DEPARTMENT OF MINES AND ENERGY

SOUTH AUSTRALIA

ENERGY BRANCH

END USES OF ENERGY IN SOUTH AUSTRALIA

1976/77

BY

KEN KING

SENIOR PROJECT OFFICER

25th September, 1978.

Rept.Bk.No. 78/93
~~E.B.~~ E.B. No. ~~8/78~~ 78/8
D.M.E. No.411/78

S

ABSTRACT

Analyses of the end uses of energy are fundamental to assessing the best direction and likely impact of energy policies. However, precise end-use data are expensive to obtain because surveys are required. They are also difficult to analyse because problems of ambiguity intrude and because the confidentiality of some of the information necessitates the use of special procedures. In this report a preliminary study has been made using readily accessible data and simple methods in order to determine the extent to which the relevant results can be determined without resort to major funding and/or Departmental effort.

End uses of energy in South Australia for 1976/77 have been broken down according to fuel types, economic sector, and purpose. Concurrent and proposed studies relating to end use analysis are also discussed.

CONTENTS PAGE

FIGURES

Text figures

Appendix figures

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 78/93
E.B. No. 8/78
D.M.E. No.411/78

END USES OF ENERGY IN SOUTH AUSTRALIA 1976/77

1. END-USE ANALYSIS

Analyses of energy end-use patterns are fundamental to assessing the best direction and likely impact of energy policies and therefore they are basic to the development of effective energy policies. Options which may be assessed in this fashion include the following.

1.1 Energy planning What changes are likely to occur in the demand for particular fuels with changes in their absolute and relative pricing levels and as a result of industrial developments, demographic trends, changes in lifestyles, living standards, housing patterns, and probable trends in the economy? What effects will present trends in appliance purchase have on energy demand, particularly peak demand for electricity?

1.2 Conservation What effects will the use of low-energy impact building design, insulation, fuel-efficient vehicles, and new industrial technology have on energy demand? What effects will new developments in telecommunications have on transport fuel use? What are the likely impacts of new taxes or subsidies on final demand?

1.3 Substitution What savings can be made through encouraging the use of public transport, LP gas, or electric vehicles? What is the potential impact of solar air conditioning, water heating, and space heating on domestic and commercial demands for electricity and natural gas? What needs to be done to influence such developments? What is the potential impact

of the development of a cheap high-temperature solar collector for industrial use? What is the effect of encouraging the use of natural gas for heating in preference to electric energy?

1.4 Research and development Which energy research projects promise the greatest fuel saving benefit? Which industrial concerns use large quantities of petroleum fuels for tasks that could be performed by new or evolving technology using more abundant fuels?

1.5 Emergency rationing How much of each fuel needs to be reserved for high priority sectors where close substitutes are not available? What priorities need to be established for the distribution of petroleum fuels during industrial or international crises?

2. AIM OF THIS PRELIMINARY ANALYSIS

Precise end-use data are expensive to obtain because surveys are required. They are also difficult to analyse because problems of ambiguity intrude and because the confidentiality of some of the information necessitates the use of special procedures.

In this report a preliminary study has been made using readily accessible data and simple methods in order to determine the extent to which the relevant results can be determined without resort to major funding and/or major Departmental effort.

The value of such an analysis lies in the fact that there are questions that can be answered unambiguously without a survey, and that areas of uncertainty can be made explicit. Available resources can then be focussed for maximum effect. This analysis provides a skeleton for end uses and it can be fleshed out by specific surveys, fuel marketers' records, and structural models.

3. METHOD

The results sought were breakdowns of fuel used by

sector, fuel by purpose, sector by fuel, sector by purpose, purpose by fuel, and purpose by sector.

Acronyms and abbreviations used in this report are listed in Appendix A; prefixes, units, and conversion factors in Appendix B; and the definitions of fuel types, economic sectors, and end-use purposes in Appendix C.

3.1 Definitions

One of the major sources of difficulty in using published or other readily accessible source material is that consumption figures are based on various definitions which are seldom explicit and frequently incompatible. In this report the definitions were framed in such a way as to facilitate the use of end-use analysis in answering policy questions while at the same time minimising the amount of correction that was needed to make the available data sources compatible.

For example, the definition of "end use" is consistent with the division of energy flow into resources, fuels, wastes, internal uses, and end uses. This division is used by this Department in analysing the overall State energy system and by many Australian and overseas computer models of energy flow. By contrast, the definition implied by the analyses of the Department of National Development includes the use of energy resources in power generation and oil refining, as well as the use of certain fuels at the point of final consumption. This reflects their interest which is primary energy whereas the interest of this Departmental study is secondary energy as this is the appropriate basis for end-use analysis for policy development.

The definitions used here, concerning particular fuels, are consistent with industry and utility data.

The definitions of economic sectors are broadly consistent

with the Australian Standard Industrial Classification (ASIC). However transport is separated out as a major sector because most of the consumption within this sector is private consumption; that is, not related to ASIC divisions. Certain deletions were also made because the particular industries were energy resource producers or fuel manufacturers rather than fuel consumers. Industrial activity such as gas production, electric power generation, and oil refining clearly relate to the earlier stages of energy flow and not to the end use stage as defined.

Finally, the definitions of purposes were constructed so as to be able to present data for the formulation of policy advice. For example it is necessary to know the substitutability of fuels. Low-grade heat is separated from other uses because it is potentially substitutable by solar energy and waste heat; traction is separated out because petroleum fuels for transport may be partly replaced by electric energy and bio-fuels.

3.2 Fuel use by economic sector

Data on the quantities of fuel used by each economic sector were assembled from a variety of sources. A full list of data sources appears in Appendix D. The data as collected had to be processed, for the reasons given in the preceding section, in order to conform with the standardised definitions adopted in Appendix C.

Alterations were required in order to account for following:

a. Distribution area Statistics were related to the same geographical area in order to be comparable. This meant that corrections for interstate transfers were required.

South Australia is a fairly well-contained statistical unit. That is, because of the concentration of population

in Adelaide and because of the large distances to major population centres in other states, most of the secondary energy required by the State is also produced within it. In addition, it is possible to gather statistical data from diverse sources and to correlate them fairly accurately since the largest inconsistencies in the data are those that are due to the minor interchanges near the relatively sparsely populated border areas.

b. Time span Statistics were collected for the same time period, 1976/77. This is the most recent year for which all the statistics are available. Minor discrepancies result from the fact that statistics refer to fuels despatched or fuel bills paid within that time span rather than to fuel actually used. Stockpiling and unread meters therefore introduce small uncertainties (of the order of 1%). No correction has been applied.

c. Physical units Some of the data published by the Australian Bureau of Statistics on fuel quantities by sector is published only in economic units (thousands of dollars) but data in physical quantities are available upon request. Electricity consumption is only recorded in economic terms and inferences back to the energy consumed require assumptions about the average tariff paid by industries of a particular size and category. Such inferences are very imprecise, say $\pm$ 25% for individual industries. The totals for overall fuel use and for sectors, being larger groupings, are known fairly accurately from utility data.

d. Intermediate uses Some potential fuels are excluded from consideration because they are not consumed at the point of end use but are used as intermediate fuels for the production of secondary energy. These potential fuels include

furnace oil and natural gas used for the generation of electric energy and coal used for the production of coke. Corrections are made accordingly to the primary data sources.

e. Independent supply Statistics on electric energy supplied are available from the ETSA Annual Report but additions and subtractions must be made in order to allow for the small amounts of electricity generated and/or distributed by private industries and/or independent supply authorities.

f. Internal uses and losses The definition of what constitutes an end use is consistent with a previous report on energy flows prepared by this Department. However, some of the primary data sources include energy which is lost in generation or distribution or include fuel consumed internally by the fuel manufacturer or distributing authority. Thus a correction must be made for this.

The calculations necessary for standardising primary data for these factors are given in Appendix E (petroleum fuels), Appendix F (natural gas and LPG), and Appendix G (electric energy).

3.3 Fuel use by purpose

In many cases, purposes can be assigned unambiguously because certain fuels are reserved almost exclusively for particular processes. Examples include aviation gasoline, aviation turbine fuel, motor spirit, power kerosine, lighting kerosine, heating oil, LP gas, and coke. In other cases some statistical records exist for fuels which are sold for specific purposes. Examples include automotive diesel oil (bunkers), industrial diesel oil (bunkers), furnace oil (bunkers), and electric energy (J-tariff, K-tariff).

However, in most instances there are ambiguities. For example electric energy can be used for traction (forklift trucks), for work (lights, machinery, refrigeration), for low-grade heat (hot water, air-conditioning, space heating), for medium-grade heat (drying ovens, stoves), and for high-grade heat (welding, furnaces, and special purposes). Other fuels which can be used for a variety of purposes include automotive diesel oil, industrial diesel oil, fuel oil, natural gas, and wood fuel.

In these cases the ambiguity can be reduced by a knowledge of the particular sectors in which the fuels are used. The Commonwealth Department of National Development (DND) conducted a survey of fuel used in the industrial sector. Fuel use for two- and three-digit ASIC categories was made available on a confidential basis and was correlated with overall end-use data. A survey was then conducted by this Department of the largest industries representing each of the subdivisions in the manufacturing sector. (see Appendix D.4). This survey restricted itself to ascertaining the purposes to which each fuel was put, and when combined with the quantitative fuel data of the DND survey yielded quantitative data on fuel use according to both purpose and subsector. (The information from both these surveys relates to specific industries and must remain confidential. Only the aggregated results can be made available).

No detailed information on domestic and commercial use is available; therefore it was assumed that almost all domestic energy use was for low-grade purposes (space-conditioning and water heating). About half the commercial use of electricity was regarded as "work" (light, machinery, refrigeration); however this was an estimate only and based on overseas studies.

4. RESULTS

The overall structure of end uses within South Australia have been analysed from available data. The results of this analysis are given in Tables 1-14 and are summarised in Figures 1-7.

There is virtually no uncertainty about the division of total energy by fuel or by sector, but some uncertainty exists concerning the division among work/low-grade heat/ medium-grade heat (Figure 1). Petroleum fuels dominate the market and transport and industry are the major sectors. Fuels used for low-grade and medium-grade heat probably constitute no more than 20 to 25% of all secondary energy and this is likely to be the maximum extent to which solar heating and cooling could contribute to the present use pattern. Most of the low-grade heat is supplied by non-petroleum fuels (Figure 6).

Many of the other questions mentioned in section 1 can be answered in a preliminary way using the results of Figures 2-7, but are not explored here.

5. FURTHER END-USE ANALYSES

This section lists the ways in which additional end-use data can be obtained. These further studies would supplement and develop the results of this report.

5.1 Transport sector

The analysis of fuel use by transport subsector and travel purpose has been done for South Australia 1974/75 (King, 1977) using ABS data on motor vehicle usage and bus fleet operations, using transportation studies, and using the reports of transport authorities. This study could be updated to 1976/77.

5.2 Industrial and commercial sectors

In order to improve the analyses in these sectors, data would need to be gathered from the fuel suppliers and a further survey would need to be conducted of the purposes for which the fuels are required. Information on purposes is not of an easily definable numerical character. It is not collected by the ABS, nor is it likely to be unless special negotiations, on a national basis, are held with the potential users of this information.

5.3 Domestic sector

The breakdown of fuel use by purpose in this sector is unknown. This Department advanced certain suggestions for changing the ABS Adelaide Household Expenditure Survey proposed for 1979. This would have overcome the deficiency but the Survey has since been deferred for financial reasons. Changes to the proposed 1981 census would also increase the knowledge of household energy use, and the Department has made a further submission to ABS on this matter.

6. RECOMMENDATIONS TO THE SOUTH AUSTRALIAN ENERGY COUNCIL

1. That Council define and rank in order of priority, those energy policy issues which it considers should be the subject of end-use analysis. (Some questions that end-use analysis can help to answer are listed in Sections 1.1 to 1.5).
2. That Council draw up specifications for the end-use analyses required to answer these questions. (Such specifications would detail the type of categories within which data are required, the compatibility sought with other studies or data sources, the maximum tolerable errors in estimation).

3. That, in view of the problems of definition mentioned in Section 3.1, Council develop workable and consistent definitions for the various fuels, sectors, and purposes. (Draft definitions are given in Appendix C).

4. That Council draw up guidelines for the collection of energy use statistics to ensure that consistent reporting from different organisations be achieved. (Such guidelines might include reference to geographical area, time span, units, independent supply, and the exclusion of intermediate and internal uses from final consumption figures. Reference to these matters is made in Section 3.2).

5. That Council recommend the use of the definitions and guidelines so adopted, on a trial basis and for the purpose of updating this report for 1977/78, to the following:
   Department of Mines and Energy,
   Electricity Trust of South Australia,
   South Australian Gas Company,
   Pipelines Authority of South Australia,
   Department of Woods and Forests, South Australia,
   BHP Co. Ltd., and
   all petroleum marketing companies.

6. That Council refer the definitions and guidelines, for comment, to the following:
   National Energy Advisory Committee,
   Australian Atomic Energy Commission,
   Australian Bureau of Statistics,
   Department of National Development,
   Electricity Supply Association of Australia,
   Australian Institute of Petroleum Ltd., and
   Australian Gas Association.
   (These organisations are all involved in studying, collecting,

reporting, analysing or using end-use data).

7. ACKNOWLEDGEMENTS

The author acknowledges the assistance of officers from ABS, BHP, DME, DND, DWF, ESAA, ETSA, Mobil, PASA, PRA, SAGASCO, and all the companies who took part in the end-use survey.

APPENDIX A: ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in the report. Those marked with an asterisk are specific to this report and may not have general currency.

ABS	-	Australian Bureau of Statistics
ADO	-	automotive diesel oil
AGL	-	Australian Gas Light Co.
AIPet	-	Australian Institute of Petroleum Ltd
ASIC	-	Australian Standard Industrial Classification
Avgas	-	aviation gasoline
Avtur	-	aviation turbine fuel
bbl	-	barrel
BHAS	-	Broken Hill Associated Smelters Pty Ltd
BHP	-	Broken Hill Proprietary Co. Ltd
BP	-	BP Australia Ltd
Btu	-	British thermal unit
CBCS	-	Commonwealth Bureau of Census and Statistics (now ABS)
CIG	-	CIG Ltd.
*DED	-	Department of Economic Development, SA
*DME	-	Department of Mines and Energy, SA
*DND	-	Department of National Development, Cwlth
*DWF	-	Department of Woods and Forests, SA
EJ	-	exajoule
ESAA	-	Electricity Supply Association of Australia
ETSA	-	Electricity Trust of South Australia
FO	-	furnace oil
GJ	-	gigajoule
GWh	-	gigawatt-hour
*HG	-	high-grade heat
*HO	-	heating oil
ICI	-	ICI Australia Ltd
IDO	-	industrial diesel oil
*ISA	-	independent supply authorities (of electricity in South Australia
kWh	-	kilowatt-hour
L	-	litre
*LG	-	low-grade heat
*LK	-	lighting kerosine
LPG	-	liquefied petroleum gas
*MG	-	medium-grade heat
MJ	-	megajoule
*MS	-	motor spirit
MWh	-	megawatt-hour
PASA	-	Pipelines Authority of South Australia
PJ	-	petajoule
*PK	-	power kerosine
PRA	-	Petroleum Refineries (Australia) Ltd.
SAA	-	Standards Association of Australia
SAGASCO	-	South Australian Gas Company
*SEC	-	(South Australian) State Energy Committee
SEV	-	State Electricity Commission, Victoria
t	-	tonne
TJ	-	terajoule
TPA	-	The Pipeline Authority, Cwlth

APPENDIX B: PREFIXES, UNITS, AND CONVERSION FACTORS

B.1 Prefixes

The Systeme Internationale (SI) system of prefixes and units has been adopted in this report. The relevant prefixes are:

Prefix	Name	Value
E	exa-	10^{18}
P	peta-	10^{15}
T	tera-	10^{12}
G	giga-	10^{9}
M	mega-	10^{6}
k	kilo-	10^{3}

B.2 Units

The most convenient unit for expressing energy reserves is the exajoule (EJ), and for expressing end uses, the petajoule (PJ). Some equivalents in non-standard units are:

1 barrel of crude oil equivalent	≃	6.4 GJ
1 tonne of black coal equivalent	≃	30 GJ
1000 cubic feet of natural gas equivalent	≃	1 GJ
1 Btu	≃	1 kJ
1 exajoule (1 EJ)	≃	156×10^6 bbl crude oil equivalent
	≃	33×10^6 t black coal equivalent
	≃	1 tcf natural gas equivalent
	≃	1 Q (quad)

The International System of Units (SI) and rules governing their use are contained in the publication

SAA (1974). The International System of units (SI) and its application, AS 1000-1974, Standards Association of Australia, Sydney, 24 pp.

and inquiries on recent changes may be made to the Metric Measurements Advisory Committee (South Australia).

B.3 Conversion factors

Energy

1 Btu	=	1.055 1 kJ
1 therm	=	100,000 BtU
	=	105.51 MJ
1 kcal	=	4.186 8 kJ
1 kWh	=	3.6 MJ (exactly)

Power and heat flow

1 hp	=	0.745 70 kW
1 Btu/hour	=	0.293 07 W
1 kcal/hour	=	1.163 W

Energy per unit volume

1 Btu/ft^3	=	37.259 $kJ.m^{-3}$
1 MMBtu/bbl	=	6.636 1 $MJ.L^{-1}$
1 Btu/gal	=	0.232 08 $kJ.L^{-1}$

APPENDIX C: DEFINITIONS

End use: An end use of energy occurs when a fuel is consumed in the performance of a task and when the energy content of that fuel is thereby converted into an unusable form.

This definition includes the use of petrol to perform transport tasks, whereby the energy content is converted ultimately to low-grade heat which is dissipated.

It specifically excludes the use of energy resources by power stations since part of the incoming energy is transformed into a usable intermediate form: electric energy.

This definition is not universally accepted but accords with the division between energy resources, fuels, and end uses implicit in the energy flow analysis produced by this Department. The Commonwealth Department of National Development however publishes data on the end uses of primary fuels and therefore considers that fuels used for oil refining and the generation of electric energy as being end uses. Their implicit definition is not useful in viewing the overall energy flow where data on resources, fuels, waste, internal uses, and end uses are all required separately.

C.1 Fuels

Fuel: A fuel is an intermediate form of energy which is derived from an energy resource and consumed at the point of end use.

This definition includes the products of an oil refinery, electric energy, natural gas cleaned and available for reticulation, coke and coke oven gas, coal which is used at the point of final consumption, firewood and mill wastes used for heat.

It specifically excludes coal used for the production

of coke and gas, wood used for timber or other non-fuel uses, any substance used for the generation of electric energy, and any energy resource which is lost in or used for the production of fuel.

The small quantities of bitumen, lubricating oil, and solvents produced are included in the analysis only because they derive from crude oil. They are allocated to a "special purpose" end-use category. Their energy contents are used in order to balance the energy flow. They are not, strictly speaking, fuels.

Petroleum fuels: Petroleum fuels are fuels derived from crude oil in refinery operations.

The definitions of the various fractions, such as motor spirit and fuel oil, are sometimes given in terms of their end uses. More precise definitions can be given by reference to the specifications that must be met in order to be marketable as fuels bearing a given description. For example motor spirit must possess satisfactory properties of antiknock, surface ignition, volatility, starting vapor lock, icing, oxidation, stability, odour, and colour. From the production point-of-view, the fuels can be defined in terms of their chemical and physical composition, principally the range of boiling points within the fraction.

The terms used in this report refer to the same categories used by the oil industry, the Australian Institute of Petroleum, and the Department of National Development. The energy contents of these fuels is given in Table 15.

C.2 sectors

Sector: An end-use sector is any category of human activity for which fuels are consumed at a point of end use.

The first problem in defining useful "sectors" is to group activities in an easily recognisable way. The second

problem is define the sectors in mutually exclusive ways so that no end use appears under more than one heading. For example, fuel used by the trucks of construction companies could be classified as "transport" (pertaining to the movement of goods), or as "commercial" (pertaining to commercial enterprise), but not both. The third problem is to ensure reasonable compatibility with the defintions used by other organisations in the collection of their data. This is sometimes difficult since the precise definitions are seldom made explicit. A comparison between the definitions used in this report and those used by other organisations is given in Table 16.

Transport sector: The transport sector consists of private transport, transport sold as a service, and motor spirit used for commercial deliveries and business trips. Fuel assigned to this sector is the principal fuel used for locomotion.

This definition excludes the use of fuels for the transport of industrial and commercial goods where this activity is carried on by the company involved in the manufacture or use of those goods. For example, automotive diesel oil used by trucks is assigned to the "mining" sector where this forms part of the total operations of the mining company. The definition also excludes the use of auxiliary energy (such as electricity used in airport terminals). It also excludes fuels which are used for producing motion but where that motion is not primarily reognisable as providing a transport service. Fuel used in forklift trucks, tractors, front-end loaders, log grabs, and aerial spraying is excluded for this reason.

The transport sector is divided into four obvious subsectors - air, road, rail, and sea transport.

Industrial sector: The industrial sector consists of agriculture, mining, manufacturing, and utilities. (See Table 16).

Agriculture: This subsector also includes forestry, fishing, and hunting and corresponds to ASIC Division A. (See Table 17).

Mining: ASIC Division B.

Manufacturing: ASIC Division C.

Utilities: ASIC Division D including street lighting.

Commercial: ASIC Divisions EFH-L

Domestic: The domestic sector includes all fuels used for private purposes other than transport fuel.

C.3 Purposes

Purpose: A purpose is the physical process for which fuel is required.

Traction: Traction is any process capable of providing translational movement.

This definition includes all air, road, rail, and sea transport and also includes all non-transport locomotions such as were excluded from the "transport" sector. It specifically excludes the work done by stationary engines.

Work: Work consists of mechanical work provided by stationary machinery, light, and electrical work (e.g. electrolysis).

This definition excludes any energy used for traction, e.g. electricity used to charge up batteries for forklift trucks. It also excludes air conditioning (which is regarded as a low-grade thermal purpose) but includes refrigeration.

Low-grade heat: Low-grade heating is loosely defined here as the application of heat to produce or maintain temperatures within the temperature limits of water

($0^{o}C$ to $100^{o}C$).

This definition includes space heating, space cooling, air conditioning, and water heating. It does not include refrigeration or steam-raising.

Medium-grade heat: Medium-grade heating is loosely defined here as the application of heat to produce temperatures above $100^{o}C$ but below $400^{o}C$.

This definition includes applications in boilers for the production of process steam, cooking ovens, drying ovens, curing ovens, and standby generators.

High-grade heat: High-grade heating is loosely defined here as the application of heat to produce temperatures above $400^{o}C$.

This definition includes kilns, metallurgical furnaces, smelters, welders, and induction heaters.

APPENDIX D: DATA SOURCES

D.1 Published data

Australian Bureau of Statistics,

1969. Australian Standard Industrial Classification (Preliminary Edition). Volume 1 - The Classification. Commonwealth Bureau of Census and Statistics, Canberra, 399 pp.

1969. Australian Standard Industrial Classification (Preliminary Edition). Volume 2 - Alphabetic Index. Commonwealth Bureau of Census and Statistics, Canberra, 207 pp.

1976. Rail, bus, and air transport 1974-75 Ref. No. 14.21. ABS, Canberra, 32 pp.

1974. Bus fleet operations survey: twelve months ended 30th June 1971. Ref. No. 14.18. ABS, Canberra, 4 pp.

1977. Survey of motor vehicle usage twelve months ended 30th September 1976 (Preliminary). Ref. No. 14.4. ABS, Canberra, 6 pp.

1974. Bus fleet operations survey: twelve months ended 30th June 1971 (Supplementary release). Ref. No. 14.19. ABS, Canberra, 12 pp.

1977. Agricultural sector. Part IV - Financial statistics 1974-75. Ref. No. 10.83. ABS, Canberra, 19 pp.

1977? Mining establishments, details of operations. Economic censuses: 1971-72 to 1975-76. Ref. No. 8401.4. ABS, Adelaide, 12 pp.

1977. Mining establishments, details of operations, 1975-76. Ref. No. 10.60. ABS, Canberra, 17 pp.

1978? Manufacturing establishments, details of operations, 1975-76. Ref. No. (not listed). ABS, Adelaide, 55 pp.

1978. Manufacturing establishments, details of operations by industry class, Australia 1975-76. Ref. No. 12.29. ABS, Canberra, 174 pp.

1977. An outline of concepts, methodology and procedures. Household expenditure survey 1974-75. Bulletin 1. Ref. No. 17.19. ABS, Canberra, 82 pp.

1976. Preliminary results. Household expenditure survey 1974-75. Bulletin 2. Ref. No. 17.20. ABS, Canberra, 15 pp.

1977. Standard errors. Household expenditure survey 1974-75. Bulletin 3. Catalogue No. 6509.0. ABS, Canberra, 64 pp.

1977. Expenditure classified by income of household. Household expenditure survey 1974-75. Bulletin 4. Ref. No. 17.22. ABS, Canberra, 28 pp.

1977. Quarterly expenditure patterns. Household expenditure survey 1974-75. Bulletin 5. Ref. No. 17.23. ABS, Canberra, 12 pp.

1977. Expenditure classified by household composition. Household expenditure survey 1974-75. Bulletin 6. Ref. No. 17.24. ABS, Canberra, 27 pp.

1977. Expenditure classified by selected household characteristics. Household expenditure survey 1974-75. Bulletin 8. Ref. No. 6514.0. ABS, Canberra, 36 pp.

1978. Australian national accounts, national income and expenditure 1976-77. Catalogue No. 5204.0. ABS, Canberra, 127 pp.

Australian Institute of Petroleum, 1978. Oil and Australia 1977. Australian Institute of Petroleum Ltd., Melbourne, 28 pp.

Department of Economic Development, 1977. Development 1976. Department of Economic Development South Australia, Adelaide, 204 pp.

Department of Minerals and Energy, 1974. End use analyses of primary fuels forecast 1971-72 to 1984-85. Petroleum Branch, Department of Minerals and Energy, Canberra, 47 pp.

Department of National Development, 1978. Demand for primary fuels, Australia, 1976-77 to 1986-87. Report. Department of National Development, Canberra, 38 pp.

Electricity Supply Association of Australia 1977. 1976-77: The electricity supply industry in Australia. ESAA, Melbourne, 70 pp.

Electricity Trust of South Australia, 1977. Annual report 1977. ETSA, Adelaide, 16 pp.

Rimmer, R.J., 1970. Petroleum. Longmans, London.

South Australian State Energy Committee 1976. Report. Government Printer, Adelaide, 178 pp.

The Pipeline Authority, 1977. Annual report 1976. Parliamentary paper No. 58/1977. Acting Commonwealth Government Printer, Canberra, 24 pp.

D.2 Unpublished data

Electricity Trust of South Australia,

1977. Analysis of kilowatt-hours and revenue for year to date ending 30th June 1977.

1977. Tariff schedule.

1977. Independent electricity supply authorities, South Australia.

South Australian Gas Company,

1977. Metropolitan tariffs: domestic.

1977. Commercial tariff schedule.

1977. Industrial tariff schedule.

Stewart, R.M., 1976. Demand pattern of hydrocarbons usage in Australia. Address to the Australian Institute of Petroleum - Queensland Branch, 27th September.

King, K., 1977. Transport energy: South Australia's options, 1975-2000. South Australian Department of Mines/ University of Adelaide. Adelaide, 185 pp.

D.3 Personal communications

Australian Bureau of Statistics,

1977. Data: Survey of motor vehicle usage for twelve months ended 30th September 1976.

1978. Data: Manufacturing establishments - usage of electricity and fuels by industry class, Australia 1975-76.

1978. Data: Usage of fuels, South Australia 1974-75 and 1975-76.

Broken Hill Proprietary Co. Ltd., 1978. Data relating to the use and generation of energy within the company 1976/77.

Department of National Development, 1978. Data: End use analyses of primary fuels forecast, South Australia 1976/77.

Department of Woods and Forests, South Australia 1978. Data relating to the use and generation of energy, within the Department, 1976/77.

Electricity Trust of South Australia, 1978. Interpretation of electricity end-use data, 1976/77.

Pipelines Authority of South Australia, 1978. Sales of natural gas, 1976/77.

South Australian Gas Co., 1978. Sales of natural gas in Adelaide and Port Pirie, 1976/77 by end-use classification.

D.4 Survey of manufacturing sector

South Australian Meat Corporation
Balfour Wauchope Pty Ltd
The South Australian Brewing Company
Onkaparinga Woollen Company Ltd
Actil Ltd
Levi strauss (Australia) Pty Ltd
R.M. Williams Pty Ltd
Department of Woods and Forests
Softwood Holdings Pty Ltd
Atco Structures Pty Ltd
Macrob Furniture Pty Ltd
The News
Advertiser Newspapers Ltd
Griffin Press Ltd
Adelaide and Wallaroo Fertilisers Ltd
Dulux Australia Ltd
Australian Glass Manufacturers Co.
Hallett Brick Industries Ltd
Adelaide Brighton Cement Ltd
Broken Hill Proprietary Co. Ltd
Tubemakers of Australia Ltd
Bundy Tubing Company (Aust.) Pty Ltd
Broken Hill Associated Smelters Pty Ltd
Carr Fasteners Pty Ltd
Chrysler Australia Ltd
General-Motors-Holden's Pty Ltd
Key Industries Pty Ltd
Simpson Pope Ltd
Warburton Franki (Adel.) Pty Ltd
Uniroyal Pty Ltd
Sabco Ltd
Sola International Pty Ltd
Barossa Co-operative Winery Ltd
South Australian Fishermen's Co-operative Ltd
Thomas Hardy and Sons Pty Ltd
Metro Meat Ltd
Cadbury Schweppes Pty Ltd
G. Gramp and Sons Pty Ltd
Berri Fruit Juices Co-operative Ltd
Seppelt and Sons Ltd
W. Woodroofe Pty Ltd
Government Printing Division

The results of this survey were combined with the survey conducted by Department of National Development on quantities used by ASIC division. The results of both surveys are confidential (Table 18).

APPENDIX E: DISTRIBUTION OF PETROLEUM PRODUCTS

The geographical distribution network for petroleum products is shown on the map (Figure 8). It is necessary to distinguish three statistical zones in South Australia:

(a) the political area (consisting of the area enclosed by the State's seaboard and borders),

(b) the product distribution area, which represents the area that is supplied by land from the Adelaide Refinery or from South Australian ports, and

(c) the state marketing area (consisting of the whole of the political area plus the Broken Hill-Wilcannia district of New South Wales and the Murrayville district of Victoria).

For correlating with South Australian industry data, consumption figures are required for the political area. Product distribution area figures would be required for correlation with refinery production and with imports and exports. However the only data readily available are collected by the Department of National Development from company sources for the marketing area.

The differences between the consumption figures for each of the areas defined could amount to about 5%. A completely accurate assessment would involve the original records from the eight major marketers and has not been attempted here.

The major transfers of petroleum products are listed in Table 19 and are depicted in Figure 9. In the figure, numbers placed in parentheses index the transfers to quantities listed in the table. For example (13) refers to the transfer of energy between the refinery (1) and the marketing companies (3) and is given in Table 19 as 92.9 PJ.

APPENDIX F: DISTRIBUTION OF NATURAL GAS AND LPG

Gas fuel is available to all inhabited areas of the State.

The geographical distribution of natural gas in South Australia is limited to Adelaide, Port Pirie, and certain major industrial consumers along the pipeline route. The network is summarised in Table 20 and depicted in Figure 10.

Liquefied petroleum gas (LPG) is available in all areas. The supply is about 70% from the PRA refinery at Port Stanvac with the rest coming from field and refinery production in Victoria. Imports and movements around the state are by road tanker (bulk), truck (cylinder), and rail (bulk). There are no significant shipments. The network of supply is depicted in Figure 10 as well.

Bulk delivery and transfers of natural gas are handled by PASA and reticulation by SAGASCO (Tables 21-23 and Figure 11). In the figure, numbers placed in parentheses index the transfers to quantities listed in the table. LPG is reticulated by SAGASCO in Whyalla (butane-air) and Mount Gambier (propane-air). Other sales of LPG are in the form of bottled or bulk propane and distribution and marketing is shared by a number of organisations - SAGASCO, Shell, Mobil, Esso, CIG and Portagas. LPG makes up about 1% of gaseous fuels sold and its transfers and allocations have not been traced in detail.

APPENDIX G: DISTRIBUTION OF ELECTRIC ENERGY

The geographical distribution network (transmission lines) for electric energy is summarised in Table 24 and depicted on the map (Figure 12). As with the other forms of secondary energy there are differences in the relevant statistical zones:

(a) the political area,

(b) the distribution areas supplied by electric energy generated within South Australia, and

(c) the consumption area for which end-use data are available.

The "distribution area" consists of those areas of the State supplied by independent supply authorities, by the Electricity Trust, and by those industries that generate for their own use. It excludes Cockburn, S.A. which is supplied from Broken Hill, N.S.W. but includes Victoria to very small extent in the sense that bulk sales are made by ETSA to the State Electricity Commission, Victoria (SECV) at Lindsay Point and Nelson.

The "consumption area" for which end-use data are available from the ESAA is restricted to the political area of South Area but excludes certain major industries which generate electric energy for their own use and some suppliers which are not recognised supply authorities.

Electric energy is available to almost all the inhabited areas of the state. The Electricity Trust generates more than 99% of the output of electricity available for public supply and ETSA supplies, directly and indirectly, more than 99% of the dwellings in the State. About 2600 dwellings are supplied by systems operated by local authorities. Some larger industries generate electricity for their own exclusive

use or for their own use together with bulk sales to ETSA. Data have been collected for transfers to and from the most significant industrial suppliers (BHP and DWF).

Generation and use of electric energy by small industries, stand-by plants, and homesteads have not been included.

The major transfers of electric energy are listed in Tables 25-27 and depicted in Figure 13. In the figure, numbers placed in parentheses index the transfers to quantities tested in the table.

Table 1: Total energy according to fuel, sector, and purpose

Category	Subcategory	Energy/PJ
Fuel		
- petroleum products	avgas	0.362
	avtur	3.849
	MS	46.451
	ADO	18.734
	IDO	12.812
	FO	7.588
	PK	0.132
	LK	0.880
	HO	3.510
	Other	5.7
	TOTAL PETROLEUM	100.02
- natural gas		22.76
- electric energy		19.99
- coal products	coke oven products	16.46
	coal	1.443
	TOTAL COAL PRODUCTS	17.90
- wood fuel	mill wastes	0.64
	fuel wood/firewood	3.07
	TOTAL WOOD FUEL	3.71
TOTAL ENERGY		164.38
Sector		
- transport	air	4.211
	road	49.592
	rail	1.935
	sea	3.538
	TOTAL TRANSPORT	59.276
- industrial	agriculture	11.492
	mining	2.158
	manufacturing	64.289
	utilities	1.23
	TOTAL INDUSTRIAL	79.17
- commercial		8.17
- domestic		17.78
TOTAL ENERGY		164.39
Purpose		
- traction		74.89
- work		7.87
- low-grade heat		23.32
- medium-grade heat		13.39
- high-grade heat		41.13
- special		3.8
TOTAL ENERGY		164.4

Table 2: Petroleum products according to sector

Sector	Fuel type (a)		Quantity /ML	Heat value $MJ.L^{-1}$	Energy /PJ
Transport					
- air	avgas	(b)	10.776	33.6	0.362
	avtur	(b)	104.864	36.7	3.849
	TOTAL				4.211
- road	MS	(c)	∿1,198.01	34.6	41.451
	ADO	(d)	∿211.47	38.5	8.141
	TOTAL				49.592
- rail	ADO	(e)	∿50	38.5	1.925
- sea	ADO	(b,f)	2.833	38.5	0.109
	IDO	(b,f)	20.457	38.7	0.792
	FO	(b,f)	64.803	40.7	2.637
	TOTAL				3.538
TOTAL TRANSPORT					59.266
Industrial					
- agricul-ture	MS	(g)	∿144.51	34.6	∿5
	PK	(b,h)	3.502	37.7	0.132
	ADO	(i)	152.99	38.5	5.890
	TOTAL				11.022
- mining	ADO	(i)	12.052	38.5	0.464
	IDO	(i)	0.827	38.7	0.032
	FO	(i)	33.710	40.7	1.372
	TOTAL				1.868
- manuf-acturing	ADO	(i)	15.896	38.5	0.612
	IDO	(b,j)	286.94	38.7	11.105
	FO	(b,j)	79.91	40.7	3.252
	LPG	(k)			1.9
	Bitumen & oils	(k)			3.8
	TOTAL				20.669
- utilit-ies		(l)			-
TOTAL INDUSTRIAL					33.559
Commercial	(m)				
	ADO	(i)	41.377	38.5	1.593
	IDO	(i)	22.894	38.7	0.886
	FO	(i)	8.034	40.7	0.327
TOTAL COMMERCIAL					2.806
Domestic					
	LK	(b,n)	23.982	36.7	0.880
	HO	(b,n)	93.343	37.6	3.510
TOTAL DOMESTIC					4.390
TOTAL PETROLEUM PRODUCTS (t)					100.02

Notes:

a. See list of abbreviations.

b. Oil and Gas Division, Department of National Development.

These figures apply to the South Australian State marketing division which also includes the Broken Hill-Wilcannia district of N.S.W. and the Murrayville district of Victoria.

c. Total motor spirit (premium and regular) as derived from (b), less the amount used in the agricultural sector (g).

d. Total inland automotive diesel oil (b) less amounts used for rail, agriculture, mining, manufacturing and commerce.

e. Estimated from the 1974/75 value of 49.4 ML (ABS).

f. Bunkers.

g. The 5 PJ of motor spirit is an estimate only and is based on 1972 figures from the Petroleum Information Bureau. See Gifford and Millington (1975).

h. All the power kerosine has been allocated to this sector.

i. Oil and Gas Division, Department of National Development. Unpublished figures for the end-use analysis of the primary fuels forecasts.

j. Difference between sales (b) and all other uses.

k. Estimated from the State Energy Report (1976).

l. Almost all the petroleum fuel used by utilities is used to generate electric energy and is therefore not included as an end use.

m. ASIC Divisions EFH-L. The amount of ADO, IDO, and FO used for auxiliary purposes within the transport and storage industries (ASIC Division G) is very small and has all been included with fuel used directly as transport energy.

n. All lighting kerosine and heating oil are assigned to the domestic sector.

Table 3: Natural gas according to sector

Sector	Area	Energy /PJ
Transport		0
Industrial		
- agriculture		0
- mining	(b)	(3.19)
- manufacturing	Port Pirie	1.03
	Adelaide	9.472
	Elsewhere	5.257
TOTAL MANUFACTURING		15.76
- utilities		0
Commercial		
	Port Pirie	0.17
	Adelaide	1.617
TOTAL COMMERCIAL		1.79
Domestic		
	Port Pirie	0.64
	Adelaide	4.572
TOTAL DOMESTIC		5.21
TOTAL NATURAL GAS		22.76

Notes:

a. Rept. Bk. 78/54.

b. Use of natural gas and natural gas liquids at the SANTOS treatment plant in the Cooper Basin. This is not an end use as it is required for the production of gas. This estimate has previously been used for estimating the net availability of gas and is not added to the other uses listed in this table.

Table 4: Electric energy according to sector

Sector	Area		Quantity /MWh	Energy /PJ
Transport				
- tram	Urban (Adelaide)	(a)	1,947	0.007
Industrial				
- agriculture	Peri-urban	(b)	25,417	
	Rural-ETSA	(b)	103,155	
	-ISA	(c)	591	
	TOTAL	(a)	129,163	0.465
- mining		(d)	∿80,000	0.288
- manufacturing	Urban (BHP Whyalla)	(e)	319,200	
	Urban (ETSA)	(f)	1,112,222	
	Rural	(c)	349,433	
	TOTAL	(c)	∿1,780,855	6.411
- utilities				
- public lighting	Urban	(g)	∿32,900	
	Rural	(g)	∿3,650	
	TOTAL	(a)	36,504	
- pipelines	Rural (Morgan-Whyalla)	(b)	60,525	
	Rural (Mannum, M. Bridge, Hahndorf)	(b)	244,748	
	TOTAL		305,273	
	TOTAL UTILITIES		341,777	1.230
TOTAL INDUSTRIAL		(h)	2,331,795	8.394
Commercial				
	Urban	(i)	822,029.6	
	Rural-ETSA	(j)	116,824.4	
	-ISA		44,313.0	
TOTAL COMMERCIAL		(k)	983,167	3.539
Domestic				
	Urban	(l)	1,652,629.5	
	Rural-ETSA	(m)	468,161.9	
	-ISA		115,511.6	
TOTAL DOMESTIC		(n)	2,236,303	8.051
TOTAL ELECTRIC ENERGY			5,553,212	19.99

Notes:

a. *Electricity Supply Association of Australia, "The electricity supply industry in Australia, 1976-77".

b. *ETSA, "Analysis of kilowatt-hours and revenue for year to date ending 30th June 1977".

c. Difference.

d. Estimated from ABS statistics at 3.0 kWh^{-1}. *ABS, "Mining establishments, details of operations: Economic censuses 1971-72 to 1975-76", Ref. No. 8401.4, Australian Bureau of Statistics, Adelaide.

e. BHP. Whyalla, from all sources including own generation.

f. ETSA "Zone 1 industrial"; less farm use (b), and less bulk sales to BHP and DWF.

g. The ratio of urban to rural use of public lighting is approximate only and is taken to be 90:10 based on ETSA figures for wattage.

h. ESAA "industrial" plus generation by industries for own use; 269,600 MWh (BHP), and 5,057 MWh (other).

i. ETSA "Zone 1 general purpose" (b), less "traction" use.

j. ETSA "Other Zones general purpose" (b).

k. ESAA "commercial" (a).

1. ETSA "Zone 1 residential" (b).

m. ETSA "Other Zones residential" (b).

n. ESAA "residential" (a).

Table 5: Coal products according to sector

Sector	Area	Energy /PJ
Transport		
- rail		0.003
Industrial		
- agriculture		0
- mining		0
- manufacturing		
coke oven products	Whyalla	15.30
coke	Port Pirie	1.16
coal	Port Pirie	1.41
TOTAL MANUFACTURING		17.87
- utilities		0
TOTAL INDUSTRIAL		17.87
Commercial		0.03
Domestic		0
TOTAL COAL PRODUCTS		17.90

Table 6: Wood fuel according to sector

Sector	Area	Energy /PJ
Transport		0
Industrial		
- agriculture		0
- mining		0
- manufacturing	South East	0.64
	Elsewhere	2.94
- utilities		0
TOTAL INDUSTRIAL		3.58
Commercial		0
Domestic		0.13
TOTAL WOOD FUEL		3.71

Table 7: Fuels according to purpose (a)

Fuel	Purpose	Energy/PJ
Petroleum products		
- avgas	traction	0.362
- avtur	traction	3.849
- MS	traction	46.451
- ADO	traction	18.734
- "	work	-
- PK	traction	0.132
- LK	LG	0.880
- HO	LG	3.510
- IDO	traction	0.792
- "	work	0.918
- "	LG	0.07
- "	MG	0.83
- "	HG	10.17
- FO	traction	2.637
- "	MG	4.459
- "	HG	0.460
- LPG	traction	1.9
- Bitumen and oils	special	3.8
TOTALS	traction	74.86
	work	0.92
	LG	4.46
	MG	5.29
	HG	10.63
	special	3.8
TOTAL PETROLEUM PRODUCTS		100.0
Natural gas	LG	7.02
	MG	4.425
	HG	11.35
TOTAL NATURAL GAS		22.8
Electric energy	traction	0.007
	work	6.95
	LG	11.68
	MG	∿0.1 ?
	HG	1.29
TOTAL ELECTRIC ENERGY		20.0
Coal products	traction	0.003
	LG	0.03
	HG	17.87
TOTAL COAL PRODUCTS		17.9
Wood fuel	LG	0.13
	MG	3.58
TOTAL WOOD FUEL		3.7
TOTAL ENERGY		164.4

Notes: a. See Table 13.

Table 8: Transport sector according to fuel

Fuel	Subsector	Energy/PJ
Petroleum products		
- avgas	air	0.362
- avtur	air	3.849
- MS	road	41.451
- ADO	road	8.141
- "	rail	1.925
- "	sea	0.109
- "	TOTAL ADO	10.18
- IDO	sea	0.792
- FO	sea	2.637
TOTAL PETROLEUM PRODUCTS		59.266
Natural gas		0
Electric energy	rail (tram)	0.007
Coal products	rail	∿0.003
Wood fuel		0
TOTAL TRANSPORT		59.28

Source: See Tables 2-6.

Table 9: Industrial sector according to fuel

Fuel	Subsector	Energy/PJ
Petroleum products		
- MS	agriculture	~5
- PK	agriculture	0.13
- ADO	agriculture	5.89
- "	mining	0.464
- "	manufacturing	0.612
- IDO	mining	0.032
- "	manufacturing	11.105
- FO	mining	1.372
- "	manufacturing	3.252
- other	manufacturing	5.7
TOTAL PETROLEUM PRODUCTS		33.559
Natural gas		
	manufacturing	15.76
Electric energy		
	agriculture	0.47
	mining	0.29
	manufacturing	6.41
	utilities	1.23
TOTAL ELECTRIC ENERGY		8.40
Coal products		
- coke and coke oven products	manufacturing	16.46
- coal	manufacturing	1.41
TOTAL COAL PRODUCTS		17.87
Wood fuel		
- mill wastes	manufacturing	0.64
- fuel wood	manufacturing	2.94
TOTAL WOOD FUEL		3.58
TOTAL INDUSTRIAL		78.17

Source: See Tables 2-6.

Table 10: Commercial sector according to fuel

Fuel	Energy/PJ
Petroleum products	
- ADO	1.593
- IDO	0.886
- FO	0.327
TOTAL PETROLEUM PRODUCTS	2.806
Natural gas	1.79
Electric energy	3.54
Coal products	0.03
Wood fuel	0
TOTAL COMMERCIAL	8.17

Source: See Tables 2-6.

Table 11: Domestic sector according to fuel

Fuel	Energy/PJ
Petroleum products	
- LK	0.880
- HO	3.510
TOTAL PETROLEUM PRODUCTS	4.390
Natural gas	5.21
Electric energy	8.05
Coal products	0
Wood fuel	
- firewood	0.13
TOTAL DOMESTIC	17.78

Source: See Tables 2-6.

Table 12: Sector according to purpose

Sector		Purpose	Energy/PJ
Transport	(a)	traction	59.276
Industrial			
- agriculture	(b)	traction	11.022
	(c)	LG	0.47
		TOTAL AGRICULTURE	11.492
- mining	(d)	traction	0.464
	(e)	work	0.322
	(f)	MG	1.372
		TOTAL MINING	2.158
- manufacturing	(g)	traction	2.53
		work	3.66
		LG	1.475
		MG	11.715
		HG	41.13
		special	3.8
		TOTAL MANUFACTURING	64.310
- utilities	(c)	work	1.23
- TOTALS		traction	14.016
		work	5.212
		LG	1.945
		MG	13.087
		HG	41.13
		special	3.8
TOTAL INDUSTRIAL			79.19
Commercial	(d)	traction	1.593
	(h)	work	2.656
	(i)	LG	3.59
		MG	0.327
TOTAL COMMERCIAL			8.17
Domestic		LG	17.78
TOTALS			
		traction	74.885
		work	7.868
		LG	23.315
		MG	13.414
		HG	41.13
		non-fuel	3.8
TOTAL ENERGY			164.412

Source: See Table 14.

Table 13: Purpose according to fuel

Purpose		Fuel	Energy/PJ
Traction	(a)	avgas	0.362
	(a)	avtur	3.849
	(a)	MS	46.451
	(a)	PK	0.132
	(a)	ADO	18.734
	(b)	IDO	0.792
	(b)	FO	2.637
	(a)	LPG	1.9
		TOTAL PETROLEUM FUELS	74.86
	(c)	electric energy	0.007
	(d)	coal products	0.003
TOTAL TRACTION			74.87
Work			
	(e)	IDO	0.918
	(f)	electric energy	6.95
TOTAL WORK			7.87
Low-grade heat	(a)	LK	0.880
	(a)	HO	3.510
	(g)	IDO	0.07
		TOTAL PETROLEUM FUELS	4.460
	(h)	natural gas	7.02
	(i)	electric energy	11.68
	(j)	wood fuel	0.13
		coal products	0.03
TOTAL LOW-GRADE HEAT			23.32
Medium-grade heat			
	(g)	IDO	0.83
	(g,l)	FO	4.459
		TOTAL PETROLEUM FUELS	5.289
	(g)	electric energy	~0.1 ?
	(g)	natural gas	4.425
	(m)	wood fuel	3.58
TOTAL MEDIUM-GRADE HEAT			13.39
High-grade heat			
	(g)	IDO	10.17
	(g)	FO	0.46
		TOTAL PETROLEUM FUELS	10.63
	(g)	natural gas	11.34
		electric energy	1.29
	(m)	coal products	17.87
TOTAL HIGH-GRADE HEAT			41.13
Special	(a)	Bitumen and oils	3.8
TOTAL ENERGY			164.38

Notes:

a. All of this fuel or product.

b. Bunkers.

c. Glenelg tram.

d. Railway use.

e. All the IDO in the mining and commercial sectors plus a proportion from the manufacturing sector (Table 18).

f. All electric energy in the mining and utilities sectors, plus a proportion from manufacturing and commercial. No domestic use has been included.

g. A proportion of manufacturing use of this fuel.

h. All domestic and commercial use, and a proportion of manufacturing use.

i. All domestic agricultural use, half the commercial use, and a proportion of manufacturing use.

j. All domestic use.

k. All commercial use.

l. Includes all furnace oil used in mining and commercial sectors.

m. All manufacturing use of this fuel.

Table 14: Purpose according to sector

Purpose		Sector	Energy/PJ
Traction	(a)	transport	59.276
		industrial	
	(b)	- agriculture	11.022
	(c)	- mining	0.464
	(d)	- manufacturing	2.53
		- TOTAL INDUSTRIAL	14.016
	(e)	commercial	1.593
TOTAL TRACTION			74.89
Work		industrial	
	(f)	- mining	0.322
	(d)	- manufacturing	3.66± 1
	(g)	- utilities	1.23
		- TOTAL INDUSTRIAL	5.21
	(h)	- commercial	2.656
	(i)	domestic	negligible
TOTAL WORK			7.87
Low-grade heat		industrial	
	(i)	- agriculture	0.47
	(d)	- manufacturing	1.48 ± 1
		- TOTAL INDUSTRIAL	1.95
	(h,j)	commercial	3.59
	(i,k)	domestic	17.78
TOTAL LOW-GRADE HEAT			23.32
Medium-grade heat		industrial	
	(l)	- mining	1.372
	(d)	- manufacturing	10.96 ± 3
		- TOTAL INDUSTRIAL	12.33
	(l)	commercial	0.327
TOTAL MEDIUM-GRADE HEAT			12.66
High-grade heat			
	(d)	- manufacturing	41.84 ± 3
Special	(d)	- manufacturing	3.8
TOTAL ENERGY			164.38

Notes:

a. All transport energy.

b. All petroleum fuels in agriculture.

c. All automotive diesel oil in mining is assigned to this purpose although some would be used for high-speed stationary engines like compressors.

d. Table 18.

e. All automotive diesel oil in commercial sector.

f. All industrial diesel oil (0.032 PJ) in mining is assigned to this purpose (low-speed stationary engines) but small quantities may be used for heating. All electrical energy used in mining is also included (0.29 PJ).

g. All electrical energy used by this sector.

h. Unlike the domestic sector, large amounts of electricity in the commercial sector are used for work (mainly lighting but also refrigeration). A 50:50 division between work and low-grade heat from electricity is assumed. All industrial diesel oil (low-speed stationary engines) is assigned to this purpose although small amounts may be used for heating.

i. Electricity is primarily used for hot water, space heating, and air conditioning. A proportion is also used for work (light, refrigeration, household appliances) and some for medium-grade heat (cooking). As the exact breakdown is unknown all electricity use in the home and on farms has been allotted to low-grade heat.

j. 50% of electrical consumption together with all natural gas and coal used in this sector.

k. All electricity, natural gas, wood, and petroleum fuels used in this sector.

l. All fuel oil used by this sector.

Table 15: Energy contents of fuels

Fuel	Range (same units as average)	Average /MJ.kg^{-1}	/MJ.L^{-1}	/MJ.m^{-3}
Coal (as mined) and coke (a)				
- black, typical	21-28	25	-	-
- brown, typical	5-15	10	-	-
- coke, typical	-	25	-	-
- Lake Phillipson (Permian) coal	-	18	-	-
- Leigh Creek (Triassic) coal	-	14.8	-	-
- Wakefield (Tertiary) coal	-	10.4	-	-
Oil and petroleum products (b)				
- crude oil, C_8+		-	34.8	-
- condensate, C_5-C_7		-	32.1	-
- ethane and LPG		-	21.6	-
- fuel oil	40.145-41.224	-	40.7	-
- industrial diesel oil	38.270-39.059	-	38.7	-
- automotive diesel oil	38.210-38.794	-	38.5	-
- power kerosine	37.490-37.871	-	37.7	-
- heating oil	37.221-37.973	-	37.6	-
- lighting kerosine	36.485-36.852	-	36.7	-
- aviation turbine fuel	36.485-36.852	-	36.7	-
- motor spirit	34.380-34.893	-	34.6	-
- aviation gasoline	33.450-33.799	-	33.6	-
Gas (c)				
- natural gas	37.2 -40.9	-	-	39.05
- LNG (methane)	-	55.1	14.3	14,300
- methane, C_1	-	55.6	-	37.1
- ethane, C_2	-	51.9	-	65.5
- propane, C_3	-	50.4	-	93.3
- butane, C_4	-	49.5	-	122.0
- coal gas				
- horizontal retorts	-	-	-	20.8
- vertical retorts with steaming	-	-	-	17.7
- low temperature process	-	-	-	33.1
- coke oven gas	-	-	-	19.5
- water gas				
- "blue"	-	-	-	11.0
- "carburretted"	16.7 -26.0	-	-	21.4
- producer gas				
- from coke	-	-	-	4.9
- from coal	-	-	-	6.1
- blast furnace gas	-	-	-	3.4
- oil gas				
- ICI "500" process	-	-	-	18.6
- CRG process	29.8 -36.3	-	-	33.1

Fuel	Range (same units as average)	Average /MJ.kg^{-1}	/MJ.L^{-1}	/MJ.m^{-3}
- manufactured gas				
- low-energy (air-blown)	5-7	-	-	∿6
- medium-energy (oxygen-blown)	10-12	-	-	∿11
- high-energy (SNG)	30-40	-	-	∿35
Wood and Charcoal				
- green	-	10	-	-
- dry	-	19	-	-
- charcoal	-	29	-	-
Alcohol				
- methanol	-	22	16	-
- ethanol	-	30	21.4	-
Waste				
- municipal (combustible)	-	9	-	-
- industrial (combustible)	-	14	-	-
- wood shavings	-	19	-	-
- tyres	-	27	-	-
- sewage (Metropolitan Adelaide)	-	8.5	-	-
- pig manure	-	6.8	-	-
- poultry manure	-	4.4	-	-
- cattle manure	-	1.5	-	-
- straw	-	13	-	-
Hydrogen				
- gaseous	-	141.9	-	12.1
- liquid	-	141.2	10.2	10,200
- vanadium hydride	-	4.7	-	28,400
- magnesium-nickel hydride	-	8.5	-	14,600
Electric energy (Exactly 3.6 MJ.kWh^{-1})				

Notes: Sources are standard and/or may be found in the relevant sections of the South Australian State Energy Committee Report (1976), except as indicated below.

a. South Australian coal: Department of Mines (1976). - "Investigation of South Australian coal deposits", DM 361/76.

b. Petroleum products: Australian Institute of Petroleum (1976). - "Oil and Australia 1976, the figures behind the facts".

c. LPG: Further data is contained in Royal Commission on Petroleum (1976). - Sixth Report: "The use of liquefied petroleum gas in Australia".

Table 16: End-use classifications (a)

SADME (b)	ASIC (c)	DND (d)	ESAA (e)	ETSA (f)	SAGASCO (g)
Transport	Division G - fuel (h)	Transport	Traction	General purpose - lighting - power - all purpose - bulk (j)	-
Commercial			Commercial		Commercial
- transport services and storage	Division G - non fuel (i)				
- construction	Division E	Domestic and commercial			
- trade	Division F				
- communication	Division H				
- services	Division I,J,K				
- entertainment etc.	Division L				
Domestic	-		Residential	Residential - lighting - power - all purpose - water heating - bulk (j)	Residential
- heating					
- cooking					
- air conditioning					
- light, work, etc.					
Industrial			Industrial	Industrial	Industrial
- agriculture	Division A	Agriculture		Farm (incl. bulk (j))	
- mining	Division B	Mining		Industry - lighting - power - all purpose - all purpose W (incl. bulk (j))	
- manufacturing	Division C	Manufacturing			
- utilities					
- pipelines	Division D370	Water (k)		Pipelines	
- public lighting	Division D3610 (1)	-	Public lighting	Public lighting (incl. bulk (j))	

Notes:

a. The sectors are not perfectly matched because the classifications exist for different purposes.

b. Energy Branch, South Australian Department of Mines and Energy.

c. Australian Standard Industrial Classification, Australian Bureau of Statistics.

d. Oil and Gas Division, Department of National Development (Canberra).

e. Electricity Supply Association of Australia.

f. Electricity Trust of South Australia.

g. South Australian Gas Comapny.

h. Energy use includes only that which attributed to transport fuel. Auxiliary energy use is included under commercial.

i. Auxiliary energy use only is included. Transport fuels are attributed to the transport sector.

j. ETSA bulk supplies (amounting to about 1% of total electricity generated) has been redistributed among the various energy end-use categories.

k. The classification "Electricity, water and gas" corresponding to ASIC Division D is much wider than the classification here which is restricted to water pumping, sewerage, and drainage.

l. Classification suggested by Australian Bureau of Statistics. Energy used as fuel for electricity generation and gas production and reticulation is not included as an end use.

Table 17: Australian standard industrial classification (a)

Division	Subdivision	Title
A		AGRICULTURE, FORESTRY, FISHING, AND HUNTING
	01	Agriculture
	02	Services to agriculture
	03	Forestry and logging
	04	Fishing and hunting.
B		MINING
	11	Metallic minerals
	12	Coal
	13	Crude petroleum (including natrual gas)
	14	Construction materials
	15	Other non-metallic minerals
	16	Services to mining.
C		MANUFACTURING
	21-22	Food, beverages, and tobacco
	23	Textiles
	24	Clothing and footwear (including knitting mills)
	25	Wood, wood products, and furniture (except sheet metal)
	26	Paper and paper products, printing and publishing
	27	Chemical, petroleum, and coal products
	28	Glass, clay, and other non-metallic mineral products
	29	Basic metal products
	31	Fabricated metal products
	32	Transport equipment
	33	Other industrial machinery and equipment, and household appliances
	34	Leather, rubber, and plastic products, and manufacturing n.e.c. (b)
D		ELECTRICITY, GAS, AND WATER
	36	Electricity and gas
	37	Water, sewerage and drainage.
E		CONSTRUCTION
	41	General construction
	42	Special trade contracting.
F		WHOLESALE AND RETAIL
	46-47	Wholesale trade
	48	Retail trade.
G		TRANSPORT AND STORAGE
	51	Road transport
	52	Railway transport
	53	Water transport
	54	Air transport
	55	Other transport & storage

Division	Subdivision	Title
H	56	COMMUNICATION.
I		FINANCE, INSURANCE, REAL ESTATE, AND BUSINESS SERVICES
	61	Finance and investment
	62	Insurance
	63	Real estate and business services.
J		PUBLIC ADMINISTRATION AND DEFENCE
	71	Public administration
	72	Defence.
K		COMMUNITY SERVICES
	81	Health
	82	Education, libraries, museums, and art galleries.
	83	Welfare, charitable services, and religious institutions
	84	Other community services.
L		ENTERTAINMENT, RECREATION, RESTAURANTS, HOTELS, AND PERSONAL SERVICES
	91	Entertainment and recreational services
	92	Restaurants, hotels, and clubs
	93	Personal services
	94	Private households employing staff
	99	Non-classifiable establishments.

Notes: a. Abridged from
* Commonwealth Bureau of Census and Statistics (1975). - "Australian Standard Industrial Classification", Volume 1 - The Classification, CBCS, Canberra.

b. n.e.c. = not elsewhere included.

Table 19: Distribution of petroleum products

		Energy /PJ	Diagram reference
Source and wholesale supply			
PRA - production	(a)	88.2	
difference	(b)	4.71	
- TOTAL		92.9	01, 13
Interstate	(c)	33.5	
Overseas	(c)	8.4	02, 23
TOTAL WHOLESALE SUPPLY		134.8	
Marketing			
Consumption	(d)	100.01	34, 40
Intermediate	(e)	5.61	35, 50
Interstate	(c)	24.5	
Overseas	(c)	4.7	36, 60
TOTAL MARKETED		134.8	

Notes:

a. Petroleum Refineries (Australia) Ltd.

b. Due to run down of stocks and/or differences attributable to the difference between the distribution and marketing areas.

c. SA Department of Marine and Harbours.

d. State marketing area. Consumption figures from the Department of National Development.

e. Electricity Trust of South Australia.

Table 20: Distribution network for natural gas

Pipeline	Operator	Termination	Gas purchaser	Length /km	Size (diameter /cm
Main pipeline (Moomba to Adelaide)	PASA	Torrens Is.	ETSA power station	782	56
Main pipeline (Moomba to Sydney)	TPA	Wilton	AGL gas marketer	1300	86
Lateral	PASA	Angaston	Adelaide-Brighton Cement Co.	39	20
Lateral	PASA	Burra	Samin Ltd Copper treatment plant	15	8
Lateral	PASA	Nuriootpa	Tarac Barossa Pty Ltd distillery	1	10
Lateral	PASA	Peterborough	Peterborough Corp. power station	3	8
Lateral	PASA	Dry Creek	ETSA gas turbine power station	1	30
Lateral	PASA	Taperoo	SAGASCO gas marketer	1	30
Lateral	PASA	Pt. Pirie	SAGASCO gas marketer	80	15

Sources: State Energy Committee (1976)
PASA
The Pipeline Authority (1976)

Table 21: Bulk delivery of natural gas

Pipeline	Energy delivered (a) /PJ	Diagram reference (b)
PASA (c), (d)	70.06	01
TPA (c)	10.24	02
TOTAL DELIVERY	80.30	

Notes:

a. It is common to quote natural gas in energy terms.

b. See Figure 10.

c. Rept. Bk. 78/54.

d. PASA figure net of delivery losses and pipeline fuel.

Table 22: Bulk transfers of natural gas

Pipeline authority	Distributing authority	Energy transferred (a) /PJ	Diagram reference (b)
PASA	PASA (c)	5.319	11
PASA	SAGASCO	17.965	13
PASA	ETSA	46.78	14
TPA	AGL	10.24	25
TOTAL TRANSFER		80.30	

Notes:

a. See Rept. Bk. 78/54.

b. See Figure 10.

c. PASA's industrial customers and the Peterborough Corporation.

Table 23: Allocation of natural gas to end uses (a)

Distributing authority	End use	Energy distributed /PJ	Diagram reference (b)
PASA	Consumption	5.257	16
SAGASCO	Consumption	17.495	26
TOTAL CONSUMPTION	(South Australia)	22.75	60
PASA	Internal uses and losses (b)	0	17
SAGASCO	Internal uses and losses	0.47	27
TOTAL INTERNAL USES AND LOSSES		0.47	70
PASA	Intermediate uses	0.062	18
ETSA	Intermediate uses	48.78	48
TOTAL INTERMEDIATE USES		48.84	80
AGL	Intermediate uses	10.24	59
TOTAL INTERSTATE USES		10.24	90
TOTAL END USES		82.30	

Notes: a. See Rept. Bk. 78/54

b. See Figure 10.

Table 24: Distribution network for electric energy

Transmission lines	Length /km	Size (Voltage) /kV
In service (June 1977)	846	275
	2,587	132
	1,328	66
	3,659	33
	19,906	19
	14,060	11
Under construction (June 1977)		
Wudinna to Streaky Bay and Ceduna		66
Neuroodla to Hawker		33

Source: *ETSA, Annual Report, 1976-77.

Table 25: Generation of electric energy

Generating authority	Energy generated /MWh	/PJ	Diagram reference
Independent supply authorities (a)	31,746	0.114	01
ETSA (b)	6,103,477	21.973	02
Industries			03
- steelworks (c)	298,993		
- sawmills-DWF (d)	∿19,192		
-ETSA (e)	15,808		
- others (f)	4,615		
TOTAL	338,608	1.219	
TOTAL GENERATION	6,473,831	23.306	

Notes:

a. Difference between total generation (excluding industry) and ETSA generation. This also includes 138 MWh generated in NSW for South Australian consumption.

*ETSA, Annual Report 1976/77.

*ESAA, The Electricity Supply Industry in Australia 1976/77.

b. Difference between total ETSA generation and the generation at the Mount Gambier power station (see note (e)).

*ETSA, Annual Report 1976/77.

c. BHP, Whyalla.

d. South Australian Department of Woods and Forests.

The total generation by Mount Gambier and Nangwarry power stations is estimated at 35,000 MWh.

e. This was generated between 1.7.76 and 31.10.76 while the Mt. Gambier station was operated by ETSA.

*ETSA, Annual Report 1976/77.

f. This is the amount of electric energy generated for sale by other industries to ETSA. The estimated generation is the amount sold plus an assumed 15% to cover transmission losses and internal uses. The small amount of electricity generated by these other industries and homesteads purely for internal consumption has been ignored.

Table 26: Bulk transfers of electric energy

Generating authority (a)	Distributing authority (a)		Energy transferred /MWh	/PJ	Diagram reference
ISA	ISA	(b)	31,746	0.114	11
ETSA	ISA	(c)	64,494	0.232	21
ETSA	ETSA	(d)	5,983,246	21.540	22
ETSA	Industries				
	- steelworks	(e)	49,600		
	- sawmills	(f)	3,351		
	TOTAL		52,951	0.191	
ETSA	Interstate	(f)	2,786	0.010	24
Industries	ETSA				32
	- steelworks	(e)	567		
	- sawmills	(g)	30,408		
	- other	(h)	3,923		33
	TOTAL	(i)	34,898	0.126	
Industries	Industries				
	- steelworks		298,426		
	- sawmills		4,592		
	- other		692		
	TOTAL		303,710	1.093	
TOTAL TRANSFER (j)			6,473,831	23.306	

Notes:

a. ISA = Independent Supply Authorities

ETSA = Electricity Trust of South Australia

Industries = which generate electric energy and which sell some of this to ETSA. This category does not include industries which purchase electric energy in the normal way as these are included under "end-uses". Nor does it include industries which generate electric energy entirely for their own uses.

b. Total generated by independent authorities.

c. Bulk sales reported, less a small amount of electric energy sold to Victoria's State Electricity Commission at Nelson (679.8 MWh) and at Lindsay Point (2,106.270 MWh).

*ETSA, Annual Report, 1976/77.

d. Difference between generation and bulk sales plus sales to the industries listed.

e. BHP, Whyalla.

f. ETSA.

g. *ETSA, Annual Report, 1976/77.

h. Difference.

*ETSA, Annual Report, 1976/77.

i. Consisting of purchases of 19,090 MWh and ETSA generation at Mount Gambier of 15,808 MWh.

*ETSA, Annual Report, 1976/77.

j. All losses have been assigned at the final division among end-uses.

Table 27: Distribution of electric energy

Distributing authority (a)	End use (b)	Energy distributed /MWh	/PJ	Diagram reference
Consumption				
ISA	Consumption (c)	94,645	0.341	15
ETSA	Consumption (d)	5,136,016	18.490	25
Industries	Consumption			35
	- steelworks (e)	319,200		
	- sawmills (d)	3,351		
	TOTAL	322,551	1.159	
TOTAL CONSUMPTION (South Australia) (b)		5,553,212	19.990	50
Internal uses and losses				
ISA	Internal use and losses (d)	1,595	0.016	16
ETSA	Internal use and losses (d)	879,342	3.166	26
Industries	Internal use and losses			36
	- BHP station losses (e)	14,616		
	- BHP distribution losses (e)	14,210		
	- Nangwarry & Mt. Gambier (g)	4,592		
	- Other (g)	692		
	TOTAL	34,110	0.125	
TOTAL INTERNAL USES AND LOSSES		917,141	3.307	60
BULK SALES TO VICTORIA		2,786	0.010	47, 70
TOTAL END USES		6,473,831	23.307	

Notes:

a. See note (a) in preceding table.

b. "Consumption" is energy available for use at the point of final sale. "Internal use" is use by the generating authority for generating the electricity or for auxiliary purposes. "Losses" include station losses, distribution losses, and any other differences between generated and sold quantities.

c. ETSA, "Independent Electricity Supply Authorities, South Australia", 1976/77.

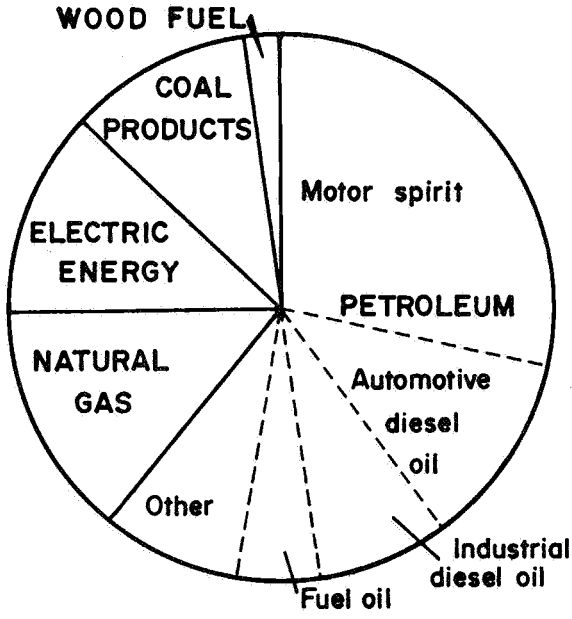
d. *ETSA, Annual Report 1976/77. All bulk sales and sales to industries that also generate their own electric energy have been subtracted.

e. BHP.

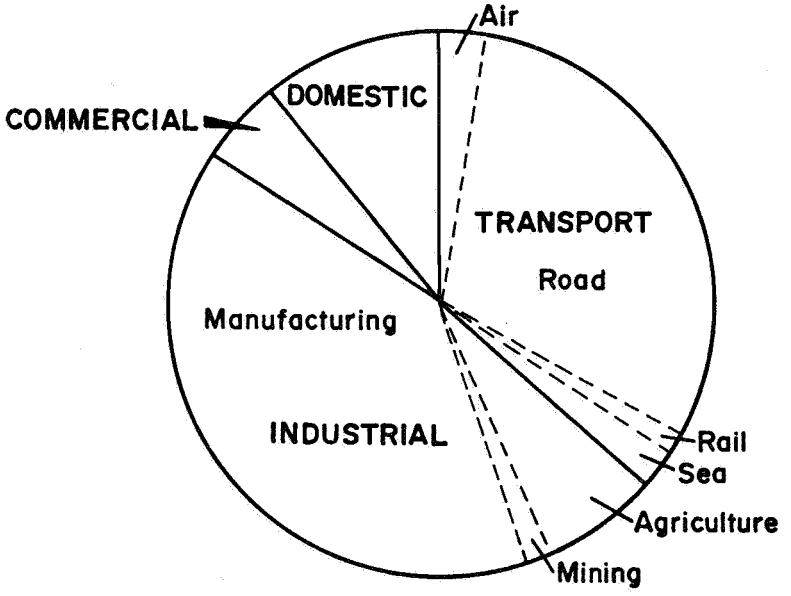
f. Total consumption as defined here should also be derivable by adding to the ESAA total the amount of energy generated by independent supply authorities not recognised by ETSA, namely the Commonwealth Railways, the South Australian Railways, and the Broken Hill Proprietary Co. Ltd (Whyalla, Iron Knob, Iron Baron), and adding the amount of energy supplied from Broken Hill (NSW) to Cockburn (SA). This amounts to 5,553, 324 MWh, i.e., 112 MWh (or 0.002%) is unaccounted for.

"Consumption" does not include electric energy generated by industries entirely for their own use. The major industries in this class are Cellulose Australia Ltd., Snuggery (∿6,000 MWh), Adelaide-Wallaroo Fertiliser, and ICI.

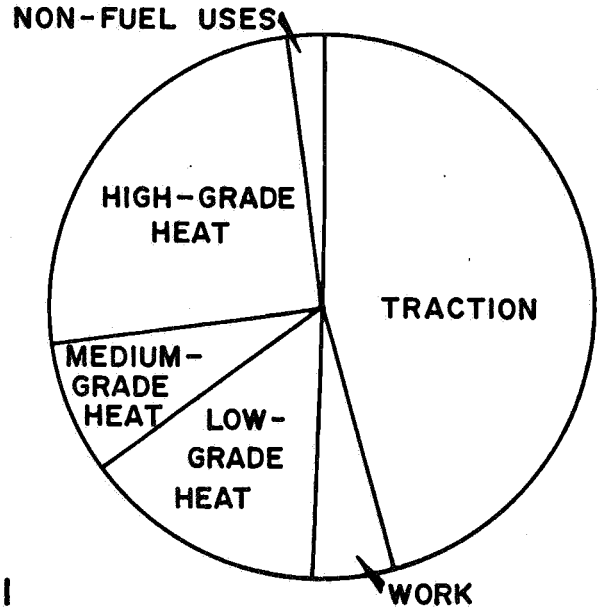
g. Calculated at 15% of generated energy.



TOTAL ENERGY BY FUEL



TOTAL ENERGY BY SECTOR

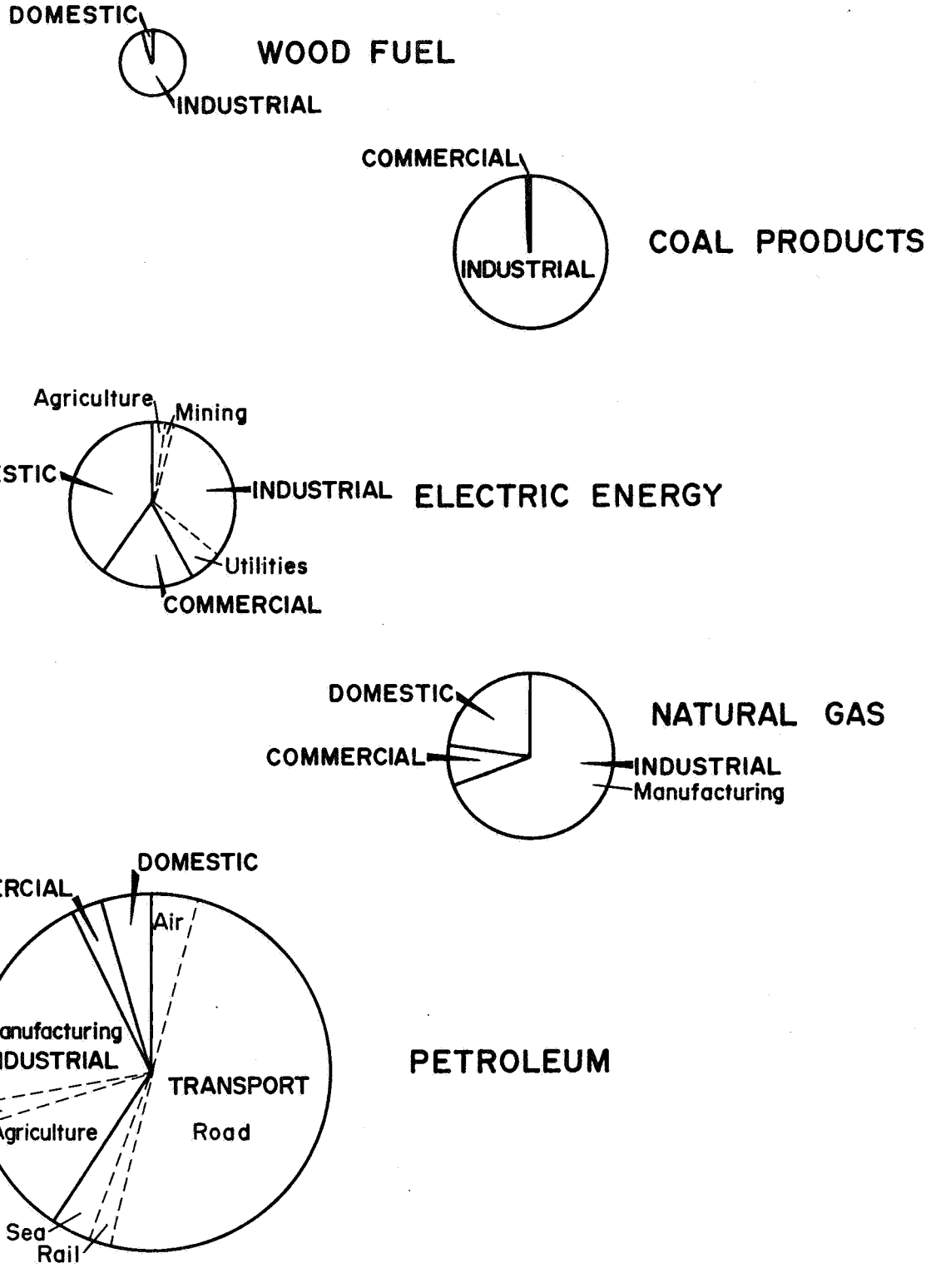


TOTAL ENERGY BY PURPOSE

Source : Table I

FIG. I

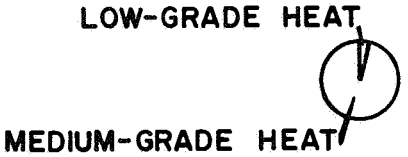
	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 4PJ. cm^{-2}
COMPILED K. King	FUEL CONSUMPTION	DATE 9-8-78
DRN I.M. CKD	TOTAL ENERGY ACCORDING TO FUEL, SECTOR, AND PURPOSE	PLAN NUMBER S13573



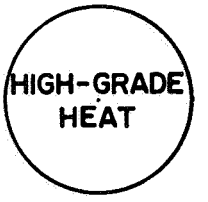
Source: Tables 2-6

FIG. 2

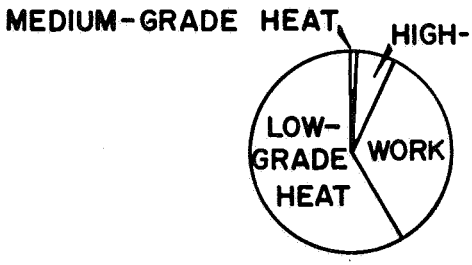
	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 4 PJ. cm^{-2}
COMPILED: K. King	FUEL CONSUMPTION	DATE: 9-8-78
DRN: I. M. CKD:	FUEL ACCORDING TO SECTOR	PLAN NUMBER S13574



WOOD FUEL

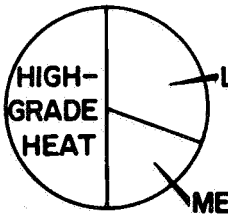


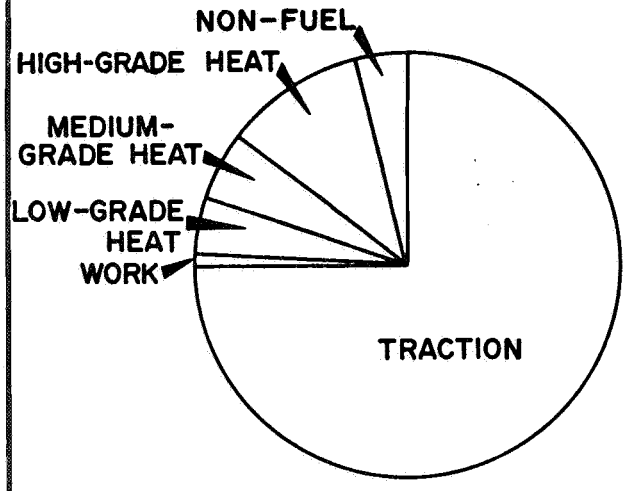
COAL PRODUCTS



ELECTRIC ENERGY

NATURAL GAS



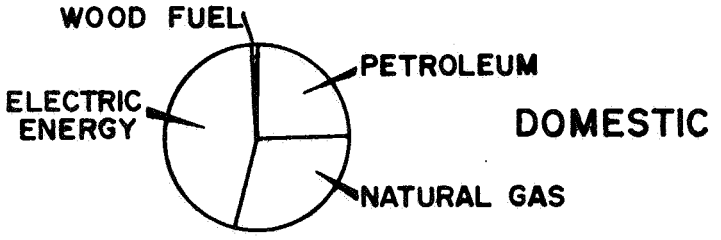


PETROLEUM

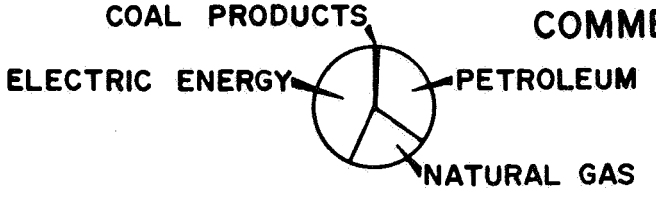
Source: Table 7

FIG. 3

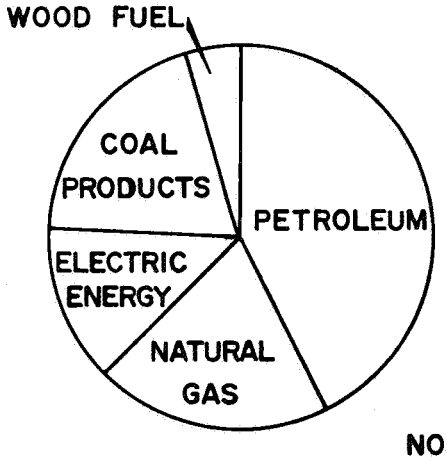
	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 4 PJ. cm^{-2}
COMPILED: K. King	FUEL CONSUMPTION	DATE: 9-8-78
DRN I.M. | CKD	FUEL ACCORDING TO PURPOSE	PLAN NUMBER S13575



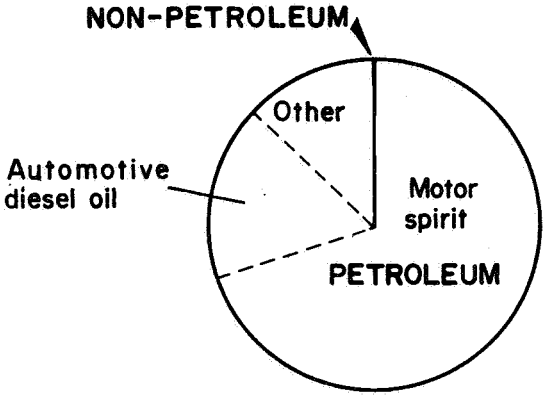
DOMESTIC



COMMERCIAL



INDUSTRIAL

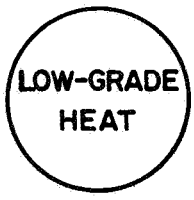


TRANSPORT

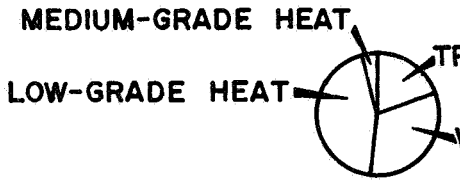
Source: Tables 8-11

FIG. 4

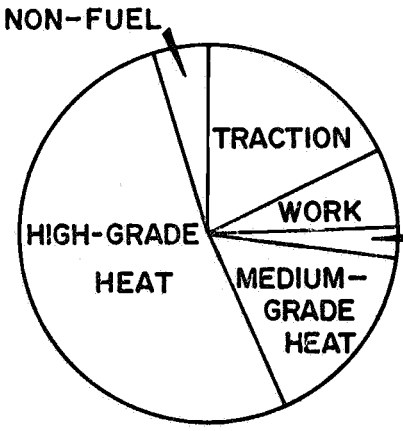
	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 4 PJ. cm^{-2}
COMPILED: K. KING	FUEL CONSUMPTION	DATE 9-8-78
DRN: I. M. CKD:	SECTOR ACCORDING TO FUEL	PLAN NUMBER S13576



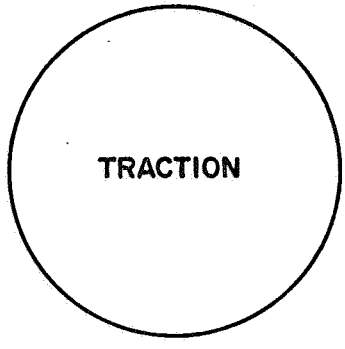
DOMESTIC



COMMERCIAL



INDUSTRIAL

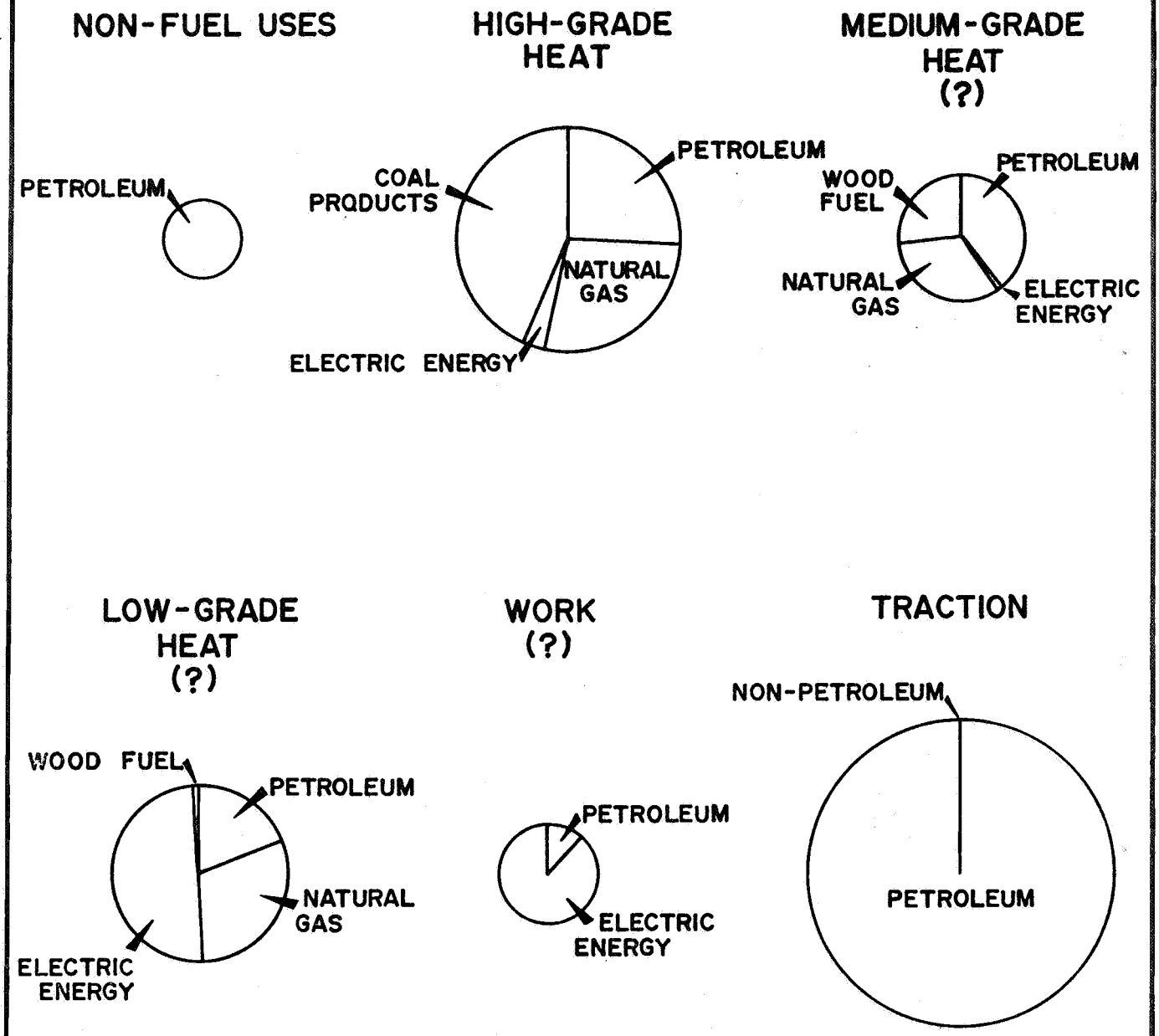


TRANSPORT

Source: Table 12

FIG. 5

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 4PJ. cm^{-2}
COMPILED: K. King	FUEL CONSUMPTION	DATE: 9-8-78
DRN I.M. CKD:	SECTOR ACCORDING TO PURPOSE	PLAN NUMBER S13577



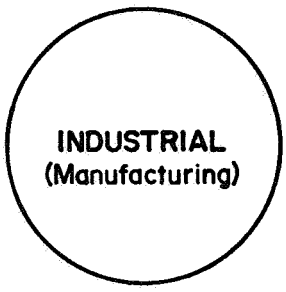
Source: Table 13

FIG. 6

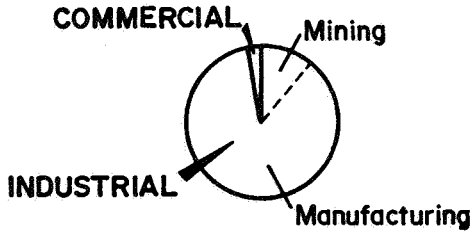
	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 4 PJ. cm^{-2}
COMPILED: K. KING	FUEL CONSUMPTION	DATE: 9-8-78
DRN: I.M. CKD:	PURPOSE ACCORDING TO FUEL	PLAN NUMBER S13578

NON-FUEL USES

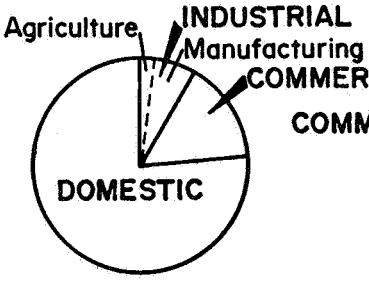
HIGH-GRADE HEAT



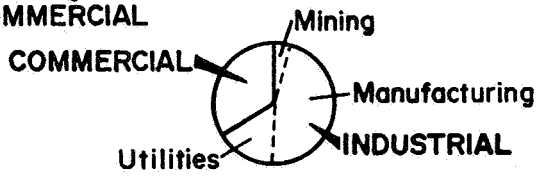
MEDIUM-GRADE HEAT (?)



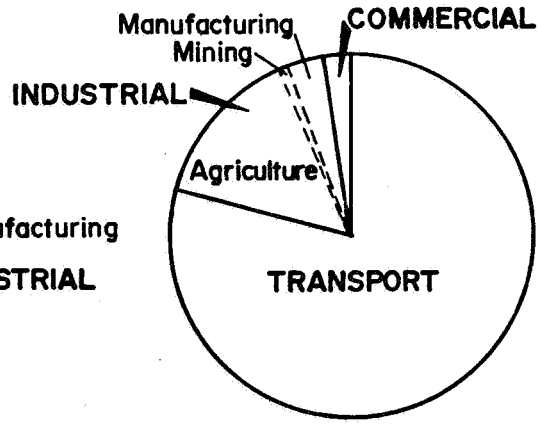
LOW-GRADE HEAT (?)



WORK (?)



TRACTION



Source: Table 14

FIG. 7

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 4PJ. cm^{-2}
COMPILED: K. King	FUEL CONSUMPTION PURPOSE ACCORDING TO SECTOR	DATE: 9-8-78
DRN: I. M. CKD:		PLAN NUMBER S13579

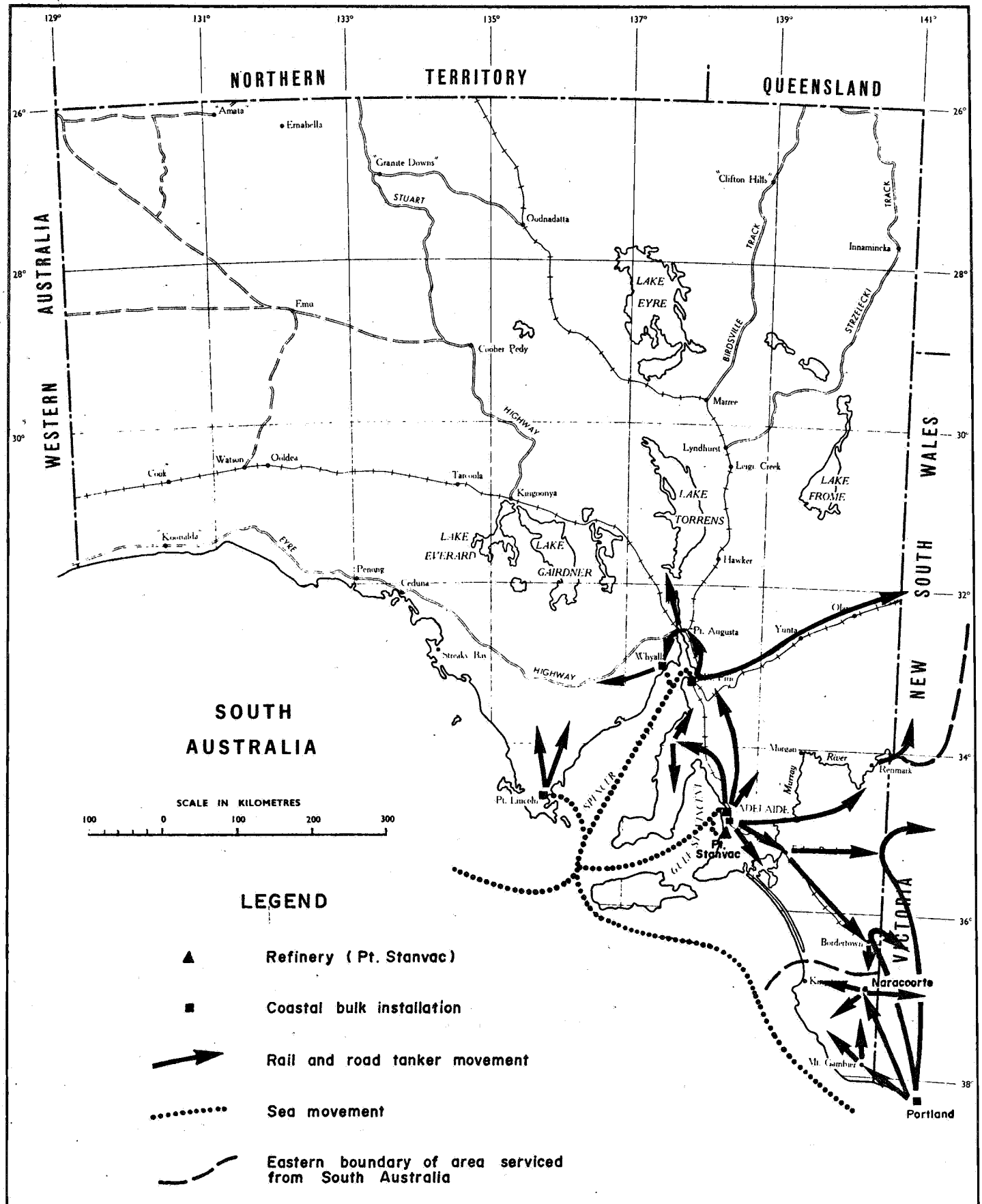


FIG. 8

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Compiled. K. King	DISTRIBUTION OF ENERGY PETROLEUM PRODUCTS	Date: AUG 1978
Drn. M.H.R. Ckd.		Drg. No. S 13588

P F No. 55850 9942

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

TRANSFERS OF ENERGY
PETROLEUM PRODUCTS

COMPILED: K. King
DRN: M.H.R. CKD:

PLAN NUMBER S 13589
DATE: AUG. 1978
SCALE:

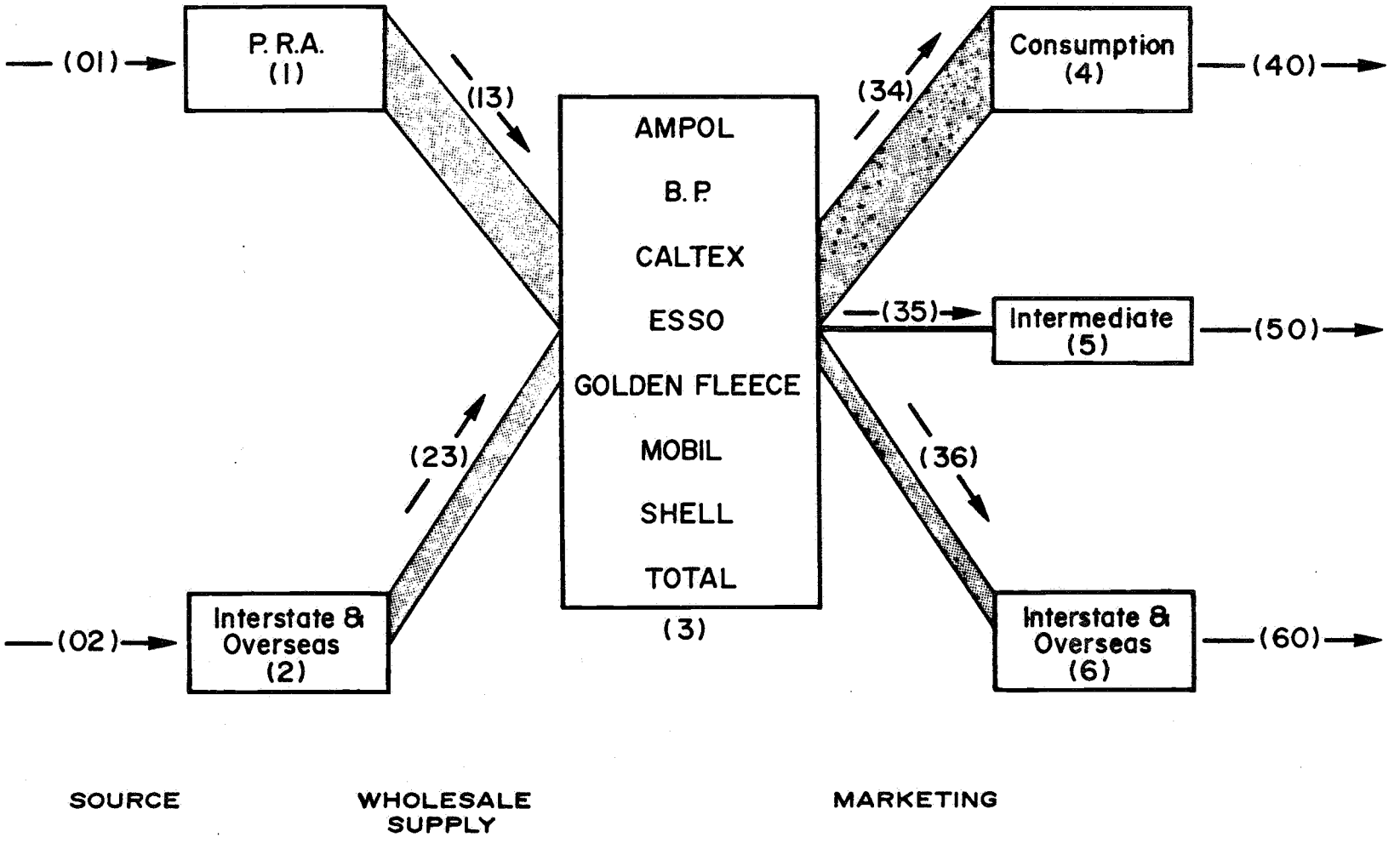


FIG. 9

NOTE — Numbers in parentheses are references to Table 19

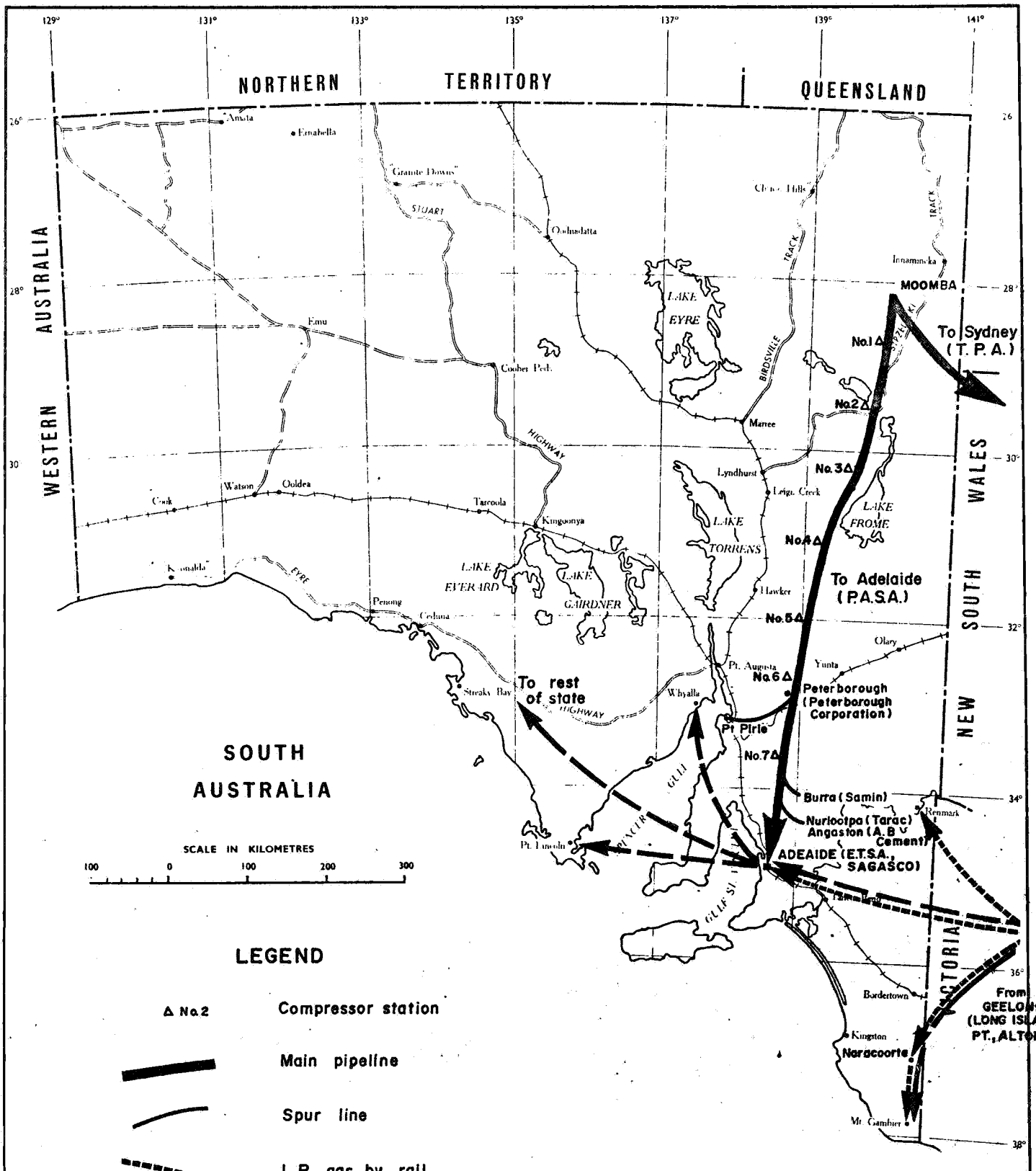
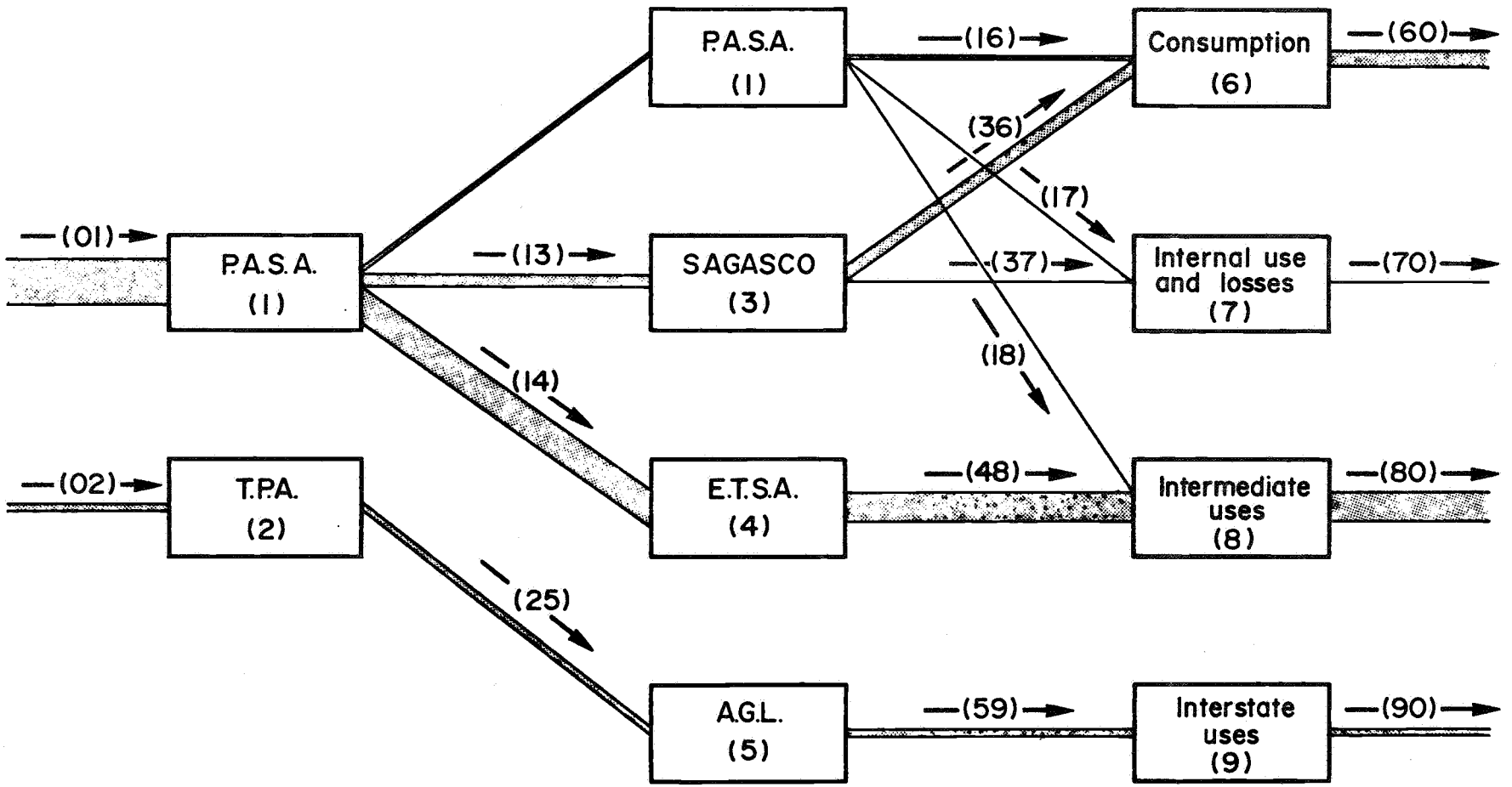


FIG. 10

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Compiled. K. King	DISTRIBUTION OF ENERGY NATURAL GAS & L.P. GAS	Date: AUG. 1978
Drn. M. H. R. Ckd.		Drg. No. S 13590

PF No. S.850 9942



NOTE – Numbers in parentheses are references to Tables 21,22,23

FIG. 11

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

TRANSFERS OF ENERGY

NATURAL GAS

COMPILED K. King
DRN M.H.R.
CKD.

SCALE:
DATE AUG. 1978
PLAN NUMBER S 13591

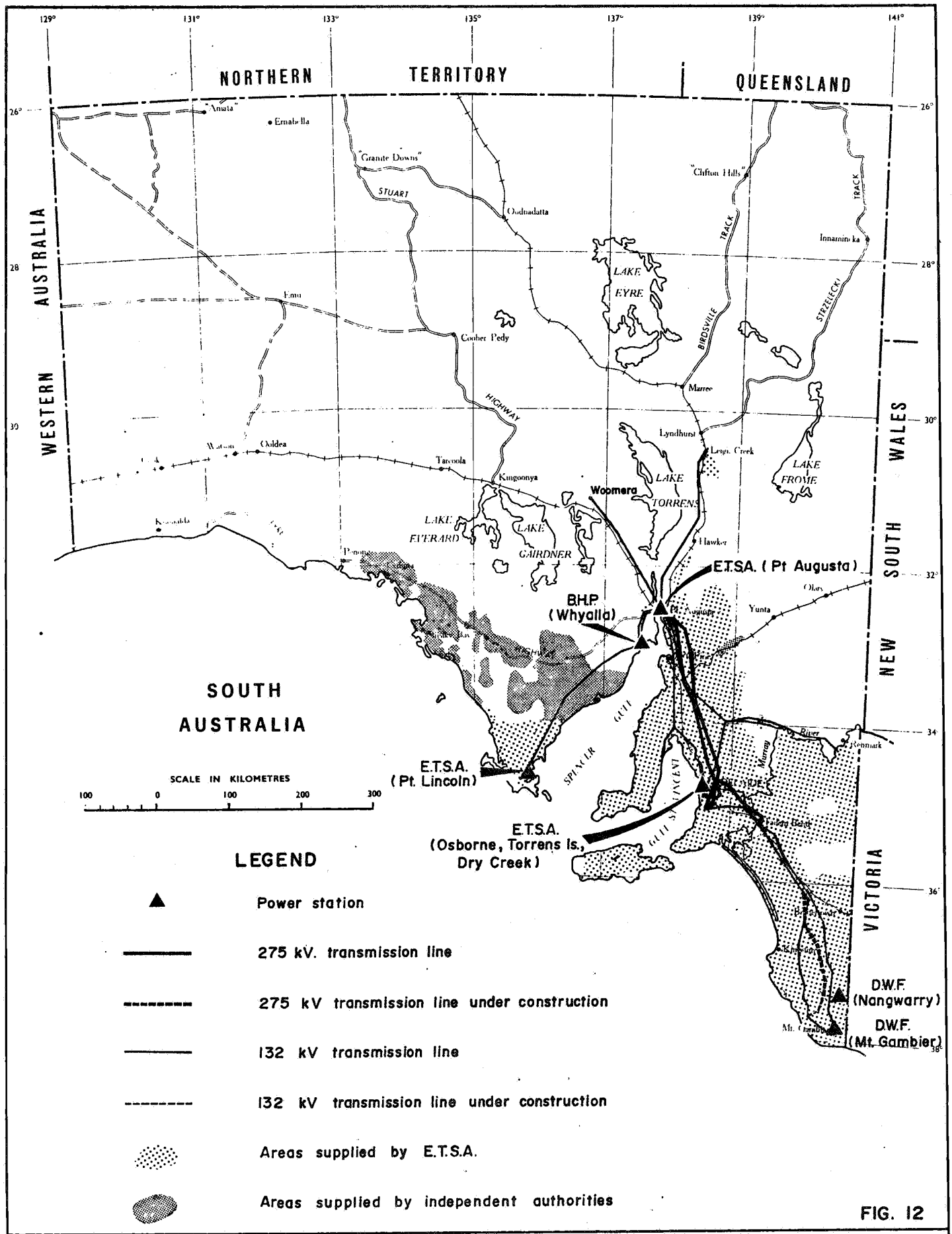
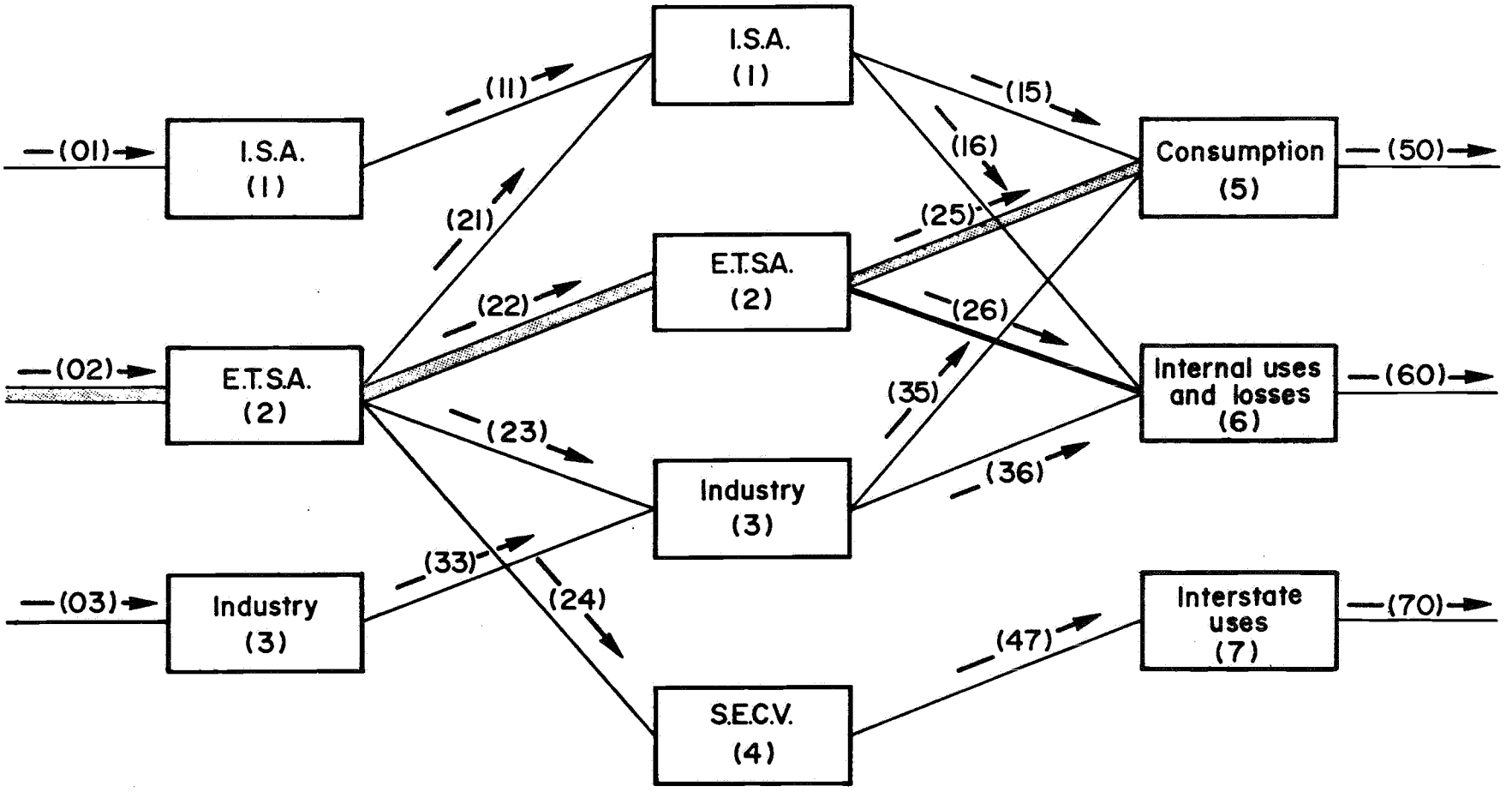


FIG. 12

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Compiled. K. King	DISTRIBUTION OF ENERGY	Date: AUG. 1978
Drn. M.H.R. Ckd	ELECTRIC ENERGY	Drg. No. S 13592



NOTE – Numbers in parentheses are references to Tables 25,26,27

FIG. 13

TRANSFERS OF ENERGY

ELECTRIC ENERGY

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED K. King
DRN M.H.R
CKD

SCALE

DATE AUG. 1978

PLAN NUMBER
S 13593