance available for profit and miscellaneous expenses are compared for each of the years 1968–69, 1969–70, and 1971–72 :

VICTORIA—MANUFACTURING ESTABLISHMENTS: SPECIFIED COSTS OF PRODUCTION, ETC., AND TURNOVER
($m)

Year	Cost of—		Movement in stocks	Balance between turnover, stocks, and costs (a)	Turnover
	Purchases and selected items of expense	Wages and salaries			
1968–69	3,860	1,342	+66	1,199	6,336
1969–70	4,307	1,497	+108	1,299	6,995
1971–72	4,810	1,802	+86	1,526	8,051

(a) Balance available to provide for all other costs such as rent, interest, insurance, pay-roll tax, income tax, depreciation, etc., as well as drawings by working proprietors and profit.

In the following table the components of cost are converted to their respective percentages of the value of turnover :

VICTORIA—MANUFACTURING ESTABLISHMENTS : PERCENTAGE OF SPECIFIED COSTS OF PRODUCTION, ETC., TO TURNOVER
(per cent)

Year	Cost of—		Movement in stocks	Balance between turnover, stocks, and costs (a)	Turnover
	Purchases and selected items of expense	Wages and salaries			
1968–69	60.9	21.2	+1.0	18.9	100.0
1969–70	61.6	21.4	+1.5	18.6	100.0
1971–72	59.7	22.4	+1.1	19.0	100.0

(a) Balance available to provide for all other costs such as rent, interest, insurance, pay-roll tax, income tax, depreciation, etc., as well as drawings by working proprietors and profit.

Fixed capital expenditure and rent and leasing

Fixed capital expenditure is the outlay on new and second-hand fixed tangible assets less disposals. Rent and leasing expense is the amount paid for renting and leasing of premises, vehicles, and equipment. The following table shows fixed capital expenditure and rent and leasing expenses for 1971–72 by industry sub-division :

VICTORIA—MANUFACTURING ESTABLISHMENTS: FIXED CAPITAL EXPENDITURE AND RENT AND LEASING EXPENSES, 1971–72
($'000)

ASIC code	Industry sub-division	Fixed capital expenditure				Rent and leasing expenses
		Land, buildings and other structures	Motor vehicles	Other plant, machinery, and equipment	Total	
21–2	Food, beverages, and tobacco	13,665	3,511	35,956	53,132	9,557
23	Textiles	543	457	13,268	14,268	3,521
24	Clothing and footwear	1,131	1,101	9,665	11,896	7,217
25	Wood, wood products, and furniture	–573	908	3,993	4,328	4,083
26	Paper, paper products, and printing	7,395	793	33,581	41,770	5,479
27	Chemical, petroleum, and coal products	7,576	507	31,382	39,465	2,797
28	Non-metallic mineral products	3,032	267	6,773	10,072	1,267
29	Basic metal products	6,542	171	47,341	54,053	3,392
31	Fabricated metal products	3,278	1,226	21,526	26,034	5,571
32	Transport equipment	14,933	1,483	42,175	58,591	6,002
33	Other machinery and equipment	5,096	1,852	29,624	36,573	8,959
34	Miscellaneous manufacturing	3,825	755	19,074	23,653	6,283
	Total	66,445	13,030	294,357	373,835	64,127

In the next table fixed capital expenditure by industry sub-division is shown for 1968–69, 1969–70, and 1971–72 :

VICTORIA—MANUFACTURING ESTABLISHMENTS : FIXED CAPITAL EXPENDITURE
($'000)

ASIC code	Industry sub-division	1968–69	1969–70	1971–72
21–2	Food, beverages, and tobacco	41,137	42,337	53,132
23	Textiles	15,339	22,928	14,268
24	Clothing and footwear	12,238	12,302	11,896
25	Wood, wood products, and furniture	5,027	5,107	4 328
26	Paper, paper products, and printing	23,391	17,839	41,770
27	Chemical, petroleum, and coal products	30,004	44,351	39,465
28	Non-metallic mineral products	14,048	16,064	10,072
29	Basic metal products	25,957	22,584	54,053
31	Fabricated metal products	17,942	20,528	26,034
32	Transport equipment	40,764	46,566	58,591
33	Other machinery and equipment	28,872	32,782	36,573
34	Miscellaneous manufacturing	22,967	16,128	23,653
	Total	277,687	299,535	373,835

Electricity and fuels used

The following tables show electricity and fuels used during the years 1968–69, 1969–70, and 1971–72 :

VICTORIA—MANUFACTURING ESTABLISHMENTS: VALUE OF ELECTRICITY AND FUELS USED BY INDUSTRY SUB-DIVISION
($'000)

ASIC code	Industry sub-division	1968–69	1969–70	1971–72
21–2	Food, beverages, and tobacco	17,807	18,816	20,648
23	Textiles	6,414	6,661	7,098
24	Clothing and footwear	3,737	3,595	4,113
25	Wood, wood products, and furniture	2,391	2,535	2,769
26	Paper, paper products, and printing	8,160	8,713	10,010
27	Chemical, petroleum, and coal products	12,262	12,458	12,804
28	Non-metallic mineral products	11,941	12,170	12,489
29	Basic metal products	8,943	13,851	12,317
31	Fabricated metal products	6,144	6,477	6,763
32	Transport equipment	8,425	8,751	10,244
33	Other machinery and equipment	8,199	8,738	8,742
34	Miscellaneous manufacturing	6,592	7,206	7,929
	Total	101,014	109,970	115,927

VICTORIA—MANUFACTURING ESTABLISHMENTS: VALUE OF ELECTRICITY AND FUELS USED

Commodity	1968–69	1969–70	1971–72	
			Cost	Percentage of total
	$'000	$'000	$'000	
Electricity	63,989	71,891	71,173	61.4
Coal and coke—				
Black coal	2,092	2,130	646	0.6
Brown coal	1,531	1,515	1,647	1.4
Brown coal briquettes	3,328	3,466	3,354	2.9
Coke (including coke breeze)	1,176	1,329	2,011	1.7
Petroleum fuels (non-gaseous)—				
Light oils, etc.	1,054	1,523	1,912	1.6
Industrial diesel fuel	2,712	3,236	5,158	4.4
Furnace oil and other fuel oil	15,930	15,524	17,579	15.2
Town gas	4,326	4,510	7,158	6.2
Other fuels	4,874	4,846	5,288	4.6
Total	101,014	109,970	115,927	100.0

VICTORIA—MANUFACTURING ESTABLISHMENTS: QUANTITIES OF FUELS USED

Commodity	Unit	1968–69	1969–70	1971–72
Coal and coke—				
Black coal	ton	228,192	227,139	55,528
Brown coal	„	701,994	685,744	582,264
Brown coal briquettes	„	409,000	455,219	422,167
Coke (including coke breeze)	„	47,350	48,401	51,312
Petroleum fuels (non-gaseous)—				
Light oils, etc.	'000 gal	6,315	7,746	8,487
Industrial diesel fuel	ton	89,716	118,704	248,735
Furnace oil and other fuel oil	„	931,788	895,418	895,682

Some principal factory products of Victoria and Australia

Annual quantity and value

The next table shows quantities of some of the principal articles manufactured in Victoria, and corresponding figures for Australia during 1971–72 and 1972–73. Owing to the limited number of producers, it is not permissible under statute to publish particulars regarding some articles of manufacture which would otherwise appear in the following table :

VICTORIA AND AUSTRALIA—PRINCIPAL ARTICLES MANUFACTURED

Commodity Code No.	Article	Unit	Victoria		Australia	
			1971–72	1972–73	1971–72	1972–73
023.09	Bacon and ham	tonnes	3,449	3,085	25,735	28,488
	bone-in bone-out	,,	10,049	11,598	19,245	32,578
027.02–29, 72 – 77 ; 023.17	Meat—canned (excluding baby food)	mill kg	38	32	56	48
051.21–27; 052.42	Milk—condensed, concentrated, and evaporated : full cream	,,	64	50	98	72
051.31	Butter	,,	131	128	191	185
051.36–46	Cheese	,,	37	48	79	93
051.61	Ice cream	mill l	58	65	195	209
051.72–73	Milk—powdered : full cream	mill kg	20	26	29	36
062.01, 32	Flour, plain–wheaten (including sharps)	'000 tonne	314	287	1,161	1,120
063.11, 21, 31	Malt	mill kg	225	196	571	339
064.21	Biscuits	,,	39	43	117	116
076.08, 15, 22	Canned or bottled apricots, peaches and pears	,,	98	116	156	170
076.60	Jams, fruit spreads, fruit butters, etc.	,,	17	18	35	33
094.02–47	Vegetables canned or bottled (including pickled)	,,	24	23	114	105
	Confectionery—					
104.06–18	Chocolate base	,,	23	22	52	50
104.21–29	Other without chocolate	,,	25	27	59	60
123.18	Sauce—tomato	mill l	14	11	22	19
152.06	Pollard	'000 tonne	72	62	254	240
171.03, 07, 08	Aerated and carbonated waters, canned or bottled (*a*)	mill l	202	221	759	874
242.07–11	Wool—scoured or carbonised	mill kg	28	24	67	57
242.33, 35, 70–76 246.46–49	Wool tops—pure and mixed	,,	10	11	23	30
261.41	Briquettes—brown coal	'000 tonne	1,329	1,221	1,329	1,221
372.22–50	Cloth piece goods woven—woollen or predominantly woollen	mill sq m	8	8	9	9
372.52–66 ; 374.51–59	Blankets, bed (*b*)	'000	857	976	1,664	1,666
403.02, 18, 20, 52–92, 96 ; 404.01–98	Plastics and synthetic resins	mill kg	137	173	285	337
472.01, 03	Bricks—clay	mill	436	443	1,749	1,874
472.12, 475.30	Tiles, roofing	,,	58	61	195	218
479.32, 33	Plaster sheets	mill sq m	16	18	42	48
503.13–32	Electric motors	'000	815	885	3,466	3,796
	Finished motor vehicles (*c*)—					
581.02–08, 10–16	Cars	'000	199	191	387	370
582.04–28	Other	'000	25	29	60	69
661.21–23	Toasters (domestic)	'000	205	225	371	489
671.14	Sinks—stainless steel	'000	99	63	230	247
773.04–25	Shirts (men's and boys')	'000 doz	998	1,123	2,461	2,542
	Underwear—					
773.90, 94 ; 774.01–17, 36–39, 96, 97	Men's and boys'	'000 ,,	1,155	1,196	2,686	2,636
774.44, 46, 48, 49, 61, 63, 68–73	Women's and girls'	'000 ,,	2,338	2,536	3,712	3,909
775.01–19	Stockings—women's (*d*)	'000 doz pair	6,540	6,982	7,960	8,385
775.51–82, 91–98; 776.01–42	Socks and stockings—men's, children's and infants'	'000 ,,	2,566	2,977	2,769	3,222
	Footwear—					
	Boots, shoes, and sandals (*e*)—					
791.01, 03, 09, 10, 15, 17, 20, 21,	Men's and youths'	'000 pair	4,901	5,257	11,371	10,944

VICTORIA AND AUSTRALIA—PRINCIPAL ARTICLES MANUFACTURED—*continued*

Commodity Code No.	Article	Unit	Victoria		Australia	
			1971–72	1972–73	1971–72	1972–73
23, 28, 29 791.31, 33, 39, 40, 45, 47, 50–53, 58, 59	Women's and maids'	'000 ,,	12,722	12,377	17,073	16,576
791.61, 62, 66, 69–75, 78, 79, 81, 82, 87–89, 91–96, 99	Children's (including infants')	'000 ,,	5,609	5,216	7,202	6,784
791.05, 07, 35, 37, 63, 64, 83, 85, 86	Slippers	'000 ,,	2,546	2,089	3,339	2,696
	Soaps and soap based products for other than personal use—	tonnes				
805.22–60	Powder and granule	,,	7,150	7,772	13,550	13,840
	Abrasive cleaners and scourers	,,	868	790	2,288	2,209
	Other	,,	5,699	6,184	12,705	10,334
844.02–67	Mattresses—all types	'000	302	369	1,072	1,190

(*a*) From October 1969 includes bulk aerated and carbonated waters.
(*b*) Double, three quarter, single ; wool, wool mixture and other fibre.
(*c*) Excludes vehicles finished by specialist body building works outside the motor vehicle manufacturers organisation.
(*d*) Includes panty hose.
(*e*) Excluding wholly of rubber.

Monthly production statistics

The Bureau collects monthly production returns and makes available printed tables of Australian production statistics within a few weeks of the month to which they relate. A list of the subjects included in these production summaries is given below.

In addition, statistical publications for the meat, gold mining, and dairying industries, and minerals and mineral products are issued each month. Australian totals for a greater range of commodities are published in these publications and production summaries than are published in the *Monthly Bulletin of Production Statistics*. Victorian figures are published in the Victorian monthly publication *Secondary Production*.

AUSTRALIA—PRODUCTION SUMMARIES

Ref. No.	Subject	Ref. No.	Subject
1	Automotive Spark Plugs and Shock Absorbers	16	Wool Top Making and Yarn Produced
2	Chemicals, etc.	17	Wool Woven Fabric, etc.
3	Plastics and Synthetic Resins and Plasticisers	18	Hosiery
4	Paints and Other Surface Coatings	19	Women's, Maids' and Girls' Clothing, and Infants' and Babywear
5	Electricity and Gas	20	Cellulosic and Synthetic Fibre Tops, Yarns and Woven Fabrics
6	Soap, Detergents, Glycerine and Fatty Acids	21	Paper, Wood Pulp and Adhesive Tapes
7	Internal Combustion Engines	22	Floor Coverings and Felts
8	Lawnmowers	23	Electric Motors
9	Electrical Appliances	24	Men's, Youths' and Boys' Clothing
10	Motor Bodies, Trailed Vehicles, Lift-on Freight Containers, etc.	25	Foundation Garments
11	Pedal Cycles	27	Gloves and Slide Fasteners
12	Meters	28	Footwear
13	Building Fittings	29	Biscuits, Cocoa, Confectionery, Ice Cream
14	Cotton Goods	30	Storage Batteries—Wet Cell
15	Fellmongering, Woolscouring and Carbonising	32	Perambulators, Pushers and Strollers

AUSTRALIA—PRODUCTION SUMMARIES—*continued*

Ref. No.	Subject	Ref. No.	Subject
33	Motor Vehicles	47	Aerated and Carbonated Waters; Cordials and Syrups
34	Television,Radios, Other Sound Equipment; Transistors	48	Sports Goods
35	Bed Bases and Mattresses	49	Building Materials
36	Processed Milk Products	50	Electrodes for Manual Welding
38	Fish Preserving	51	Hides and Skins Used in Tanneries
39	Jam, Preserved Fruit and Vegetables	52	Electrical Power Frequencies Transformers, Chokes and Ballasts
40	Cereal Products	53	Plastics Film, Sheeting and Coated Materials
41	Vegetable Oils; Margarine and Other Edible Processed Fats	55	Butter and Cheese
42	Malt and Beer	56	Canned Meat
43	Stock and Poultry Foods and Canned Pet Food	58	Steel Wire and Wire Products
45	Gramophone Records	59	Non-ferrous Rolled, Extruded and Drawn Products

Secondary industry and the environment

The pioneers of Victoria, who came largely from Great Britain, followed the customs of their homeland in their new life, and in doing so were influenced by the industrial revolution, which did not consider deeply the need for the protection of the atmosphere, the water, or the land.

Early development

Before 1860 Victoria had only a few industries based on simple processing of agricultural products, but during the gold rushes manufacturing industries began to develop by expansion of these early industries and the introduction of more complicated operations. Land was readily available, and the infant industries were frequently located on sites which were convenient for water supply or transportation. With continued expansion, these sites were extended ; as a result many choice sites, particularly in the Melbourne area, are occupied by factories. The river or stream that was originally a source of fresh and clean water then became a convenient drain for the waste from the factory when water became freely obtainable from the reticulated supply.

In the United Kingdom some of the worst examples of pollution led to the passing of the Alkali Act and the establishment of the office of the Alkali Inspector. Over the years this office developed standards for emissions from particular industries which did a great deal to reduce the mounting atmospheric gas pollution. In order to meet these standards it was necessary to improve the design and operation of many processes which could be serious polluters of the atmosphere. When similar processes were being established in Victoria, people tended to adopt similar standards in default of any local standards ; it was not until 1936 that the Victorian Smoke Abatement regulations were enacted.

As manufacturing became more competitive and management improved in technical skill, improvements in the utilisation of raw materials and fuel resulted in a considerable reduction of many discharges to the environment ; the smoking factory chimney became the sign, not of a busy factory, but of poor technical management. Victoria passed further legislation with the Clean Air Act in 1958 and various other anti-pollution measures, all administered by different government departments or local councils.

Pollution

Recent years had also brought technological changes. Synthetic organic pesticides of hitherto unimagined activity had been developed and unfortunately used to excess before the problems of their persistence had been realised. Higher applications of fertiliser due to its cheapness and the demand for higher yields per acre, plus the use of synthetic detergents, have resulted in increased run-off of plant nutrients into streams causing excessive algae growth and eutrophication. Rapid population increase and the inability of communities to keep pace with the demands for proper sewerage also caused polluted rivers. The increase in the number of motor cars, particularly in urban areas, with the resulting high concentration of oxides of nitrogen and of hydrocarbons, has led to the development of smog, which now occurs in many cities.

In recent years it has been realised that the world is becoming polluted. In developed countries protests have become widespread and governments have introduced and strengthened legislation to protect the environment. Victoria passed the Environment Protection Act in 1970. The Act set up the Environment Protection Authority with wide powers to control discharges or deposition of materials to the environment. Not only were solid, liquid, and gaseous wastes brought under control, but significant controls on environmental noise were also made possible. The Authority's powers and functions are more fully described in another article on pages 29–30. In 1972 the Conservation Act was passed with the object of combining in the Ministry for Conservation the many governmental agencies concerned with protecting the environment. The objectives of the Conservation Act are the protection and preservation of the environment and the proper management and utilisation of the land and aquatic resources of Victoria.

Conservation

The implications for secondary industry of the Conservation Act are numerous. The most general case to be considered is the establishment of a new industry on a " green-field " site ; in such a case a so-called impact study is most desirable. Such studies have been required recently for Australian Government projects and there are some companies which require them internally for major proposals. The impact study requires a detailed analysis of the proposed production unit to delineate the likely discharges to all parts of the environment. Unless these discharges meet the conditions to be imposed by the licensing sections of the Authority, further consideration is given to the technical proposals and equipment in order to meet the discharge conditions. It is important in the planning stage that low capital and operating costs should not be built into a cost structure which subsequently proves to be inadequate because the requirements of the Authority cannot be met.

The choice of site is important. A new operation may meet opposition on aesthetic grounds or it may be considered to threaten areas regarded as having botanical, zoological, or geological interest. Construction activities and access roads, pressure for housing, and development close to a large industrial site must also be considered for their effect on the total environment. Noise must also be considered ; the noise level for the surroundings must be kept to an acceptable figure, and this aspect is one of the responsibilities of the Authority. Many modern factories in Victoria provide a good facade. Most

industrialists prefer their plants to be clean, tidy, and attractive places in order to provide the incentive for safety and efficiency among their workers, but some production units by their nature will not blend with the landscape, and the siting of such must be considered in relation to the public enjoyment of a particular area.

In a number of industries the prospective manufacturer must consider the possibility of some reaction on environmental grounds. Such reaction may lead to delays, as occurred during the laying of the ethane pipeline across Port Phillip Bay. A full impact study, however, would show the areas where public opinion may be sensitive, and this could lead to alternative solutions.

Waste discharges

Control of discharges of waste onto the surface of any land requires that there is no damage to either surface or underground waters. It is no longer possible to discharge liquid or solid wastes on land or to unlined lagoons without a licence. Licences will be granted for land disposal schemes, such as dairy residues being used for spray irrigation. It is beyond the capacity of many factories to treat their waste, and carriers who remove such materials for disposal will be licensed to deposit these wastes at suitable sites. Frequently carriers cannot be sure of the composition of a waste, so industry will be required to define the waste material and, in particular, any hazardous or objectionable materials contained in it.

The planned waste treatment plant at Brooklyn is intended to provide a waste disposal service to industry. It is expected that there will be incineration facilities with proper equipment to make gaseous discharges acceptable to the Authority together with biological treatment facilities to render liquid wastes acceptable for discharge to Melbourne and Metropolitan Board of Works sewers. The operators of the plant will have the opportunity by suitable blending of waste to effect more economical disposal than an individual operation could achieve.

Opportunities for research

There will be opportunities for industry in the supply of designs and equipment for controlling waste discharges in new and established factories, as many discharges will not meet the new standards. For gaseous discharges to the atmosphere a whole range of cleaning devices are available—scrubbing systems, various types of particle removal equipment, multiclones, and electrostatic precipitators. Many of the designs will be proprietary and users will in most cases prefer to purchase units whose performance is well established, but it is anticipated that Victoria's local engineering industry will participate. Waste water discharges to streams and the sea will require high standards of purity, and again there will be an opportunity for industry to develop and supply processes and equipment for purifying waste streams. The material to be removed will range from metal ions and various chemicals to substances with a high biological oxygen content as in the food industry. This field possibly offers the greatest scope for converting waste into useful material, or utilising it to advantage.

Industry has the opportunity of obtaining research and development grants from the Australian Government for some of the expenditure incurred in developing measures or equipment for recovery and cleaning processes. There are major research and development opportunities available

for industry, and local industrialists are known to be interested in some of these. Examples include methods of cleaning up oil spills on water; desalination of water, which might remove harmful ions; devices for reducing harmful exhaust emissions from internal combustion engines; and even new engine designs which may be pollution free. There may also be more radical developments, such as degradable plastics for packaging and solar power. Developments which will almost certainly affect the oil industry will be the possible reduction in lead content of motor fuels, and the probable need to raise the octane rating by other means. The recent revival of interest in methanol as an anti-detonant in fuel could lead to large-scale manufacture locally.

Conclusion

Industry is confronted with the situation that the new emission standards will be enforced, and the Authority and its delegated agencies will maintain a mobile inspectorate to investigate complaints and check emissions. Many licences for discharges will require that the holder of the licence monitors a particular discharge. Penalties for infringements can be substantial. Industry must therefore train its personnel not only to maintain these standards under normal operations but to meet the unplanned situation which could lead to excessive discharge unless corrective action is taken. It will mean that the workforce at all levels must develop and maintain an awareness of the effect of the factory operations on the environment.

Because of capital costs of new or improved equipment, plus extra operating costs and licensing fees, the manufacturer must expect higher product costs, but his competitors in other States and in most developed countries overseas will be in a similar situation. Ultimately the consumer must pay for the protection of the environment as a direct cost, rather than as a charge against posterity.

History of manufacturing, 1961; Motor vehicle industry, 1962; Chemical industry, 1963; Petrochemical industry, 1964; Glass industry, 1965; Agricultural machinery industry, 1966; Aluminium industry, 1967; Automation and technical development in industry, 1967; Textile industry, 1968; Canning of foodstuffs, 1969; Butter, cheese, and processed milk products, 1970; Heavy engineering, 1971; Light engineering, 1972

ENERGY

Ministry of Fuel and Power

Following the discovery of natural gas off the east Gippsland coast early in 1965 and anticipating the discovery of oil, the Victorian Government, reviving an earlier proposal, passed the *Fuel and Power Act* 1965. This Act made the Minister for Fuel and Power responsible for determining the means by which the present and future supplies of fuel and power in Victoria could best be developed and utilised. The Act also established the administrative machinery of the Ministry and made the Minister responsible for the State Electricity Commission of Victoria and the Gas and Fuel Corporation of Victoria. The broad terms of the Act also enable the Minister to deal with legislative and other problems concerned with the production and marketing of energy which may be referred to him by private oil and gas companies.

Since 1966 the Minister has determined policy and legislative matters relating to the utilisation of the oil and gas discovered in Victoria's Gippsland fields, the establishment of a pipelines commission in 1966 and its subsequent

incorporation in 1971 into the Gas and Fuel Corporation, the taking over of private gas companies by the Gas and Fuel Corporation between 1966 and 1973, the erection of power stations, and the determining of routes of pipelines to convey hydrocarbons.

Electricity industry

The most widely used and extensively distributed form of energy supplied in Victoria is electricity. This is carried out by the State Electricity Commission of Victoria, a public utility formed by Act of Parliament in 1921. At 30 June 1972, the Commission, with a staff of 19,593 persons and capital assets of nearly $1,500m, distributed electricity to 1,077,036 consumers throughout the State including a number of municipal authorities (which redistribute through their own systems), through a network of 67,000 route miles of high and low voltage power lines.

Early history

Pioneer electrical development in Melbourne dates from 1878 and 1879 when two firms, Sands and McDougall and the Apollo Candle Company, each imported an arc lamp and generating equipment, and produced power for commercial lighting. The State's first commercial electricity company, the Victorian Electric Light Company, was formed in 1880. It erected a small generating station to supply the central part of the city of Melbourne with electric light. During the next 30 years a number of other electricity supply companies were formed and gradually the supply spread to the suburbs of Melbourne and the larger provincial cities. During this period electricity commenced to be used for operating tramway services.

In 1894 the Melbourne City Council started to generate electricity at a power station in Spencer Street for domestic and industrial consumption and for lighting the streets. To cater for a constantly increasing demand the Council progressively developed its power station, which by 1967 had an installed capacity of 109 megawatts. This station now forms part of the State Electricity Commission's generating and supply system, although still owned by the Council. At Bendigo and Ballarat the Electric Supply Company of Victoria was granted a franchise to generate and distribute electricity for domestic and industrial purposes and for the operation of the tramways. The company purchased the assets of existing undertakings and began operations in Bendigo in 1903 and in Ballarat in 1905. Tramway services were established in both cities. In 1934 these undertakings and the tramways were acquired by the State Electricity Commission. In 1972 the tramways were phased out of regular operation as being uneconomical, but are still partly used as a tourist attraction.

During the first 40 years of operation in Victoria the sole fuel used for the generation of electricity was black coal, the bulk of which was imported from New South Wales. During this period a number of municipalities formed electricity branches as adjuncts to normal municipal services. While the various independent electricity undertakings operating prior to 1918 did valuable pioneering work there was no uniformity in respect to systems, voltages, and tariffs. Companies and syndicates operated without regulation or restriction until Parliament passed the *Electric Light and Power Act* 1896.

State Electricity Commission of Victoria

In 1918 the Victorian Government passed legislation appointing a body known as The Electricity Commissioners. This was prompted by the urgency of the electricity supply situation, particularly in the metropolitan area where a shortage of power was imminent, the inadequacy of Victoria's black coal resources, and the threat to the continuity of supply of black coal from New South Wales due to recurring industrial disputes.

The practicability of using the huge brown coal deposits known to exist in the La Trobe valley had been under study for nearly 20 years and the newly appointed Electricity Commissioners' first task was to submit a " scheme for coal mining and electricity undertaking to be undertaken in the neighbourhood of Morwell, and the distribution of electricity therefrom ; and also a report setting forth the results of an enquiry into the relative practicability of utilising water power for electrical undertakings ". The title of The Electricity Commissioners was changed in January 1921 to the State Electricity Commission of Victoria—the name by which the Commission has been known ever since, and Sir John Monash was appointed its first full-time Chairman.

Functions and responsibilities

The Commission has, since 1921, been headed by a full-time Chairman and three part-time Commissioners. It functions in accordance with the provisions of the *State Electricity Commission Act* 1958 and its principal duty is to co-ordinate and extend, on an economic basis, the supply of electricity throughout Victoria. For this purpose it is vested with power to erect, own, and operate power stations and other electrical plant and installations ; supply electricity either direct to individual customers or in bulk to any corporation or public institution ; acquire electricity undertakings and incorporate them into its own system ; develop, own, and operate brown coal open cuts and briquetting works ; develop the State's hydro-electric resources ; and form or acquire interests in any company for the purpose of selling char, coal, and briquettes.

From its own revenues, which it controls, the Commission must meet all expenditure in the operation of its power, fuel, and subsidiary undertakings ; and all interest and other charges incurred in the service of its loans and other capital commitments.

Under the provisions of the *Electric Light and Power Act* 1958 the Commission is the controlling authority for all electrical undertakings in Victoria. It is responsible for the registration of electrical contractors, the licensing of electrical mechanics, the control of installation methods and material, and the testing and approval of electrical equipment and appliances.

Electricity generation

Since it began operating in 1919 the State Electricity Commission has expanded and co-ordinated the production and supply of electricity on a State-wide basis to the point where its system now generates almost all of the electricity produced in Victoria and serves virtually all of the population.

The development of Victoria's electricity system is based on the utilisation for both power and fuel of Victoria's extensive brown coal

resources in the La Trobe valley in Gippsland, with supplementary development of the hydro-electric potential of north-eastern Victoria. Victoria is entitled to one third of the electricity from the Snowy Mountains Hydro-Electric Scheme after the Australian Government has taken the power it needs. Victoria also shares with New South Wales in the electricity generated at the Hume Hydro Station on the Murray River.

By far the greater part of the State's electricity is generated from brown coal, either used in its raw state or manufactured into a higher quality fuel in the form of briquettes. (See also the section on brown coal below.) The brown coal open cuts and the briquetting plant are owned and operated by the Commission, which also distributes a proportion of these fuels to privately owned reseller outlets. Output of brown coal in 1971–72 from the three open cuts at Yallourn, Yallourn North, and Morwell totalled 22.6 million tonnes of which 18.7 million tonnes were used in the Commission's own power stations, and 3.6 million tonnes were manufactured into 1.3 million tonnes of brown coal briquettes, 20 per cent of the briquette output then being used for electricity production, mainly in Newport Power Station. The two functions, generation of electricity and production of fuel, are therefore closely integrated. Apart from the large proportion of brown coal and briquette fuel consumed in the power stations, the process of briquette manufacture results also in the generation of electricity, since the steam needed for processing the raw coal for briquetting is first used to operate turbo-generators.

Electricity generated in the State system or purchased by it totalled 14,641 million kWh in 1971–72. The system comprises a series of thermal and hydro-electric power stations. Inclusive of generator capacity both within the State and available to the Victorian system from outside the State, the total installed generator capacity at 30 June 1972 was 3,719 MW. Power stations are interconnected and feed electricity into a common pool for general supply.

The major power station in this interconnected system is the 1,600 MW brown coal fuelled power station at Hazelwood, which alone generates 56 per cent of Victoria's electricity. Other power stations in the interconnected system comprise two other base load power stations—Yallourn (which contributes 18 per cent) and Morwell; the first set of a new base load power station, Yallourn W; steam stations in Melbourne (Newport, Richmond, and Spencer Street), and at Red Cliffs, which in addition has some internal combustion plant; and hydro-electric stations at Kiewa, Eildon, on the Rubicon and Royston Rivers near Eildon, and at Cairn Curran on Eppalock Reservoir on the Campaspe River near Bendigo. All major power stations within Victoria are owned by the Commission except the Spencer Street power station which remains the property of the Melbourne City Council, although operated as a unit in the interconnected system.

La Trobe valley base load stations

Yallourn

Subsequent to their establishment in 1918 The Electricity Commissioners reported that the generation of electricity through the use of brown coal as a fuel to fire the boilers was practicable and the Commissioners' successor—the State Electricity Commission of Victoria—acquired rights over the land

in the La Trobe valley under which the deposits were located, established the township of Yallourn, and in 1922 commenced excavation of an open cut to recover the coal. Work was commenced on building a power station adjacent to the open cut and the erection of a 132 kV transmission line to Melbourne. Two years later in 1924, the first electricity generated from brown coal in Victoria reached Melbourne and marked the beginning of the vast generating, transmission, and distribution system which today covers the State of Victoria, is linked to New South Wales and South Australia, and which, because of its magnitude and economy of operation, enables standard tariffs to be charged throughout the State.

Gradually over the years the State Electricity Commission became the State's principal generating and supply authority under the provisions of its enabling legislation and it acquired many private companies and municipal undertakings including the associated local power stations. Among these was the large, peak load station at Newport, acquired in 1951. At Yallourn more power stations were built over the years with the generating capacity increasing as the technology of utilising brown coal as a fuel improved and demand for electricity expanded. The last of the currently operating generating units at the Yallourn complex installed in 1962 had a capacity of 120 MW, a very extensive increase over the early 12.5 MW sets installed in 1924. The Yallourn complex of stations currently produces about 2,700 million kilowatt hours a year or 18 per cent of total requirements.

Morwell

Post-war strikes and shortages in the New South Wales black coal industry between 1946 and 1950, coupled with the necessity to provide for the enormous expansion in the demand for electricity and solid fuels—a world-wide trend—led to the Government authorising the Commission to establish a second complex in the La Trobe valley. Accordingly at Morwell, a few kilometres east of Yallourn, the Commission opened up a second large coal field and erected a combined power station and briquetting factory. This power station with an installed capacity of 170 MW was commissioned in December 1958 and currently produces about 1,100 million kilowatt hours a year or 8 per cent of total requirements.

Hazelwood

To cope with the expected demands of the late 1960s and early 1970s, the Commission began the construction of a new power station in the La Trobe valley in 1959 at Hazelwood located about three km south of Morwell and 145 km east of Melbourne. It is the third power development on the brown coal fields of the La Trobe valley, is the largest generating project so far constructed by the Commission, and is a major development by world standards.

The station has a capacity of 1,600 MW or about 57 per cent of all the generating capacity available to Victoria in 1973. It comprises eight 200 MW turbo-generators each having a single boiler burning brown coal supplied from a large open cut brown coal mine at Morwell. Together with the Yallourn and Morwell power stations it produces about 84 per cent of Victoria's annual electricity requirements. The Hazelwood project was approved by Parliament in 1959. Site works commenced in 1960 and the power station was completed early in 1971 at a capital cost of $237m.

Each of Hazelwood's eight turbo-generators is designed to produce 1,400 million kWh of electricity annually. The machines, each 30 metres long and weighing 760 tonnes, operate at 3,000 revolutions a minute and generate electricity at 16,500 volts. Each turbo-generator has its own steam-raising boiler capable of burning 270 tonnes of brown coal an hour. Advances in power plant design and the use of coal with a slightly lower moisture content than coal from the original Yallourn open cut contribute largely to Hazelwood's generating efficiency. Coal consumption for each kWh of electricity generated is less than half the average rate of consumption in the pre-war La Trobe valley plant.

Coal from the open cut is supplied to a 30,000 tonne storage bunker by an elaborate conveyor system directed from an electronically equipped control centre. Operations within the power station are also highly automated with four control rooms each operating a pair of generators and their associated boilers. Sixty men a shift are able to operate the entire power station. Cooling water for the station's steam condensers is drawn from a large artificial pondage which is about five square kilometres in area and holds 30 million cubic metres of constantly circulating water.

Yallourn " W "

This comprises a 1,400 MW base load power station being erected in two stages immediately to the north of the old stations built at Yallourn between 1923 and 1961. Construction of the first stage comprising two 350 MW turbo-generators began in 1965. The cost was then estimated at approximately $123m. The first unit was commissioned during the winter of 1973 and the second one is scheduled to commence operating in 1974.

An announcement was made by the Victorian Government on 30 August 1972 that the State Electricity Commission would build a new brown coal fired power station at Yallourn. This station would comprise an extension of the existing Yallourn " W " project by adding two additional 350 MW generators and would cost about $200m. The two new generators would be needed to meet the growth in Victoria's requirements after 1978. The first unit is scheduled to be commissioned by the winter of 1979 and the second one in 1980. Site works are planned to begin in 1975.

Yallourn " W " boilers are among the largest in the world designed for the combustion of raw brown coal. Each boiler is more than 80 metres high and contains 200 km of steam tubing and 137 km of water tubing. At full load each boiler can consume 600 tonnes of coal an hour.

Hydro-generated power

The water resources in the mountainous region of the Australian Alps in north-eastern Victoria attracted the attention of the Commission during the 1920s and 1930s and small stations were installed in the region between 1926 and 1929. In 1938 work commenced on the Kiewa hydro-electric scheme but only a total of 184 MW generating capacity was installed in the three hydro power stations built, one of which is underground. The imminent availability of power from the giant Snowy Mountains Hydro-Electric Scheme in higher alpine areas in New South Wales about 85 km to the north east made any further expansion uneconomic as well as impracticable through the shortage of available water. (See pages 298–302.)

The most important source of hydro-generated powe for use in Victoria is the Snowy Mountains Hydro-Electric Scheme. The first electricity from this scheme was transmitted to Victoria in 1959 and at the present time, total purchases on interchange agreements between Victoria and New South Wales, of which the Snowy scheme is the principal one, amount to about 11 per cent of the Commission's total requirements. The total ratio of electricity supplied from hydro-generated sources comprises only about 14 per cent of the Commission's total needs.

The following table shows the predominant part taken by the State Electricity Commission in the generation of public supply electric power in Victoria, the amount of power generated by water power and other sources, and the relative importance of the main power stations :

VICTORIA—PUBLIC SUPPLY ELECTRICITY GENERATED: POWER STATIONS: CAPACITIES AND SOURCES OF POWER

Station	Maximum continuous rating (*a*)	Electricity production			
		1970–71	1971–72	1972–73	
				Quantity	Percentage of production
	MW	mill kWh	mill kWh	mill kWh	
State Electricity Commission—					
Thermal stations—					
Hazelwood	1,600.0	7,423.6	8,134.8	8,550.4	57.2
Yallourn (*b*)	546.0	2,860.2	2,685.1	2,663.9	17.8
Morwell	170.0	1,109.2	1,129.8	1,134.5	7.6
Newport	228.0	202.1	279.6	140.4	1.0
Spencer Street (*c*)	90.0	63.5	55.4	15.2	0.1
Richmond	38.0	35.7	27.4	5.2	(*g*)
Provincial thermal stations (*d*)	15.6	2.3	0.6	0.6	(*g*)
Total—S.E.C. thermal	2,687.6	11,696.6	12,312.7	12,510.2	83.7
Hydro stations—					
Kiewa (*e*)	183.6	445.3	346.9	286.2	1.9
Eildon (*f*)	134.9	403.2	340.8	306.4	2.0
Total—S.E.C. hydro	318.5	848.5	687.7	592.6	3.9
Total—S.E.C.	3,006.1	12,545.1	13,000.4	13,102.8	87.6
Other public supply generation	n.a.	0.2	0.2	n.a.	n.a.
Total—public supply undertakings	3,006.1	12,545.3	13,000.6	13,102.8	87.6
Net interstate purchases	n.a.	1,151.3	1,003.9	1,848.4	12.4
Total	n.a.	13,696.6	14,004.5	14,951.2	100.0

Source : Ministry of Fuel and Power.
(*a*) At 30 June 1972.
(*b*) Including briquette factory.
(*c*) Melbourne City Council station.
(*d*) Geelong, Ballarat, and Red Cliffs.
(*e*) McKay Creek, West Kiewa, and Clover.
(*f*) Eildon, Rubicon, Lower Rubicon, Royston, Rubicon Falls, and Cairn Curran.
(*g*) Less than 0.1.

Distribution of electricity

State Electricity Commission

Electrification of Victoria was virtually completed on 29 July 1972, with a ceremonial switching on of power at Mallacoota in the eastern corner of the State.

By 30 June 1972 almost all dwellings in Victoria and 74,174 of a possible 75,000 farm connections were supplied with electricity through the State Electricity Commission's system. The number of customers receiving power from the Commission was 1,323,411.

The Commission sells electricity direct to consumers in all areas except part of the metropolitan area, where it sells in bulk to eleven municipal undertakings that operate as supply authorities under franchises granted before the Commission was established. Bulk supply is also being provided at present to several New South Wales municipalities and irrigation settlements bordering the Murray River. The number of customers served by the Commission's system outside the Melbourne metropolitan area is 645,438. The Commission's direct customers numbered 1,077,036 at 30 June 1972. Supply is administered through the metropolitan branch and nine extra-metropolitan branches. At 30 June 1972 there were branch and district supply offices in Melbourne and 93 other cities and towns in Victoria.

Two 330 kV transmission lines link the Victorian system with the Snowy Mountains undertaking and also provide facilities for interconnection between the Victorian and New South Wales State generating systems. Also linked with the Victorian interconnected system is the hydro station at Hume Reservoir on the Murray River. This power station is operated by the Electricity Commission of New South Wales. Output and operating costs are shared by Victoria and New South Wales.

In meeting the total demand on the system, which fluctuates throughout the day and from month to month, each group of stations in the interconnected system is assigned a predetermined function dependent upon the availability of power from each group and the economics of generation. The various stations are utilised in the combination which will meet the system load most economically at a given time.

The electrical transmission and distribution system in the State supply network at 30 June 1972 comprised 102,416 km of power lines, 4 auto-transformation stations, 26 terminal receiving stations, 164 zone sub-stations, and nearly 66,000 distribution sub-stations. Main transmission is by 500 kV, 330 kV, 220 kV, and 66 kV power lines, which supply the principal distribution centres and also provide interconnection between the power stations. The 500 kV, 330 kV and 220 kV systems total 3,346 route km.

The transmission of energy from Hazelwood at 500 kV is the highest voltage for electricity transmission in the southern hemisphere.

Other distributors

In accordance with the provisions of a number of Acts of Parliament dating between 1896 and 1915, electricity is purchased in bulk by a number of municipalities from the State Electricity Commission and distributed to ratepayers and businesses within the municipalities through their own power line networks. The municipalities, which originally generated their own

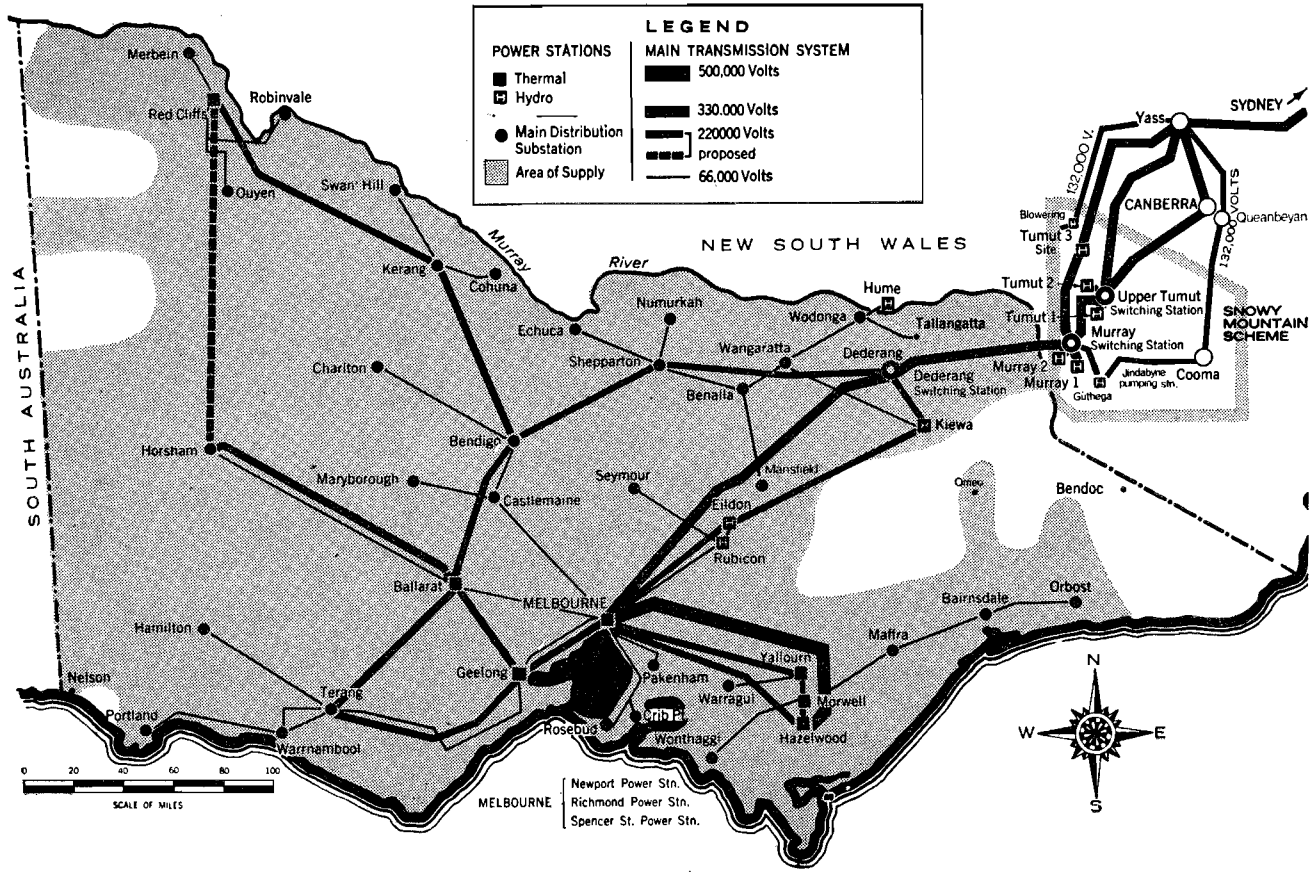

FIGURE 17. Victoria's main power transmission system at 30 June 1972.

electricity, are the City of Melbourne and the cities of Footscray, Preston, Brunswick, Port Melbourne, Heidelberg, Coburg, Box Hill, Williamstown, Doncaster and Templestowe, and Northcote. The consumer tariffs are the same as those charged by the Commission.

Electricity is also generated by Alcoa of Australia Ltd at a 15 MW power station at its Anglesea brown coal field and taken by the company's own transmission line to its alumina smelter and fabrication plant at Point Henry, to satisfy part of its needs for this particular form of energy.

Future development

Apart from the proposed extension of the Yallourn " W " station in the La Trobe valley the most important development during the coming decade is the 1,000 MW peak and intermediate load power station to be built at Newport near the mouth of the Yarra River, at a cost of about $145m. Site works began in 1972 and a public environment impact inquiry was carried out by the Environment Protection Authority during the first half of 1973. One of the station's two 500 MW generating sets is scheduled to commence operating in 1976 and the other in 1978. The new station has been designed to use natural gas as a fuel and will be one of the world's most advanced power developments with many distinctive engineering features.

A new hydro-electric power station containing a single unit 150 MW generating set is planned for Dartmouth in north-eastern Victoria. It will operate from 1979 in association with the irrigation storage now being built on the Mitta Mitta River.

Gas industry

Gas was being supplied to 606,394 customers in Victoria at 31 December 1972 through a network of about 1,000 miles of high pressure transmission pipelines and 6,500 miles of medium and low pressure transmission lines and mains. About 98 per cent of the total supplied is natural gas. It is distributed by the State's gas authority—the Gas and Fuel Corporation of Victoria—throughout the Melbourne metropolitan area and to Geelong, Ballarat, Bendigo, and several other country cities and towns.

Early history

The first gas company in Victoria, known as the City of Melbourne Gas and Coke Company, was formed on 4 November 1850. It was later authorised by an Act which came into operation on 12 January 1853. The company was amalgamated, with two other metropolitan companies, into the Metropolitan Gas Company by Act of Parliament in 1877. This latter company went out of operation on 1 July 1951 when it was absorbed into the newly created Gas and Fuel Corporation of Victoria.

Gas companies were also established through Acts of Parliament in a number of country towns during the last half of the nineteenth century. These included The Ballarat Gas Company in 1857, The Geelong Gas Company in 1858, and The Bendigo Gas Company in 1860. In many of the larger towns in the State gas works were constructed by local municipal authorities between 1860 and 1900. During the late nineteenth century The Colonial Gas Association Ltd became established in Victoria. Originally incorporated in

England in 1888 as the Australasian Gas Association Ltd, the company built works at Warragul, Seymour, Maldon, Shepparton, Wangaratta, and Box Hill between 1888 and 1890. In 1893 it changed its name to The Colonial Gas Association Ltd.

Gas made in retorts from black coal shipped initially from Scotland and later from New South Wales was used in homes and for the street lighting, for cooking, and in light industry. The resulting by-product, coke, was used in furnaces in industry and in hospitals, offices, etc., for producing hot water and for steam raising, and in homes for heating rooms.

Gas and Fuel Corporation of Victoria

The Gas and Fuel Corporation was created by the *Gas and Fuel Corporation Act* 1950, which established it as a joint enterprise combining the State of Victoria with the shareholders of the Metropolitan Gas Company and the Brighton Gas Company. The structure of the Board of the Corporation is that the chairman and three directors are appointed by the Victorian Government, and three directors by the preference shareholders. The new Corporation commenced operating on 1 January 1951. The purpose of the legislation was to provide the means for developing a method of using Victorian brown coal instead of New South Wales black coal for the production of gas thereby freeing the State from repeated gas rationing, and to consolidate and rationalise the gas industry by providing for the takeover or absorption of other gas utilities. In 1973 the Corporation, through subsequent enabling legislation, became the sole authority for the distribution of gas throughout Victoria.

Using the Lurgi high pressure process developed in Germany in the 1930s the Corporation commenced the production of gas from brown coal briquettes in 1956 at a newly built plant at Morwell and laid Australia's first long distance gas pipeline 18 inches in diameter over a total distance of 100 miles from Morwell to the West Melbourne gas works. The country centres of Morwell, Warragul, and Trafalgar were connected to gas during 1959 and 1960 and a small diameter line was laid to Traralgon seven miles to the east.

The Gas and Fuel Corporation of Victoria during the years 1956 to 1971 exercised its powers to acquire other gas undertakings in the State and with the acquisition of The Colonial Gas Association Ltd, the last privately owned undertaking in the State, by takeover in 1973, it is now the sole distributor of gas in Victoria except for liquefied petroleum gas sold by oil companies in certain areas in the State as provided for in the *Gas Franchises Act* 1970.

Natural gas

From initially in the 1850s using only black coal to produce towns gas, the industry in Victoria changed considerably during the period 1955 to 1969. Refinery and liquefied petroleum gases were introduced in 1955 following the erection of oil refineries at Altona and Geelong during that year; production of Lurgi gas made from brown coal briquettes began in 1956; gas was made from oil following the installation of Onia-Gegi plants in 1962; and finally more refinery gas and LPG became available when the new BP refinery at Crib Point came on stream in 1966. Thus, prior to the introduction of natural gas in April 1969, towns gas comprised, through reforming and

blending techniques, a mixture of black coal gas, Lurgi brown coal gas, water gas, oil gas, and liquefied petroleum gas and refinery gases.

The partnership of Esso Exploration and Production Australia Inc. and Hematite Petroleum Pty Ltd, a wholly owned subsidiary of the Broken Hill Proprietary Co. Ltd, discovered natural gas in the offshore waters of east Gippsland in 1965, and late in 1965 the Corporation entered into negotiations with the discoverers to buy the gas on behalf of the gas industry in the State. In 1967 all parties concluded a " Letter of Intent " setting out prices, terms, and conditions, etc.; this was later ratified by formal contracts. Development of the two fields commenced and two years later the natural gas era in Victoria began.

Distribution

In order to provide means of transporting contract specification natural gas between Esso/B.H.P's treatment plant at Longford and the Gas and Fuel Corporation's principal distribution terminal at Dandenong, 20 miles south-east of Melbourne, the Victorian Government in 1966 created the Victorian Pipelines Commission to build gas trunk-lines in Victoria. The Commission constructed a 108 mile, 30 inch diameter pipeline in 1968 and 1969 between Longford and Dandenong and natural gas first reached the latter point on 31 March 1969. From the metering and regulating station at Dandenong the Corporation commenced distributing natural gas to its own customers in April 1969 and to The Colonial Gas Association Ltd during the following month.

When it was realised that natural gas would become available to the Victorian gas industry both the Gas and Fuel Corporation and The Colonial Gas Association Ltd commenced planning for its introduction. The first two tasks were to ensure that there was an adequate system of pipelines to distribute gas to customers and, because the combustion characteristics of natural gas vary considerably from those of manufactured gas, to convert the existing gas appliances of consumers to burn natural gas correctly and efficiently.

During the late 1960s the Gas and Fuel Corporation commenced the construction of a ring main around Melbourne initially to cope with normal expansion of gas supply to the rapidly developing suburban areas and, subsequently for the distribution of natural gas to its own customers and The Colonial Gas Association Ltd. The northern section of the ring main—51 miles in length and 18 inches in diameter—passing through the eastern and northern suburbs, was completed late in 1969 and the 22 mile, 30 inch diameter southern section direct from the Dandenong City Gate to West Melbourne came fully into operation in May 1970. Built at a cost of $11m this 73 mile long pipeline forms an essential part of the Corporation's entire metropolitan distribution system. It also supplies The Colonial Gas Association Ltd's areas in the eastern and western suburbs and provides gas for the 33 mile, 14 inch diameter pipeline laid by the Victorian Pipelines Commission to Geelong during 1970 and 1971.

Conversion of appliances

The conversion of existing gas appliances in the Melbourne metropolitan area by the gas utilities was completed just before Christmas 1970. The towns

in central Gippsland already supplied by the Gas and Fuel Corporation received natural gas during the closing months of 1969. In Geelong conversion finished near the end of 1971, about five months after commencement. At 31 December 1972 a total of 1,331,489 appliances owned by 545,722 customers had been converted. By the time conversion had been completed the Lurgi plant at Morwell and the gas making plants at West Melbourne, Highett, Footscray, and Box Hill in the metropolitan area had closed down.

Following the laying of a 122 mile system to Ballarat and Bendigo during 1972 and 1973 the former city first received natural gas on 14 April 1973. The conversion programme involving over 36,000 appliances used by about 17,000 customers was carried out in these two cities and at Castlemaine and Bacchus Marsh by the Corporation's own staff during 1973 at a cost of about $1.6m. This brought the total number of customers converted in the State to 563,000 and the overall cost to nearly $40m.

Gas supply areas

At 31 December 1972 there was a total of 591,382 customers receiving natural gas in Victoria. A further 15,015 customers were using other reticulated gases, mainly tempered or reformed liquid petroleum gas, making a total of 606,397 customers.

The areas supplied with reticulated gas and the companies concerned are shown in the following table :

VICTORIA—AREAS SUPPLIED WITH GAS AT 31 DECEMBER 1973 (*a*)

Supplier	Area supplied with	
	Natural gas	Other gases (*b*)
Public utilities—		
Gas and Fuel Corporation of Victoria	Bacchus Marsh Ballarat Bendigo Castlemaine Maffra Melbourne Morwell Sale Trafalgar Traralgon Warragul	Ararat Colac Hamilton Kyneton Portland Stawell Wodonga Warrnambool
The Geelong Gas Company (owned by the Gas and Fuel Corporation of Victoria)	Geelong	Queenscliff
The Colonial Gas Association Ltd (owned by the Gas and Fuel Corporation of Victoria)	Melbourne	Benalla Horsham Melton Seymour Shepparton Wangaratta
Private suppliers—		
Esso Exploration and Production Australia Inc. and Hematite Petroleum Pty Ltd (B.H.P.)	Western Port North Geelong	

Source: Ministry of Fuel and Power.
(*a*) Excludes Esso–B.H.P. plant use at Longford and Long Island Point.
(*b*) In addition the Gas and Fuel Corporation of Victoria supplies Maryborough and Warracknabeal with bottled LPG, with on-site filling being used at the latter town.
NOTE. Public utilities supply 591,379 consumers with natural gas and 15,015 with other gas, and private suppliers supply 3 consumers (2 at Western Port and 1 at North Geelong).

Gas is supplied to consumers in Victoria by three utilities (the Gas and Fuel Corporation of Victoria, The Geelong Gas Company, and The Colonial Gas Association Ltd), and by Esso Exploration and Production Australia Inc. and Hematite Petroleum Pty Ltd (B.H.P.). The Geelong Gas Company and The Colonial Gas Association Ltd are now both subsidiaries of the Gas and Fuel Corporation of Victoria. These two companies will, however, for the time being continue to operate as separate companies under the provisions of the *Companies Act* 1968. In addition the Corporation transports gas to three industries which purchase directly from Esso and B.H.P. at Western Port and Geelong; and to the partnership's fractionation plant at Long Island Point.

Liquefied petroleum gas is also supplied by reticulation and cylinder by the three gas utilities and by cylinder by oil companies or subsidiary LPG marketing companies.

Gas utility legislation 1969 to 1973

The *Gas and Fuel Corporation Act* 1958 empowers the Corporation, the State's sole public gas authority, to acquire or take over other gas undertakings operated in the State and by 1969 a considerable number had been incorporated into the Corporation by this means. As a result of agreements, later ratified by Acts of Parliament in 1969 and 1970, the Corporation purchased from The Gas Supply Co. Ltd all of its gas installations in Victoria, including the one at Sale in 1969 and those at Ballarat and a number of other country towns in 1970. During the early part of 1971 Victoria passed an Act authorising the Corporation to make an offer to the shareholders in The Geelong Gas Company to purchase their shares. The bid was successful and in June of that year ownership of the company passed to the Corporation. About the same time as the Corporation acquired The Geelong Gas Company it took over, through enabling legislation, the functions and assets of the Victorian Pipelines Commission. The ownership and operation of the 108 mile natural gas trunkline from Longford to Dandenong and the 33 mile transmission line from Brooklyn to Corio, passed to the Corporation on 1 July 1971.

Late in 1970 the Victorian Government, believing that the expenditure totalling about $80m, incurred by the Gas and Fuel Corporation and The Colonial Gas Association Ltd in introducing natural gas in the Melbourne metropolitan area and in a number of country centres in the State, should be safeguarded, passed the *Gas Franchises Act* 1970. This legislation established the rights of the two utilities to supply reticulated gas and, subject to certain conditions, to sell liquefied petroleum gas in bulk, within geographical areas defined in the Act. A further Act passed by the Victorian Parliament late in 1972 extended the provisions of the *Gas Franchises Act* 1970 to the Geelong area, enlarged the geographical boundaries of the areas of supply and provided for the dissolution of The Geelong Gas Company, the last of the original private gas companies formed by Act of Parliament dating back to 1858. No action has yet been taken to dissolve the company.

On 19 December 1972 the Gas and Fuel Corporation announced its intention to submit an offer to acquire all the issued capital of Colonial Gas Holdings Ltd. The formal offer was submitted to shareholders on 15 January 1973 after it had been unanimously recommended by the directors of the

company and on 3 April 1973 an Act passed by the Victorian Parliament entitled the *Gas and Fuel Corporation (Colonial Gas Holdings Limited) Act* 1973, came into operation. Ownership of Colonial Gas Holdings Ltd of which The Colonial Gas Association Ltd is a subsidiary, passed to the Corporation and a new Board was elected on 18 April 1973. The company is continuing to operate under its own name for the time being.

Sales

Sales rose sharply following the introduction of natural gas in April 1969. During the 12 month period ending 30 June 1968, the last full year before the introduction of natural gas, sales showed an increase of only 5.5 per cent over the previous year. Although the Corporation's sales areas were enlarged through the purchase of undertakings in several country towns during the next three years, the ratio of additional consumers in these areas was relatively small compared with the total. Sales during the 12 months period ending 30 June 1972 increased by 41 per cent and the expansion ratio is currently running at 31 per cent.

VICTORIA—GAS SALES BY UTILITIES

Year	Gas and Fuel Corporation		Colonial Gas Association	
	Sales in millions of therms	Increase over previous period	Sales in millions of therms	Increase over previous period
		per cent		per cent
1968–69	108,072	12.6	18,083	17.9
1969–70	129,966	20.3	23,331	29.0
1970–71	(*a*)178,669	37.5	35,365	51.6
1971–72	247,011	38.3	49,692	40.5
1972–73	337,911	36.8	64,607	30.0

Source : Ministry of Fuel and Power.
(*a*) Includes the undertakings purchased from The Gas Supply Co. Ltd, from December 1970 and The Geelong Gas Co., acquired in June 1971, for the whole of the 1970–71 period.

The Victorian utilities realised at a very early stage that successful and economical marketing of natural gas depended on capturing large loads in the industrial sector. Industrial sales by the Gas and Fuel Corporation rose from 17,100,000 therms in 1968 to 100,429,000 therms in 1972. The principal industries concerned included paper and board manufacturers ; cement works ; brick, tile, and pipe works ; food processors ; metal fabrication and finishing ; alumina smelting and fabrication ; and for operations ancillary to the treatment of sewerage.

During 1971 two large industrial contracts were arranged. The first of these was for the supply of natural gas by the Corporation to Australian Paper Manufacturers mills at Fairfield and Maryvale. Pipelines were laid

during the year and supplies to the two plants commenced early in 1972. The second one was the largest industrial contract yet negotiated by the Corporation and the largest in Australia, involving the supply of natural gas to the Australian Portland Cement Company's works at Fyansford near Geelong. A 14 inch pipeline was laid during 1972 and gas commenced being supplied to the plant commercially on 12 December 1972.

On 8 January 1973 the Gas and Fuel Corporation and Alcoa of Australia Ltd jointly announced the conclusion of a multi-million dollar contract for the supply of natural gas to Alcoa's alumina smelter and fabrication plant at Point Henry near Geelong. Natural gas will replace fuel oils and LPG for certain processes. A pipeline, part of which was laid in 1970, has now been extended to the plant and supply commenced on 20 August 1973.

Extension to country areas

Natural gas became available in the Gippsland towns of Sale, Maffra, Traralgon, Morwell, Trafalgar, and Warragul in 1969, and at Geelong in 1971. In 1972 laying commenced of a system of pipelines totalling about 125 miles to bring natural gas to Victoria's two largest inland cities, Ballarat and Bendigo, and to Castlemaine and Bacchus Marsh. This pipeline was completed during the first half of 1973 and in April 1973 Ballarat commenced being supplied with gas. Conversion followed progressively in Bendigo, Castlemaine, and Bacchus Marsh. The laying of a pipeline to the township of Melton about 20 miles west of Melbourne and which is adjacent to the pipeline route to Ballarat, has commenced, and it is expected that natural gas will become available there during the early part of 1974. The supply of natural gas to all these areas is aiding decentralisation of population and industry.

Petroleum industry

Early history

Petroleum products were first imported into Victoria during the latter years of the nineteenth century and initially the principal one was kerosene. However, as the use of the motor car grew during the early years of the present century, the demand for petrol gradually overtook and passed that for kerosene and it became necessary to construct bulk storage facilities (now known as tank farms) at Newport, Williamstown, and Port Melbourne to hold reserves of the quantities required and to install special discharging facilities at adjacent wharves where the then rather primitive tanker could unload its highly inflammable cargo. As the demand for motor spirit grew during the 1920s tank farms were erected at Geelong and Portland; and Commonwealth Oil Refineries (later to be sold by the Australian Government to the British Petroleum Company) erected Victoria's first refinery at Laverton, about 12 miles south-west of Melbourne.

Modern refineries

Victoria's second refinery, operated by Standard Vacuum, opened at Altona in 1949 and five years later was expanded into a full scale, modern plant. This resulted in the operation of the nearby C.O.R. refinery at Laverton becoming uneconomical and it was closed in 1955. The Shell Company of Australia opened a refinery, now the most extensive in Australia, at Corio near Geelong during the same year, and laid Victoria's

first long distance oil pipeline, 8 inches in diameter and 33 miles in length to convey refined petroleum products (white) to the company's distribution installations at Newport.

The establishment of these two refineries resulted in an increase in the range of finished and semi-finished petroleum products and made available for the first time in Victoria products such as refinery gas and liquefied petroleum gas, which were highly suitable for use in the gas industry after blending with gases produced from black coal, brown coal, and oil. When a third large refinery was erected at Crib Point on Western Port by BP Australia Ltd in the mid-1960s, almost the whole of Victoria's petroleum products requirements could be satisfied from local refineries.

Refined products from the BP refinery were taken to the company's distribution terminal at Dandenong about 20 miles south-east of Melbourne through a 23 mile, 8 inch pipeline. The first duplication of an existing long distance oil pipeline occurred in 1965 when Shell laid its second pipeline from its refinery at Corio to its storage and distribution facilities at Newport for the purposes of conveying fuel and furnace (black) oils.

At this time the base stock for refining was imported crude oil of a heavy type which resulted in large volumes of fuel oil, industrial diesel fuel, and automotive distillate becoming available to make a highly significant contribution to the State's energy requirements. This position, however, changed during the early 1970s when the lighter indigenous Gippsland crudes became available to Victoria's three refineries. The result was an increased production of lighter or " white " products such as petrol and aviation turbine fuel and kerosine. However the importation of some Middle East and Indonesian crude oil continued to be necessary to produce asphalt or bitumen and heavier or " black " fuels of an industrial and fuel oil type.

Gippsland crude oil

The first shipment of Gippsland crude was made from the Long Island Point jetty late in March 1970 and initially tankers transported Gippsland crude to all of Victoria's three refineries. The first one to be connected by pipeline was the BP refinery at Crib Point, which was connected in May 1969 by a 42 inch diameter pipeline 7 miles in length with the Long Island Point tank farm. At the same time connection was made to the north berth of the adjacent jetty and the first tanker of Gippsland crude was loaded there early in July of that year.

Construction of the second principal crude oil distribution lines to Victoria's refineries began in September 1971 when Shell as the operator for W.A.G. Pipeline Pty Ltd, a joint Shell–Mobil–Esso enterprise, commenced laying an 84 mile pipeline to Victoria's two other refineries. This line comprised 51 miles of 24 inch diameter pipe from Western Port to the Altona refinery operated by Petroleum Refineries (Australia) Pty Ltd and 33 miles of 16 inch diameter pipe to the Shell refinery at Corio near Geelong. It commenced operating on 27 August 1972 and to 31 May 1973 it had conveyed 35 million barrels of oil.

The three Victorian refineries are now absorbing Gippsland crude oil, wholly through pipelines at an average rate of approximately 170,000 barrels a day or about 52 per cent of the total available from the Gippsland fields. Western Port is now the second busiest port in Victoria due to tankers loading crude oil for delivery to refineries.

Refining

The introduction of Gippsland crude in 1969 caused some refineries to modify their refining process and in some instances to install new plant. Until that time output had been designed for the processing of heavy crudes from the Middle East and Indonesia blended with small volumes of light indigenous crudes from the Moonie and Barrow Island fields. All Australian crudes are light with low sulphur content containing mainly fractionations suitable for the production of petroleum, jet fuel, and diesel oils. The BP refinery needed only very minor modifications but Shell and P.R.A. installed additional plant and modified their processes to overcome the problems encountered. The Shell refinery at Corio erected an alkylation plant during 1970 at a cost of about $6m and nearly doubled its electricity generation plant while the P.R.A. refinery at Altona carried out a big expansion and modification programme, including additional pipelines, costing about $26m.

After the work had been completed the Shell refinery had increased its processing capacity to between 104,444 and 110,000 barrels a stream day (b s d) according to the blend of indigenous and imported crude oils used. Production at the P.R.A. refinery just using 100 per cent Gippsland crude is now rated at 93,000 b s d while the BP refinery at Crib Point almost wholly using Gippsland crude remains unchanged at 50,000 b s d. The total refining capacity is 11,780,000 tons a year. The various expansion and conversion programmes cost about $50m and increased Victoria's maximum refinery capacity to 253,000 b s d or about 36 per cent of Australia's total. Shell also operates a lubricating oil refinery at Corio and imported crudes are used for the production of special oils and for bitumen, asphalt, and certain other " heavy ends " products.

Petroleum products

Motor spirit in two grades—98 octane (super grade) and 89 octane (standard grade)—and a wide range of other petroleum products are marketed in Victoria through a number of industry terminals and depots and 4,803 retail outlets (31 December 1972), the majority of which are operated by the nine major oil companies. Victoria has a capacity to store in bulk 707,685,000 gallons at 22 installations in Melbourne (15), Geelong (1), Crib Point (1), Long Island Point (1), and Portland (4), including refineries.

A fourth refinery is currently under construction at Hastings. This will be operated by Henry Roach (Petroleum) Pty Ltd, a subsidiary of I.O.C. Holdings Ltd. The necessary storage tanks have been erected but no processing facilities have yet been installed, nor pipelines laid.

These quantities total 1,430,981,000 gallons or 25 per cent of the Australian total of the main petroleum fuels.

About three quarters of Australia's petroleum products requirements, principally the light ends, are met from Australian crude oils. The balance are derived from imported crudes, the bulk of which come from the Middle East (Persian Gulf) with lesser amounts from Indonesia and Brunei.

The principal products marketed in Victoria's marketing area are shown in the following table:

VICTORIA—PRINCIPAL PETROLEUM PRODUCTS MARKETED, 1972

Item	Quantity
	'000 gals
Motor spirit	718,835
Automotive distillate	159,936
Industrial diesel fuel	93,651
Fuel oil	308,663
Heating oil	73,919
Aviation turbine fuel	56,597
Aviation gas	3,172
Lighting kerosene	12,418
Power kerosene	3,790

Source: Fuel Branch, Department of Minerals and Energy, 1972.

Propane, butane (LPG), and ethane

Liquefied petroleum gas (LPG) comprising almost wholly propane and butane is a fuel assuming significance in the petroleum industry in Victoria. While some LPG is produced at each of the three refineries in the State, the largest quantity is produced at the Esso–B.H.P. fractionation plant at Long Island Point. After treatment of the gas liquids received from Longford at the fractionation plant, marketable propane and butane are stored in refrigerated storage tanks to await shipment to overseas markets—principally Japan.

On 5 July 1970 the first load of propane and butane was exported from Long Island Point in a refrigerated carrier to Japan. Since then many tankers have been loaded for destinations outside Victoria. About two thirds of the overseas shipments have been made to markets in Japan. Some has also been shipped to Argentina, Spain, and the Pacific islands. The balance of the shipments have been made in small pressure carriers to ports in Australia. Of significance was the maiden voyage of the world's largest LPG carrier, *Esso–Fuji,* to Long Island Point in March 1973. This vessel, capable of carrying nearly 60,000 tonnes of LPG, is scheduled to ply regularly between Western Port and Japan.

To 30 April 1973, 748,064 tonnes of propane and 1,047,861 tonnes of butane had been shipped. These volumes also contribute about 2 per cent of the revenue of petroleum royalties.

Ethane gas, the third product, was first conveyed on 31 December 1972 through a pipeline 10 inches in diameter and 49 miles in length to the Altona Petrochemical Company Ltd. Following the completion of separate contracts with Esso and B.H.P. assuring ethane shipments spread over several years the company commenced an expansion programme in 1969. This programme provided for the erection of ethane cracking facilities to produce ethylene, a raw material used in production of a wide range of plastics.