

## CHAPTER 6

# MINING, MANUFACTURING AND TRANSPORT



*Morwell open-cut coalmine, Victoria. Photograph by Ray Joyce, 1982. WELDON TRANNIES*

SINCE THE GOLD RUSHES of the 1850s mineral discoveries and mining have helped shape Australia's history. The first gold rushes brought thousands of immigrants in search of their fortune, especially to Victoria. Since the first rush, Australians have sought other minerals throughout the continent. Mineral discoveries have led to the development of railways and new settlements to serve the mines. The expansion of railways is mapped, as they are an integral part of economic development, being the means by which primary exports are moved to the ports. Manufacturing expanded in the capital cities to serve their growing populations. The expansion of manufacturing required an increasing supply of energy, resulting in the development of electricity systems and the exploitation of oil and gas. An examination of the changing pattern of Australia's trade since 1950 completes the chapter.

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**A**USTRALIA IS RICH in minerals, and the mining industry has made an important contribution to its economic growth. In addition to supplying raw materials for secondary industry, mining has been a major source of export earnings and has attracted capital and migrants from overseas. Goldmining dominated the mining industry before 1900, while iron, coal, oil and natural gas have been more important in the twentieth century.

Coal and copper were the first two minerals mined in large quantities in Australia. Coalmining commenced in the Hunter valley at the end of the 1790s, and in the 1840s copper mining became important in South Australia. But the discovery of major deposits of alluvial gold in New South Wales and Victoria in the 1850s was of greater economic importance than either coal or copper. The success of the goldfields led to an almost continuous search for gold in the other colonies; by 1860 gold had been discovered in Queensland and Tasmania.

Gold continued to be the most significant mineral in Australia from 1860 to 1880. Major discoveries were made in Queensland, including the Gympie goldfield and the Palmer field. Substantial copper deposits were discovered in South Australia, Queensland and New South Wales, and Australia also became the world's major producer of tin for a short time in the 1870s, with mines near Inverell and at Stanthorpe and Herberton in Queensland and Mount Bischoff in Tasmania.

Western Australia became a major producer of gold between 1880 and 1900. A rush to the Pilbara started in 1886 and within a decade gold was discovered at Peak Hill, Mount Magnet, Coolgardie and Kalgoorlie. In northern Queensland goldmining started at Croydon and, together with copper mining, at Mount Morgan. In 1883 silver-lead deposits at Broken Hill were discovered, and by 1886 were being smelted locally. Mining of silver, lead and copper started on the west coast of Tasmania before 1890. The first major opal field at White Cliffs in New South Wales was in production by 1890. By 1900 BHP was mining iron ore in the Middleback Ranges of South Australia.

Relatively few major mineral discoveries were made, or mining ventures commenced, from 1900 to 1960. The most significant was the commencement of mining of lead and copper at Mount Isa in Queensland. Small quantities of uranium were mined at Radium Hill in South Australia from 1910 to 1931. In 1949 uranium was also discovered at Rum Jungle in the Northern Territory, and in 1954 at Mary Kathleen. Iron ore was found in Western Australia in the 1950s.

The discovery of vast iron ore deposits in Western Australia dominated the history of mining in the early 1960s, with mining at Tom Price, Hamersley and Paraburdo. Rich nickel ore deposits were found at Kambalda, also in Western Australia, and were mined from 1967. In the Northern Territory the production of manganese commenced at Groote Eylandt. Large underground coal reserves in the Hunter valley and in central Queensland were discovered and mined during the 1970s.

Bauxite was found at Jarrahdale and Pinjarra in the southwest in the early 1960s. By the mid-1960s it was being mined in the Northern Territory and Queensland; Australia is now the world's largest producer of bauxite. Rutile and zircon are extracted from mineral sands on the east and west coasts. In 1979 a diamond deposit of world importance was discovered in the Kimberley region. Uranium discoveries to date give Australia an estimated 15-16 per cent of the western world's low-cost uranium resources.



### Major mineral discoveries

Date of first major working	Minerals
Before 1860	C Cu G
1860-1880	C Cu D G T
1880-1900	C Cu G Ir L S Z
1900-1960	Ab Bs C Cl Cu Ir L M O T U Z
After 1960	Al Bs C D Ir L N Ng Pe S U Z

- Minerals**
- Ab Asbestos
  - Al Aluminium
  - Bs Beach sands
  - C Black coal
  - Cl Brown coal
  - Cu Copper
  - D Diamonds
  - G Gold
  - Ir Iron
  - L Lead
  - M Manganese
  - N Nickel
  - Ng Natural gas
  - O Opals
  - Pe Petroleum
  - S Silver
  - T Tin
  - U Uranium
  - Z Zinc

SCALE 1:10 000 000  
 Kilometres 0 100 200 300 400  
 Simple Conic Projection with Two Standard Parallels (18°S and 36°S)

1. T Mt Bischoff
2. LS Que River
3. LSZ Mt Rosebery
4. T Renison-Bell

# Gold

**G**OLD BROUGHT WEALTH to the colonies in which it was found. Their populations increased, new towns were established and the country was opened up. The first official gold discovery was made on 12 February 1851 at Ophir in New South Wales, by Edward Hargraves. Major discoveries were subsequently made in Victoria (1850s), Queensland (1860s), the Northern Territory (1870s) and Western Australia (1890s).

There were two distinct peaks in gold production in Australia, as the first graph shows. The first peak followed the early discoveries in the 1850s, the second the discovery and development of the Western Australian fields at the turn of the century. Production reached its zenith between 1901 and 1905. After World War II production remained relatively stable, because of the government subsidy paid between 1954 and 1975 and the rise in gold prices during the 1970s.

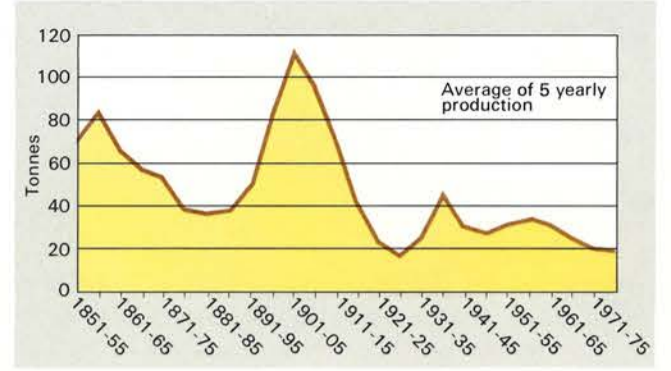
Australia's major gold producing colonies changed over time, as the pie charts show. Victoria was the country's most important gold producing colony until the end of the nineteenth century. Queensland had also emerged as a major producer by the 1890s. After 1900 production declined in the eastern states, and Western Australia became the major producer, accounting for 85 per cent of production in 1926-30. Western Australia was still Australia's major producer in the 1970s, although production in the Northern Territory had also increased significantly.

## Victoria

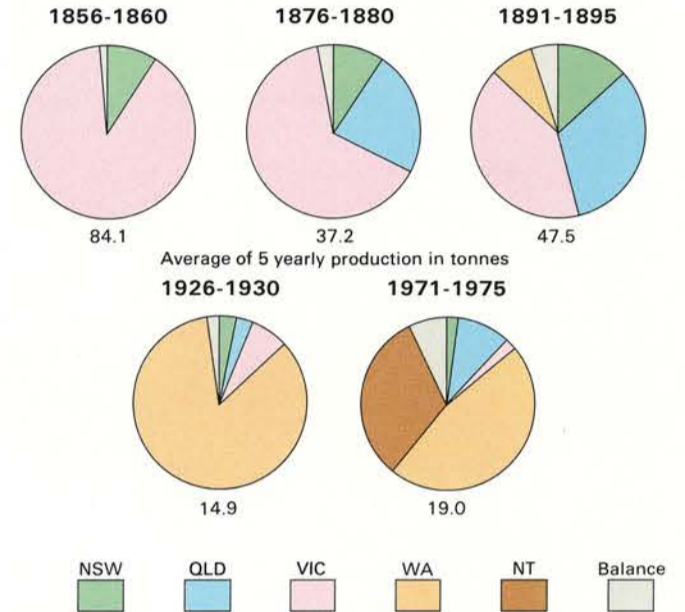
As in New South Wales, gold was discovered in Victoria before 1851. The small map shows the places in which these early, though unofficial, discoveries were made.

Major fields were discovered at Clunes, Ballarat, Castlemaine and Bendigo by the end of 1851 and at Beechworth in 1852. Diggers moved out from these established fields to find new deposits. Between 1856 and 1860, a more systematic search was made in areas already being mined, and the map shows the results of this process of infilling. During the 1860s, attention was concentrated on the search for gold-bearing reefs, particularly in the mountainous areas to the east. Walhalla was one such discovery. Little was discovered between 1870 and the end of the

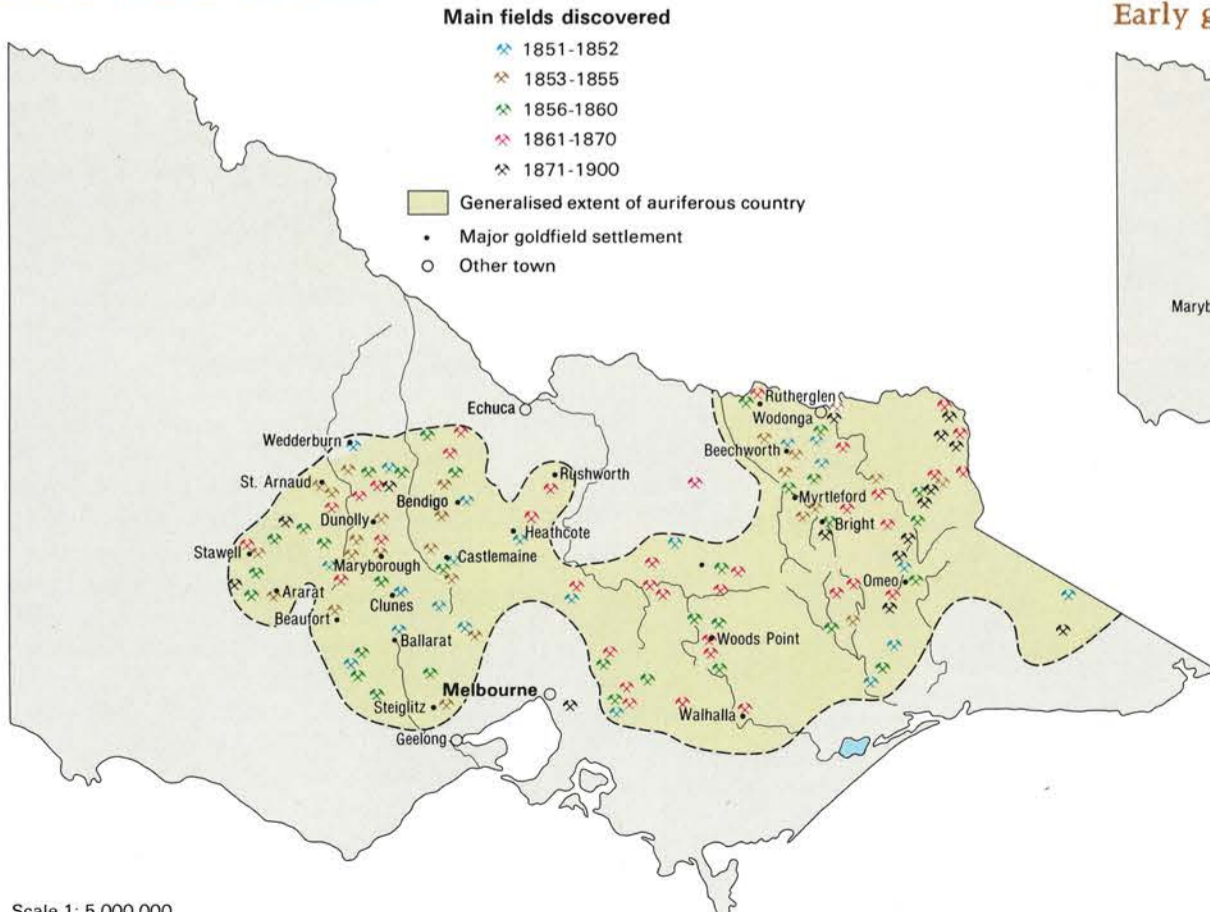
Total Australian production



Percentage share of each colony/state



## Gold in Victoria 1851-1900



## Early gold discoveries



Urban development followed gold. Many of Victoria's towns were founded during the gold years. Others owed their growth indirectly to gold. Echuca and Wodonga, for example, grew as river ports and service centres supplying the goldfields population with food and other goods.

century. By 1900, all the workable Victorian gold deposits had been found.

## Western Australia

The discovery of gold in New South Wales and Victoria wrought an almost magical change in the material welfare of those colonies. It is hardly, therefore, to be wondered at that attention of settlers in Western Australia was directed towards the discovery of mineral deposits.

So began an official contemporary history of the

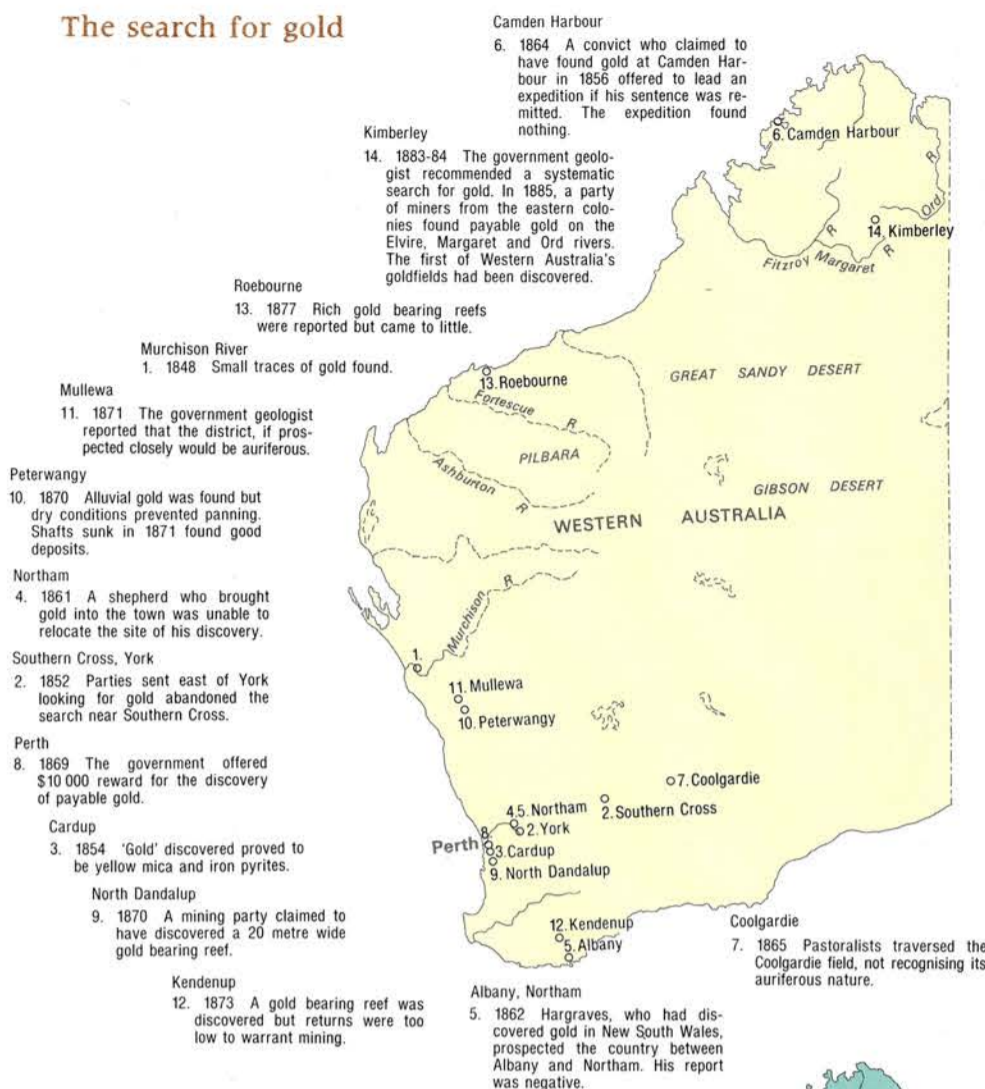
discovery of gold in Western Australia. The details of that search are shown on the map on the right.

Western Australia proved to be the richest source of gold in Australia. The map of goldfield districts presents a broad summary of developments after the discovery of gold in the Kimberleys in 1885. Until 1891, most discoveries were made in the northwest with the opening of the Pilbara, Ashburton and Murchison fields. Yilgarn was the only field in the south. In 1892 gold was discovered at Coolgardie and in 1893 the richest field was found at Kalgoorlie, the famous 'golden mile'. From 1892 and 1893, most goldmining activity was concentrated in the Eastern Goldfields, as the number of fields proclaimed shows.

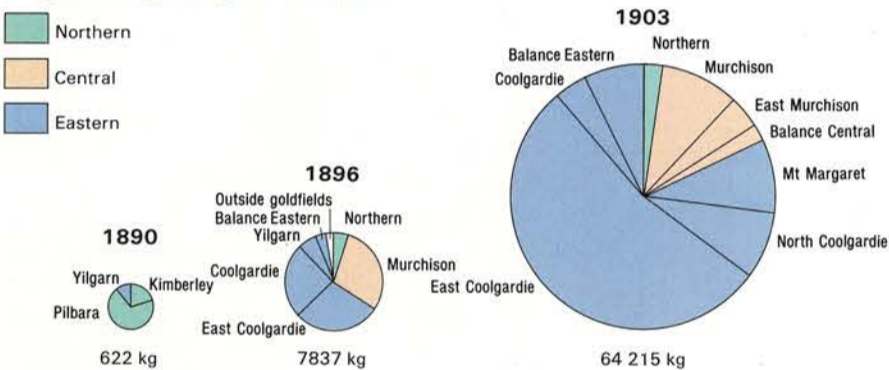
Production was not evenly distributed throughout the fields, as the pie charts show. In 1890 the Northern fields accounted for 90 per cent of production, but by 1896 their share had dropped to 5 per cent. The Central fields accounted for 29 per cent and over half the gold produced in the colony came from the Eastern fields. By 1903 the Eastern fields were the major producers, accounting for as much as 82 per cent of the state's gold.

The graph shows not only the dominance of the Eastern fields from the late 1890s but also the dominance of one field, East Coolgardie, in gold production. East Coolgardie's share of total production after 1898 was never less than 50 per cent, and it peaked at 71 per cent in the three-year period 1922-24.

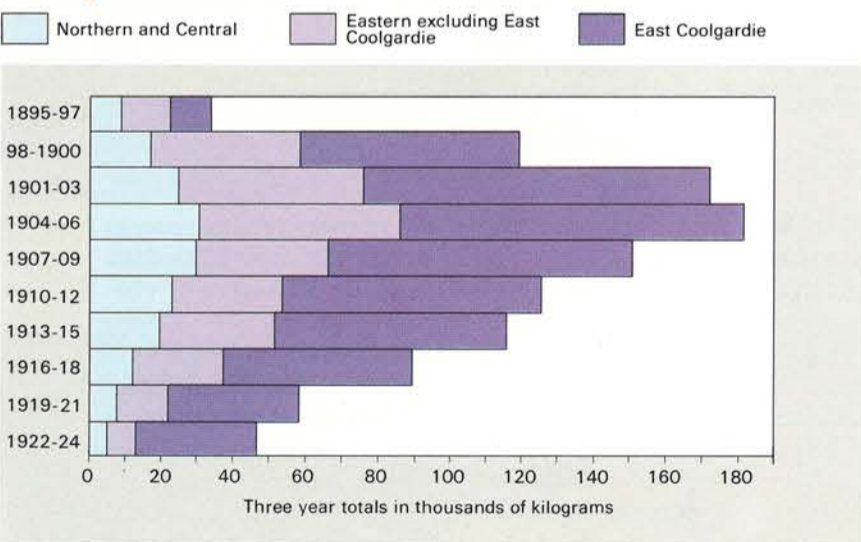
### The search for gold



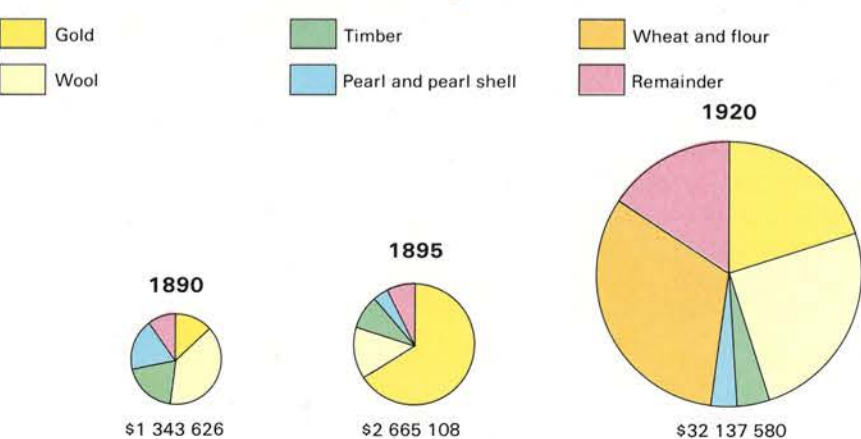
### Regional gold production



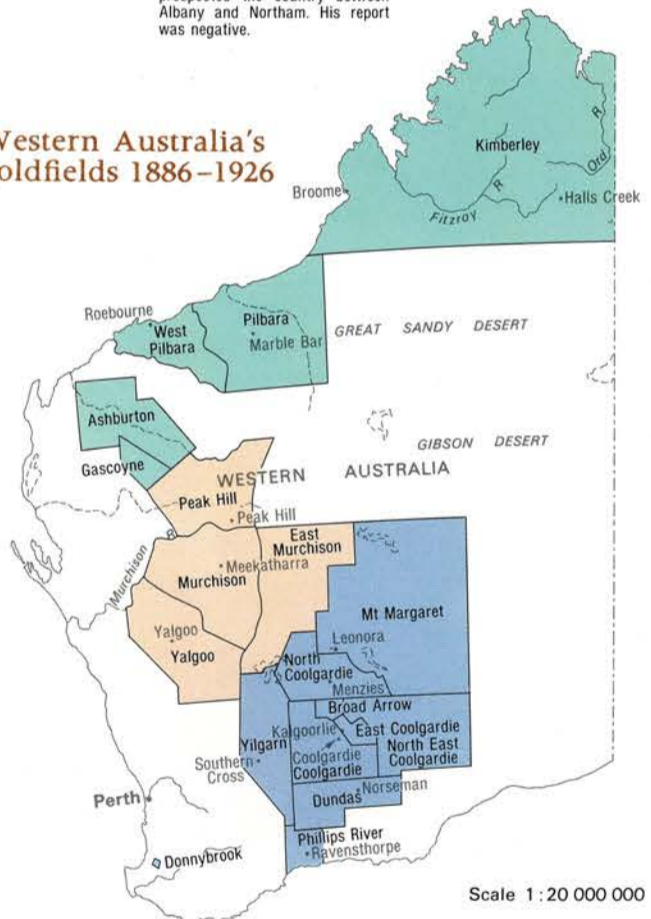
### Gold production 1895-1924



### Gold's contribution to total exports



### Western Australia's goldfields 1886-1926

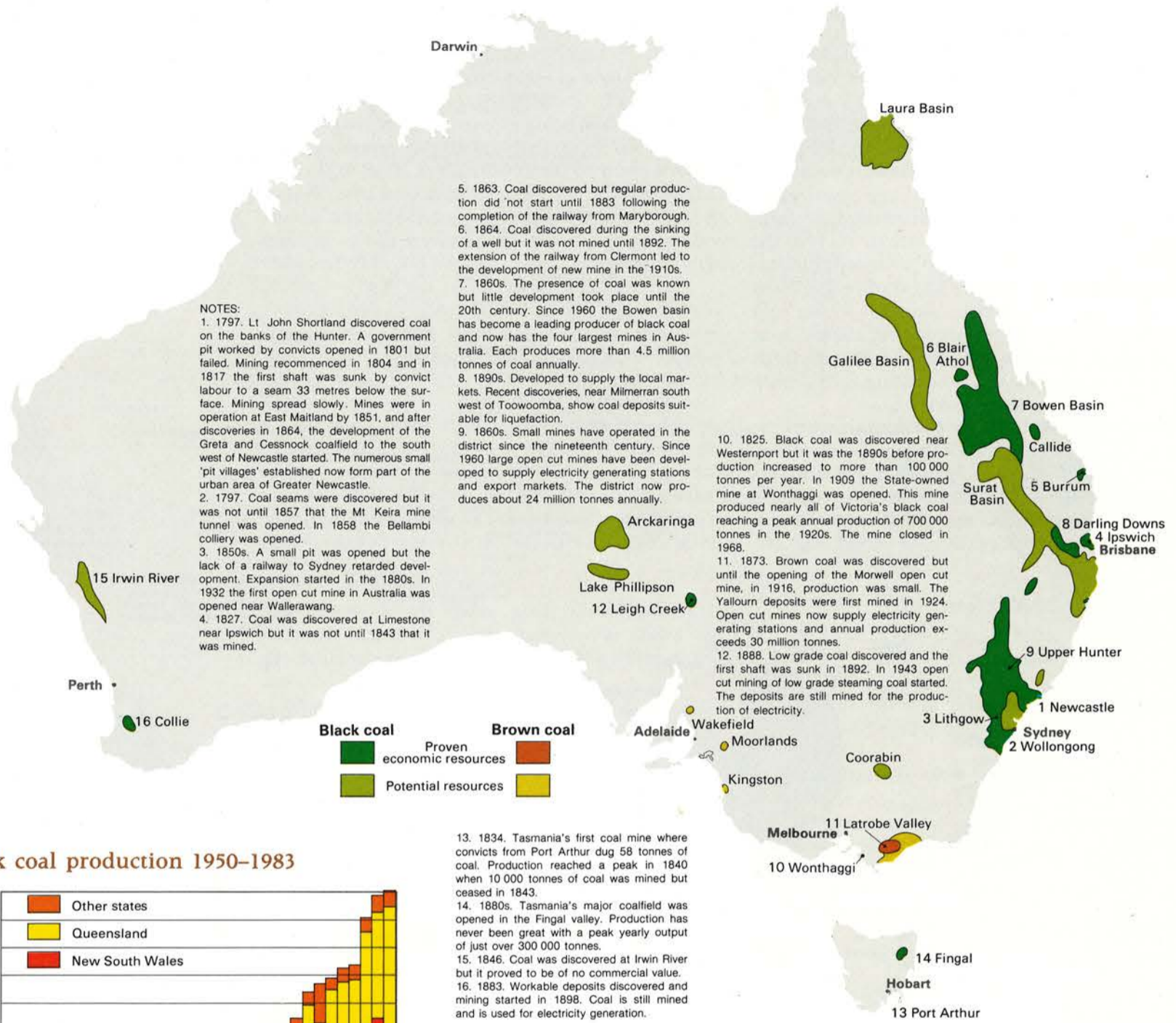


Field	Proclaimed	Year
Kimberley	NORTHERN	1886
Pilbara		1888
West Pilbara		1895
Ashburton		1890
Gascoyne		1897
Peak Hill	CENTRAL	1897
East Murchison		1895
Murchison		1891
Yalgarie		1895
Mt Margaret	EASTERN	1897
North Coolgardie		1895
Broad Arrow		1896
North East Coolgardie		1896
East Coolgardie		1896
Coolgardie		1896
Yilgarn		1888
Dundas		1893
Phillips River		1902
Donnybrook		1899

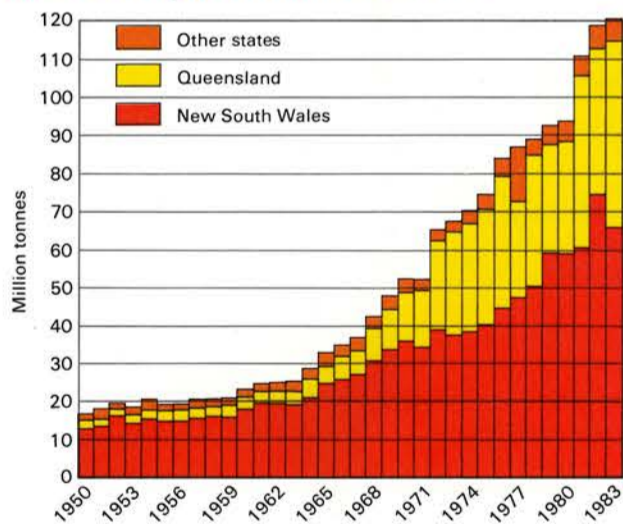
These pie charts show the impact of gold on Western Australia's exports. The value of trade rose substantially and the share of the value of exports by commodities changed. In 1890 wool was the major export earner, with timber, pearls and pearl shell earning more than gold. The discovery of the Eastern fields is clearly reflected in the pie chart for 1895. Gold began to dominate exports. By 1920, even though production had fallen, gold was still an important export earner. Exports in wheat and flour were in part due indirectly to gold, as many gold-seekers remained in Western Australia and took up land for wheat farming.

# Coal

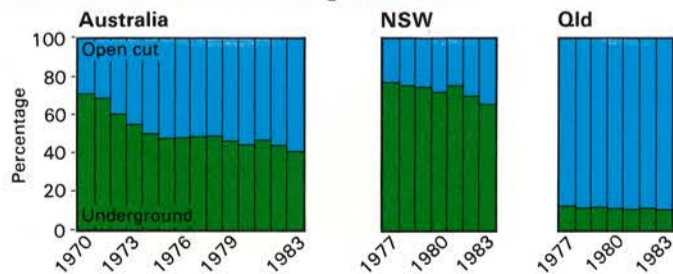
## Black and brown coal resources



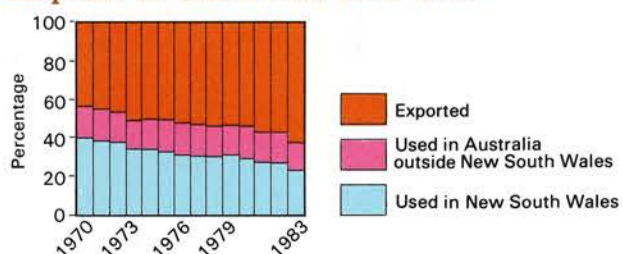
## Black coal production 1950-1983



## Sources of black coal produced



## Disposal of black coal 1970-1983



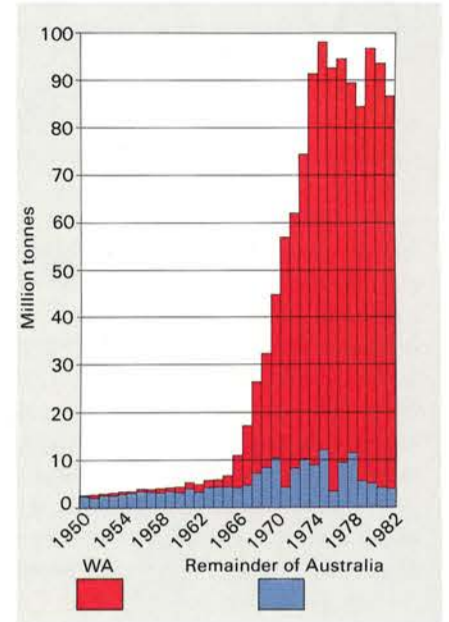
COAL WAS THE FIRST of Australia's non-renewable energy resources to be exploited, and is by far the most abundant. Australia's known coal resources include all types of coal, although anthracite is found in only very small quantities. The mining of black coal dominates, accounting for approximately two-thirds of total output. Black coal mining is concentrated in New South Wales and Queensland. Brown coal is chiefly mined in the Latrobe valley in Victoria. The production and export of black coal, principally steaming and coking coals, have undergone dramatic changes since the 1950s, when the production of black coal did not exceed 24 million tonnes, mostly from underground mines in New South Wales. During the 1960s the output of black coal doubled, still mainly from New South Wales. In 1970 New South Wales mined 36 million tonnes of a total Australian production of 52 million tonnes. The 1970s brought rapid expansion of the industry in response to the world energy crisis which pushed oil prices up. This expansion was particularly noticeable in Queensland, where production increased from 13 million tonnes to nearly 38 million tonnes after major discoveries of both coking and steaming coals in the centre of the state. Production of coal in Queensland had reached 50 million tonnes a year by the early 1980s. The majority of this increased output came from open-cut mines. Of the coal currently mined in Australia, approximately two-thirds is exported, primarily to Japan.

# Iron ore

**A**USTRALIA RANKS AS one of the world's leading producers and exporters of iron ore. It has vast reserves totalling more than 35 000 million tonnes. Although iron ore has been mined since the nineteenth century, by Broken Hill Proprietary Limited in the Middleback Ranges since 1897 in particular, significant growth in the industry did not take place until the mid-1960s. In 1952 Pilbara grazier Lang Hancock discovered iron ore in the Hamersley Ranges in northwest Western Australia. A ban on the export of iron ore, designed to ensure sufficient supplies for the Australian iron and steel industry, prevented the ore being mined until the 1960s. In December 1960 the ban was lifted, and by

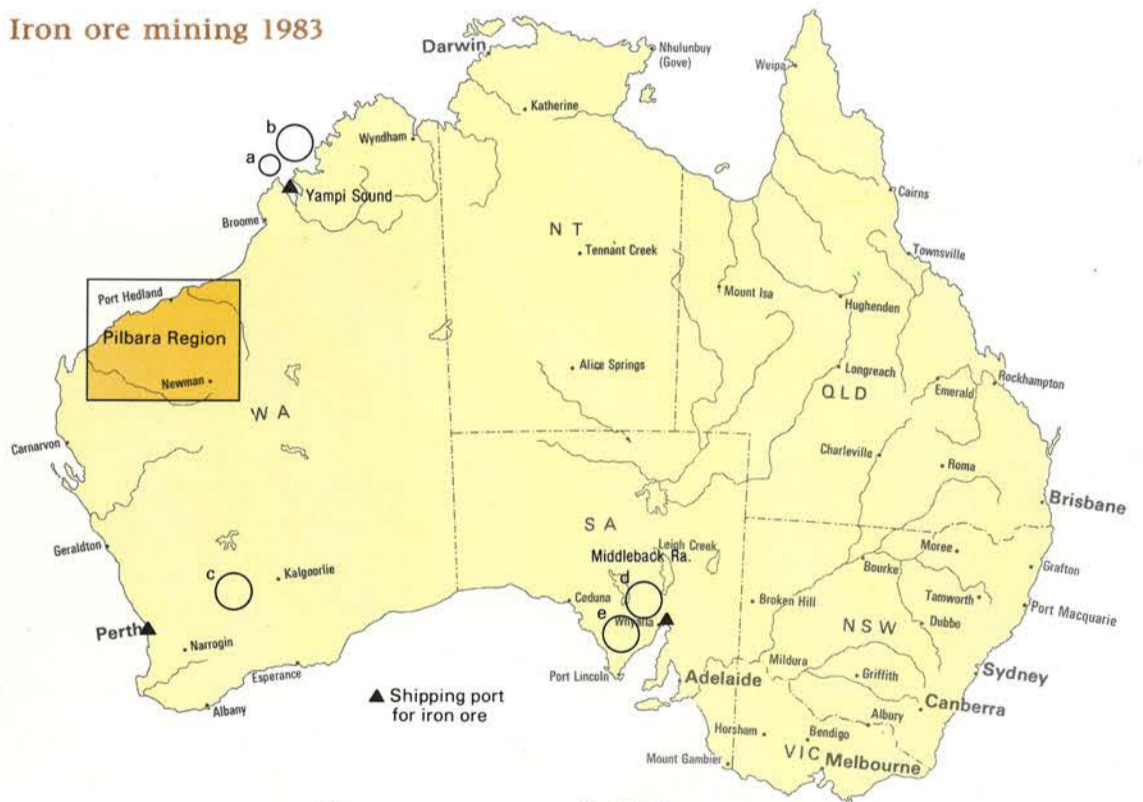
1963 the first long-term contract to supply iron ore to Japanese steel mills was signed; by 1965 production had reached 7 million tonnes. In 1966 three other companies started exporting iron ore on a large scale, from previously unexploited deposits in Western Australia. Output of ore rapidly increased: in 1970 it reached 50 million tonnes and, in 1980, 95 million tonnes; Australia had become the world's largest exporter with 80 million tonnes valued at \$1164 million. A substantial amount of ore is also used in the domestic iron and steel industry, which in 1980 produced over 7 million tonnes each of pig-iron and steel ingots.

**Iron ore production 1950-1983**



*Iron ore mining on Koolan Island in Yampi Sound, Western Australia. Mining began on the island in 1965, and the ore produced was shipped to steel mills in the eastern states for refining. Much of the Yampi Sound ore is now exported. Photograph by Reg Morrison, 1985. WELDON TRANNIES*

**Iron ore mining 1983**



- Mine**
- a. Cockatoo Island
  - b. Koolan Island
  - c. Koolyanobbing
  - d. Iron Baron-Iron Prince
  - e. Iron Knob
  - f. Savage River

- Ore type**
- Hematite
  - Hematite
  - Hematite, goethite
  - Hematite
  - Hematite
  - Magnetite

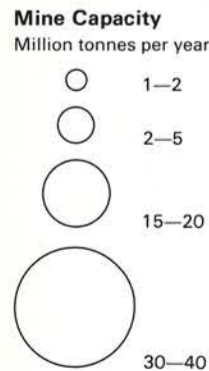
**Mining towns and ports**

Town*	Port	Company
■	▲	Goldsworthy
■	▲	Mt Newman
■	▲	Hamersley
■	▲	Cliff Robe River

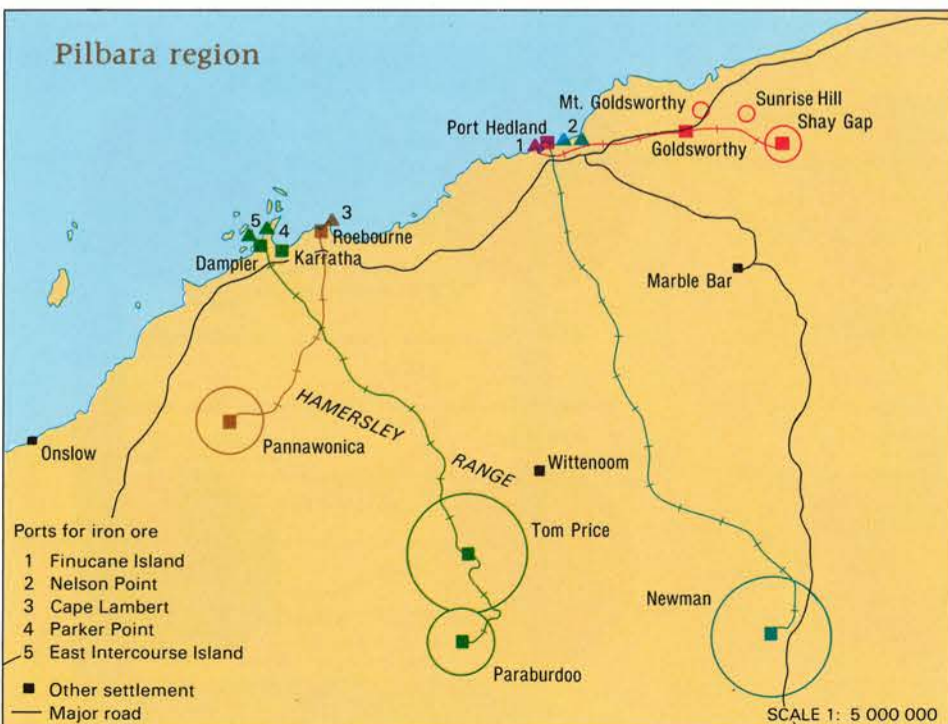
\*Includes other company residential areas

Company iron ore railways

- Goldsworthy
- Mt Newman
- Hamersley
- Cliff Robe River



SCALE 1:30 000 000



SCALE 1: 5 000 000

# Electric power

ALTHOUGH PRIVATE COMPANIES and local councils began to generate and distribute electric power in the larger cities during the 1880s, it was not until the 1920s that the demand for a clean, quiet and efficient source of energy, both in the workplace and at home, led to the extensive production of electricity. Government took an active role in supplying electricity. Generating stations were built in all major cities and country towns. Local power stations serving urban centres remained the general mode of electricity supply until the 1950s, as the map of New South Wales and Victoria shows. Most power stations were small by today's standards, with a generating capacity of less than 100 megawatts; capital cities were served by several stations. Technical difficulties in transmitting electricity over long distances restricted its use to the towns where stations had been built. Adjacent rural districts continued to rely on more traditional forms of energy: kerosene, paraffin and wood.

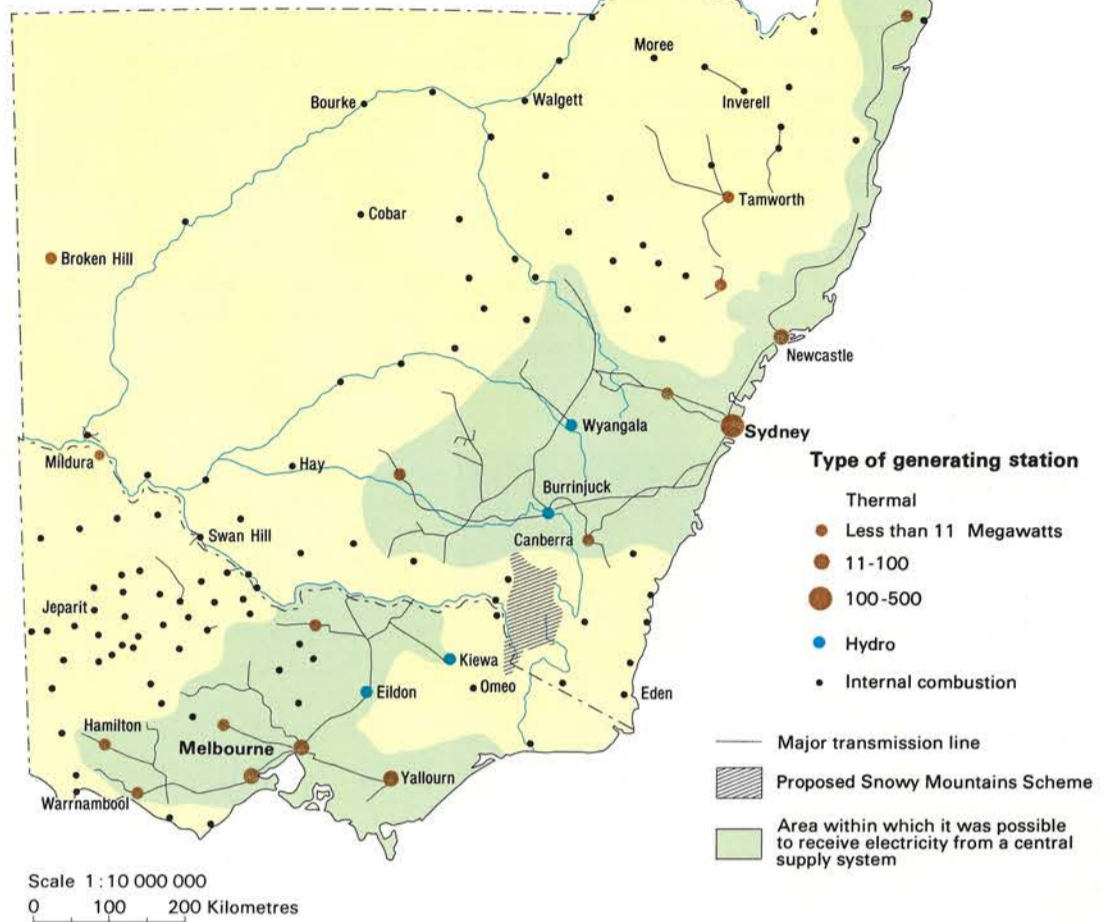
By 1981 the pattern had completely changed. Local stations were replaced by a small number of large power stations with generating capacities in excess of 1000 megawatts. Concentrated in areas close to the source of fuel, they supplied three-quarters of the total electricity in both states. In Victoria they were located close to the Latrobe valley's open-cut brown coal mines. In New South Wales, they were located close to, or had direct rail links with, the coal resources of the Hunter valley and Lithgow.

In addition to these thermal, or heat-driven, power stations, both New South Wales and Victoria had built hydro-electric power stations and obtained additional electricity from the Snowy Mountains scheme. In both states, over 90 per cent of rural areas had been supplied with electricity.

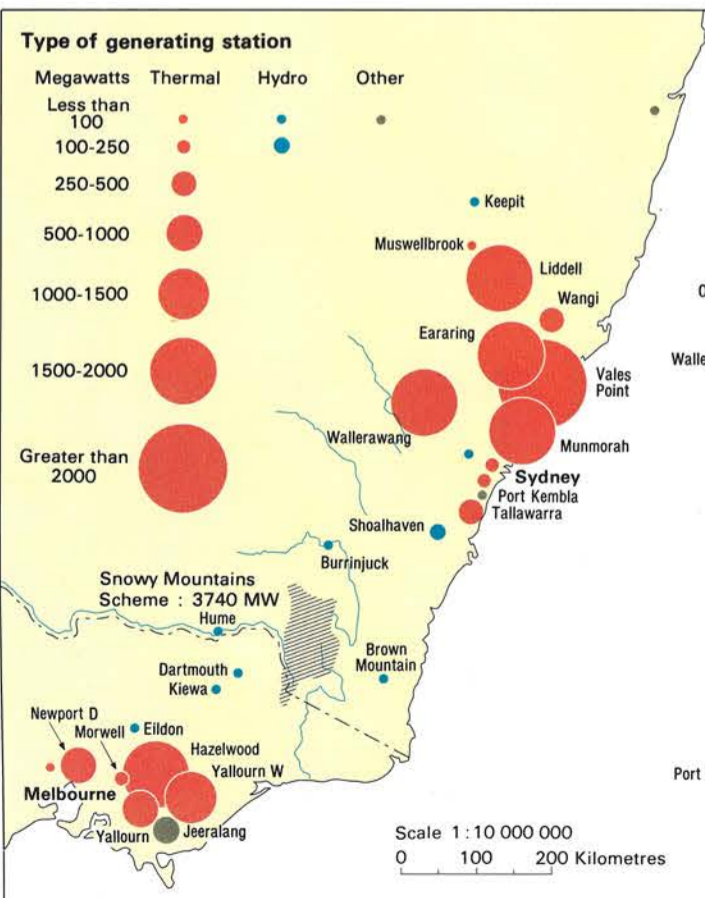
The pattern of concentration of power stations and the use of thermal sources for generation had been repeated in all other states but one by 1981. In Queensland, South Australia and Western Australia, a small number of coal-fired power stations produced two-thirds of all electricity generated. The exception was Tasmania, where 23 hydro-electric generating stations supplied 90 per cent of the state's electricity. A thermal station was built at Bell Bay

## Electricity generation 1949-1950

New South Wales and Victoria

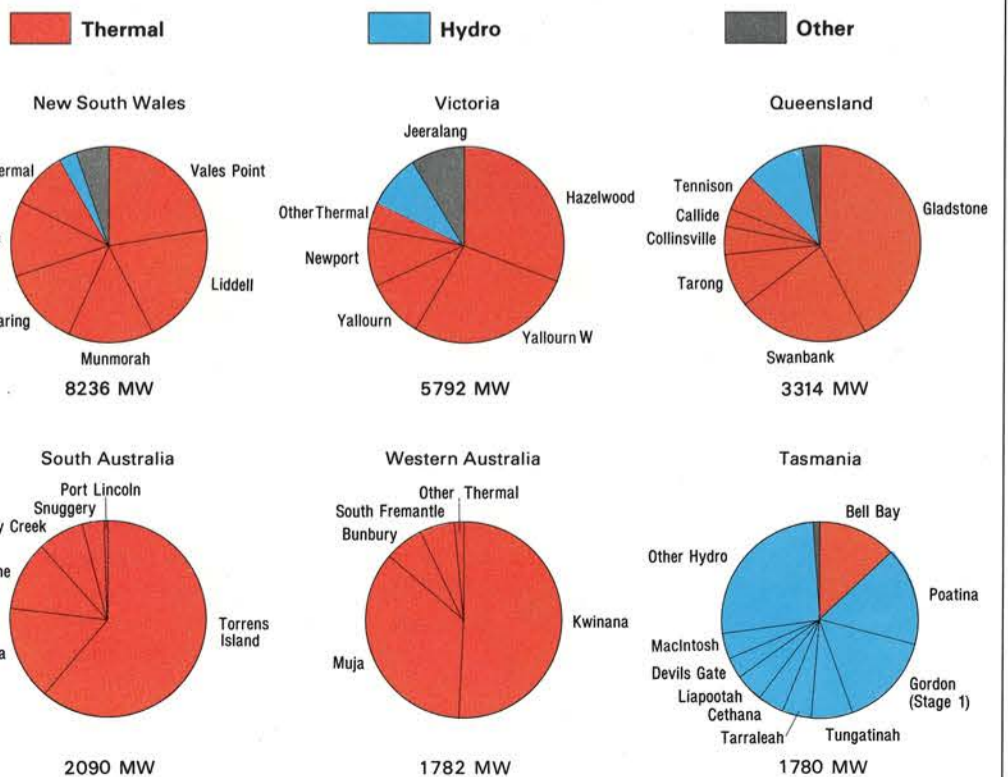


Large thermal power stations have been constructed in the upper Hunter valley in New South Wales, where there are extensive deposits of black coal. This photograph shows the 2640-megawatt Bayswater power station in its final stages of construction. The plume of steam in the background is from the 2000-megawatt Liddell power station. Water to cool the thermal generators of both Bayswater and Liddell comes from the artificial Lake Liddell, fed by the Hunter River, and by water diverted from the upper reaches of the Barnard River, a tributary of the Manning.  
ELECTRICITY COMMISSION OF NEW SOUTH WALES



## Electricity generation 1981

Sources of electric power



during the 1960s, to safeguard against drought reducing the amount of water available for electricity generation.

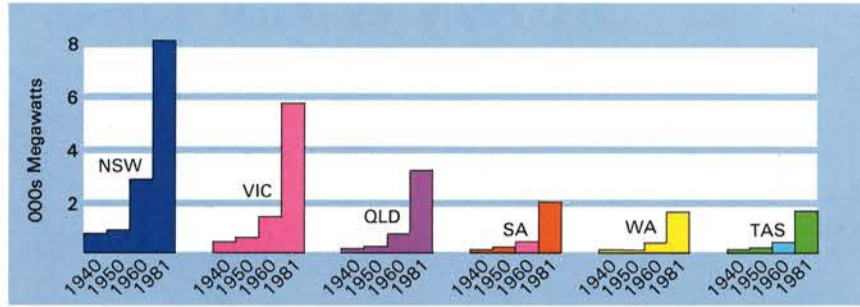
The development of generating capacity, and the use of electricity in Australia, is shown at state level in the graphs here. The variation between the states reflects the size of each state's population and the importance of its manufacturing industry, a major user of electric power. The spectacular growth between 1960 and 1981 was due to the extension of electric power supplies and to the rise in oil prices during the 1970s, which made electric power a cheaper alternative energy source.

Electricity has taken on increasing importance as a primary energy source in Australia; in 1980, it supplied 34 per cent of Australia's primary energy. By the year 2000 electricity's share will have risen to an estimated 42 per cent, making it the major source of primary energy in Australia.

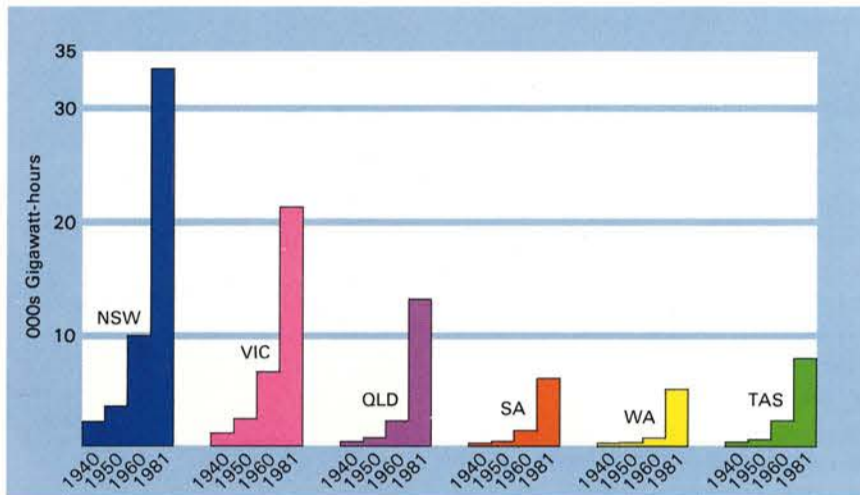
New South Wales provides a good case study of the general features of the growth in demand for electric power, the development of a state's generating capacity and the geographical concentration of power stations. Between 1960 and 1980, total electricity sales increased three-fold and demand continued to rise. Five large thermal power stations were built in the Hunter valley after 1960. The region's other power station, Wangi, was commissioned in the 1950s. The most recently built stations (at Eraring and Bayswater) have generating capacities of 2000 megawatts or more. Both are capable of producing over 8000 gigawatt hours of electrical energy each year, more than the total electricity consumed in New South Wales during any year in the 1950s. The Hunter's power stations are supplied by the valley's coal mines.

The concentration of thermal power stations can cause problems. One is acid rain, rain in which sulphur oxides, a by-product of burning coal, have dissolved, forming sulphuric acid. Acid rain harms the local urban environment and endangers rural production. The Hunter valley's vineyards are probably the best-known potential casualties.

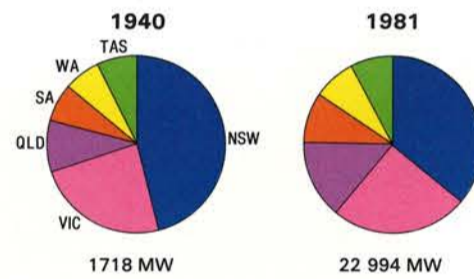
**Generating capacity**



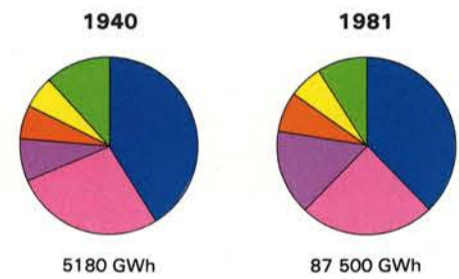
**Electricity generated**



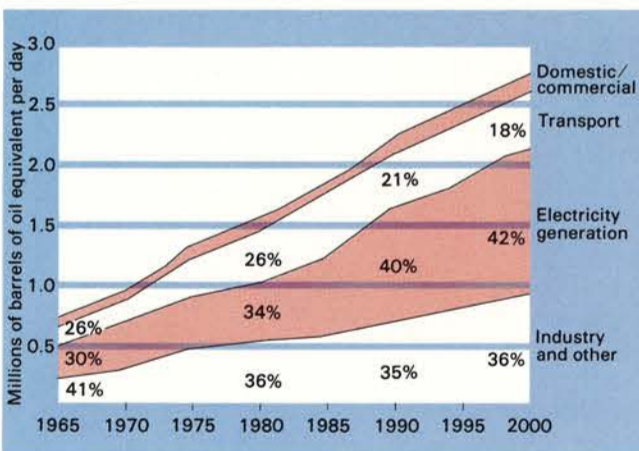
**Generating capacity**



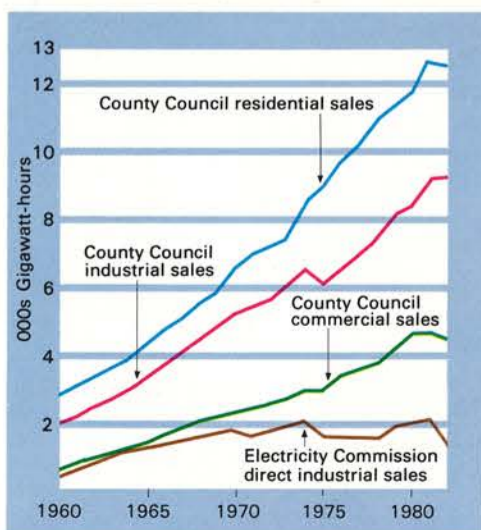
**Electricity generated**



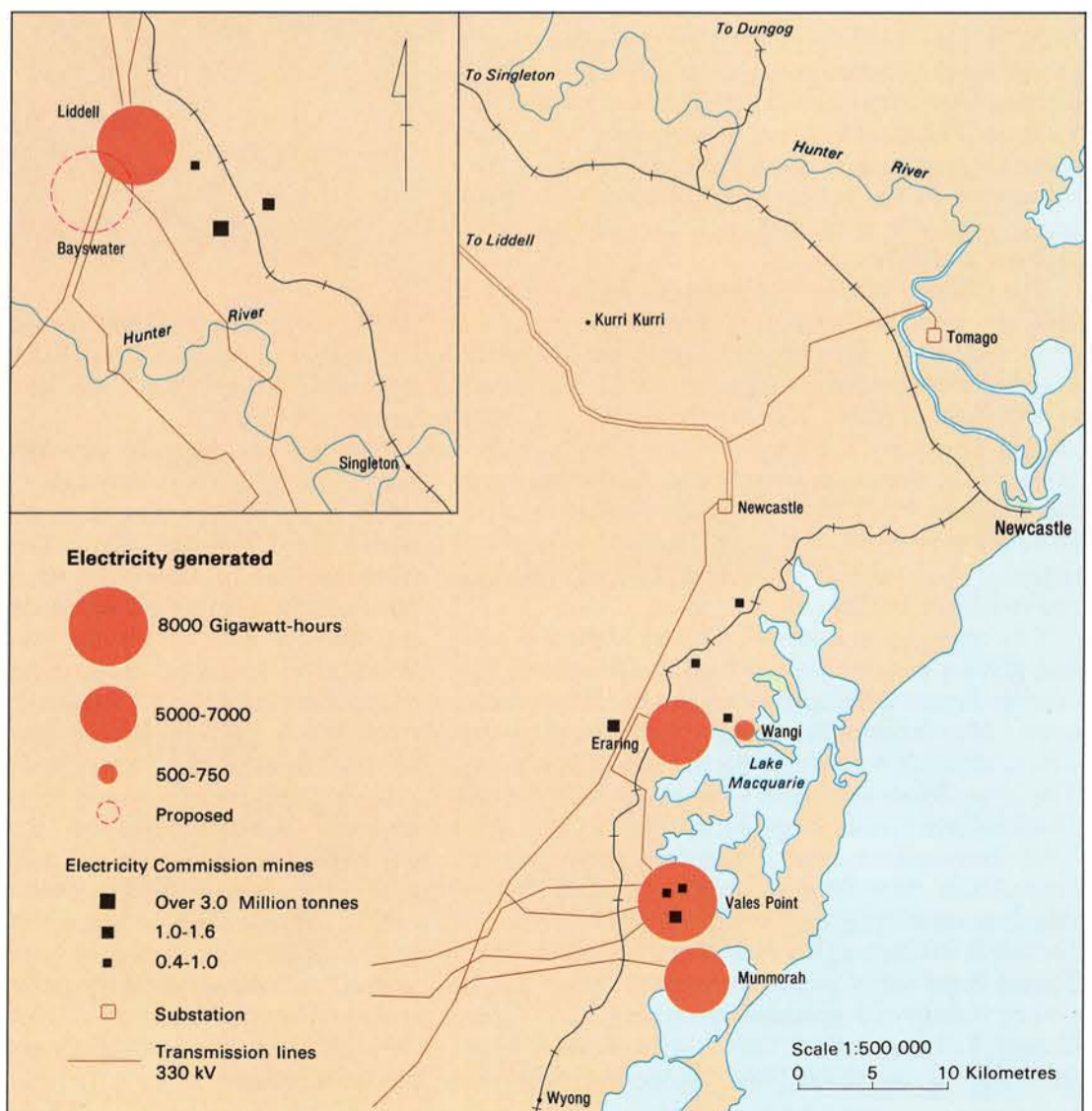
**Australian energy demand**



**NSW electricity sales**



**Hunter Valley 1982-1983**





## Snowy Mountains scheme

**T**HE SNOWY MOUNTAINS Hydro-electric Scheme was the largest and most ambitious public works project ever undertaken in Australia. Construction began in 1949 and finished in 1972.

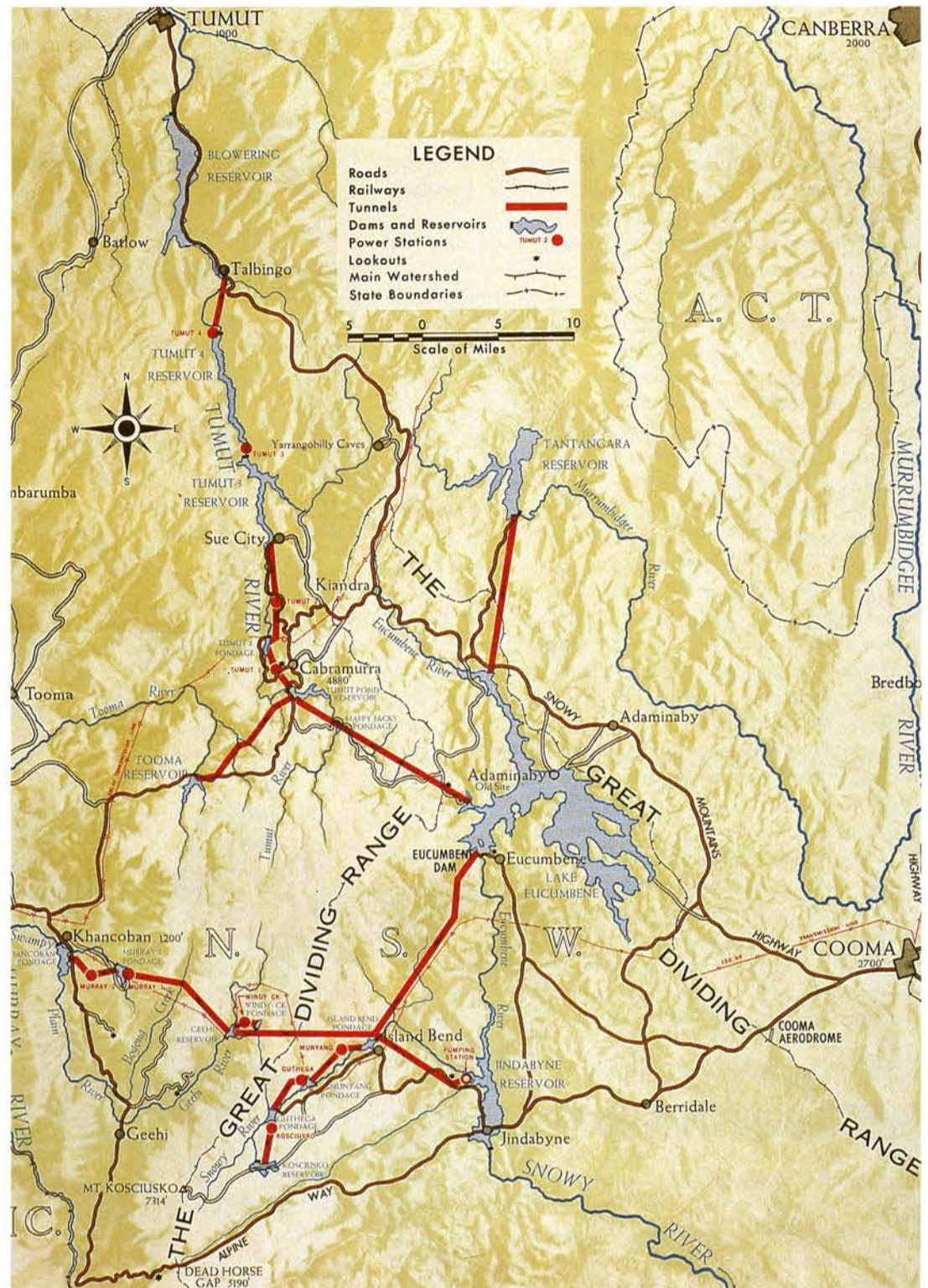
The Snowy River rises in the well-watered Kosciusko region of New South Wales and flows south, mostly through sparsely inhabited mountainous country, into Bass Strait. It used to flood regularly, with devastating effect on the dairying country near its mouth.

The Snowy River's potential for generating power had been recognised as early as 1886 when a survey by Haylock, under the direction of the surveyor-general, Adams, demonstrated that it was feasible to divert the river above Jindabyne to supply Sydney with water. The project lapsed as Sydney began to tap water resources closer to home. In 1920, William Corin proposed that the Snowy be used to generate hydro-electricity. In 1926, T.W. Keele investigated the possibility of diverting the Snowy at Jindabyne to generate electricity and supply Sydney and Canberra with water. Corin's and Keele's proposals were refined by consulting engineers in 1937, and in 1941 McKay also suggested diverting some of the Snowy's waters into the Murrumbidgee River for irrigation purposes. These proposals were further investigated in 1942 and in 1944. The report submitted to the New South Wales government in 1944 proposed the diversion of the Snowy to the Murrumbidgee via a storage at Jindabyne, mainly for irrigation purposes, but also to provide some hydro-electric power. The Victorian government, naturally interested in any plans that would affect a river running through the state, suggested that the water be diverted from Jindabyne to the Murray. The commonwealth government had also been considering diverting the Snowy as a postwar reconstruction project.

The three governments met in 1946 and established a committee which submitted a report in 1948. In July 1949 the Snowy Mountains Act was passed by the commonwealth parliament with supporting legislation passed in New South Wales and Victoria. The main function of the Snowy Mountains scheme was to divert water from the Snowy and its tributaries to the inland river systems, the water being used for irrigation and the generation of hydro-electric power.

The scheme outlined in 1949 was far more ambitious than any previous proposals. Two diversions were proposed. One, the Snowy-Tumut development, diverted the Eucumbene, a tributary of the Snowy, to the Tumut River and thence to the Murrumbidgee. The other, the Snowy-Murray development, diverted the Snowy at Island Bend and Jindabyne to the Swampy Plain River and thence to the Murray. Storages were planned to regulate the flow of water required. A system of tunnels and pumps was planned to realise the scheme.

The map shows how the scheme looked in 1963 and gives a general overview of the proposal. The Snowy-Tumut development tapped the Eucumbene, upper Murrumbidgee, Tooma and Tumut rivers. The completed system works in the following way. The upper Murrumbidgee's waters are diverted by a 17-kilometre tunnel from Tantangara Reservoir to Lake Eucumbene, the scheme's largest storage. From there they flow to Tumut Pond Reservoir, which is supplemented by water diverted from the Tooma River through a 14-kilometre tunnel. From Tumut Pond water passes through the three Tumut power stations to generate electricity, the largest, Tumut 3, lying below Talbingo Reservoir. From there the water flows into Blowering Reservoir



through Jounama Pondage for release into the Murrumbidgee via Tumut 1 and Tumut 2, completed by 1962, and Tumut 3 and the Blowering Reservoir, completed by 1972.

The Snowy-Murray development diverts the Snowy to the Murray through a system of tunnels, shafts and pipelines. The main diversion is from the Island Bend Pondage to the Geehi Reservoir and from the Geehi Reservoir to the Murray River power stations before release into Khancoban Pondage and into the Murray via the Swampy Plain River. When river levels are high, water is diverted from Island Bend to Lake Eucumbene, to be returned as river levels fall. Jindabyne Reservoir stores the residual flow of the Snowy and Eucumbene river systems and pumps water to Island Bend when required. Construction on the Snowy-Murray development began after Eucumbene Dam was completed, and finished in 1969.

The Snowy River scheme today supplies about 2300 million cubic metres of water annually for irrigation, and almost 4000 megawatts of electricity. It is also one of the few cases in which the often voiced desire to turn the continent's coastal rivers inland has been realised.

*Snowy Mountains scheme, c1963. Snowy Mountains Authority. NATIONAL LIBRARY*

# Oil and gas

**A**T LEAST HALF of Australia's energy requirements are met by oil and gas. Australia has aimed to reduce expenditure on foreign supplies by fulfilling the demand for oil and gas from domestic sources.

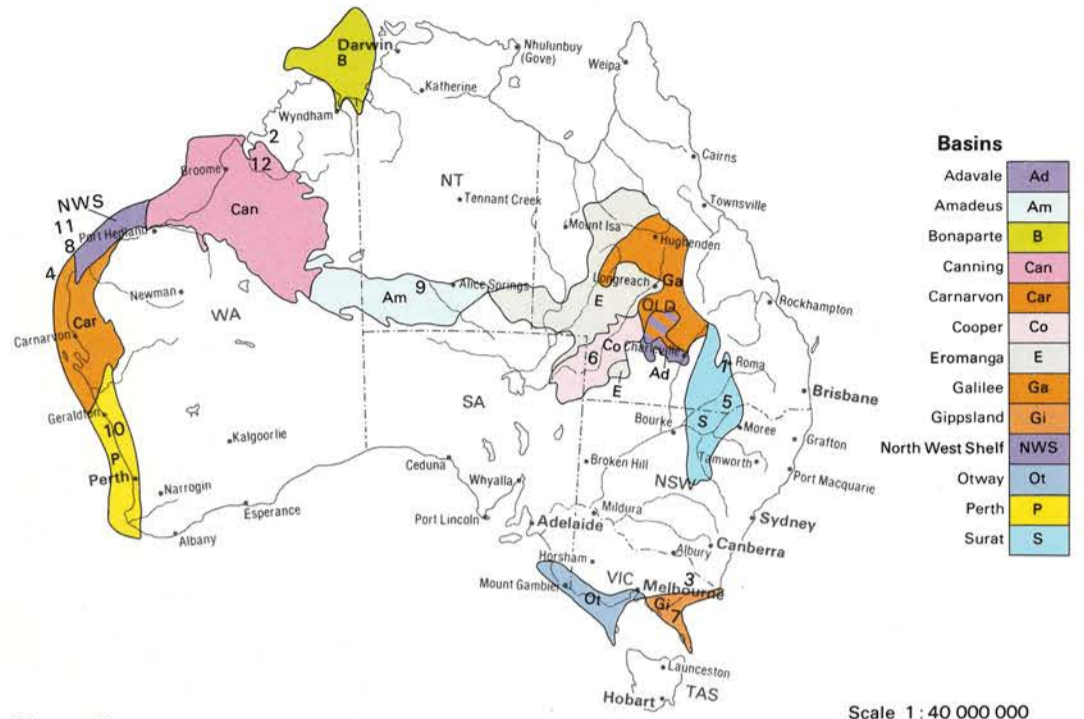
The search for oil and gas in Australia and on its continental shelf, begun seriously in the 1950s, has been concentrated in selected sedimentary basins, identified on the map. Most of Australia's demonstrated oil deposits occur in the Gippsland basin, and the off-shore portions of the Carnarvon and Canning basins contain the largest reserves of natural gas.

Australia's first commercial oilfield commenced production in April 1964 at Moonie in Queensland. It had an initial oil flow of 6000 barrels per day — one barrel is equal to 159 litres — and yielded 347 megalitres in 1964–65. The crude oil from the fifteen wells on the field was piped 310 kilometres to Brisbane to be refined.

Output of oil and gas remained small until the late 1960s when the Gippsland and Western Australian fields began to be tapped. In the early 1970s crude oil production increased, peaking in 1977–78 at 25 369 megalitres. Output subsequently fell; by 1982–83 it was 22 069 megalitres. Unless new discoveries of oil are made, supply will fall to less than 50 000 barrels (7.9 megalitres) of oil per day by the year 2000. The graph shows the estimated future supply position.

The output of natural gas has continued to increase since its first commercial tapping at Gidgealpa in the Cooper basin. By 1983 it had reached 11 765 gigalitres per year.

## Petroleum exploration and development to 1984

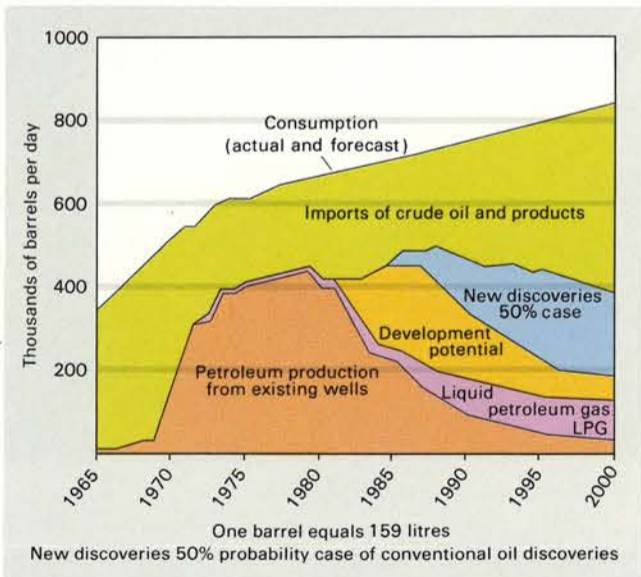


### Discoveries

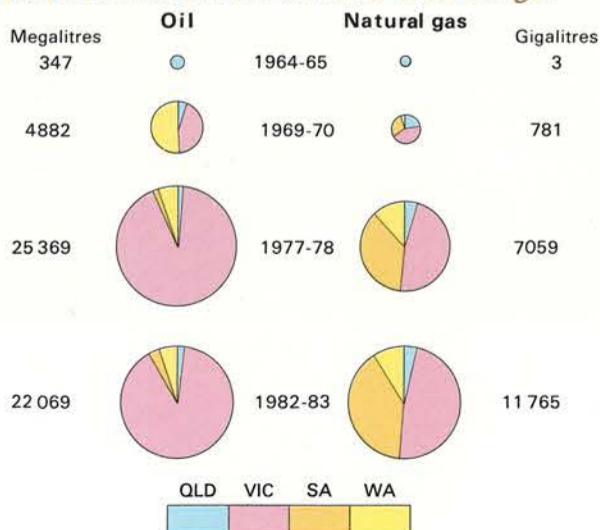
1. 1900. Natural gas discovered in Roma's town water bore. 1960, small discoveries of gas made near Roma and commercial development started and in 1969 the field was linked to Brisbane by pipeline.
2. 1919. Traces of oil found on Gogo Station in the West Kimberley district.
3. 1924. A water bore at Lakes Entrance struck artesian water which showed traces of oil.
4. 1953. A well drilled by Western Australia Petroleum struck oil which flowed for 25 hours at the rate of 3 636 litres per hour. Another 15 wells were drilled but the field proved to be non-commercial.
5. 1961. First commercial oil field in Australia discovered at Moonie. Production of crude oil started in 1964.
6. 1963. Gas, which was to lead to the commercial development of the Cooper Basin, was discovered at Gidgealpa. Following further discoveries at Moomba the field was linked to Adelaide by pipeline in 1969.
7. 1964. First off-shore well, Barracoutta 1, drilled by Esso/BHP on the Gippsland shelf. Commercial natural gas discovered in February 1965. In 1967 commercial oil discovered. Production of gas and oil started in 1969.
8. 1964. Oil discovered on Barrow Island and the field was declared commercial in 1966. The production of crude oil commenced in 1967.
9. 1964. Oil and gas discovered at Mereenie. In 1970 gas was discovered at Palm Valley.
10. 1967. Natural gas discovered at Dongarra. A pipeline was laid to Perth and production started in 1971.
11. 1971. Massive discoveries of natural gas on the North West Shelf. By the end of 1972, 23 wells had been drilled.
12. 1981. Oil discovered at Blina in the Canning Basin.

Scale 1 : 40 000 000

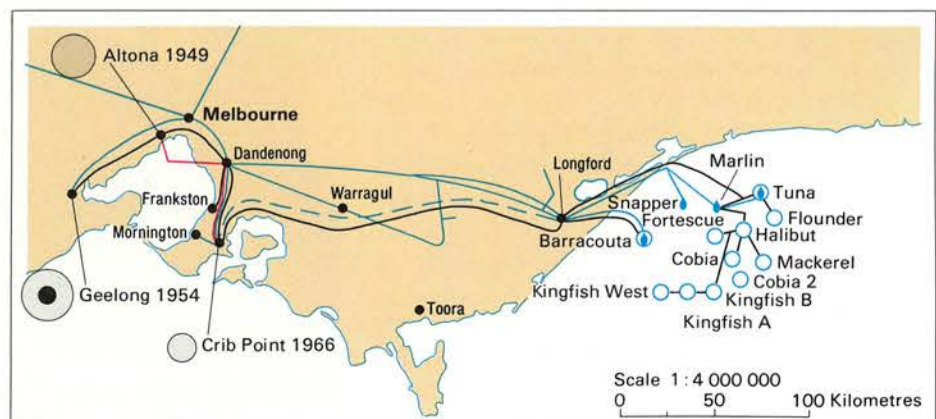
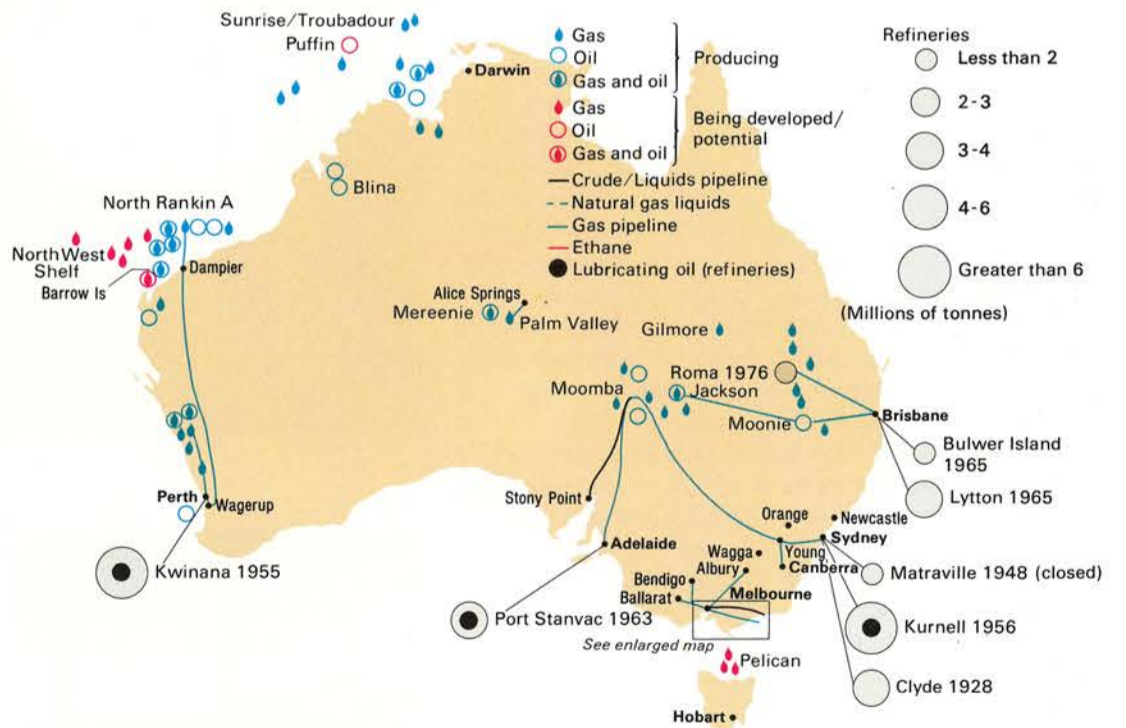
## Consumption and production



## Production of crude oil and natural gas



## Petroleum resources, pipelines and refineries 1984



Scale 1 : 4 000 000  
0 50 100 Kilometres

# Manufacturing

AUSTRALIAN MANUFACTURING BEGAN early in the nineteenth century as a series of highly varied, largely craft activities. After 1860 it expanded rapidly and narrowed in scope, broadening again after 1918. It expanded further during World War II and in the 1950s, with the aid of foreign capital and technology. During the 1960s many Australian manufacturing industries could not compete with imports, and the mineral resources boom after 1970 attracted investment away from manufacturing.

For much of the first century of European settlement, local production was given some protection against imports by the slowness and cost of transport from overseas. Between 1860 and 1914 transport improved and competition from imports intensified. Manufacturing concentrated on the processing of rural products, on repairs and maintenance, and on the production of building materials. In the late 1880s it contributed 11 per cent of the gross domestic product.

From 1890 to 1914 a shift from pastoral industry to agriculture stimulated expansion in the processing of rural products, such as wheat, meat and dairy products, which required only limited skills and capital. Because domestic transport was expensive, much processing — for example of foodstuffs, iron and steel — was done near raw materials rather than urban markets.

A severe shipping shortage during World War I encouraged the production of import substitutes such as vehicles, rubber, electrical goods and steel, which continued after the war under the protection of rising tariffs. Tariff protection attracted overseas foreign capital and technology, most of it British. By 1929–30 manufacturing employed half a million people and contributed 18 per cent of the gross domestic product. As road and rail transport improved, old processing industries moved from near the source of their raw materials, to join the more complex industries in cities.

From 1939 to 1945 war again encouraged local manufacturing and extended its range to include, for example, the making of fighters and bombers. Many men and women acquired new industrial skills. Restriction of imports after the war again provoked the inflow of capital and technology, this time much of it from non-British countries. Until the early 1960s the most rapid growth occurred in the production of durable goods — vehicles and household goods such as refrigerators, radio and television sets and washing machines. If they were to compete with imports these industries had to achieve economies of large-scale production. The alternative was to protect them from competition using import restrictions. Because of the extent of postwar immigration there was pressure to create industrial jobs, and protection continued. Quantitative restrictions on imports were abandoned in the early 1960s, restoring the tariff as the means of protection. As the tariff was high, Australian manufacturing expanded, though haltingly, to a peak in 1970 when it employed 27 per cent of the workforce (1.3 million). The iron and steel, chemical and paper industries had grown the most.

From 1970 to 1984 manufacturing declined. In 1984 it employed not only a smaller proportion of the workforce (15.5 per cent) but actually fewer people: one million. Lower tariffs resulted in greater foreign competition. Competition for capital from mining projects, and rises in oil prices and interest rates, all helped to make manufacturing less profitable. 'Stagflation' — lack of growth combined with high inflation — and general recession have accentuated its problems. Moreover, much of Australian

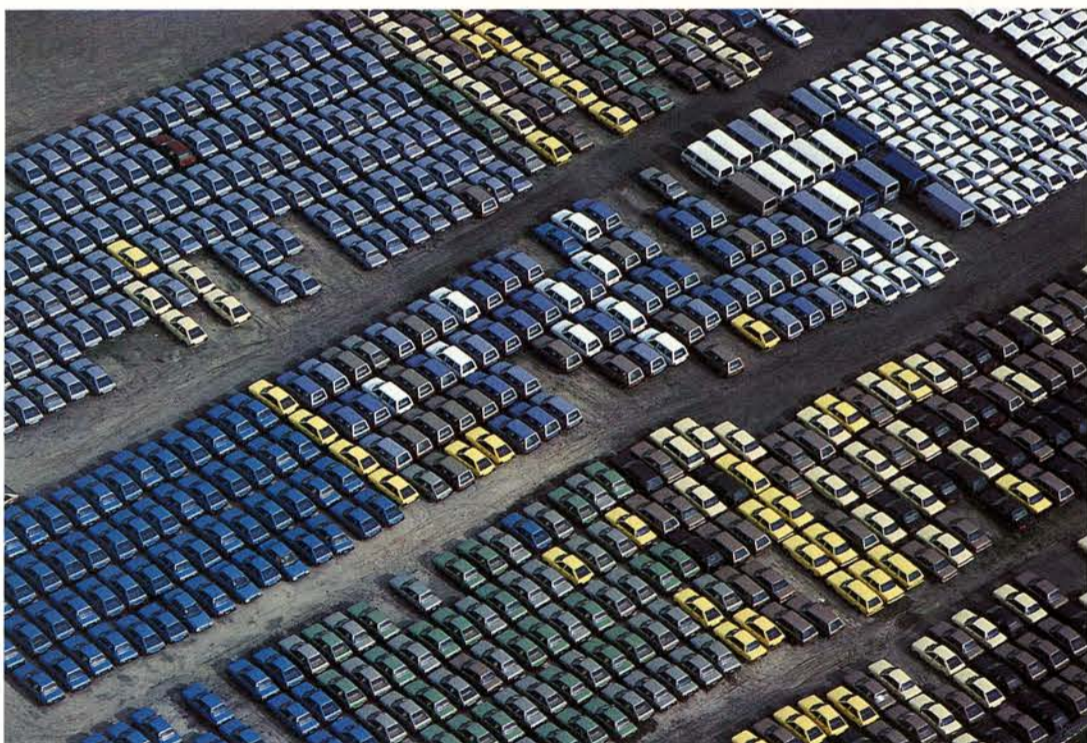


*Arrowfield winery at Jerry Plains in New South Wales. Photograph by Reg Morrison, 1982.*

WELDON TRANNIES

*Onkaparinga wool processing plant at Lobethal in South Australia. Photograph by Gunther Deichmann.*

WELDON TRANNIES



*Car assembly plant, Sydney. Photograph by George Hall, 1985.*

WELDON TRANNIES



*Tuna processing plant at Port Lincoln, South Australia. Photograph by Gunther Deichmann, 1983.*

WELDON TRANNIES

*BHP steelworks, Whyalla, South Australia. Photograph by Gunther Deichmann, 1983.*

WELDON TRANNIES

industry has become subject to the strategic decisions of multi-national corporations. Industries unable to achieve economies of scale selling to an Australian market, and those unable to afford re-equipment with new technologies, have been especially hard hit. This happened first to clothing and footwear, then to vehicles and steel.

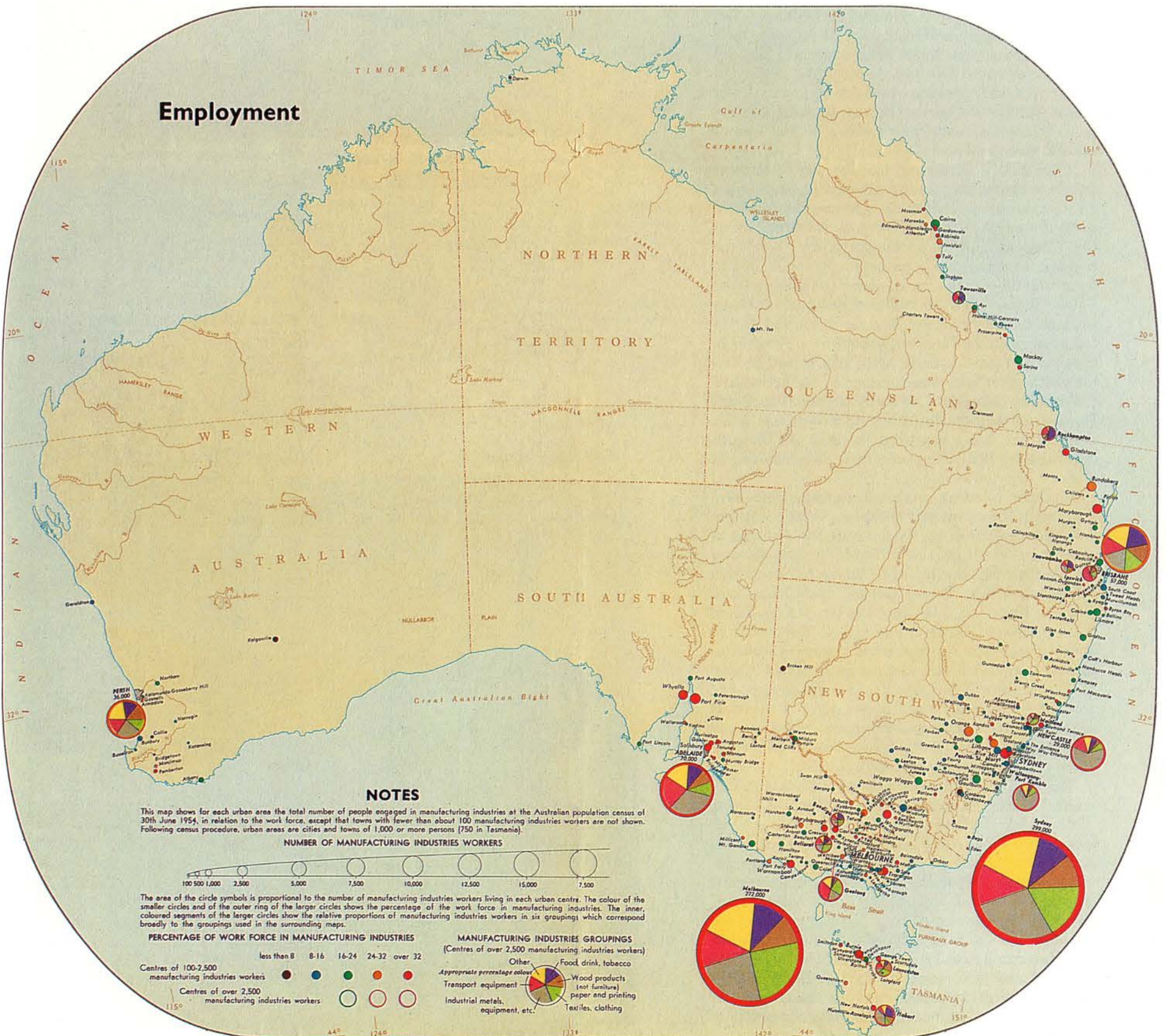
The map for 1958 shows the increased concentration of manufacturing in the main cities. Recent adverse changes have been felt mainly in those cities. The fluctuations in manufacturing are also linked to its distributions across Australia. State governments have made strenuous efforts to attract manufacturing, supported by federal parliamentarians mindful of their own electoral interests. The result has been to disperse parts of many manufacturing enterprises, fragmenting their activities and preventing the realisation of whatever opportunities there may have been for economies of scale

in a relatively small economy. Judgment on such policies is, however, a complex matter: Australians may well place a high value on the dispersion of jobs among the states.

Each capital city, together with its nearby centres (Newcastle, Wollongong and Geelong), has a wide range of industries. Few Australian manufacturers export, and as capital cities contain most of the population they constitute most of the market.

Transport improvements, such as standard-gauge rail links and better roads, have recently helped some elements of a national market to emerge. The map shows some differences in specialisation between urban locations. Sydney tends to concentrate on metal products, Melbourne on textiles and clothing and Adelaide on vehicles and household equipment. Newcastle and Wollongong specialise in metal processing. Perth, Brisbane and the small cities basically serve their own markets and hinterlands.

### Employment



# Railways

**R**AILWAYS WERE CRUCIAL in the economic development of the colonies. Australia's railway age began in the late 1850s, and patterns had emerged in railway construction and financing by the 1870s. Initially, construction was undertaken by private companies, but high costs, and poor returns on investments, discouraged them. It was left to colonial governments to finance construction by borrowing from English investors. Responsibility for determining gauges, routes, the quality of construction and services, and charges levied for passage and freight rested with politicians.

Their efforts were not always co-ordinated, particularly in the matter of gauges. New South Wales adopted the British standard gauge of 4 feet 8½ inches (1435mm), Victoria the Irish gauge of 5 feet 3 inches (1600mm), a gauge also adopted by South Australia for its main lines and Tasmania for its first line. Queensland, Tasmania and Western Australia used the narrow 3 feet 6 inches (1067mm) gauge as did South Australia on its less important lines.

Until 1870, the spread of the rail network was slow. Only 1454 kilometres of track were operating by 1870. In Victoria and New South Wales trunk lines radiated from capital cities. This pattern was to be repeated in South Australia, Western Australia and, to a lesser extent, Tasmania. Only in Queensland did a different pattern develop, with lines running inland from a number of coastal ports.

In the 1870s governments made greater investment in lines to serve the pastoral industry. In Victoria the line to Echuca, opened in 1864, was supported by lines to Wodonga (1873) and to Wahgunyah (1878), and in the goldfields and the southwest of the colony the building of branch lines was begun. In the 1870s Victoria built more than 1300 kilometres of railway. New South Wales built 812 kilometres, pushing lines towards the Riverina and Murray River and northwards through the New England district. Progress in Queensland and South Australia was steady. In Tasmania the first line, which ran from Launceston to Deloraine, opened in 1871. A second line from Hobart to Western Junction, 16 kilometres from Launceston, was completed by 1876. In Western Australia, by 1880, there were only 55 kilometres of railway.

Railway building boomed in the 1880s and accounted for about half the capital expenditure of colonial governments. By the mid-1890s an extensive branch line network had been built in Victoria and lines reached north to the Murray. In New South Wales trunk lines served Bourke, the Queensland border, Albury and Hay. Separate systems ran inland from Brisbane, Rockhampton and Townsville in Queensland. The South Australian system was connected to the Victorian system, to Broken Hill and to Oodnadatta. The Tasmanian system covered 672 kilometres and in Western Australia, Perth was connected to Geraldton, Bunbury and Southern Cross. More than 16 300 kilometres of line were open throughout the six colonies.

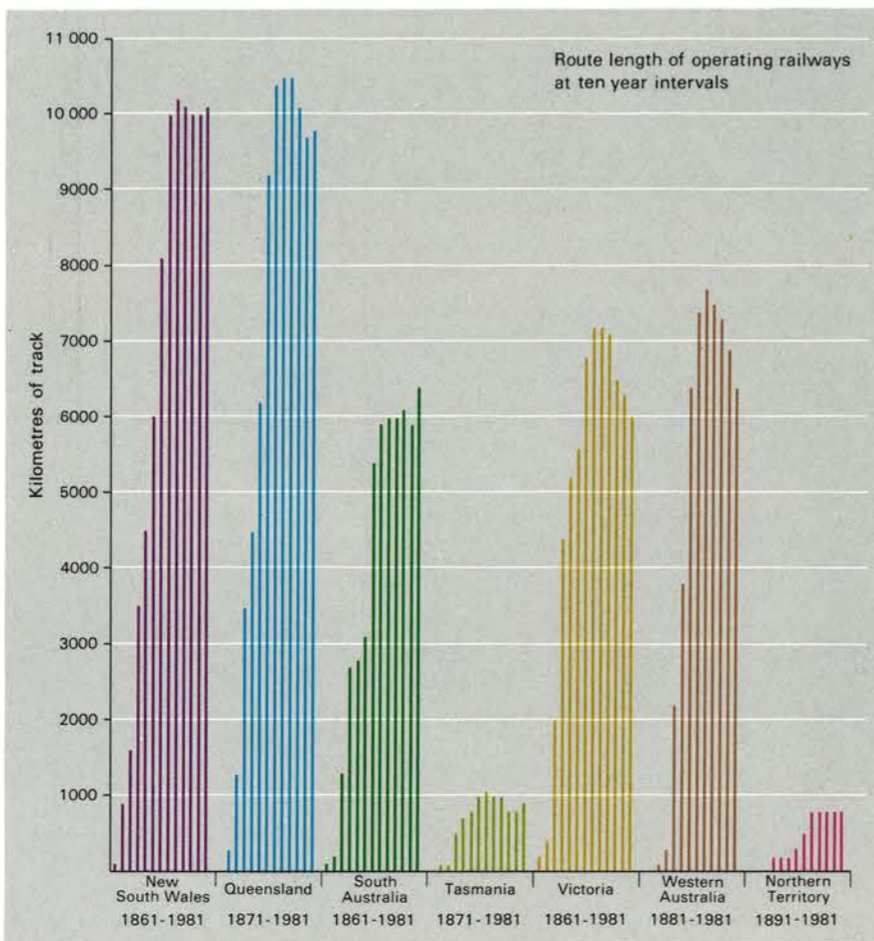
Railway construction slowed in all colonies except Western Australia during the 1890s, but in the 1900s building again gathered momentum. In Western Australia the links from Kalgoorlie to Leonora and from Geraldton to Meekatharra were completed. From 1906 the first of the state's agricultural railways was built, and by 1911 eleven such lines, totalling 508 kilometres, were operating. Closer settlement and the expansion of the wheatbelt led to the construction of several branch lines in New South Wales. In Queensland the link between Brisbane and Rockhampton was finished, and the Townsville to Hughenden line was extended to Cloncurry.

**Lines opened by**

- 1870
- 1881
- 1895
- 1911
- 1925
- 1941

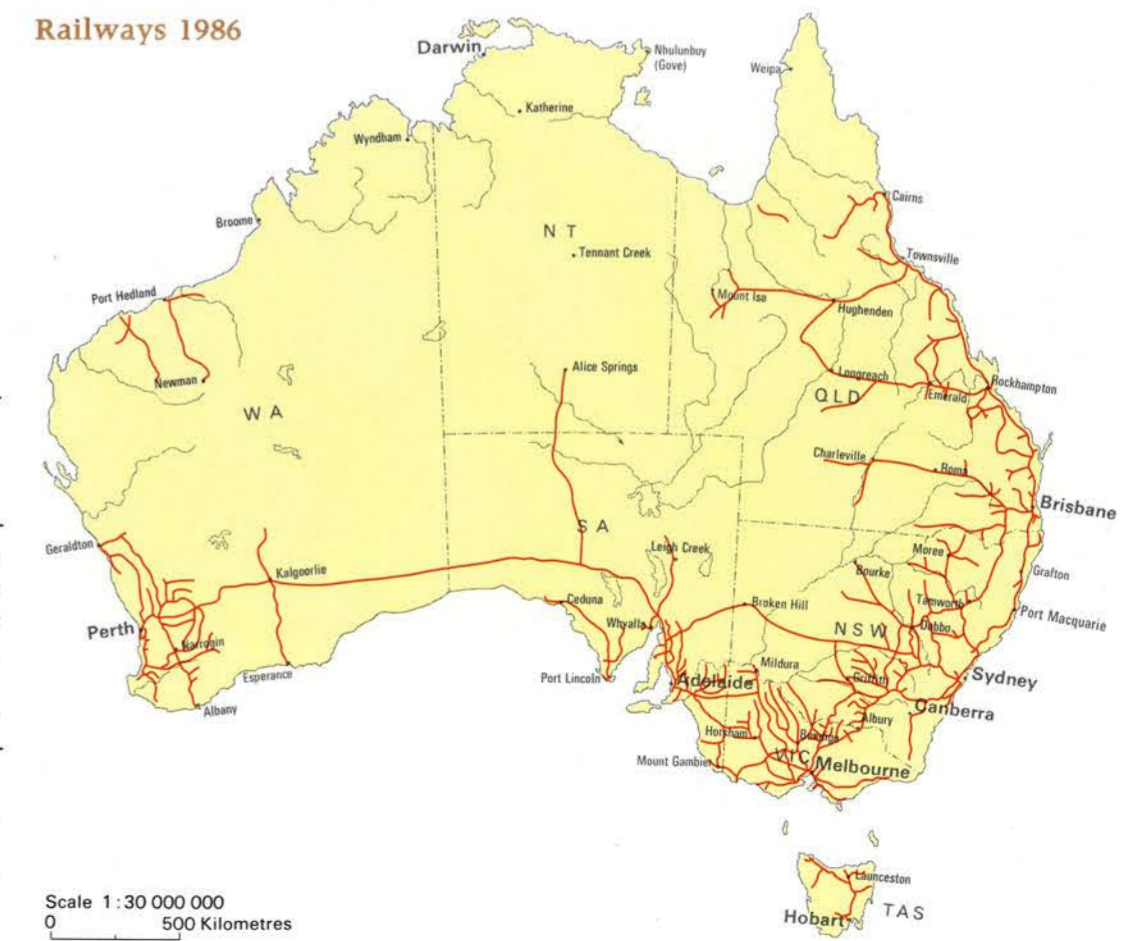


Railways 1861-1981

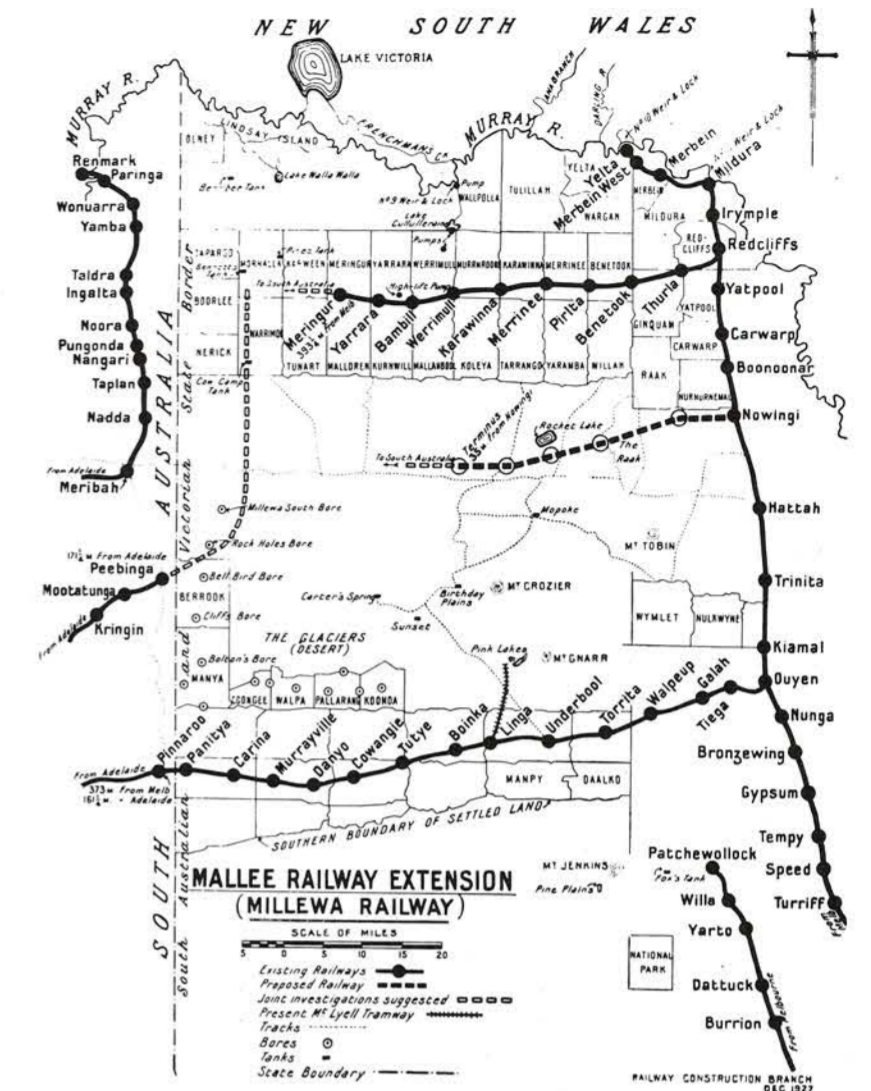


Scale 1:15 000 000  
0 200 Kilometres

Railways 1986



Scale 1:30 000 000  
0 500 Kilometres



During the 1920s, the Victorian government (along with other state governments) borrowed money for capital works, including the construction of railway branch lines. The map reproduced here shows a line proposed for an area opened up for soldier settlement, and two further links between the Victorian and South Australian systems. The map also shows the importance of railways in early twentieth-century Victoria. Most places along the lines were sidings at which farmers' produce was collected for shipment to Melbourne — such as wool, wheat and some fruit and vegetables from the irrigation settlements at Redcliffs, Mildura and Merbein. Victorian Parliamentary Papers, 1927.

From 1911 to the end of the 1920s, railway construction was carried out mainly in the wheatbelts. Branch lines were built in all mainland states. The commonwealth government started to build and operate its own railways: the east-west transcontinental link between Port Augusta and Kalgoorlie was opened in 1917; the Darwin-Pine Creek line (1879) was extended to Birdum by 1929, and the line from South Australia to Alice Springs opened in 1929. The building of new lines slowed in the 1930s, when only about 1000 kilometres were added to the system. Nevertheless, the railway network of Australia reached a peak of 43 850 kilometres in 1941.

Since 1941, many branch lines have been closed in areas where road transport was cheaper. New lines have been built to meet special needs, notably by the state government in Queensland and by mining companies in Western Australia.

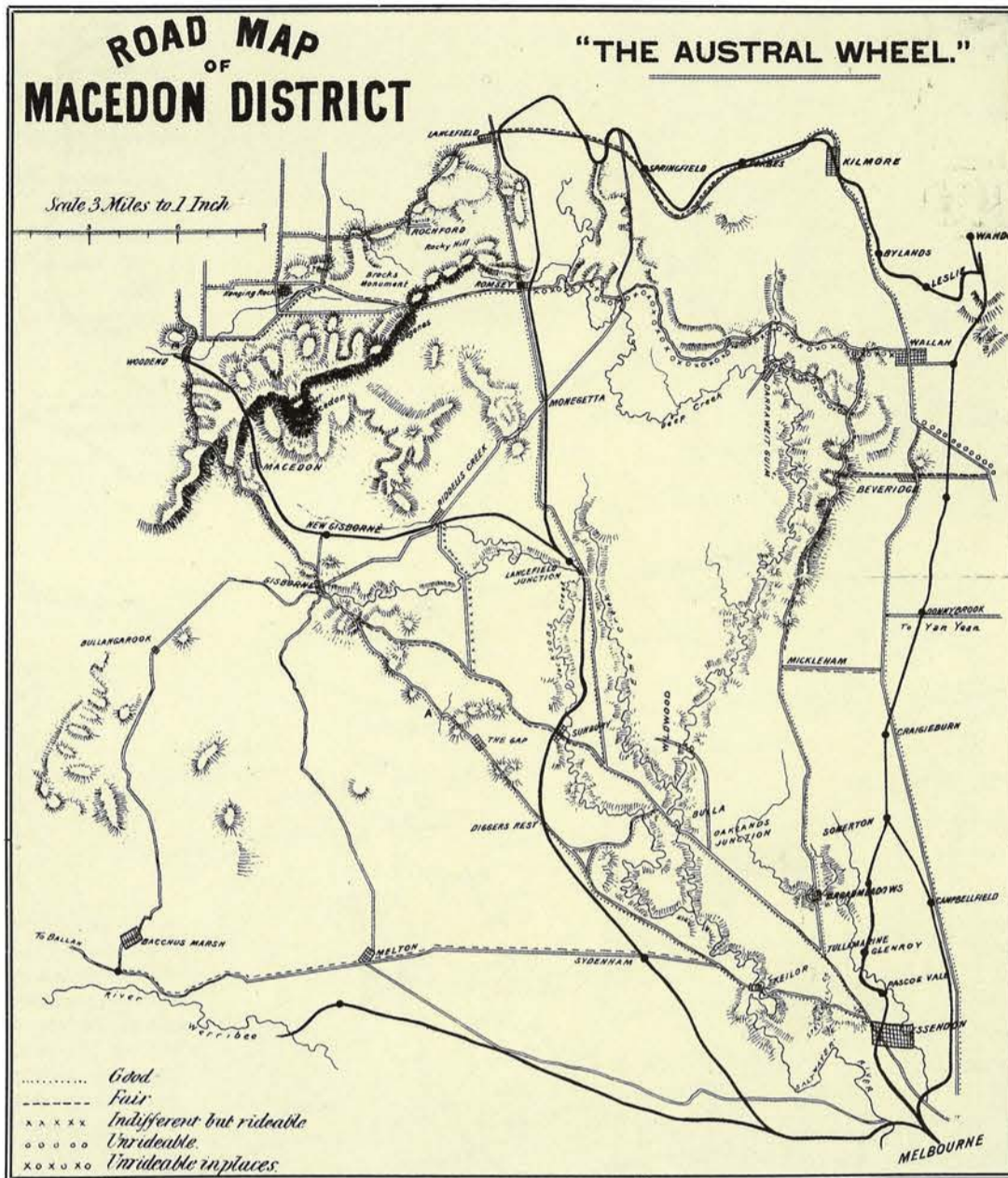
# Roads

**T**HE PRE-EMINENCE of road transport in Australia is a relatively recent development. In the early years of settlement, roads were low on colonial governors' lists of priorities. Water transport was more important than the improvement of the meandering dirt tracks that passed for roads. As settlement expanded, however, the demand for roads grew. Most were built using convict labour, except in South Australia and Victoria, where an extensive system of private roads was developed. On most the traveller paid a toll for using the road, which went towards the cost of construction and upkeep. Australia's first arterial roads ran from Sydney to Bathurst (completed in 1815) and from Hobart to Launceston (completed in 1826).

Although the demand for roads grew during the 1850s and 1860s, the railway eclipsed roads as the favoured system of land transport. Railways provided a cheaper, faster and more reliable system of long distance transport, and roads were built mainly to provide access to railway lines and as a supplementary transport system in areas not served by the railway.

The availability of the car to many families, and the development of trucks capable of efficiently hauling goods, changed the picture. From the 1920s the number of cars and other motor vehicles in Australia rose rapidly. Railway construction tapered off and governments began to fund road improvement and development schemes. A national highway system was designated and the commonwealth government took an increasingly active role in funding and planning Australia's road system.

The most significant developments, however, came after World War II. Road transport of most goods became cheaper, quicker and more efficient, although rail transport was still more efficient for bulky goods like coal and wheat, and the car became a common household possession. New roads and, later, freeways were built in the metropolitan areas, and older roads and parts of the national highway system were upgraded, among them the Hume Highway, the main road link between Melbourne and Sydney. Today roads are Australia's most important means of transport.



Australian road maps, designed to show road conditions and distances, were first developed by and for cycle tourists during the 1890s, long before the motor car came into popular use. This map of the Macedon district in Victoria was part of a colony-wide series produced by the cycling magazine *Austral Wheel* between 1896 and 1898.



Although the improving and upgrading of Australia's major highways began during the 1920s and 1930s, work was suspended during World War II. After the war, as the use of motor transport became more common, the conditions of national highways were substantially improved. These two photographs show the building of a new stretch of the Hume Highway and the condition of the road north of Albury in 1956. MAGAZINE PROMOTIONS

# Overseas trade

THE FOUR CARTOGRAMS on this page show the significant changes in the destinations of Australia's exports, and in the sources of imports, between 1954 and 1980. The destinations of exports and the origins of imports are shown as a percentage of their total values. The nature of Australia's exports and imports is shown in the graph at the bottom of each cartogram.

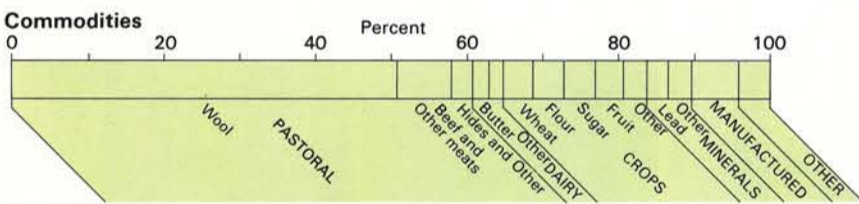
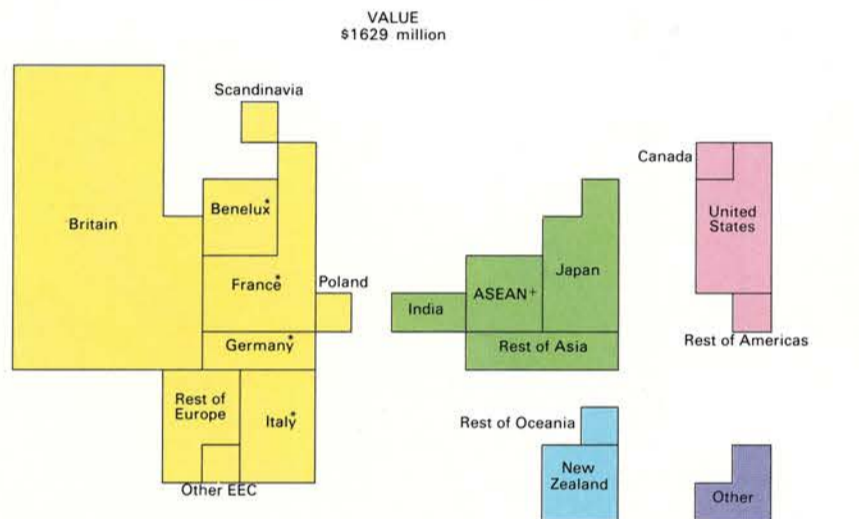
From Federation until 1954 Europe was Australia's major export market, with Britain the largest importer. In 1954 Britain took 36 per cent of Australia's exports and the rest of Europe took another 29 per cent. By 1980 Europe's share of the Australian export market had fallen to 22 per cent, Britain's to 5 per cent. Britain's entry into the European Economic Community (EEC) had cut off many traditional Australian markets, and restrictions placed on imports to the EEC had also reduced markets. Asia emerged as Australia's major export market and

Japan, with 27 per cent, took more Australian exports than any other country. Markets in Oceania and the Americas had also grown.

The sources of Australia's imports changed in similar ways. By 1980 the United States had emerged as Australia's major source of imports, accounting for 22 per cent of the total value of imports once Australia abandoned preferential tariffs favouring British goods.

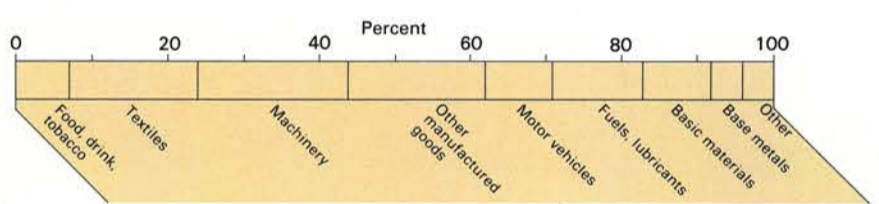
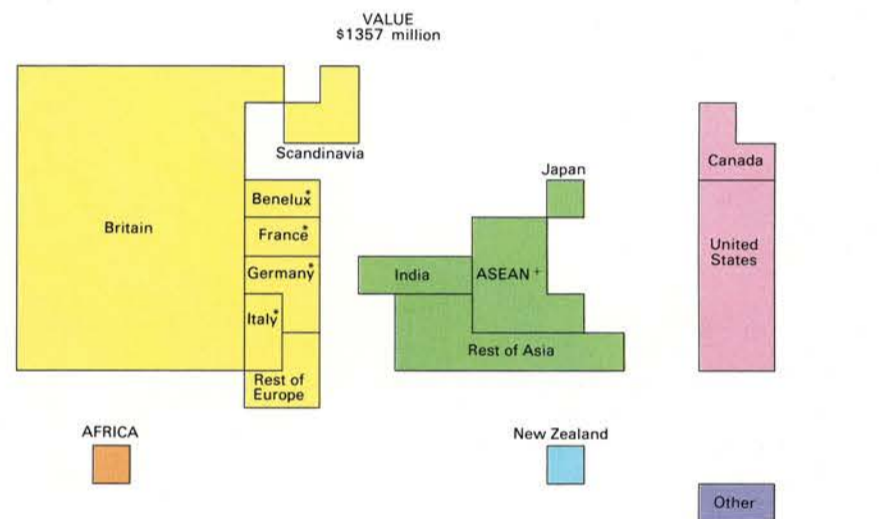
During the nineteenth century and the first half of the twentieth century, Australia exported mainly primary goods. In 1954, primary products still accounted for 90 per cent of exports. Wool was the most important, reflecting rising demand during the early 1950s. By 1980 dairying and the pastoral sector had declined substantially, wool falling from 51 to 9 per cent of the value of exports. Minerals had re-emerged as a major export earner with 28 per cent of the total value of exports. Manufactured goods accounted for 23 per cent of export earnings.

## Exports 1954

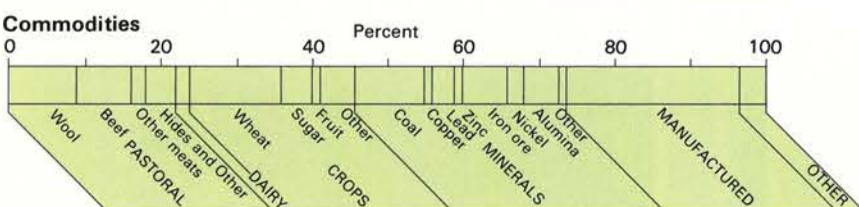
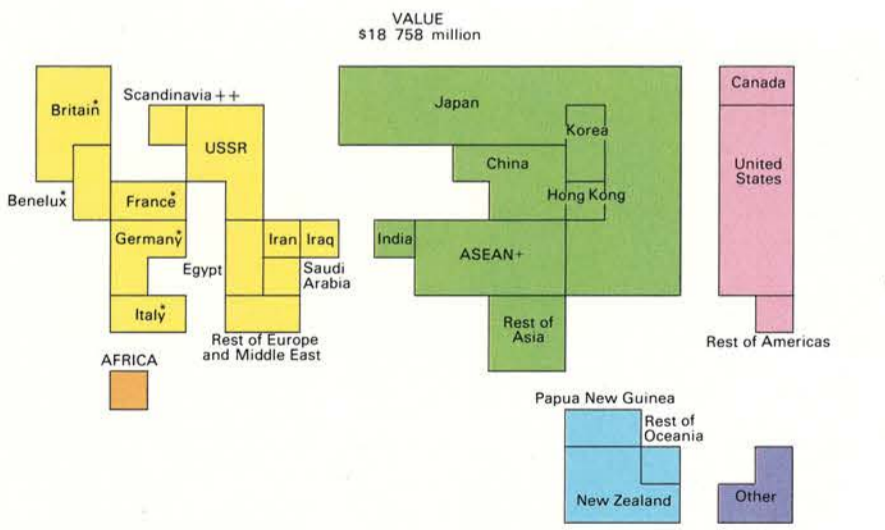


## Imports 1954

Benelux: Belgium, Netherlands and Luxemburg  
 \* Members of the European Economic Community  
 + ASEAN: Malaya, Singapore, Indonesia, Philippines, Thailand.

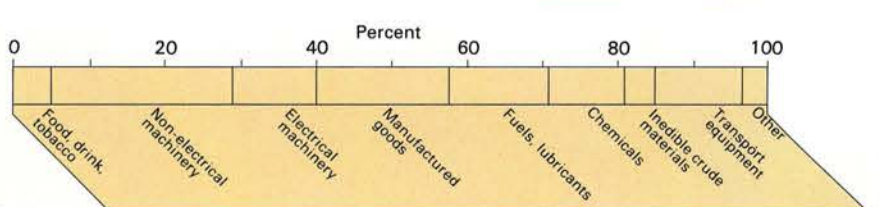
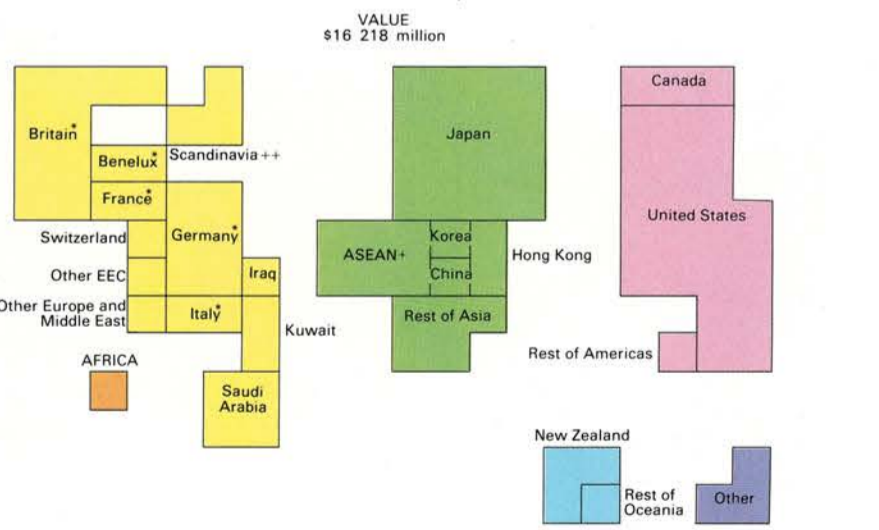


## Exports 1980



## Imports 1980

\* EEC  
 + ASEAN: Malaysia, Singapore, Indonesia, Philippines, Thailand  
 ++ Excludes Norway.



RECONSTRUCTION OF  
FASTMAN'S MAP  
From his original map  
of the "East Indies"



LINGNE ESQUINOCIALIS

Lingne equinoctialis

Tropicus capricornus

TROPICVS CAPRICIVVS

COMPAGNIS NIEV NEDERLAND

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gestippelde passage by d'ijckten Limmen Loekmoen end het qual d'ieyde  
kan worden t. nu

Landt van d'ijckten Limmen  
gouden Tempel van middelland  
A. B. G. L. Faerman's passage

Antienis van diemenis landt  
dit is t'ijckste miltianderen van diemen  
van d'ijckten Limmen Loekmoen  
A. B. G. L. Faerman's passage

A. B. G. L. Faerman's passage

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