



Electric Power Engineers -‘Battling Supply & Demand’

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SYNOPSIS:

Demand for qualified and experienced electric power engineers is soaring, not only in New Zealand, but also internationally. To add to this, the global electricity industry looks to be getting very close to an ever widening and inevitable 'knowledge gap'. According to a recent US study, a large percentage of experienced industry engineers and technicians, from executive through to trades level, are rapidly approaching retirement age over the next 3 years (2008-2011). These experienced engineers (mainly baby boomers) are also set to take over 60% of industry know-how (i.e. knowledge assets) with them into retirement. The study also indicates that the solution to this critical issue resides in academia, where more new specialist power engineers must be produced to meet future industry challenges. Meanwhile, academia in recent times has seen the rapid decline of electric power graduate numbers (globally), influenced by a number of factors such as competition between degrees and marketing in the academic environment. It estimates that in the US alone, universities currently produce an average of only 10 power engineering graduates per year, per state. However, the situation in New Zealand does not appear as grim, mainly as a result of an industry-academia joint initiative launched 6 years ago. It was in 2002 that a number of players in the NZ power industry, together with the University of Canterbury, had the foresight and commitment to take action against this trend. They did this by establishing New Zealand's Centre of Excellence for electric power engineering, the EPECentre (Electric Power Engineering Centre, [ww.epecentre.ac.nz](http://www.epecentre.ac.nz)) at the University of Canterbury, considered by many as the traditional hub for electric power engineering education in the country.

Since its launch, a tremendous leap forward has been achieved in the growth of power engineering graduate numbers entering New Zealand industry via the University of Canterbury, taking what was 15% of electrical engineering graduates specialising in power in 2000 (pre-EPECentre) to 47% in 2008. Between 2006 and 2008, the average number of power graduates entering industry per year is 35. Furthermore, industry demand for graduates is at an all time high, with as many as 3 job offers in some instances for a graduate specialised in electric power.

INTRODUCTION

Retirements and overseas temptation for staff are just some of the growing woes affecting the power engineering industry in NZ. These issues are acutely driving up demand and competition for qualified electric power engineers. Consequently, a number of factors must be considered (e.g. ageing workforce, talent retention drivers, level of industry-academia collaboration, etc.) to analyse the situation and take action to preserve a positive balance between the supply and demand for power engineers, especially initiatives to increase and maintain power graduate numbers.

THE AGEING WORKFORCE & SKILLS SHORTAGE

“Our workforce is aging”. The lowest rate of unemployment is in the 50-59 age group in NZ (approx. 1% in 2006). By 2050, 1 in 4 workers is forecasted to be aged 65 or older, compared with 1 in 8 today, as well as a reduction in the overall labour force. In Australia, research shows that workers are looking to retire by 50, diminishing government and industry hopes of people working into their 70s.³

Work ethics (e.g. loyalty) of the workforce are also said to be changing, although a study at Auckland University has found that contrary to popular belief, Baby Boomers, Generation X and Generation Y are actually not all that different.¹

A recent NZIM (New Zealand Institute of Management) study found that 85% of NZ employers are finding it difficult to recruit staff. Thus, part-time work, phased retirement and job sharing for older workers are growing measures to curb recruitment shortfalls.² Also, a growing trend appears to be health and wellness incentives for the ageing workforce, such as health insurance and gym membership.³

According to many recruitment experts⁴, the greatest ‘talent shortage’ for professional staff is in the “work-horse” (mid-career) stage or the 26-35 age group, within the \$50K-\$100K salary bracket. The other gap is in the 35-45 age group, the so called “experienced campaigners”.⁴ A contributing factor is that loyalty for younger employees is no longer a given, it is now something an employer has to put serious effort into earning. This also means that many younger employees are tempted to go overseas. A recent NZ survey revealed that more than 25% would change jobs without much consideration, 29% would move for the money and over 33% would move for career development.⁵ Meanwhile, another survey indicates that only 11% of organisations have formal programmes to integrate newcomers into the workforce, especially immigrants.⁶

TALENT RETENTION & ATTRACTION

Skilled people want to do challenging work – they want to be in organisations doing new and exciting projects. If those opportunities are increasing overseas, that is where the majority of those skilled people will head. It is not just about paying people more, it is about giving them great things to do.⁷

Top reasons why people quit: some of the major factors that influence people to quit include the unexpected nature of the work, mismatch between job and individual, too little coaching or feedback, few opportunities for growth and advancement, feeling devalued and unrecognised and stress from overwork or work-life imbalance. This is in addition to mistrust and confidence in senior leaders;⁸

Replacing people: The single most important issue when an individual resigns is the loss of experience (i.e. job knowledge) that goes with them, which has far more of an impact on an organisation than the actual cost of simply recruiting and training a new employee, thus creating a 'knowledge gap' within the organisation. However, there are also the people who have 'left' but haven't left, i.e. people who are still employed, but their hearts and minds are elsewhere.⁸ This type of individuals are somewhat destructive to an organisation, because of their lack of willingness to contribute.

Retention and/or attraction drivers: There are a number of drivers for retaining and/or attracting staff, such as giving people the opportunity for development or to make a difference while succeeding, giving regular feedback and recognition (i.e. supportive management), developing trust with the leadership, as well as ensuring that staff has meaningful work that is challenging in nature, but achievable, e.g. innovative new projects.

Other factors that influence staff retention or attraction is appropriate remuneration (at market-rates), good work-life balance (e.g. ability to work remotely), and a flat organisational structure that promotes collaboration. Some examples of incentives include offering extended leave options (e.g. 6-8 weeks instead of 4), prospect to own part of the business or receive a profit share, or perhaps a corporate car (given the rising cost of fuel).^{9,10} Organisations should also recognise that new staff may require assistance with relocation.

Moreover, research shows that individuals who receive regular recognition, praise and development support, increase their individual productivity and are therefore more likely to stay with their organisation.¹¹ Nevertheless, due to the intangible nature of ROI (Return on Investment) on human resource initiatives (e.g. professional development or training), NZ businesses fall easy prey to cost cutting according to a study by Deloitte Human Capital - the value of such initiatives to reduce staff turnover should not be overlooked or underestimated.¹² It is up to managers to adopt and champion staff development practice (this applies to all industries, including power).

People hold the power – “if companies take care of their people, the people will take care of the business”¹³ - salary is the price of admission, not the differentiator.

There are also signs that organisations in general are addicted to the flexibility of the staff leasing option.¹⁴ However, unlike other industries (e.g. IT or finance) this option is not as feasible for the electricity industry, where specialist professional engineering services are required. Instead, power industry asset owners subcontract much of this work through to consultancies and contractors, mainly to reduce risk and liability.

POWER ENGINEER SUPPLY & DEMAND TRENDS

A US study says that the power industry faces a severe manpower shortage as the majority of its workforce plans for retirement. They believe that a substantial number of mission-critical employees in the industry from executives to linesmen are rapidly approaching retirement age within the next 3 years (2008-2011), including over 40% of senior electric power engineers. This is a group that represents over 60% of the industry knowledge base (i.e. knowledge assets or know-how). To add to this, 44% of power companies in the US do not have succession plans in place for senior

management roles. It also states that the solutions resides in academia at the undergraduate level, where power graduate numbers have plummeted from over 2000 graduates per state per year in the 1980s to a dismal 10 per year per state in 2006. However, in developing countries such as China and India, power graduates are plentiful.¹⁵

Industry experts in the US believe that the electricity industry in the US could collapse if the industry doesn't put a plan in place for staffing, retention, recruitment and training – “We need to seriously question if we will be able to keep the lights on in the next 10 years” Mike Brown, Senior Consultant and Utilities Sector Leader for Hay Group, USA, 2006.¹⁵

Similar concerns for power engineers resonate in Australia, UK (38% are reaching retirement¹⁶) and NZ. Moreover, supply shortages of power engineers in the US, UK and Australia is more than likely to attract overseas head-hunters into NZ. This will escalate the impending problem here, especially to meet NZ's future electricity industry challenges such as going 90% renewable and carbon-neutral.

Meanwhile, in Australia, the boom in Queensland and Western Australia has driven up demand for skilled staff in engineering, both technical and management. This is in addition to strong demand coming from the Persian Gulf, particularly Dubai in the United Arab Emirates.¹⁷ This international demand further highlights the threat to NZ, as a target for overseas recruiters.

Electric power graduates: A report on electrical power engineering manpower requirements in Australia by Engineers' Australia estimates that they will require at least 276 electric power graduates per year to meet future challenges.¹⁸ This equates to 35 engineers a year for each of the 8 Australian states and territories. Anecdotally, the target requirement (demand) for NZ could be viewed as being the equivalent of 1 Australian state i.e. 35 power graduates per year.

The supply in NZ through the University of Canterbury (the traditional hub for power engineering education in NZ) was as low as 15 in 2002, threatening the viability of the power curriculum at the University all together. However, since the launch of the industry-funded Electric Power Engineering Centre (EPECentre) in mid-2002, numbers have dramatically increased and power is now considered the strongest discipline in the Department of Electrical & Computer Engineering at the University of Canterbury, with almost 1 in every 2 students specialising in power.

Furthermore, the average number of specialist power graduates has been maintained at 35 per year between 2006 and 2008 - an increase of over 133% on the 2002 number (as depicted in figure 1). In terms of market share for electrical engineering graduates in the Department of Electrical & Computer Engineering (ECE) (between all major electrical engineering disciplines), power has gone from 17% in 2002 to 47% in 2008, an increase of over 176%, as shown in figure 2.

Inevitably the increase in market share does mean that other disciplines in electrical engineering (e.g. communications or nanotechnology) have lower numbers. However, given current engineering industry trends, power is certainly the area in electrical engineering with the majority of jobs according to IPENZ. However, in recognition of

this, the EPECentre is implementing initiatives to increase the overall talent pool into engineering, thereby creating a larger nest-egg for all disciplines to share.

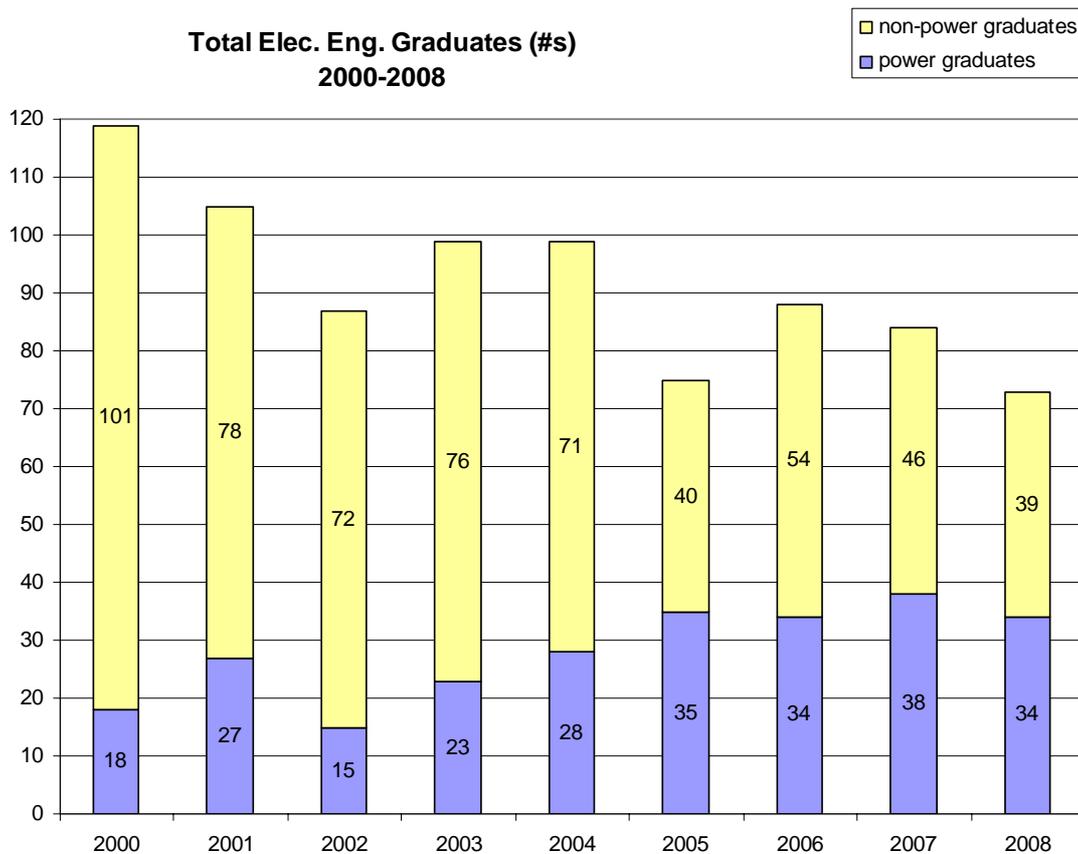


Fig 1. The specialisation of electrical & electronic engineering graduates in terms of student enrolment numbers (#s) at the University of Canterbury.

In the UK and Australia, organisations such as the IET (formerly IEE, with its Power Academy) and the Australian Power Institute are also initiating joint industry-academia collaborative programmes to battle the looming supply and demand crisis for professional power engineers. While in NZ, it is mainly the EPECentre (NZ’s Centre of Excellence for electric power engineering) in partnership with its industry partners in the Power Engineering Excellence Trust (PEET). The PEET is an entity solely dedicated to sponsoring the activities and initiatives of the EPECentre, since 2002.

Note: other organisations active in promotion of engineering but with less focus on professional electric power engineers (i.e. bachelor of engineering qualified) is ESITO (Electricity Supply Industry Training Organisation), ETITO (Electro-Technology Industry Training Organisation), both of which are primarily aimed at encouraging trades and technician level cadets, while FutureinTech by IPENZ promotes general technology careers, including science. In terms of professional power engineering education in NZ, besides the University of Canterbury, Auckland University has a small power programme.

According to an undergraduate survey conducted in 2007 by the EPECentre at the University of Canterbury, 96% of all final year (3rd Pro) power students said “yes” to awareness of power increased because of the EPECentre, and 100% said they have been involved with EPECentre programmes/initiatives and wanted to be employed in

the NZ power industry. Note: EPECentre involvement with students increases from 1st pro onwards and peaks at 3rd pro level, with almost all power students on a first name with EPECentre staff during their 3rd pro year.

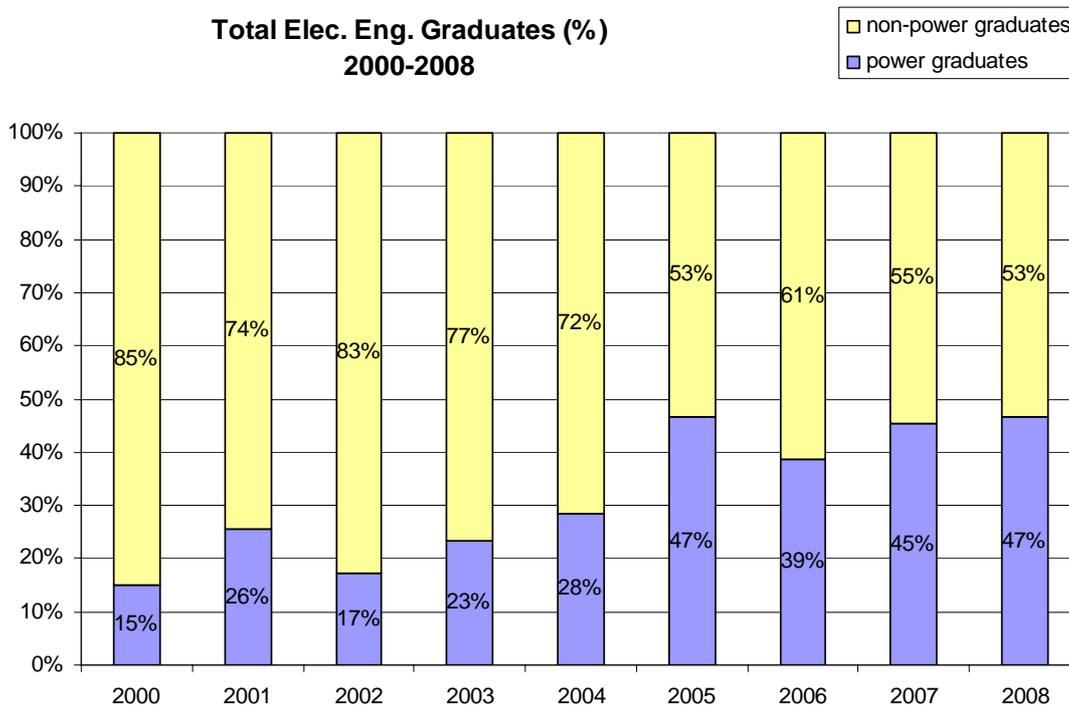


Fig 2. The specialisation of electrical & electronic engineering graduates in terms of a percentage (%) of enrolled students at the University of Canterbury.

EPECentre programmes and initiatives: undergraduate and postgraduate scholarships, EPECentre Convention (to promote industry opportunities), North & South Island power industry field trips; annual R&D Expo (to promote innovation in power), student mentoring, professional development events (seminars, workshops and conferences), undergraduate surveys, industry work placement for students and graduates (facilitates 100s of applications each year), visiting lecturer programme (for course modules and one-off lectures), industry-academia R&D programme (launched in 2005 to support industry R&D), teaching and laboratory support, sponsoring of educational events (e.g. final year project presentations, IET short paper competition, etc.), Energise Your Future Challenge (annual competition to promote engineering in secondary schools with scholarships to study engineering for winners), Energise Your Future Network (a scheme to highlight and promote power careers for secondary schools), bi-annual EPECentre e-Bulletin (distributed to over 500+ industry recipients), etc.

In general, EPECentre programmes and initiatives are built around four founding pillars: (1) education, (2) industry-interaction, (3) innovation and (4) research. To ensure flexibility in the approach and maximise opportunities, the EPECentre undertakes quarterly business planning and adjusts strategy to suit market conditions. It does this through regular industry-academia interaction i.e. acts an interface between power industry and academia.

Threats: one of the biggest threats to losing graduates overseas is temptation to go on OE (overseas experiences), which sometimes turns into permanent migration –

mostly to UK and Australia. Student loan debt is also a major contributing factor with the promise of big salary packages overseas, this debt is currently \$30,000 on average.¹⁹ However, on a positive note, the EPECentre has observed that the majority of power graduates that have come through the University of Canterbury in recent times (from 2003 onward) have remained in NZ. The premium scholarships offered by the EPECentre at undergraduate (10 scholarships, worth \$5,000 each) and postgraduate level (\$12,500 for Masters and \$25,000 p.a. for PhDs) to support top power students also has an impact i.e. reducing student loan debt and encouraging top future talent to stay in NZ. Coincidentally, plans by the UK to ‘abolish’ the ancestry visa for commonwealth citizens (including NZ citizens)¹⁹ may also help the cause i.e. help retain power engineering graduates in NZ.

Salary & career paths: according to IPENZ, the average salary for an engineering graduate in NZ is currently \$48,000 p.a. From the experience of the EPECentre, power industry is currently offering between \$45,000 and \$48,000 p.a. to attract graduates. Not surprisingly, salaries are more than competitive, with senior power engineers earning 30 to 40 percent more than computer science engineers.¹⁵ The base salary for senior engineers in NZ is \$100,000 according to IPENZ.

Nevertheless, many students today are directed at school level toward careers in aerospace, mechatronics and biotechnology – areas with little or no future in NZ i.e. no industry for employment. This indicates that there is a clear lack of strategic planning between government, academia and industry in NZ, because many young people are choosing careers with little value to NZ.²⁰ Academia especially, has a social responsibility to constantly monitor local market needs and cater the courses accordingly or talents will be lost overseas (e.g. mechatronics engineering degrees ~ popular in academia but no real job prospects in NZ or even Australia). This is shown in figure 1, which depicts a snapshot of engineering job vacancies in Australasia at the end of 2007 for various engineering disciplines (based on market research conducted by the EPECentre). In terms of NZ Ministry of Education policy, such as the NZ Tertiary Education Strategy 2007-12, engineering is ‘clumped’ in with all other technology careers, without segmentation between the various disciplines (e.g. Electrical or Civil) and hence no specific planning for the sectors. From this perspective, specifics have been left for tertiary institutes and industries to determine.

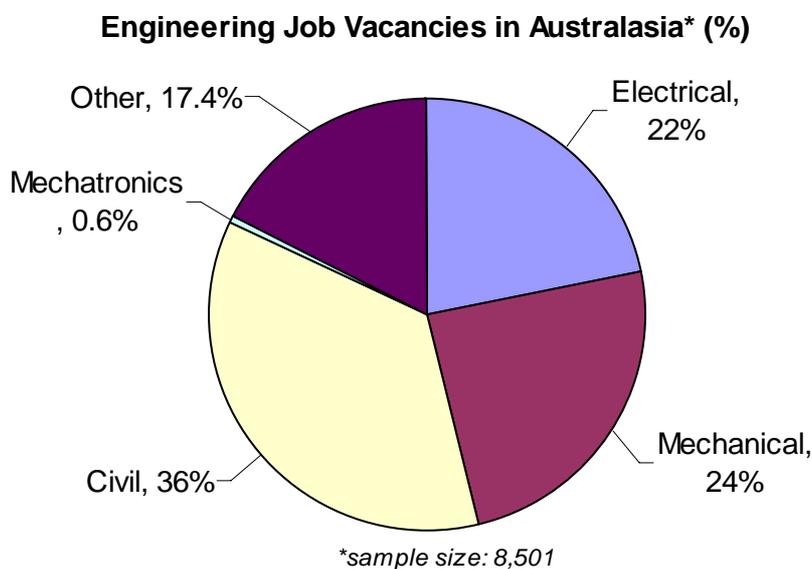


Fig. 1 a snapshot of engineering job vacancies in Australasia

Furthermore, the recent introduction of ‘specialised’ degrees such as mechatronics engineering and computer engineering at the University of Canterbury has had a major ‘negative’ impact on student numbers into the electrical & electronic engineering programme. Figure 2 reveals the ‘cannibalising affect’ the specialised degrees (co-hosted through the department) have had on student numbers in the electrical & electronic engineering programme. However, intense marketing and promotional initiatives undertaken by the EPECentre (e.g. student events) in partnership with the ECE department in 2007 has helped reverse the trend for 2008, from 72 to 89 (a 23% increase). Note: the department currently has the capacity to take on at least 120 students per year if enrolment numbers were to increase.

Women in engineering ‘the final frontier’: in the US, women account for only 17% of the engineering workforce (dropping from what was 20% a few years before).¹⁵ Over in NZ, only around 10% of engineering graduates at the University of Canterbury are female. This represents a significant untapped resource for engineering talent – NZ as a nation must implement initiatives to tap into this and action must be taken by government, academia and industry groups such as IPENZ to make this happen. It is also interesting to note that 2006 NZQA (New Zealand Qualifications Authority) figures show that girls are ahead of boys in ‘science’, while boys are ahead in ‘technology’ and both do just as well in ‘mathematics’.²¹ This implies that there is virtually no difference between the abilities of male and female students to pursue careers in engineering – *“more must be done to encourage females (as well as more males) into engineering”*.

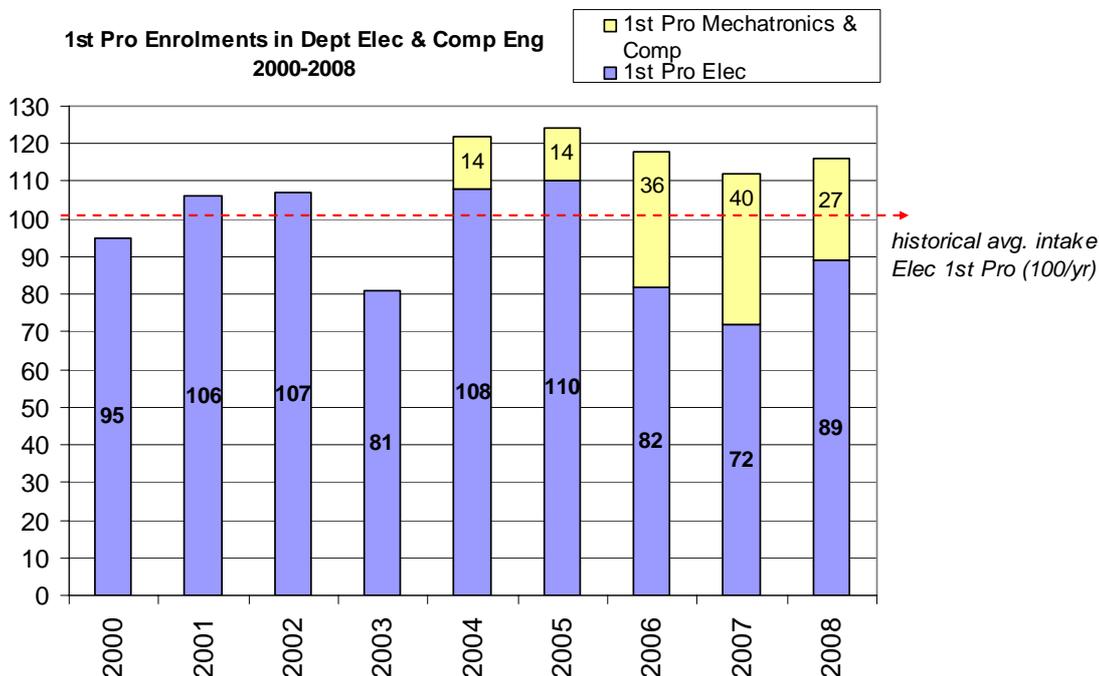


Fig. 2 1st Pro enrolments in the UC Department of Electrical Engineering

Influencing career paths: from the experience of the EPECentre, students are influenced on career choice by their family during the early years (primary school) and then their teachers and peers in high-school (secondary school), in addition to television and media. Therefore, interaction with schools is a key route to increasing the overall talent pool to meet demand shortages in all engineering industries.

Continuation in science and mathematics in school is also a major factor (i.e. prerequisites for engineering). The EPECentre currently runs the 'Energise Your Future Challenge' in high schools nationwide (prizes include 9 scholarships to study engineering and a cash donation to the winning school) and the 'Kids-fest Spark & Arcs' event for primary school level children in Christchurch. The EPECentre also produced and distributed a DVD on power engineers to over 440 schools nationwide and recently ran a NZ wide cinema advertising campaign with Orion to promote power careers (targeting the 15-18year old demographic). This is in addition to numerous tours and presentations on engineering by EPECentre in partnership with the Department of Electrical & Computer Engineering for visiting school teachers and students to the University of Canterbury. Looking ahead to 2009, the EPECentre will aim to host the NZ segment of the 'International Young Physicists' Tournament', in partnership with NZ physics teachers.

CONCLUSION

The looming worldwide shortage for qualified electric power engineers, driven by the changing dynamics of the workforce (e.g. ageing workers closing in on retirement, talent retention and recruitment drivers, etc.) will have a major impact on NZ. These dynamics will be sensitive to international conditions, particularly overseas shortages (mainly in the UK, USA, Australia and the Middle-East) for power engineers. Thus, NZ will be increasingly seen as an obvious resource pool ('fishing pond') for quality power engineering talent, ahead of developing countries such as India and China. Consequently, the EPECentre is working in close collaboration with its industry partners to maintain the balance between supply and demand for power engineers in NZ, currently an average of 35 graduates per year via the University of Canterbury (a 176% increase on numbers pre-EPECentre, in 2002). However, demand is likely to ramp up given future challenges facing NZ, such as the push to go 90% renewable by 2025. Hence, the EPECentre is taking strategic action through targeted programmes (from school level onwards) to help meet future demand.

According to Geoff Hunt, former Managing Director of Transfield Services in a paper presented at the 2004 EEA Conference on the topic of power engineering staff shortages, "*companies relying on other companies to develop future resources should be viewed as 'poor' industry corporate citizens, with an unsustainable approach for the future*". Therefore, it is imperative that all power industry members in NZ support organisations such as the EPECentre for the welfare of NZ's future, to balance supply and demand for future power engineers. The industry cannot afford to rely on (broad and unspecific) NZ education strategy and tertiary education policy to fulfil this need.

Current sponsorship levels for the EPECentre via the Power Engineering Excellence Trust (PEET, www.epecentre.ac.nz/peet) for individual companies range from \$5,000 - \$20,000 p.a. These funds are managed by a pan-industry governance board, which includes a trustee for each industry sector (generation, transmission, distribution, consulting, contracting, etc.). Ultimately, NZ's ability to balance supply and demand would not have been possible without this industry sponsorship. The foresight and leadership shown by the power industry and the University of Canterbury to launch such an initiative in 2002 is to be commended - "*the creation of the EPECentre has indeed been timely for NZ and its ROI to industry is proving invaluable*".

"New Zealand's Centre of Excellence for Electric Power Engineering"

www.epecentre.ac.nz

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