



ONTARIO
SOCIETY
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ENGINEERS

ENGINEERING EMPLOYMENT IN ONTARIO: RESEARCH AND ANALYSIS

From Classroom to Career:

A Snapshot of Employment and Underemployment Among Ontario's Engineering Graduates

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Executive Summary

This report provides a snapshot of indicators based on the disconnect between what employers say – there is a shortage of workers with the specialized skills they need – and the ongoing reports of individuals with engineering degrees who cannot find relevant work. As such, this report concentrates on individuals with engineering degrees working in jobs not necessarily requiring a university degree. Although there is no universally agreed to definition, for the purposes of this report, the Ontario Society of Professional Engineers (OSPE) terms this as “underemployment” and defines it 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.

Information in the report is derived from the Canadian National Census 2011 National Household Survey (NHS). According to the 2011 NHS,¹ only 29.7 per cent (67,045 out of 225,490) of employed individuals in Ontario with a Bachelor's degree or higher in engineering were working as an engineer/engineering manager. A further 37.0 per cent (83,365 out of 225,490) worked in professional positions that normally require a university degree. Therefore, just over 65 per cent of employed Ontarians with engineering degrees were gainfully employed in a profession that requires or benefits from having a university degree. Those not working as an engineer or in a position not necessarily requiring a degree represent 33.3 per cent (75,090 out of 225,490), a proportion that OSPE considers high and that indicates significant underemployment in the engineering profession.

In comparing engineering with other regulated professions, data indicate that by a wide margin, employed individuals with a Bachelor's degree or higher in engineering do not work in their field of study as compared to other professions.

Looking at other provinces, almost 46 per cent of individuals with engineering degrees work as engineers/engineering managers in Alberta versus 29.7 per cent in Ontario, the lowest percentage of all five provinces that were compared as well as Canada as a whole.

Analyzing data based on age groups demonstrates that at 34.3 per cent, employed individuals 25 to 34 years of age with a Bachelor's degree or higher in engineering work as engineers/engineering managers, the highest percentage of any working age bracket. At 27.3 and 27.8 per cents, the age groups with the lowest percentage working as an engineer are 35 to 44 and 45 to 54 year olds, respectively. Correspondingly, the 25 to 34 year old group has the lowest per cent of individuals working in jobs not necessarily requiring a degree, at 25.2 per cent, and the 45 to 54 year old group the highest at 36.3 per cent, a higher level than any other age bracket or provincial average.

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

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The stated NHS number of 75,090 employed individuals living in Ontario at the time of the 2011 census with a degree in engineering but not working as engineers/engineering manager nor in jobs typically requiring a degree could be indicative of a wide variety of issues and generates a variety of questions. Any one, all or a combination of the following questions can be asked based on the snapshots outlined in this report:

1. Are too many engineering degree holders entering the workforce either through immigration or Canada's university system?
2. Are a lack of co-op positions a primary reason why many engineering graduates cannot find work as engineers?
3. Are employers doing their part to generate entry level positions and to train engineers in-house to develop the skills industry needs or providing co-op positions to engineering students?
4. Are university programs educating engineering students in the skills industry needs?
5. Can the Ontario and global economies grow and strengthen to expand opportunities in order to generate more jobs for engineers?
6. Are some of the 33.3 per cent of the underemployed simply not going to find work as engineers or in professions requiring a degree because of reasons other than demonstrable skills?
7. Are some of the 33.3 per cent of underemployed and/or the 37 per cent working in positions requiring a degree but not as engineers/engineering managers satisfied with their career paths and have no desire to work in engineering?
8. Does Canada's immigration system contribute to the underemployment situation? Will recent changes to the system improve the rate of engineering and professional employment among immigrants with engineering degrees?

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Introduction

In recent years, headlines across Canada have raged about ongoing labour and skills shortages within a wide variety of sectors. These shortfalls reportedly cost the economy billions of dollars and threaten Ontario's global competitiveness. OSPE's own research into this issue specific to the 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 are grappling with not being able to find employment in their field of study.

In OSPE conducted interviews and focus groups, engineering employers confirmed they are hard pressed to find experienced individuals to fill specialized engineering positions. Nonetheless, OSPE is seeing many new engineering graduates, internationally trained engineers (ITEs) and even seasoned engineering professionals face significant barriers to finding engineering work.

In late 2012, Engineers Canada released a labour market study, projecting a solid demand of about 5,000 engineering positions in Canada per year through the remainder of this decade. The study also specifically predicts that over 1,300 engineering positions will remain unfilled annually in Ontario. The same study reveals that only 35 per cent of engineering graduates work in engineering or engineering management jobs. Whether this low participation is prompted by choice or necessity is unclear and certainly calls for further research. Either way, a problematic gap remains between industry's challenge in filling engineering positions and a surplus of individuals who have graduated with an engineering degree.

As the advocacy and member services body for Ontario's engineers, OSPE has undertaken an examination of the issue more closely. At this point, we are still facing more questions than answers. However, establishing an evidence-based foundation to help us 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 data that may generate evidence to foster a better understanding of what type of job engineering graduates are employed in is census data.

Despite the disappointing decision by the federal government to eliminate the mandatory long-form census from the 2011 Canadian National Census, detailed information about the type of jobs Canadians held, categorized by the field of study they obtained their degree in, was captured by those voluntarily completing the 2011 National Household Survey (NHS). Data generated from the survey were statistically extrapolated to the general population by Statistics Canada. While Statistics Canada cautions that the numbers cannot be considered completely accurate due to a self-reporting bias and the voluntary nature of compliance, Statistics Canada nonetheless stated to OSPE that it is still valid to describe and analyze the data contained therein. OSPE stresses that the 2011 data analyzed in this report are only one element of the equation to obtain evidence related to determining what jobs engineering graduates are working in. However, it is the only comprehensive data set conveniently available to the public that classifies labour market statistics in such detail and therefore worthy of investigation.

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For the purposes of this report, OSPE makes clear that this is only a snapshot of data solely derived from the 2011 NHS and one table based on the 2006 census and not a comprehensive scholarly analysis. It purposely does not have a literature review as reports on the subject are numerous and readily available through web searches. OSPE considers it a foundation to offer observations and to foster further questions to be raised, and future research and analysis to be conducted.

This snapshot is of key indicators from the 2011 NHS demonstrating whether employed individuals at the time of the census with a Bachelor's degree or higher in engineering in Ontario are working as engineers/engineering managers or in a job normally requiring a university degree. It is apparent that individuals with an engineering degree and working as an engineer/engineering manager can be classified as gainfully employed in their field of study. Jobs typically requiring a university degree include managerial and executive positions in business, finance and industry (excluding engineering), 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 and 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, excluding engineering – all levels	Sales and services workers
Business and finance professionals	Administrators, office support, distribution and scheduling workers
Sciences and mathematics	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, education
Art, culture, recreation and sports – professionals	Art, culture, recreation and sports – talent and technical
Manufacturing professionals	Manufacturing and utilities workers

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OSPE does not have the data to determine whether engineering graduates who pursue other non-engineer positions do so by choice or are forced to do so because they can not find work in engineering. However, surveys of fourth year engineering students conducted by Professional Engineers of Ontario (PEO) overwhelmingly indicate that students intend to pursue working as an engineer upon graduation. If young people do not work as an engineer/engineering manager after graduation, it could mean they were 'pushed' into another job because they could not find engineering employment or 'pulled' into another job that was more appealing than working in engineering. For the purposes of this report, OSPE considers individuals either working as an engineer/engineering manager or in a position normally requiring a university degree as employment utilizing post-secondary education knowledge. These are jobs which an engineering degree is required or highly desirable and/or which uses the skills attained from an engineering degree program, whether they are technical or not (e.g. analytical, problem solving, software development, etc.). OSPE therefore does not consider these jobs as indicative of underemployment. Although from a public education and labour market point of view the government may be concerned that engineering graduates are displacing graduates from arts and science programs in the labour market.

This snapshot of indicators is based on the disconnect between what employers say – there is a shortage of workers with the specialized skills they need – and the ongoing reports of individuals with engineering degrees who cannot find relevant work. As such, this report concentrates on individuals with engineering degrees working in jobs not necessarily requiring a university degree. Although there is no universally agreed-to definition, for the purposes of this report, OSPE terms this as “underemployment” and defines it 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 just because a job may not require a university degree does not necessarily mean it is not gainful employment. Nor does OSPE distinguish if a person is satisfied in a job that is not in their field of study or that requires a university degree. However, it seems reasonable to ask, “Why would society invest thousands of dollars in a full-time university education for individuals who are happy with a job that does not require a university degree?” These individuals can be better served at much lower cost by allowing them to attend specific courses of interest at a college or university level while they are working if the institutions provide that opportunity in their continuing education programs.

While far from exhaustive, the following are key indicators of high relevance to labour market descriptions of what types of jobs engineering graduates are working in.

Snapshot 1: How Does Engineering Compare with Other Professions?

While no comparable table was published by Statistics Canada for the 2011 NHS, data from the 2006 Census were analyzed and presented by Statistics Canada showing 'match' rates for various regulated professions. These indicators demonstrate the per cent of the sampled population by their field of study and whether they were working in a job that matched their degree. As shown in Table 1, only 31 per cent of employed individuals surveyed in 2006 with an engineering degree worked as engineers. That was the lowest match rate of all compared regulated professions.

Further analysis in this report focuses on 2011 data, but based on the 2006 Census, a 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.

According to the 2011 NHS,² only 29.7 per cent (67,045 out of 225,490) of employed individuals in Ontario with a Bachelor's degree or higher in engineering were working as an engineer/engineering manager. A further 37.0 per cent (83,365 out of 225,490) worked in professional positions that normally require a university degree. Therefore just over 65 per cent of employed Ontarians with engineering degrees were gainfully employed in a profession that requires or benefits from having a university degree. Those not working as an engineer or in a position not necessarily requiring a degree represent 33.3 per cent (75,090 out of 225,490), a proportion that OSPE considers high. That indicates significant underemployment in the engineering profession. High underemployment suggests we may have one or more of five potential causes:

- There is an excess supply of engineers entering the labour market, and/or;
- There is an insufficient number of engineering jobs being created in the economy, and/or;
- Employers are demanding specialized knowledge and skills before they will hire an engineer to avoid the costs and time required with on-the-job training, and/or;
- Universities are graduating engineers with insufficient job related skills to successfully compete for the available engineering jobs, and/or;
- Society is, or parents are, pushing students that do not have the aptitude to be good engineers to enter engineering programs with the false assumption that an engineering graduate will always be able to find a good engineering job.

Some additional research and analysis in other jurisdictions such as the United States, the European Union, Australia, etc. may be useful to determine if 33.3 per cent is indeed too high a number by industrialized country norms. If the rate is also high in other industrialized countries, it may suggest more fundamental labour market changes are occurring that may require a coordinated international policy response. Having one-third of engineering graduates working in non-university level jobs is clearly not a healthy situation for an individual country and would be even worse if it applies to all industrialized countries.

² Statistics Canada, 2011 National Household Survey: Data Tables.

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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

Source: Statistics Canada, Census of Population, 2006

It is not the case that a low percentage of degree holders working in their field of study is common amongst other regulated professions in Canada. Figure 1 indicates that by a wide margin, employed individuals in Ontario with a Bachelor's degree or higher in engineering do not work in their field of study as compared to other professions. The red portion of the bars (total working in jobs not necessarily requiring a university degree) indicates the percentage of employed individuals that could be considered underemployed, as defined above in this report. With 33.3 per cent for engineers, the next highest proportion of underemployed for other professions requiring a degree is teaching at 21.8 per cent – still comparatively lower than engineering.

Care should be taken to not compare job outcomes directly between engineering and some of the regulated professions, especially law and medicine. Lawyers and medical doctors need to obtain at least a second degree to pursue licensure. After articling or residency, lawyers or physicians are typically in their late twenties or older. There is usually an age gap between an engineering graduate and a law or medical graduate in terms of work and life experience. Moreover, both lawyers and doctors have

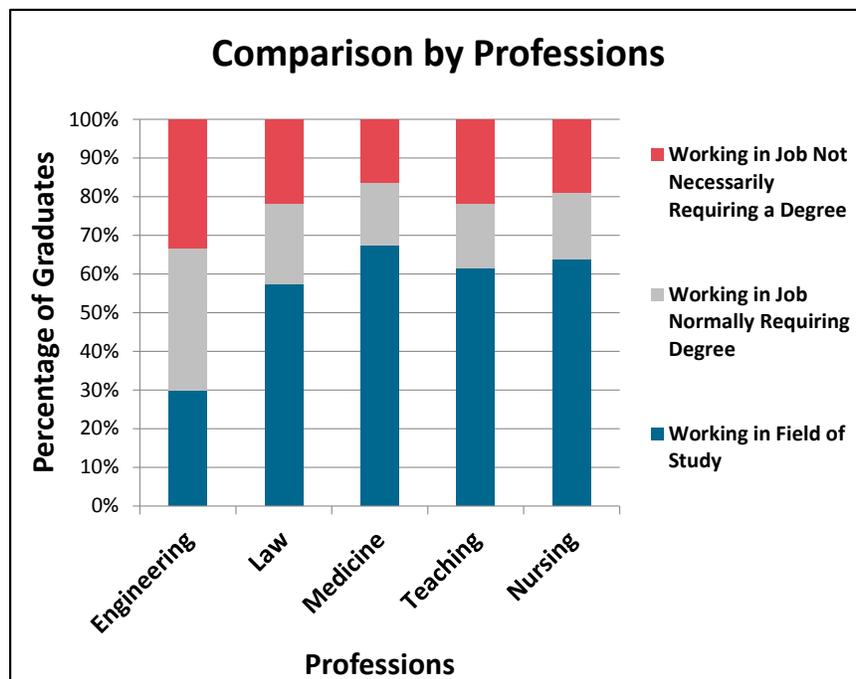
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“structured” articling or residency programs incorporated into their training before they become licensed. Similarly, nursing and teaching programs typically incorporate a practicum whereby students are placed in medical facilities or actual classrooms, respectively, before they graduate. The legal, medical, teaching and nursing professions all have a higher rate of degree holders working in their field of study. Many engineering programs do not incorporate mandatory co-ops or other on-the-job components in their curricula nor do they have “structured” internships after they are employed. Other OSPE research confirms that employers overwhelmingly prefer to hire engineering graduates that have co-op experience. Therefore, is it a coincidence that engineering has among the lowest levels of degree holders working in the engineering field compared with other regulated professions? This snapshot analysis indicates not.

Figure 1

Comparison of Ontario Employed Holders of a Bachelor's Degree or Higher and Type of Job in Selected Regulated Professions Requiring a Degree



Source: Statistic Canada, 2011 National Household Survey

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Snapshot 2:

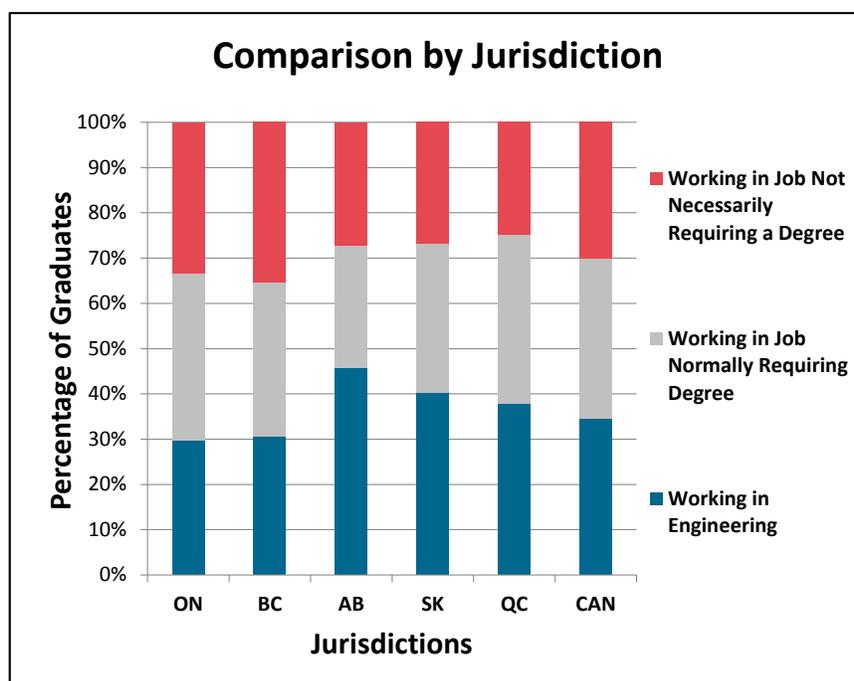
How Do Ontario Engineers Fare Compared to Engineers in Other Provinces?

It is well known that Alberta and Saskatchewan have a high rate of employment of engineers because of their extensive energy resources. The 2011 NHS indeed indicates this, as expected. Figure 2 shows that almost 46 per cent of individuals with engineering degrees work as engineers/engineering managers in Alberta versus 29.7 per cent in Ontario, the lowest percentage of all five provinces that were compared as well as Canada as a whole.

In terms of what is deemed underemployment, Ontario at 33.3 per cent and British Columbia at 35.4 per cent have the highest levels of individuals working in jobs not necessarily requiring a degree amongst all jurisdictions compared, including Canada as a whole. It is also interesting to note that these two provinces contain two of the top three cities (Toronto and Vancouver) that typically attract the highest number of immigrants. While immigration data on specific occupations is not yet available from the 2011 NHS, historically, immigrants have a higher rate of underemployment than those educated in Canada. The higher level of engineering underemployment in Ontario and British Columbia could be partially attributed to a higher number of immigrant engineers who are unable to find work at the university level.

Figure 2

Comparison of Employed Holders of Bachelor's Degrees and Higher in



Source: Statistic Canada, 2011 National Household Survey

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Snapshot 3: How do Ontario Engineers Compare in Terms of Age Groups?

Much has been written about the difficulty new engineering graduates have in finding entry level positions in the engineering sector. Conventional wisdom would expect that fewer young people with engineering degrees work as engineers than older, more experienced workers. According to the 2011 NHS this is not the case.

Figure 3 demonstrates that at 34.3 per cent, employed individuals 25 to 34 years of age with a Bachelor's degree or higher in engineering work as engineers/engineering managers, the highest percentage of any working age bracket. At 27.3 and 27.8 per cents, the age groups with the lowest percentage working as an engineer/engineering manager are 35 to 44 and 45 to 54 year olds, respectively. Correspondingly, the 25 to 34 year old group has the lowest per cent of individuals working in jobs not necessarily requiring a degree, at 25.2 per cent, and the 45 to 54 year old group the highest at 36.3 per cent, a higher level than any other age bracket or provincial average.

While only an hypothesis until further studies are conducted, the 45 to 54 age bracket corresponds to the ages at which large numbers of engineering immigrants who came to Canada in the early 2000s would be at in 2014. The higher rate of underemployment could possibly be explained by this. It could also be partially attributed to more seasoned engineers who were laid off in the 2008 great recession from industries such as manufacturing that never fully recovered in terms of employment numbers. These professionals may not have found new work as an engineer or in professions normally requiring a degree. To make matters worse for this group, employers typically will not hire an engineer who has been without an engineering job for five years or more according to input OSPE has received from employer focus groups.

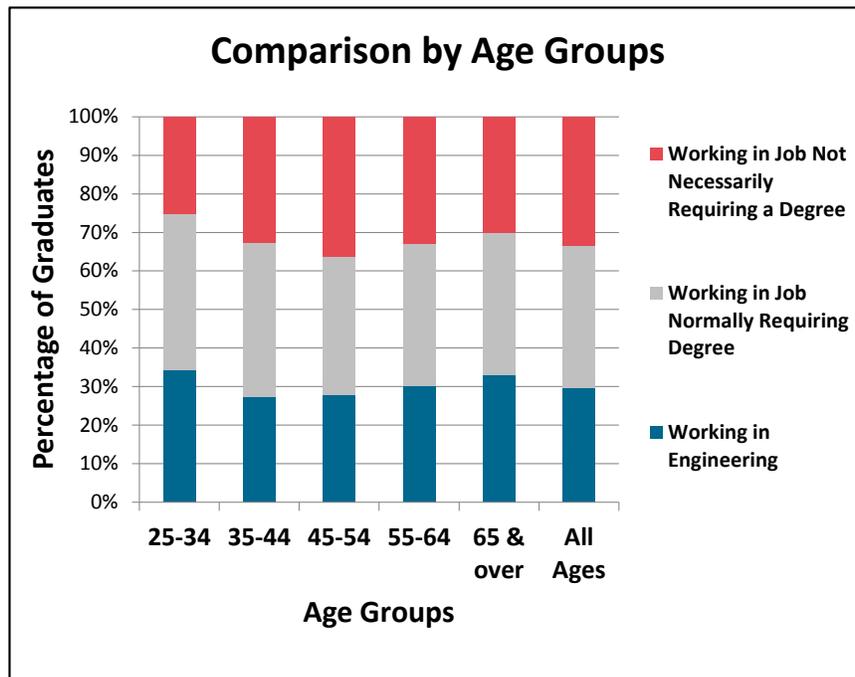
As a proportion of jobs normally requiring a degree, including working in engineering, the 25 to 34 and 35 to 44 year olds seem to be faring the best, with almost 75 and 67 per cent, respectively, of those age groups considered employed in jobs typically needing and utilizing skills attained from a university degree program. That does not discount the fact that between 25 and 33 per cent, respectively, of individuals in those two age groups are considered as underemployed, which is higher than desirable. It remains as a focus for future study whether those who moved or started in non-engineering professions normally requiring a degree did so because they could not obtain work as an engineer or if the job was more appealing than working as an engineer.

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Figure 3

Comparison of Ontario Employed Holders of Bachelor's Degree and Higher in Engineering by Age Group



Source: Statistic Canada, 2011 National Household Survey

Conclusions and More Questions

Conclusions based strictly on the data presented in this snapshot report are subjective but nonetheless serve as a foundation of evidence on which to make inferences. Accepted at face value, OSPE considers 33.3 per cent of employed Ontarians with a Bachelor's degree or higher in engineering who do not work as an engineer/engineering manager or in a job typically requiring a university degree as too high and indicative of serious underemployment that needs to be addressed and alleviated.

If other regulated professions had similar proportions of respective underemployment, it could be inferred that such levels of underemployment are the norm. The snapshot comparing other professions, however, does not support this hypothesis. Therefore an inference can be stated that engineering graduates either:

- Face a more difficult time qualifying for jobs in their field than other major regulated professions, and/or;
- There are not enough engineering jobs given the current supply, and/or;
- That more engineering graduates choose not to work as an engineer/engineering manager than graduates from other programs in their respective professions.

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

1. Are too many engineering degree holders entering the workforce either through immigration or Canada's university system?
2. Are a lack of co-op positions a primary reason why many engineering graduates cannot find work as engineers?
3. Are employers doing their part to generate entry level positions and to train engineers in-house to develop the skills industry needs or providing co-op positions to engineering students?
4. Are university programs educating engineering students in the skills industry needs?
5. Can the Ontario and global economies grow and strengthen to expand opportunities in order to generate more jobs for engineers?
6. Are some of the 33.3 per cent of the underemployed simply not going to find work as engineers or in professions requiring a degree because of reasons other than demonstrable skills?
7. Are some of the 33.3 per cent of underemployed and/or the 37 per cent working in positions requiring a degree but not as engineers/engineering managers satisfied with their career paths and have no desire to work in engineering?
8. Does Canada's immigration system contribute to the underemployment situation? Will recent changes to the system improve the rate of engineering and professional employment among immigrants with engineering degrees?

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

Regardless of the questions this snapshot analysis has elicited and recognizing that conclusions are based on an imperfect set of data, OSPE nonetheless considers underemployment as a serious problem for individuals with engineering degrees and 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, underemployment – alleviation of the condition of university educated individuals working in jobs not necessarily requiring a degree involves all stakeholders to tackle the problem. Universities need to evaluate their programs to ensure students graduate with the skills industry needs, without diminishing academic rigour and theoretical foundations. Industry needs to provide more on-the-job training and provide more co-ops to university students because universities cannot hope to match the real life learning environment offered in the workplace. Government needs to provide more incentives to encourage industry to provide more co-ops and paid internships to create more programs to increase innovation and economic growth. Professional associations need to increase advocacy and lobbying efforts to effect change in all areas. Finally, students and parents need to truly assess whether entering an engineering program is the best fit for the student and to encourage students that do not have the required aptitude to investigate opportunities other than a university degree and develop skills other than engineering.

For its part, OSPE will continue to address underemployment and seek to improve the situation by:

- Advocating to both the federal and provincial governments to encourage the creation of more co-ops, paid internships and on-the-job training for students, new graduates, internationally trained engineers and seasoned engineers seeking to transition to a new sector or position as an engineer.
- Partnering with educational organizations and industry associations to examine university engineering programs, with a view to ensuring alignment between those programs and the skills employers need now and for the future.
- Encouraging the expansion of tax incentive programs, which currently help bring college graduates into apprenticeship roles, to include similar programs aimed at integrating university engineering graduates, internationally trained engineers and experienced engineers displaced from sectors that are shrinking, into the workforce.



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