CHAPTER 2: THE LEVEL OF R&D UNDERTAKEN

Australia's R&D performance

2.1 The most common measure of a country's R&D effort is its gross expenditure on R&D (GERD) expressed as a proportion of its GDP – in other words, the share of the country's production devoted to R&D. Australia's GERD figure stood at just under $8.7 billion in 1996-97, corresponding to 1.68 percent of GDP.[46]

2.2 The table overleaf shows the GERD/GDP ratio for 20 OECD and four other economies. Australia ranks 13th in the list.

2.3 When R&D expenditure in government agencies and universities is considered in isolation from business expenditure (see table on page 19), Australia's ratio of 0.86 percent of GDP is the third highest in the OECD.[47] The rate of increase in this ratio in Australia from 1988 to 1995 was nearly twice the OECD average[48] (albeit concentrated in low and medium technology rather than high technology fields).[49]

2.4 The source of Australia's indifferent ranking in *gross* expenditure on R&D, therefore, is our low business expenditure on R&D (BERD). As shown in the table on page 20, Australia's BERD/GDP ratio is only 0.80 percent compared with the OECD average of 1.27 percent. This places Australia 19th on the list of 24 selected economies.

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46 Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 3.3. To use a different measure, Australia publishes some 970 scientific papers per million of population per year. On this measure Australia ranks 10th in international scientific effort.

47 ibid, p. 4.2.

48 The Hon John Moore MP, *Science and Technology Budget Statement 1998-1999*, DIST, 1998, p. 4.4 (exhibit no. 19).

49 AVCC, submission no. 49, p. 2.

Box 4: Gross Expenditure on R&D (GERD) – International Comparisons

			Period 1991 to 1997		
	GERD/ GDP	GERD (est. 1996 US $m)	Change	Average annual real increase in GERD	Average annual real increase in GDP
Sweden (1995)	3.59	6008	0.65	6.6	1.5
Japan (1996)	2.83	82817	-0.21	1.3	1.1
South Korea (1996)	2.79	17252	0.86	12.7	6.0
Switzerland (1996)	2.74	4946	-0.09	1.0	0.5
Finland (1997)	2.73	2828	0.66	7.3	3.2
United States (1997)	2.64	202486	-0.17	1.9	3.1
Germany (1997)	2.39	42683	-0.23	-0.3	1.6
France (1997)	2.26	27972	-0.15	0.2	1.6
Netherlands (1996)	2.09	6787	0.05	3.1	2.6
Denmark (1997)	2.02	2456	0.32	5.8	2.7
United Kingdom (1996)	1.94	21088	-0.17	0.7	2.6
Chinese Taipei (1996)	1.84	5020	0.15	8.1	6.4
Australia (1996)	**1.68**	**6487**	**0.31**	**5.4**	**3.7**
Canada (1997)	1.64	11013	0.11	3.6	2.5
Belgium (1995)	1.59	3392	-0.05	0.3	1.6
Norway (1997)	1.56	1721	-0.09	2.7	3.9
Austria (1997)	1.52	2700	0.03	2.3	1.9
Ireland (1995)	1.39	868	0.42	17.1	8.3
Singapore (1994)	1.25	667	0.21	11.4	5.9
Italy (1997)	1.05	12186	-0.18	-2.0	1.3
New Zealand (1995)	0.97	601	-0.03	3.6	3.5
Spain (1997)	0.89	5346	0.01	1.3	2.1
India (1992)	0.74	7928	0.00	4.1	4.3
China (1996)	0.49	33469	-0.21	4.5	13.9
Average (24 economies)	***1.86***		***0.09***	***4.8***	***3.1***
Average (20 OECD only)	***1.97***		***0.10***	***3.6***	***2.2***

Source: *Science and Technology Budget Statement 1999-2000*, p. 4.3.

Box 5: Expenditure on R&D in Government Laboratories and Universities – International Comparisons

	R&D expend in govt and universities as % GDP	Period 1991 to 1997	
		Change	Average annual % real increase in R&D
Netherlands (1996)	0.97	-0.01	2.2
Sweden (1995)	0.92	-0.09	1.2
Australia (1996)	**0.86**	**0.06**	**3.5**
Finland (1997)	0.85	-0.02	1.7
France (1997)	0.85	-0.06	0.4
Germany (1997)	0.76	-0.03	0.8
Norway (1997)	0.74	-0.01	2.3
Denmark (1997)	0.74	0.05	4.1
Switzerland (1996)	0.73	0.05	-0.7
South Korea (1996)	0.71	0.96	21.2
New Zealand (1995)	0.71	-0.01	3.4
Japan (1996)	0.68	-0.08	5.2
United Kingdom (1996)	0.66	0.00	2.7
Austria (1997)	0.65	0.11	na
United States (1997)	0.60	-0.08	0.9
Canada (1997)	0.58	-0.11	-0.6
India (1992)	0.54	na	1.9
Singapore (1994)	0.53	0.20	6.6
Belgium (1995)	0.49	-0.03	-0.9
Italy (1997)	0.48	-0.07	-1.5
Chinese Taipei (1996)	0.44	0.03	6.7
Spain (1997)	0.44	0.06	2.8
Ireland (1995)	0.39	0.05	10.7
China (1996)	0.26	-0.15	2.0
Average (24 economies)	***0.65***	***0.03***	***3.0***
Average (20 OECD only)	***0.69***	***0.04***	***1.6***

Source: *Science and Technology Budget Statement 1999-2000*, p. 4.6.

Box 6: Business Expenditure on R&D (BERD) – International Comparisons

	%BERD/GDP (latest)	Period 1991 to 1997	
		Change	Average annual real increase in BERD
Sweden (1995)	2.67	0.74	8.7
South Korea (1996)	2.04	0.67	13.4
Japan (1996)	2.01	-0.14	0.1
United States (1997)	1.96	-0.08	2.3
Switzerland (1996)	1.94	-0.18	1.2
Finland (1997)	1.88	0.70	11.0
Germany (1997)	1.63	-0.18	-0.7
France (1997)	1.38	-0.10	0.0
Denmark (1997)	1.27	0.27	6.9
United Kingdom (1996)	1.26	-0.16	0.0
Netherlands (1996)	1.10	0.09	4.6
Belgium (1995)	1.07	-0.02	0.7
Chinese Taipei (1996)	1.07	0.16	9.8
Canada (1997)	1.04	0.22	6.6
Ireland (1995)	0.99	0.37	20.6
Norway (1997)	0.97	0.07	4.6
Singapore (1994)	0.90	0.27	17.3
Austria (1997)	0.83	0.03	na
Australia (1996)	**0.80**	**0.25**	**10.2**
Italy (1997)	0.57	-0.12	-2.4
Spain (1997)	0.44	-0.05	-0.4
New Zealand (1995)	0.26	-0.02	4.0
India (1992)	0.19	0.01	10.7
China (1996)	0.18	-0.01	10.7
Average (24 economies)	***1.19***	***0.12***	***6.3***
Average (20 OECD only)	***1.27***	***0.12***	***4.2***

Source: *Science and Technology Budget Statement 1999-2000*, p. 4.11.

2.5 Australia's BERD/GDP ratio is significantly below the OECD average, let alone the ratios recorded by the best performers. Nonetheless, Australia's BERD growth rate from 1991 to 1997 was the fourth highest in the OECD.[50] With the exception of a recession-induced pause in 1990-91, BERD increased each year from 1984-85 to 1995-96.[51]

2.6 Although computer software R&D contributed significantly to BERD growth during the 1980s, more recent increases are mostly due to manufacturing R&D.[52] According to a 1997 report produced for the Australian Business Foundation (the Marceau report):

> *The manufacturing sector accounts for over half of all business R&D expenditure, despite accounting for only 14 per cent of national economic output. Services – especially communications – have shown the fastest growth rate, and Australia's services sector R&D intensity ranks as the highest in the OECD. Most R&D has been conducted in the medium-low and low-tech sectors of manufacturing – reflecting Australia's concentration in these industries – and in some services areas such as computer software. Australia's R&D performance in medium-high tech industries, such as automotive, remains poor by world standards.*[53]

2.7 Australia's corporate R&D expenditure is highly concentrated. Only two percent of Australian firms are engaged in R&D spending, with the top ten R&D spenders accounting for nearly 30 percent of BERD. Of those ten firms, just two (Telstra and BHP) account for 12 percent of Australia's BERD. As the Marceau report notes, this suggests a degree of national vulnerability "…to the decisions of a tiny number of firms".[54] Indeed, as this report was being finalised BHP announced that its R&D spending is to be

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50 Senator the Hon Mick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 4.2.

51 DIST, *Australian Science and Technology … at a Glance*, AGPS, 1997, p. 22 (exhibit no. 20).

52 ibid.

53 Professor Jane Marceau et al, *The High Road or the Low Road?*, Summary Report, p. 20. See also Professor Jane Marceau, "Industry Policy and the Nation State", *Evatt Papers*, pp. 82-83.

54 Professor Jane Marceau et al, *The High Road or the Low Road?*, Summary Report, p. 21 and Chapter Nine of the full report. See also Professor Jane Marceau, "Industry Policy and the Nation State", *Evatt Papers*, pp. 83-84; and AVCC, submission no. 49, p. 2 & p. 7. For a company-by-company view of industrial innovation in Australia, see Industry Research and Development Board, *Scoreboard 98: Business Expenditure on Research and Development*, 1998 (included in exhibit no. 28) at http://www.ausindustry.gov.au/scripts/ShowMenuPageDetail.asp?PageID=178 (as at 7 July 1999).

substantially reduced. The decision to make the cuts follows a major review of the company's R&D effort and was driven by low commodity prices.[55]

2.8 The reasons for Australia's low BERD levels are many and complex.[56] The Industry Commission, in its 1995 report on R&D, made the following observations about Australia's industrial profile:

- *small size of the manufacturing sector* – in all countries, manufacturing industries perform a high proportion of business R&D. Australia's manufacturing sector accounts for a smaller share of GDP than that of many other countries;[57]

- *different industry structure within manufacturing* – within manufacturing, the ratio of R&D expenditure to added value (R&D intensity) varies across industries. Compared to the OECD average, Australian manufacturing has a bias towards low and medium R&D-intensive industries; and

- *low R&D intensity within manufacturing industries* – within most manufacturing industries, Australian companies tend to be less R&D intensive than their overseas counterparts.[58]

2.9 The Commission also suggested that the gap between Australian and overseas BERD figures could, in part, be a legacy of Australia's former protectionist policies and

> *… traditionally low participation in world trade – a major source of technological knowledge. It is no coincidence that the opening of the Australian economy has coincided with rising [business] use of R&D; but catching up will unavoidably take time.*[59]

The fall in business expenditure on R&D since 1996-97

2.10 The BERD statistics for 1994-95 were the most recent available during public hearings for the inquiry. Those statistics indicated a substantial increase in R&D spending in the decade under review. However, throughout the inquiry there were suggestions that recent changes in government policy,

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55 "BHP Research Reveals Need to Cut R&D Funding in Half", *The Australian Financial Review*, 27 April 1999.

56 House of Representatives Standing Committee on Industry, Science and Technology, pp. 84-85.

57 See also Mr Michael Rice, submission no. 50, pp. 1-2.

58 Industry Commission, *Research and Development*, p. 493. See also Professor Jane Marceau et al, *The High Road or the Low Road?*, Summary Report, pp. 20-21 and pp. 9.15-9.16 of the full report.

59 Industry Commission, *Research and Development*, p. 27.

particularly in relation to the R&D tax concession (Chapter 5 refers), were likely to cause the first reduction in BERD in many years.

2.11 The Australian Bureau of Statistics (ABS) subsequently reported that in 1996-97 BERD decreased for the first time since the ABS started measuring R&D in the mid 1970s.[60] BERD fell seven percent in real terms, from $4.3 billion in 1995-96 to $4.1 billion in 1996-97.[61] BERD/GDP fell from 0.86 percent in 1995-96 to 0.80 percent in 1996-97.

2.12 Around 850 businesses which together spent $323 million on R&D in 1995-96 did not report any expenditure for 1996-97, while the 2800 businesses that continued their R&D spending reduced it by 2.5 percent. The amount of person-years devoted to business R&D also fell by 851, or three percent.

2.13 The fall in R&D was mainly in the finance and insurance industry (22 percent) and the property and business services industry (17 percent). Manufacturing R&D fell by one percent. In mining R&D, however, there was an increase of four percent.

2.14 As this report was being completed, the ABS advised that in 1997-98 BERD declined by a further four percent (in current price terms) compared with 1996-97 and seven percent compared with 1995-96.[62] BERD/GDP fell to 0.72 percent, while the human resources devoted to R&D fell by eight percent. The mining and manufacturing sectors recorded falls in R&D spending of 24 percent and five percent respectively compared with 1996-97.

2.15 Business reported that it expects BERD to fall to $3.65 billion in 1998-99, which is ten percent lower than the actual expenditure incurred in 1997-98. However, expenditure for 1996-97 and 1997-98 exceeded expectations by ten percent and four percent respectively.

2.16 The government has suggested that the fall in BERD is largely attributable to the termination, in 1996, of the "syndication" component of the R&D tax concession (examined in Chapter 5):

> *The figures … confirm the Government's expectation that changes to the R&D tax concession to reduce abuse of the system would have an impact on the measured level of BERD in Australia…*

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60 ABS, *Research and Experimental Development, Business Enterprises, Australia, 1996-97* (Cat. No. 8104.0), 1998. See also 9 July 1998 press release at http://www.abs.gov.au/websitedbs/D3110125.NSF/ (as at 10 February 1999) and "Government Attacked on R&D Spending Fall", *The Age*, 10 July 1998.

61 The fall of seven percent is measured in average 1989-90 dollars.

62 ABS, *Research and Experimental Development, Business Enterprises, Australia, 1997-98* (Cat. No. 8104.0), 1999. See also 4 June 1999 press release at http://www.abs.gov.au (as at 6 July 1999).

- *the syndication component alone used up to $1.8 billion of taxpayers' funds through elaborate financing schemes, while generating only $400 million in actual sales to date (or less than 1 percent of the $70 billion in sales initially forecast by the syndicates).*

- *The impact of the elimination of syndication accounts for some $200m of the nearly $300m observed reduction in R&D from the artificially high numbers of 1995-96 when abuse of the R&D tax concession was at its height.*

The Government also cleaned up abuses relating to claims for pilot plant and feedstock for the general concession which have also impacted on the measured R&D figures.

It was inevitable that the combination of these responses to abuse of the tax concession would have an impact on measured BERD. However, the Government is confident that the R&D which is now being claimed will be better quality, and more clearly focussed on commercial outcomes…[63]

2.17 While this Committee agrees with its predecessor in the 37th Parliament and the Industry Commission that there should not be a "catch-up target based on some international ratio of BERD to GDP",[64] the recent decrease in BERD from an already low base ought to be cause for concern. The Committee therefore welcomes the National Innovation Summit to be hosted in February 2000 by the government and the Business Council of Australia. The objective of the Summit is to develop "…a compendium of practical, new and/or modified, policy options which will improve tangibly Australia's innovation capacities".[65]

2.18 The Committee expects the government will take the opportunity to assess the causes of the recent decline in BERD and take measures to restore the former consistent rates of increase.

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63 Senator the Hon Nick Minchin, "Australian Business Still Behind International Competitors in R&D Expenditure" (media release), 7 June 1999 at http://www.disr.gov.au/media/1999/minchin/minchin99_56.html (as at 6 July 1999). See also DISR, submission no. 48.2, p. 5. Rio Tinto has responded that "the argument that the fall is due to the lack of syndication is unlikely, particularly given that many of the larger applications with syndication which were cut-off, promptly applied for and in many cases received [grants under other government schemes]". Rio Tinto, submission no. 25.1.

64 Industry Commission, *Research and Development*, pp. 496-499 & p. 649 and House of Representatives Standing Committee on Industry, Science and Technology, p. 105.

65 DISR, submission no. 42, p. 7 & p. 10. For further details on the Summit see DISR at http://www.isr.gov.au/industry/summit (as at 23 August 1999) and Senator the Hon Nick Minchin, "National Innovation Summit" (media release), 1 July 1999 at http://www.disr.gov.au/media/1999/minchin/minchin99_64.html (as at 6 July 1999).

The effect of policy changes on the *level* of R&D

2.19 In relation to the effects of competition policy on the level of R&D, the Executive Director of the National Competition Council reminded the inquiry that:

> *… like competition, research and development is not a good in itself; it is a means to an end. Like competition, introduction or promotion of it needs to be considered in the light of the public interest…*
>
> *… consideration of what [is] the appropriate level and direction of R&D resources and funding should be a question addressed from the point of view of the community interest and the implications economy wide rather than simply saying R&D might be reduced here and therefore that is a bad thing. We can agree that generally R&D expenditure just like competition is a good thing, but that is not always going to be the case in every instance.*[66]

2.20 As was expected, concerns expressed to the Committee about the effects on R&D of corporatisation, privatisation and competition policy were mostly in relation to *public* agencies making the transition to a more competitive environment. Cochlear Ltd – a company that has always been in the private sector – was relatively positive about the effects on R&D of the policy changes.[67] Similarly, the members of the Metal Trades Industry Association (MTIA) "overwhelmingly" cited recent reductions in the R&D tax concession (Chapter 5 refers) as having the biggest single impact on their ability to undertake R&D.[68] As for the policy changes being examined by the Committee:

> *The majority of respondents saw no impact of these policy changes on their R&D effort. A few reported a moderate increase in their R&D due to corporatisation, however this was balanced by a similar number who saw this policy change as resulting in either a moderate or significant decrease.*[69]

2.21 A difficulty with assessing the effects on R&D of the competition policy process is that it is being applied at varying speed to different utility sectors, different organisations within sectors and comparable sectors in different States. ASTEC's study also found that quarantining the effects of

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66 Mr Ed Willett, NCC, transcript of evidence, p. 4.

67 Cochlear Ltd, submission no. 1, p. 1.

68 MTIA, submission no. 7, p. 2. Since the evidence to this inquiry was received, the MTIA and the Australian Chamber of Manufactures (ACM) have merged to form the Australian Industry Group (AIG).

69 ibid, p. 5.

public policy changes on R&D is difficult, and accurate data is not readily available.[70] A further difficulty is that with the implementation of competition policy, changes in the nature of R&D are likely to challenge standard definitions, with an increase in "soft" research designed to enhance market knowledge rather than tangible products.[71]

2.22 As mentioned in Chapter 1, most of the utilities examined by ASTEC are in a "shakedown" phase in which all business inputs are being critically examined. R&D may be less important during this phase because of efficiencies and cost reductions being achieved through management restructuring, industrial relations and other changes:

> *Also, given the utilities are first and foremost service providers, and not technology developers, it would be surprising to find the role of R&D within the utilities was not being reassessed. Following the shakeout phase, a period of stabilisation is evident with the utilities learning to manage with reduced resources. At this point, R&D becomes an important means of reducing maintenance and operational costs. Subject to the legislative and regulatory environment … some of the utilities may eventually enter into a growth phase supported, at least in part, by additional focused R&D.*[72]

2.23 The issues described above are not unique to Australia. Similar changes are occurring in the electricity industry overseas (for example in Canada) as R&D is concentrated on issues which have more immediate operational outcomes.[73]

2.24 ASTEC's observations were supported by the Electricity Supply Association of Australia (ESAA). While the ESAA's members still recognise the strategic importance of R&D, their main focus is currently on the demands of the competitive market. This involves more interest in the acquisition and exploitation of new technologies than in direct involvement in R&D:

> *… it is understandable that electricity supply businesses at this time should be more strongly focussed on the opportunities offered by the commercialisation of existing technology, with most investment directed towards overcoming market barriers rather than to the development of new technology. The competitive environment, which has been endorsed and facilitated by governments of all political persuasions, provides little incentive for*

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70 ASTEC, submission no. 42, p. 13 and Professor Ron Johnston, ASTEC, transcript of evidence, p. 208.

71 ESAA, submission no. 40, p. 6 and ASTEC, submission no. 42, p. 6.

72 ASTEC, submission no. 42, p. 7.

73 Optima Energy, submission no. 41, p. 3.

> *investment in local research with its accompanying risks, while access to internationally-developed technology offers opportunities for commercial exploitation with considerably lower risk.*[74]

2.25 The ESAA stated that this does not close the door on opportunities for new R&D in Australia. Rather, the challenge for government and business is to identify opportunities for R&D relevant to the new strategic direction of energy supply, and then to work in partnership with the R&D community to fulfil those opportunities.[75]

2.26 While ASTEC could not say definitively whether competition policy has brought about a change in the quantum of R&D undertaken, it "at least found no strong evidence of a major downturn".[76] DIST similarly advised that there is little evidence that competition policy and public sector reform have had a negative impact on the overall level of R&D.[77]

2.27 While there is no direct evidence that the utilities' total R&D funding has diminished, it does appear that those funds are being allocated to fewer projects. According to the Academy of Technological Sciences and Engineering:

> *In the former, monopoly, electric industry R&D was concerned with cooperating with other utilities to provide common technical solutions at a minimum overall cost. The, then, industry tried to provide continuous, albeit small, funding to provide continuity for researchers.*
>
> *In the competitive electricity market which now prevails, R&D is about investigating techno-economic problems with highly individual solutions to enhance competitive advantage for the respective organisation. The real nature of this type of R&D, that it is a discontinuous need, has been made clear with relatively large funds made available for specific projects and little else.*[78]

2.28 Figures supplied by DIST (see Box 7 overleaf) suggest that the increase in R&D from 1986 to 1996 was reflected in a substantial increase in R&D within the gas, electricity and water supply industries. The most notable feature is a jump of over $70 million in gas and electricity R&D from 1993-94 to 1994-95.

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74 ESAA, submission no. 40, p. 2.

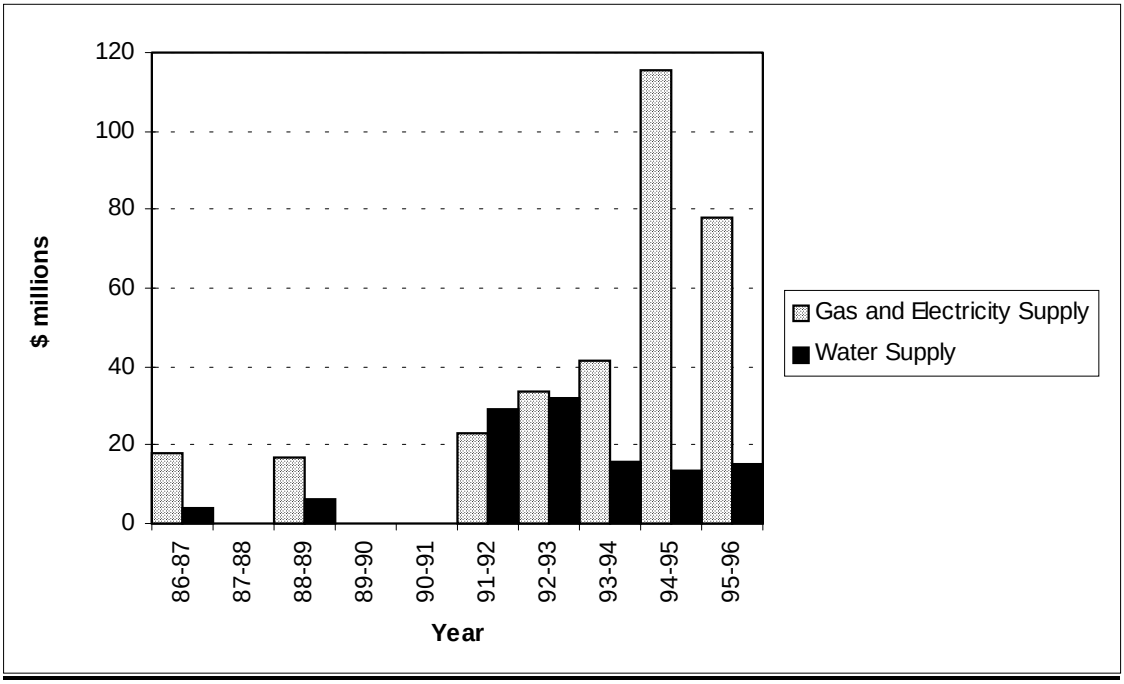
75 ibid.

76 ASTEC, submission no. 42, p. 13. See also ASTEC, transcript of evidence, p. 208.

77 DIST, submission no. 48, p. 11.

78 Academy of Technological Sciences and Engineering, submission no. 30, p. 3. See also ANSTO, submission no. 6, p. 2 and ESAA, submission no. 40, p. 6.

Box 7: R&D Expenditure in Gas, Electricity and Water Utilities



Source: DIST, submission no. 48, p. 11.

2.29 Analysis of company level data shows that the commencement of a few large projects accounts for almost all of the increase in gas and electricity R&D. As already noted, it is difficult to separate out the change in R&D spending that can be attributed to the policy changes being investigated by the Committee.[79]

2.30 In summary, where the level of R&D will settle in those sectors affected by corporatisation, privatisation and competition policy remains unclear. The Committee can only hope that speculation by DIST during the public hearings proves accurate:

> *I think you would expect, as those organisations find their place in the marketplace against other competitors in other states and territories, that they are likely then to start to look at the whole of the portfolio of their activities and to look at their R&D interface and their R&D needs with a portfolio approach.*
>
> *I suspect what we are looking at is a moment in time when research and development in organisations such as Telstra, the water companies, energy enterprises or whatever, will decline for a short number of years and then reposition themselves. The end point of all of that, though, is that they will focus on the relevance of the research that they are actually conducting, that actually adds value for their*

79 DIST submission no. 48, pp. 10-11.

> *shareholders because that is what they are now charged to do.*[80]

2.31 The relevance of R&D to the commercial needs of industry is examined further in the next chapter.

Will policy changes drive R&D offshore?

2.32 The Committee received evidence that privatisation and increased competition can lead to affected bodies conducting less R&D in Australia and either purchasing it from overseas sources or carrying it out in related overseas companies.

2.33 Increased competitive pressures may encourage firms to reduce costs by cutting their R&D effort, purchasing "off the shelf" technology from overseas and customising it to local conditions.

2.34 The Committee took evidence of such an effect in the energy, water and telecommunications sectors.[81] ASTEC's study concluded that while some of the utilities it examined have become "leading-edge customers" and worked with suppliers, both foreign and domestic, to create new products which have been sold on the international market:

> *… it must be expected with the utilities sourcing more technology on the global market, there will be an inevitable loss in the local R&D effort.*[82]

2.35 The Managing Director of the ESAA, Mr Keith Orchison, expressed the view that:

> *The issue is not whether the electricity industry engages in research – my word we do – and the issue is not whether there is going to be a wholesale importation of research because we are privatising and so on. The issue is how to make [use of] the best research available, regardless of where it is.*[83]

2.36 Secondly, it is claimed that privatisation of utilities has led to ownership moving to foreign firms, which prefer to source technology from their countries of origin.[84] The Australian Academy of Science and others also

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80 Dr Paul Wellings, DIST, transcript of evidence, pp. 194-195.

81 For further comment on this effect in the telecommunications sector, see Productivity Commission, *Telecommunications Equipment, Systems and Services*, pp. 81-83.

82 ASTEC, submission no. 42, p. 10.

83 Mr Keith Orchison, ESAA, transcript of evidence, p. 164.

84 For further comment on the effect of foreign ownership on Australian industry's R&D performance, see Professor Jane Marceau et al, *The High Road or the Low Road?* and Industry Commission, *Research and Development*, pp. 495-496.

commented that outsourcing of functions appears to favour overseas companies. The effects of outsourcing are examined at page 65.

2.37 Not all foreign owned firms have a policy which is opposed to Australian R&D. For example, the telecommunications firm Ericsson Australia has the fourth-highest R&D expenditure of any company in Australia, and commissions a high level of research from Australian universities.[85] Mr Stan Jeffery, a former General Manager of Product Development at Toshiba, noted that an overseas multinational with good management may achieve more for Australia than an unrealistic Australian enterprise.[86] However, it does appear that overseas companies sometimes can make questionable decisions to perform R&D in their countries of origin. The University of Western Sydney's Professor Jane Marceau advised that:

> *Last year I did a small survey of the biomedical device industry in Australia and I was actually quite struck by the multinational companies that said to me, 'Well, we are not allowed to spend more than $1000 here without permission from headquarters' or 'We do not even look at innovations that come to us here, we just automatically send them back to the US or wherever.' I had really thought that that was past but it is obviously still there.*[87]

2.38 In relation to the energy sector, the Australian Academy of Technological Sciences and Engineering stated that:

> *The increase in management defined research in the electric power industry, coupled with overseas ownership, has resulted in a tendency to contract research to overseas laboratories, often with the parent company. An excellent example of this is the transfer of some brown coal research to a R&D facility in the UK where there is little direct experience with this material and great difficulty in transporting samples in a stable state. This work could probably have been done in a superior manner in Australia. It is expected that the trend to source R&D from other countries will be a permanent, and increasing, feature of the industry.*[88]

85 Professor Jane Marceau, UWS, transcript of evidence, p. 113 and IR&D Board, *Scoreboard 98*.

86 Mr Stan Jeffery, submission no. 19.

87 Professor Jane Marceau, UWS, transcript of evidence, p. 113.

88 Academy of Technological Sciences and Engineering, submission no. 30, p. 2.

2.39 Mr Orchison of the ESAA suggested that many of the concerns put to the Committee were overstated:

> *A comment was made to this committee … that there was a danger that technology might be brought in here that did not work in Australia. I singularly fail to understand the point, because why would any company, having looked around the world for the best technology available and having found it, want to bring in something that did not work here? We very often have to adapt technology to work in Australia. That is something on which we work with universities and others.*
>
> *I do not think that this area should be seen as something negative … there is huge change taking place. It is by and large for the good and we are all learning how to make it work, and that has to include the research sector.*[89]

2.40 The Committee stresses the importance of maintaining an indigenous R&D capacity. Otherwise Australia will become a receiver of technology, which almost invariably means "…being a receiver of technology which is at least one generation out of date".[90] Also, restrictions are often applied when firms do gain access to imported technology. A 1988 study by the Bureau of Industry Economics (BIE) found that overseas suppliers were reluctant to transfer their latest technology unless they could nominate the territories in which the resultant products could be sold.[91] Similarly, the MTIA informed the Industry Commission's R&D inquiry that if a design is purchased overseas for manufacture of a product in Australia, the market in which that product can be exploited is almost invariably restricted to Australia.[92]

2.41 The Committee accepts that there is little value in limiting foreign ownership of former public utilities, or in dictating to commercial entities where they should source their R&D. A better philosophy would be to create a policy environment conducive to R&D spending in Australia, by Australian *and* overseas companies. Policy matters which have been raised in this context include the R&D tax concession, mechanisms to encourage linkages between firms and between firms and research bodies, Australia's capital gains tax regime and the availability of venture capital. Those matters are examined elsewhere in this report.

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89 Mr Keith Orchison, ESAA, transcript of evidence, p. 164.

90 Rio Tinto, submission no. 25, p. 10.

91 Quoted in Industry Commission, *Research and Development*, p. 139.

92 ibid.

Should R&D subsidies be repaid when firms move overseas?

2.42 When former Australian companies relocate overseas, a question arises as to whether taxpayer support of their R&D should be recouped as that funding has helped develop intellectual property (IP) that might subsequently compete against Australian products. The Committee's interest was raised by cases such as water purification company Memtec and computing company CSA.

2.43 Having examined this issue the Committee accepts that recouping past subsidies is not practical, for reasons including those put forward by the MTIA:

> *… the overall benefits to the economy of supporting private sector R&D through [means such as] the tax concession are positive. Any "leakage" of intellectual property overseas is inevitable, and is likely to be balanced by similar benefits accruing to Australian business from access to international technology, including intellectual property which has received support from taxpayers in other countries.*[93]

2.44 As DIST noted, Australia produces only two percent of the world's R&D and thus relies on access to overseas technology.[94] It would not be prudent for Australia to implement measures that could jeopardise the free flow of information from other countries.

2.45 The department also drew to the Committee's attention sections of the Industry Research and Development Act specifying "benefit of the Australian economy" as a factor in assessing R&D tax concession claims and R&D Start grant proposals (Chapter 5 refers), and sections of both the Act and the guidelines for the operation of CRCs concerning exploitation of intellectual property.[95] DIST noted that intelligent licensing arrangements can overcome some of the concerns described:

> *… some of the large organisations, like CSIRO, have made decisions at their board level over at least the last seven or eight years to try to ensure that intellectual property that is generated through moneys coming from Commonwealth appropriation is not sold to anyone at all but, in fact, is licensed across, rather than being sold. Very often, it is licensed in such a way as to have a rubber band on it. So, if an Australian [enterprise] then gets into a relationship with a major overseas company, the Commonwealth, through*

93 MTIA, submission no. 7.01, p. 2.

94 Mr Janko Spasojevic, DIST, transcript of evidence, p. 224.

95 DISR, submission no. 48.1, pp. 1-5 and Part IIIA of the Commonwealth *Industry Research and Development Act 1986*, "Functions of Board in Relation to Income Tax Concessions" (exhibit no. 25).

> *CSIRO, has the right to pull the IP back in, if that was a sensible thing to be doing. Those sorts of mechanisms are in place.*
>
> *I know the [CSIRO board and the CRCs have] tried to write clauses into those commercial relationships to ensure that Australian users or industries are first, or equal first, to use any new technology emerging out of those patents of other intellectual properties or know-hows that have been licensed. That means that our industries are never running with a time delay on those technology streams. I think that is a very important principle.*[96]

2.46 The Committee reiterates that Australia would be better served by lifting its performance in business R&D, and creating an environment where more firms can commercialise research without having to go overseas, than by imposing restrictions on the international movement of technology.[97] The Committee also notes that "managing intellectual property" is a topic to be considered by a National Innovation Summit working group.[98]

Loss of "critical mass" for R&D

2.47 The problem of scale has important implications for smaller enterprises and their capacity to commit resources to an ongoing R&D program. Smaller enterprises often have limited resources and cannot afford activities, such as R&D, that might not result in quick returns. These difficulties can preclude many small to medium enterprises (SMEs) from undertaking R&D.[99]

2.48 One of the potentially negative effects of competition policy is the loss of "critical mass" for R&D in affected sectors. As ASTEC noted, while the break-up of vertically integrated monopolies has a basis in economic theory:

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96 Dr Paul Wellings, DIST, transcript of evidence, p. 225.

97 Covering letter to exhibits nos. 22-24 from the Institution of Engineers (letter dated 2 July 1998).

98 DISR, submission no. 48.2, p. 7. On a related matter, the government has announced a review of Australia's intellectual property framework in relation to competition policy. The review is expected to report by June 2000. See Mr Warren Entsch MP, "Review of Australia's Intellectual Property Framework to Contribute to Competition Reform" (media release), 24 June 1999 at http://www.disr.gov.au/media/1999/entsch/entsch99_21.html (as at 6 July 1999); submission no. 15.1 (CSIRO); submission no. 29.2 (Australian Photonics CRC); CSIRO submission to the NCC concerning "Draft Report for the Review of Sections 51(2) and 51(3) of the *Trade Practices Act*" (exhibit no. 33); and NCC, *Review of Sections 51(2) and 51(3) of the Trade Practices Act 1974, Final Report*, March 1999 at http://www.ncc.gov.au (as at 6 July 1999).

99 House of Representatives Standing Committee on Industry, Science and Technology, p. 66.

> *… without doubt it has lead to a fragmentation of the total R&D effort. The utilities now have a lesser capacity relative to their respective predecessors to invest in R&D. Even before the break-ups occurred, most water and electricity authorities were small business units compared to foreign companies operating in the international, and increasingly, Australian markets. The break-up of these small business units has exacerbated an existing problem resulting in the formation of companies which are too small, or think they are too small, to undertake individually a significant amount of R&D. Concurrent with this reduction in capacity to invest in R&D has been a general increase in the price of undertaking R&D.*[100]

2.49 ASTEC noted that this loss of scale might be exacerbated by the legislation and licence conditions under which corporatised utilities operate. Legislation establishing a regime of "controlled competition" largely prevents takeovers, while licences limit revenue growth by restricting many utilities from operating outside their franchise area. Licences also specify how the utilities can obtain returns on their asset investments – some licences employ price regulation, while others use a revenue cap. The latter instrument in particular may promote a focus on cost-cutting rather than growth.[101]

2.50 A related issue is the willingness of the new organisations to co-operate with each other. As explained by ASTEC:

> *A consequence of the recent transition to a competitive environment, particularly in the water and electricity industries, is lack of experience in R&D cooperation. One manifestation of this is a propensity to guard R&D results closely just in case they have some commercial or strategic value … Another, perhaps more worrying manifestation [is] the utilities being less likely to want to involve multiple partners in R&D.*[102]

2.51 The CSIRO and the ESAA both observed that it has become much more difficult to broker collaborative research with the disaggregated electricity agencies:

> *Their primary orientation at the moment, which I suppose in a sense is one of the objectives of competition policy, is to push electricity out of the door at the lowest price. But*

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100 ASTEC, submission no. 42, p. 10.

101 ibid, p. 11.

102 ibid, pp. 10-11. See also Queensland Government, submission no. 27.1, p. 4; NT Power and Water Authority, submission no. 44; and Water Corporation of WA, submission no. 47, p. 3.

> *there are research issues on the horizon which probably are not being addressed.*[103]

2.52 ASTEC advised that co-operative mechanisms such as the Co-operative Research Centre (CRC) program have played an offsetting role (see pages 39 to 42), while the CSIRO noted that some generally pre-competitive research of common interest is funded through utilities' contributions to industry associations.[104] Such associations could play a greater role in facilitating R&D by their members.[105] Also, a system of sector-wide research brokers could prove beneficial.

Sectoral research bodies

2.53 In its science policy, the Federation of Australian Scientific and Technological Societies (FASTS) suggested that:

> *We should encourage industries that have a special common interest to set up research funding bodies, via voluntary sector levies, to consider specific research proposals from universities, Government and private organisations. These research proposals should be for work in generic areas of interest to the industry, and not for direct applications which may have proprietary interest. This would be a particularly important innovation for small to medium sized enterprises, which on their own cannot perform R&D requiring a high level of investment. FASTS supports the continuance of the Rural Industry R&D Corporations as an appropriate model.*[106]

2.54 Fifteen organisations operate under the Rural R&D Corporation (RDC) framework within the AFFA portfolio. These include 12 corporations (cotton, dairy, fisheries, forest and wood products, grains, grape and wine, horticulture, land and water, pigs, rural industries, sugar and tobacco); similar corporate arrangements for wool and meat and livestock; and a council for dried fruits R&D.

2.55 RDC funds are in most cases drawn from a combination of industry levies and matching Commonwealth Government contributions. Under the matching arrangements applicable to most RDCs, the Commonwealth provides dollar for dollar matching of corporation expenditures on R&D from

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103 Dr John Radcliffe, CSIRO, transcript of evidence, p. 49. See also ESAA, submission no. 40, p. 3.

104 Dr John Radcliffe, CSIRO, transcript of evidence, pp. 49-50 & pp. 60-61.

105 Mr Frank Forster, transcript of evidence, pp. 85-86 and House of Representatives Standing Committee on Industry, Science and Technology, pp. 60-61.

106 FASTS, *A Science Policy for Australia in the 21st Century*, 1998, p. 19 (exhibit no. 1).

levy-derived funds, up to the level of 0.5 percent of the industry's gross value of production.[107]

2.56 The dollar-for-dollar subsidy provides an incentive for the primary sector to increase its own R&D funding and to become more involved in R&D priority-setting. The government contribution also recognises that activities funded by the RDCs generate a mix of public and private benefits.[108]

2.57 All of the available evidence supports the RDCs' assertion that:

> *… corporatisation of the producer funded and government matching R&D arrangements is something of a major, internationally admired, success story. The RDC structure has enabled industry to have a much greater say in the direction of R&D and permitted greater flexibility in the management of R&D. It has changed the culture toward R&D, with R&D now viewed as an investment and not a cost – an investment which has high payoffs but which needs also to be managed in an investment framework. The result has been a higher level of rural R&D than otherwise with consequent benefits to the rural industries and the wider community generally.*[109]

2.58 The CSIRO suggested that the Australian Mineral Industries Research Association (AMIRA) could provide an alternative model to the RDC model for development of research bodies in other industry sectors.[110] Like the RDCs, AMIRA contracts out R&D to various research providers:

> *AMIRA is a research broker whose primary activity is to establish collaborative, pre-competitive research projects between our members and public sector research institutions in Australia and overseas. In addition, AMIRA manages the Australian Coal Association Research Program (ACARP).*
>
> *… Since its establishment in 1959, AMIRA has established over 600 research projects, many of which are effectively longer-term, strategic research programs.*[111]

2.59 The R&D brokered by AMIRA is not funded by an industry levy. Instead, collaborative projects proceed if individual companies are prepared to fund them, with the research results remaining confidential to those

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107 Rural RDCs, submission no. 12.1.

108 DPIE, submission no. 46, p. 9.

109 Rural RDCs, submission no. 12, Executive Summary p. 2. See also Rural RDCs, submission no. 12.1 and AVCC, submission no. 49, pp. 6-7.

110 CSIRO, submission no. 15.

111 AMIRA, submission no. 21, p. 2.

companies. The companies that fund the research thereby gain the benefits of the research.[112] Unlike the RDCs there is no matching government contribution provided to AMIRA, although companies' project funding is eligible for the R&D tax concession.

2.60 The models described will not be appropriate for every sector of the economy. In particular, the Industry Commission has noted a lack of enthusiasm for levy-based models on the part of manufacturing industries.[113]

2.61 In relation to those sectors most affected by public policy changes, however, the Committee concurs with FASTS, the CSIRO, the Australian Academy of Science and the Australian Vice-Chancellors' Committee (AVCC) that the RDC and AMIRA models are worthy of serious consideration.[114]

Recommendation 1:

2.62 The Committee recommends that the forthcoming National Innovation Summit's working group on "increasing critical mass in both public and private R&D" examine:

- **establishing sectoral R&D brokers for collaborative, pre-competitive research; and**
- **the extent to which such collective research should be financed by industry levies as against public subsidies.**

2.63 The Committee supports the two important principles for government R&D policy articulated in the 1995 reports of the Industry Commission and this Committee's predecessor:

- first, private incentives should be built on where possible, with government action leveraging funds from the private sector and focusing on user-driven research; and

112 Industry Commission, *Research and Development*, pp. 680-681.

113 ibid, pp. 682-683 & p. 807. This lack of enthusiasm is attributable to three factors. First, most manufacturing companies use research and design to differentiate their products (unlike the agricultural and commodity sectors, where "generic" products using "generic" processes are more common). Second, difficulties arise in equitably matching participants' contributions and benefits. Third, in most manufacturing industries vertical collaboration between companies (customer/supplier links) appears to be more important than horizontal (intra-industry) co-operation.

114 Australian Academy of Science, submission no. 10.1; CSIRO, submission no. 15; AVCC, submission no. 49, p. 4; and FASTS, *A Science Policy for Australia in the 21st Century*, p. 19.

- second, funding should ideally be "contestable", or open to all researchers who can do the job rather than being reserved for particular groups. Both AMIRA and the RDCs "shop around" for the research providers who might best meet the needs of their constituents.[115]

The Energy Research and Development Corporation (ERDC)

2.64 Given the desirability of encouraging pre-competitive R&D in individual sectors, the Committee has serious reservations about the government's withdrawal of funding for the Energy Research and Development Corporation (ERDC) in 1997. A range of organisations told the Committee that the ERDC was both efficient and effective, and that its abolition "will see the demise of several promising initiatives".[116]

2.65 The former Chairman of the ERDC, Mr Peter Laver (speaking on behalf of the Academy of Technological Sciences and Engineering) told the Committee that in Australia:

> *We seem to have run to a grinding halt when we get to the situation that we have proved the technology but … we need to build a pilot plant or a demonstration model or something so that we can go along to a bank and raise some money from it. That is why I still regret the departure of the ERDC because that was exactly the sector that ERDC was working in …You actually had to prove your technology and perhaps even have your patents but ERDC would match anything between a one to one up to a one to five – one of government money up to four or five of the actual owner's money – to build the next stage so they have actually got something that the venture capitalists can come along and kick the tyres and say, 'Yes, that looks as though it is going to work. We will lend you money to develop it.'*[117]

115 Industry Commission, *Research and Development*, p. 11 & p. 200 and House of Representatives Standing Committee on Industry, Science and Technology, pp. 87-88.

116 AMIRA, submission no. 21, attachment p. 5. See also ESAA, submission no. 40, p. 2; NT Power and Water Authority, submission no. 44; AVCC submission no. 49, p. 4; Mr Peter Laver, Academy of Technological Sciences and Engineering, transcript of evidence, p. 12 & p. 19; Mr Richard Davies, AMIRA, transcript of evidence, p. 30; Dr John Webster, Institution of Engineers, Australia, transcript of evidence, p. 97; and Mr Keith Orchison, ESAA, transcript of evidence, pp. 161-163 & p. 165.

117 Mr Peter Laver, Academy of Technological Science and Engineering, transcript of evidence, p. 19.

2.66 The ESAA's Mr Keith Orchison stated that the ERDC:

> *… enabled us to get research off the ground in a number of areas where it would have been difficult to do so if we were only using private funds. But I think it is important to make the point that the leverage the Commonwealth was getting out of the ERDC ran from as much as three to one to seven to one. The Commonwealth, in terms of increasing the benefits to Australia of research, was actually getting a return in terms of leverage on the money it invested.*
>
> *I have been involved in one form or another … with research in this country for the best part of 25 years. The ERDC was one of the most sensible ways of addressing the necessary partnership between government and industry that I have seen. We have made no bones about the fact that we were bitterly disappointed that it was closed down. We believe it is a mistake.*[118]

2.67 Given the unanimously favourable industry view of the ERDC's work, the Committee hopes that recent government initiatives such as the Renewable Energy Equity Fund[119] – and the recommendations in this report – will provide mechanisms through which the functions described by Mr Laver and Mr Orchison can be carried out.

The Co-operative Research Centre (CRC) program

2.68 ASTEC informed the Committee that perhaps the most important finding of its study was:

> *…the vital role the Cooperative Research Centres (CRCs) and other cooperative R&D mechanisms are now playing in re-establishing the critical mass required to undertake R&D following the break-up of many former water boards and electricity commissions. This is an important point to recognise because this role was not a primary aim of the CRC Program and as a consequence, it may be overlooked in any future consideration of funding for the program and/or individual CRCs. ASTEC believes Australia has indeed been fortunate to have had the CRC Program in*

118 Mr Keith Orchison, ESAA, transcript of evidence, p. 163.

119 The REEF will provide $30 million of funding specifically for the commercialisation and application of renewable energy technologies. Applications for a REEF fund manager were called in the national press on 9 April 1999. The REEF is based on the government's Innovation Investment Fund, as discussed in Chapter 5 of this report. DISR, submission no. 48.2, p. 9 and Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 2.6 & p. 5.52.

> *place at the time of competition policy reform so as to help off-set an adverse consequence of the reforms.*[120]

2.69 CRCs are established under formal contracts with the Commonwealth Government, normally for seven years, to undertake long-term strategic research focusing primarily on the natural sciences, engineering and their application.[121] Typically each CRC is supported by several companies, one or more universities and a State or Commonwealth research agency to conduct research on a specific priority issue.[122]

2.70 The CRCs have a different role from industry bodies such as AMIRA and the Rural RDCs. The latter are R&D contractors covering the full range of an industry's interests, while the CRCs are research providers performing more fundamental strategic-basic research on particular topics.[123]

2.71 The first CRCs were established in 1991. There are now 67 CRCs, with participants in the program (as at May 1998) including over 250 companies, 35 universities, 61 State government departments and agencies, 24 CSIRO divisions, eight other Commonwealth agencies, eight Rural RDCs and numerous other organisations.[124]

2.72 The CRC program will receive $140 million in Commonwealth funding in 1999-00. Other partners will provide additional funding, infrastructure or other in-kind support. Private industry funding of CRCs is steadily increasing, from 11.3 percent in the first selection round (1991) to 25.3 percent in the fifth round (1996). Industry committed more funding for the CRCs selected in the fifth round than did the government.[125]

2.73 The CRC program has been widely acclaimed as being:

> *… demonstrably the most successful and visionary industry/university collaborative process that has as yet been devised for Australia and one that is admired*

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120 ASTEC, submission no. 42, p. 13. See also ESAA, submission no. 40, p. 4; Melbourne Water Corporation, submission no. 45; and Dr Michael Sargent, ASTEC, transcript of evidence, p. 212.

121 The Hon John Moore MP, *Science and Technology Budget Statement 1998-1999*, p. 6.68.

122 DPIE, submission no. 46, pp. 23-24. For a more detailed overview of the CRC program, see CRC Review Steering Committee (Mr Don Mercer and Professor John Stocker), *Review of Greater Commercialisation and Self Funding in the Cooperative Research Centres Programme*, DIST, May 1998, pp. 1-6 & p. 81 at http://www.disr.gov.au/crc/review/finalds.pdf (as at 10 February 1999).

123 AMIRA, submission no. 21, attachment p. 5 and DPIE, submission no. 46, p. 16.

124 CRC Review Steering Committee, p. 2.

125 ibid, p. 14 and Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 6.66.

internationally as a model for bringing research institutions and industry together.[126]

2.74 Weaknesses in the national innovation system addressed by the program include:

- disincentives to collaboration among research providers and Australian businesses;
- weak links between research organisations and users;
- lack of critical mass due to the institutional and geographical dispersion of Australian research and research application;
- lack of mobility of personnel between government research, academia and industry; and
- the challenges of effective international links for a country isolated from international centres of research and innovation.[127]

2.75 The Committee notes that in the 1998-99 budget, Commonwealth funding for the program was reduced by nine percent in real terms.[128] Given the success of the program, and the role it has played in countering the effects on R&D of public policy changes, long-term funding should be maintained at least at current levels.[129]

Recommendation 2:

2.76 The Committee recommends that in recognition of the success of the CRC program, and its important role in re-establishing "critical mass" for R&D in sectors affected by public policy changes, the government at least maintain real funding for the program at current levels.

2.77 The Committee therefore rejects the Mortimer review's recommendation that public funding of the CRC program be slashed to $20 million per year, on the basis that the funding supports "institutions rather than activities" and confers a private benefit to participants.[130]

126 CRC Review Steering Committee, pp. 28-29.

127 DIST, submission no. 48, Appendix 2, pp. 2-3.

128 DISR at http://www.disr.gov.au/science/analysis/budget98/highlight.html#notes (as at 6 July 1999).

129 ESAA, submission no. 40, p. 4.

130 Mortimer Review of Business Programs, p. 125.

2.78 The government's own review of options for greater commercialisation and self-funding in the CRC program (the 1998 Mercer-Stocker review) rejected Mortimer's criticisms as "ill-founded", and concluded that CRC funding is no more to be regarded as "business assistance" than is funding of universities and the CSIRO.[131] The Industry Commission has also commented that:

> *To some degree the Mortimer Report's negative assessment is based on (questionable) a priori reasoning rather than evidence…*
>
> *R&D rarely generates purely private or public benefits. To say that there is a clear private benefit earned by firms' participation in all CRCs is not a sufficient basis for reducing the scope of the programme. After all, the R&D tax concession was not subjected to the same criticism, yet it clearly also provides public support for what will be predominantly projects earning private returns. The key questions are: (a) whether the expected private benefits are big enough so that private agents have incentives to undertake the investments without government subsidies; and (b) if they are not big enough, are there spillovers or other benefits from the induced R&D which are worth the public subsidy? The Mortimer report makes no assessment of these issues.*
>
> *The distinction between supporting an institution and an activity can be blurred. The funds available for CRCs are not initially earmarked for any particular institutions, and indeed one of the strengths of the programme is the strong contestability for funds on a seven year rolling basis.*[132]

2.79 While there should be rigorous and ongoing review of competing CRC proposals, unreasonable expectations of commercial funding would be destructive of the program. This is because many of the benefits of R&D, at the level that CRCs work, are not appropriable by individual firms but are available to many in the medium-to-longer term.[133]

131 CRC Review Steering Committee, p. vi & pp. 44-47.

132 Quoted in ibid, p. 80.

133 Australian Academy of Science, submission no. 10 and Sir Gustav Nossal, Australian Academy of Science, transcript of evidence, p. 40.

Lack of adequate data

2.80 A major difficulty throughout the inquiry was a lack of reliable, consistent data with which to measure the effects of policy changes on both the level and the type of R&D conducted. As ASTEC stated:

> *… policy analysis and development must always be underpinned by quality and accurate data and [ASTEC] is concerned that, in this case, such data are not readily available at this time. Mechanisms are urgently needed to collect R&D expenditure data which truly reflects the rapidly changing R&D environment, if for no other reason, than to satisfy ourselves as a nation that all is well with R&D following the implementation of the reforms.*[134]

2.81 In relation to the limited availability of R&D data in Australia, the Industry Commission has noted that:

> *…many overseas researchers obtain access to detailed information for individual firms through private surveys and the financial market data services. Stock exchange listing requirements in North America require companies to disclose details of their R&D activities. While the Australian Stock Exchange does not require this of Australian firms, a firm may voluntarily disclose details of its R&D activities. Few, however, do.*[135]

2.82 The Committee therefore reiterates its predecessor's recommendation that organisations which are required to submit annual reports, in both the public and private sectors, include in those reports information collected in a consistent manner on their R&D expenditure.[136]

Recommendation 3:

2.83 The Committee recommends that the government require organisations in both the public and private sectors, which are required to submit annual reports, to include in those annual reports information on their R&D expenditure. The government, in conjunction with the ABS and industry, should develop an agreed basis according to which such expenditure can be measured.

134 ASTEC, submission no. 42, p. 13. See also Queensland Government, submission no. 27.1, p. 3 and AVCC, submission no. 49, p. 1.

135 Industry Commission, *Research and Development*, pp. QA31-32.

136 House of Representatives Standing Committee on Industry, Science and Technology, pp. 105-106.