IPENZ
ENGINEERS NEW ZEALAND

Women in Engineering: Snapshot 2013

Acknowledgement

IPENZ acknowledges the 30 employers that provided data to IPENZ, without whom this report would not have been possible.

Contents

> Since 2011 IPENZ has been actively working to support women to enter, remain and advance in the engineering profession.

Executive Summary

Engineers are in high demand, particularly since the Canterbury earthquakes in 2010 and 2011. Attracting women into the engineering profession and then retaining them is one method of meeting this need. Increased gender diversity can lead to better outcomes including increased innovation, more cohesive teams and better financial management and governance.

In New Zealand approximately 13 per cent of professional engineers and 16 per cent of engineering technicians are female. Since 2011 IPENZ has been actively working to increase these figures and encourage and support women to enter, remain and advance in the engineering profession.

To better understand the current status of women in engineering in New Zealand, IPENZ has pulled together data from Education Counts, the IPENZ Membership database and 30 employers of engineers who voluntarily shared data with IPENZ. These employers employ 18,216 staff, 29 per cent of whom are female; 4,324 of these staff are engineers, 14 per cent of whom are female.

This report shows the recruitment of women into engineering is low, with just 23 per cent of enrolled students being female. Female students show preference for particular engineering specialisms and it is recommended that further work be undertaken to better understand these preferences.

Of the 30 participating employers, 22 ensure their interview panels have both a male and female interviewer. IPENZ recommends all employers of engineers use gender (and ethnically) balanced interview panels to reduce the impact of unconscious bias in the recruitment of employees.

IPENZ also recommends employers help their employees find mentors, particularly for those who are in the first few years of their careers. Twenty-three per cent of male employees and 32 per cent of female employees of the 30 employers currently have mentors.

Employers of engineers appear supportive of their employees, with over 80 per cent of the 30 employers offering flexible hours, the ability to work remotely and the ability to work part-time. However, there has been little uptake of these options despite the legislative backing for flexible working through the Employment Relations (Flexible Working Arrangements) Amendment Act 2007. IPENZ recommends further work be undertaken to better understand the limitations and perceived limitations on employees that take up flexibility. IPENZ also recommends investigating an alternative business model so taking career breaks or working flexibly is not seen as career-limiting. Work is also needed to better support female engineers so they retain their confidence and competence, and are ready and able to return to the workplace following a career break, if they wish to do so.

Female representation at senior levels remains an area for further improvement. It is recommended that work be undertaken to support women so they can balance their work and domestic responsibilities. It is also recommended that organisations put senior women forward for senior roles including IPENZ Fellowship and Board positions.

This report shows the recruitment of women into engineering is low, with just 23 per cent of enrolled students being female.

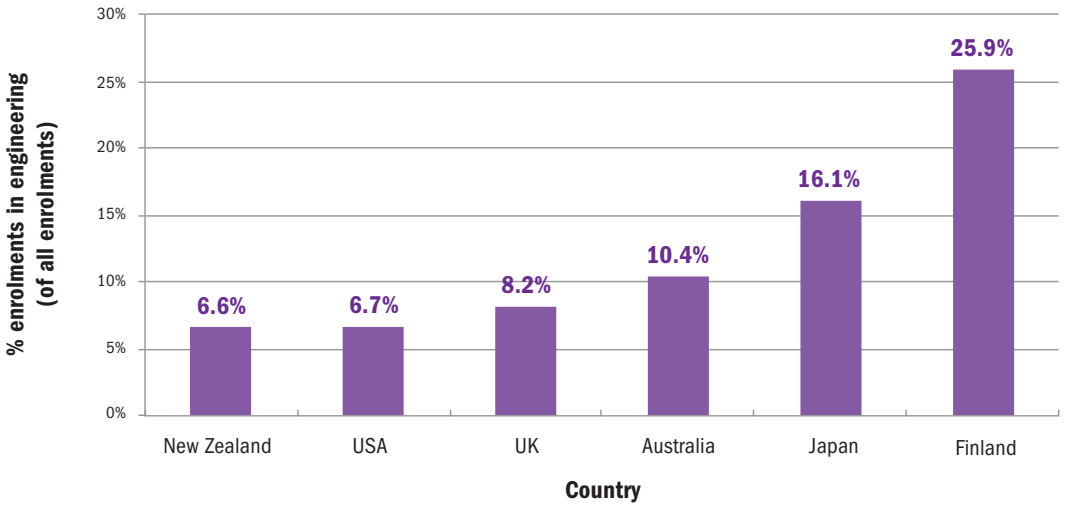
Introduction

Increased gender diversity can lead to better outcomes. These include increased innovation, more cohesive teams and better financial management and governance. According to the Department of Labour and IPENZ (2008) approximately 13 per cent of professional engineers and 16 per cent of engineering technicians are female. Since 2011 IPENZ has been actively working to increase these figures and encourage and support women to enter, remain and advance in the engineering profession.

The IPENZ vision for women in engineering is that: "as a result of its diversity, engineering is seen as making a highly relevant contribution to New Zealand's economic growth and well-being. The engineering profession is recognised as an employer of the best and brightest. Engineering workplaces are diverse and have exemplary employment practices. The number of engineers is sustainable in the long term."

The proportion of enrolments in tertiary engineering qualifications is low compared to other countries as shown below (United Nations Educational Scientific and Cultural Organisation, 2010).

FIGURE 1 – PROPORTION OF TERTIARY ENROLMENTS THAT ARE IN ENGINEERING (2008 DATA)



In 2012 the New Zealand Government announced (Joyce, 2012) it was providing funding for 1,000 more engineering places at universities and institutes of technology in 2013. At the time, the Minister for Tertiary Education, Skills and Employment said "The reality is if we want faster economic growth for New Zealand then we need to invest in skills that will help grow the economy. Having more engineers will assist in building a more productive and competitive economy."

New Zealand has a shortage of engineers. IPENZ, as the manager of the National Engineering Education Plan project, has estimated the need for engineers with a business as usual economy and an innovation-led economy. These figures are shown below, along with university completion data.

TABLE 1 – SUPPLY OF AND DEMAND FOR ENGINEERS (IPENZ, 2010)

	2008 COMPLETIONS	ANNUAL NEEDS	
		Business as usual	Innovation-led economy
Level 6 Engineering Technicians	270	500	750
Level 7 Engineering Technologists	180	400	600
Level 8 Professional Engineers	1050	1100	1400

Engineers are frequently included on Immigration New Zealand's skills' shortage lists. The Long Term Skill Shortage List includes the following occupations (Immigration New Zealand, 2013):

- Construction Project Manager
- Chemical Engineer
- Materials Engineer
- Civil Engineer
- Geotechnical Engineer
- Structural Engineer
- Transport Engineer
- Electrical Engineer
- Electronics Engineer
- Industrial Engineer
- Mechanical Engineer
- Production or Plant Engineer
- Mining Engineer
- Petroleum Engineer
- Aeronautical Engineer
- Agricultural Engineer
- Biomedical Engineer
- Environmental Engineer
- Marine Designer.

The shortages, particularly for civil, structural and electrical engineers or technicians have been exacerbated by the Canterbury earthquakes. Immigration New Zealand has a Canterbury Skill Shortage List which highlights similar engineering skills are needed to rebuild Canterbury (Immigration New Zealand, 2013).

Education data (New Zealand Qualifications Authority, 2010) shows young women perform as well as, if not better than, young men in school level mathematics and science. The Ministry of Women's Affairs, in its 2012–2015 Statement of Intent has set a goal to increase the number of women entering tertiary study in information technology, engineering and related fields. This goal is part of the Ministry's work to increase women's economic independence, and in this respect the Ministry notes: "Women can achieve greater economic independence through improved lifetime incomes and a better return on the investment in their skills. Young women, in particular, can make career choices that strengthen their ability to be economically independent over their lifetimes".

This document provides a snapshot of women in engineering in New Zealand and an overview of the diversity policies and practices of employers of engineers. Data has been sourced from Education Counts, the IPENZ Membership database and employers of engineers who voluntarily shared data with IPENZ. More information about these employers is provided overleaf.

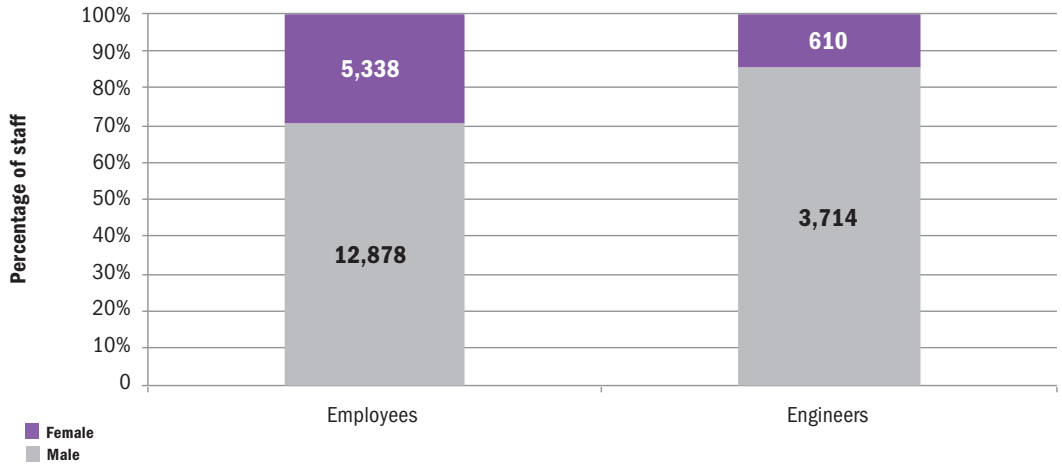
The Participating Employers

The 30 employers that provided data are a diverse group and include those from – engineering consultancies, central and local government and engineering manufacturers. They employ a total of 18,216 staff in New Zealand, 29 per cent of whom are female. The largest employer has over 3,500 employees and the smallest has 17 employees. The average employer has just over 600 staff.

The employers have a total of 4,324 engineers on their staff, 14 per cent of whom are female. The largest employer has over 700 engineers on their staff, while the average employer has 145 engineers on their staff. One participating employer has no engineers on their staff at present.

The employers of engineers are not named in this report to ensure confidentiality.

FIGURE 2 – GENDER COMPOSITION OF THE 30 PARTICIPATING EMPLOYERS



Findings

Participation at Tertiary Institutions

The participation of women studying engineering at tertiary institutions is shown in Figure 3 (Education Counts, 2012).

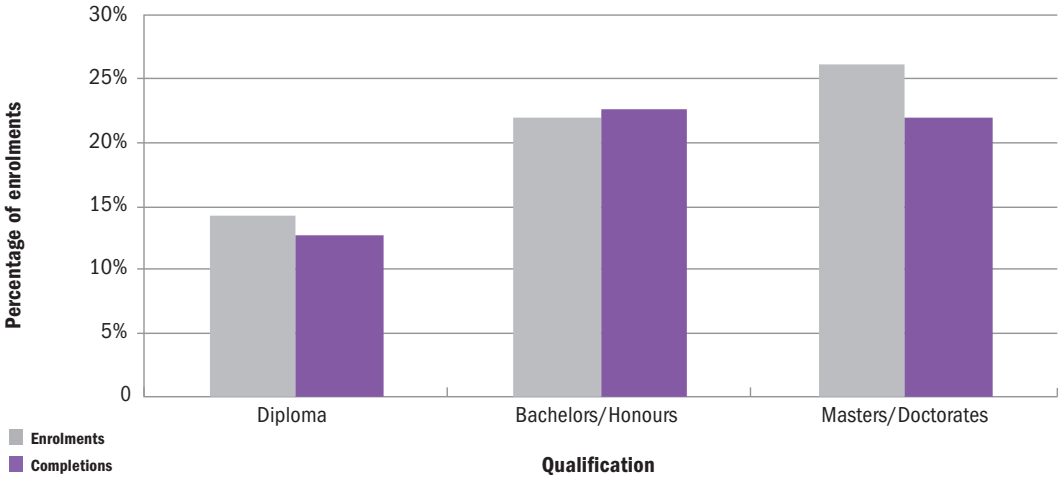
These figures are low compared with other professions where women make up at least half of the enrolments, as shown in Figure 4 (Education Counts, 2008).

Those studying towards a tertiary qualification in engineering are eligible for IPENZ Student Membership. At present, 21 per cent of IPENZ's 3,663 Student Members are female.

Research (Ministry of Women's Affairs and IPENZ, 2012) shows women choose to study some engineering disciplines over others. The specialisms of female engineering students are shown in Figure 5.

As shown, women are more likely to be studying to become geomatic, process or maritime engineers and less likely to be studying mechanical, aerospace or electrical and electronic engineering. The Ministry of Women's Affairs and IPENZ (2012) study found women were more likely to choose to be chemical and materials, or biomedical engineers and less likely to choose to be mechanical or computer engineers. This segregation appeared to be due to preference as graduates reported engineering specialties being equally emphasised in their first year at university.

FIGURE 3 – PARTICIPATION OF WOMEN IN TERTIARY ENGINEERING STUDIES



> The Ministry of Women's Affairs and IPENZ study found women were more likely to choose to be chemical and materials, or biomedical engineers and less likely to choose to be mechanical or computer engineers.

FIGURE 4 – PARTICIPATION OF WOMEN ENGAGED IN TERTIARY STUDIES BY PROFESSION

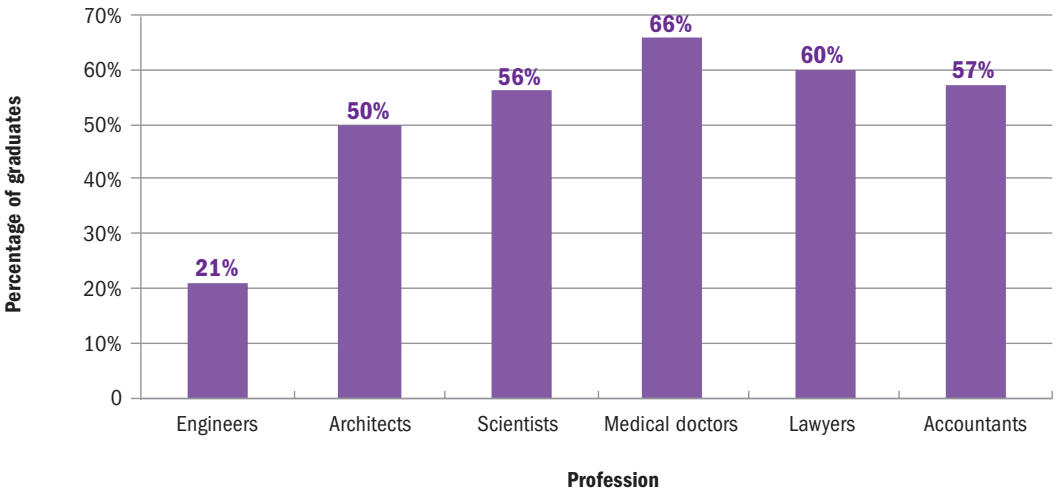
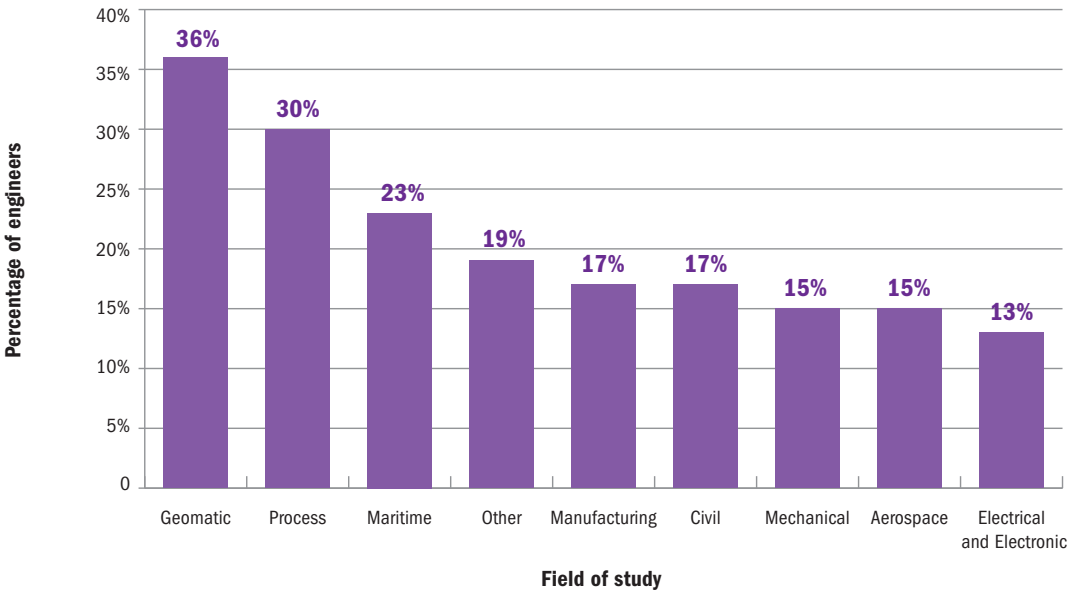


FIGURE 5 – REPRESENTATION OF WOMEN IN ENGINEERING STUDIES BY FIELD OF STUDY



Entry to the Profession

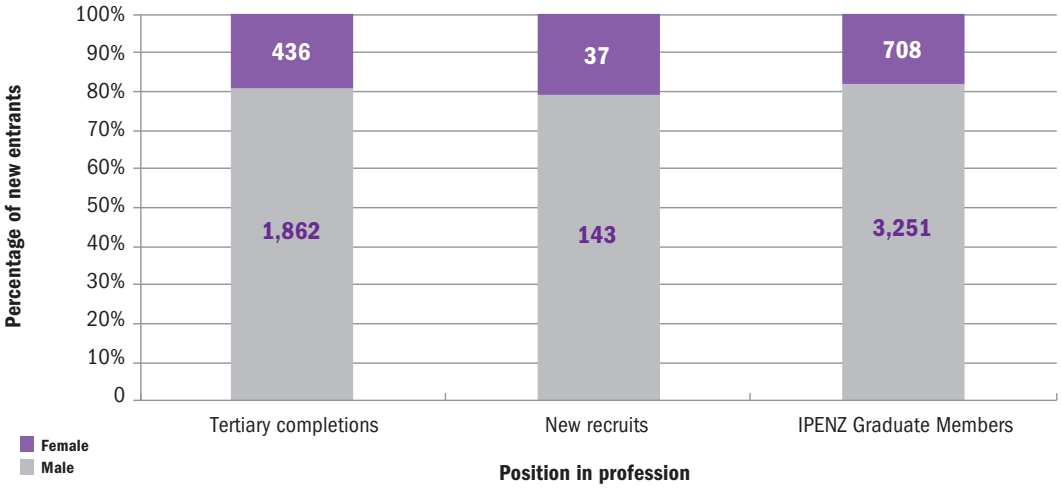
Most engineering graduates (95 per cent) work in an engineering role when they graduate (Ministry of Women's Affairs and IPENZ, 2012). Many graduates obtain their first job through graduate recruitment programmes with one of the large consulting companies, or by sending out CVs to employers. An organisation's reputation and the career opportunities they offer are the most important considerations for both male and female engineers when selecting an employer.

Figure 6 below compares the gender composition of those completing tertiary qualifications in engineering, new engineering graduates joining the 30 employers in the last year, and the IPENZ Graduate class of Membership.

As shown in Figure 6, the 30 employers have employed a total of 180 engineering graduates in the past 12 months, 21 per cent of whom were female.

Graduates with a tertiary qualification in engineering which has been accredited by IPENZ as being of good internationally-benchmarked quality can become Graduate Members of IPENZ. Approximately 18 per cent of the 3,959 IPENZ Graduate Members are female.

FIGURE 6 – GENDER OF NEW ENTRANTS TO THE ENGINEERING PROFESSION



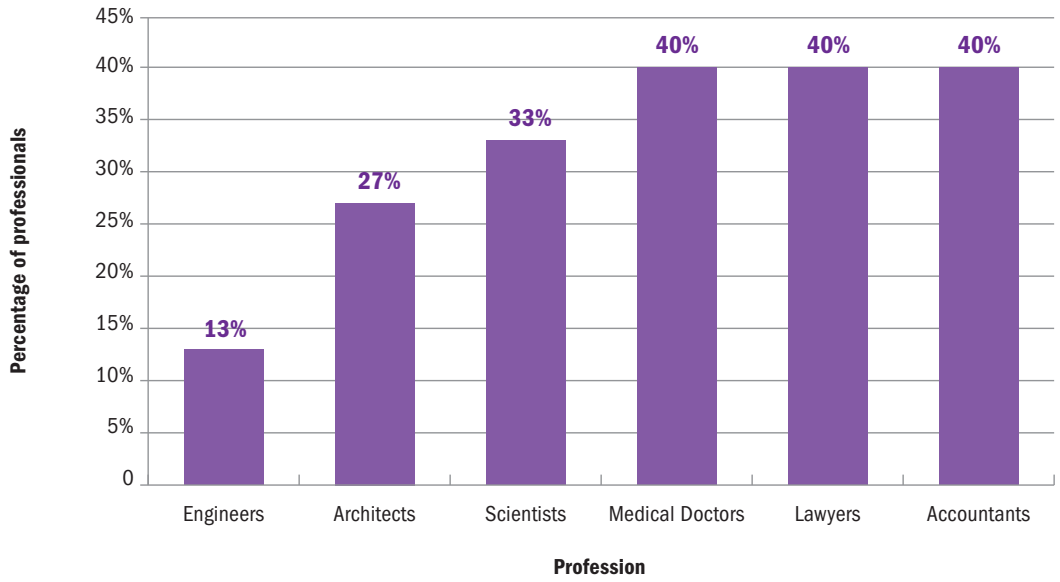
Involvement in the Workforce

According to the Department of Labour and IPENZ, New Zealand has approximately 54,000 people employed in engineering occupations – 32,000 as architects, engineers and related professionals and the remainder as physical science and engineering technicians. Approximately 13 per cent and 16 per cent of these respective populations are female. These figures are low compared with other professions, as shown below. Data is from the Institute of Policy Studies (2008), New Zealand Law Society, New Zealand Association of Scientists, and the New Zealand Institute of Chartered Accountants.

The gender profile of the 30 employers of engineers, the IPENZ Membership and Chartered Professional Engineers is shown in Figure 8. Note MIPENZ represents Professional Members of IPENZ, TIPENZ represents Technical Members of IPENZ and AIPENZ represents Associate Members of IPENZ.

As shown, the 30 participating employers have 5,338 female employees, out of a total of 18,216 employees (29 per cent). When only engineering employees are considered, the employers employ 4,324 engineers in total, 14 per cent of whom are women on average.

FIGURE 7 – PARTICIPATION OF WOMEN IN THE PROFESSIONS



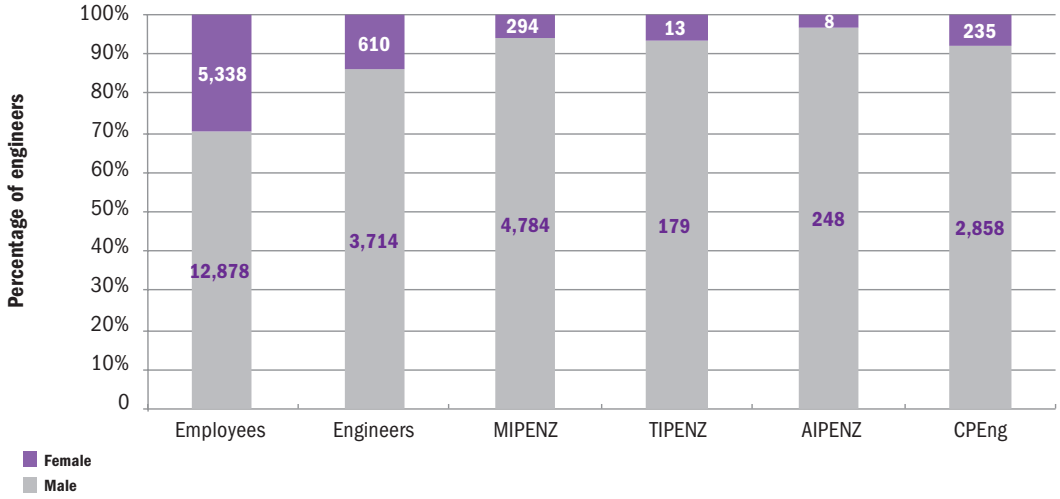
IPENZ has three Membership classes for practising engineers – Professional Membership, Technical Membership and Associate Membership:

- A Professional Member is a person assessed as competent to practise as an independent professional capable of designing innovative solutions to complex engineering problems. Professional Members will have developed a high level of engineering judgement by taking significant responsibility for engineering outcomes across a range of situations. They provide technical and/or managerial leadership to projects or activities. Professional Members have typically done a four-year engineering degree which provides them with a broad base of engineering principles and practices. They have then developed their skills in mentored employment for four to five years after which they will have undergone an IPENZ competence assessment to reach the Professional Member (MIPENZ) class.
- A Technical Member has been assessed as meeting a standard of engineering practice that is sufficient for them to work independently in a range of engineering situations. They are competent to innovatively apply and modify engineering practices and often provide managerial input into projects or activities. They are thus experienced engineering practitioners, who are very competent in the application of engineering. They normally hold a three-year degree (or assessed equivalent) with a strong "application" focus, usually in one engineering discipline. They have then developed their skills in mentored employment, after which they will have undergone an IPENZ engineering practice assessment to reach the class of Technical Member (TIPENZ).
- An Associate Member has been assessed as a competent engineering practitioner, based on strongly developed technical knowledge and practical experience. Associate Members are able to perform many standard engineering functions themselves, and, they often work in teams where they take responsibility for technical input. Associate Members are not normally in practice on their own account; they are often employees, and are not usually allowed to sign regulatory documents. They generally hold an engineering qualification equivalent to two years of study at a tertiary education institution. They have then developed their skills in mentored employment, after which they will have undergone an IPENZ engineering practice assessment to reach the class of Associate Member (AIPENZ).

As shown in Figure 8, six per cent (or 294) of Professional Members are female. For Technical Members women comprise seven per cent of this group. There are just eight female Associate Members, making up three per cent of the 256 Associate Members.

In addition to being a professional body, IPENZ is the Registration Authority for Chartered Professional Engineers under the Chartered Professional Engineers of New Zealand Act 2002. Under the Act, IPENZ assesses engineers to determine their current competence, with Chartered Professional Engineer being a quality mark for an engineer who has been assessed as being currently competent. In March 2013 there were 3,093 Chartered Professional Engineers in New Zealand, eight per cent of whom are female. For the 30 employers who supplied data there are 756 Chartered Professional Engineers on staff, 10 per cent of whom are female.

FIGURE 8 – GENDER PROFILE OF THE ENGINEERING PROFESSION



Representation at Senior Levels

Women leave the engineering profession at a higher rate than men (Ministry of Women's Affairs and IPENZ, 2012) and often face difficulties balancing their "double burden" – the combination of work and domestic responsibilities and fitting the traditional advancement model which presupposes a linear career path model with no space for career breaks (McKinsey and Company, 2007). IPENZ wants female engineers to remain in the profession for two reasons – so they can continue to share their skills and knowledge for the betterment of New Zealand and so there is reduced turnover and disruption in engineering organisations.

The loss of female engineers and the historic male domination of the engineering profession are reflected in the make-up of organisations' boards, senior management teams and management teams, as shown below. Note – the figures on the male/female part of the bars are absolute numbers of men/women.

As shown, a total of 158 people are on the 30 employers' boards, 15 per cent of whom are women. It should be noted that not all employers provided board figures as some employers are multi-national and this study was focussed on New Zealand employees and board members.

The proportion of women on the employers' boards (15 per cent) is lower than the comparative figure for the boards of State Owned Enterprises (33 per cent, Crown Ownership Monitoring Unit, 2013) but similar to that of NZX listed companies (11 per cent, Lynch, 2012).

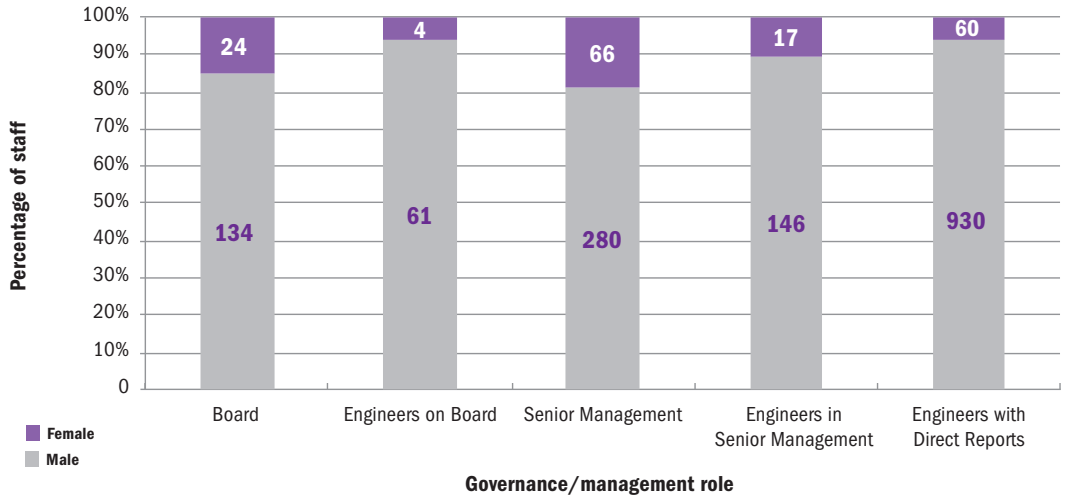
When only engineers are considered, the 30 employers have a total of 65 engineers on their boards, six per cent of whom are female.

At senior management level, 19 per cent of senior managers are female but this figure drops to just 10 per cent when only engineers on senior management teams are considered.

At management level (deemed here to be those with direct reports), the 30 employers employ a total of 990 engineers with direct reports, six per cent of whom are women.

Within IPENZ, Fellowship is a measure of an individual's contribution to the profession or IPENZ. IPENZ has the classes of Honorary Fellow (generally for those with a background outside engineering), Fellow and Distinguished Fellow. At present IPENZ has a total of 802 Fellows, Distinguished Fellows and Honorary Fellows. Twenty-three (three per cent) of these are women.

FIGURE 9 – GENDER COMPOSITION OF THE 30 PARTICIPATING EMPLOYERS' BOARDS, SENIOR MANAGEMENT AND MANAGEMENT TEAMS



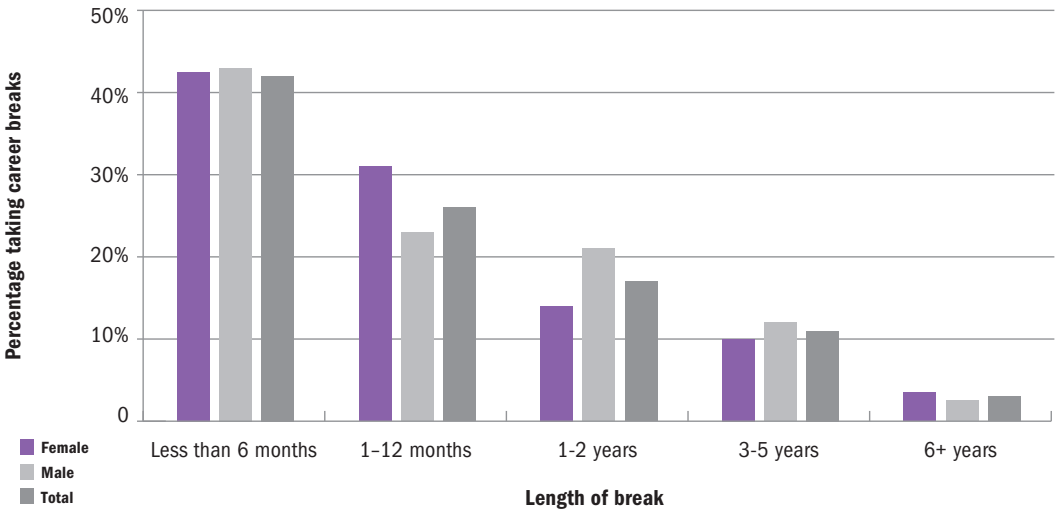
Support for Employees

Having children has a major impact on the careers of female engineers (Ministry of Women's Affairs and IPENZ, 2012). Engineers, particularly female engineers, can require support and flexibility to enable them to balance the pressures and expectations of a family and a career. The Ministry of Women's Affairs and IPENZ (2012) found a number of female engineers resume their careers following the arrival of children at a level below their competence so they can work part-time or with flexibility.

A study by the Department of Labour and IPENZ (2008) also reported a similar finding, noting that one in six women returning from a career break returned to a job that was lower than the position they had left.

The 2008 research (Department of Labour and IPENZ) showed approximately 27 per cent of engineers had taken a career break. The length of career breaks taken is shown below.

FIGURE 10 – CAREER BREAKS OF ENGINEERS



The main reason for taking a career break differs by gender with travel being the main reason for men, and travel and parental leave the main reasons for women.

This finding is supported by data from the 30 employers of engineers. This shows the majority of engineering employees currently on parental leave are women – 28 of a total of 29 employees. Similarly, the majority of employees that returned from parental leave in the past 12 months were women (88 per cent of the total 43 employees who returned).

The data also shows very few engineering employees work part-time – 204 of the 4,324 engineers across the 30 employers (five per cent). Of the engineers working part time, 47 per cent are women.

The 30 employers also have 60 managers employed part-time. The majority (65 per cent) of these are women.

The low number of managers working part-time (60 of 990) aligns with a Ministry of Women's Affairs and IPENZ (2012) finding that management roles are almost always designated as full-time roles.

A number of employers (43 per cent of the 30 employers) have a diversity policy. Some employers have had a diversity policy for over five years.

Many employers of engineers offer some form of flexibility (Ministry of Women's Affairs and IPENZ, 2012). Working flexibly can be career-limiting, as management roles are usually designated as full-time and working long hours is necessary (or perceived as necessary) for an engineer to progress to a management position (Ministry of Women's Affairs and IPENZ, 2012). However, flexibility is not limited to working part-time. The table below shows the flexibility offered by employers of engineers and take-up by employees.

> Engineers, particularly female engineers, can require support and flexibility to enable them to balance the pressures and expectations of a family and a career.

TABLE 2 – FLEXIBILITY OFFERED BY EMPLOYERS OF ENGINEERS

FLEXIBILITY OR SUPPORT OFFERED	% OF 30 EMPLOYERS OFFERING THIS FLEXIBILITY	% OF RESPONDENTS THAT HAD TAKEN UP FLEXIBILITY (DEPARTMENT OF LABOUR AND IPENZ, 2008)
Flexible hours	90%	62%
Opportunity to work remotely	83%	Not asked
Opportunity to work part-time	97%	15%
Opportunity to take career breaks/sabbaticals	67%	16% female 8% male
Opportunity to buy additional leave	63%	34%
Paid employee assistance, counselling or support service	83%	Not asked

It is clear that flexibility is offered, but it is not widely taken up. This is despite the legislative backing for flexible working through the Employment Relations (Flexible Working Arrangements) Amendment Act 2007. Under this Amendment Act employees with caring responsibilities have the right to request flexible working arrangements. To qualify, an employee must have care of another person, have been employed by their employer for six months or more and have not made another request under the Amendment Act to work flexibly in the past 12 months (Ministry of Business, Innovation and Employment, n.d.). Employers that receive requests under the Amendment Act have a duty to consider the request and must respond to a request within three months of receiving it. Under the Amendment Act, a request can only be declined if the employee is not eligible, or there are Recognised Business Grounds (which relate to the need to work with other staff or produce quality work), or the request would conflict with a collective agreement.

Other practices of employers can help or hinder diversity. Gender balanced interview panels, for example, can be beneficial as bias and stereotyping are less likely to influence hiring when panels are balanced, although this can be dependent on the individual panellists and their biases. In New Zealand there is no requirement for gender balanced interview panels although the National Equal Opportunities Network (2013) notes it is desirable for interview panels to be gender and ethnicity balanced. Of the 30 employers that provided IPENZ with data, 22 ensure their interview panels have both a male and female interviewer, while some others try to have balance but do not necessarily have a balanced interview panel in all cases.

Mentoring is an important support and development mechanism for both male and female graduate engineers, especially in the first few years after graduation. IPENZ sees the role of mentoring as being to "aid and support a graduate's progression by promoting a caring and genuine interest in developing their abilities and talents" (IPENZ, 2011). Good mentoring transfers professional knowledge, organisational awareness and can empower mentees, making them more productive, innovative and driven. IPENZ notes there are at least three models of mentoring – traditional mentoring (a one-on-one relationship between an experienced senior engineer and a less experienced engineer), peer mentoring (where the mentor and mentee are following career paths and the mentor is not necessarily a senior engineer with significant status) and group mentoring (where a group of engineers with similar experience meet regularly to support each other). For the 30 employers that participated in this study, 23 per cent of male employees and 32 per cent of female employees currently have mentors. Unfortunately the data collected does not enable differentiation between the number of recent graduates and more experienced engineers with mentors.

Support for employees on career breaks is also important. This is because a lack of confidence and feeling technically out of date are the main reasons engineers choose not to re-join their profession after a career break (Department of Labour and IPENZ, 2008). Of the 30 employers that provided data to IPENZ, 29 remain in contact with their employees while they are on career breaks.

Providing onsite childcare can also be beneficial to both employees and employers. Berry (2011) suggests onsite childcare can result in increased employee attendance and productivity as parents do not have to travel to pick up their children. In addition, employees are likely to be happier, resulting in them being harder-working and less likely to leave their employer. Another advantage of onsite childcare is that mothers can return to work earlier, shortening the parental leave they need to take. This benefits both the employer and the employee as these skilled women can continue to contribute to the organisation's performance. It also enables their movement up the career ladder to continue. Finally, Berry suggests the provision of onsite childcare can help organisations attract new recruits. This is because employers providing onsite childcare are likely to be seen as being supportive employers, so they attract prospective employees that have caring responsibilities. None of the 30 employers that participated in this study provide onsite childcare.

Conclusion

Recruitment of women into engineering is low, with just 23 per cent of enrolled students being female. The preference of female students for particular specialisms is of interest and it is recommended that work be undertaken to determine the reasons for this preference so the marketing of engineering as a career can be improved.

The 30 participating employers and IPENZ Membership are largely representative of the population of engineers. For example, at the entry stage 19 per cent of recent graduates are female, while 21 per cent of the recent graduates employed by the 30 employers are female and 18 per cent of IPENZ's Graduate Members are female. IPENZ recommends employers of engineers use gender and ethnically balanced interview panels to reduce the impact of unconscious bias in the recruitment of employees. IPENZ also recommends employers support their employees to find a mentor, particularly for employees who are in the first few years of their careers.

Employers of engineers are largely supportive of their employees, as shown by over 80 per cent of the 30 employers offering flexible hours, the ability to work remotely, and the ability to work part-time. However, there has been little uptake of this flexibility despite the legislative backing for flexible working through the Employment Relations (Flexible Working Arrangements) Amendment Act 2007. Further work is needed to better understand the limitations on those employees that take up flexibility and to investigate an alternative business model so taking career breaks or working flexibly is not seen as career-limiting. Work is also needed to better support female engineers so they retain their confidence and competence and are ready and able to return to the workplace following a career break, if they wish to do so.

Female representation at senior levels remains an area for further improvement, although it is noted that this can only be achieved if the number of women entering and remaining in the engineering profession continues to increase. Further work is needed to support women in engineering so they can balance their work and domestic responsibilities. A review of business practices is also needed to determine if alternative models of advancement are possible so long hours are not the only way to advancement in the engineering profession, and so managers can have the option of working flexibly or part-time. Support for capable senior women, through proposing them for IPENZ Fellowship or Board positions, is also recommended.

> Good mentoring transfers professional knowledge, organisational awareness and can empower mentees, making them more productive, innovative and driven.

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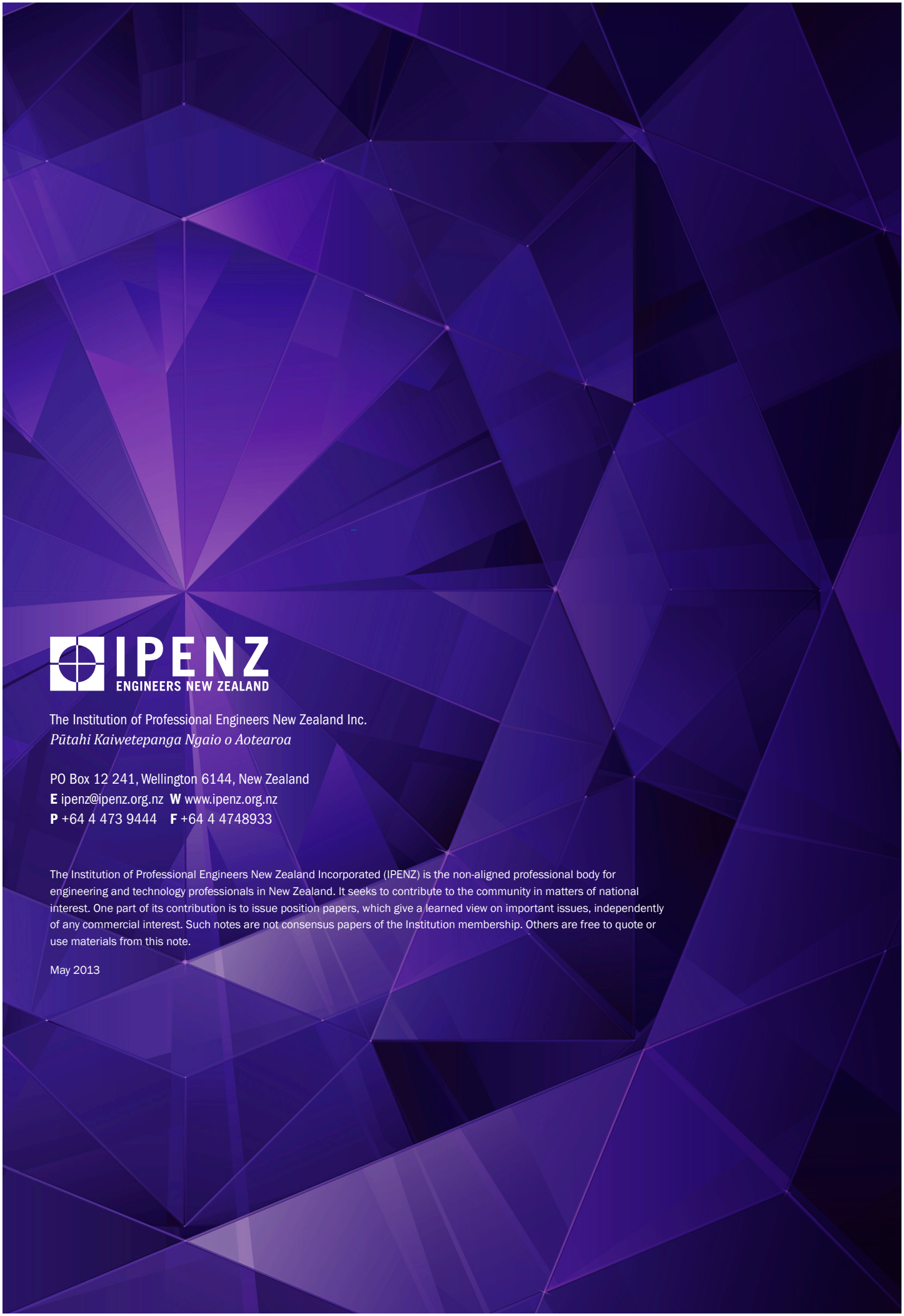

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