WHY NO ACTION ON ENGINEERING TRAINING?

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Severe shortages of professional engineers are now evident in Australia. Yet the Australian Government has shown no interest in expanding domestic training levels. The reasons for this inaction include a lack of awareness that there has been no increase in the training of domestic engineering students since the Coalition came to power in 1996 and unrealistic expectations that migrant engineers can fill the gap.

Organisations representing the engineering industry, including Engineers Australia, have long argued that if Australia is to compete in high value-added industries it must increase its investment in science and technology training. Their case has been supported by various authorities on the issue, including the Australian Academy of Sciences[1] and the Coalition Government's Chief Scientist, Robin Batterham.[2]

The Australian Government has responded at the postdoctoral level with sharp increases in expenditure on Centres of Excellence and Cooperative Research Centres. This response has provided new opportunities for post-doctoral research for both Australian- and overseas-trained PhDs.

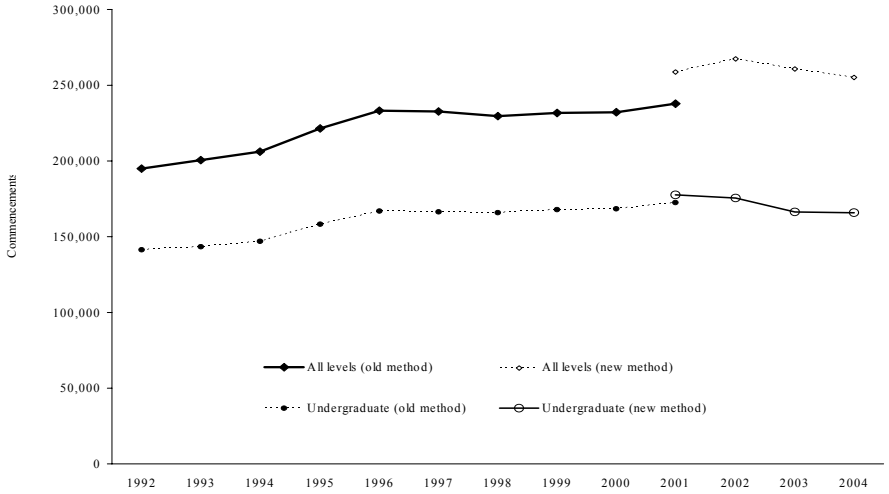
However, there has been no increase in engineering training at the coalface — that is in domestic commencements at the undergraduate and postgraduate level (See Figure 1b) — since the Coalition came to office in 1996.

Though the problem is acute for the engineering field, other areas of higher education have been similarly affected. Since 1996 there has been little change in domestic training as measured by undergraduate commencements (whether in places in the government-subsidised Higher Education Contribution Scheme [HECS] or in full-fee places).[3] The extent of this increase is difficult to measure since, as Figure 1a shows, there was a sharp break in the statistical series produced by Department of Education Science and Training (DEST) in 2001. Prior to 2001, the census of university students was taken at a set point in time each year, but since 2001 all students have been included regardless of when they were enrolled during the year. The effect, as is evident in Figure 1a, is to increase the numbers of commencing students in the records relative to the methodology used prior to 2001.

In 1995, domestic undergraduate commencing students numbered 158,160, but by the last year under the old data collection method (2000), their numbers had expanded to 168,563. In the more recent period shown in Figure 2a, these commencements fell from 177,694 in 2001 to 165,682 in 2004. Given that this latter figure is inflated relative to the pre-2001 numbers, it can be concluded that the numbers of domestic undergraduate commencements in 2004 were similar to the levels in 1995.[4]

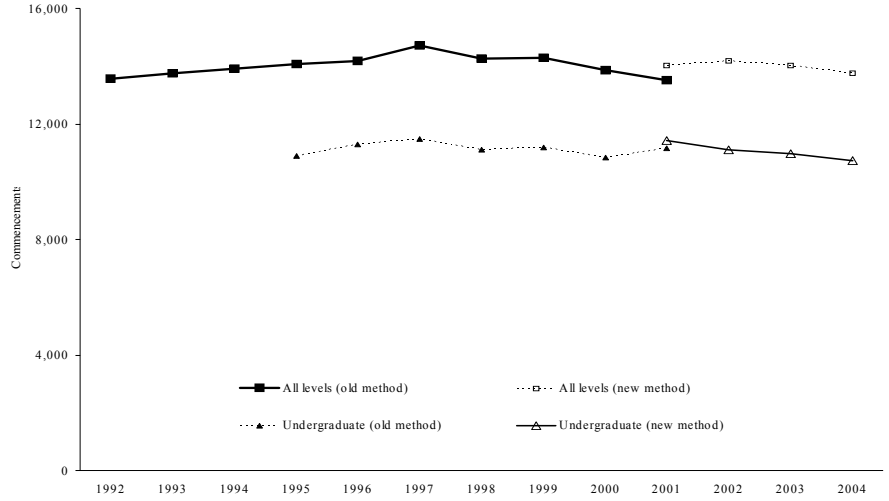
However, as far as engineering is concerned, there appears to have been a decline in commencements after a peak of 11,500 in 1997.[5] In the mid 1990s, as can be seen in Figure 1b, the number of domestic students commencing an undergraduate engineering course (as counted under the earlier collection method) hovered around the 11,000 mark.

Figure 1a: Total and undergraduate domestic commencements, all fields, 1992 to 2004



Source: see Figure 2

Figure 1b: Total and undergraduate domestic commencements, engineering and related technologies, 1992 to 2004



Source: DEST aggregated datasets and published tables

Notes

The data take into account the coding of Combined Courses into two fields of education since 1997. This mainly occurs at the bachelor degree level.

The new method of counting introduced in 2001 counts persons who were enrolled in a course at any time of the year. Before 2001 the data were collected at one point of time each year.

A new classification of fields of education was also introduced in 2001. Engineering benefited from the reclassification of around 200 commencing undergraduate students from Nautical Science to Marine Engineering.

The line for total engineering commencements derives from published DEST data which map the broad field of study codes used pre-2001 to the broad field of education codes used from 2001 on.

The line for undergraduate engineering commencements derives from aggregate DEST data files held by CPUR. The Nautical Science numbers have been added to the numbers studying engineering and surveying courses.

As Figure 2b shows, under the new data collection method the number of undergraduates continued this pattern, dropping from 11,425 in 2001 to 10,727 in 2004. We conclude that domestic undergraduate commencements in engineering have declined since the Coalition came to office in 1996.

WHY THE LACK OF AWARENESS OF STATIC DOMESTIC COMMENCEMENT NUMBERS

These enrolment data may surprise since many commentators think there has been an increase in domestic training — including in the engineering field. There are two sources of this misapprehension. One is that commentators often do not differentiate between overseas student (onshore and offshore) and domestic enrolments. As detailed below, there has been a significant increase in the former (see Figures 2a and 2b). The other source is the change in the statistical collection methodology just discussed.

Recent comments by the Minister for Education, Science and Training, Brendan Nelson, illustrate the importance of this changed methodology. When specifically questioned on university training levels by Laurie Oakes on the Sunday program, Nelson stated that the number of students in Australian universities has increased by 135,000 over the last nine years — a figure which the minister asserted was equivalent to a 23 per cent increase.[6]

As Table 1 indicates, Nelson appears to be correct. He has avoided the trap of conflating overseas and domestic enrolments. The DEST statistics for domestic students do show a 135,000 increase in enrolments between 1996 and 2004 — but, as the bottom right-hand cell of Table 1 shows, around half of this increase is attributable to the new collection method. Much of the rest reflects increases in postgraduate enrolment. As noted shortly, the latter do not add significantly to the size of the professional workforce.

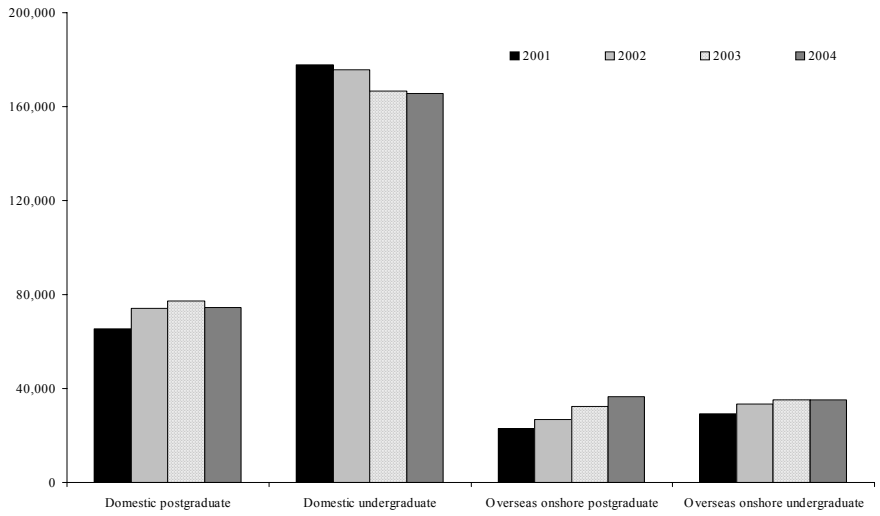
The key point, highlighted in Table 1, is that undergraduate domestic student commencements declined over the same period. Indeed, this decline is understated in the DEST statistics because of the change in the data collection methodology. It is likely that the modest increase in undergraduate enrolments left after these measurement adjustments are made is a consequence of students elongating their courses. For some students, this reflects the necessity to undertake part-time employment to make up for the decline in government funding for student living allowances since 1996.

THE GROWTH IN OVERSEAS STUDENT ONSHORE COMMENCEMENTS

As noted above, when the domestic and overseas student numbers (both onshore and offshore) numbers are combined, there does appear to be a healthy growth in university training levels. Figure 3 provides details about the 2001 to 2004 experiences for commencing domestic students and overseas students studying onshore. Together with Figures 2a and 2b, Figure 3 shows that almost all of the growth in commencements is attributable to overseas students enrolled onshore.

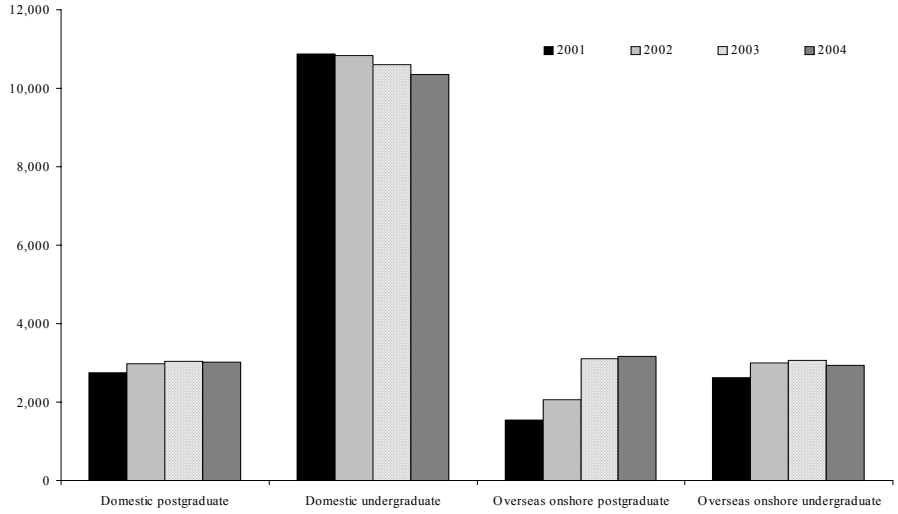
There was a slight increase in overall domestic commencements in the years 1999 to 2002. This reflected over-enrolments on the part of universities (that is enrolments above the allocated number of funded HECS places — for which universities received relatively low financial compensation). This increase was manifested in parallel increases in completions (in some fields) through

Figure 2a: Domestic postgraduate and undergraduate commencements, all fields by domestic and overseas students onshore, 2001 to 2004



Source: see Figure 2b

Figure 2b: Domestic postgraduate and undergraduate commencements, engineering and related technology, by domestic and overseas students onshore, 2001 to 2004



Source: DEST aggregated data sets 2001-2004 held by CPUR
Note: Figure 2b only shows the number of commencements whose main field of education is engineering. The fields do not include any commencers who are undertaking engineering as a supplementary field of education in a combined degree recorded under another field. This occurs primarily at the Bachelor level and there are around 300 such domestic commencements each year. Very few overseas students are so recorded.

2002 and 2003. Since 2002 the number of over-enrolments at Australian universities has contracted.

Thus the recent increase in domestic undergraduate completions will not last. As Figures 2a and 2b show, domestic undergraduate commencements have fallen since 2001, both for all undergraduates and for engineers. Therefore it is very likely that domestic undergraduate completions will fall over the next few years. There has been a slight increase in postgraduate domestic commencements (Figures 2a and 2b). However, from the point of view of the impact on the labour market, postgraduate enrolments actually delay entry into the workforce (unless the students are already working and are studying part-time). As a result, the current shortages of graduates (in some fields) will be exacerbated unless overseas students stay on in Australia and enter the domestic workforce.

Figures 2a and 2b show very forcefully how growth in higher education in Australia has been dependent on overseas enrolments, particularly at the postgraduate level. This point applies with particular emphasis to engineering. As Figure 1b shows, domestic engineering commencements have been flat since 1996. Engineering did not even share in the temporary increase in enrolments associated with the over-enrolment phenomenon described above. As Figure 2b shows graphically, to the extent that there has been any increase in engineering training at Australian universities it is due to growth in the numbers of overseas student enrolments. Most of this increase as been at the postgraduate level, where the number of commencing onshore overseas students almost doubled between 2001 and 2003.

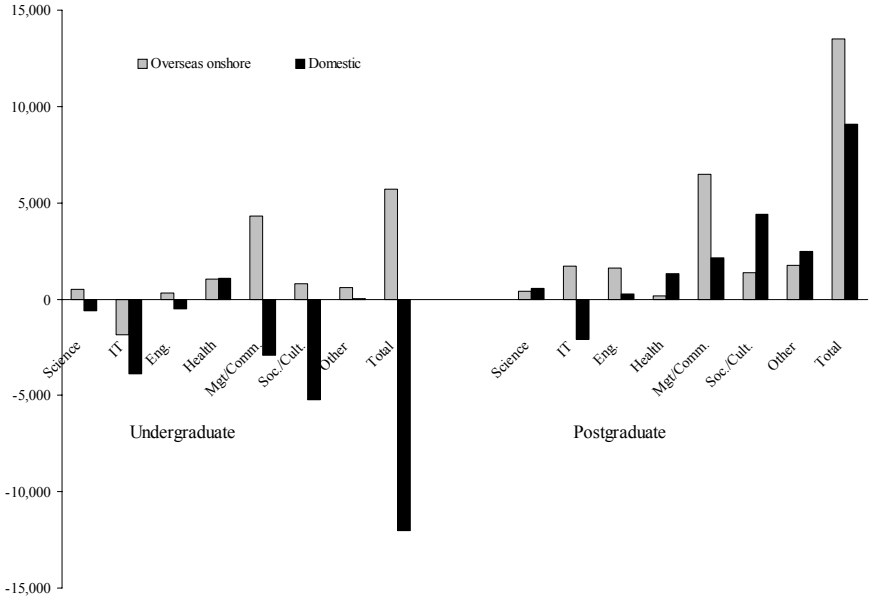
Figure 3 provides a more detailed breakdown of commencement data between 2001 and 2004 by field of education. It shows how sharp the commencement decline has been since 2001 at the undergraduate level for domestic students in most fields, including society and culture, and management and commerce — fields which some current Commonwealth ministers think have been producing too many graduates. No parallel data by field of education are

Table 1: Total and commencing domestic students by level, 1996-2004, and the impact of changes to the data collection methodology on apparent numbers counted

	Old method		New method		Change 1996-2004		Impact of new methodology on numbers recorded in 2001
Course level	1996	2001	2001	2004	No.	Per cent	
	Commencements						
Postgraduate	59,145	56,316	65,218	74,297	15,152	26	8,902
Undergraduate	167,059	172,215	177,694	165,682	-1,377	-1	5,479
Other	7,106	9,429	15,610	14,971	7,865	111	6,181
Total	233,310	237,960	258,522	254,950	21,640	9	20,562
	Total enrolments						
Postgraduate	118,346	118,033	147,035	173,159	54,813	46	29,002
Undergraduate	453,863	485,491	520,221	525,505	71,642	16	34,730
Other	8,697	10,552	17,719	17,758	9,061	104	7,167
Total	580,906	614,076	684,975	716,422	135,516	23	70,899

Source: calculated from 1996 Selected Higher Education Student Statistics, 1996, AGPS, pp. 17, 36, 104, 115; 2001 from two DEST aggregated data files held by CPUR, one supplied in 2002 under old data collection methodology and the second supplied in 2005 under new collection method as a customised order with the 2004 file

Figure 3: Undergraduate and postgraduate commencements, domestic and onshore overseas students by field of education, variation between 2001 and 2004



Source: DEST aggregated data sets 2001-2004 held by CPUR
Note: this chart only shows the main field of education. The fields do not include any commencing students who are undertaking the fields of education as a supplementary field in a combined degree (primarily at the Bachelor level).

available for the earlier period because of changes in the DEST classification of fields of education, as well as changes in the collection methodology in 2001 noted above. In the case of engineering, Figure 3 reinforces the above findings that the flat trajectory in domestic training in engineering (since 1996) has continued into this century.

SKILL SHORTAGES? ... NO WORRIES

Ministers in the Commonwealth Government (notably Nelson and the Prime Minister John Howard) have repeatedly asserted that there is nothing to worry about in the above situation. They appear to believe that current skill shortages are concentrated in the traditional trades and that one cause of this problem is an excessive focus on university-level training. The stabilisation of domestic higher education training since 1996 described above refutes this belief. This stabilisation has also occurred at a time when the number of Year 12 students seeking to gain a university place has increased. As a consequence, Australia is one of the few Western countries where participation rates in higher education for domestic students have fallen in recent years.

Furthermore, the implication that there is too much university training is wrong. There is strong evidence that a knowledge-based economy requires an increase in professional-level training. The emergence of significant skill shortages (including in engineering fields) is just one of the pieces of evidence supporting this contention.

Nelson has raised a further issue in defence of the Coalition's stance on

higher education. He claims that universities are recruiting low performance students (as measured by their year 12 ENTER ranks). He has stated that: 'Across Victorian universities are students who secured a government sponsored university place with an entry score of 55 per cent or less… You've got to say to yourself, just how many more university places do you want or need?'[7] This is a serious argument. If students achieving ENTERs at this level were being recruited to engineering or science this would challenge the argument for more HECS places. In fact, detailed study of ENTERs in Victoria show that the great bulk of students offered a place have to achieve ENTERs of 70 or above. Only a small number with ENTERs below 60 receive an offer, and almost all of these offers are made by campuses in regional Victoria.[8] If additional HECS places were made available at the major metropolitan universities, where competition for entry is fierce, there would be plenty of well-qualified students available to take them up.

HAVE THE 'CHICKENS COME HOME TO ROOST'?

The domestic economy is expanding rapidly. It is being driven by a boom in consumer consumption and housing which dates from the late 1990s. The recent dramatic expansion in demand for commodities comes on top of this boom. In consequence, demand for skilled labour (including engineers) has increased in order to build the infrastructure (freeways and so on) needed in the rapidly expanding metropolises. The skilled labour demands of the mineral industry are adding to an already stretched labour market.

It should come as no surprise that a shortage of engineers has become apparent. The sharp end of this shortage is indicated by the Migrant Occupations in Demand List (MODL) (prepared by the Department of Employment and Workplace Relations [DEWR]). This list identifies skilled occupations in national shortage. It currently includes civil engineers, mining engineers, chemical engineers and petroleum engineers. Other indications of shortages of engineers are evident.

Another indication of the strong demand for domestic students trained as engineers can be found in the recent Graduate Destination Survey. This shows that 78 per cent or more of people who had completed a domestic bachelor degree in engineering in 2003 and who were in full-time work in 2004 were in a professional position (the great majority in engineering work). By comparison, only 48 per cent of computing graduates in full-time work had found a job in their broad field of training.[9] This demand is further evidenced in starting salaries for graduates, which in the case of mining engineers has reached $65,000.[10]

The outlook is that the shortage of engineers will become more acute, because over the next few years domestic completions in engineering are unlikely to rise, given the slight fall in commencements in recent years as described above. Table 2 shows the number of completions in engineering by major branch of engineering field over the time period for which comparable data are available for both domestic students and overseas students. The number of domestic students graduating (all levels) has been stable at around 7,856 to 7,843 over the years 2001 to 2003.

The shortage has potentially serious implications for the Australian public and for employers. One example, amongst many, is the shortage of electrical power engineers, a specialist sub-discipline within electrical engineering. Since the

Table 2: Engineering course completions by field and level, domestic students and overseas students onshore, 2001-2003

	Domestic			Overseas onshore		
	2001	2002	2003	2001	2002	2003
Process and Resources Engineering						
Higher degree by research	131	139	127	40	26	42
Masters by Coursework	17	15	20	15	22	41
Other postgraduate	49	66	94	2	11	11
Bachelors	692	700	607	106	141	165
Other undergraduate						
Total	889	920	848	163	200	259
Mechanical and Industrial Engineering and Technology						
Higher degree by research	64	83	88	23	20	14
Masters by Coursework	44	47	38	65	91	137
Other postgraduate	60	36	50	1	2	4
Bachelors	840	812	770	282	269	230
Other undergraduate	14	22	10			
Total	1,022	1,000	956	371	382	385
Civil Engineering						
Higher degree by research	79	102	113	21	27	29
Masters by Coursework	180	168	179	208	182	225
Other postgraduate	31	14	19	2	4	5
Bachelors	904	809	811	191	150	156
Other undergraduate	21	16	16			
Total	1,215	1,109	1,138	422	363	415
Electrical and Electronic Engineering and Technology						
Higher degree by research	132	142	187	49	49	53
Masters by Coursework	168	208	234	232	390	766
Other postgraduate	34	36	38	33	24	43
Bachelors	1,727	1,545	1,752	537	532	712
Other undergraduate	22	30	16			11
Total	2,083	1,961	2,227	851	995	1,585
Other Engineering fields						
Higher degree by research	65	63	55	20	15	10
Masters by Coursework	227	186	192	201	203	281
Other postgraduate	235	182	210	16	13	33
Bachelors	1,898	1,855	1,891	269	267	268
Other undergraduate	222	410	326	18	41	70
Total	2,647	2,696	2,674	524	539	662
Total Engineering and Related Technologies						
Higher degree by research	471	529	570	153	137	148
Masters by Coursework	636	624	663	721	888	1,450
Other postgraduate	409	334	411	54	54	96
Bachelors	6,061	5,721	5,831	1,385	1,359	1,531
Other undergraduate	279	478	368	18	41	81
Total	7,856	7,686	7,843	2,331	2,479	3,306

Includes bachelor degree completions where the supplementary field of education is an engineering field of study.
Source: DEST aggregated data sets

privatisation of electricity utilities there has been a reduction in the building of new generating plant with the consequence that power shortfalls will be more probable in the peak summer months.[11] Electrical distribution equipment, such as power transformers, is often being used well past its design life yet there are few graduating engineers to plan for the replacement of this vital infrastructure. It is difficult for engineering faculties to open up training in this field again at a time when there are so many other demands for additional engineers (as in the civil and mining areas) and no extra government-funded places.

Can overseas students trained in Australia fill the gap?

Table 2 shows that completions for overseas students have increased by nearly 1,000 from 2,331 to 3,301 (an increase of 42 per cent) over the same time period. Almost all of this growth in completions has been at the level of Masters by Coursework, primarily in the field of electrical and electronic engineering and technology (mainly the computing and communications subfields), where 735 more onshore overseas students completed in 2003 than 2001.

This dependence on overseas students will be accentuated over the next few years because the number of onshore commencing overseas students has increased sharply. As Table 3 shows, there has been rapid growth at the Masters by Coursework level, particularly in the electrical and electronic fields, where the numbers tripled between 2001 and 2003 from 405 to 1,289.

THE MIGRATION RECRUITMENT EFFORT

In response to the skills shortage crisis, the Government has increased the skilled immigration intake. The results for the period 2000-01 to 2004-05, as they affect engineers, are shown in Table 4. The table reports the number of visas issued to Principal Applicants in the various permanent-resident skilled-migration categories where the Principal Applicant's nominated occupation was that of engineer. We used the visa-issued data because they are the most reliable and up-to-date indicator of the response to the drive for migrants selected because of their skills. Table 4 does not include engineers entering Australia under the two other main visa categories (family reunion and humanitarian), nor does it include those who entered as New Zealand citizens, or as spouses of Principal Applicants.

Table 4 indicates that the skilled migration program is augmenting Australia's engineering workforce significantly. At a time when domestic completions have been flat, at around 7,500 per year, the number of migrant

Table 3: Overseas students onshore, Masters by Coursework commencements in Engineering and Related Technologies, 2001-2004

	2001	2002	2003	2004
Manufacturing Engineering and Technology	3	32	61	156
Process and Resources Engineering	30	31	64	119
Mechanical and Industrial Engineering and Technology	105	134	173	196
Civil Engineering	187	251	306	207
Electrical and Electronic Engineering and Technology	405	760	1,289	1,249
Other Engineering and Related Technologies fields	292	312	664	633
Total Engineering and Related Technologies	1,022	1,520	2,557	2,560

Source: DEST, aggregated data sets

engineers visaed has increased from around 1,000 in 2000-01 to some 2,600 in 2004-05. The increase has also occurred across all the engineering sub-fields, including civil and chemical engineering, which are both listed on the MODL. Most of the growth in the numbers of engineers granted permanent visas has been from those who applied for permanent residence in Australia after finishing their training in Australia. But Australian employers are also attracting a significant number of overseas engineers on temporary work visas.[12]

On these figures, the skilled migration program is helping to augment skill shortages in the engineering workforce. But this is at the expense of local access to the engineering profession. There is a strong argument that the first obligation of the Australian Government is to provide opportunities for Australian youth to meet the skill needs of their country. The growing dependence on migrants is a direct consequence of the lack of expansion in Commonwealth-supported places (under HECS).

But whatever one's views about Australia's obligations to train domestic aspirants, questions remain about whether reliance on migrant engineers is a sustainable solution to Australia's skill shortages in this field. In commenting on this issue we distinguish between offshore and onshore sources of supply.

The main potential source for overseas-trained engineers with some professional experience is Asia. In 2004-05, only 23 per cent of building and engineering professionals visaed under the non-overseas student part of the general skilled migration program came from the main English-speaking-background countries. On the other hand, 17 per cent came from India, and a further 40 per cent came from other parts of Asia. Migrant engineers are still coming from the UK, South Africa and New Zealand but, in recent years, they have constituted a minority. There is a huge stock of engineering graduates in China, the subcontinent of India and elsewhere in Asia. But whether these graduates have the training and experience relevant to Australian employers' needs, or the English communication skills employers require is another matter. A recent study has suggested that of China's 1.6 million young engineers only ten per cent of them would be considered suitable for work with multinational companies.[13] As Table 4 indicates, despite the recent expansion in the skilled migration program, there has been little growth in the numbers visaed under the offshore skilled independent category. This is because many potential applicants cannot meet the credential requirements specified by the relevant Australian accrediting authority (Engineers Australia) nor can they meet the threshold English language requirements of the selection system.

Once in Australia, many Asian engineers struggle to gain employment in their field. Data from the 2001 Census show that in the case of those trained at university level in engineering and who came from China over the years 1996-2001, only seven per cent were employed at a professional level in engineering by 2001 and another 16 per cent in other professions. The comparable figure for Indians was nine per cent and 31 per cent. By contrast, of the engineers from the UK, 26 per cent were employed at the professional engineering level by 2001 and another 25 per cent in other professions.[14] (All of these figures include persons who may have come via the family reunion program or via New Zealand, and thus did not have to meet the specifications of the skilled migration visa categories.)

Partly because of the difficulties some overseas trained professionals were

Table 4: Visas granted to Building and Engineering Professionals, Principal Applicants, 2000-01 to 2004-05

ASCO Occupation and year of visa grant	Skill - Independent	Overseas student	Other General Skilled Migration Program	Employer Nomination Scheme		Other	Total
				Offshore	Onshore		
Engineers identifiable under Minor ASCO Group 212 Building and Engineering Professionals							
2124 Civil Engineers							
2000-01	204	0	26	5	3	2	240
2001-02	198	43	19	2	1	1	264
2002-03	226	65	29	7	2	4	333
2003-04	181	123	38	2	6	5	355
2004-05	189	168	68	1	16	6	448
2125 Electrical & Electronics Engineers							
2000-01	207	0	24	1	2	4	238
2001-02	164	26	18	10	10	8	236
2002-03	186	62	18	7	6	1	280
2003-04	185	160	54	5	3	4	411
2004-05	227	273	75	4	33	9	621
2126 Mechanical Prodn & Plant Engineers							
2000-01	192	0	24	3	4	3	226
2001-02	146	26	13	3	5	0	193
2002-03	220	72	31	6	2	0	331
2003-04	240	132	26	6	12	7	423
2004-05	255	196	84	2	29	16	582
2127 Mining & Materials Engineers							
2000-01	36	0	6	3	0	0	45
2001-02	43	2	3	2	2	0	52
2002-03	36	4	0	0	1	0	41
2003-04	41	12	2	0	1	3	59
2004-05	42	13	3	4	19	5	86
2128 Engineering Technologists							
2000-01	88	0	26	1	4	2	121
2001-02	139	35	13	1	1	4	193
2002-03	160	34	22	0	7	3	226
2003-04	145	139	36	0	1	0	321
2004-05	181	237	70	3	24	5	520
2129-17 Chemical Engineers							
2000/2001	76	0	6	3	0	3	88
2001/2002	61	22	6	0	0	0	89
2002/2003	85	48	9	4	1	1	148
2003/2004	60	56	10	2	1	2	131
2004/2005	65	147	9	1	6	1	229
Other Engineers classified under 2129							
2000/2001	45	0	4	3	1	1	54
2001/2002	31	8	4	0	0	4	47
2002/2003	37	14	9	0	1	2	63
2003/2004	41	43	9	1	3	1	98
2004/2005	70	67	7	0	5	1	150
Total identifiable Engineers within Minor ASCO Group 212 Building and Engineering Professionals							
2000/2001	848	0	116	19	14	15	1,012
2001/2002	782	162	76	18	19	17	1,074
2002/2003	950	299	118	24	20	11	1,422
2003/2004	893	665	175	16	27	22	1,798
2004/2005	1,029	1,101	316	15	132	43	2,636

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ASCO Occupation and year of visa grant	Skill - Independent	Overseas student	Other General Skilled Migration Program	Employer Nomination Scheme		Other	Total
				Offshore	Onshore		
Remainder of Minor ASCO Group 212 Building and Engineering Professionals (includes engineers not identified above)							
2121, 2122, 2123 Building Professionals*							
2000-01	189	0	25	0	3	2	219
2001-02	158	69	17	0	3	1	248
2002-03	252	90	27	2	4	6	381
2003-04	200	168	32	2	2	4	408
2004-05	195	243	49	1	18	6	512
Rest of Building and Engineering Professionals							
2000-01	221	0	20	1	0	0	242
2001-02	235	90	12	0	0	0	337
2002-03	320	129	22	1	3	1	476
2003-04	280	257	31	1	3	2	574
2004-05	291	551	59	2	14	3	920
Total Minor ASCO Group 212 Building and Engineering Professionals							
2000-01	1,258	0	161	20	17	17	1,473
2001-02	1,175	321	105	18	22	18	1,659
2002-03	1,522	518	167	27	27	18	2,279
2003-04	1,373	1,090	238	19	32	28	2,780
2004-05	1,515	1,895	424	18	164	52	4,068

* Building Professionals includes Architects and Landscape Architects, Quantity Surveyors, and Cartographers and Surveyors.
Source: DIMIA, unpublished data

experiencing in gaining professional level work, the Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) decided to target Australia-trained applicants. (The Department did this by giving extra points for Australian training and waiving the experience it requires from offshore skilled applicants.) Also, since mid-2001, former overseas students can apply for permanent residence without first leaving Australia, as long as they do so within six months of completing their course. Migrants trained in Australia to our specifications should be in a good position to offer the skills (including English language skills) that employers need.

In the case of engineering, this strategy appears to be working, particularly amongst those who have completed Masters courses (nearly half of whom come from India). Since these Masters students would have completed undergraduate engineering degrees in their country of origin, the Masters degree is a good preparation for entry into the Australian engineering workforce.

A high proportion of overseas student engineers trained in Australia have sought permanent residence on completion of their studies here. In some fields, including mechanical and civil engineering, around half of those completing their courses are taking up the onshore migration option. This estimate is based on a comparison of the number of overseas students completing courses in Australia (Table 2) with the number obtaining a visa at the time.

There is one concern, however, about their value in filling gaps in the Australian engineering workforce. The onshore student program is focussed on electrical and electronic engineering (see Table 3). Enrolments of domestic students in this field of engineering have declined in recent years (in line with the

parallel decline in IT undergraduate enrolments, which in turn reflects the softness of the IT market in Australia).

CONCLUSION

There is now an acute awareness of the depth of skill shortages in Australia. The causes of these shortages are more controversial. In the case of engineering, this study has shown that current shortages of engineers are directly linked to the disjunction between growing demand for such professionals on the one hand and static training levels for domestic students over the past decade on the other. The Coalition Government is reluctant to acknowledge this disjunction, in part because of a misreading of the statistics on the issue. University-level training in engineering has grown since the Coalition came to office, but all of this growth has been amongst overseas students.

Part of the solution must be an expansion in Government-subsidised university places for domestic students. The rationale for this measure is not just the strong moral claim that local students ought to be given an opportunity to prepare for positions in well paid and prestigious professional areas in their own country. There is also a more pragmatic justification.

As noted above, the Coalition Government has turned on the immigration tap, with some success as far as engineers are concerned. But this is unlikely to be a satisfactory long-term solution. There is a limited stock of engineers working overseas who are ready to come to Australia with the skills and experience employers want. There are also limits to the willingness of overseas students to come here, complete engineering courses at their own expense and then seek permanent residence. The best engineers from the Australian employers' perspective are those trained in full-time four-year undergraduate degrees. Few overseas students interested in permanent residence will take on a four-year undergraduate degree. It is too hard and too expensive. The undergraduate overseas students in engineering currently studying in Australia mainly come from Malaysia, Singapore and Hong Kong. They tend to return home, where salary levels approach those in Australia. The immigration market is mainly a postgraduate market because it only involves a two-year investment. The students drawn to this market mainly come from India and China, where there is a vast difference between the terms and conditions of employment relative to those available in Australia. Thus the best way to expand the stock of fully trained engineers in Australia is to train our own.

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