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UNCNRSE : AUSTRALIAN NATIONAL PAPER

Prepared by the Australian Government Department of
National Development and Energy

CONTENTS

A. POLICIES, PRIORITIES, PLANS AND PROGRAMMES FOR INCREASED USE OF NEW AND RENEWABLE SOURCES OF ENERGY

(a) Governmental organisations

1. At the national level responsibility for energy policy, including energy research, development and demonstration (R, D & D) policy, is vested in the Federal Minister for National Development and Energy and his Department (DNDE). Within his Department, the National Energy Office (NEO) was established in mid-1978 to meet the Department's responsibilities for "national energy policy, including planning and research into coal, oil and gas, uranium, solar energy and other forms of energy".

2. In addition, two advisory bodies report to the Minister. The National Energy Advisory Committee (NEAC) was established to advise on broad energy policy issues. It has published a number of reports, a list of which is at Attachment A. Another report on Renewable Energy Sources is in preparation and is expected to be published around August 1981. The National Energy Research, Development and Demonstration Council (NERDDC) advises on the development and co-ordination of a national program of energy research, development and demonstration (NERD & D Program), including the allocation of grants for individual domestic projects. It also provides advice on support for international projects. The NEO provides secretariat support for both NEAC and NERDDC and is represented on both.

3. The executive role of DNDE and the advisory roles of NERDDC and NEAC are closely integrated, and there is a free flow of information between the three bodies. DNDE also has a range of contacts with other Federal and State organisations and with industry.

4. Another arm of the Australian Government with an interest in energy policy is the Australian Science and Technology Council (ASTEC). Unlike NEAC's relationship to the Minister for National Development and Energy, ASTEC does not report to the Minister for Science and Technology, but reports direct to the Prime Minister. It provides an additional source of advice to the Government on Science and Technology. It advises on the adequacy, effectiveness and overall balance of scientific and technological activities in Australia. DNDE has observer status on ASTEC, as does ASTEC on NEAC, and there is a close working relationship between the Department and ASTEC.

5. The Federal Constitution allows for significant powers to be exercised by the Australian State Governments. Thus the six States and the Northern Territory are free to establish their own independent energy policies and energy R, D & D programs. The Australian Minerals and Energy Council (AMEC) provides the forum for Federal/State consultation at ministerial level on major energy issues, including energy R, D & D. The Minister for National Development and Energy represents the Federal Government in discussions on energy.

6. Australia has joined the IEA Energy Systems Analysis Project which seeks to assess the potential contribution of new energy technologies in the future and to develop the R, D & D strategies that will be required to bring about these technologies. DNDE serves as the Operating Agent for this project while the Australian Atomic Energy Commission (AAEC), a statutory body of the Australian Parliament, reporting to the Minister for National Development and Energy, acts as the designated agency.

7. There is no all embracing scheme under which Australian energy R, D & D is funded. However, the Federally financed NERD&D Program provides a significant component of the total funding and is directed to meet national policy objectives. These funds are available to all sectors performing energy R, D & D including Federal and State Government organisations, tertiary education establishments, and private individuals. The State Governments also develop and fund their own programs of energy R, D & D according to their own State and regional policies. Similarly, industry undertakes energy R, D & D utilising its own funds. The tertiary education sector also carries out energy related work supported from non-NERD & D Program funds and supplies basic facilities, staff and support.

8. From 1978/79 to 1980/81, the three years of operation of the NERD & D Program, total commitments under the Program were $(Aust) 58.4 million. However, it must be borne in mind that this allocation is superimposed on the existing activity, and as a result, has the effect of modifying the overall balance of energy R, D & D and directing it more towards national energy objectives. The distibution of total NERD & D Program funds among the new and renewable sources of energy of interest is shown in Attachment B.

9. It is recognised that the simplest way to commercialise energy R, D & D results is to have the original work performed by industry. Indeed the percentage of total NERD & D Program grants to private industry has increased from 31% in 1978/79 to 49.5% in 1980/81. In assessing proposals from non-industrial applicants, NERDDC takes into account interest shown by Australian industry to date.

10. Funds for energy R, D & D projects in industry are also provided by the Australian Industrial Research and Development Incentives Board (AIRDIB). Up to 50% of the total project cost may be provided as a grant. In addition to projects selected for support as a result of publicly invited applications, AIRDIB, in collaboration with the Department of Science and Technology, arranges for projects to be undertaken in the public interest. Such projects are particularly directed towards the commercial development by industry, of important Australian innovations which would not proceed without significant Government support.

11. Small to medium demonstration projects are currently being supported under the NERD & D Program. The terms of reference of NERDDC include provision for the Council to advise the Minister of the desirability of making a submission to the Government for special additional funding in the case of major demonstration projects aimed at assessing the technical feasibility of new technologies. Demonstration projects aimed primarily at commercialisation are mainly the responsibility of private enterprise. The Australian Government considers that its key task is to ensure that the basic economic climate is conducive to long-term investment by private enterprise in new technologies.

(b) Assessment of the need for different forms of energy

12. Australia has well developed systems of energy statistics collection and analysis which aid the energy planning process. Both the Federal Government and States are engaged in analysis of present demand and prediction of future trends in their respective areas of responsibility, and the results of their analyses play an essential part in their policy formulating and planning activities.

13. DNDE regularly publishes reports indicating historical and future trends in energy demand by fuel type and major end-use sectors.

14. The latest report on historical fuel use, titled "Demand for Primary and Secondary Fuels Australia: 1960-61 to 1979-80", was published in February 1981. The data contained in this report is based primarily on the results from a fuel survey of the mining, manufacturing, electricity and natural gas supply industries. Data collected also includes information on the fuel equipment devices and process temperatures used in these industries, which will be useful in evaluating the potential impact of new and renewable energy sources in these industries.

15. The data collected from the fuel survey is complemented by other less detailed statistical collection for the other sectors. Data is not available however for energy use in the domestic sector dissected by end-use purpose (e.g. cooking, lighting, heating).

16. The data for energy demand is combined with information on energy supplies and published in an energy balance format (both tabular and as a flow chart) for coal, oil, natural gas, and electricity, and the renewable sources; wood, bagasse and hydro-electricity.

17. DNDE also prepares and publishes projections of future energy demand and supply. The next report containing these projections is expected to be published in May 1981.

18. Price data for electricity and natural gas is available in the form of average revenues paid and as published tariff rates for various end-users for all States. Maximum justified wholesale petroleum product prices are set and published by the Prices Justification Tribunal.

(c) Assessment of available new and renewable sources of energy

19. Australia has long been aware of the need for accurate assessments of its energy resources. The Bureau of Mineral Resources (BMR) was established in 1946 to study geological and geophysical information, and carry out a wide range of geoscientific research to form a basis for expanded exploration activity and improved assessment of Australia's mineral and petroleum resources. BMR is now a part of DNDE.

20. The task of resource assessment in Australia has been greatly assisted through the availability of accurate maps, prepared by the Department of National Development and Energy's Division of National Mapping.

21. As one of its first tasks after its establishment, the National Energy Advisory Council (NEAC) during 1977 prepared a report summarising Australia's renewable and non-renewable energy resources. The report also included an assessment of the adequacy of the information on energy resources available for decision making at the national level in the field of energy policy. An updated version of this report is expected to be released in mid-1981.

22. In its first report on energy resources in Australia, NEAC considered that there were still some major areas where information was inadequate for effective analysis of Australia's renewable and non-renewable energy resources, and that for most forms of energy considerable additional exploration, research and assessment was required to achieve a desirable level of knowledge.

23. This situation has improved markedly since the release of the first report. The Commonwealth Scientific and Industrial Research Organization (CSIRO) is a statutory body responsible to the Minister for Science and Technology. As a part of its ongoing research activity into new and renewable sources of energy, CSIRO recently released reports on the potential for liquid fuels from agriculture and forestry in Australia, and the potential of oilseeds as a renewable source of diesel fuel.

24. In addition, the Bureau of Agricultural Economics (BAE), part of the Department of Primary Industry, has undertaken research into the economics of the production of fuels from agricultural products.

25. The Commonwealth Government, through the National Energy Research, Development and Demonstration Council, has funded resource assessment studies such as the determination of the extent of Australia's oil shale deposits, estimation of the potential productivity of cassava for ethanol production, and wind energy availability and potential in Bass Strait.

(d) Sectoral Priorities

26. Most populated areas of Australia are already well supplied with energy from conventional sources. Electricity is widely distributed in each State through grid systems, natural gas pipelines are being extended in a number of areas, and a widespread petroleum products distribution network has been in place for many years. As a result of the ready availability of these sources of energy, planning focusses on meeting the overall levels of demand where it is economic to do so, rather than specific sectoral requirements. Special account would, of course, be taken of large projects within a particular sector, such as aluminium smelters or shale oil development, which might place special demands on energy supply systems.

27. Alternative liquid fuels offer one important means of meeting Australia's liquid fuel needs, as Australia's own reserves of conventional oil are depleted in the future. Large-scale projects to provide liquid fuel from alternative sources, such as the Rundle and Julia Creek oil shale projects, are therefore being encouraged through oil pricing and other policies.

28. Populations in remote areas of Australia are usually dependent on petroleum products for all their energy needs. Transport costs to these remote locations greatly increase the economic costs of the fuel, and hence these areas could benefit greatly from utilisation of renewable energy sources such as wind or solar energy. The Government recognises the needs of these areas in the distribution of research, development and demonstration funding through the National Energy Research, Development and Demonstration Program.

B. CURRENT USAGE AND EXPERIENCE OF NEW AND RENEWABLE SOURCES OF ENERGY

(a) Institutional framework

29. As described in the opening section, the NEO is responsible for national energy policy including energy R,D&D policy.

30. It gathers statistics and carries out energy forecasting and modelling studies as well as energy surveys, and provides considerable information on energy in published and unpublished forms, ranging from pamphlets to major statistical compilations and research reports.

31. The State Governments are also active in the field of energy and have Departments and advisory bodies responsible to State Ministers for Energy. In addition, most States own and operate public utilities which support energy R,D&D in their own areas of interest.

32. The Australian Atomic Energy Commission (AAEC), a statutory body reporting to the Minister for National Development and Energy, together with the CSIRO and BMR, are the three major performers of energy R,D&D at the Federal level. Each of these organisations funds and develops its own core programs of energy R,D&D, most of which are undertaken "in-house".

33. In addition to the performance of research "in house" by private enterprises, a number of research associations, which are co-operative ventures, undertake R&D on behalf of groups of companies of like interest. These research associations are also involved in information transfer to the industry they serve. For example, the Sugar Research Institute undertakes research into sugar cane harvesting, transport and processing on behalf of sugar mills in Queensland. Some of this research is related to biomass energy.

34. Australian universities and other tertiary institutions also make an important contribution to research into new and renewable forms of energy.

35. A list of the major establishments in all sectors involved in the field of new and renewable energy research, and their current activities, is shown in Attachment C.

36. The Standards Association of Australia (SAA), an independent non-government body, has established a Technical Committee on Energy Auditing with the object of devising standards and guidelines as aids to energy management. It is currently working to produce standards for the thermal performance of buildings and efficiency standards for appliances, equipment and building management. State Governments are expected to require the labelling of major household appliances once these standards have been set.

(b) <u>National capacity to generate, adapt and utilise the necessary technology</u>

37. New and renewable energy resources currently contribute some 8% of Australia's primary energy supplies. Most of this is from hydroelectricity, but there is a small and growing component of renewable resources using newer technologies. Shale oil is expected to contribute to Australia's liquid fuel supplies by the end of the century.

(i) Oil Shale

38. Australia has substantial oil shale resources. Some deposits have been utilised periodically for oil production, such as the deposit at Glen Davis in N.S.W., but most interest is now centred on the major deposits in Queensland, at Rundle, Julia Creek, Nagoorin, Yaamba, Duaringa and Condor.

(ii) Solar

a. Household Water Heating

39. There are at present some 80,000 household solar hot water systems operating in Australia, mainly in the North and West of the country where climate and electricity tariffs provide the most suitable conditions for them. This represents 3% of the potential national market. Substantial penetration of the largest markets in the south-east of the country cannot be expected until system prices drop or the price of electricity and gas rises, or both.

b. Industrial and Agricultural Uses

40. Apart from longstanding applications such as salt production there is no significant use of solar energy in agriculture and industry at present. This will require higher fuel prices and lower cost equipment operating at temperatures below 100°C and the development of a new generation of low-cost collectors which can generate heat at 100°C and above. Research and development is currently proceeding on a range of advanced flat plate, vacuum tube, and concentrating collector designs and one, the Vulcan, is now being marketed. Industrial demonstration installations in the food processing industry are either in place or being planned in all states.

41. Research into some agricultural applications such as heating of green houses and crop drying has yielded promising results. These applications could well be economic in the near term.

c. Heating and Cooling of Buildings

42. There are some 30 houses documented in Australia which have been specifically designed to capture and utilise solar energy with "passive" features such as house orientation, shading and thermal mass. Computer models have been developed to assist the design of such houses and a number of experiments to determine the effectiveness of these features is underway. There are a few examples of "thermal design" in commercial and industrial buildings in Australia, but much experimental work still needs to be done to determine which measures are most appropriate for particular climates. Nevertheless, it is already apparent that passive features in both commercial and domestic building can yield an economic rate of return at current energy prices.

43. A number of buildings with either active heating or cooling systems (i.e. those which incorporate specialised machinery to capture and utilise solar energy) are at present being evaluated. Research on conventional and solar-boosted heat pump systems is also being carried out.

d. Photovoltaics

44. Currently, photovoltaic arrays are installed and are providing power for isolated communications installations and other specialised uses, although they are uneconomic (at about $12 per peak watt) for widespread use. As array costs drop, they will probably find much wider application in remote areas.

e. Solar Thermal Electricity Generation

45. Solar-thermal electricity generation systems will be installed at White Cliffs, N.S.W., and Meekatharra W.A. Studies of the feasibility of a one megawatt plant at several sites in Northern Australia indicate that this technology may only be viable in the long-term when new developments might bring system costs down.

(iii) Biomass

46. Australia's primary interest in biomass is as a source of alternative liquid fuels. Technology for the production of ethanol from such feedstocks as sugar cane is already well known, although research into novel feedstocks and the improvement of present technology is underway. The only current commercial use of ethanol as a transport fuel is in a marketing trial for an ethanol blend at present underway in the Queensland town of Mackay.

47. The potential of vegetable oils to act as an extender or replacement for distillate is being assessed by way of a program looking at agronomy of possible crops, harvesting, extraction and treatment of the oils and their suitability in diesel engines.

(iv) Wind

48. Wind powered water pumps have been a feature of rural Australia for many years. Interest in electricity generating systems in the 5-10 KW range for remote area applications has been rekindled in recent years following the oil crisis. R&D is focussing on some novel designs such as a hybrid solar/wind power development by Dunlite. There is no R&D into large scale wind systems in Australia, although some State electricity authorities are considering medium to large scale systems for some remote, windy sites.

(v) Hydropower

49. Hydro resources currently contribute some 5% to Australia's primary energy needs, but this is not expected to increase significantly in future as most suitable sites have been developed.

(vi) Fuelwood and Bagasse

50. About 3% of Australia's primary energy requirements are currently provided by fuelwood (1%) and fibrous sugar cane waste (bagasse) (2%). Bagasse is exclusively consumed in sugarmills where it is used to raise steam for process heat and electricity generation; excess electricity is often fed back into the local grid. Fuelwood is used in domestic and minor commercial applications. It is expected that the contribution from these energy sources will remain constant in absolute terms.

(vii) Energy from the Ocean

51. The use of tidal energy to generate electricity has been investigated and it appears that the most suitable sites are in the north-west of the continent where tidal movements are large. Development costs are still too high to be considered economic, and in any case the suitable sites are far removed from any substantial electricity market.

(viii) RD&D Infrastructure

52. Australia has a relatively sophisticated research and industrial infrastructure which generally does not impose constraints on the development and deployment of new and renewable energy technologies, although much technology will be imported. In the more remote areas the lack of a nearby technical infrastructure does place a premium on technologies which require little or relatively unsophisticated maintenance.

(c) Constraints (environmental and social) hindering the increased utilisation of energy from new and renewable sources

53. The Australian Government is in favour of the development of new and renewable energy resources, but not "at any price". Protection of the environment is an important national and regional consideration, and as a consequence large-scale projects must satisfy both Federal and State laws relating to their impact on their surroundings. Before commencement of any project developers are required to prepare an environmental impact statement which details the extent of air and water pollution, resource and manpower requirements, and social and cultural impact of the project, and demonstrates that the project will meet the legislated environmental standards.

54. Compared with other countries there are few social attitudes constraining the development or increased utilisation of energy from new and renewable sources. Social attitudes have however had an impact on the development of hydro-electricity in the State of Tasmania, where further development has been widely questioned on the grounds that it will destroy river valley wilderness areas in the State. The issue is still the subject of considerable debate within the Australian community. The use of food-crops for the production of ethanol could become an issue of debate, if large-scale ethanol production were ever envisaged in Australia.

(d) Issues relevant to enhancing the greater use of energy from new and renewable sources

55. The major obstacle to the greater use of new and renewable sources of energy is their high capital cost relative to the alternatives of coal, oil, gas and electricity. Market penetration will increase as R&D and mass production techniques bring costs down and as the price of oil increases.

56. In areas such as the passive design of buildings to improve thermal performance, a major constraint is the dissemination of design information to building users and designers. This will require a major effort to overcome.

57. Control of effluents and adequate rehabilitation of mined land are problems common to all mining and processing ventures. In the case of the very large scale synfuels technologies such as oil from shale, the potential hazards are correspondingly larger and not always known. Adequate control will require an ongoing research and monitoring effort.

(e) National policy for the increased use of energy from new and renewable sources

58. The overall direction of Australia's energy policy is determined by the fact that Australia is well endowed with most energy resources except conventional oil. Its broad thrust is two fold:

(i) achievement of the maximum practicable self-sufficiency in liquid fuels (taking into account appropriate economic considerations); and

(ii) realisation of the industrial development and related export opportunities open to Australia as an energy resource rich country.

59. The most immediate issues relate to the need to secure Australia's supplies of liquid fuels. The Australian Government has introduced a number of measures to accomplish this. These measures will:

(i) encourage conservation of scarce sources of energy - in particular liquid fuels

(ii) promote the use of locally available alternatives to oil - particularly natural gas, LPG and coal based electricity

(iii) stimulate commercial development of major new energy projects in areas such as shale oil, coal liquefaction and ethanol

(iv) provide a major incentive to increase oil exploration activity and maximise development of existing fields.

Fundamental to achieving these objectives has been the use of market forces, through the realistic pricing of petroleum products. This measure alone will do much to encourage consumers to adjust their energy useage patterns and promote the production of alternative and conventional forms of energy.

60. To further encourage these changes in energy consumption patterns, the Government has organised national energy conservation programs aimed at motor vehicle users, and industry. These measures have been supplemented by the introduction of a number of incentives to encourage consumers to switch away from oil to alternatives such as natural gas, coal, solar or biomass. These include:

(i) removal of sales tax from all solar applicances, from non-oil fired domestic space heating appliances and from kits for converting motor vehicles to LPG or CNG;

(ii) a tax incentive whereby, when oil fired equipment is replaced by equipment powered by other fuels, 40% of the cost of replacement plant is deductible in the year in which the plant is first used or when oil-fired equipment is converted or adapted for other fuels. The capital costs are allowed as an outright deduction in the year in which the costs are incurred;

(iii) exemption of fuel ethanol from excise and a licensing scheme to permit working trials of small-scale fuel ethanol production, particularly in the rural sector.

61. The need for research and development to improve the utilisation of energy resources, both non-renewable and renewable, is recognised by the Government, and assisted at the Federal level through the National Energy Research Development and Demonstration Program. Funding for projects is distributed in accordance with priorities which stem from the broad objectives discussed above. (These priorities are covered in detail in Attachment D).

62. In view of Australia's rich endowment of depletable energy resources, it is not expected that renewable sources of energy will make a major contribution to Australia's energy before the end of the century. The Government's aim is to ensure that the resources available for the development of all energy sources within the country will be utilised in the most efficient manner, through the application of market forces. No particular energy source therefore has a rigidly designated role in Australia's energy future.

63. It is recognised, however, that new and renewable sources of energy have the potential to make a significant contribution to Australia's future energy needs, and Australia's energy strategy therefore includes the provision of funds for research and development of these energy sources.

C. SCOPE FOR INTERNATIONAL CO-OPERATION

64. Over the last five years Australia has made efforts to intensify international co-operation in the field of renewable energy. International co-operation is seen as a necessary supplement extending the national program currently underway in Australia. However the success of any international co-operation depends on a vigorous and well co-ordinated national research program. Australia's energy research program, the National Energy Research, Development and Demonstration Program, provides such a basis.

65. Australia's international co-operation program includes information exchanges, personnel exchanges, joint research projects, feasibility studies and technology exchange arrangements.

66. A brief outline of Australia's activities in these areas is provided below.

(a) Information

67. Australia has developed a renewable resources bibliography covering Australian research. This bibliographical information data base is exchanged with the US through a co-operative arrangement.

68. Additionally, in 1978 it was agreed by the Energy Group formed under the Commonwealth Heads of Government Regional Meeting (CHOGRM) to form a regional renewable resources index based on the original Australian bibliographical data base. This system, called the Commonwealth Regional Renewable Energy Resources Information System (CRRERIS), commenced operation in 1980 and is serving the seventeen countries of the CHOGRM grouping. It is managed on behalf of DNDE by the CSIRO and consists of a network centre in CSIRO, Melbourne, and liaison centres in member countries. CRRERIS services include:

(i) a computer based bibliographical information system for renewable energy technology;

(ii) a document clearing house;

(iii) a newsletter;

(iv) a published index.

69. Australia sees scope for extension of such information exchanges.

70. Australia is also in the process of establishing a computer-based information system which will include data on new and renewable energy research projects being conducted nationally. It is intended that the biographical data base and the research project information system will enable easy access by researchers to the latest research results. Both these systems are still in the early development stages. Consideration is being given to possible extension of these systems as a means of facilitiating further international co-operation.

(b) Personnel exchanges

71. Australia has given increased emphasis recently to personnel exchanges. We believe that this can often be achieved by using existing bilateral and multilateral mechanisms.

72. Australia has bilateral science and technology agreements with a number of countries including India, USA, West Germany, Japan, China and the USSR. These are umbrella agreements, which typically allow for research co-operation involving visits between the two countries involved for seminars, workshops and general personnel exchange activities. Through these agreements a number of expert workshops have been held on specialised topics and these have stimulated co-operative research projects.

73. The Australian Government through the Australian Development Assistance Bureau (ADAB) sponsors students from developing countries who come to Australia to study a variety of subjects. An Energy Planners' Course is being planned at the moment and, it is hoped, will attract such students.

74. Other activities planned by ADAB include the Workshop on Energy to be held in Lae, Papua New Guinea in July 1981. Australia is providing many of the speakers for the Lae Workshop which will be dealing with problems of energy planning, demand and supply. It will also be concentrating on renewables through a post-Workshop tour to several project installations.

75. Australia would welcome proposals for technical personnel exchange in the energy field - particularly in the area of renewable sources.

(c) Joint Research Projects

76. Australia's efforts in pursuing joint research projects have been essentially bilateral in nature.

77. Areas of mutual interest under study with India, Japan, West Germany and the United States include projects on solar air conditioning, collector design and development, solar thermal power systems and photovoltaic arrays.

78. Co-operation also occurs at the multilateral level. Within the IEA we are involved in projects covering solar collector technology and computer based studies.

79. At the regional level co-operation has been facilitated by regional groupings such as CHOGRM. The CHOGRM Working Group on Energy provides a forum for initiatives and problems common to the region. Consideration is also being given to co-operation with ASEAN countries.

80. Australia sees further scope for co-operation, especially at the regional level, where 3-4 countries could focus on problems of mutual interest. Our experience indicates that co-operation between a small number of countries is potentially the most useful for research projects. Co-operation on a larger scale tends to become unwieldy, especially when trying to develop particular technologies. We propose putting further effort towards strengthening regional co-operation in this way.

(d) Technology exchange arrangements

81. Technology exchange between countries can often be best handled at the level of commercial exchanges. Governments can facilitate such exchanges by providing satisfactory conditions for co-operation in areas such as patents management.

82. Governments also have an important and increasing role to play in areas of major technology and in initiating and supporting feasibility studies. For example, Australia is at present involved in a feasibility study for a solar thermal power station in the Northern Territory. The study will involve consideration of the appropriateness of Japanese technology for such a situation. Additionally, experts in areas such as hydro power generation are supported to undertake studies in many developing countries on the suitability of hydro power schemes for particular situation.

83. Australia sees an important role for international bodies such as ESCAP and UNESCO in the area of renewable energy. The major functions of such bodies should be directed to the policy level and the creation of a climate which will facilitate recognition of opportunities in the area of renewable energy: this depends in turn upon a ready exchange of information between countries. International organisations would have a role in ensuring that all possible exchange of information is occurring and that systems are compatible.

ATTACHMENT A

NEAC Reports

1. An Australian Conservation of Energy Program (September 1977)
2. Australia's Energy Resources: An Assessment (December 1977)
3. A Research and Development Program for Energy (December 1977)
4. Motor Spirit-Octane Ratings and Lead Additives (February 1977)
5. Electric Vehicles (June 1978)
6. Exploration for Oil and Gas in Australia (December 1978)
7. Fuel Economy Goals for Passenger Cars (May 1979)
8. Efficient Use of Liquid Fuels in Road Vehicles (July 1979)
9. Liquid Fuels - Longer Term Needs, Prospects and Issues (December 1979)
10. Strategies for the Greater Utilisation of Australian Coal (completed May 1980)
11. Natural Gas: The Key Issues (completed June 1980)
12. Alternative Liquid Fuels (completed July 1980)
13. Energy Conservation in Buildings (forthcoming)
14. Australia's Energy Resources: An Assessment (an update of NEAC No. 2, forthcoming)

ATTACHMENT B

TABLE

DISTRIBUTION OF NERD&D PROGRAM FUNDS FOR THE PERIOD 1978/79 TO 1980/81

		Funds Committed ($M)	
Sources of energy relevant to UNCNRSE:			
	- Solar	5.3	(9.1%)
	- Biomass	5.1	(8.8%)
	- Wind	0.3	(0.4%)
	- Geothermal	-	
	- Hydropower	-	
	- Oil Shale	1.6	(2.8%)
	- Fuel Wood/Charcoal	-	
	- Ocean	-	
Sources of energy not being discussed at UNCNRSE:		46.0	(78.9%)
	TOTAL	58.4	(100%)

ATTACHMENT C

MAJOR ESTABLISHMENTS IN AUSTRALIA UNDERTAKING RD&D IN THE FIELD OF NEW AND RENEWABLE ENERGY RESOURCES

1. Commonwealth Government

(a) Australian Atomic Energy Commission

- hydrogen production by solar assisted electrolysis of water
- IEA Energy Technology Systems Analysis program (Australian designated agency for this program)
- feasibility study of a solar thermal power plant

(b) Bureau of Mineral Resources, Geology and Geophysics

- geothermal studies of the heat flow region in various tectonic provinces in Australia
- studies of marine oil shale deposition
- assessment of oil shale in the Toolebuc formation (joint project with CSIRO)

(c) Commonwealth Scientific and Industrial Research Organisation

Within the CSIRO Energy Program, there are several research programs concerned with new and renewable sources of energy. These are:

- oil shale exploration and characterisation
- coal conversion
- organic chemistry of fuels and metals
- agroindustrial assessment
- biotechnology
- solar energy research
- assessment of renewable energy sources

- wind energy
- energy storage

Within these programs the following projects are of particular interest:

- biosynthetic production of fuels from lignocellulose
- development of flat-plate collectors for use up to 150°C
- industrial solar water heating (joint project with SERIWA and Solokool Drinks)
- integration of wind power on a large scale into State electricity grids with short term storage
- oil shale: assessment of properties and regional controls
- photovoltaics and photoelectrochemistry
- ion-beam deposited thin film coatings for solar energy devices
- solar space heating system for low-energy-consumption house
- IEA solar R&D Tasks III - performance testing of solar collectors
- development of solar heat generating systems suitable for large-scale use in Australia. Systems include a soft drink factory, solar space cooling project suitable for Australia's hot, humid conditions, and development of low energy greenhouses.
- solar industrial demonstration program technology transfer
- solar photolysis of water
- preparation of low reflectance films on cover plates used in solar collectors
- transparent conducting films for MIS solar cells (joint project with University of New South Wales

- assessment of the potential for wind power applications in Australia
- wind monitoring and analysis of data
- catalytic upgrading of Australian shale oils
- nuclear geophysical techniques in oil shale industry

(d) Telecom Australia

- testing, evaluation and demonstration of solar cell array

(e) Bureau of Agricultural Economics

- the economics of alternative fuels from agricultural products

2. State Government

(a) Energy Authority of New South Wales

- Forbes Abattoir solar energy installation (proposed joint project with CSIRO and Norwest Beef Industries Ltd)
- passive solar energy housing for Sydney growth areas (joint project with University of NSW and Housing Commission of NSW)
- solar appliance testing (joint project with the University of New South Wales)

(b) Gas and Fuel Corporation of Victoria

- evaluation of solar collectors in the temperature range 100-300°C

(c) Health Commission of New South Wales

- assessment of performance of solar airconditioning installation at Jerilderie hospital

(d) Hydro-electric Commission (Tasmania)

- Bass Strait wind energy study

(e) New South Wales Department of Agriculture

- enzyme hydrolysis of insoluble polysaccharides
- experimental and economic evaluation of farm scale ethanol production
- utilisation of vegetable oil as a distillate replacement

(f) Northern Territory Department of Mines and Energy

- small scale application of solar energy in remote areas in substitution for fuel generated power

(g) Solar Energy Research Institute of Western Australia

- industrial solar water heating
- solar airconditioning using evacuated tube collectors (joint project with Yanchep Sun City Pty Ltd)
- solar housing construction and monitoring program (joint project with State Housing Commission of Western Australia)
- solar housing competition: performance analysis of winning designs
- radiation, temperature and wind monitoring network
- solar steam generation for industrial applications - demonstration project

(h) State Energy Commission of Western Australia

- controlled tests of vegetable oil fuel for compression ignition engines
- investigation of alternative transport fuels including hydrated ethanol and ethanol/petrol blends
- remote area power supply investigation involving solar thermal generation, wind generators and systems modelling

(i) Western Australian Department of Agriculture

- minimum tillage research
- small scale aqueous processing of oilseeds for fuel oil and improved meal production

(j) Victorian Solar Energy Research Committee

- demonstration of solar water heating in the meat processing industry, for swimming pools and milk pasteurization
- Warrnambool wool scour: demonstration of solar water heating
- demonstration of passive and active building heating systems
- demonstration of solar boosted heat-pump systems

(k) South Australian Department of Mines and Energy

- Industrial Solar Water Heating (joint project with CSIRO and Southern Farmers Ltd)

3. Private Enterprise

(a) APACE Research Ltd

- ethanol - distillate emulsified blends in diesel engines
- recovery of ethanol from ethanol-water mixtures

(b) Australian Cassava Products Pty Ltd

- agronomical research of cassava for power alcohol

(c) Biotechnology Australia Pty Ltd

- pilot scale continuous ethanol fermentation

(d) Broken Hill Proprietary Co Ltd

- design of a $50m^3$/day solar desalination plant

(e) Bureau of Sugar Experiment Stations

- sugar cane biomass

- waste treatment in an "ethanol from sugar cane" plant

(f) CSR Ltd

- Cassava agronomy
- conversion of Julia Creek shale oil into automotive fuels
- ethanol from cassava for transport fuel by batch fermentation
- improved yeast technology for ethanol production
- Julia Creek oil shale retorting
- treatment of waste water from alcohol production from cassava
- enhanced extension of petrol with aqueous alcohol

(g) S.W. Hart and Co. Pty Ltd

- development of a new low cost high efficiency solar collector using a chrome black surface
- chrome black treatment bath plant

(h) Millaquin Sugar Co Pty Ltd

- evaporation and incineration of ethanol distillery effluent

(i) National Iron and Steel Pty Ltd

- industrial solar airconditioning using concentrating collectors (joint project with University of Western Australia)

(j) Queensland Cane Growers' Council

- an economic assessment of the integration of sugar and ethanol production in Australia

(k) Repco Ltd

- evaluation of ethanol use in vehicles

(l) Siddons Industries Ltd

- development of solar-boosted heat pumps
- commercialisation of mild steel flooded passage flat plate collector

(m) Solarex Pty Ltd

- development of low concentration solar power supply using novel tracking system

(n) Sugar Research Institute

- biological treatment of effluent from distilleries fermenting cane juice and molasses
- use of bagasse as a fuel in boilers instead of fuel oil (joint project with University of Queensland)

(o) Tideland Energy Pty Ltd

- development of solar photovoltaic cells and manufacturing methods including improved module encapsulation techniques

(p) Vulcan Australia Ltd

- development of a self tracking parabolic trough concentrating solar collector

4. Tertiary Education

(a) Australian National University

- design,construction of a 25KWe solar thermal power station
- demonstration and performance testing of a parabolic dish solar collector
- demonstration of a laboratory scale chemical (ammonia) heat pipe
- an energy model for Australia
- hydrogen formation by photosynthetic processes

(b) Flinders University of South Australia

- conversion of direct solar energy: high temperature (130°C - 180°C) concentrating collector system
- vertical axis wind turbine

(c) James Cook University of North Queensland

- analysis of agriculturally produced oils for diesel engine fuels (jointly with University of South Pacific, Fiji)
- an integrated energy/environment systems model for Australia: an operational policy design tool
- facilitation of the breakdown of waste lignocellulosics
- investigation into microstructural and optical properties of solar collector materials under various environmental conditions
- a solar ice plant
- a study of solar airconditioning and refrigeration systems

(d) Macquarie University

- solar energy utilisation through chemical processes at catalyst surface

(e) Monash University

- mirror augmentation for high temperature flat-plate solar collectors
- solar collector testing facilities
- solar transmittance of honeycombs, slats and vee corrugated covers for high temperature flat-plate solar collectors
- use of rotary regenerative heat exchangers for conservation of energy in buildings and for airconditioning systems utilising waste or solar heat

(f) Murdoch University

- development of a new solar cell using metal sulphide films
- production of ethanol from wastepaper and crop residues

(g) Tasmanian College of Advanced Education

- seasonal performance of heat pumps
- two demonstration houses with passive solar heating utilising modified Trombe-Nichel wall in Tasmania

(h) University of Melbourne

- demonstration of solar boosted heat pump systems
- development of an air cooled solar absorption cycle plant
- energy conservation techniques and solar energy applications in agriculture
- the potential for use of refuse derived fuels in Australia
- power ethanol production
- using a liquid to collect and store solar energy in greenhouses
- passive solar demonstration houses : direct gain and trombe wall
- use of hydrogen as an engine fuel for vehicle use
- use of solar ponds for salt production
- use of stationary spherical concentrating solar collecting for process heat (500^{o}C) and power production

(i) University of Newcastle

- automated testing of solar panels
- the swimming pool as a solar absorber/energy store for heating/cooling houses by heat pump

(j) University of New South Wales

- bioconversion of cellulosic materials to ethanol
- conversion of solar energy to electricity using electrolytic films
- pilot scale development of Zymomonas process for ethanol fermentation
- development of low cost MIS silicon solar cells

- long term performance of solar collectors
- modelling of anaerobic digesters for the production of methane
- new technology for fermentation ethanol from agricultural materials
- non-focusing solar concentrators for solar energy utilisation
- non-tracking concentrators : solar thermal and solar electric
- performance of solar water heaters
- photoconducting polymers in solar energy and imaging processes
- photovoltaic collector technology : refracting concentrators
- silicon solar cells with integrated bypass diode
- solar appliance testing
- solar drying of primary produce
- solar electricity (using MIS solar cells) for remote rural holdings
- solid state transport : application in the field of solar energy conversion and storage
- stationary solar concentrators
- thermoelectric generator using a non-focussing solar concentrator
- characteristics of thermo-syphon flow in solar collectors

(k) University of Queensland

- estimation of cassava productivity for potential alcohol production in northern Australia
- ethanol production by continuous stirred tank fermentation: design operation and waste treatment
- evaluation of a concentrating collector for solar domestic water heating
- evaluation of a 5-10 kWe solar thermal electric generator
- fundamental studies in enzymatic biomass conversion
- improvement of the microbial process and development of new fermentation technology for the production of ethanol from sugar using Zymomonas mobilis
- induced junction silicon photovoltaic solar cells
- latent heat storage for solar energy systems
- passive cooling/heating : variable emittance roof
- photovoltaic cells using electrodeposited semiconductor films
- solar power supply for remote rural consumers
- monitoring of prototype solar pond for electricity generation

(l) University of Sydney

- concentrating collector (evacuated tube) test facility
- production of ethanol from cassava for use as a petrol substitute or extender: continuous tower fermentation
- solar assisted water/lithium bromide airconditioning system
- solar simulator for testing non-focussing solar collectors under reproducible conditions
- solar thermal electric generation (1-3 kWe) with medium temperatures

- tubular glass evacuated solar collectors
- ammonia/water absorption cycle in the active cooling of buildings

(m) University of Tasmania

- review of possible uses of wood wastes

(n) University of Western Australia

- development of a high temperature stable black chrome selective surface
- low cost concentrating photovoltaic system for remote power supply
- low cost concentrating solar collectors for industrial and mineral processing applications
- system connected with wind power generation
- Wheatlands grain ethanol production and use

(o) University of Wollongong

- low rank oil shales (joint project with the University of Newcastle)

(p) Western Australian Institute of Technology

- solar thermal energy storage by phase change materials

ATTACHMENT D

RANKING OF ENERGY R,D&D AREAS IN PRIORITY ORDER

(a) High Priority

- Conservation of liquid fuels including increased efficiency in all uses
- Technology of exploration, assessment and recovery of oil, oil shale and gas
- Development of liquid fuel alternatives to petroleum for transport such as
  - . methanol
  - . oil from shale
  - . oil from coal
  - . ethanol
  - . vegetable oils and plant hydrocarbons
- Substitution of other fuels and energy sources for petroleum based fuels
  - . conversion of oil-fired installations to coal-fired
  - . use of solar energy in industry and for space heating and cooling
- Improvement in the exploration, assessment and production of coal
- Improvement in coal combustion technologies, including emission control
- Economic and social effects of changes in the pattern of energy supply and demand
- Environmental effects of increased coal and shale mining and their conversion to synthetic liquid fuels

(b) Medium Priority

- Uranium exploration, mining and enrichment
- Environmental effects of increased uranium mining and enrichment, including waste management
- Coal gasification including in situ production
- Development of efficient long range electric vehicles and batteries
- Remote area applications of solar energy - both thermal and photovoltaic

(c) Low Priority

- Nuclear fusion
- Magneto-hydrodynamics
- Nuclear power generation
- Use of hydrogen as a fuel
- Pyrolysis of wastes to produce liquid and gaseous fuels
- Large scale wind energy systems
- Wave, tidal, ocean thermal and geothermal energy systems