



ONTARIO
SOCIETY
OF PROFESSIONAL
ENGINEERS



Crisis in Ontario's
Engineering Labour Market:
Underemployment
Among Ontario's
Engineering-Degree Holders



ABOUT OSPE

Founded by engineers in 2000, the Ontario Society of Professional Engineers (OSPE) is the Voice of the engineering profession across the province. OSPE advances the professional and economic interests of Ontario engineers by advocating with governments, industry and the public and by providing valued member services and opportunities for ongoing professional development for engineers. OSPE's vision is to be a strong, progressive organization that champions a community of engineers.

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EXECUTIVE SUMMARY

In May 2014, the Ontario Society of Professional Engineers (OSPE) presented a snapshot of employment-related indicators in a report entitled *From Classroom to Career: Employment and Underemployment Among Ontario's Engineering Graduates*. The report discussed the disconnect between what employers say – that there is a shortage of workers who have the specialized skills they need – and the ongoing accounts we hear from individuals with engineering degrees who cannot find relevant or appropriate work.

In September 2014, OSPE published *From the World to the Workforce: Hiring and Recruitment Perceptions of Engineering Employers and Internationally Trained Engineers in Ontario*. The report's core finding was that asymmetries or misalignments exist between the recruitment processes of employers and the job search practices of internationally trained engineers (ITEs).

Now we go a step further. *Crisis in Ontario's Engineering Labour Market: Underemployment Among Ontario's Engineering-Degree Holders* focuses on individuals with engineering degrees who are working in jobs that don't necessarily require a university degree. For the purposes of this report, OSPE terms this condition as "underemployment". There is no universally agreed-to definition of underemployment. So, for the purposes of this report, we are using the term to refer to a state of employment in which an individual with an engineering degree is employed in a job that does not necessarily require a university degree of any kind.

Information referred to in this report is derived from the Canadian National Census 2011 National Household Survey (NHS). According to the 2011 NHS¹, only about 30 per cent of employed individuals in Ontario who held a bachelor's degree or higher in engineering were working as engineers or engineering managers. Fully two-thirds of engineering-degree holders were not working in engineering at all. Many had jobs that didn't necessarily require a university degree. OSPE considers this unacceptable, and an indicator of significant underemployment of those who hold engineering degrees.

By a wide margin, employed individuals with bachelor's degrees or higher in engineering did not work in their field of study compared with those with medical, law, nursing or education degrees. The percentage of people with engineering degrees who actually worked as engineers or engineering managers was lower in Ontario than in any of the five provinces to which it was compared, and Canada as a whole. In Ontario, just 29.7 per cent of individuals with engineering degrees worked as engineers or engineering managers. This compares with almost 46 per cent of similarly educated individuals in Alberta, for instance.

Job prospects appeared brighter for younger people aged 25-to-34 years. However, slightly over one-third of those were working as engineers or engineering managers. This contrasts with the next group (aged 35-to-44 years), in which only about one-quarter worked in engineering. The 45-to-54-year olds had the bleakest picture. Here, a 10-point spread separated those working in jobs not necessarily requiring a degree compared to those working in engineering.

Additionally, those who obtain their engineering degrees outside Canada faced, and continue to face, a troubling situation when it comes to employment. There was much greater underemployment in this group than among those whose degrees were from Canada. If we assume that individuals with degrees from outside Canada are immigrants and internationally trained engineers (ITEs), just over 20 per cent actually worked as engineers or engineering managers.

Considering gender differences, just over 20 per cent of women with engineering degrees worked as engineers or engineering managers. Indicators are worse with respect to underemployment for this group. Well over one-third of women who had engineering degrees worked in jobs not necessarily requiring a degree. This was especially true for women with degrees from outside Canada as 50 per cent were unemployed.

¹ Statistics Canada, 2011 National Household Survey: Data Tables, 99-012-X2011056, Ottawa, Ont.: Statistics Canada, 2013

This report discusses all of these observations in greater detail, leading us to ask one, all, or any combination of the following questions:

1. Are engineering students who graduate from university reasonably expecting to find employment in engineering?
2. Are we graduating too many engineers in Canada?
3. Are a lack of co-op positions a primary reason why many engineering graduates cannot find work as engineers?
4. Are employers doing their part to generate entry-level positions and train engineers in-house to develop the skills that industry needs? Or to provide co-op positions to engineering students?
5. Are university programs educating engineering students with the essential skills needed to find employment in an engineering field upon graduation?
6. Can the economy grow and strengthen opportunities in order to generate more jobs for engineers?
7. Are some of the 33.3 per cent of the underemployed simply never going to find work as engineers or in professions requiring a degree because of reasons other than demonstrable skills?
8. Are some of these 33.3 per cent of underemployed and/or the 37 per cent who are working in positions requiring a degree, but not as engineers or engineering managers, satisfied with their career paths? Do they desire to work in engineering?
9. Did our immigration system contribute to the underemployment situation? Will recent changes to the system improve the rate of engineering and professional employment among permanent immigrants with engineering degrees?
10. What role, if any, does mentorship have in assisting new Canadians and recent graduates to find appropriate employment within their fields of interest?
11. Given the high rate of underemployment, why does government and some industry leaders believe there is a shortage of engineers in the province?
12. Are our government policies contributing to weak job prospects for engineering graduates given that a significant portion of job growth in recent decades in developed countries has been created by sectors that are driven by engineering innovations?



INTRODUCTION

This report builds on and integrates the snapshot of indicators presented in OSPE's May 2014 report, *From Classroom to Career: Employment and Underemployment Among Ontario's Engineering Graduates*. That report evolved from articles and headlines in recent years that say there are ongoing labour and skills shortages in a wide variety of sectors across Canada. These shortfalls reportedly cost the economy billions of dollars and threaten Canada's global competitiveness. OSPE's own research, which is specific to Ontario's engineering sector, indeed indicates that employers are struggling to find individuals with the specialized skills they need. At the same time, individuals with engineering degrees report they are not able to find employment in their field of study.

In late 2012, Engineers Canada released a labour market study projecting there would be a solid demand for about 5,000 engineering positions per year in Canada for the remainder of this decade. The study also predicted that over 1,300 engineering positions would remain unfilled in Ontario annually. Ironically, it also revealed that only 35 per cent of engineering graduates actually worked in engineering or engineering management jobs. Whether this condition was prompted by choice or necessity is unclear and certainly calls for further research. Either way, a problematic gap remains between industry's challenge to fill engineering positions and the surplus of individuals who have engineering degrees.

In September 2014, OSPE published findings from a series of interviews and focus groups. These were summarized in the report, *From the World to the Workforce: Hiring and Recruitment Perceptions of Engineering Employers and Internationally Trained Engineers in Ontario*. In it, engineering employers confirmed they were hard-pressed to find experienced individuals to fill specialized engineering positions. Indeed, the report's core finding was that asymmetries or misalignments exist between the recruitment processes of employers and the job search practices of internationally trained engineers (ITEs). Furthermore, OSPE is seeing not just ITEs but many new engineering graduates and seasoned engineering professionals who are facing significant barriers to finding appropriate engineering work.

As the advocacy and member-services body for Ontario's engineers, OSPE has undertaken an examination of the issue even more closely. At this point, we are still facing more questions than answers. However, establishing an evidence-based foundation to better understand the market forces at play is a critical first step in developing solutions to aid employers, engineers and Ontario's economy. One source of reliable, evidence-based data that can lead to a better understanding of the types of jobs in which engineering graduates are employed are census data.

Detailed information about the types of jobs Canadians held, categorized by the field of study in which they obtained their degree, was captured by those who voluntarily completed the 2011 National Household Survey (NHS).

The NHS also captured information about income levels, income by gender and the location of university study (in or outside Canada).

Data from the survey were statistically extrapolated to the general population by Statistics Canada, who cautions that the numbers cannot be considered completely accurate due to the voluntary nature of compliance and self-reporting. Nonetheless, Statistics Canada confirmed it is still valid to describe and analyze what data the NHS does contain.

The 2011 database analyzed in this report are only part of the evidence related to determining the jobs in which engineering graduates are working. However, it is the only comprehensive data that is conveniently available to the public (or by customized order) that classifies labour market statistics in such detail and therefore worthy of investigation. Nonetheless, there is a dearth of labour market statistics that provide a clear picture of the situation.

The data examined in this report are solely derived from the 2011 NHS, with two exhibits from the 1995, 2001 and/or 2006 censuses. It is not a comprehensive scholarly analysis. It purposely does not include a literature review, as reports on the subject are numerous and readily available through web searches. OSPE considers it a foundation to offer observations, raise further questions, and identify future research and analysis that needs to be conducted.

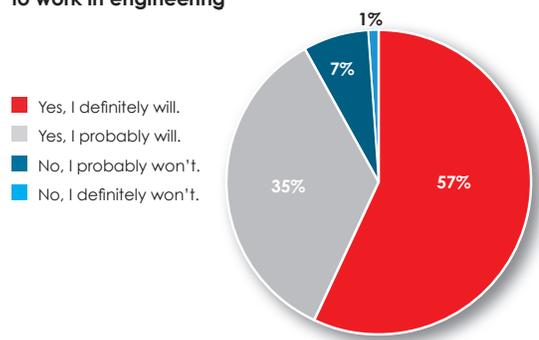
This snapshot is composed of key indicators from the 2011 NHS. It demonstrates whether individuals in Ontario with bachelor's degrees or higher in engineering (being the highest degree attained) who were employed at the time of the census were working as engineers or engineering managers or in jobs normally requiring a university degree. Such individuals may be considered to be gainfully employed. Jobs that typically require a university degree include managerial and executive positions in business, finance, industry, education (e.g., professors and teachers), computer or information technology (IT) specialists and many other positions. Other jobs are those not necessarily requiring a university degree (i.e., college diploma and/or other vocational training or only a minimum level of educational attainment).

Jobs or job categories from the 2011 NHS described in this report are classified as follows:

Normally requiring a university degree	Not necessarily requiring a university degree
Engineer and engineering manager	Natural resources and agriculture production
Management – all levels	Sales and services workers
Business and finance professionals	Administrators, office support, distribution and scheduling workers
Scientists and mathematicians	Sciences and engineering technicians
Architects, urban planners, surveyors	Public protection workers
Computer and IT specialists	Trades, transport, equipment operators
Health professionals	Health technicians and caregivers
Education professionals	Legal/education support
Law, government, social, policy professionals	Paraprofessionals in legal, social, and education work
Art, culture, recreation and sport – professionals	Art, culture, recreation and sports – talent and technical
Manufacturing professionals	Manufacturing and utilities workers

OSPE does not have the data to determine whether engineering graduates who pursue other non-engineering positions do so by choice or because they cannot find work in engineering. However, a survey of fourth-year engineering students conducted by IPSOS Reid (March 2013) on behalf of Professional Engineers of Ontario (PEO) overwhelmingly indicated that these students intended to pursue work as engineers upon graduation (Figure 1).

FIGURE 1
Intents of 2013 Ontario engineering students after graduation to work in engineering



If young people do not work as engineers or engineering managers after graduation, it could mean they were pushed into other jobs because they could not find engineering employment. It could also mean they were pulled into other jobs that were more appealing than engineering work. The same conditions may hold true for ITEs, although it is assumed most immigrants want to work in the same occupation as they did in their native country to maximize their market value.

For the purposes of this report, OSPE considers individuals who are either working as engineers or engineering managers, or in positions normally requiring a university degree, to have employment that uses post-secondary-education knowledge. These are jobs in which an engineering degree is required or highly desirable, and/or that use the kind of skills learned in an engineering degree program, whether technical or not (e.g., analytical, problem-solving, software development, etc.). Therefore, we do not consider these jobs to be indicative of underemployment. Although, from a public-education and labour-market point of view, the government may be concerned that engineering graduates doing non-engineering work may be displacing graduates from arts and science programs in the labour market.

This snapshot of indicators is based on the disconnect between what employers say – that there is a shortage of workers with the specialized skills they need – and the ongoing reports of people with engineering degrees who cannot find pertinent work in this field. As such, this report focuses on people with engineering degrees working in positions and jobs not necessarily requiring a university degree – a condition that is often termed as “underemployment.”

Although there is no universally agreed-to definition, for the purposes of this report OSPE defines underemployment *as a state of employment in which an individual with an engineering degree is employed in a job that does not necessarily require a university degree*. OSPE recognizes that gainful employment does not necessarily require a university degree. Nor do we consider whether a person is satisfied in a job that is not in their field of study or doesn't require a university degree. However, it seems reasonable to ask why society would invest thousands of dollars in full-time university education for individuals who are happy with jobs that do not require a university degree. These individuals might be better served at much lower cost by allowing them to attend specific courses of interest at the university-level while they are working, provided that universities have such opportunities in their continuing education programs.

OSPE also analyzed income levels as a measure of gainful employment or underemployment. The intent was to speculate if those with engineering degrees were attracted to non-engineering jobs by higher pay.

Differences in the types of employment and income between genders and between those who obtained their engineering degree in or outside Canada are also analyzed. These measures help us understand whether gender or location of study makes a difference in the type of job one has and the income earned in that job.

While far from exhaustive, the following are key indicators, highly relevant to labour market descriptions.

WHAT TYPES OF JOBS DO ENGINEERING GRADUATES HAVE?

SNAPSHOT 1

HOW DOES ENGINEERING COMPARE WITH OTHER PROFESSIONS?

While there was no comparable table published by Statistics Canada for the 2011 NHS, data from the 2006 census show match rates for various regulated professions were analyzed and presented. These illustrated the relative portions of the sampled population by their field of study and whether they were working in a job that matched their degree.

As Table 1 illustrates, only 31 per cent of employed people surveyed in 2006 with engineering degrees worked as engineers. This was the lowest match rate of all the regulated professions the survey compared.

Furthermore, Figure 2 demonstrates the gap between individuals who reported having an engineering degree and those who said they work in engineering in censuses since 1996. It must be noted that Statistics Canada worded the questions differently in each census, so the figures are not as precise as they might be otherwise. Figure 2 must therefore be considered as demonstrating a trend only. But that trend clearly indicates an increasing number of people holding engineering degrees but not working in engineering. Ontario's economy and industries have provided jobs or absorbed engineering-degree holders into jobs directly related to their field of study at a rate much lower than the supply of engineers for the past 20 years.

Further analysis in this report focuses on 2011 data. But before discussing the census data from that year, consider the 2006 census. The 31 per cent match rate is considered low by OSPE and an indicator that the majority of engineers were not working in engineering at that time. Analysis of 2011 data suggests a similar finding.

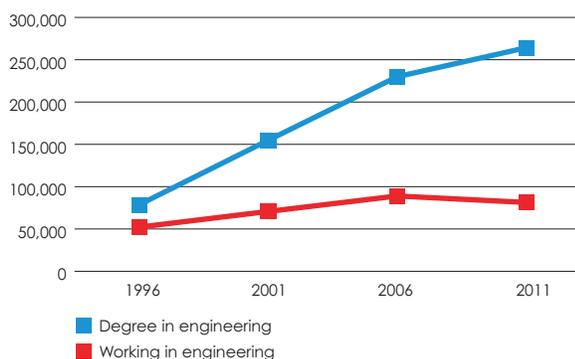
TABLE 1

Match rates of employed individuals in the corresponding occupation – 2006

Employed Canadian residents in sample		
	Total	Match Rate (%)
Optometry	3,100	89
Chiropractics	6,090	87
Medicine	43,905	81
Occupational therapy	9,905	81
Dentistry	14,215	78
Physiotherapy	14,475	76
Pharmacy	24,780	75
Nursing	92,030	71
Veterinary medicine	8,805	69
Law	93,910	62
Teaching	444,655	59
Diet/nutrition	3,660	55
Architecture	21,555	45
Accounting	114,855	43
Engineering	325,190	31
Total	1,221,130	53

FIGURE 2

Trends since 1996 census – Ontarians with degrees in engineering compared with those reporting they work in engineering



Source: Statistics Canada, Census of Population, 1996, 2001, 2006, 2011

According to the 2011 NHS, only 29.7 per cent (67,045 out of 225,490) of employed individuals in Ontario with bachelor's degrees or higher in engineering were working as engineers or engineering managers. A further 37 per cent (83,365 out of 225,490) worked in professional positions that normally require a university degree. In other words, only just over 65 per cent of employed Ontarians with engineering degrees were gainfully employed in professions that normally require or benefit from having a university degree.

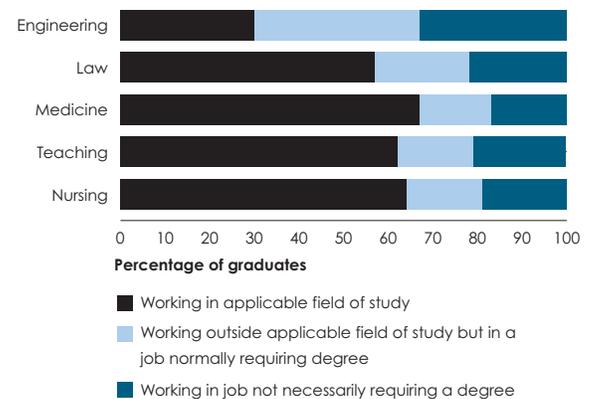
Those who were not working as engineers and were working in positions that don't necessarily require a degree made up fully 33.3 per cent (75,090 out of 225,490) of the total. This is an amount that OSPE considers high and indicates significant underemployment in the engineering profession. This high underemployment points to one or more of at least six possible causes.

- There may be an excess supply of engineers entering the labour market.
- There may be too few engineering jobs being created in the economy.
- Employers may be demanding specialized knowledge and skills before they will hire an engineer to avoid the costs and time that on-the-job training involves.
- Universities may be graduating engineers with insufficient job-related skills. This may be impeding their success in obtaining the available engineering jobs.
- Society or parents may be pushing students to enter engineering programs when they really lack the aptitude to be good engineers. This may be because they falsely assume that an engineering graduate will always be able to find a good engineering job.
- Internationally trained engineers may be immigrating to Canada with the false assumption that an engineer will always be able to find a good engineering job shortly after arrival.

It is uncommon to find low percentages of degree holders working in their fields of study in most regulated professions in Canada. However, as Figure 3 indicates, this is the case with employed people who have bachelor's degrees or higher in engineering, and by a wide margin.

The dark blue portion of the bars (total working in jobs not necessarily requiring a university degree) reflects the percentage of employed people who might be considered to be underemployed, as defined above in this report. After 33.3 per cent for engineers, the next highest proportion of underemployment in other regulated professions requiring a degree are teachers at 21.8 per cent. This is still comparatively lower than for engineering.

FIGURE 3
Comparison of employed holders of bachelor's degrees or higher and types of job in selected regulated professions requiring a degree in Ontario



Source: Statistic Canada, 2011 National Household Survey

Job outcomes between engineering and some of the other regulated professions, especially law and medicine, may not lend themselves to direct comparison. Lawyers and medical doctors need to obtain at least a second degree to pursue licensure. After articling or interning, fully licensed lawyers or physicians are typically in their late twenties or older. There is quite a difference in terms of work and life experience between a graduate of an engineering program in his or her early twenties and a 27-plus-year-old lawyer or doctor.

Moreover, both lawyers and doctors have “structured” articling or internship programs incorporated into their training programs before they may become licensed. Similarly, nursing and teaching programs typically incorporate a practicum in which students are placed in medical facilities or actual classrooms, respectively, before they graduate.

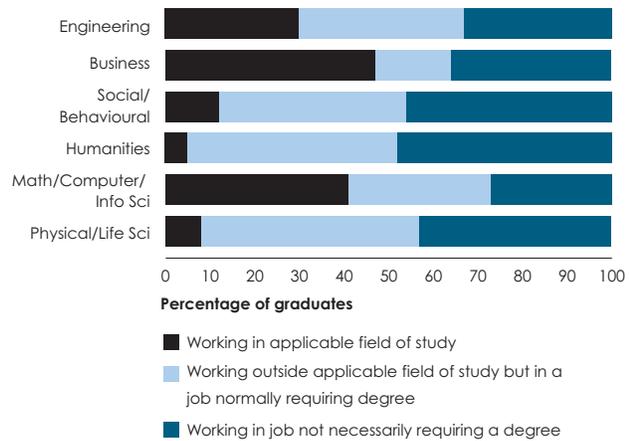
Law, medical, teaching and nursing professions all have a higher rate of degree holders working in their field of study than engineering. By and large, engineering programs do not incorporate mandatory co-ops or other on-the-job components in their curricula. Nor do they have structured internships when they begin to work. Other OSPE research confirms that employers overwhelmingly prefer to hire engineering graduates who have co-op experience. (See: *From the World to the Workforce: Hiring and Recruitment Perceptions of Engineering Employers and Internationally Trained Engineers in Ontario*.) Is it a coincidence that engineering has among the lowest levels of degree holders working in their field compared with other regulated professions? This snapshot analysis indicates not.

It's clear that, compared with other regulated professions, employed individuals with engineering degrees do not fare as well when it comes to working in their field of study or in jobs normally requiring a degree. So, how do engineering-degree holders compare with non-regulated professions?

As Figure 4 shows, Ontarians holding degrees in engineering fare quite favourably when compared with other degree holders. Only business/management and mathematics/computer/information-sciences-degree holders have higher percentages of individuals working in their fields of study (46.7 per cent and 41.2 per cent respectively) than engineering-degree holders (29.7 per cent).

Similarly, when we look at degree holders working in jobs that don't necessarily require a degree, only the mathematics/computer/information-sciences category has a smaller percentage of people working in those non-degree-requiring jobs than engineering-degree holders (27 per cent versus 33.3 per cent respectively).

FIGURE 4
Comparison of engineering degree with degrees for non-regulated professions



Source: Statistic Canada, 2011 National Household Survey

These observations are open to interpretation. Do employers look favourably on individuals with engineering degrees because they have educational foundations in analytical thinking and problem-solving? It can be argued that the two fields of study whose graduates have the lowest rates of underemployment are most likely to be viewed as analytically based – engineering and mathematics/computer/information sciences. This suggests that employers desire technical/computer, math, analytical, and problem-solving skills.

However, from an overall labour-market perspective, this interpretation might also be viewed as an indication that engineering-degree holders are displacing other types of degree holders. This could be forcing non-engineers into lower-paying, non-professional jobs. If this is the case, the overall economy may suffer as government tax revenue and spending power would decline for the non-engineering group.

Why then should programs and actions be implemented that focus on decreasing underemployment among engineering-degree holders, when this group has lower underemployment rates than many others with non-engineering degrees?

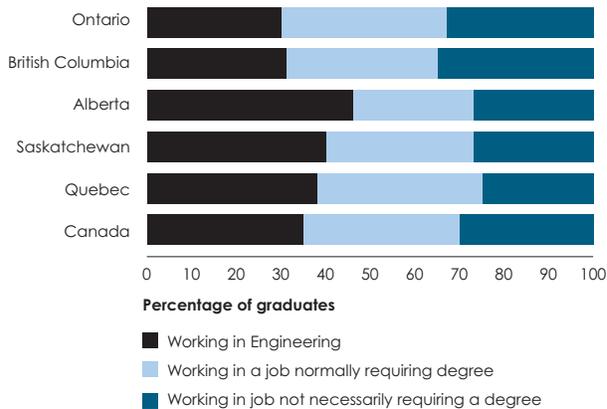
One reason is that engineers are key motivators of innovation. They are needed as developers of infrastructure design, planning, construction and maintenance. The more engineers we have entering the workforce and applying their skills, the greater the economic engine that drives the economy that in turn creates jobs for a large number of non-engineers.

SNAPSHOT 2**HOW DO ONTARIO ENGINEERS FARE COMPARED TO ENGINEERS IN OTHER PROVINCES?**

It is well known that in 2011, engineers in Alberta and Saskatchewan had a higher rate of employment. The 2011 NHS confirms this. Figure 5 shows that almost 46 per cent of people with engineering degrees worked as engineers or engineering managers in Alberta. This compares to just 29.7 per cent in Ontario, which had the lowest percentage of all four provinces with which it was compared, as well as Canada as a whole.

FIGURE 5

Comparison of employed holders of bachelor's degrees and higher in engineering by jurisdiction



Source: Statistic Canada, 2011 National Household Survey

In underemployment, Ontario sat at 33.3 per cent and British Columbia at 35.4 per cent. These two provinces had the highest proportions of people working in jobs not necessarily requiring a degree amongst all the jurisdictions compared, including Canada as a whole. Perhaps not coincidentally, these two provinces also contain two of the top three cities (Toronto and Vancouver) that typically attract the highest number of immigrants. Historically, immigrants have had a higher rate of underemployment than people educated in Canada, a condition discussed later in this report. The higher level of engineering underemployment in Ontario and British Columbia might be attributed, at least partially, to the higher level of immigrant engineers who were unable to find work at the university-level.

SNAPSHOT 3**HOW DO THE AGES OF ONTARIO ENGINEERS COMPARE?**

Much has been written about the difficulty new engineering graduates have in finding entry-level positions in the engineering sector. Conventional wisdom would suggest that fewer young people with engineering degrees work as engineers than older, more experienced workers. According to the NHS, this was not necessarily the case.

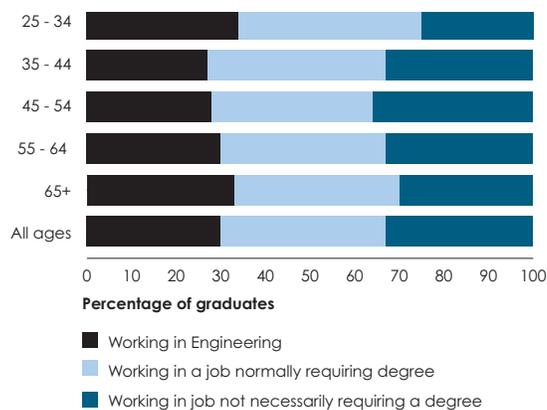
Figure 6 illustrates that at 34.3 per cent, the highest percentage of people employed as engineers or engineering managers were those aged 25-to-34 years who had bachelor's degrees or higher in engineering. This group was the highest of any working age bracket.

At 27.3 and 27.8 per cents, the age groups with the lowest percentages working in engineering were those aged 35-to-44 and 45-to-54 years respectively. Correspondingly, the 25-to-34-year-old group had the lowest per cent of people working in jobs not necessarily requiring a degree at 25.2 per cent. Those aged 45-to-54 years had the highest at 36.3 per cent, a level higher than any other age bracket or provincial average.

OSPE speculates that, even in 2014, the 45-to-54-years bracket corresponds to the ages of large numbers of engineering immigrants who came to Canada in the early 2000's. The higher rate of underemployment could possibly be explained by this. It could also be partially attributed to cases where more seasoned engineers were laid off in the 2008 recession from industries that never fully recovered their employment numbers, such as manufacturing. These professionals may not have been able to find new work as engineers or in professions normally requiring a degree. To make matters worse for this group, according to input OSPE has received from employer focus groups, employers typically will not hire an engineer who has been without an engineering job for five years or more.

As a proportion of people who find jobs normally requiring a degree, including work in engineering, those aged 25-to-34 and 35-to-44 years seem to be faring the best. Almost 75 and 67 per cent, respectively, of people in those age groups were considered to be employed in jobs that typically need and use skills attained from a university degree program. That does not discount the fact that between 25 and 33 per cent of individuals in those two respective age groups were considered to be underemployed, an amount higher than desirable.

FIGURE 6
Comparison of Ontario-employed holders of bachelor's degrees and higher in engineering by age group



Source: Statistics Canada, 2011 National Household Survey

SNAPSHOT 4

HOW DO ONTARIO ENGINEERS COMPARE IN TERMS OF WHERE THEY ATTAINED THEIR DEGREE?

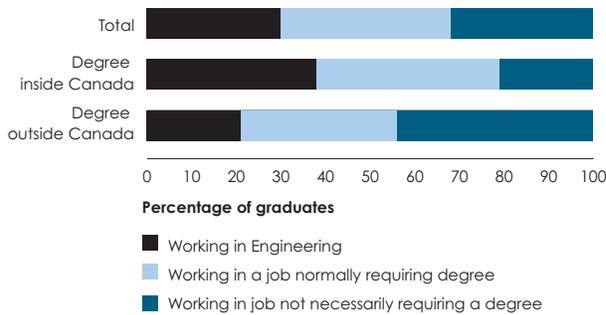
The answer to this question is troubling. Fully half of employed individuals in Ontario with engineering degrees attained their degree outside of Canada (112,955), compared to 112,535 who had a Canadian degree. (We are unable to determine whether Canadian citizens had obtained degrees outside Canada.) However, for the purposes of our discussion, we will assume that those with degrees from outside Canada are immigrants and internationally trained engineers (ITEs).

Among immigrants, 23,975 worked as engineers or engineering managers versus 43,060 of those with a degree from Canada. This means only 21.2 per cent of ITEs were working in their field of study, compared to 38.3 per cent of those with Canadian degrees. If, as discussed earlier, 29.7 per cent of all engineering-degree holders working in engineering is considered low, this 21.2 per cent figure is considerably worse. It means that only about 21 of every 100 ITEs was working in engineering in Ontario.

The picture is even gloomier when we consider other jobs at which engineering-degree holders worked. Of those jobs that typically require a degree, only 35 per cent of those with engineering degrees from outside Canada held them, compared to 40.5 per cent of Canadian degree holders. For jobs that meet our definition of underemployment (not necessarily requiring a degree), fully 43.8 per cent of ITEs held them, versus only 21.2 per cent of those with a Canadian degree.

From an immigration perspective, this indicates that for every 100 immigrants arriving in Ontario with an engineering degree, 44 of them can expect to work in a job not requiring a degree, let alone an engineering degree. (Note that almost 10,000 ITEs worked as engineering technicians, jobs which do not require a degree and so meet our definition of underemployment. At least these jobs fall within the engineering field or could potentially lead to jobs in engineering.) Figure 7 graphically describes the above findings.

FIGURE 7
Comparison of the types of jobs employing engineering-degree holders by location of study.



Source: Statistics Canada, 2011 National Household Survey

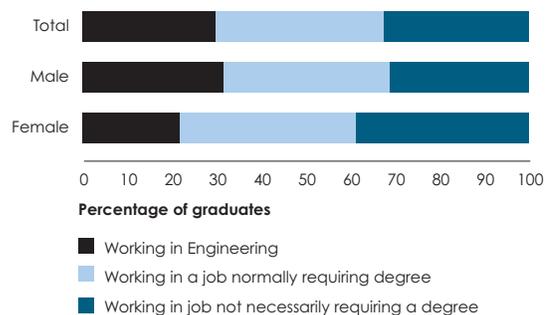
No discussion of immigration can take place without addressing the role of temporary foreign workers (TFWs). In 2001 and 2002, foreign engineers who arrived in Canada peaked at almost 12,000 permanent immigrants and over 2,000 TFWs. In recent years, TFWs have exceeded permanent immigrants as a source of foreign engineers. However, in 2014, many changes were made to the TFW program that led to significant restrictions on obtaining approvals to hire TFW engineers. OSPE analysis has shown that, overall, TFWs do not have a significant impact on the engineering profession in Ontario. More information can be found in the Fall 2013 issue of OSPE's *The Voice* magazine.

SNAPSHOT 5
HOW DO ONTARIO ENGINEERS COMPARE IN TERMS OF GENDER?

The answer to this question is only slightly less troubling than that for immigrants. At the time of the 2011 NHS, there were 40,130 employed females with engineering degrees in Ontario versus 185,365 males. Women represented 17.8 per cent of the total number of people in Ontario with an engineering degree. However, out of 225,490 employed Ontarians with engineering degrees, only 67,040 worked in engineering. Of those 67,040, 8,695 women and 58,355 men reported that they work as engineers or engineering manager. Thus, women represented only 13.0 per cent of the engineering workforce.

Out of the total population of 40,130 women with engineering degrees, 21.7 per cent worked in engineering, a low figure by OSPE's standards and in line with the per cent of immigrant engineers working in engineering. At 39.6 per cent, 15,895 worked in a professional occupation, slightly more than their male counterparts (37.4 per cent). However, at 38.7 per cent, more women than men (31.2 per cent) worked in jobs deemed as underemployment (Figure 8).

FIGURE 8
Comparison of the types of jobs in which engineering-degree holders are employed in by gender



Source: Statistics Canada, 2011 National Household Survey

This low number may be due, in part, to the fact that the NHS asked respondents to indicate only the highest degree they had obtained. There may be many women-engineering-bachelor-degree holders who went on to obtain a masters degree in another discipline, especially an MBA. Analyzing whether the engineering degree was obtained inside or outside Canada, categorized by male and female, may also shed light on the situation.

SNAPSHOT 6

HOW DO ONTARIO ENGINEERS COMPARE IN TERMS OF LOCATION OF STUDY CATEGORIZED BY GENDER?

An analysis between genders and where degrees were obtained clearly indicates that Canadian-educated males with engineering degrees have an advantage over those with degrees from outside Canada, and over all females.

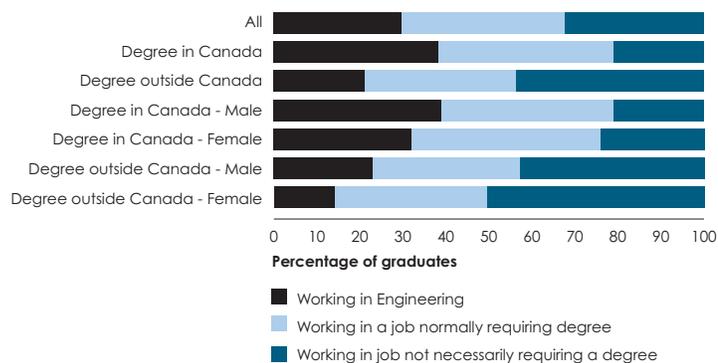
Among Canadian-educated-male-engineering-degree holders, 38.3 per cent worked as engineers or engineering managers. This compares to 32.1 per cent of Canadian-educated females, 23.1 per cent for non-Canadian-educated-males and only 14.1 per cent for non-Canadian-educated females. In other words, only 14 out of 100 women ITEs were working in engineering in Ontario.

At 21.2 per cent, a significant number of Canadian-educated males with engineering degrees worked in jobs not necessarily requiring a degree (underemployed). While OSPE considers this high, it compares favourably to the rate of Canadian-educated females who hold engineering degrees (25.2 per cent), male holders of engineering degrees who were not educated in Canada (42.3 per cent) and female holders of engineering degrees who were not educated in Canada (48.5 per cent). Fully half of women ITEs may be considered underemployed – an astounding number (Figure 9).

There is another surprising comparison concerning the overall number of Ontarians who have engineering degrees: There were more females with non-Canadian engineering degrees than with Canadian degrees (23,200 and 16,925, respectively). Of the previously stated 17.8 per cent of all engineering-degree holders who were female, 10.3 per cent were non-Canadian educated and 7.5 per cent were Canadian educated.

FIGURE 9

Comparison of the types of jobs engineering-degree holders have by gender and location of study



Source: Statistics Canada, 2011 National Household Survey

DOES WORKING IN ENGINEERING RESULT IN HIGHER INCOME?

SNAPSHOT 7

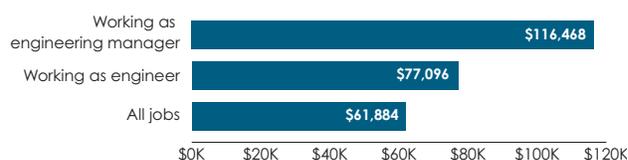
WHAT ARE THE OVERALL INCOMES OF ENGINEERS AND ENGINEERING MANAGERS COMPARED TO JOBS IN OTHER FIELDS?

Do employers recognize that people with engineering degrees have analytic and problem-solving skills that add value to the work they do? If so, those with engineering degrees, no matter what work they do, may have higher incomes than those with other types of degrees working in the same job categories. Looking only at jobs classified as engineering, individuals working as engineers and with engineering degrees earned a median income of \$77,096. Engineering managers earned \$116,468. Figure 10 demonstrates incomes are much higher for engineering-degree holders working in engineering than all other jobs.

We compared the median income of engineering-degree holders working as engineers to the median incomes of all types of degrees in non-engineering job categories. The incomes were lower for engineers (\$77,096 versus \$84,049) only in the major job category of management, who earn 9 per cent more. In the subcategories of mathematicians/statisticians, the difference was just 1 per cent (\$77,096 versus \$77,603) and in front-line protection (police, fire-fighters) it was 15 per cent (\$77,096 versus \$88,347).

No major job categories displayed median income levels higher than those of engineering managers. Overall, the overall median income of all occupations of engineering-degree holders (\$61,884) was 20 per cent lower than the median salary of individuals working as engineers (\$77,096). The difference is 47 per cent less than engineering managers (\$61,884 versus \$116,468). The 2011 NHS therefore indicated that the incomes of engineering-degree holders working as engineers or engineering managers did indeed compare favourably to income levels of engineering-degree holders in non-engineering jobs.

FIGURE 10
Median income of engineering-degree holders working in engineering and in all jobs



SNAPSHOT 8

HOW DO THE INCOMES OF NON-ENGINEERING JOBS HELD BY ENGINEERING-DEGREE HOLDERS COMPARE WITH THE SAME JOBS HELD BY ALL TYPES OF DEGREE HOLDERS?

Across all jobs and all categories, individuals with other types of degrees earned 15 per cent less than individuals with engineering degrees (\$61,884 versus \$52,818). Using a customized database purchased from Statistics Canada, it can be determined what engineering-degree holders earn in all job categories and subcategories. These amounts may then be compared to the incomes of individuals with all types of degrees in the same job categories and subcategories. Three job categories and subcategories warrant separate discussion.

SNAPSHOT 8.1

Subcategory – management (all levels)

This job category had the most engineering-degree holders in non-engineering jobs (35,280). The most prominent variations in income between engineering and all types of degree holders occurred in subcategories of management positions.

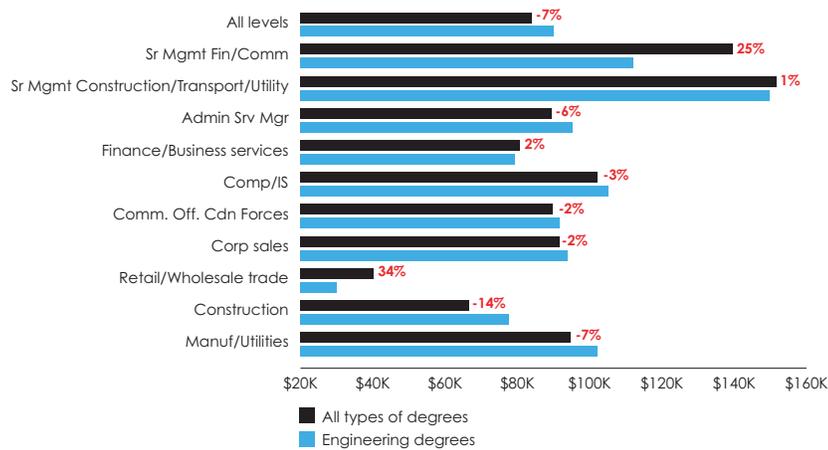
Figure 11 illustrates that, overall, those with engineering degrees working in all types of management, including engineering management, were at a 7 per cent advantage in income earned compared to individuals with non-engineering degrees (\$90,081 versus \$84,049). However, when looking at subcategories of management, in which more than 1,000 individuals with engineering degrees work, there are a few exceptions.

For senior managers in finance and communications, individuals with all types of degrees earned 25 per cent more than those working in the same positions with engineering degrees (\$139,657 versus \$112,073). Similarly, managers in retail and wholesale trade with all types of degrees earned a median income that was 34 per cent more than their counterparts with engineering degrees (\$40,206 versus \$30,052).

In other subcategories of management, the differences in income ranged from 2 to 6 per cent among various types of degrees. All were very near or higher than the median salary of individuals working as engineers (\$77,096). One exception was construction managers, in which individuals with engineering degrees had a 14 per cent advantage over those with all other types of degrees (\$77,688 versus \$66,572).

The category with the highest income was senior manager in construction, transportation and utilities. In these areas, engineer-degree holders earned a median income of \$149,937, slightly less than all types of degree holders (\$151,695).

FIGURE 11
Comparison of median income levels between all degree types and engineering degrees among subcategories of management



Source: Statistics Canada, 2011 National Household Survey

SNAPSHOT 8.2
Subcategory – education

There are anomalies in the data in the overall category of education professionals which suggests a need for more detailed analysis. Within the major category of education professionals, there was an astounding 82 per cent-negative difference in income between individuals with engineering degrees and all degree holders. Only when subcategories are viewed does a more realistic scenario emerge.

The anomaly is in the subcategory of post-secondary teaching/research assistants. These are normally graduate students who earned a median income of \$10,685, with engineering students making even less at \$10,126. Because 13 per cent of all graduate students (3,960 out of 30,370) possessed engineering degrees, their higher numbers skewed the median income figures.

For example, there were 3,960 teaching/research assistants with engineering degrees compared with 2,330 university professors, 1,235 college professors and 1,340 post-secondary instructors with engineering degrees. In income, university professors overall earned 14 per cent less than professors with engineering degrees (\$85,958 versus \$99,852). There was a 30 per cent difference in income between college instructors with all types of degrees and those with engineering degrees (\$50,764 versus \$72,424), while engineering-degree holders teaching in secondary schools earned less than teachers overall (\$65,629 versus \$70,835).

If teaching/research assistants are removed from the equation, education professionals with engineering degrees earned substantially more than their counterparts with all types of degrees, except for secondary teachers. Because we are comparing median incomes, we cannot simply remove a subcategory from the major job category. Therefore, the major job category of education is excluded from graphic comparisons in this report. University professors with engineering degrees earned higher incomes than those working as engineers and in many other jobs normally requiring a degree.

SNAPSHOT 8.3

Subcategory – sales and services

Many individuals with engineering degrees (18,675) worked in sales and services – jobs classified as not necessarily requiring a degree. OSPE deems these individuals to be underemployed given their education. However, this distinction could be refuted when one subcategory of sales and services is considered.

In the category of Technical Sales Specialist – Wholesale, engineering-degree holders earned a median income of \$76,915 compared to \$78,245 for those with all other types of degrees. This \$76,915 was only slightly less than the median income of those working as engineers (\$77,096), and these specialist jobs may also require a university degree or college diploma in engineering.

Despite the relatively high income of technical sales specialists, over 70,000 individuals with engineering degrees worked in jobs not necessarily requiring a degree. This includes six subcategories of the top 10 jobs deemed to be underemployment for engineering-degree holders. An analysis of these top 10 jobs provides an even clearer picture of the income engineering-degree holders are earning.

SNAPSHOT 8.4

Top 10 job subcategories of engineering-degree holders

Figure 12 provides the top 10 job categories (both major and subcategories) in which engineering-degree holders worked (except for the education category for reasons explained above). It also includes their median income, the number of engineering-degree holders working in those

positions, and a comparison of each grouping's median income to the median income of those working as engineers. Only those engineering-degree holders working in management (all levels) had higher earnings than the median income of engineers.

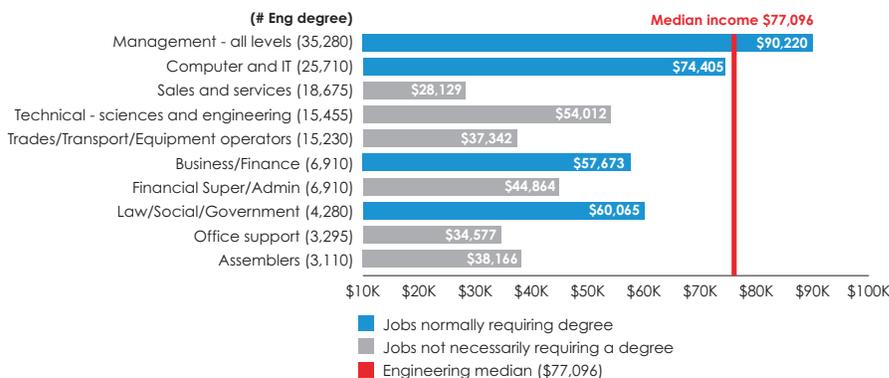
Figure 13 shows median incomes of the top 10 job categories and compares all types of degree holders with engineering-degree holders. When engineering-degree holders in these top 10 non-engineering jobs are compared to all types of degree holders working in the same job categories, it is again clear that engineering-degree holders earned more when working in management (\$90,081 versus \$84,049). For other categories normally requiring a degree, engineering-degree holders earned slightly more in computer/IT (\$74,405 versus \$72,001) but slightly less in business/finance (\$57,673 versus \$61,830) and law/social/government (\$60,064 versus \$63,486).

Engineering-degree holders also had higher incomes than all other types of degree holders when working in jobs not necessarily requiring a degree. Incomes in those categories were clearly less than jobs normally requiring a degree and are all still deemed to be underemployment. Sales and service jobs were the most egregious and represented the third-highest job category employing engineering-degree holders (\$28,129 for engineering-degree holders versus \$22,791 for all types of degrees).

While work as a technologist/technician in engineering may be viewed as a possible stepping stone to working as an engineer, salaries in this category were still lower than jobs requiring a degree. Engineering-degree holders working as technicians earned a median income of \$54,012, marginally higher than those with other types of degrees at \$53,513 (note that the figure does not include diploma holders).

FIGURE 12

Comparison of the median income of engineers (\$77,096) to the median income of engineering-degree holders in major job categories (number of engineering-degree holders in job categories in brackets)



Source: Statistics Canada, 2011 National Household Survey

SNAPSHOT 9
HOW DO INCOME DISPARITIES BETWEEN GENDERS COMPARE IN ENGINEERING AND NON-ENGINEERING JOBS HELD BY ENGINEERING-DEGREE HOLDERS?

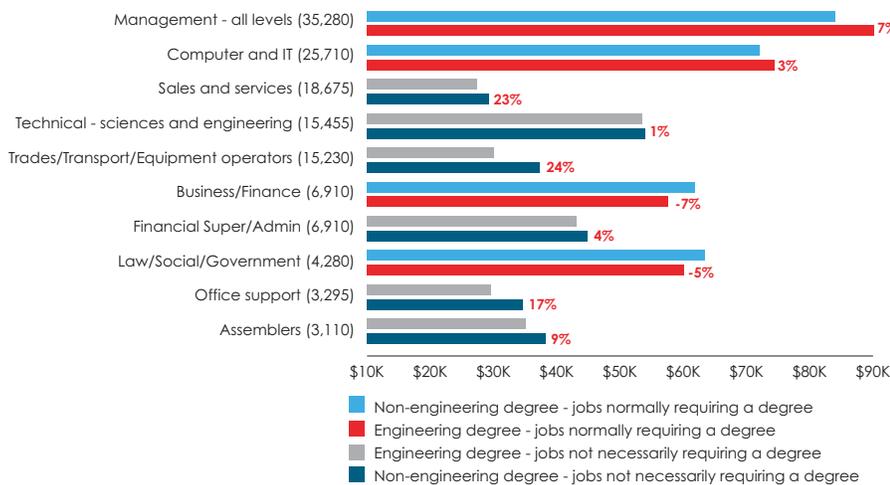
The short answer to this question is, unfortunately, no surprise. Women uniformly earned less than men in the same job categories. Median incomes for those working in engineering were similarly lower for females across the three broad categories cited in this study.

For civil, mechanical, electrical and chemical engineers, women earned 16 per cent less than their male counterparts (\$66,703 versus \$79,540). For other types of engineers, earnings were 15 per cent lower (\$67,284); for engineering managers, 17 per cent lower (\$98,009 versus \$117,489). Differences are much more pronounced in other non-engineering job categories.

The most glaring examples were in management, which is the largest non-engineering job category normally requiring a degree in which both male and female engineering-degree holders work. Overall, women earned 23 per cent less in all types of management than men. Specific types of management were widely divergent, however (Figure 14). Only in one subcategory – senior management in construction, transportation and utilities – did females earn 11 per cent more than males. It should be noted, however, that only 75 females worked in this category versus 1,880 males.

Looking at the top 10 job categories in which engineering-degree holders worked as outlined in Snapshot 8, women earned less than men across the entire spectrum of jobs, both those that normally required a degree and those that did not.

FIGURE 13
Median income of top 10 job categories with degree holders compared to all types of degree holders



Source: Statistics Canada, 2011 National Household Survey

SNAPSHOT 10

HOW DO INCOMES COMPARE BETWEEN LOCATION OF STUDY AND GENDER IN ENGINEERING AND NON-ENGINEERING JOBS HELD BY ENGINEERING-DEGREE HOLDERS?

Not surprisingly, non-Canadian-degree holders fared poorly compared to their Canadian-educated counterparts, especially females. For all non-Canadian-engineering-degree holders working in engineering, the salary differentials were not as great as they were between women and men in the overall population.

Non-Canadian-degree holders working as civil, mechanical, electrical and chemical engineers had median incomes only 10 per cent lower (\$72,760 versus \$79,895) than those who were Canadian educated. (OSPE is not suggesting this is acceptable, but it is a lower figure than in many other job

categories.) For other engineers, income differences were also 10 per cent lower (\$72,397 versus \$80,256). For engineering managers, 13 per cent (\$105,010 versus \$120,691).

Huge differences exist in non-engineering categories, however. For all levels of management occupations, non-Canadian-engineering-degree holders had earnings that were 32 per cent less than Canadian-educated counterparts (\$69,389 versus \$102,097). The only subcategory where non-Canadian-educated-engineering-degree holders earned more than the Canadian educated is, surprisingly, commissioned officers of the Canadian Forces (\$102,939 versus \$91,715). For sales and service jobs not necessarily requiring a degrees, the 12,190 non-Canadian-engineering-degree holders earned 27 per cent less than the median income of the 6,385 Canadian-educated-engineering-degree holders working in jobs in the same category (\$26,190 versus \$35,945). For the top 10 job categories in which engineering-degree holders worked, the findings are similarly troubling (Figure 15).

FIGURE 14

Comparison of median income of engineering-degree holders by gender in management subcategories

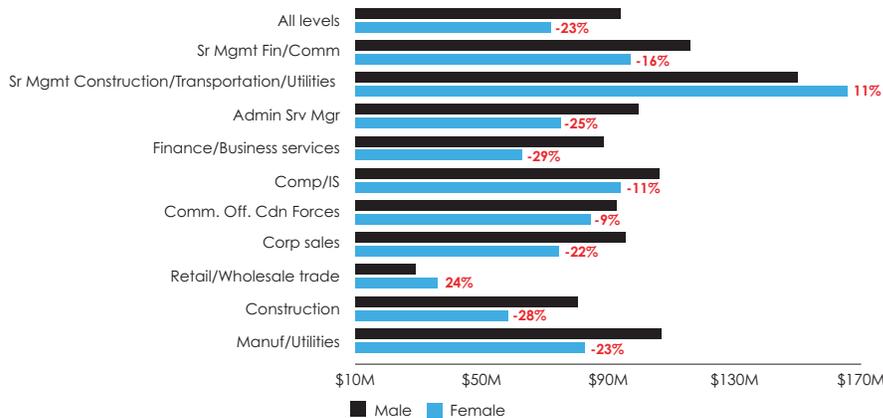
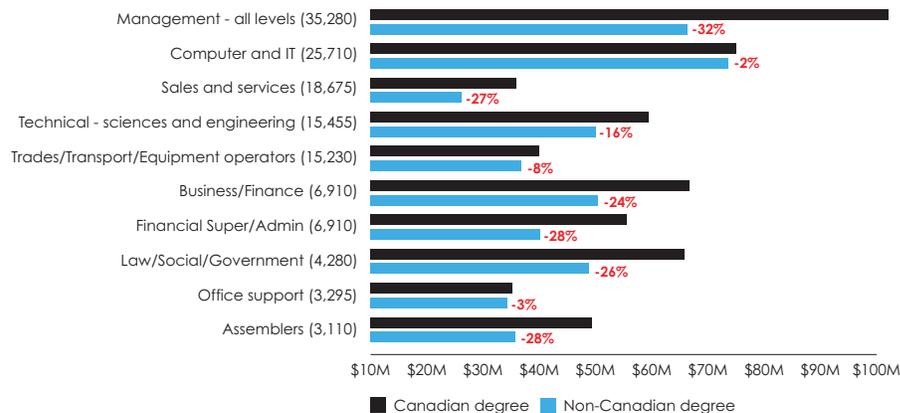


FIGURE 15

Median incomes of the top 10 job categories of degree holders based on location of study compared with all types of degree holders



Source: Statistics Canada, 2011 National Household Survey

SUMMARY

Compared to other regulated professions especially, it is clear that according to the 2011 NHS, most Ontarians with engineering degrees were not working in their field of study. Some argue that engineers leave their chosen profession because of greater opportunities elsewhere, underscoring the great versatility of an engineering degree. While we acknowledge that an engineering degree is accepted by a wide variety of employers, we also believe that this exodus of engineers is an indictment of our profession. It will never be possible to gauge the “happiness” of engineers who work outside of engineering. However, it is possible to measure job satisfaction another way: by wages.

Analysis of the 2011 NHS shows a grim reality. Engineers working outside the engineering sector earned substantially less than those working in engineering, except for those in mid- to senior-management careers. This deflates the notion that most individuals with engineering degrees who left the profession have done better elsewhere. Most engineers who leave the profession are not moving to higher-paying jobs. It is quite probable that engineers leave the profession because they are forced out or never gain entry due to a supply and demand imbalance.

Both economic well-being and quality of life in modern societies are directly related to their level of technological advancement. Engineering is the driver of technological advancement. A high level of underemployment among engineers is therefore an indication that Ontario is not reaching its full economic or quality-of-life potential.

OSPE believes that the underemployment problem for engineers in Ontario is unacceptable and worsening. It is our legitimate role to take action to alleviate the extent of this condition. An improvement in the underemployment situation could bring greater benefit to the more-than 225,000 engineering-degree holders in the province, perhaps more than any other single initiative that OSPE might undertake. It may well be that underemployment is the engineering profession’s greatest challenge and, as such, demands strong and immediate action.

CONCLUSIONS AND MORE QUESTIONS

Conclusions based strictly on the data presented in this snapshot report are subjective, but nonetheless they serve as a foundation of evidence on which to make inferences.

Accepted at face value, OSPE considers that having 33.3 per cent of all Ontarians with bachelor’s degrees or higher in engineering not working as engineers or engineering managers, or in jobs typically requiring a university degree, is simply too high a figure. Further, we believe it is indicative of serious underemployment that needs to be addressed and alleviated.

If other regulated professions had similar proportions of underemployment, it might be inferred to be the norm. But the snapshot that compares ours to other professions does not support this hypothesis. Therefore, we might infer that engineering graduates and immigrants:

- face a more difficult time qualifying for jobs in their field than other major regulated professions; and/or
- are in too great supply for the number of engineering jobs available; and/or
- choose not to work as engineers or engineering managers in greater numbers than do individuals with degrees from other programs in their respective professions.

The 2011 NHS stated there were 75,090 employed individuals living in Ontario at the time of the 2011 census with a degree in engineering but not working as engineers or engineering managers, nor in jobs typically requiring a degree. This may point to a wide variety of issues and generate a variety of questions. Any one, all, or a combination of the following questions may be asked based on the snapshots outlined in this report:

1. Are engineering students who graduate from university reasonably expecting to find employment in engineering?
2. Are we graduating too many engineers in Canada?
3. Are a lack of co-op positions a primary reason why many engineering graduates cannot find work as engineers?

4. Are employers doing their part to generate entry-level positions and train engineers in-house to develop the skills that industry needs? Or to provide co-op positions to engineering students?
5. Are university programs educating engineering students with the essential skills needed to find employment in an engineering field upon graduation?
6. Can the economy grow and strengthen opportunities in order to generate more jobs for engineers?
7. Are some of the 33.3 per cent of the underemployed simply never going to find work as engineers or in professions requiring a degree because of reasons other than demonstrable skills?
8. Are some of these 33.3 per cent of underemployed and/or the 37 per cent who are working in positions requiring a degree, but not as engineers or engineering managers, satisfied with their career paths? Do they desire to work in engineering?
9. Did our immigration system contribute to the underemployment situation? Will recent changes to the system improve the rate of engineering and professional employment among permanent immigrants with engineering degrees?
10. What role, if any, does mentorship have in assisting new Canadians and recent graduates to find appropriate employment within their fields of interest?
11. Given the high rate of underemployment, why does government and some industry leaders believe there is a shortage of engineers in the province?
12. Are our government policies contributing to weak job prospects for engineering graduates given that a significant portion of job growth in recent decades in developed countries has been created by sectors that are driven by engineering innovations?

It is obvious that definitive answers to these questions may be challenging to obtain. Others, such as questions about job satisfaction, can be answered only with exhaustive and costly opinion polling.

Regardless of the questions this snapshot analysis has raised, and recognizing that conclusions are based on imperfect data, OSPE nonetheless considers underemployment to be a serious problem for people with engineering degrees. It is one that OSPE, government, educational institutions and industry should seek to alleviate.

WHERE TO GO FROM HERE?

No matter what term is used – skills shortage, labour shortage, skills mismatch, or underemployment – the issue is the same. Having university-educated individuals working in jobs that don't necessarily require a degree behooves all stakeholders to step-up and tackle the problem.

Firstly, OSPE advocates that provincial and federal governments improve the quality and availability of labour market information. OSPE strongly urges reinstatement of the mandatory long-form census for 2016 as a step forward to alleviate a lack of data.

Universities need to evaluate their programs to ensure students graduate with the skills industry needs, and to do so without diminishing academic rigour and theoretical foundations.

Industry needs to provide more on-the-job training and provide more co-op opportunities to university students because universities cannot hope to match the real-life learning environment offered in the workplace.

Companies also need to be more culturally aware of cues given by ITEs. These may be interpreted differently between employer and applicant, resulting in qualified individuals losing out on job offers due to misunderstandings. Bridging programs that address the conditions and circumstances leading to severe underemployment for ITEs need to be expanded, and concerted efforts need to be made to alleviate the situation in the first place.

Government needs to do more to encourage industry to provide more co-ops and create more programs to increase innovation and economic growth. As well, communication with potential immigrants needs to be improved so ITEs have a greater awareness of the challenges they will face when seeking employment in Canada. Data on underemployment must be made available to federal and provincial officials for them to take into consideration when setting immigration policies.

Professional associations need to increase advocacy and lobbying efforts to effect change in all these areas.

Finally, students, parents and potential immigrants need to truly assess whether entering an engineering program or moving to Canada is the best fit for the student or immigrant. Students and immigrants who do not have the required aptitude should perhaps be encouraged to investigate opportunities in other professions than engineering.



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