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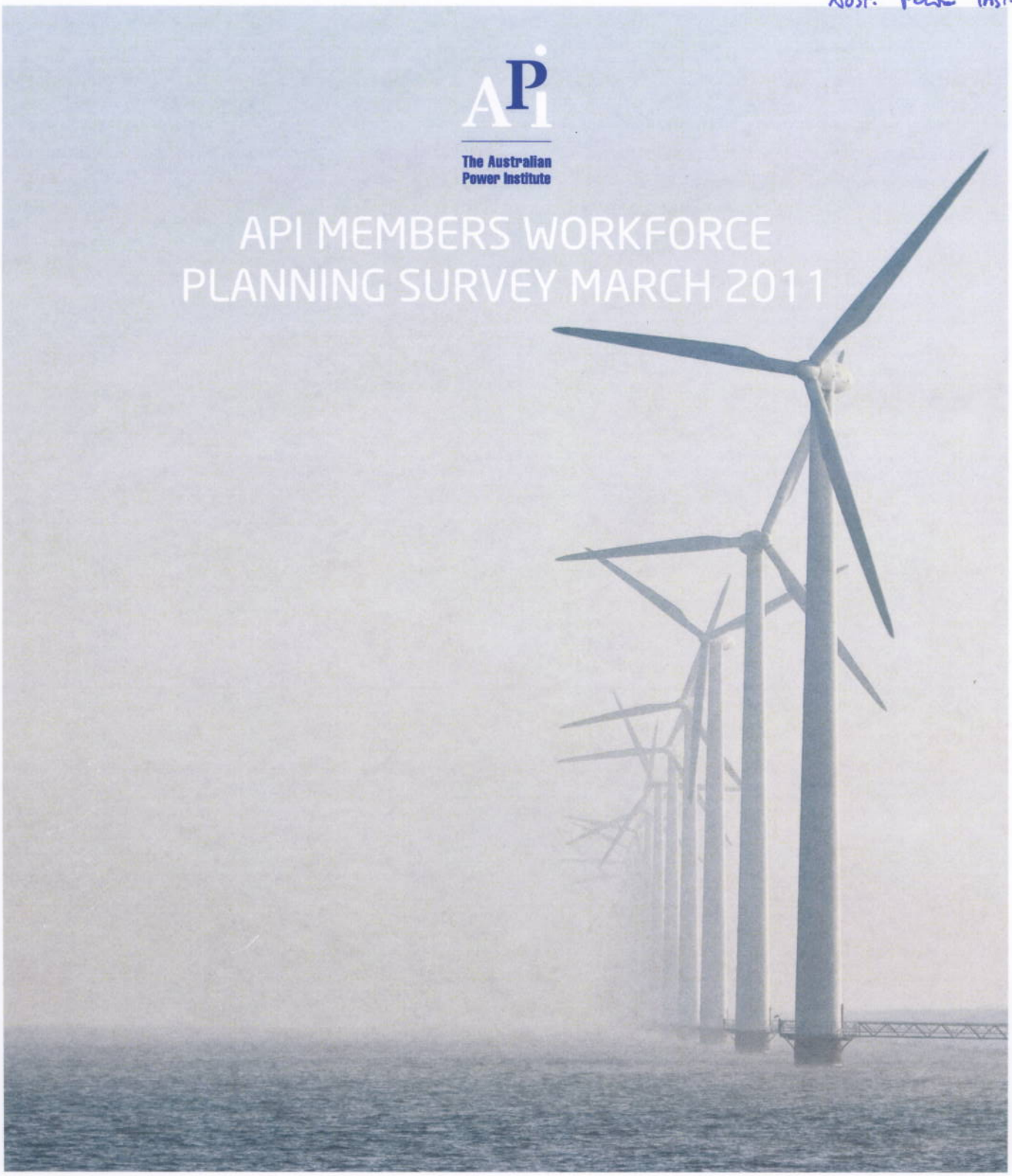
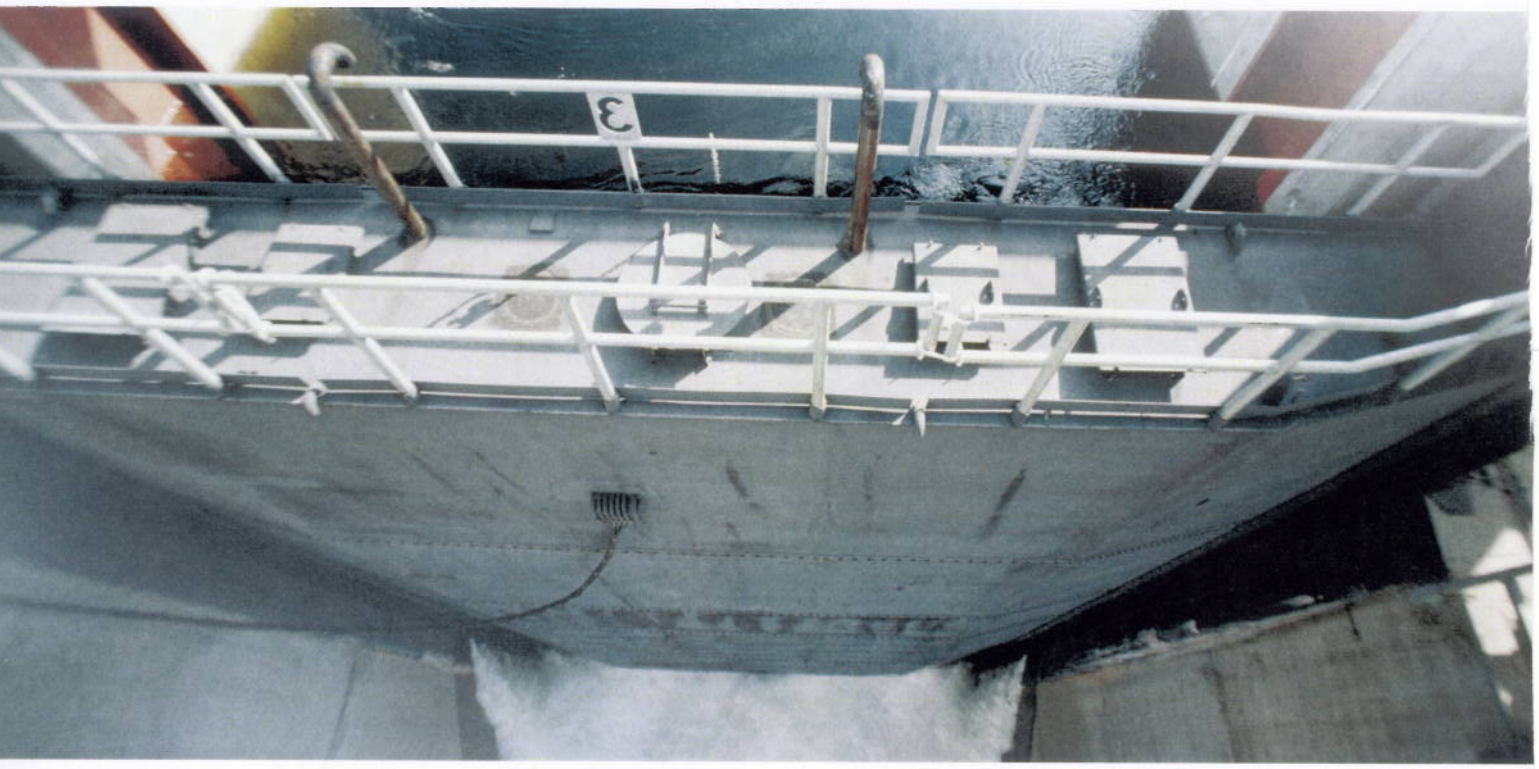
API MEMBERS WORKFORCE PLANNING SURVEY MARCH 2011



API WORKFORCE PLANNING: SKILLS AND DEMAND IN INDUSTRY

REPORT ON AUSTRALIAN ELECTRICAL POWER ENGINEERING HUMAN RESOURCES FOR THE ELECTRICITY SUPPLY INDUSTRY.



The last comprehensive assessment of professional power engineering skills capability was undertaken in the report "Electrical Power Engineering: Assessing the Future of Electrical Power Engineering – A Report on Electrical Power Engineering Manpower Requirements in Australia" by Vic Gosbell & Duane Robinson for Engineers Australia and esaa (completed in April 2004). That study concluded there was cause for concern that there would be a shortage of suitable electric power engineers, and more importantly it determined that the relationships between universities and the power industry needed to be improved to address such shortages effectively. Further, it was concluded that more promotion was needed of careers in engineering in general and power engineering in particular.

This work was a catalyst for the power industry to form the Australian Power Institute (API), which has since grown to include 35 major industry employers. Through the API, relationships between the electricity supply industry and universities have strengthened to the extent that API was awarded the 2011 Business Higher Education Roundtable Award for Outstanding Achievement in Collaboration in Higher Education and Training, sponsored by the Federal Department of Education, Employment and Workforce Relations. The strong relationship with universities has enabled joint work to improve the quality of available power engineering studies. A National Power Engineering Bursary Program to attract young Australians to study power engineering has also been implemented, as has a continuing education and development program for power engineers.

Over the period since the 2004 study, demand for engineers has grown substantially, as industry work programs have been elevated to meet increases in peak electricity demand, and to replace ageing infrastructure. The rapid growth in the industry has driven widespread outsourcing of core electrical design, construction and maintenance work. The industry structure has disaggregated further with separation of retail, generation, transmission and distribution sectors in many jurisdictions and further privatisation of Government owned businesses. Competition for engineering talent has intensified from other industries, particularly mining and petroleum and major infrastructure developers. As was forecast, a shortage of power engineers has been experienced since the 2004 study, although this has been moderated by success in increasing power engineering enrolments and graduation rates.

In March 2011 API conducted a further survey of member companies to assess current professional engineering workforce conditions.

Information was also sought from Australian universities regarding student numbers and teaching capability.

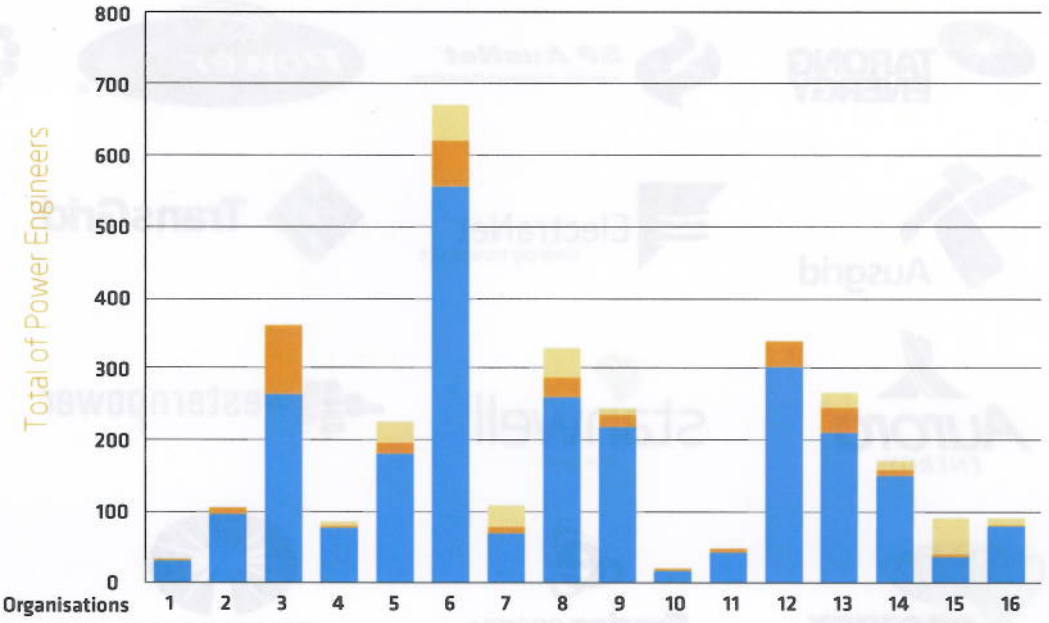
RESEARCH METHOD

Survey questions, shown in Appendix 1, were sent to the 35 member companies of the Australian Power Institute on March 2011. Responses were received from the 16 companies shown below:

All respondents are utility companies, with collective employment of 2,595 power engineers, representing approximately 40% of the existing total professional power engineering workforce in Australia. These companies also employ 254 power engineering consultants. In addition to the survey of API member companies, information was also sought from API's university partners regarding student numbers and teaching capability as part of the annual request for proposals from universities for funding by API.

POWER ENGINEERING EMPLOYMENT PROFILE - KEY STATISTICS

- 2,595 engineers across 16 companies with a wide range of employee numbers between companies
- 254 consultant engineers, representing approximately 10% of employee engineers
- Considerable variation in the concentration of consultant engineers, from zero to 135%
- 62% of respondents utilize power engineering consultants
- 331 Female engineers comprise 13% of the sample, with all companies employing female power engineers.

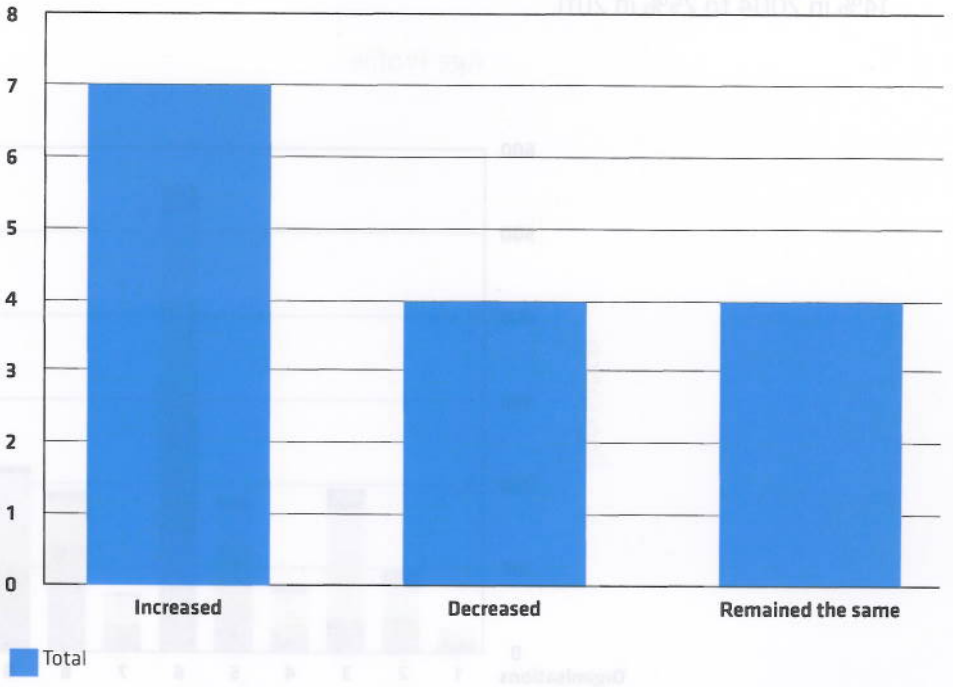


Organisations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Approximate number of power engineering professional working for your business in a consulting and/or contracting basis				5	29	50	30	40	9	0			20	11	50	10
Number of female professional with power engineering qualifications	1	8	96	3	14	64	9	28	16	3	4	36	35	9	4	1
Number of existing professionals with power engineering qualifications (i.e. Electrical, mechanical, mechatronic engineering) in your business	32	97	264	77	182	555	69	260	219	17	43	302	211	150	37	80

GENDER ISSUES

- Females are grossly under-represented in power engineering roles, as in student enrolments
- Almost half of respondents have increased the proportion of female recruits, although proportions have decreased in some respondents
- Increases in female representation are happening, but slowly - 13% females in power engineering is higher than the 9.5% of women with tertiary qualifications working in engineering or related occupations (Engineering Australia, The Engineering Profession: A Statistical Overview).

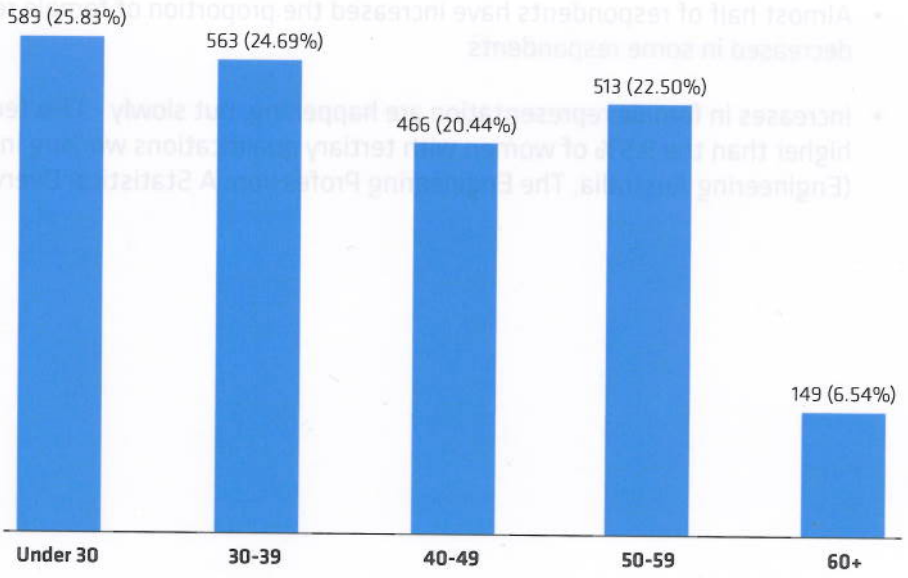
Over the last 4-5 years, proportion of females recruited to engineering roles



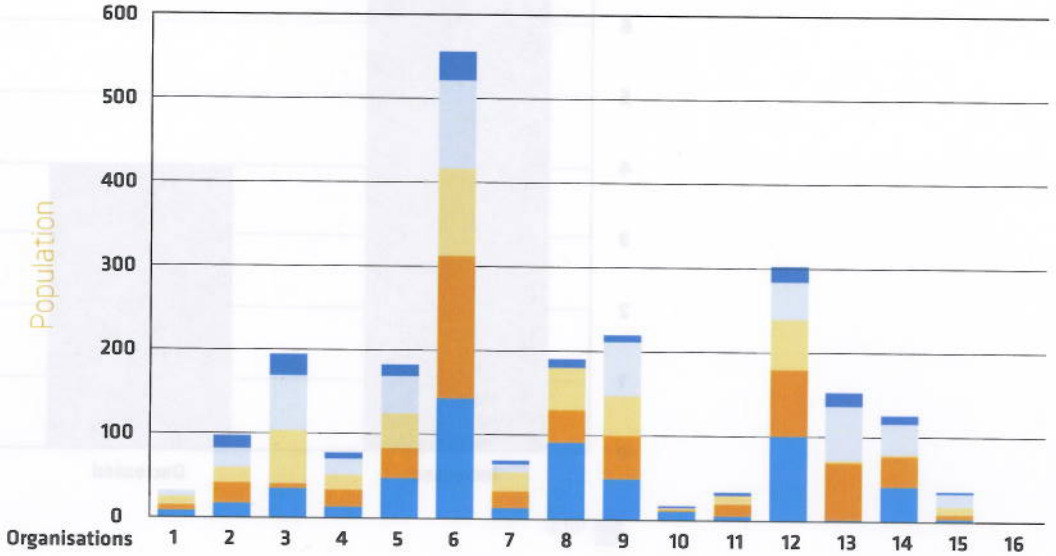
AGE

- 29.04% of the existing professional engineer workforce is over 50 years of age, an increase from the 27% shown in the last survey.
- Only 20.44% of engineers were in the 40-49 year age group, compared with 30% in the 2004 survey. This age group typically provides the senior professional leaders and managers.
- In line with the extended recruitment of new graduates over recent years, the proportion of engineers under 30 years of age has increased from 14% in 2004 to 25% in 2011.

Total Age (%) Profile in the Survey



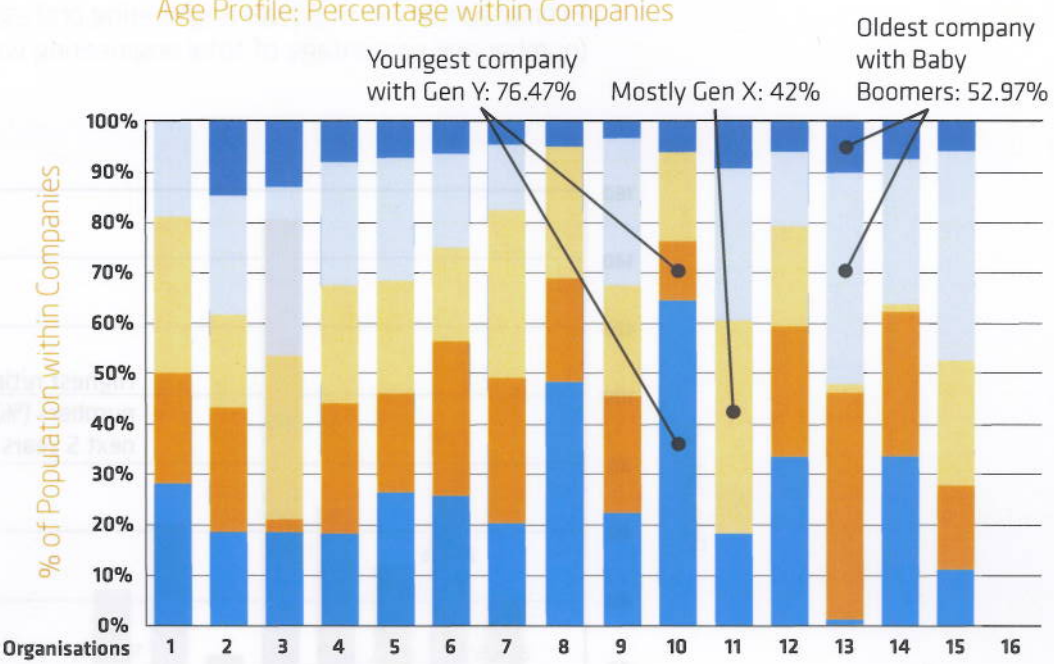
Age Profile



Organisations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
60+	0	14	25	6	13	34	3		7	0	3	18	15	9	2	
50-59	6	23	65	19	44	104	9	9	64	1	10	44	64	36	15	
40-49	10	18	63	18	41	104	23	50	48	3	14	60	3	2	9	
30-39	7	24	5	20	36	170	20	39	51	2		79	68	36	6	
Under 30	9	18	36	14	48	143	14	92	49	11	6	101	2	42	4	

There is considerable variation between companies in age profiles, with workforce demographic risks evident in some cases, including succession risks and professional supervision challenges.

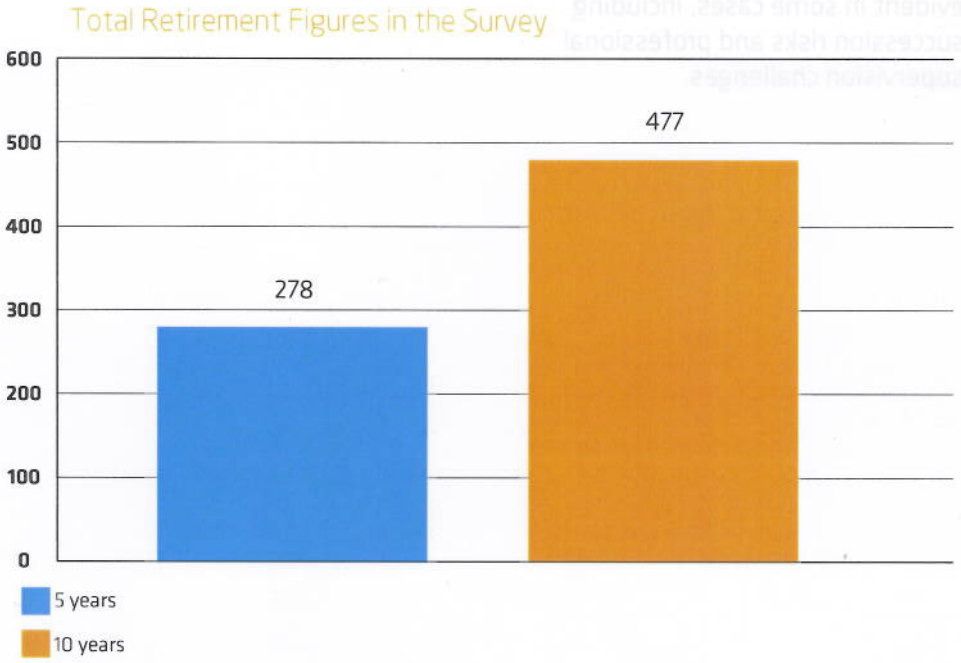
Age Profile: Percentage within Companies

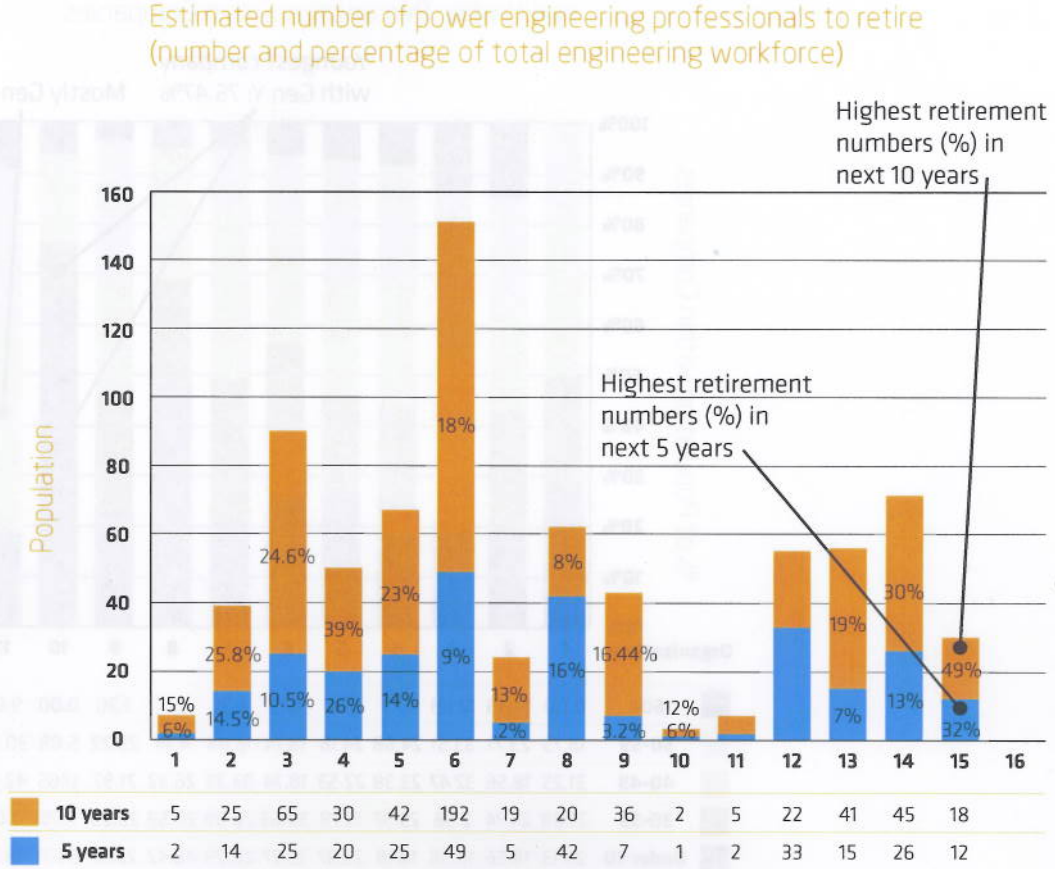


Organisations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
60+	0.00	14.43	12.89	7.79	7.14	6.13	4.35		3.20	0.00	9.09	5.96	9.87	7.20	5.56	
50-59	18.75	23.71	33.51	24.68	24.18	18.74	13.04	4.74	29.22	5.88	30.30	14.57	42.11	28.80	41.67	
40-49	31.25	18.56	32.47	23.38	22.53	18.74	33.33	26.32	21.92	17.65	42.42	19.87	1.97	1.60	25.00	
30-39	21.88	24.74	2.58	25.97	19.78	30.63	28.99	20.53	23.29	11.76	0.00	26.16	44.74	28.80	16.67	
Under 30	28.13	18.56	18.56	18.18	26.37	25.77	20.29	48.42	22.37	64.71	18.18	33.44	1.32	33.60	11.11	

RETIREMENT FORECASTS

- Total retirement forecasts by respondents totalled 10.77% of power engineers over the next 5 years and 18% over the coming 10 years
- Given that almost 30% of the power engineers employed are already over 50 years of age, and the average retirement age approximates 58 years, these estimates seem conservative
- Considerable variation was shown in results, with forecast retirement rates as high as 32% and 49%.

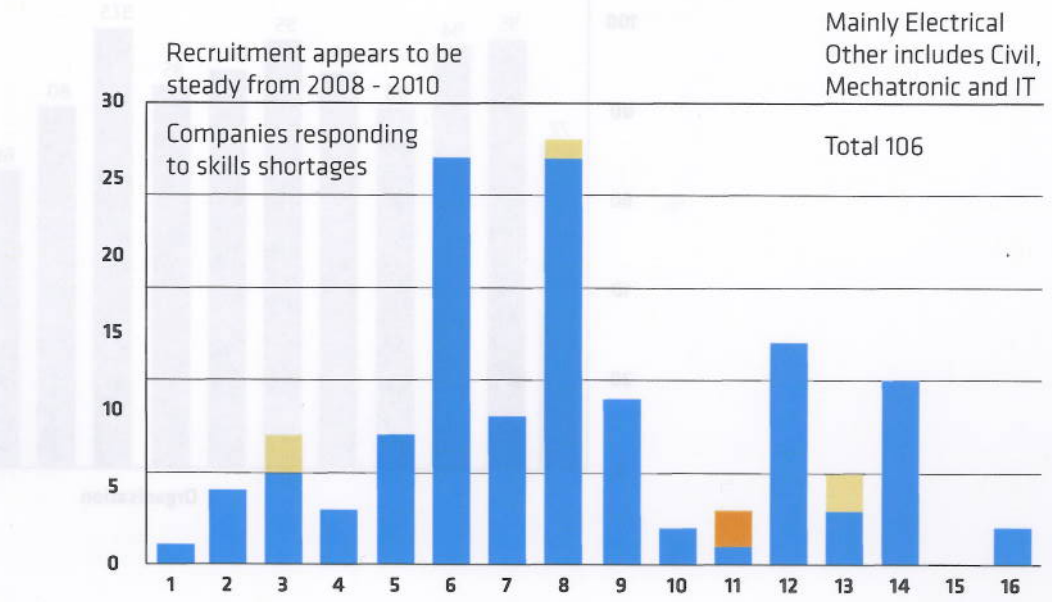




GRADUATE RECRUITMENT

- Graduate recruitment levels reported were relatively stable over the previous 3 years, despite anecdotal evidence of a need for increased power engineers
- Graduates are mainly electrical engineers, with a slight increase in other disciplines such as Mechatronics and IT.

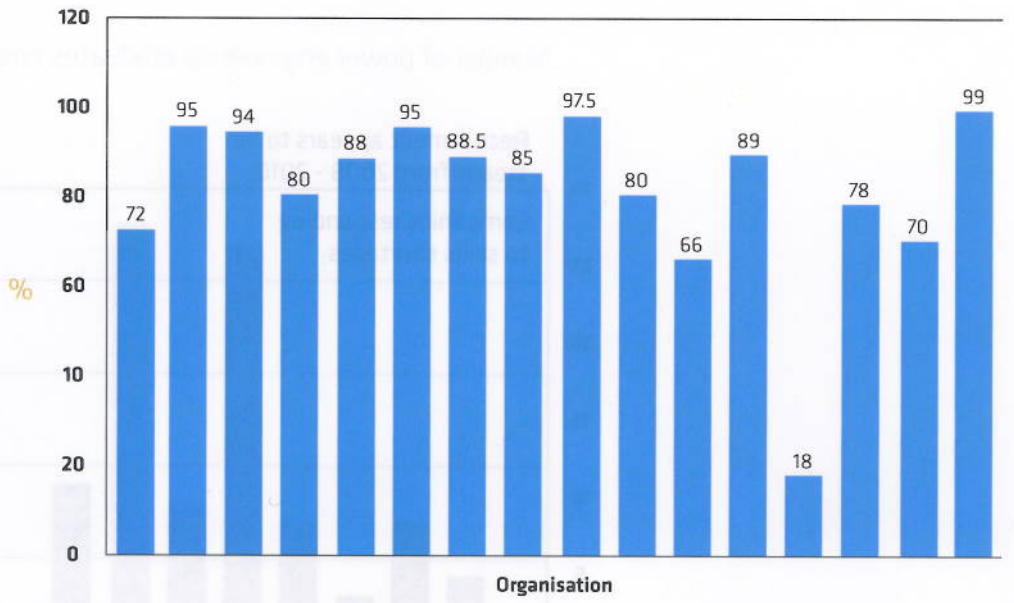
Number of power engineering graduates employed in 2010



GRADUATE RETENTION

- Retention of graduates hired over the last 5 years is above 80% overall, however varies considerably across companies
- A loss of 20% of graduates in the first 5 years of development programs would represent a major cost, and perhaps reflects the opportunities available to young power engineers.

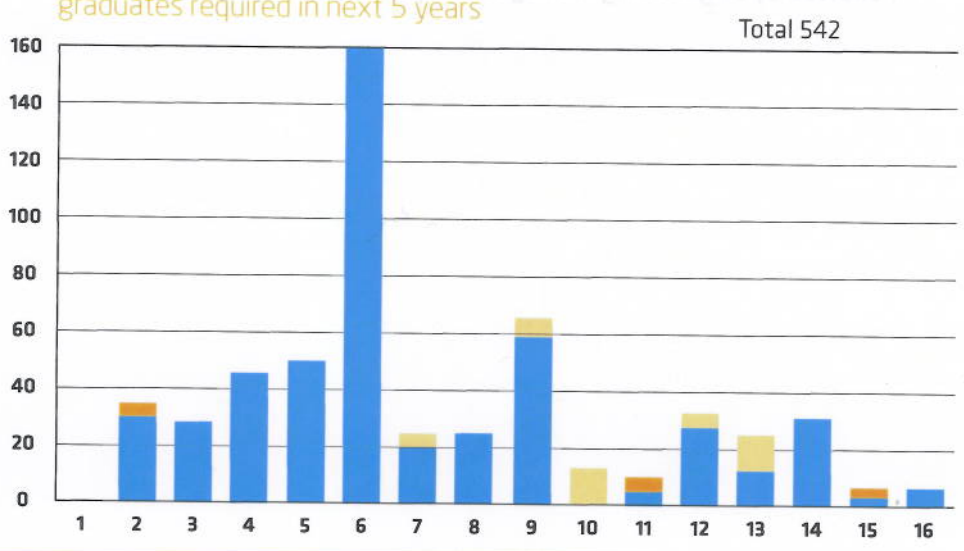
Approximate retention rate of power engineering graduates employed over the last 5 years



GRADUATE ENGINEER REQUIREMENTS

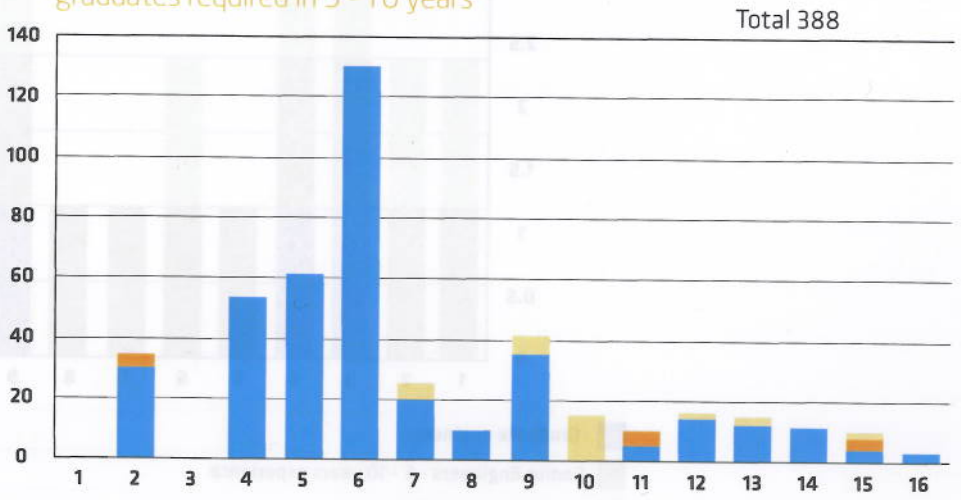
- Continued strong demand for power engineering graduates is anticipated over the next 5 years and beyond
- Sample respondents forecast aggregate demand for 542 graduates over the next 5 years. As this sample represents 40% of total industry employees, it is estimated that total graduate requirements of the industry would approximate 1355 over the next 5 years.

Estimated number of future power engineering graduates required in next 5 years



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Other					0		5		7	14		4	13			0
Mechanical		5			0				0		5				3	0
Electrical		30	28	46	50	160	20	25	59		5	28	12	33	3	6

Estimated number of future power engineering graduates required in 5 - 10 years

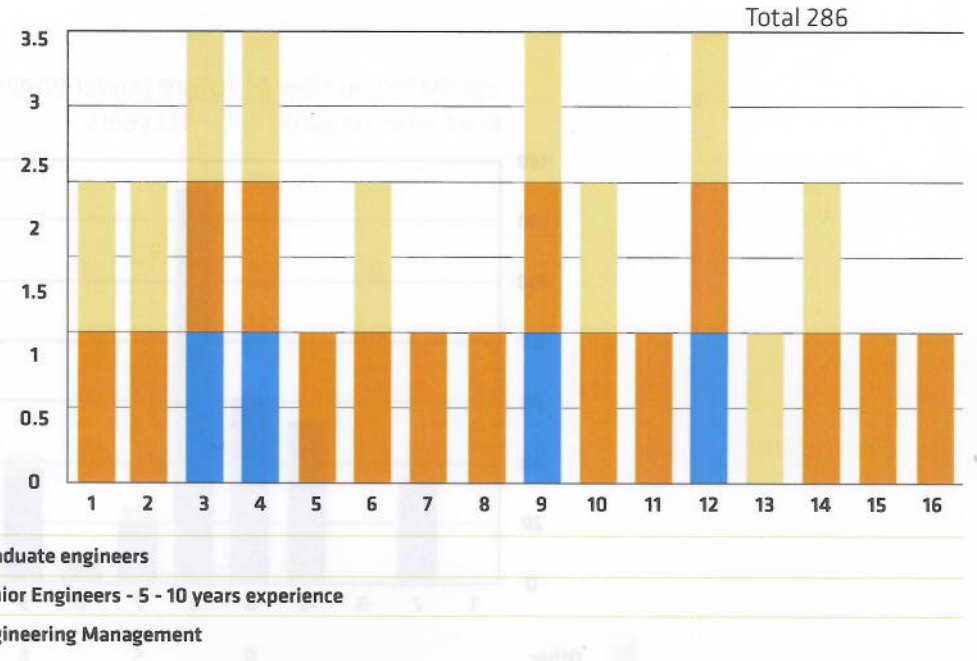


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Other					0		5		6	15		2	3		2	0
Mechanical		4			0				0		5				4	0
Electrical		30		53	61	130	20	10	35		5	14	12	11	4	3

RECRUITMENT ISSUES

- Almost universal difficulties in recruiting Senior Engineers (5-10 years experience) - 94%
- Followed by Engineering Management positions – 62%.

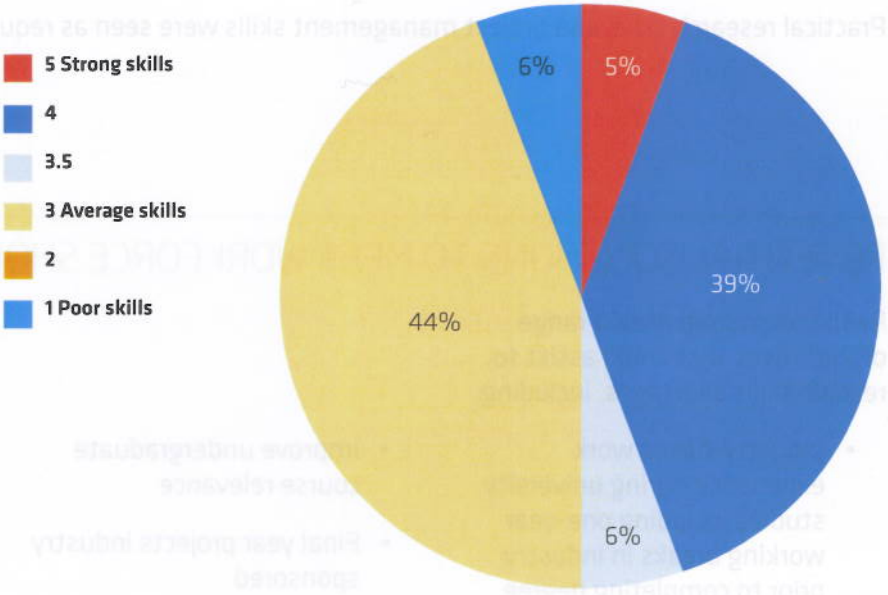
Areas of recruitment problems



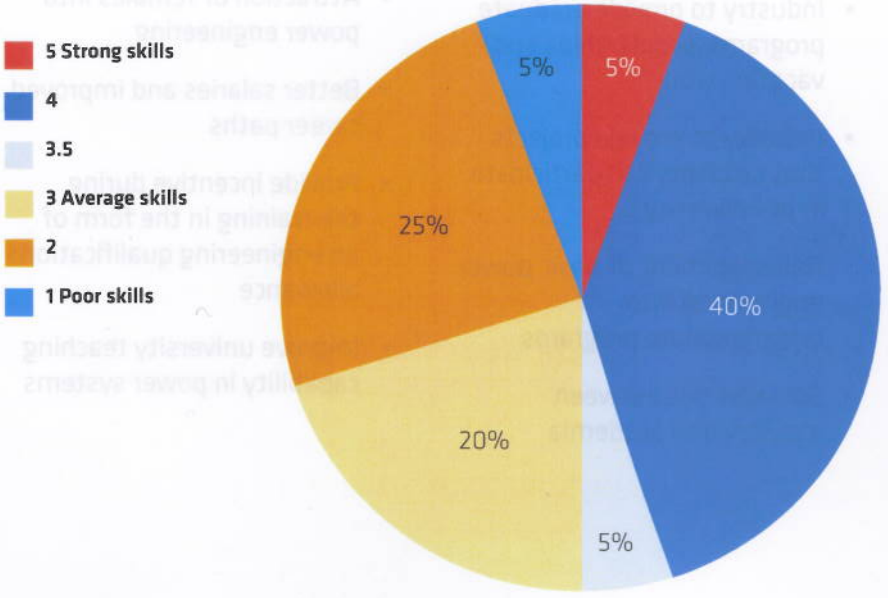
GRADUATE QUALITY

- Graduates are generally presenting well for vacant positions, with fundamental engineering skills to match business needs. Only one of 16 company respondents felt graduate applicant skills were poor
- This represents a much improved assessment from the 2004 findings.

Quality of graduate engineering professional applications for vacancies



Assessment of graduate power engineering professionals



- Assessments of graduate power engineering professionals preparation to meet future industry challenges (e.g. energy security and sustainability, intelligent generation and networks) are not so positive, however
- 30% of respondents rate professionals as poorly prepared, and a further 20% only see "some preparation" of graduates for these challenges.

GRADUATE PREPARATION

Respondents overwhelmingly identified improvement for graduates through increased multi-disciplinary studies e.g. Power systems + computing + telecommunications/control.

Topics reported as requiring attention to meet future business needs include: intelligent network concepts including real time control and automation systems, load flow analysis, telecommunications and digital networking, smart grid network design, integration of distributed generation and storage components into a network, integration and access techniques for smart grid enabled services, "Operational Technology" incorporating IT, Telecommunications and Power Engineering, energy security and sustainability, metrology and smart systems, Asset management (with increased IT,PC focus) and system planning and dynamics.

Practical research skills and project management skills were seen as requiring further emphasis.

POTENTIAL SOLUTIONS TO MEET WORKFORCE SHORTAGES

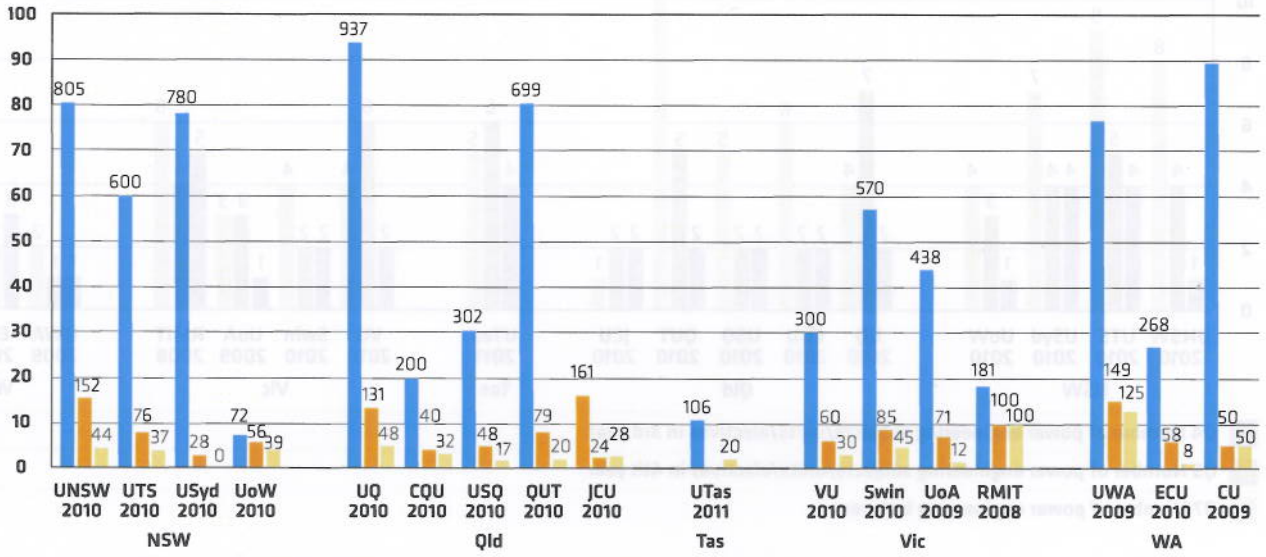
Respondents reported a range of initiatives that could assist to resolve skills shortages, including:

- Industry-based work experience during university studies including one-year working breaks in industry prior to completing degree
- Promoting power engineering opportunities directly to the students at career fairs
- Industry to provide graduate programs, scholarships and vacation work
- Industry to provide projects that students can participate in at university
- Reinstatement of basic power engineering into undergraduate programs
- Stronger ties between industry and academia
- Improve undergraduate course relevance
- Final year projects industry sponsored
- Business and financial analysis into undergraduate programs
- Attraction of females into power engineering
- Better salaries and improved career paths
- Provide incentive during the training in the form of an engineering qualification allowance
- Improve university teaching capability in power systems
- Allow immigration of engineers
- Offer subsidised university studies e.g. 1st year engineering degree is free
- Governments to increase the status of Chartered status and the National Professional Engineers Register
- API to examine vocational training packages / unit of competency as complimentary to the power engineering need (ESI competency based qualifications)
- School-based mentor program.

STUDENT NUMBERS

- UQ has the largest intake of first year engineering students
- In NSW, only 38% undertake more than 4 power engineering units in their 3rd and 4th years
- In Qld, conversion of first year engineering students deciding to take Electrical Engineering is 14%. Only 45% undertake more than 4 power engineering subjects/units/electives in their 3rd and 4th years. In Victoria, RMIT has the highest conversion of first year engineering students deciding to take Electrical Engineering at 55%. Same number is retained in 3rd and 4th years and so 100% undertake more than 4 power engineering subjects/units/electives.

National Comparison Across Universities for Q1, Q2 and Q3

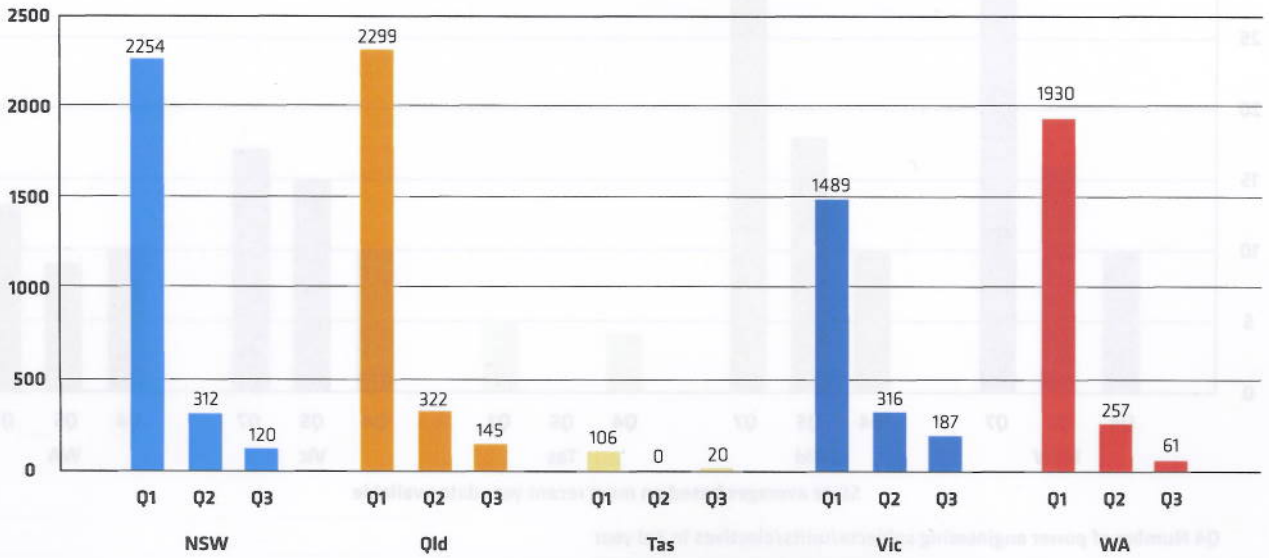


Q1 Number of 1st year Engineering students (all disciplines)

Q2 Number of students choosing to do Electrical engineering in 2nd year

Q3 Number of 3rd and 4th year students taking more than 4 power engineering subject/units/electives over last 2 years of study

National Total Comparison Across States Q1, Q2 and Q3



State averages based on most recent year data available

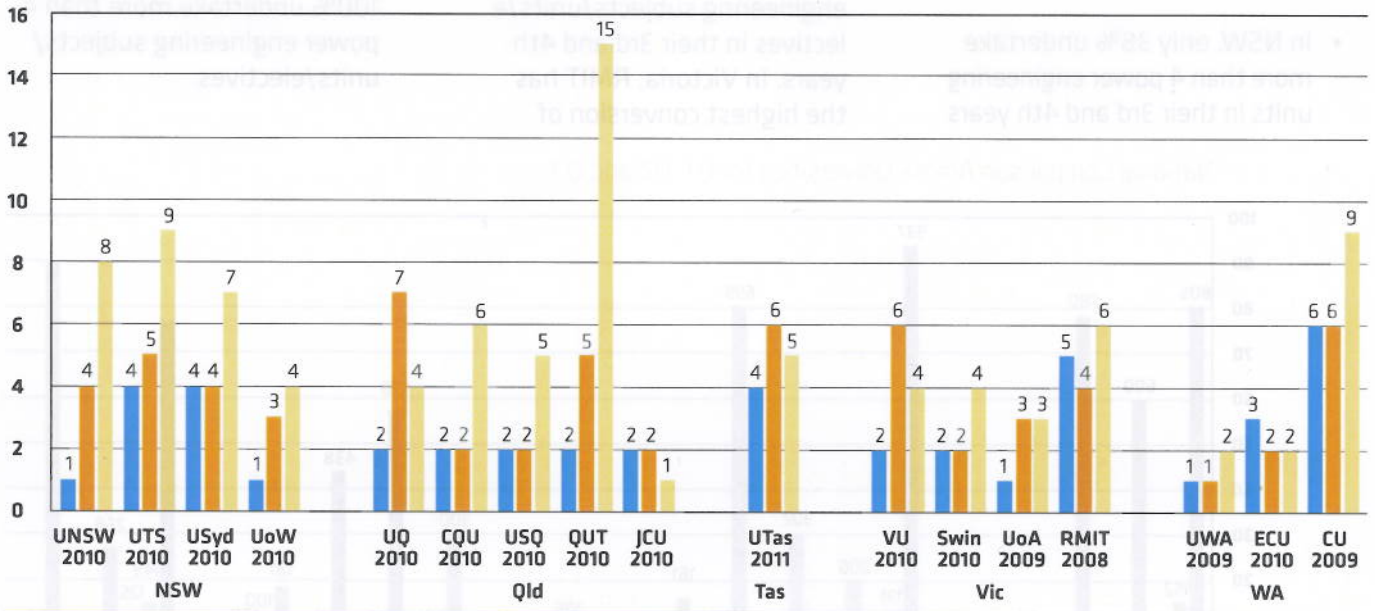
Q1 Number of 1st year Engineering students (all disciplines)

Q2 Number of students choosing to do Electrical engineering in 2nd year

Q3 Number of 3rd and 4th year students taking more than 4 power engineering subject/units/electives over last 2 years of study

- Overall, Victorian universities appear to have the highest conversion rate from first year engineering to electrical engineering, Universities in WA appear to have the greatest numbers of students undertaking more than 4 power engineering subjects.

National Comparison Across Universities for Q1, Q2 and Q3

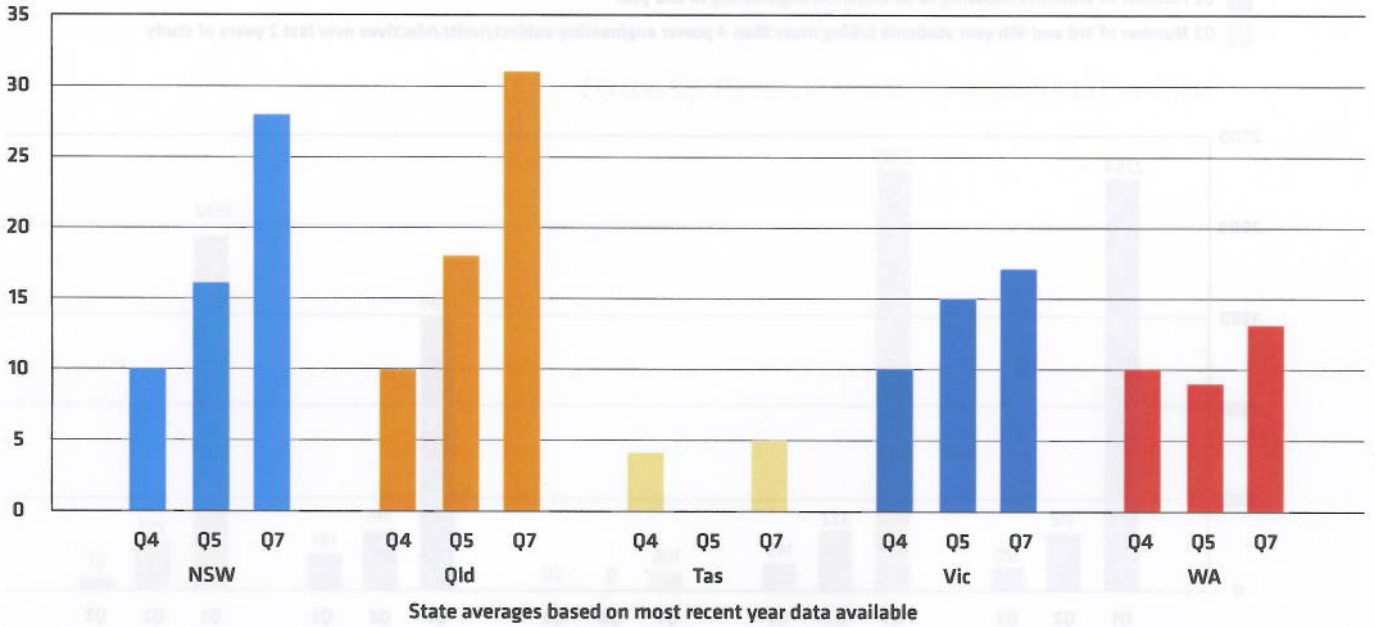


Q4 Number of power engineering subjects/units/electives in 3rd year

Q5 Number of power engineering subjects/units/electives in 4th year

Q7 Number of power engineering lecturers

National Total Comparison Across States Q4, Q5 and Q7



State averages based on most recent year data available

Q4 Number of power engineering subjects/units/electives in 3rd year

Q5 Number of power engineering subjects/units/electives in 4th year

Q7 Number of power engineering lecturers (please also state their name for 2010)

1. Demand for graduate power engineers is expected to remain at historically high levels for the next 5 years. Approximately 1355 graduates are intended to be recruited by the Australian electricity supply industry over this period.

2. Shortages and recruitment difficulties are being experienced for Senior Engineers throughout the industry, and for power engineering management very widely.

3. The historically large proportion (25%) of power engineers under 30 years of age, combined with the reduction in the 40-49 band (from 30% to 20%), will accentuate continuing professional development challenges.

4. With almost 30% of the estimated 6,500 power engineers already over 50 years of age, there will be a major exodus of professional staff through retirements over the next decade.

5. University programs for power engineers need to be modified to improve graduates capability to meet future industry technical challenges e.g. energy security and sustainability, intelligent generation and networks. Increased multi-disciplinary emphasis is also indicated.

6. Universities are graduating approximately 260 power engineering students each year, who have completed 3-4 power subjects in 3rd and 4th years. If sustained over the next 5 years this would total 1300 graduates, approximately equal to forecast needs of the electricity supply industry. There would however, be competition from other industries (e.g. mining) for some of these graduates. In addition, as a large proportion (31%) of engineering students are overseas students this may mean significant leakage of graduates to overseas employment.

WORKFORCE PLANNING: SKILLS & DEMAND IN INDUSTRY SURVEY - MARCH 2011

1. Number of existing professionals with power engineering qualifications (i.e. electrical, mechanical, mechatronic engineering) in your business

   .....

   Number of female professionals with power engineering qualifications

   .....

   Over the last 4-5 years has the proportion of females you recruited to engineering roles (please circle):
   Increased Decreased Remained the Same

   Approximate number of power engineering professionals working for your business in a consulting and/or contracting basis?

   .....

2. Age profile of these power engineering professionals (number in each age band)
   Under 30 30-39 40-49 50-59 60+

3. Estimated number of power engineering professionals to retire (number and percentage of total engineering workforce) in next
   5 years: ...../.....%
   10 years ...../.....%

4. Number of power engineering graduates employed over the last 3 years

Year	Total	Electrical	Mechanical	Other
2008				
2009				
2010				

5. What is the approximate retention rate of power engineering graduates you have employed over the last 5 years?

   .....%

6. Estimated number of future power engineering graduates required in

Period	Total	Electrical	Mechanical	Other (specify)
Next 3 years				
Next 5 years				
5 to 10 years				

7. Approximate number of applications for power engineering professional each graduate vacancy in last 3 years

   .....

8. Are you currently experiencing problems in recruiting (please circle):

Graduate Engineers	Senior Engineers 5-10 yrs experience	Engineering Management

9. What are your recruiting strategies to address these problems?

   .....

   .....

10. Quality of graduate power engineering professional applications for vacancies (i.e. fundamental engineering skills to match business needs)

Strong skills		Average skills		Poor skills
5	4	3	2	1

11. Power engineering skills/competencies graduates are lacking/need to be improved in their university courses

    .....

    .....

12. Assessment of graduate power engineering professionals fundamental skills/competencies to meet future industry technical challenges (e.g. energy security and sustainability, intelligent generation and networks)

Well prepared		Some preparation		Little preparation
5	4	3	2	1

13. What new streams of engineering do you anticipate will be needed for your business in the future?

    .....

    .....

14. What actions, either by the engineering institutions, the Government, yourselves , API or others do you believe would help resolve any skills shortages you perceive

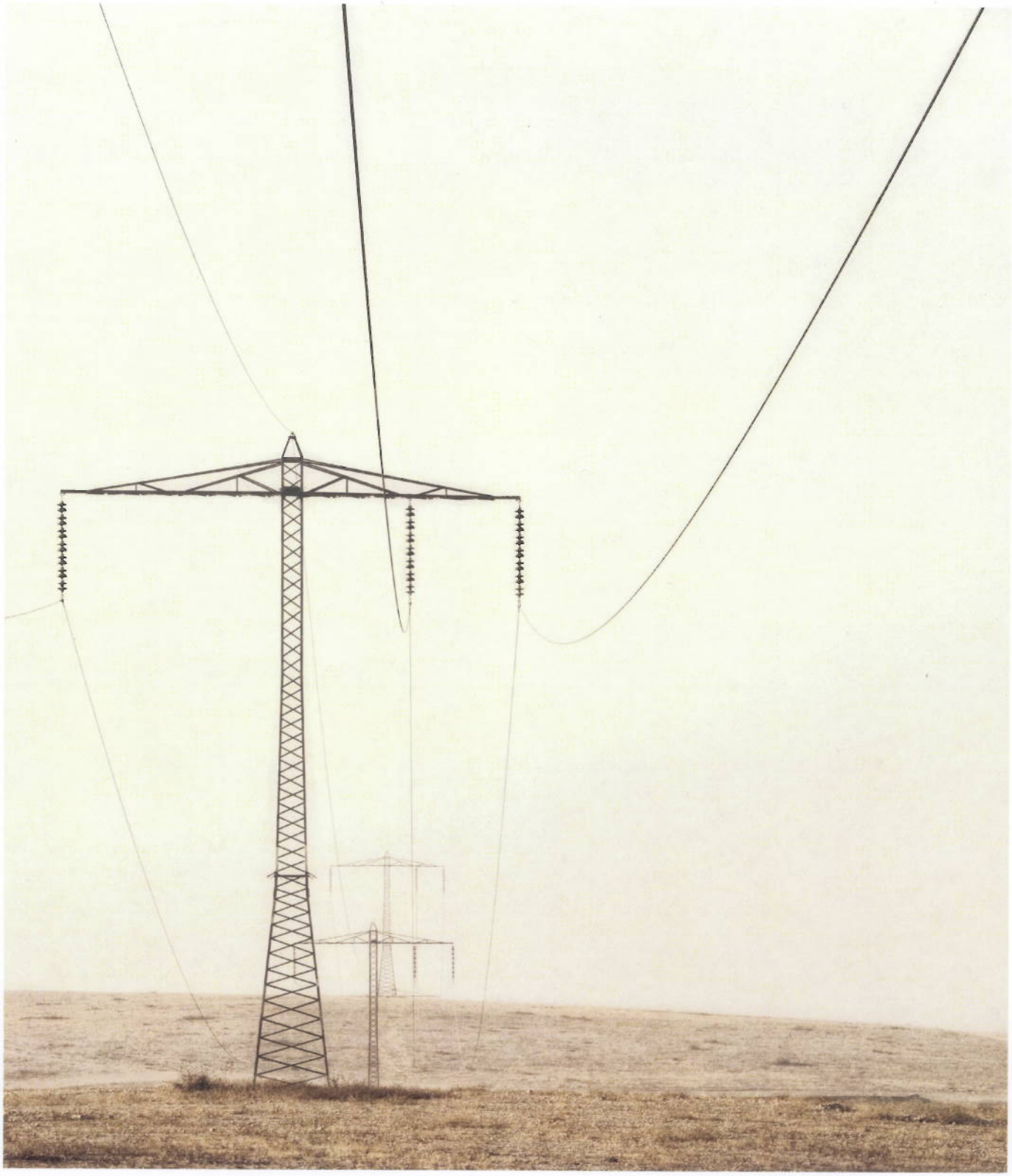
    .....

    .....

15. Additional comments/information you consider relevant to power engineering workforce planning

    .....

    .....



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