



# THE ENGINEERING LABOUR MARKET IN CANADA: PROJECTIONS TO 2020

FINAL REPORT, OCTOBER, 2012

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Monitoring the pulse of the

# ENGINEERING\*

profession

# Table of Contents

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<i>Executive Summary.....</i>	<i>4</i>
<i>Part 1     Introduction and Methodology.....</i>	<i>11</i>
<i>Part 2     National Overview.....</i>	<i>17</i>
<i>Part 3     Risks and Alternative Scenarios .....</i>	<i>36</i>
<i>Part 4     Labour Market Assessments.....</i>	<i>40</i>
<i>B.C. Overview.....</i>	<i>42</i>
<i>Alberta Overview.....</i>	<i>49</i>
<i>Saskatchewan Overview .....</i>	<i>56</i>
<i>Manitoba Overview .....</i>	<i>62</i>
<i>Ontario Overview .....</i>	<i>67</i>
<i>Québec Overview.....</i>	<i>74</i>
<i>New Brunswick .....</i>	<i>80</i>
<i>Nova Scotia Overview .....</i>	<i>85</i>
<i>Prince Edward Island Overview .....</i>	<i>90</i>
<i>Newfoundland and Labrador Overview .....</i>	<i>91</i>
<i>Part 5     Conclusions.....</i>	<i>96</i>

# Table of Exhibits

---

Market Coverage, Occupations and Provinces.....	5
Exhibit 1.1: Market Coverage, Occupations and Provinces.....	12
Exhibit 1.2: Engineering Labour Market Tracking System, Summary of Main Components.....	13
Exhibit 1.3: Engineering Labour Market Tracking System, Descriptions of Rankings.....	15
Exhibit 2.1: Employment Drivers – Distribution of Growth across Industries, Investment and Provinces.....	18
Exhibit 2.2: National Engineering Employment Growth by Industry (Expansion Demand) Index.....	19
Exhibit 2.2a: Employment Share of Industry, 2012 – Canada.....	20
Exhibit 2.3: Employment Growth Expansion (Expansion Demand).....	21
Exhibit 2.4: Replacement Demand Patterns by Occupation – Canada.....	23
Exhibit 2.5a&b: Replacement Demand, All Occupations by Province.....	24
Exhibit 2.6: Engineering Labour Market Tracking System Supply Side Dynamics.....	25
Exhibit 2.7: Enrolments in Canadian Undergraduate Programs as a Percentage of the Population.....	26
Exhibit 2.8: Trends in Undergraduate Engineering Programs, High and "Discouraged Youth" Case.....	28
Exhibit 2.9a: Trends in Post Secondary Enrolments.....	29
Exhibit 2.9b: Trends in Post Secondary Enrolments.....	30
Exhibit 2.10a: Trends in Engineering Graduates Entering the Labour Force, All Programs.....	31
Exhibit 2.10b: Trends in Engineering Graduates Entering the Labour Force.....	32
Exhibit 2.11: Permanent and Temporary Engineering Immigration to Canada.....	33
Exhibit 3.1: Assessing Risks in the Market Assessments.....	38
Exhibit A.1: Engineering Work Force Estimates 2011, British Columbia.....	43
Exhibit A.2: British Columbia Engineering Employment Growth by Industry.....	44
Exhibit A.3: British Columbia Market Rankings.....	45
Exhibit A.4: British Columbia - Replacement Demand and Supply Side Measures.....	46
Exhibit B.1: Engineering Work Force Estimates 2011, Alberta.....	50
Exhibit B.2: Alberta Engineering Employment Growth by Industry.....	51
Exhibit B.3: Alberta Market Rankings.....	52
Exhibit B.4: Alberta - Replacement Demand and Supply Side Measures.....	53
Exhibit C.1: Engineering Work Force Estimates 2011, Saskatchewan.....	57
Exhibit C.2: Saskatchewan Engineering Employment Growth by Industry.....	58
Exhibit C.3: Saskatchewan Market Rankings.....	59
Exhibit C.4: Saskatchewan - Replacement Demand and Supply Side Measures.....	60
Exhibit D.1: Engineering Work Force Estimates 2011, Manitoba.....	63
Exhibit D.2: Manitoba Engineering Employment Growth.....	64
Exhibit D.3: Manitoba Market Rankings.....	65
Exhibit D.4: Manitoba - Replacement Demand and Supply Side Measures.....	66
Exhibit E.1: Engineering Work Force Estimates 2011, Ontario.....	68
Exhibit E.2: Ontario Engineering Employment Growth by Industry.....	69
Exhibit E.3: Ontario Market Rankings.....	70
Exhibit E.4: Ontario - Replacement Demand and Supply Side Measures.....	72
Exhibit F.1: Engineering Work Force Estimates 2011, Québec.....	75
Exhibit F.2: Québec Engineering Employment Growth by Industry.....	76
Exhibit F.3: Québec Market Rankings.....	77
Exhibit F.4: Québec - Replacement Demand and Supply Side Measures.....	78
Exhibit G.1: Engineering Work Force Estimates 2011, New Brunswick.....	81
Exhibit G.2: New Brunswick Engineering Employment Growth by Industry.....	82
Exhibit G.3: New Brunswick Market Ranking.....	83
Exhibit G.4: New Brunswick - Replacement Demand and Supply Side Measures.....	84
Exhibit H.1: Engineering Work Force Estimates 2011, Nova Scotia.....	86

Exhibit H.2: Nova Scotia Engineering Employment Growth by Industry .....	87
Exhibit H.3: Nova Scotia Market Rankings.....	88
Exhibit H.4: Nova Scotia - Replacement Demand and Supply Side Measures.....	88
Exhibit I.1: Engineering Work Force Estimates 2011, Newfoundland and Labrador.....	92
Exhibit I.2: Newfoundland & Labrador Engineering Employment Growth by Industry.....	93
Exhibit I.3: Newfoundland and Labrador Rankings.....	94
Exhibit I.4: Newfoundland and Labrador - Replacement Demand and Supply Side Measures.....	94

## Executive Summary

The 2012 update of the Engineering Labour Market Tracking System focuses on market imbalances that challenge managers, planners, recruiters and job seekers alike. The core imbalance finds an abundance of Canadians seeking work as engineers coexisting with an acute shortage of engineering skills. There are at least three market realities that contribute to this situation;

First, there is a growing regional imbalance with tighter markets in the west while markets are weaker in the east. Second, requirements to replace retiring engineers far exceed the number of new jobs created by economic growth. This contributes to a skills shortage that is most acute in the market for specialized engineers with over ten years of experience. Third, there is an abundance of young engineering students enrolled in and completing engineering programs but lacking practical skills. As this labour pool grows, there is a coincident increase in engineers arriving as Temporary Foreign Workers to fill job vacancies. Many of the Temporary Foreign Workers will stay in Canada permanently.

Equivalent or larger imbalances can be seen in the specific markets covered in the report; impacting conditions by discipline and province.

These imbalances have been apparent for some years but grow more acute as a rising proportion of the workforce approach retirement and specialized project demands drive recruiting. The 2012 Update considers the potential for enhanced flexibility to help balance markets. Analysis reflects on the potential of consulting (both domestic and foreign) and mobility of engineers across disciplines to help balance markets. Regional mobility of both experienced and new engineers becomes a key factor in labour market planning.

This 2012 update includes a new economic background with a detailed forecast of international conditions, commodity and financial markets and a list of the key industrial, resource, infrastructure and other projects. These drivers are used to track changes in industrial output and, in turn, jobs in engineering. Demographic conditions are the second key driver and detailed analysis of the age distribution of the population, participation, retirement and mortality patterns and immigration are included.

Each update of the system includes improvements and the 2012 version significantly expands coverage of markets (i.e. occupations by province) from 26 in the 2010 version to 79 in the current version. This version also includes a new analysis of risks through the presentation of a base case and alternative scenarios that describe the impact of changes to retirement behaviour, patterns of entry and graduations in post-secondary programs and competitive outcomes for Canadian engineering consulting firms.

Assessments are summarized with a ranking system that describes each market on a scale from 1 (a very weak market with severe challenges for job seekers) to 5 (a very tight market with severe challenges for recruiters). Markets in the middle rank (3) often reflect the various imbalances. They are described as having moderate supply pressures where, for example, new entrants from post-secondary programs will face a difficult job search but recruiting qualified engineers with over five years of experience will also be difficult. See “Rankings” for more details.

### Labour Market Assessments

The core of the system is the 79 market assessments that cover each year from 2011 to 2020. Readers can go straight to this detail through the Labour Markets window or through Exhibit 1.1 here.

This summary highlights conditions by comparing the rankings for each occupation in large provinces. A limited description is available for Prince Edward Island and no market measures are presented for the Yukon, the North-West Territories and Nunavut. Reliable statistical measures are difficult to find or not available for these small markets. All the rankings are built up from a base of economic, demographic and supply side analysis and these common features are set out first. Local conditions including the impact of major investment projects and government policies often move individual market rankings away from the broader trends.

Market Coverage, Occupations and Provinces									
Occupation by Region – Engineers	Newfoundland & Labrador	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Civil engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mechanical engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical & Electronics engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chemical engineers	X	✓	✓	✓	✓	X	✓	✓	✓
Industrial & Manufacturing engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Metallurgical and materials engineers	X	X	X	✓	✓	X	X	✓	✓
Mining engineers	X	X	X	✓	✓	X	✓	✓	✓
Geological engineers	X	X	X	✓	✓	X	✓	✓	✓
Petroleum engineers	✓	X	X	X	✓	X	✓	✓	✓
Aerospace engineers	X	X	X	✓	✓	✓	X	✓	✓
Computer engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Other engineers	X	✓	X	✓	✓	X	X	✓	✓

Source: Prism Economics & Analysis

## *National Trends*

On the demand side labour market conditions are driven by expansion and replacement requirements. The former tracks the jobs added or lost as the economy expands and contracts. These changes are largely associated with output and investment cycles in key “engineering intensive” industries. Replacement demand captures labour requirements related to demographic trends and the departure of engineers as they permanently leave the workforce.

- Expansion demands

Expansion demand forecasts are weaker in the 2012 findings than in earlier reports. This is due to a shift in global conditions to lower spending prompted by high debt levels and restrictive government policies. These features are prominent across Canada with government restraint holding back the economy in most provinces. Major forces adding to growth include investment in machinery and equipment, resource and infrastructure projects. These investments are concentrated in the West and in key industries including mining, oil and gas, transportation and utilities. These are “engineering intensive” activities and provide new jobs for engineers. Manufacturing activity is also strong, but in most regions the gains reflect a recovery from a very steep decline that began in 2007 or earlier. Few manufacturing industries restore output to previous peaks and employment gains are restrained by productivity improvements. Expansion demand, on a national basis, creates 16,000 jobs for engineers from 2011 to 2020 – a gain of 8%. Virtually all the gains are west of Québec.

- Replacement Demands

Replacement demands related to retirement patterns are the dominant issue in labour markets and human resources management. From a national perspective, the average age of engineers varies from a low of 34.6 for computer, petroleum, mining and geological to 42.1 for civil engineers. Large numbers in each group move into their early to mid-60’s from 2011 to 2020. The 2012 report considers minimum levels of annual labour force losses that run from 1.7% to 2.6% of the workforce, each year, as the age profiles rise. These proportions rise in a more complete analysis of “limited retirements” that include the proportion of the work force that take pension benefits while remaining in part time or consulting roles. Adding a provision for limited retirement increases the proportion of the workforce retiring to as much as 4.6% for civil engineers by the end of the scenario in 2020. These conditions will account for over 95,000 job openings as engineers retire and this is the dominant force driving labour requirements and recruiting. Managing this process and recruiting to meet this replacement demand is a priority and it focuses attention on the need to find experienced and specialized engineers.

- Post-Secondary Programs

The demographics of younger Canadians are reflected in patterns of new registrations and graduations from post-secondary engineering programs. Rising trends in enrolments are projected to continue until 2013 or 2014. At this point in the scenario the source population of Canadians under age 34 begins to decline. Declining enrolments may be a factor from 2015 to 2020, but graduations will continue to add to the workforce through most of the coming decade. In the base case scenario the number of new



graduates entering the workforce reaches 102,000 or just under the total requirements of expansion and replacement demand. This pattern might be consistent with an oversupply of young engineers.

- Immigration

Canada has received a large complement of internationally trained engineers over the past decade. Immigration increased in 2011 but remains below the trend set in the past decade. If the current levels are sustained a further 80,000 engineers will arrive by 2020. These gains represent just under half of the immigrants who arrived from 2001 to 2010.

The overall national trends provided above imply that, for much of the coming decade, there will be moderate supply pressures in many markets. This general finding is consistent with the range of rankings reported in the analysis. But broad trends miss very important regional, industry and age driven conditions.

For example, industry feedback validating earlier findings have suggested that demographic trends combine with other factors to create very tight markets for older, experienced and specialized engineers but weaker markets for young graduates.

Regional differences provide distinct variations from national trends.

### *British Columbia*

BC has the tightest engineering labour markets across the coming decade. A strong rebound in 2010 was followed by modest job gains in 2011 and 2012. Supply caught up to demand leaving just moderate supply constraints for all occupations except mining where markets are already tight. New resource and infrastructure projects begin in 2013 and by 2014 all markets are under significant supply pressures (a ranking of 4) by the mid-point of the scenario. These conditions persist in almost every market to 2020. Rising replacement demand adds to expansion demand as the decade progresses. Graduates from post-secondary programs are rising and peak in 2017. These additions are not sufficient to cover demands. Immigration levels are assumed to remain at the relatively low levels reported in 2011.

### *Alberta*

Alberta has similar market conditions to BC across the decade with significant supply pressures (4) as the dominant rank. Like BC, resource and infrastructure projects drive employment but the timing of market shifts is different. Alberta begins the decade with tight conditions related to strong employment growth in 2011. There is a pause in oil and gas and some government infrastructure work in 2013 and 2014 that limits some markets to moderate supply constraints. By 2015 resource investment resumes and both expansion and replacement demand drive tight supply conditions for the balance of the scenario.

Patterns of post-secondary registrations and graduations help moderate constraints in some Alberta markets as both measures rise in each year across the scenario. But post-secondary enrolments in



Alberta have lagged the national trend; adding to the pressures faced by recruiters. Like B.C., immigration to Alberta dropped to lower levels in last five years and these low levels are projected to continue.

### *Saskatchewan*

Markets in Saskatchewan are more cyclical and more varied, but the supply constraints are an issue in the majority of markets across the decade. Like B.C., markets rebounded in 2010 and growth continued during 2011 and 2012. Resource projects are absorbing all available engineers in key occupations – especially mining engineers. Resource and infrastructure projects peak in 2015 and markets weaken after that. Market conditions vary from supply constraints (5) to supply pressures in key occupations from 2013 to 2015 and then an excess of supply in some markets after 2016.

Saskatchewan is a small market with big project demands that come and go. Local post-secondary programs are not able to keep pace. Engineering immigration has been limited and strong current demand is reflected as Canadians from other provinces seek jobs and licensure in Saskatchewan. Limited flexibility in supply may leave markets vulnerable to shifting demand and changing rankings. Cyclical periods of supply constraints would likely be associated with added demands for engineering consulting services and these requirements could be filled from outside the province.

### *Manitoba*

Expansion demands in Manitoba are concentrated in resource and utility projects. The strong recovery in 2010 was followed by few gains in 2011 and 2012. But project demands tighten markets, especially for civil and electrical engineers from 2013 to 2020. A modest manufacturing recovery helps industrial and aerospace engineers. Other markets are varied but there are consistent supply side pressures across the scenario in Manitoba.

As in Saskatchewan, local post-secondary programs cannot match the shifting markets. The industry in Manitoba has encouraged the integration of new engineers. A growing reliance on immigration, especially temporary foreign workers, adds a more flexible supply side. Half of Manitoba's markets face only moderate supply side pressures (3) while the other half are assessed with significant supply pressures (4).

### *Ontario*

Engineering labour markets in Ontario begin the decade with very limited growth from 2011 to 2013. Markets initially have moderate or excess supply (2) conditions. Mild cycles and shifting expansion demand gradually tighten some markets. Resource projects in the north and infrastructure in most regions lead job creation. Steady improvements in manufacturing create supply pressures for industrial engineers. Resource and infrastructure projects add jobs and create significant supply pressures (4) for mining and civil engineers.

Markets move to more moderate supply constraints in the last half of the decade as demand is matched by gains in post-secondary graduates. Immigration in 2011 was at its lowest point since 2006 and this level is extended to 2020 – adding enough engineers given limited gains in expansion demand.

### *Québec*

Demographic limits and government restraint largely eliminate expansion demand for engineers across the scenario. Labour requirements for resource and utility projects early in the decade are not large enough to cover losses in other industries. Replacement demands are significant but moderate increases in graduates from postsecondary programs and immigration are more than sufficient to cover these needs. These demand/supply balances create moderate supply pressures (3) in about half of Québec's engineering labour markets and an excess of supply over demand in the others.

### *New Brunswick and Prince Edward Island*

Major projects are being completed and activity is slowing in most industries in New Brunswick and P.E.I. Expansion demand is limited and labour requirements rise for just civil and industrial engineers. Utility projects in areas like electricity generation drive specialized needs but they are hard to measure in a small market. A moderately older age profile creates high replacement demands in some occupations including civil engineering.

Trends in post-secondary education programs are increasing the number of graduations across most of the scenario. These new engineers may not bring the skills needed to replace the retiring workforce and supply conditions in most markets reflect an imbalance between new and experienced engineers.

### *Nova Scotia*

Labour requirements in Nova Scotia are similar to New Brunswick and P.E.I. with minimal expansion and growing replacement demands. The difference is on the supply side where trends in enrolments and graduates are notably lower. Immigration has declined as well. The result is a risk that as many as one third of engineering labour markets will face significant supply constraints later in the scenario – mainly related to retirements.

### *Newfoundland and Labrador*

Markets in Newfoundland and Labrador are more cyclical than other provinces. This is related to variable expansion demands as major resource and infrastructure projects start and end. The tracking system assigns a portion of these requirements to local engineers, but there is a significant likelihood that strong requirements, especially from 2012 to 2014 will be filled by consulting engineers from outside the province.

Significant supply pressures and even supply constraints (5) are anticipated at regular intervals. These conditions may reflect a shift in demands that will add work in engineering services in markets that have weak conditions and can provide the experience and specialties needed for the Newfoundland and Labrador projects.

## *Conclusions and Next Steps*

Painted in broad strokes, current trends in the supply of engineers across Canada from 2011 to 2020 will leave moderate market pressures and shortfalls given expected requirements. Requirements are heavily skewed to replacing retiring workers with fewer new jobs related to expansion demands. Expansion demands are focused on resource, utility and infrastructure projects and many are in the west. In numerical terms, projected new entrants to the workforce from post-secondary programs meet a large proportion of the requirements and current levels of immigration are more than sufficient to fill the balance.

There is a core imbalance that persists as a large group of Canadians and permanent immigrants are seeking work as engineers but often lack the skills and experience that is sought by recruiters. The result is an oversupply of potential new entrants at the same time as recruiters face a shortage of skills. This is most apparent as retiring engineers take valued skills out of the market and these cannot be replaced by new graduates. The concentration of new jobs in the west and in resource and infrastructure projects is also mismatched with supply trends.

Applying long term projections and detailed analysis of this type to human resource planning or industry HR policy involves risks. Alternative scenarios in the report consider some of the risks that drive market rankings under different conditions. Three alternative scenarios are available to test key assumptions. Differences between the alternative scenarios and the base case suggest that;

- Patterns of “limited retirement” reflect the potential for older engineers to leave fulltime employment, perhaps with a pension, and remain in part time or consulting jobs. Recruiters in large organizations must calculate replacement demands under these conditions.
- Allowance for discouraged youth limiting enrolment in postsecondary programs has a very limited impact on market balances as few of the new students will actually enter the labour markets and the existing student population determines short term trends in graduates.
- A rising share in increasing international opportunities for engineering consulting for Canadian firms will add to expansion demands and create significant supply pressures.

Core imbalances and needed adjustments in individual markets create challenges for human resource planning. Results point to adaptations that will better match supply and demand. For example, the findings imply that markets will function better if human resources planning for engineers includes;

- Retaining older engineers in the workforce longer and adding to programs to accelerate the on-the-job learning of new graduates,
- Adapting post-secondary programs to meet the specialized needs of employers,
- Increasing the supply of engineers in the west, through post-secondary programs and immigration, and
- Added flexibility and portability of specialized engineering services across regions and specialities.

## Part 1 Introduction and Methodology

The 2012 Engineering Labour Market report marks the third update of Engineers Canada’s analysis of human resources issues. This initiative began with the 2008 Engineering and Technology Labour Study. Indeed, this work dates back to the 2003 “From Consideration to Integration” reports on the experience of international engineering graduates in Canada. Each stage of this process has underlined the need for timely and accurate labour market information that will improve decisions by stakeholders including:

- Employers
- Job Seekers
- Potential and new engineering immigrants
- Faculty and students in engineering programs and
- Immigration policymakers

Each update reflects current economic conditions and adds improvements to the system. The 2012 results include a major expansion of the markets covered. Data restrictions in the past have limited the reliability to estimates of all but the biggest markets. Feedback from users has consistently asked for wider coverage of markets (i.e. occupations by region). The 2012 results cover 79 markets – a major increase from the original 26. Details provided for the new markets have been validated through a series of meetings and webinars with key industry stakeholders.<sup>1</sup>

Analysis focuses on *future* labour market conditions. These conditions are measured in “scenarios” that combine several assumptions about international economic conditions, demographics and government policy decisions. These scenarios have associated risks that can be measured by altering key assumptions. The 2012 findings include *alternative scenarios* that assess these risks in three areas:

1. Alternative interpretations of retirement behaviour
2. Alternative international macroeconomic conditions, and
3. Alternative patterns of registrations in engineering post-secondary education programs

See the [Risks and Alternative Scenarios](#) section for more details.

Engineers Canada acknowledges the key contribution of participants in validation discussions and, in particular, the contribution of Randstad Engineering for their support of this work.

Extended coverage of engineering labour markets in the 2012 findings is made possible by the new Provincial Occupational Modeling System (POMS) released by Stokes Economic Consulting in association with Prism Economics and Analysis.<sup>2</sup> The POMS system is based on detailed analysis of Census, labour force and employer data that allows new estimates of employment by occupations and region.

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<sup>1</sup> Webinars and meetings were arranged during August 2012 with provincial associations, engineering faculties and the Association of Consulting Engineers of Canada.

<sup>2</sup> A more detailed description of the economic models maintained at Stokes Economic Consultants and the POMS is available at [workforceoutlooks.ca](http://workforceoutlooks.ca)

Research at Engineers Canada adds further detail through the annual report on enrolments and degrees awarded in post-secondary programs.<sup>3</sup> Earlier versions of the market tracking system have introduced immigration measures to the supply side.

Exhibit #1.1 reports the new market coverage. Each market noted in the exhibit is described later in this report with measures of employment, the available labour force, unemployment, immigration, graduates from post-secondary programs and related market assessments. Some markets have been excluded where there are fewer than 150 employed and limitations in measures of related post-secondary programs. Some province-wide data allows commentary on Prince Edward Island. Data restrictions rule out analysis in the Yukon, the Northwest Territories and Nunavut.

**Exhibit 1.1: Market Coverage, Occupations and Provinces**

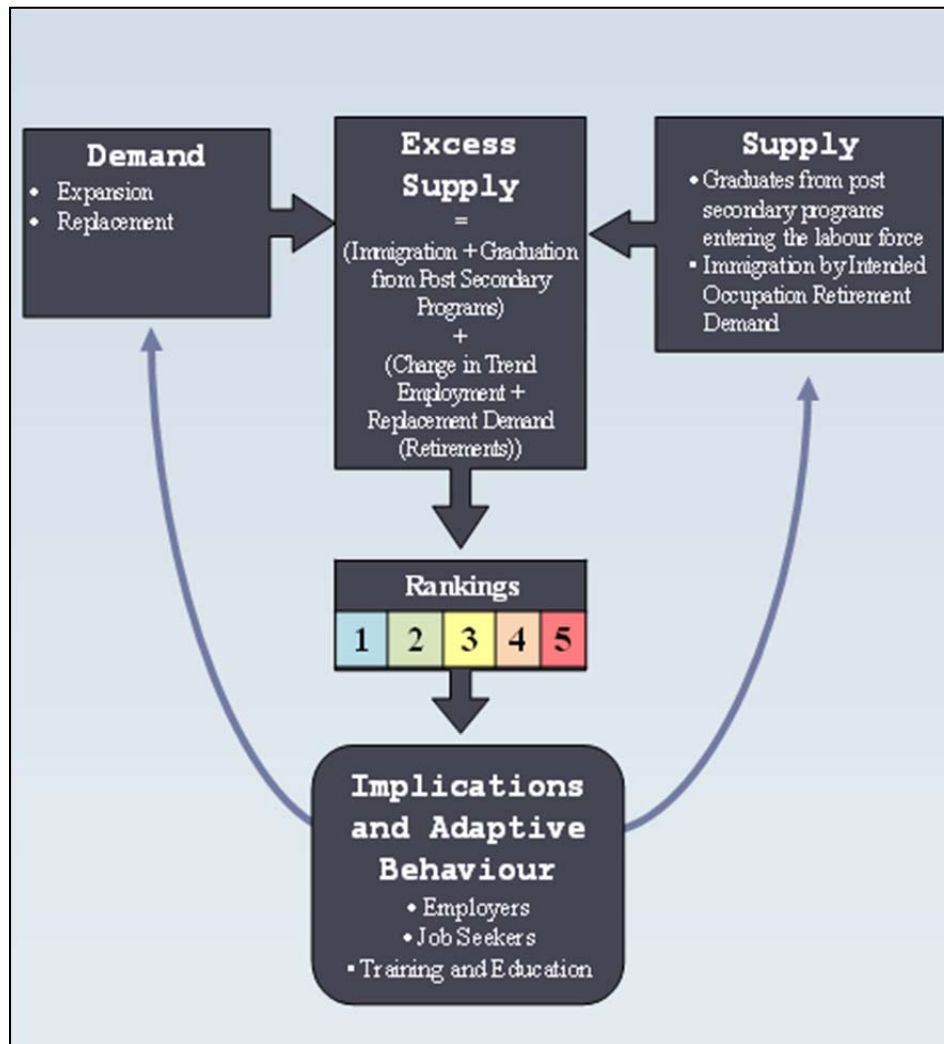
Occupation by Region – Engineers	Newfoundland & Labrador	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Civil engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mechanical engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical & Electronics engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chemical engineers	X	✓	✓	✓	✓	X	✓	✓	✓
Industrial & Manufacturing engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Metallurgical and materials engineers	X	X	X	✓	✓	X	X	✓	✓
Mining engineers	X	X	X	✓	✓	X	✓	✓	✓
Geological engineers	X	X	X	✓	✓	X	✓	✓	✓
Petroleum engineers	✓	X	X	X	✓	X	✓	✓	✓
Aerospace engineers	X	X	X	✓	✓	✓	X	✓	✓
Computer engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Other engineers	X	✓	X	✓	✓	X	X	✓	✓

Source: Prism Economics & Analysis

<sup>3</sup> See “Canadian Engineers for Tomorrow; Trends in Engineering Enrolment and Degrees Awarded 2006 – 2010” Prism Economics and Analysis | The Engineering Labour Market in Canada: Projections to 2020

There are no measures of national markets. Research suggests that national aggregates create broad averages that combine very distinct local conditions. These averages can be very misleading as they conceal critical local factors. A review of national trends for the economy, industries, demographics and post-secondary programs is included in the next section. This description covers trends that apply in each region and form a common thread in all the market assessments. Individual market descriptions cover distinct local conditions that shift labour markets.

**Exhibit 1.2: Engineering Labour Market Tracking System, Summary of Main Components**



Source: Prism Economics & Analysis

Exhibit #1.2 sets out the basic supply and demand measures that are used to assess market balance. Labour requirements are divided into expansion demand and replacement demand. The former tracks the jobs added or lost as the economy expands and contracts. These changes are largely associated with output and investment cycles in key “engineering intensive” industries. Replacement demand captures labour requirements related to demographic trends – both the arrival of new engineers entering the market for the first time and the departure of engineers as they permanently leave the workforce. New entrants can enter the labour force from post-secondary programs and as immigrants.

There are also alternative exit paths as engineers move out of the active workforce into other non-engineering employment (e.g. management) or retire. The connections among these measures are complex. For example, post-secondary education for engineers is a key preparation for the labour market. But there are no fixed links. Many graduates do not enter engineering labour markets at all. Graduates from one program may develop experience and specializations that move them away from their initial education. Thus, for example, chemical engineers may move into petroleum engineering. Links between immigration and labour markets are also uncertain. For example, new permanent immigrants, who intend to work in engineering, may discover that their qualifications are not sufficient to secure work.

The combined impact of all the measures tracked in the system is summarized in a market ranking. Exhibit #1.3 describes the range of rankings, from 1 to 5, that characterize the markets from weak (high unemployment and difficulty with job search) to strong (skill shortages and recruiting from remote markets).



**Exhibit 1.3: Engineering Labour Market Tracking System, Descriptions of Rankings**

<b>1</b>	<b>Significant excess of supply over demand</b> No difficulty in recruiting qualified engineering staff with 0-5 years or 5-10 years of Canadian experience at established compensation norms within the local labour market.
<b>2</b>	<b>Excess of supply over demand</b> No difficulty in recruiting qualified engineering staff with 0-5 years or with 5-10 years of Canadian experience at established compensation norms within the local or regional labour market. The geographic range of recruiting and the range of acceptable qualifications is broader than in 1.
<b>3</b>	<b>Moderate supply pressures</b> Difficulty in recruiting qualified engineering staff with more than 5 years of Canadian experience, with industry or technology-specific skills, and with appropriate non-technical skills. The time required to fill these positions is typically longer than historic norms. Vacancies sometimes need to be re-posted. Employers actively solicit applications from outside the local and regional labour market and reimburse applicants for travel expenses related to interviews, etc. Recruiting engineering staff with 0-5 years of Canadian experience poses fewer challenges.
<b>4</b>	<b>Significant supply pressures</b> Difficulty across the board in recruiting qualified engineering staff in the local and regional labour market. It is normal practice to actively solicit applications from outside the local and regional labour market and to reimburse applicants for travel expenses related to interviews. Employers are generally obliged to improve offered terms of compensation and to assist with re-location costs. Recruitment difficulties lead many employers to increase their use of third-party recruiters and to increase their outsourcing of engineering and technology work to consultancies or staff the assignment with engineering workers from another region. There is a significant increase in the risk of project delays and compensation-driven cost escalations.
<b>5</b>	<b>Supply constraints</b> Systemic difficulty in recruiting qualified engineering staff. International recruiting is common among large employers. There is widespread perception that the consulting sector is working at full capacity and that there is little, if any, remaining scope to outsource engineering and technology work to qualified consultancies with a known track record.

Source: Prism Economics & Analysis

There are several broad trends that span all provinces and occupations; setting the underlying pattern for many rankings. These national patterns are described in Part 2. Part 4 then takes the analysis and commentary down to the level of each market and provides the reader with the details for the key measures.

This report and the associated web site are divided into five parts. This Introduction and Methodology is followed by a National Overview. Part 3 describes the Risks and Alternative Scenarios associated with the market assessments. Part 4 contains the individual Labour Markets Assessments in each province. Part 5 draws the findings together in a discussion of conclusions and implications.

## Part 2      National Overview

*This section sets out the national trends and repeated themes that drive demand and supply. A first section reviews key factors in engineering labour markets and a second section describes the national economic forecast.*

### 2.a      Trends in Industry, Demographics and Post-secondary Programs

Each engineering labour market is analyzed in four major components; expansion and replacement demand and post-secondary programs and immigration. The focus is on recent trends that have shifted the market balance and determine the critical starting point for conditions across the scenarios in all the provinces.

#### Supply and Demand Drivers

The view of labour markets begins with analysis of recent history (2006 to 2010), provides estimates for 2011 and projections from 2012 to 2020. Building blocks for this system include detailed historical data, a model of provincial economic, industry, demographic and investment activity and international measures of other economies and global markets.<sup>4</sup> The addition of the Canadian Provincial Occupational Modeling System (POMS) in this update creates new historical data and projections for the seventy-nine engineering labour markets presented here. Prism Economics and Analysis has collaborated with Stokes Economic Consulting in the development of the POMS system and with the addition of detailed tracking of post-secondary enrolments and degrees awarded data, as well as analysis of retirement patterns for engineers.

##### *i. Industry Projections and Expansion demand*

Projections of industry investment and output are the key driver for expansion demand. Exhibit #2.1 summarizes these trends for seven “engineering intensive” industries and seven categories of investment. These measures – and the related import and export flows – create new job opportunities for engineers. Basic economic forces, described briefly in the national and provincial summaries, dictate trend growth of 2.1% per year, or 22% across the decade, for the economy in general and for industry growth on average. Variations across provinces, industries and investments are highlighted in Exhibit #2.1 where strong growth exceeding 25% from 2011 to 2020 is captured in orange and weak growth below 10%, in green.

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<sup>4</sup> These starting points are developed by the Center for Spatial Economic and Stokes Economic Consulting. The models and historical data are described in a documentation of methodology. See “Provincial Economic Models, June 2010” for a detailed model description and “The Canadian Provincial Occupational Modeling System, July 2011” for a detailed description of the labour markets covered here. The January 2012 economic outlook that drives the market assessments reported here is included in Appendix A.

## Exhibit 2.1 Employment Drivers – Distribution of Growth across Industries, Investment and Provinces

Industry	Growth 2011-2020								
	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Newfoundland & Labrador
Forestry	19.7	39.5	18.9	31.8	20.6	29.2	10.9	2.9	6.3
Oil & Gas Mining	50.1	28.7	8.4	-15.1	14.1	0		64.1	30.9
Mining	42.6	9.5	50.6	28.7	49.2	32.4	75	19.8	23.2
Manufacturing	26	27.3	20.6	24.4	30.6	24.8	18.4	14.3	11.7
Utilities	19.2	27.3	23.7	20.7	21.7	11.7	14.8	11.8	49.7
Construction	17.8	16.1	8.5	14.4	15.1	9.4	5.7	15.2	-9.7
Information, Professional, Scientific, Managerial	27.8	24.2	13.6	19.6	21.6	15.8	13.8	11.5	7.9
Government Services	5.5	21.5	17.8	17.3	6.8	4.8	5.9	7.8	9
<b>Investment by Industry</b>									
Primary	34.6	10.9	-3.6	22.5	15.3	-6.7	18.1	-12.4	-5
Manufacturing	29.9	49.8	-1.7	36.3	59.8	48.6	81.2	33.9	-78.9
Utilities	26.2	0.6	-36	36.5	38	-5.2	20.8	42.4	248.4
Transportation & Warehousing	43.5	14.9	5.7	23.7	14.1	33.9	40.3	46.2	24.8
Government Services	-12.6	7.5	5.7	-4.4	-17.9	-5.3	-0.8	3.2	-23.2
<b>Investment by Asset Class</b>									
Engineering Construction	29.1	1.9	1.4	4.2	7.5	-3.2	5.7	8.7	-1.4
Building Construction	19	31.3	6.7	23.1	12.1	36.5	12.6	32.7	-1.6
Machinery & Equipment	28.1	29.4	1.3	17.7	28.6	18.9	9.8	11.7	-34.8

Strong Growth (exceeds 25%) Weak Growth (below 10%)

Source: Prism Economics & Analysis, CS4E

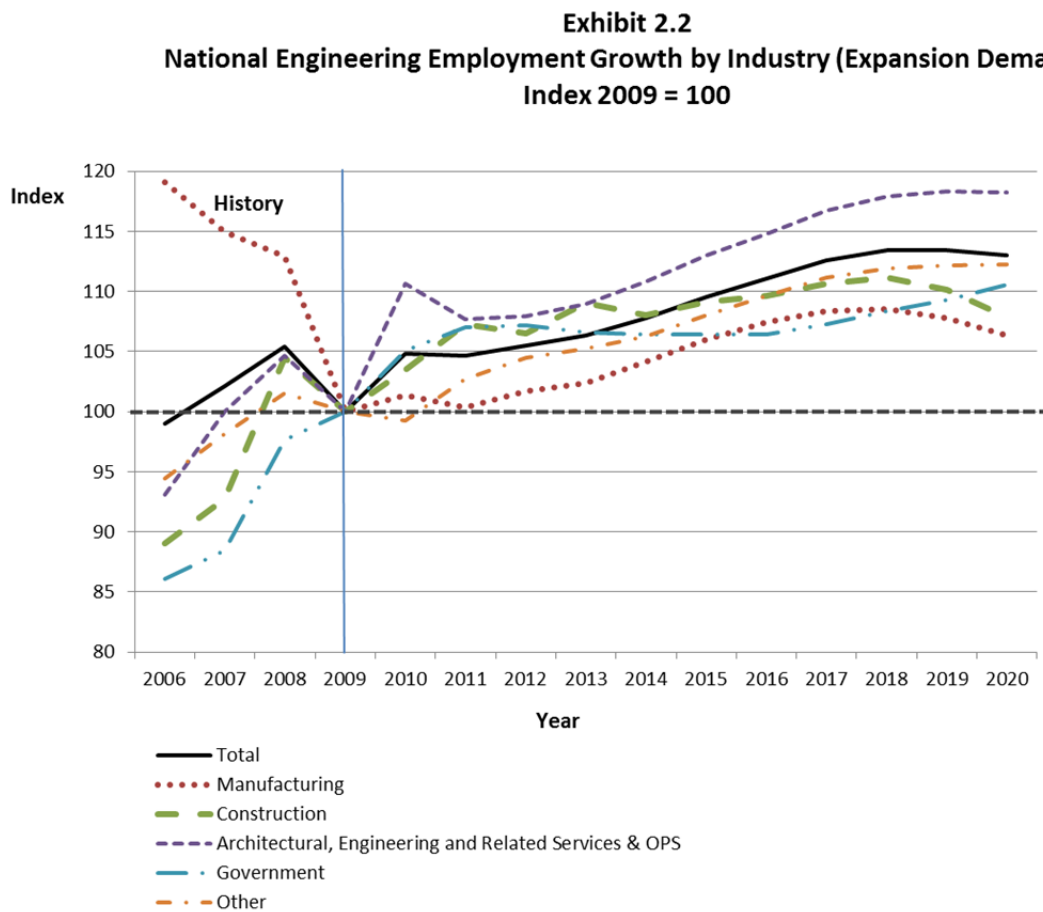
Strong expansion demand is apparent in British Columbia, Alberta and Manitoba. Ontario trends approach the national average and there is weaker growth in Québec and the east. Industry trends are dominated by strength in mining, oil and gas and manufacturing. The expansion of resource industries is moving investment, output and employment into new record high levels and providing the majority of net new jobs. Growth in manufacturing is notable but is best seen in the context of past levels of activity. Output and employment losses in manufacturing across the last decade often exceeded 30% so that projected recovery of 25% or more is not enough to restore activity to previous peak levels. Similarly, the more modest gains in construction and utilities conceal the record high levels achieved in these industries by 2011 and 2012. Even modest growth in these sectors represents important expansion of new capacity.

Government activity is generally among the weakest and this represents declines from recent high levels and steady but modest fiscal restraint.

Investment activity is a particularly powerful “engineering intensive” driver and the stronger industries are also leaders in new investment. Manufacturing, utility and transportation investments are notably strong in many provinces and government investment is weak.

The Engineers Canada system allocates these economic trends to each labour market based on the patterns of employment and specialization in each occupation. Overall the trends point to limited

employment growth in engineering so that a market with gains of 20% across the period from 2011 to 2020 would be well above average.



2009 = 100

Source: Prism Economics & Analysis, C4SE

Exhibit # 2.2 captures the employment changes for all engineering occupations across industries. This Exhibit is designed to highlight both recent history and the projected trends.

The best available historical data suggests that there have been recent, volatile swings in employment – especially in the smaller markets. Cyclical changes include gains in 2007 and 2008 with big losses in 2009. Indeed losses during the recession can exceed 10% in several markets. Evidence on gains in 2010 and 2011 are both important and volatile. Gains are reported in 2010 and these often recouped all jobs lost in 2009; restoring employment but leaving higher unemployment as the work force continued to expand. Finally, 2011 was a weak year in some markets; leaving employment lower or unchanged and unemployment relatively high.

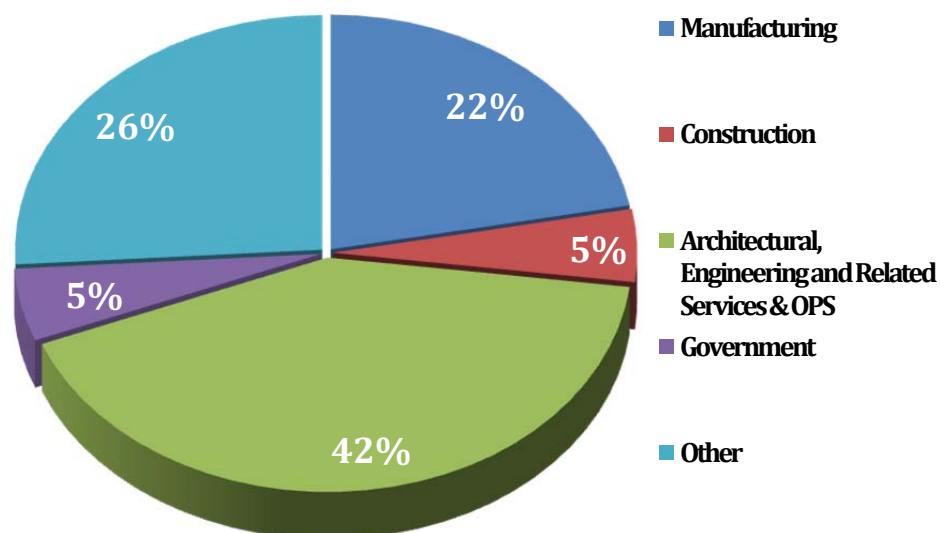
*These short term changes leave weak market conditions in place at the start of the forecast in 2012. Generally weak economic prospects make it likely that the cyclical jump in unemployment in 2009 will not be eliminated soon. This adds a generally weak tone to the assessments of several markets.*

Evidence presented in both the Alberta and Saskatchewan validation sessions documented stronger employment in 2011 and 2012. Revisions in selected markets were introduced to raise the historical starting point for engineering employment in those provinces.

The historical volatility from 2006 to 2011, tracked in Exhibit #2.2, is replaced by steady trend growth from 2012 to 2020.<sup>5</sup> Note that growth is concentrated in resource industries and the services sector. Relative employment gains in resources are a well-documented feature of the Canadian economy and the implications for engineering are derived here. This expansion demand is concentrated in a few occupations and local markets that are highlighted in the next section.

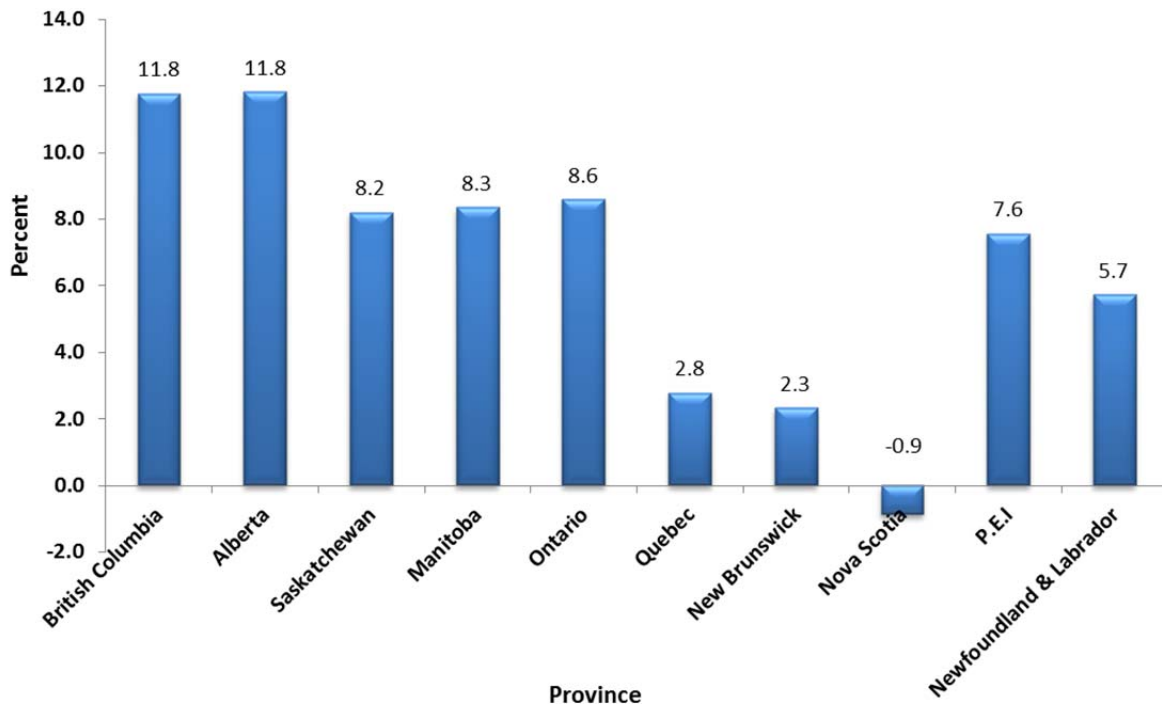
Trends in services reflect a continuing shift as the share of engineering, computer and management consulting employment approaches almost half of the workforce. These labour requirements in consulting services reflect the balance of exports and imports of Canadian engineering consulting. Above average overall growth in services is consistent with strong growth in international consulting. This growth includes both stronger imports of engineering services to fill domestic needs and rising exports as Canadian engineering consultants gain international share. The balance of exports over imports remains largely unchanged from the recent past with *exports ahead of imports*.

**Exhibit 2.2a Employment Share of Industry, 2012 – Canada**



<sup>5</sup> Of course more cyclical change may well occur but industry specific volatility is hard to forecast and would move around the trends set out.

**Exhibit 2.3 - Engineering Employment Growth Expansion (Expansion Demand) by Province, 2011 to 2020**



Source: Prism Economics & Analysis

Exhibit #2.3 summarizes the national trends for expansion demands across the full scenario from 2011 to 2020. Results emphasize the shift to the west and to resource industries. Limited growth in Ontario and Québec reinforce the common, current observation that Canada's economic center of gravity is shifting west.

Employment projections lag behind output, reflecting rising productivity in all industries and for all occupations. Engineers can be described as the agents of innovation and the leaders of productivity gains. It might be expected that employment growth would rise for engineers as investment in machinery and equipment rises and industries grow more efficient. Evidence for these impacts is limited. In the manufacturing sector, where productivity gains are most evident, the limited gains in engineering employment probably reflect the long decline in employment for this group across the past decade. There is a pool of skilled and experienced engineers who are available now to help implement the next wave of manufacturing investment. For example the Ontario labour force for industrial and manufacturing engineers exceeded 11,000 in 2006. Years of weak markets and recession reduced the labour force by 2,000 by 2011 and the 9.5% recovery to 2020 does not create enough jobs to restore the 2006 peak workforce. In other industries, especially mining, the expected pattern is apparent and there are many provincial markets with strong expansion demands and limited supply of mining engineers.



The report returns to the question of engineers as agents in innovation and the role of consulting engineers in the *Risks and Alternative Scenarios* section.

Labour markets for civil and other engineers involved in infrastructure building and other government work are difficult to interpret. On the one hand announced government restraint will certainly reduce employment related to many projects – especially the stimulus projects from 2009 and 2010. On the other hand there are many transportation, transit, electrical generation and transmission and other infrastructure projects in the plans. A closer look at the detail reveals that engineering employment related to federal spending is more restricted and gains in provincial and municipal governments are much stronger. It appears that these offsetting factors balance in many provinces leaving limited employment growth for civil and related occupations.

#### *ii. Trends in replacement demand*

The pattern of expansion demand set out above is often not the first concern of human resource managers. They are more likely to be focused on recruiting specialized or experienced engineers – often as part of a plan to manage retirements. This challenge is gaining prominence as the oldest Boomers pass into their mid-60s. Research into retirement and related human resource issues is clarifying a wide range of possible choices and outcomes. Two alternative scenarios have been developed in the *Risks and Alternative Scenarios* to emphasize the potential impact of alternative outcomes. This analysis estimates “replacement demand” or the number of engineers changing their work patterns as they grow older.

The 2008 and 2010 “Engineering Labour Market Conditions” focused on measuring permanent losses to the engineering labour force as older engineers stop working. This measure of replacement demand is based on labour force statistics that have tracked the permanent exit of each occupation as the work force grows older.<sup>6</sup> Historical patterns are projected into the future and forecast permanent losses to the labour force. *This “labour market loss” measure is used here to define the lowest boundary for replacement.*

Research suggests that the labour market losses described above do not capture a number of engineers who may leave full time jobs as they accept pensions. This group is often included in “retirement” as they represent a loss and must be replaced by employers. A large proportion of engineers accepting a pension may remain in the workforce either working on a part time or consulting basis or in other jobs. Various estimates from employer surveys allow the Engineers Canada research team to approximate *the extent of “limited retirement” as an upper boundary to replacement demand.*<sup>7</sup>

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<sup>6</sup> Traditional statistical sources measure mortality and the decline in their participation rate as the source of permanent exits.

<sup>7</sup> Research done by Prism Economics for large employers of other professional groups like engineers show that the percent of some organizations projected to take pensions can be well over 5% across the coming decade. These measures are tied to the age profile and pension provisions of the organizations and are not representative of the broader workforce.

These research findings suggest lower and upper boundaries that can be used to assess the impacts of both labour market loss and limited retirement. The labour markets assessments set out in Part 4 are based on the upper boundary, i.e. include both labour force losses and limited retirements. The differences in labour market impacts vary by market with the labour force loss calculation rising from 1.6% to 2.5% from 2010 to 2020 depending on the average of the workforce in 2010. Upper bound estimates add together both the limited retirement and the permanent labour market losses and vary from annual losses of 3.3% to over 5.0% based on the age profile of the workforce and average age at retirement.

Exhibit #2.4 describes the range of outcomes for both labour force loss and limited retirement at the national level for each engineering occupation.

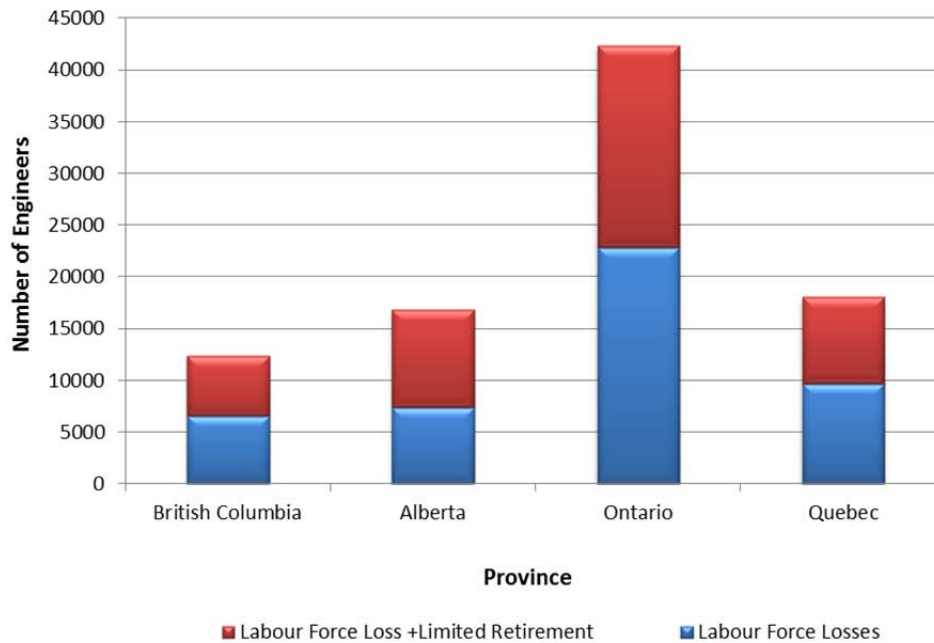
**Exhibit 2.4 Replacement Demand Patterns by Occupation – Canada**

Occupation	Average Age	% of the Labour Force			
		Labour Force Loss		Labour Force Loss + Limited Retirement	
		2011	2020	2011	2020
Civil engineers	42.1	2.47	2.47	4.60	4.60
Mechanical engineers	41.9	2.09	2.12	3.87	3.90
Electrical and electronics engineers	41.9	2.24	2.27	4.16	4.19
Chemical engineers	36.5	1.71	1.77	3.14	3.19
Industrial and manufacturing engineers	36.5	1.92	1.98	3.54	3.60
Metallurgical and materials engineers	36.5	1.88	1.86	3.39	3.37
Mining engineers	36.5	1.88	1.82	3.39	3.33
Geological engineers	34.6	1.86	1.83	3.37	3.35
Petroleum engineers	34.6	1.71	1.77	3.11	3.17
Aerospace engineers	34.6	1.83	1.90	3.35	3.43
Computer engineers (except software engineers)	34.6	1.67	1.78	3.12	3.23
Other professional engineers, n.e.c.	34.6	1.81	1.82	3.32	3.34

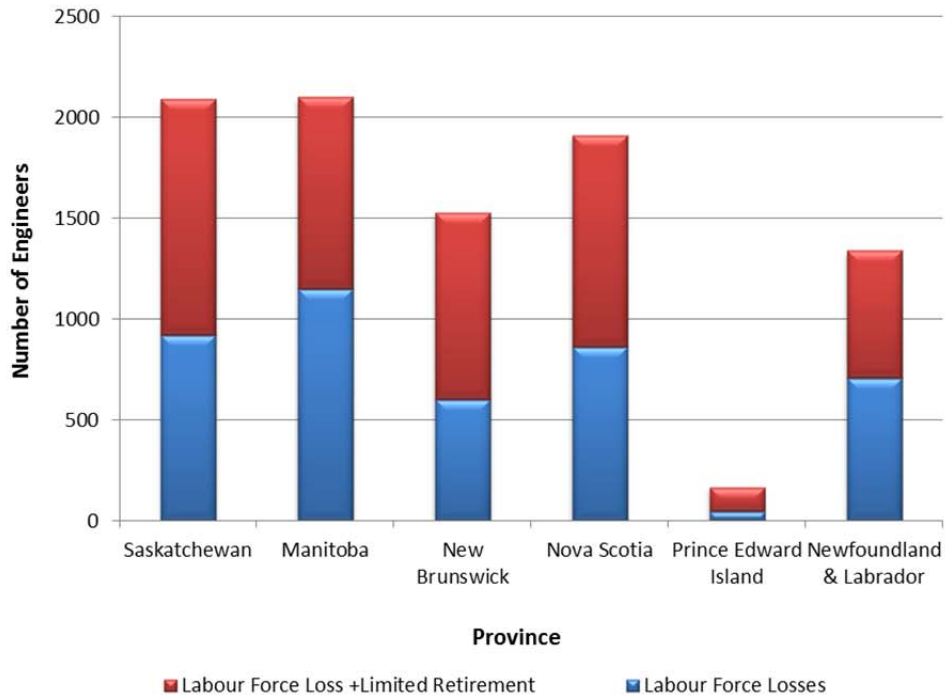
Source: Prism Economics & Analysis

Exhibit # 2.5a and b look at the total replacement demand across the 2011 to 2020 scenario by province. These measures reflect a deliberately wide band that brackets the lowest likely losses and minimum replacement demand with a high measure that adds on the recruiting needs and human resources challenges related to limited retirement.

**Exhibit 2.5a - Replacement Demand, All Occupations by Province, Total Number 2011 to 2020**



**Exhibit 2.5b - Replacement Demand, All Occupations by Province, Total Number 2011 to 2020**



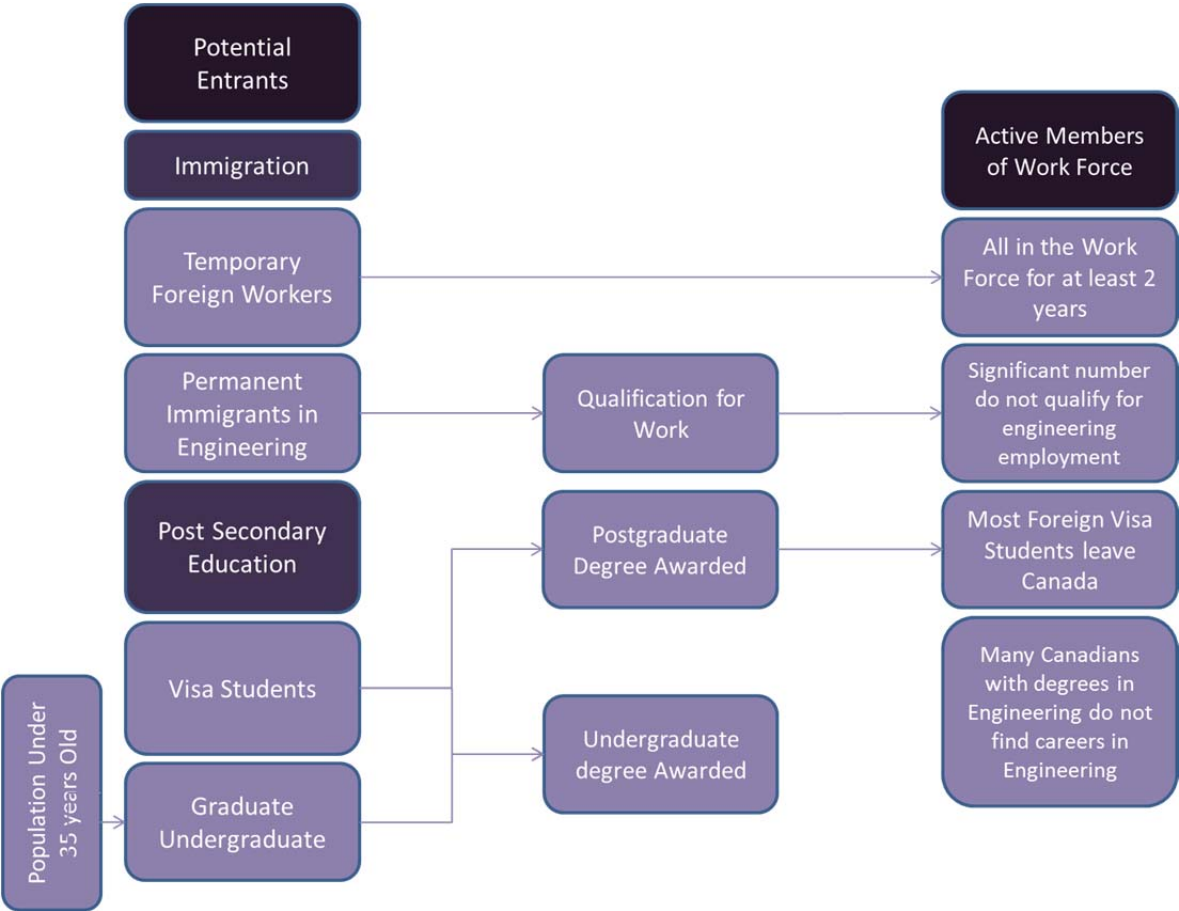
Source: Prism Economics & Analysis

Replacement demand, which is the larger of the two components of demand, is roughly doubled by this accounting for exit behaviour. *The timing and circumstances that surround retirement and permanent exit are the most important factors determining future labour market conditions.*

iii. *New entrants – Post-secondary Programs*

Turning now to the entry side of the labour market, the analysis considers the dynamics of post-secondary enrolments, graduates and immigration. The tracking system has been improved with new links that measure progress across a variety of steps connecting potential entrants with active members of the workforce. Many potential entrants to the workforce do not become active in the labour market. The possible extent of this gap is apparent in the 2006 Census results that show only 49% of engineering graduates are employed in engineering and related occupations. Roughly half of graduates are employed outside engineering and are potentially under-employed. Exhibit #2.6 describes the paths for immigrants and students.

**Exhibit 2.6: Engineering Labour Market Tracking System Supply Side Dynamics**

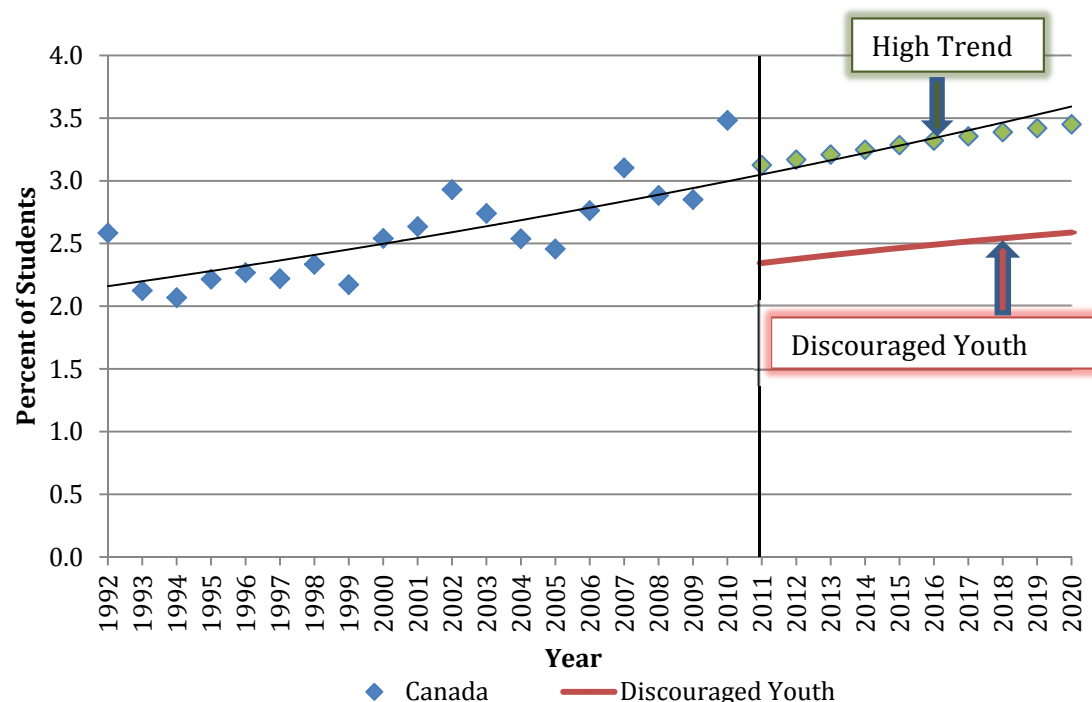


Source: Prism Economics & Analysis

The steps that separate potential entrants from active participation can be minimal (e.g. Temporary Foreign Workers are in the workforce on arrival) to extended (e.g. few Canadian first year undergraduates will take all the steps to find a career in engineering).

The 2012 Engineers Canada system has added another improvement, at the very first stage, as it tracks the proportion of each province's population under age 34 entering engineering programs. Exhibit #2.7 tracks the national experience, showing that the proportion of undergraduates entering engineering programs has been on a rising trend. These trends are extrapolated into the future – assuming continuing gains in the proportion of the young population entering engineering programs.

**Exhibit 2.7 - Enrolments in Canadian Undergraduate Programs as a Percentage of the Population Under Age 34, Canada, All Programs**



Source: Engineers Canada, Prism Economics & Analysis

This rising trend is a generally positive signal for engineering and the economy.

Data released by Engineers Canada provides a more detailed accounting for the population of engineering students and graduates.<sup>8</sup> These trends point to a large and growing engineering student enrolment that may not match the emerging labour requirements. For example the growth in enrolments from 2007 to 2011 is below the national average in Alberta and Saskatchewan – perhaps

<sup>8</sup> Trends are documented in the Engineers Canada publication "Canadian Engineers for Tomorrow; Trends in Enrolment and Degrees Awarded – 2006 to 2010". 2011 data will be released in the Fall of 2012.

signalling constraints in the strongest job markets for engineers. Data for degrees awarded across the provinces show more strength in Alberta and Saskatchewan but point to another problem. The rapid rise in visa students has translated into a 24% increase in enrolment and 34% jump in degrees awarded to foreign students but just 3.4% gain for Canadian enrolments while degrees awarded to residents declined across the 2007 to 2011 period. .

Other trends point to imbalance in the post-secondary system as, for example, enrolment for electrical engineers is declining while civil programs are growing rapidly.

At the same time, changes to the system point to growing flexibility that will better match the changing supply of engineers to employer requirements. Discussions with stakeholders highlighted;

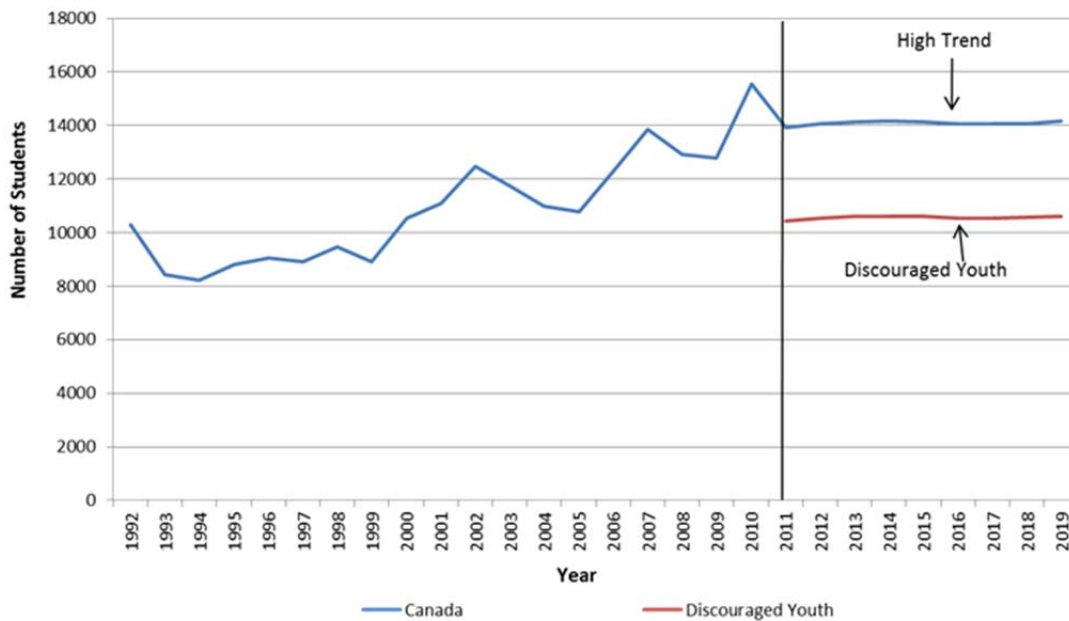
- government policy to retain foreign students in Canada,
- new programs that add practical business skills to undergraduate programs and
- internationalization of engineering programs

These findings confirm past evidence that the initial labour market experience of Canadians completing undergraduate programs has not been encouraging. Employers report an abundance of candidates in this category and job seekers report difficulties finding work.

These findings have prompted an alternative scenario for engineering markets based on a lower trend in undergraduate registrations. The trend calculation in Exhibit 2.7 assumes that rising numbers of visa students continue to choose Canadian universities and that a growing proportion of the Canadian youth chose engineering. A more pessimistic view, called “discouraged youth” is constructed where this key proportion is set 25% below the trend in every labour market. See *“Risks and Alternative Scenarios”* for more details. This pessimistic view assumes that Canadian youth realize that the weak economy will generate limited job opportunities and foreign youth recognise the limited success of permanent immigrants arriving in Canada with the intention to work as engineers. The “discouraged youth” scenario therefore assumes a long term drop in new registrations and then in degrees awarded in engineering.

Exhibit 2.8 provides data on new registrations in engineering programs since 1991. Registrations rise on a mildly cyclical trend with a 34% increase over the twenty years from 1992 to 2012. Almost all of this gain is a result of the rise in engineering registrations as a percent of the population as the source population has changed very little over that period. Since 2006 a large proportion of the increase in registrations is related to new visa students.

**Exhibit 2.8 - Trends in Undergraduate Engineering Programs, Canada, All Programs, High and "Discouraged Youth" Case**



Source: Engineers Canada, Prism Economics & Analysis

Note that the “Discouraged Youth” case moves the share of population back down towards the levels of the 90s and mid-2000s. The impact of lower enrolments is considered later in the report.

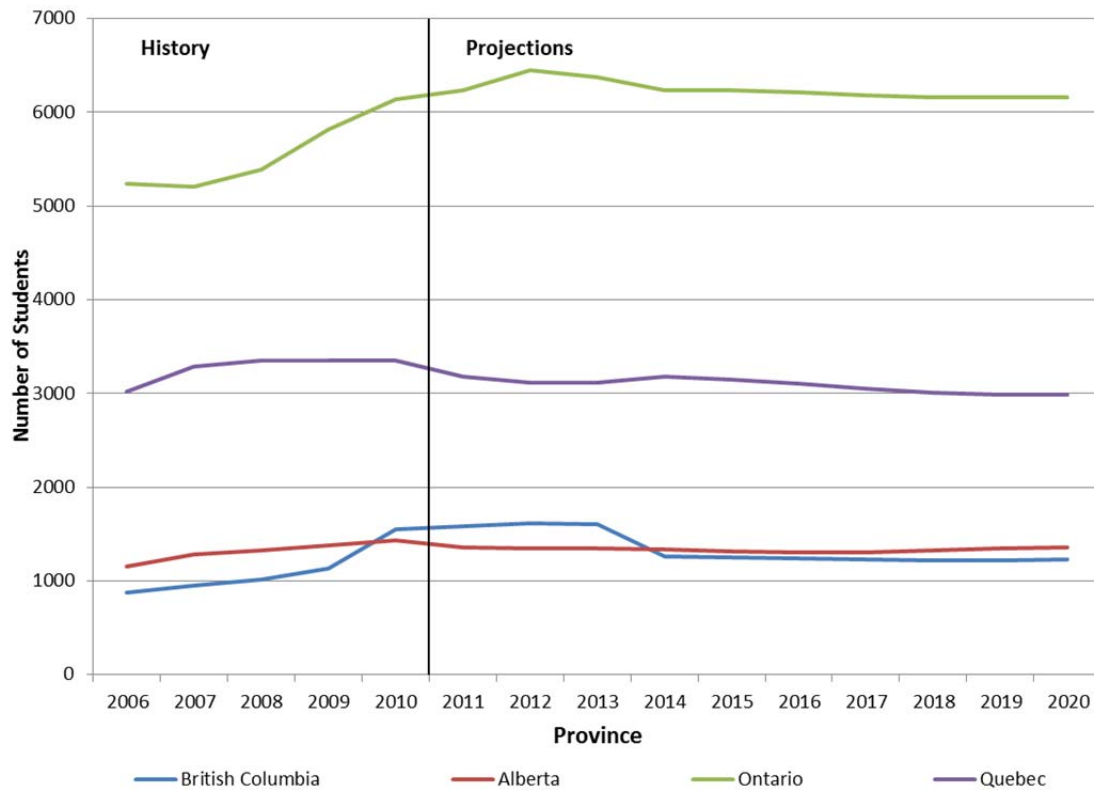
The forecast level of higher new registrations reflects the rising share of a declining population. Canada’s population under age 34 is projected to peak in 2012 and decline in each subsequent year. In the high case, engineering programs would continue to attract a rising portion of youth.

National trends for all occupations are often not a good guide for local markets. There are large variations in all these measures across markets and Part 4 below highlights many distinct patterns of enrolments and graduations.

New enrolments each year are tracked on Exhibit # 2.9 a and b. Degrees awarded each year are linked to registrations four or five years earlier so that annual variations will impact the supply side of labour markets. Note, in particular, the large rise in enrolments in 2010, the last year of actual data. This gain shows up as an increase in graduates and potential market entrants starting in 2014 and 2015.

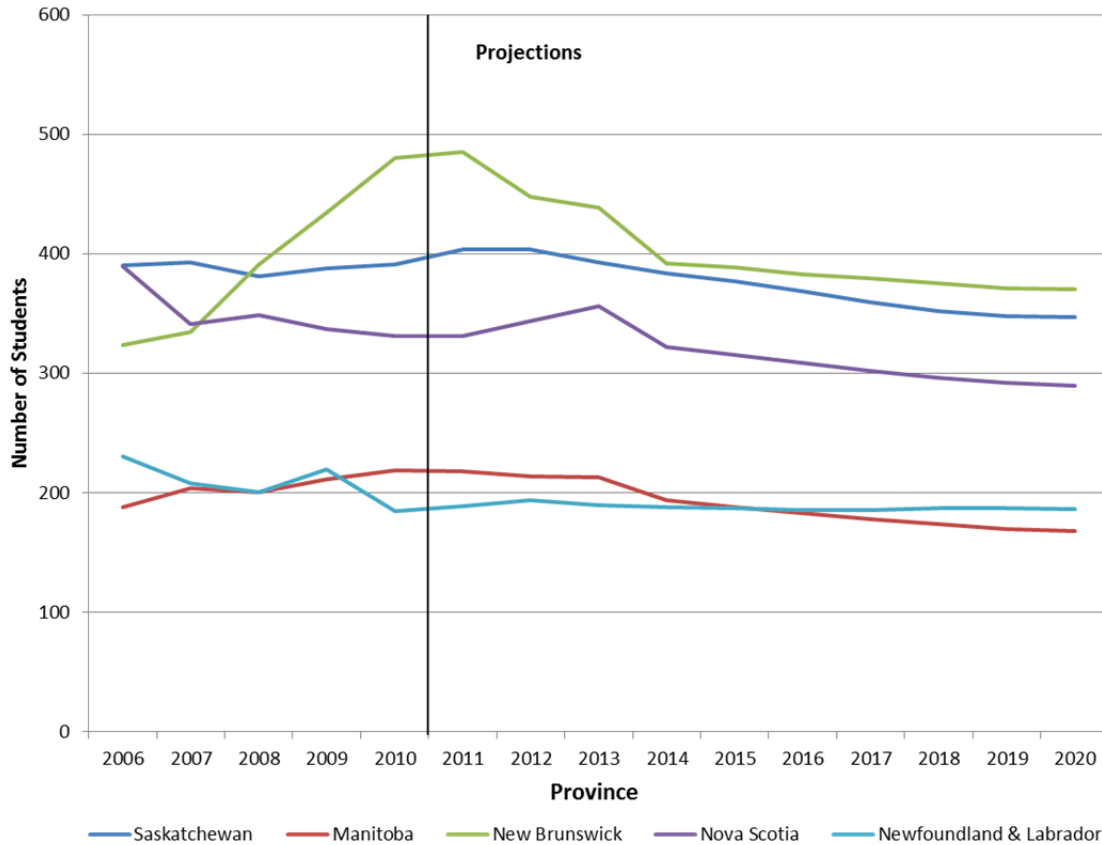


**Exhibit 2.9 a - Trends in Post Secondary Enrolments  
Engineering, All Programs by Province  
2006 to 2020**



Source: Engineers Canada, Prism Economics & Analysis

**Exhibit 2.9b - Trends in Post Secondary Enrolments  
Engineering, All Programs by Province  
2006 to 2020**



Source: Engineers Canada, Prism Economics & Analysis

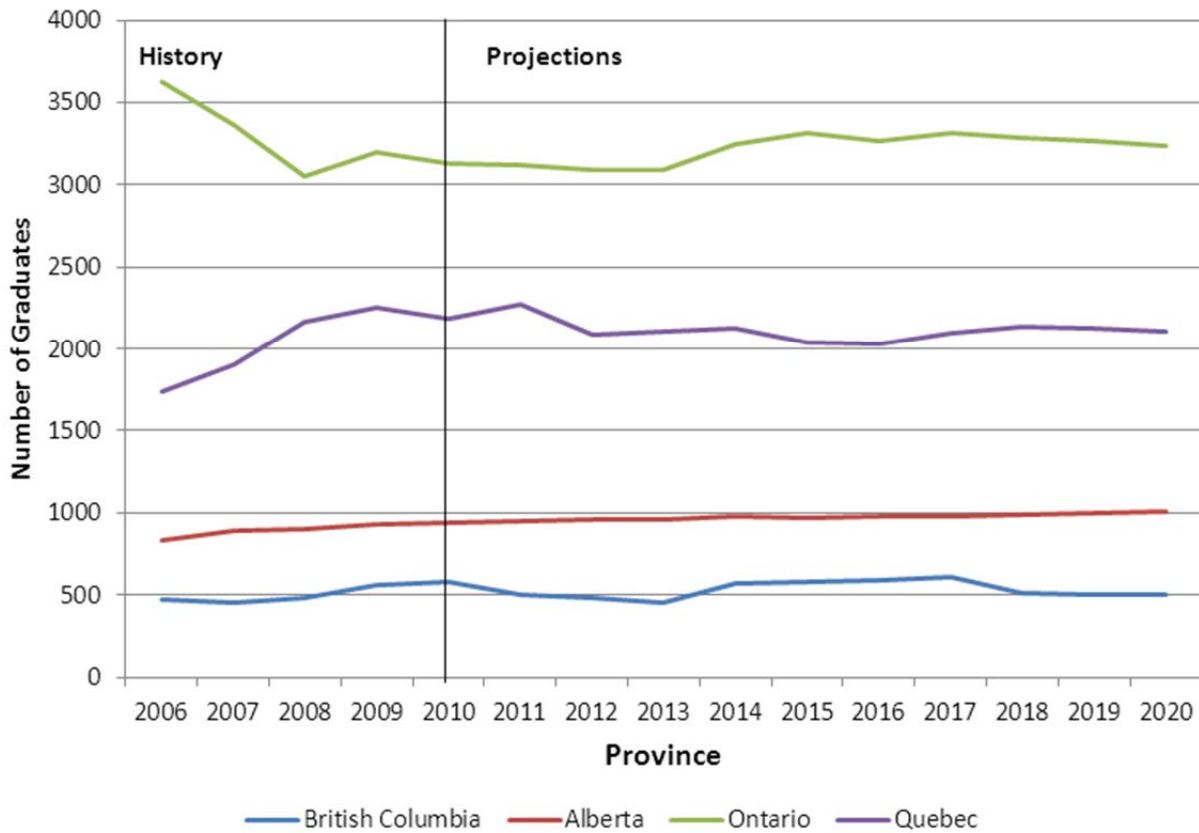
Exhibits 2.10a and b report the number of engineering graduates entering the labour force each year.

These numbers are estimated in two steps:

- First the number of registered students is tracked through the four or five year program with allowance for withdrawals
- Second, a portion of the graduates are assumed to enter the job market; finding or seeking work.

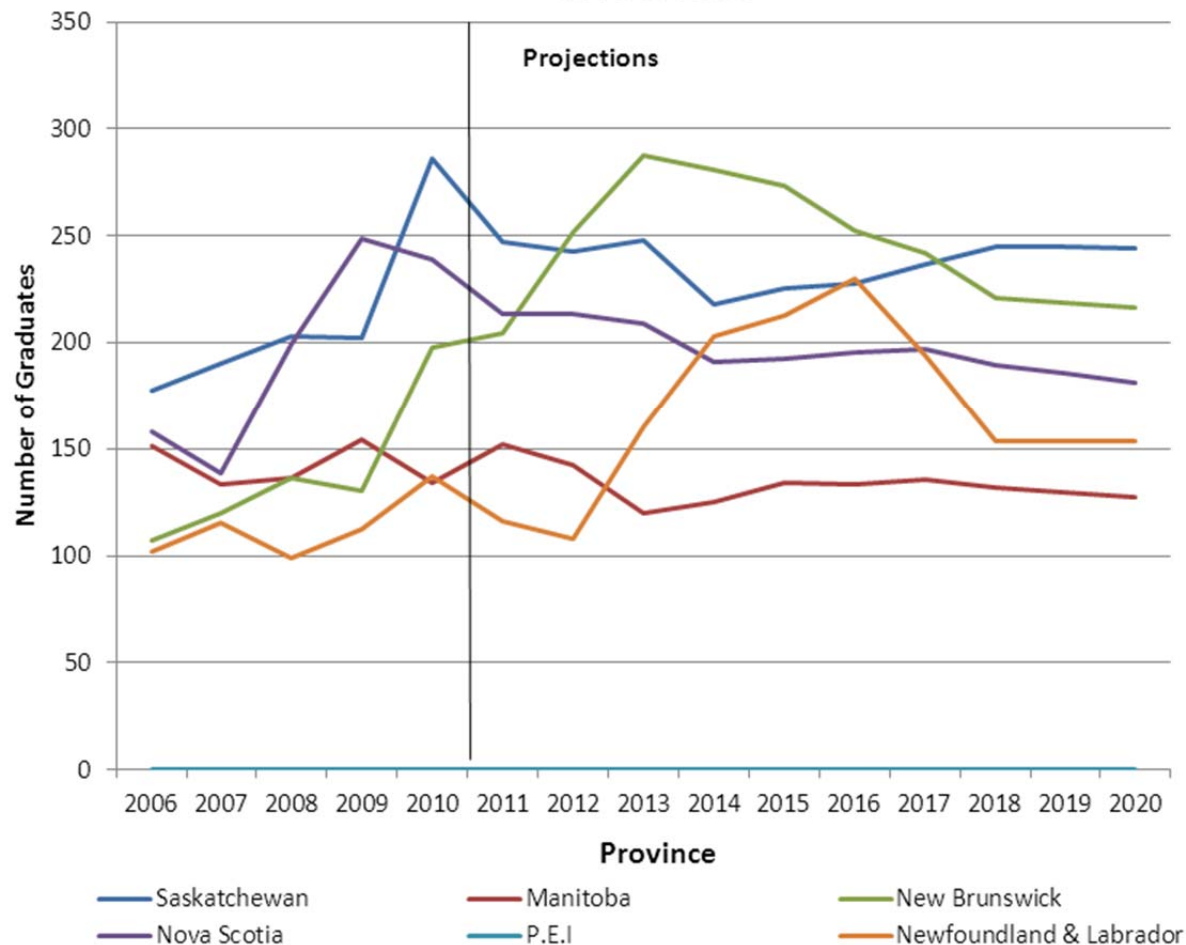
The second adjustment allows for the movement of undergraduates into post graduate programs and for the departure of visa students. A large proportion of the remaining Canadian students do not move on to seek jobs in engineering. Census data and other sources suggest that only around 60% of graduating undergraduates and even fewer post graduates (30%) enter the job market.

**Exhibit 2.10 a - Trends in Engineering Graduates Entering the  
Labour Force, All Programs, by Province  
2006 to 2020**



Source: Engineers Canada, Prism Economics & Analysis

**Exhibit 2.10b - Trends in Engineering Graduates Entering the Labour Force, All Programs, by Province  
2006 to 2020**



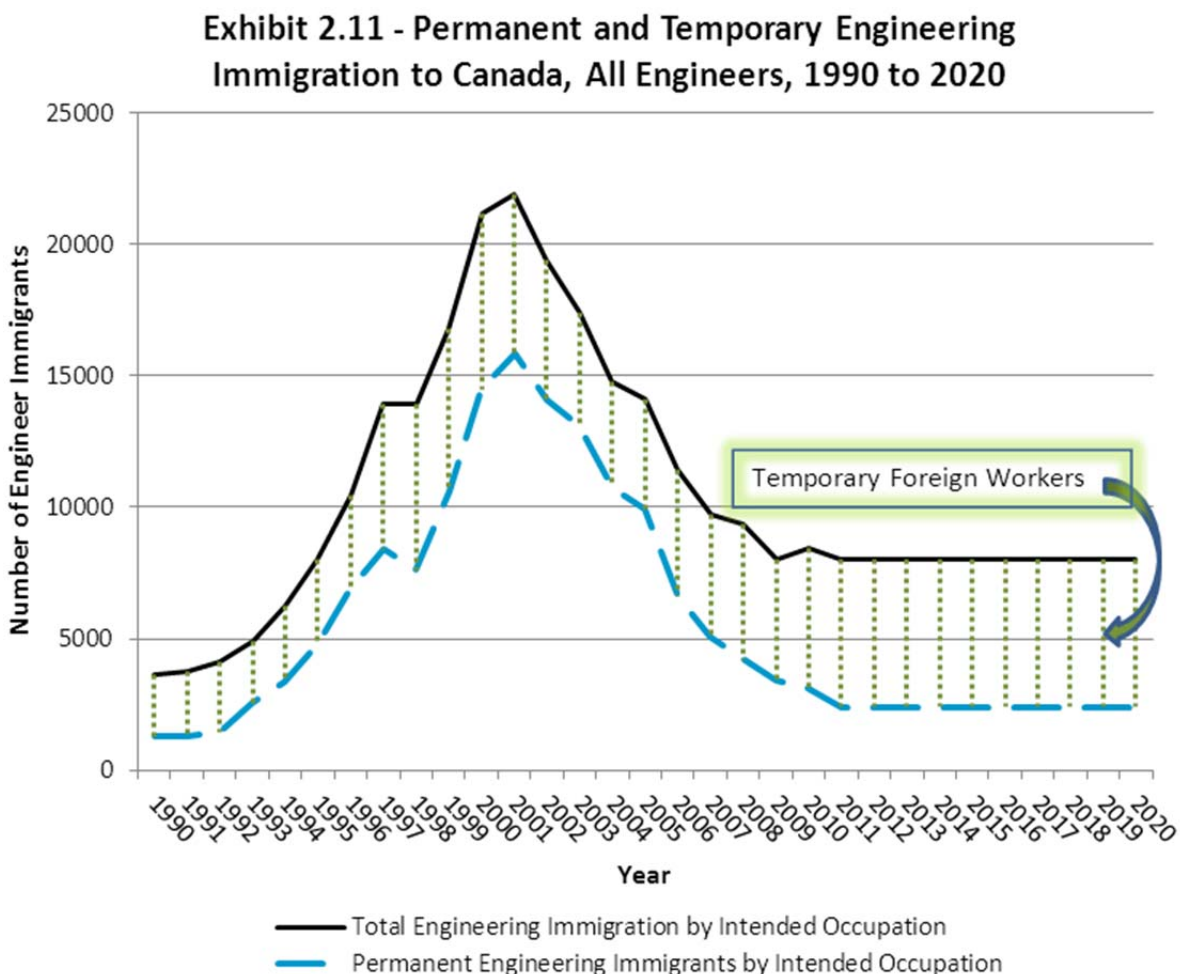
Source: Engineers Canada, Prism Economics & Analysis

Graduates entering the labour market are the largest single source of supply to the market. Immigration has been a strong second source in the past.

#### *iv. New entrants -- Immigration*

There are two broad classes of immigrants seeking to enter engineering jobs; temporary foreign workers and permanent immigrants. Exhibit # 2.11 tracks the history for these groups including all engineering occupations going back to 1990. The very large increase to 2001 and subsequent decline reflects both employment opportunities and policy. Immigration was encouraged in the late 1990s by the surge in demand for computer and related engineers and a recovery in some sectors like construction. Weaker economic conditions after 2000, especially in information technology, reversed the market conditions

but the flow of immigrants was slow to adjust and this added to a surplus in some labour markets. Note the recent drop in permanent immigrants has been quite steep but there has been a partial offset through rising numbers of temporary foreign workers.



Source: Citizenship & Immigration Canada, Prism Economics & Analysis adjusted data

Recent changes in federal and provincial government policy will contribute to further shifts. The proportion of temporary foreign workers is likely to continue to rise as employers seek experienced or specialized engineers and as the Provinces allow these workers to extend their temporary status into permanent residency through the Provincial Nominee Programs.

At the same time market conditions described below may well discourage the traditional permanent immigrants who will face limited job prospects in many occupations and competition from young Canadians and other immigrants who have their qualifications recognized after a delay.

## 2.b The National Economy

This section reviews the international and national economic conditions that drive the provincial and industrial markets. Projections are taken from the January 2012 Center for Spatial Economics Provincial Economic Forecast.

The short to medium term outlook for real GDP growth of the Canadian economy is somewhat weaker than the outlook used in the 2010 Engineering Labour Market analysis. Real GDP increases 2.3 percent in 2011 with growth slowing slightly to 2.2 in 2012 in line with declines in residential and government investment expenditures. In the medium term as a whole, real GDP growth averages 2.2 percent. The reduction in growth in 2014 is a result largely of fiscal tightening needed to reduce large government deficits and weak growth in business investment expenditures following their strong recovery from 2009. The long term outlook is similar to the 2010 report with GDP growth averaging just over 2.0 percent per year. The slowdown in trend growth continues to be related to growth in the U.S. economy, weaker labour force growth resulting from population aging, and the continued negative impact of fiscal tightening.

Non-residential investment expenditures make the largest contribution to economic growth in 2011. In 2012, investment growth slows somewhat with the end of the federal stimulus program in 2011. With continued high commodity prices and profits, investment has returned as an important driver of growth over the short to medium term - more than replacing the loss of government stimulus spending. Over the long term, investment growth slows in line with economic growth, with machinery and equipment investment growth averaging 2.3 percent and non-residential construction investment growth averaging about 0.6 percent per year, after averaging 4.7 and 6.1 percent, respectively, in the medium term.

These overall economic trends are linked to the pattern of growth for six key “engineering intensive” industries that are tracked in detail in the Engineering Labour Market system.

*Primary industries* including oil and gas and mining are a leading sector – especially in the west. There is a strongly cyclical element to the growth in this sector as investment rises and falls following the path of major projects. A long list of major resource projects are planned for most provinces. Many are underway and activity seems likely to be sustained until at least 2015. Both the construction and operation phase of this resource development is engineering intensive. But it is not clear that all the new engineering jobs will be in the industries and regions themselves. A growing proportion of the work is done by consulting firms; often in other provinces or outside Canada. Some of this activity is captured in the output and employment of the architecture, engineering and related services industry.

*Manufacturing* activity is projected to recover much of the ground lost over the last decade. Output gains will climb back to previous levels in many industries but this will take most of the coming decade. Employment growth will lag output reflecting very strong gains in productivity. This leaves manufacturing employment well below past peak levels at the end of the scenario in 2020.

Manufacturing investment will be strong in the recovery. While this is an engineering intensive process, the direct employment gains in manufacturing are limited. This is partly related to the pool of unemployed industrial engineers who lost jobs during the last decade. It is also related to growth in work for specialized and experienced engineers in the services sector. Some of this work is managed with services provided from outside Canada.

*Construction* shows limited growth from 2012 to 2020 but this overall trend conceals many shifts in the mix of activity. Construction had reached record high levels in every province by 2011 and is expected to sustain these peaks until 2020. Building shifted from strong residential activity in the last decade to gains in non-residential from 2010 to 2020. Within non-residential construction there has been a shift from institutional and industrial work in the past five years to major engineering, resource and infrastructure projects in areas like oil and gas, electricity, pipelines, transit and mining. Again this activity is engineering intensive and construction related engineering employment rises above current record levels. But overall job gains across the decade are less than 10% in most markets – far below gains in the past decade. These projections assume that engineers are displaced from the lagging construction sectors and find work in the new projects. There is also an assumption that many of the jobs added in the service sector are related to construction work.

Consulting Engineering employs 40% of the engineering workforce. This activity is captured in the “*architecture, engineering and related services*” industry and market conditions for these services are a key driver. While engineering employment growth attributed to this group is among the strongest in many markets, job gains rarely exceed 15% from 2012 to 2020. Projections here are based on complex and uncertain conditions. Much of the activity in this sector is dominated by imports and exports of specialized engineering. Canada has a major international presence in this area and the projections used here assume that exports of engineering services grow in line with imports. But this pattern is consistent with strong growth in the demand for specialized engineering services from outside Canada related to the resource, manufacturing and investment activity described above. Employment projections in the market assessments in the *Risks and Alternative Scenarios* take a more aggressive view, raising overall gains for Canadian engineering consulting.

*Government* services are the weakest component of engineering intensive economic activity. This reflects the broadly based assumption of restraint in public spending driven by restrictive fiscal policy. There are many cases of announced projects and local priorities that will drive infrastructure spending in areas like electricity and transit and this work may be managed through public-private partnerships (PPP) or other “off budget” arrangements. The employment projections that drive market assessments in Part 3 often include relatively strong municipal and provincial government capital spending notwithstanding the announced fiscal policy.

*Utilities and Transportation* are a strong source of employment in several provinces. The main drivers here are major electricity projects that cover generation, transmission and distribution as well as renewable energy work in wind and solar. Major transportation projects are planned for highways, transit systems, bridges and related infrastructure as well as pipelines. In some cases these projects are linked to resource development.



## Part 3      Risks and Alternative Scenarios

Each labour market ranking is built on a complex series of assumptions about the economy, retirement patterns, immigration, postsecondary engineering programs and other factors. The scenarios look ten years into the future. This section describes the risks to these scenarios by altering three key assumptions and studying the associated change in the rankings.

### **Retirement**

A minimum number of engineers will leave the workforce as the large population of Baby Boomers move into their sixties. Lower participation and mortality will reduce the workforce each year by as little as 1.7% in 2011, for the younger occupations, rising to 2.5% in 2020 for the older occupations. These losses are referred to as “labour market losses”.

This estimate does not take into account the likelihood that a growing number of engineers will take advantage of pension benefits to leave full time jobs. This risk is a serious challenge for HR management and recruiting – even if a large proportion of the departing engineers continue with part time or consulting work. Higher replacement demands are estimated with research findings that vary from 3.0% of the labour force in younger occupations in 2011 and rise to 4.6% in older occupations in 2020 when these retirements are added to labour force losses. These higher levels of replacement demand are referred to as “limited retirements”.

### **Post-Secondary Programs**

Research at Engineers Canada offers important insights into the pattern of entry into and graduation from postsecondary engineering programs. New registrations are a rising proportion Canada’s population under age 34. This trend anticipates a high and potentially growing supply of graduates of trained engineers in the base case scenario. But a closer look at the data highlights a risk that new registrations may fall. First, a growing proportion of visa students are in the programs. Second, young Canadians are reporting difficulties finding jobs after graduation.

An alternative scenario assumes that the rising trend will be reversed as these conditions change and the proportion of Canada’s young people entering engineering will fall back closer to historical levels. This alternative scenario is called “discouraged youth”.

### **International Competition**

In the base case scenario economic growth drops to annual gains of only 2% and prospects for new jobs in engineering become limited. Outside of strength in resource and infrastructure projects in the West, most labour markets for engineering will expand by less than 10% from 2011 to 2020. This pattern holds engineering opportunities back and runs below past trends. This limited job growth is related, in part, to the assumption that trade in engineering services will simply extend the current balance of exports and imports.

There is evidence that international demand for engineering services will rise more rapidly than trend growth in Canada. Canadian consulting engineering firms have established a strong reputation abroad and are increasingly able to compete against foreign firms for work in Canada. The third risk is that trend measures may underestimate the capacity of Canadian engineering to grow.

A third scenario captures this potential by increasing the share of Canadian service exports in engineering. Almost 40% of engineering employment is in the service sector and this share is assumed to grow in the “Rising Share” alternative case. This case tests the capacity of engineering labour markets to meet the demands of a 10% gain in employment related to success by Canadian consultancies in winning new contracts abroad and beating foreign competition for work in Canada.

### **Assessing the Risks**

Each of these risks can be assessed by comparing the market impacts of the alternative scenarios. *The Base Case scenario is set to reflect the most likely circumstances in the view of the research team. This would include the key assumptions:*

- *High retirement trends that include both labour force losses and extended retirements,*
- *Trend increases in new registrations in post-secondary programs as a proportion of the young population, and*
- *No gains in the Canadian share of international engineering consulting work.*

*Market assessments presented in Part 4 below are based on these three assumptions.* To test the sensitivity of the final market assessments to these assumptions, alternative scenarios are compared in each case.

Exhibit # 2.12 summarizes the findings. The two big factors are replacement demands related to extended retirements and rising market shares in engineering services. Significant changes in the pattern of post-secondary enrolments have a much more muted impact.

### Exhibit 3.1: Assessing Risks in the Market Assessments

Base and Alternative Cases	Impact of Alternative Cases	Risks Assessed
<b><u>Retirement</u></b> Base Case = high and rising replacement demands related to both labour force loss and limited retirement Alternative Case = labour force losses only	Replacement Demand would be almost doubled the national impact of extended retirement Engineers Lost to the Workforce Base Case = 48,104 Alternative Case = 50,862	Markets become notably tighter for older occupations mostly in the later years. In BC and Alberta where markets are tight, retirement patterns could create shortages in half the markets in most years.
<b><u>Post-Secondary Enrolment</u></b> Base Case = Trend Increase Alternative Case = Discouraged youth and lower proportion of population enrolled	Discouraged youth and limited arrivals of visa students would cause a national, cumulative loss from 2011 to 2019 of new engineering students of 31,691 and a loss of labour force entrants of 17,905	Few markets are impacted as the proportion of students entering the labour market is limited and post-secondary programs cannot be identified as supplying many markets (e.g. petroleum engineers)
<b><u>Trade Share</u></b> Base Case = Canada's share of trade constant from 2011 to 2020 Alternative Case = Canada's share of trade rising 10% by 2020	Total employment of Canadian engineers rises from 2011 to 2020. Base Case Increase = 16,283 Alternative Case Increase = 54,000	Almost all markets become tighter as employment rises. A rising trade share combined with extended retirement conditions would create shortages in Ontario and exceed supply capacity in the West

Source: Prism Economics & Analysis

These assumptions are added to the Engineers Canada Labour Market Tracking system and new market rankings are created. The impact of each alternative is assessed by comparing the rankings against the base case conditions.<sup>9</sup>

The labour force loss analysis reveals that findings are very sensitive to retirement patterns. Rankings are lower in 50 of the 79 markets when the high levels of extended retirement behaviour are relaxed and replacement demand is limited. The added labour requirements for extended retirements will create serious shortages in most of the markets in British Columbia and Alberta and will absorb many of the temporary foreign workers that are expected to join the workforce in the other provinces. Retirement behaviour and industry and employer policies related to it will be a major determinant of market conditions.

These findings are consistent with a key theme that has emerged in earlier reports. Market conditions are regularly reported to be distinctly different for young and older engineers. New graduates report difficulty finding work and recruiters report an abundance of applicants for entry level positions. In contrast, recruiting engineers with over five years of experience is difficult and requires searching over larger distances and turning to consulting support or temporary foreign worker

<sup>9</sup> See Part 4 below for a complete discussion of the Base Case markets

arrangements. This split in the market will be aggravated by the “limited retirement” patterns that are reported in our research and are included in the Base Case assessments described in Part 4.

In contrast, the “discouraged youth” assumption has a much more limited impact on labour market rankings. Only 14 of 80 market rankings are impacted by the assumptions of lower post-secondary registrations. This is because a relatively small proportion of enrolled and graduating students actually join the labour market. When they do look for or find work, it is hard to properly allocate their participation across occupations. Many university programs can be directly linked to specific markets. This includes civil, mechanical, chemical, mining and computer engineering. Others like electrical and electronics pose problems related to specializations – for example allocating a portion of the graduates to work in utilities or manufacturing. In other cases, like petroleum, there are some designated graduates but their numbers are far below market requirements and it is clear that graduates (for example from chemical engineering) may join these markets.

For all these reasons the impacts of shifting post-secondary enrolment on labour markets is hard to specify and is likely limited. This finding, combined with the observed challenging job search for graduates, focuses attention on the transition from school to work for engineers.

## Part 4 Labour Market Assessments

*This section presents the assessments of the 79 labour markets set out in Exhibit 1.1.*

Occupation by Region – Engineers	Newfoundland & Labrador	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Civil engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mechanical engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical & Electronics engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chemical engineers	X	✓	✓	✓	✓	X	✓	✓	✓
Industrial & Manufacturing engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Metallurgical and materials engineers	X	X	X	✓	✓	X	X	✓	✓
Mining engineers	X	X	X	✓	✓	X	✓	✓	✓
Geological engineers	X	X	X	✓	✓	X	✓	✓	✓
Petroleum engineers	✓	X	X	X	✓	X	✓	✓	✓
Aerospace engineers	X	X	X	✓	✓	✓	X	✓	✓
Computer engineers	X	✓	✓	✓	✓	✓	✓	✓	✓
Other engineers	X	✓	X	✓	✓	X	X	✓	✓

Source: Prism Economics & Analysis

Provincial sections include estimates of the workforce in 2011 and compare the membership of the provincial engineering associations with the Engineers Canada Labour Market Tracking System. Each section presents a summary of the conditions that drive employment projections. Rankings are presented for each market and notes are added to highlight where local conditions differ from the national themes described in Part 2. Exhibits summarize the conditions for expansion and replacement demand and for the changes to the available work force related to the postsecondary education system and immigration.

*These rankings are for the Base Case scenario, reflecting the most likely circumstances in the view of the research team. Each scenario assumes:*

- *High retirement trends that include both labour force losses and extended retirements,*
- *Trend increases in new registrations in post-secondary programs as a proportion of the young population, and*
- *No gains in the Canadian share of international engineering consulting work.*

*Market assessments presented in Part 4 below are based on these three assumptions.*

## B.C. Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2011-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

British Columbia experienced a severe drop in GDP in 2009 of 2.6 percent but also had a significant upswing in 2010 of 3.2 percent. Economic growth in B.C. remains solid in 2012 and 2013 at 2.4 percent and 2.6 percent respectively from strong growth in plant and equipment and continued exports, associated with major capital projects.

Plant and equipment investment is the leading contributor to growth in the medium term, averaging 5.0 percent per year. With commodity prices at a relatively high level, investment in the mining industry experiences rapid growth as the industry adds new capacity. The utilities industry is experiencing strong investment growth over the medium term with several hydroelectric, wind power, and electric power transmission projects beginning construction. The transportation and warehousing industry also plays an important role in driving investment expenditures with several new port expansions, pipelines, rail lines, and a new liquefied natural gas terminal being constructed in Kitimat.

Plant and equipment investment averages 2.6 percent in the long term as several mining, utilities, and transportation and warehousing projects are scheduled for construction. Export growth after 2015 continues as the U.S. economy is assumed to achieve higher average growth in that period.

The Provincial labour market has been relatively weak with the unemployment rate staying above 7 percent until 2012. As the scenario progresses the unemployment rate declines to an annual average 6.4 percent through to 2015 and declining even further to an annual average of 3.9 percent between 2016 and 2020. The impact of the falling unemployment rate shows up in the medium term in strengthening wage inflation. Wage inflation reduces the demand for labour relative to capital, which leads to an increase in productivity growth as firms substitute capital for labour.<sup>10</sup>

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<sup>10</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

### Exhibit A.1: Engineering Work Force Estimates 2011, British Columbia

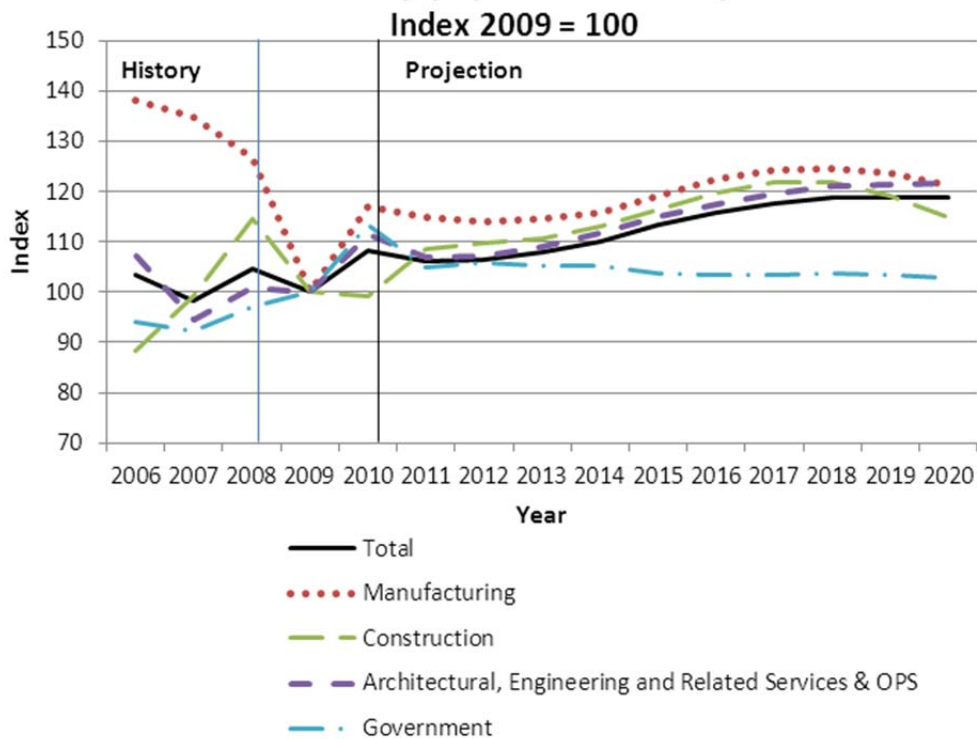
Work Force Estimates	2011
Professional Membership	20,074
Engineering in Training	3,295
<b>Total</b>	<b>23,369</b>

Employment	2011
Civil engineers	7,262
Mechanical engineers	4,186
Electrical and electronics engineers	3,859
Chemical engineers	878
Industrial and manufacturing engineers	1,190
Metallurgical and materials engineers	255
Mining engineers	575
Geological engineers	638
Petroleum engineers	337
Aerospace engineers	266
Computer engineers (except software engineers)	3,289
Other professional engineers, n.e.c.	605
<b>Total</b>	<b>23,340</b>

Source: Association of Professional Engineers and Geoscientists of BC, Statistics Canada



## Exhibit A.2 - British Columbia Engineering Employment Growth by Industry (Expansion Demand)



Source: Prism Economics & Analysis, C4SE

Index numbers, with 2009 = 100, are shown in Exhibit A.2, tracking the cumulative growth in all engineering employment by industry in B.C.

### Key Points:

- Manufacturing is a leading industry but most of the gains were in 2010 and peak levels in 2018 are well below the 2006 peak
- Government employment growth is the weakest
- Construction employment was the only area rising in 2011
- Expansion demand gains momentum in 2012 and 2013 and markets tighten quickly in resource related areas
- New projects that are included in the scenario reach employment peaks in 2015 and labour shortages will be most challenging at that time
- Employment growth is not strong by historical standards -- cumulative growth from the recession just passes 20% and employment growth is closer to 10% after 2011

### Exhibit A.3: British Columbia Market Rankings

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	3	4	4	4	4	4	4	4	4
Mechanical engineers	3	3	4	4	4	4	4	4	4
Electrical and electronics engineers	3	3	3	4	4	4	4	4	3
Chemical engineers	2	4	4	4	4	4	4	4	4
Industrial and manufacturing engineers	3	3	4	4	4	4	4	4	3
Metallurgical and materials engineers	2	2	3	4	4	3	3	3	3
Mining engineers	2	4	4	5	4	4	4	4	4
Geological engineers	3	3	4	4	4	4	4	4	4
Petroleum engineers	4	3	3	4	4	4	4	4	4
Aerospace engineers	3	3	4	4	4	4	4	4	4
Computer engineers (except software engineers)	3	3	3	4	4	4	4	4	3
Other professional engineers, n.e.c.	3	3	4	4	4	4	4	4	4

Source: Prism Economics & Analysis

#### Key Points:

- B.C. has one of the two strongest engineering labour markets in Canada
- Rankings in 2012 reflect the market weakness from the 2009 recession, lower employment in 2011 and lingering unemployment
- Both post-secondary graduations and Immigration declined in 2011
- Immigration is assumed to hold at 2011 levels while post-secondary grads rise to a peak in 2016
- Skill shortages and volatile markets dominate the rankings for resource related occupations like mining, metallurgical and petroleum engineers
- Conditions are more balanced for computer and industrial engineers
- The average age of engineers in B.C. is higher than in other provinces and this raises replacement demand and the rankings later in the scenario
- B.C. employers will need to source engineers from other markets for much of the coming decade
- Industry stakeholders comment that it is hard to attract engineers from other western provinces because of competitive compensation levels
- The focus will be on specialized and experienced engineers to replace retirements and to meet cyclical resource driven conditions

**Exhibit A.4: British Columbia - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil engineers</b>					
Enrolment in Post-Secondary Programs	130	140	157	291	239
Graduates Entering the Labour Force	81	89	89	90	147
Permanent and Temporary Immigration	110	118	85	93	90
Replacement Demand	332	358	362	385	425
As a % of the Labour Force	5.0	5.0	5.0	4.9	5.3
<b>Mechanical engineers</b>					
Enrolment in Post-Secondary Programs	189	203	215	265	242
Graduates entering the Labour Force	79	81	80	97	111
Permanent and Temporary Immigration	108	88	70	68	63
Replacement Demand	190	197	196	211	221
As a % of the Labour Force	4.7	4.7	4.7	4.6	4.8
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	215	208	218	237	246
Graduates Entering the Labour Force	118	132	105	119	132
Permanent and Temporary Immigration	105	100	73	70	53
Replacement Demand	161	171	163	179	216
As a % of the Labour Force	4.3	4.3	4.3	4.3	5.0
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	100	80	1	0	0
Graduates Entering the Labour Force	45	53	136	108	11
Permanent and Temporary Immigration	30	23	20	23	15
Replacement Demand	40	42	41	42	50
As a % of the Labour Force	4.5	4.5	4.5	4.4	5.1
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	0	0	0	0	0
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	20	28	25	23	11
Replacement Demand	56	56	54	57	65

Occupations	2007	2008	2009	2010	Average 2011 to 2020
As a % of the Labour Force	4.4	4.4	4.5	4.4	5.0
<b>Metallurgical and materials engineers</b>					
Enrolment in Post-Secondary Programs	49	50	53	54	53
Graduates Entering the Labour Force	17	19	15	18	20
Permanent and Temporary Immigration	6	6	4	5	6
Replacement Demand	11	12	12	13	15
As a % of the Labour Force	4.6	4.6	4.6	4.6	5.2
<b>Mining engineers</b>					
Enrolment in Post-Secondary Programs	73	75	55	44	53
Graduates Entering the Labour Force	10	13	32	48	28
Permanent and Temporary Immigration	15	18	6	14	24
Replacement Demand	28	32	32	32	35
As a % of the Labour Force	4.9	4.8	4.8	4.7	5.2
<b>Geological engineers</b>					
Enrolment in Post-Secondary Programs	26	31	31	37	31
Graduates Entering the Labour Force	14	15	17	17	22
Permanent and Temporary Immigration	13	13	11	15	19
Replacement Demand	27	30	29	32	37
As a % of the Labour Force	4.8	4.7	4.5	4.5	5.1
<b>Petroleum engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	4	4	5	5	6
Replacement Demand	9	10	10	11	16
As a % of the Labour Force	3.1	3.0	3.0	3.0	4.1
<b>Aerospace engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	6	8	2	2	9
Replacement Demand	14	14	12	13	19
As a % of the Labour Force	4.9	5.0	4.6	4.6	6.5

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	129	125	102	107	107
Graduates Entering the Labour Force	93	77	88	79	59
Permanent and Temporary Immigration	68	55	35	33	30
Replacement Demand	74	75	77	79	109
As a % of the Labour Force	2.2	2.3	2.3	2.3	2.9
<b>Other professional engineers, n.e.c.</b>					
Enrolment in Post-Secondary Programs	318	359	384	473	564
Graduates Entering the Labour Force	231	254	313	348	469
Permanent and Temporary Immigration	23	25	18	15	18
Replacement Demand	27	28	27	30	34
As a % of the Labour Force	4.6	4.6	4.6	4.5	5.1

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Alberta Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2011-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Real GDP growth in Alberta is expected to slow to 2.6 percent in 2012 and then 2.4 percent in 2013 as non-residential investment growth weakens and governments slow their current spending and make strong capital spending cuts. Growth in 2012 is related to strong increases in plant and equipment investment coupled with employment growth leading to relatively strong growth in residential investment and consumer spending. Consumer spending and residential investment drive growth in 2013. The utilities industry experiences very strong investment growth as two major transmission lines begin construction and several other electric power production facilities continue construction in 2012.

A weak recovery in natural gas prices cause the conventional oil and gas industry to experience slow investment spending after a strong recovery in 2010 and 2011 that brought the level of investment back near their pre-recession level. Despite this slow growth in conventional oil and gas investment, the non-conventional oil and gas industry experiences healthy growth over the medium term in line with a rebound in oil prices.

With the collapse of energy prices and the 2009 recession, the provincial budget balance changed from large surplus to a deficit. The end of the federal infrastructure program will combine with the slowing economy and reductions in government investment to limit growth in the medium term. As the economy strengthens and the budget balances improve, provincial government investment expenditures will begin to rise again by 2016.

After two relatively strong years of construction growth in 2011 and 2012, the construction industry averages 0.8 percent until 2015. As governments begin to increase investment again after 2015 and non-residential investment remains positive, construction GDP growth picks up and averages 3.2 percent in the second half of the forecast period. The manufacturing industry experiences the fastest GDP growth over the medium term as demand for Alberta's products increases. Manufacturing GDP growth registers 3.8 percent per year over the medium term. Over the long term, manufacturing investment returns to its pre-recession levels. There are a number of manufacturing projects scheduled for completion over the medium term including biofuel production facilities, and Government infrastructure projects are planned for water, sewers and roads, as well as hospital and school construction.

The unemployment rate remains steady near 5.5 percent until 2013 and then falls to 3.5 percent over the long term. A relatively high unemployment rate depresses migration to the province and leads to slower population growth in the short term relative to the growth rates experienced before 2010.<sup>11</sup>

#### Exhibit B.1: Engineering Work Force Estimates 2011, Alberta

Work Force Estimates	2012
Professional Membership	41626
Engineering in Training	8396
<b>Total</b>	<b>50,022</b>

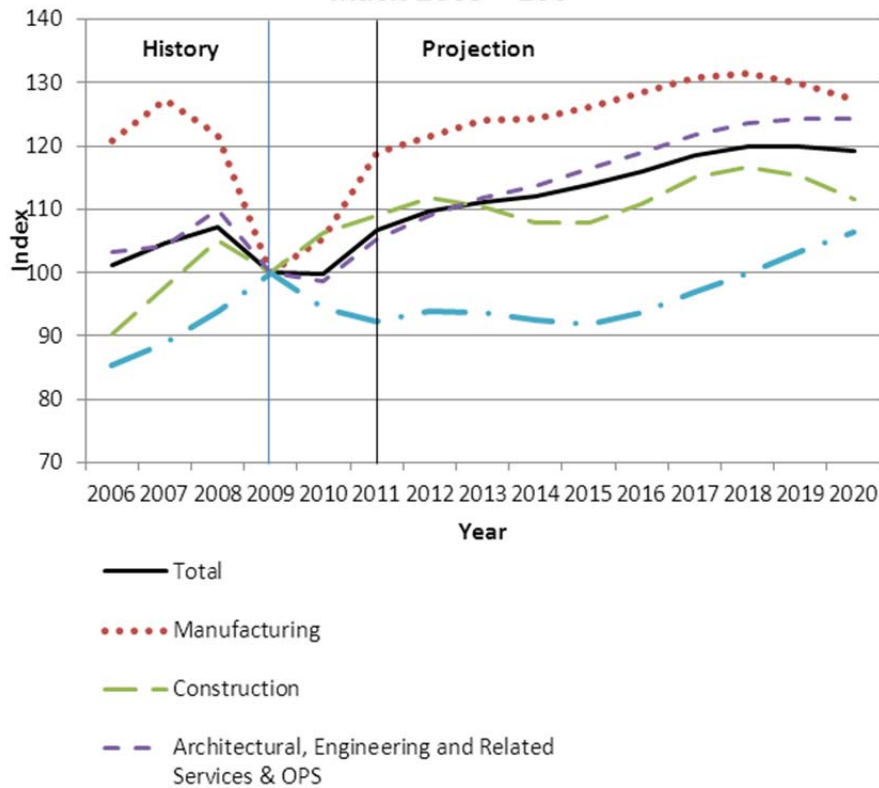
Employment	2011
Civil engineers	7,544
Mechanical engineers	6,167
Electrical and electronics engineers	4,894
Chemical engineers	3,063
Industrial and manufacturing engineers	1,876
Metallurgical and materials engineers	470
Mining engineers	492
Geological engineers	579
Petroleum engineers	9,633
Aerospace engineers	145
Computer engineers (except software engineers)	2,690
Other professional engineers, n.e.c.	291
<b>Total</b>	<b>37,844</b>

Source: Association of Professional Engineers and Geoscientists of Alberta, Statistics Canada

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<sup>11</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

**Exhibit B.2 - Alberta Engineering Employment Growth by Industry (Expansion Demand)**  
Index 2009 = 100



Source: Prism Economics & Analysis, C4SE

Index numbers with 2009 = 100 are shown in Exhibit B.2, tracking the cumulative growth in all engineering employment by industry in Alberta.

#### Key Points:

- Manufacturing is a leading industry with strong gains in 2010 and 2011. Peak levels in 2018 are above the previous peak in 2007
- Government employment growth is the weakest
- Construction related employment has been very strong, and remains at record levels, but hits a slow growth period from 2012 to 2015
- Expansion demand remains below past peak activity until 2012 and resumes modest growth in 2013. Markets begin to tighten in 2015 in computers and resource related areas
- Stakeholders document strong employment gains in 2011 and 2012 and starting levels have been adjusted upwards
- Employment growth after 2013 is limited by historical standards - cumulative growth from the recession reaches 20% and is closer to 10% after 2011



**Exhibit B.3: Alberta Market Rankings**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	4	4	4	4	5	5	4	4	4
Mechanical engineers	4	4	3	4	4	4	4	4	3
Electrical and electronics engineers	4	4	3	4	4	4	4	4	4
Chemical engineers	3	4	3	3	3	3	3	3	3
Industrial and manufacturing engineers	4	4	3	4	4	4	4	4	4
Metallurgical and materials engineers	3	3	2	3	3	4	3	3	3
Mining engineers	4	3	3	3	4	3	4	4	4
Geological engineers	4	4	4	4	4	5	4	4	4
Petroleum engineers	4	3	3	4	4	4	4	4	4
Aerospace engineers	4	4	3	3	4	4	4	4	4
Computer engineers (except software engineers)	4	4	3	4	4	4	4	4	4
Other professional engineers, n.e.c.	4	3	3	3	4	5	5	4	4

Source: Prism Economics & Analysis

#### Key Points:

- Alberta, along with B.C. is the strongest engineering market in Canada
- Strong employment growth in 2011 is distinctly different from other provinces and makes the Alberta market the strongest in the first years of the scenario
- New employment estimates for 2012 raise market rankings; indicating that markets are tight for most disciplines
- There is a pause in employment growth from 2013 to 2015 and this restores more balanced conditions in most markets
- Additions to the workforce from Post-Secondary programs and immigration meet labour market needs, for some disciplines from 2012 to 2014
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills. New graduates from engineering programs have difficulties finding jobs
- Rankings of 3 or 4 in 2012 and 2013 may understate the extent of market shortages for experienced engineers,
- Industry feedback points to;
  - rising off shore recruiting and pressure to bring in more qualified immigrants, and
  - the potential for engineers to move out of disciplines at graduation into new and more specialized areas (e.g. chemical engineers qualifying as petroleum engineers)
- Growth in enrolments in post-secondary programs for engineers in Alberta has lagged behind national trends and may contribute to tight market rankings
- Net in mobility of about 900 engineers is required in most years to balance markets

**Exhibit B.4: Alberta - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	238	233	261	272	236
Graduates Entering the Labour Force	190	208	218	210	207
Permanent and Temporary Immigration	140	158	118	128	135
Replacement Demand	338	352	344	339	410
As a % of the Labour Force	4.4	4.4	4.5	4.5	4.8
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	301	321	354	391	439
Graduates entering the Labour Force	190	196	212	227	275
Permanent and Temporary Immigration	250	220	145	173	168
Replacement Demand	233	241	231	230	283
As a % of the Labour Force	3.7	3.7	3.8	3.8	4.1
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	229	233	234	233	211
Graduates Entering the Labour Force	153	154	155	163	151
Permanent and Temporary Immigration	190	225	170	195	195
Replacement Demand	184	188	184	183	224
As a % of the Labour Force	3.6	3.7	3.7	3.7	4.1
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	199	215	224	248	250
Graduates Entering the Labour Force	110	117	127	136	147
Permanent and Temporary Immigration	140	210	125	145	155
Replacement Demand	69	71	70	70	91
As a % of the Labour Force	2.3	2.3	2.4	2.4	2.6
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	48	58	75	86	104
Graduates Entering the Labour Force	31	34	40	47	67
Permanent and Temporary Immigration	60	65	40	60	50
Replacement Demand	87	89	84	84	96

Occupations	2007	2008	2009	2010	Average 2011 to 2020
As a % of the Labour Force	4.5	4.6	4.6	4.6	4.7
<b>Metallurgical and materials engineers</b>					
Enrolment in Post-Secondary Programs	34	40	43	50	52
Graduates Entering the Labour Force	23	26	27	29	35
Permanent and Temporary Immigration	25	10	15	15	20
Replacement Demand	18	19	18	17	21
As a % of the Labour Force	3.8	3.7	3.8	3.8	4.0
<b>Mining engineers</b>					
Enrolment in Post-Secondary Programs	36	40	39	41	49
Graduates Entering the Labour Force	40	31	25	28	33
Permanent and Temporary Immigration	20	25	25	35	25
Replacement Demand	17	19	18	18	23
As a % of the Labour Force	3.6	3.7	3.8	3.8	4.0
<b>Geological engineers</b>					
Enrolment in Post-Secondary Programs	0	0	0	0	0
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	20	30	30	40	35
Replacement Demand	21	22	21	21	26
As a % of the Labour Force	3.7	3.7	3.7	3.7	3.9
<b>Petroleum engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	95	150	85	105	110
Replacement Demand	309	320	313	314	409
As a % of the Labour Force	3.3	3.3	3.4	3.4	4.1
<b>Aerospace engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	20	5	2	0	2
Replacement Demand	6	6	6	5	8
As a % of the Labour Force	4.0	4.0	4.1	3.3	4.9

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	188	143	113	80	66
Graduates Entering the Labour Force	157	133	125	101	61
Permanent and Temporary Immigration	30	60	45	60	60
Replacement Demand	61	60	63	61	85
As a % of the Labour Force	2.2	2.2	2.3	2.3	2.8
<b>Other professional engineers, n.e.c.</b>					
Enrolment in Post-Secondary Programs	136	149	155	164	151
Graduates Entering the Labour Force	103	108	114	119	121
Permanent and Temporary Immigration	15	20	15	15	20
Replacement Demand	10	10	11	11	13
As a % of the Labour Force	3.3	3.3	3.7	3.7	3.9

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Saskatchewan Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Saskatchewan is expected to grow by 4.2 percent in 2012, an improvement on growth of 3.6 percent in 2011. Growth is driven by strong business investment expenditures and the continued recovery in agriculture output. Growth remains strong in 2013 at 3.4 percent boosted by strong export growth, and will decelerate through the remainder of the medium term due to the wind down of the investment cycle. Growth is expected to average 2.9 percent a year for the medium term as a whole. Growth will slow in the long run to average 1.2 percent a year. The slowdown is largely caused by declining business and residential investment expenditures, caused by completion of a number of major projects and lower household formation, along with weaker export growth.

The construction sector is expected to grow by over 10 percent in 2012 boosted by a number of mining projects. Growth will remain strong in 2013 as projects continue to ramp up before declining in 2014 and 2015 as the investment cycle winds down. The manufacturing industry is expected to grow by 0.8 percent in 2012 and 1.7 percent in 2013. The relatively slow growth is largely driven by the strength of the Canadian dollar, which is negatively impacting export demand and rising costs within the province. Growth is anticipated to average 1.3 percent a year for the medium term as a whole before strengthening to 2 percent a year in the long run as the impacts of the rising dollar are mitigated.

The demand for potash remains high and the current boom is anticipated to continue. Potash mine expansions continue to lead high levels of investment. These projects include the expansion at Vanscoy by Agrium Inc. and the Jansen mine by BHP, amongst others. There is also a large number of manufacturing investment projects underway or scheduled for construction. These include a mineral processing facility, and the expansion of the Consumers CO-OP Refinery in Regina.

Labour force growth will fail to meet job openings in 2012 and 2013, resulting in the unemployment rate declining to 4.6 percent by 2013. As employment growth slows for the remainder of the medium term and the labour force continues steady growth, the unemployment rate will rise to over 5 percent a year. In the long run, declining participation rates caused by an aging population will result in the labour force declining slightly. Increasing employment will result in the unemployment rate declining to average less than 5 percent a year. Net in-migration will strengthen in 2013 before weakening through the remainder of the medium term averaging 7.5 thousand persons a year for the medium term as a whole. In the long run, as labour market pressures rise elsewhere in Canada, the number of net in migrants will fall to less than 2 thousand people a year, caused by outward interprovincial migration.<sup>12</sup>

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<sup>12</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

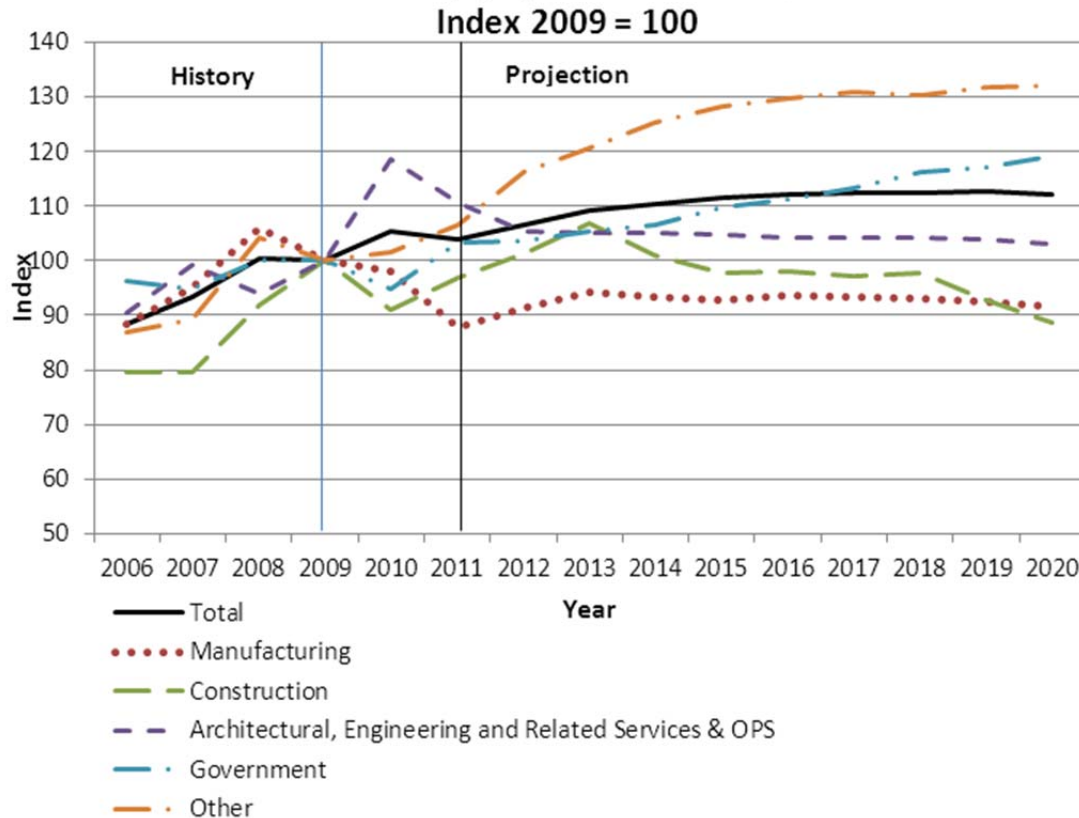
### Exhibit C.1: Engineering Work Force Estimates 2011, Saskatchewan

Work Force Estimates	2010
Professional Membership	5287
Engineering in Training	1234
<b>Total</b>	<b>6,521</b>

Employment	2011
Civil engineers	1143
Mechanical engineers	787
Electrical and electronics engineers	640
Chemical engineers	217
Industrial and manufacturing engineers	341
Metallurgical and materials engineers	0
Mining engineers	327
Geological engineers	117
Petroleum engineers	203
Aerospace engineers	27
Computer engineers (except software engineers)	262
Other professional engineers, n.e.c.	107
<b>Total</b>	<b>4171</b>

Source: Association of Professional Engineers and Geoscientists of Saskatchewan, Statistics Canada

## Exhibit C.2 - Saskatchewan Engineering Employment Growth by Industry (Expansion Demand)



Source: Prism Economics & Analysis, C4SE

Index numbers with 2009 = 100 are shown in Exhibit C.2, tracking the cumulative growth in all engineering employment by industry in Saskatchewan.

### Key Points:

- Stakeholder feedback documented gains in employment from the recession in 2009 to 2012
- Employment levels were adjusted upwards to reflect this new evidence
- Resource activity in mining and other areas is captured in “other” and employment this industry leads all sectors
- Manufacturing is a lagging industry as costs are rising and competitiveness challenged
- Government employment growth is moderate but stronger than other provinces due to strong finances
- Construction employment peaks in 2013 at record high levels
- Expansion demand gains momentum in 2012 and 2013 and markets tighten quickly in resource related areas
- Lower expansion demand is expected for manufacturing and computer engineering
- Employment growth is limited – cumulative growth is less than 10% from 2011 to 2020

### Exhibit C.3: Saskatchewan Market Rankings

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	3	3	4	4	4	4	4	3	3
Mechanical engineers	3	4	4	4	4	4	3	4	4
Electrical and electronics engineers	4	4	4	3	4	4	4	4	3
Chemical engineers	4	4	4	3	3	3	3	3	3
Industrial and manufacturing engineers	3	4	3	2	3	3	3	3	3
Mining engineers	5	5	5	5	4	4	4	4	4
Petroleum engineers	5	5	4	4	4	3	3	4	4
Computer engineers (except software engineers)	3	3	3	2	3	3	2	3	3

Source: Prism Economics & Analysis

#### Key Points:

- Rising enrolments, graduations and immigration had peaked in 2010 following a period of expansion
- Industry guidance raises employment levels and rankings in 2012
- Periods of peak demand are filled with out-of-province engineers
  - Up to half of registered engineers in Saskatchewan have a residence in other provinces
  - A large proportion of non-resident engineers, registered with APEGS, are from Ontario, Quebec and New Brunswick
- Strength in resources and infrastructure related work drives tight labour markets for electrical, mining and petroleum engineers
- Growth in enrolments in post-secondary programs for engineers in Saskatchewan has lagged behind national trends and
- Constraints may be leading to tight market rankings
- Weak or declining employment in computer and manufacturing engineering leaves new graduates unemployed after 2014
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with over 5 to 10 years of experience or specialized skills. New graduates from engineering programs have difficulties finding jobs.



**Exhibit C.4: Saskatchewan - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	76	89	109	73	104
Graduates Entering the Labour Force	0	0	0	66	53
Permanent and Temporary Immigration	6	9	9	19	25
Replacement Demand	54	55	57	60	63
As a % of the Labour Force	5.0	5.0	5.0	5.0	5.4
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	92	102	102	78	84
Graduates entering the Labour Force	34	33	34	49	37
Permanent and Temporary Immigration	9	9	14	14	24
Replacement Demand	27	29	30	31	39
As a % of the Labour Force	3.7	3.8	3.8	3.8	4.7
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	77	79	77	60	65
Graduates Entering the Labour Force	37	37	32	41	35
Permanent and Temporary Immigration	2	2	11	11	15
Replacement Demand	29	33	33	34	38
As a % of the Labour Force	5.0	5.0	5.0	5.1	5.5
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	56	55	57	51	52
Graduates Entering the Labour Force	27	27	36	45	36
Permanent and Temporary Immigration	1	6	6	6	8
Replacement Demand	6	6	6	7	10
As a % of the Labour Force	3.0	3.0	3.0	2.9	3.9
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	35	34	33	40	45
Graduates Entering the Labour Force	28	29	27	25	29
Permanent and Temporary Immigration	1	2	9	3	5
Replacement Demand	9	10	10	10	11
As a % of the Labour Force	2.8	2.7	2.7	2.7	3.0
<b>Mining engineers</b>					
Enrolment in Post-Secondary Programs	0	0	0	0	0
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	2	5	3	3	6
Replacement Demand	6	8	9	9	17

Occupations	2007	2008	2009	2010	Average 2011 to 2020
As a % of the Labour Force	2.5	2.8	2.8	2.8	3.8
<b>Geological engineers</b>					
Enrolment in Post-Secondary Programs	21	26	25	22	23
Graduates Entering the Labour Force	11	7	11	18	14
Permanent and Temporary Immigration	2	5	1	2	3
Replacement Demand	3	3	4	4	6
As a % of the Labour Force	2.5	2.5	3.4	3.3	4.3
<b>Petroleum engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	0	2	1	1	1
Replacement Demand	6	6	6	6	9
As a % of the Labour Force	3.0	3.0	3.0	3.0	3.9
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	90	63	48	47	52
Graduates Entering the Labour Force	53	70	63	42	34
Permanent and Temporary Immigration	1	4	6	5	9
Replacement Demand	14	14	14	13	12
As a % of the Labour Force	5.2	5.2	5.2	5.2	4.3

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Manitoba Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Growth in Manitoba is expected to accelerate in 2012 to 2.3 percent, and then to 2.6 percent in 2013, driven by strong business investment and increasing exports. Growth is expected to average 2.4 percent through the medium term as a whole, with rising private investment expenditures and exports more than offsetting declines in government investment. Declining business, residential investment expenditures and slower export growth result in long run growth slowing to 1.8 percent a year.

Investment expenditures in the private business sector are expected to continue to grow through the medium term averaging near 7 percent a year. Key to the strong growth in business expenditures are the continued investments in a number of large electric power projects through the medium term and the recovery in investment in other industries. The construction industry is expected to be the strongest performer over the medium term. Growth will reach near 6 percent in 2012 and 2013 before moderating through the remainder of the medium term as the investment cycle winds down. The industry is expected to grow by an average 4.4 percent a year in the medium term and will decline by 0.4 percent a year in the long run as a number of major projects are completed. The highest value projects are the Manitoba Hydro facilities and the Blue Bombers stadium. In addition there is the Lalor project in the mining sector along with a number of smaller projects in the service sector.

Employment growth is expected to remain under 1 percent in 2012 before accelerating for the remainder of the medium term, in line with higher growth and productivity gains near 1 percent. Employment growth will average 1.3 percent a year for the medium term as a whole before slowing to 1 percent a year in the long run as the economy slows.

The unemployment rate will increase to 5.7 percent in 2012 as labour force growth exceeds employment growth. As employment growth picks up the labour force will struggle to keep pace, resulting in the unemployment rate declining towards the end of the forecast period. The unemployment rate will average 5.6 percent a year in the medium term, and will average near 5 percent a year in the long term. Net in migration is expected to increase throughout the medium term as the labour force struggles to keep pace with demands. Net in-migration will average 12.2 thousand people a year in the medium term before increasing slightly in the long run to 13.2 thousand people a year. The main source of growth is from immigration as inter-provincial migration will remain fairly steady throughout the forecast.<sup>13</sup>

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<sup>13</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

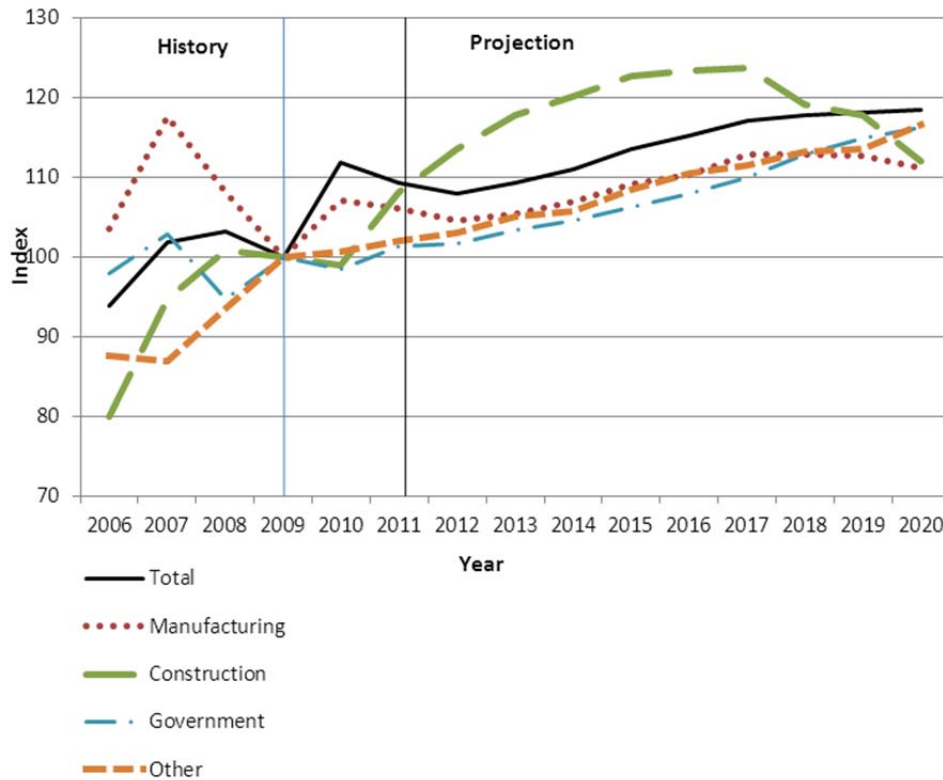
### Exhibit D.1: Engineering Work Force Estimates 2011, Manitoba

Work Force Estimates	2011
Professional Membership	4885
Engineering in Training	1015
<b>Total</b>	<b>5,900</b>

Employment	2011
Civil engineers	1324
Mechanical engineers	798
Electrical and electronics engineers	821
Chemical engineers	71
Industrial and manufacturing engineers	366
Metallurgical and materials engineers	53
Mining engineers	70
Geological engineers	63
Petroleum engineers	0
Aerospace engineers	273
Computer engineers (except software engineers)	546
Other professional engineers, n.e.c.	97
<b>Total</b>	<b>4482</b>

Source: Association of Professional Engineers and Geoscientists of the Province of Manitoba, Statistics Canada

**Exhibit D.2 - Manitoba Engineering Employment Growth by  
Industry (Expansion Demand)  
Index 2009 = 100**



Source: Prism Economics & Analysis, C4SE

Index numbers with 2009 = 100 are shown in Exhibit D.2, tracking the cumulative growth in all engineering employment by industry in Manitoba.

#### Key Points:

- Engineering employment in Manitoba had a mild recession and a very strong rebound in 2010 and 2011
- While employment has retreated from the big gains reported in 2010, market conditions in 2011 may still reflect shortages
- Construction, in particular in electrical generation and transmission is a big driver
- Resource activity in mining and other areas is captured in “other” where growth is steady
- Manufacturing is a leading driver but note that gains, even by 2020, do not raise employment back to previous peaks
- Government employment growth is the lowest
- Expansion demand gains momentum in 2013 and 2014 and markets tighten quickly in resource related areas
- Employment growth is weak -- cumulative growth is less than 10% from 2011 to 2020

### Exhibit D.3: Manitoba Market Rankings

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	3	4	4	4	4	4	4	4	3
Mechanical engineers	2	3	3	3	3	3	3	3	3
Electrical and electronics engineers	2	4	4	4	4	4	4	3	4
Industrial and manufacturing engineers	2	3	3	4	3	3	3	3	3
Aerospace engineers	2	3	3	4	3	4	3	3	3
Computer engineers (except software engineers)	2	3	3	3	3	3	3	3	3

Source: Prism Economics & Analysis

#### Key Points:

- Low rankings in 2011 and 2012 may underestimate market conditions,
  - Additions from Post-Secondary programs and in-migration may have balanced tight markets in 2010 and then again in 2011 and 2012
  - Manitoba has a strong track record integrating new engineers into the labour market
- Gains after 2012 will tighten markets especially related to electricity infrastructure and other construction
- Manufacturing gains may be centered in aerospace and there are no local postsecondary programs in support and
- Projected steady levels of Post-Secondary graduates and immigration may not balance other markets in the future as well
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills. New graduates from engineering programs have difficulties finding jobs.

**Exhibit D.4: Manitoba - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	57	62	62	64	62
Graduates Entering the Labour Force	30	31	41	36	39
Permanent and Temporary Immigration	10	9	3	13	15
Replacement Demand	57	59	59	65	74
As a % of the Labour Force	4.7	4.7	4.7	4.7	5.1
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	89	85	85	89	86
Graduates entering the Labour Force	30	35	43	41	37
Permanent and Temporary Immigration	14	9	11	19	21
Replacement Demand	27	27	27	29	36
As a % of the Labour Force	3.5	3.5	3.5	3.5	4.1
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	39	38	37	39	34
Graduates Entering the Labour Force	29	28	25	20	24
Permanent and Temporary Immigration	11	9	9	16	19
Replacement Demand	31	32	33	37	42
As a % of the Labour Force	4.2	4.2	4.3	4.3	4.7
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	11	10	12	13	11
Graduates Entering the Labour Force	11	7	4	9	12
Permanent and Temporary Immigration	10	9	2	2	1
Replacement Demand	11	11	10	11	15
As a % of the Labour Force	2.9	2.9	2.9	2.9	3.8
<b>Aerospace engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	1	2	0	1	1
Replacement Demand	9	8	8	8	11
As a % of the Labour Force	2.9	3.0	3.0	3.0	3.6
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	56	41	31	34	40
Graduates Entering the Labour Force	33	36	42	28	21
Permanent and Temporary Immigration	2	3	11	9	10
Replacement Demand	16	18	18	19	19
As a % of the Labour Force	3.1	3.1	3.3	3.3	3.2

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Ontario Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2011-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Real GDP is expected to grow 2.1 percent in 2012 slightly up from 2.0 percent in 2011. Despite significant projected cutbacks in both government investment and current expenditures, economic growth averages 2.2 percent a year over the medium term due to strong plant and equipment investment and sustained export growth. Over the remainder of the forecast an average economic growth rate of 2.1 percent per year is projected, as the federal and provincial governments continue to reduce deficits caused by the recession and stimulus packages.

The most significant drivers of economic growth this year are strong increases in plant and equipment investment expenditures combined with continuing export growth. Plant and equipment investment expenditures experience growth of 5.6 percent in 2012 and 11.0 percent in 2013, driven by mining industry investment and investment in the utilities industry.

The outlook for the economy in the long term reflects downward trending growth in Ontario's major trading partners and weak growth in government current spending. The construction industry shows weak growth averaging 1.6 percent in the medium term, consistent with weak residential investment growth and negative growth in government capital spending. Mining investments have continued to move ahead such as a Vale copper mine expansion and Detour Gold Corp's Detour Lake project. There are a number of large projects expected to begin construction in the medium term. Vale is expected to begin construction of an addition to its Copper Cliff Nickel Smelter atmospheric emission reduction plant this year. The utilities sector is expanding with many projects currently underway. Ontario Power generation's Niagara Tunnel Project will continue through the medium term of the outlook. The Darlington Nuclear Plant refurbishment, started in 2010, will continue through the whole outlook period. In addition, refurbishment of the Bruce Nuclear power plant is expected to begin in 2014.

Employment growth weakens from 1.9 percent in 2011 to 1.2 percent in 2012. Average employment growth in the medium term is 1.3 percent a year. However, as growth in the economy slows in the long term, employment growth slows to average below 1.0 percent per year. GDP growth averages just above 2.0 percent for the outlook period as a whole, and productivity measured on an hourly basis averages just below 1.0 percent per year. Despite relatively slow employment growth in the long run and net in-migration averaging over 100,000 people per year for the overall population, the average long run unemployment rate falls to 6.0 percent, which is a result of the negative impact of population aging on labour force growth.<sup>14</sup>

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<sup>14</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.



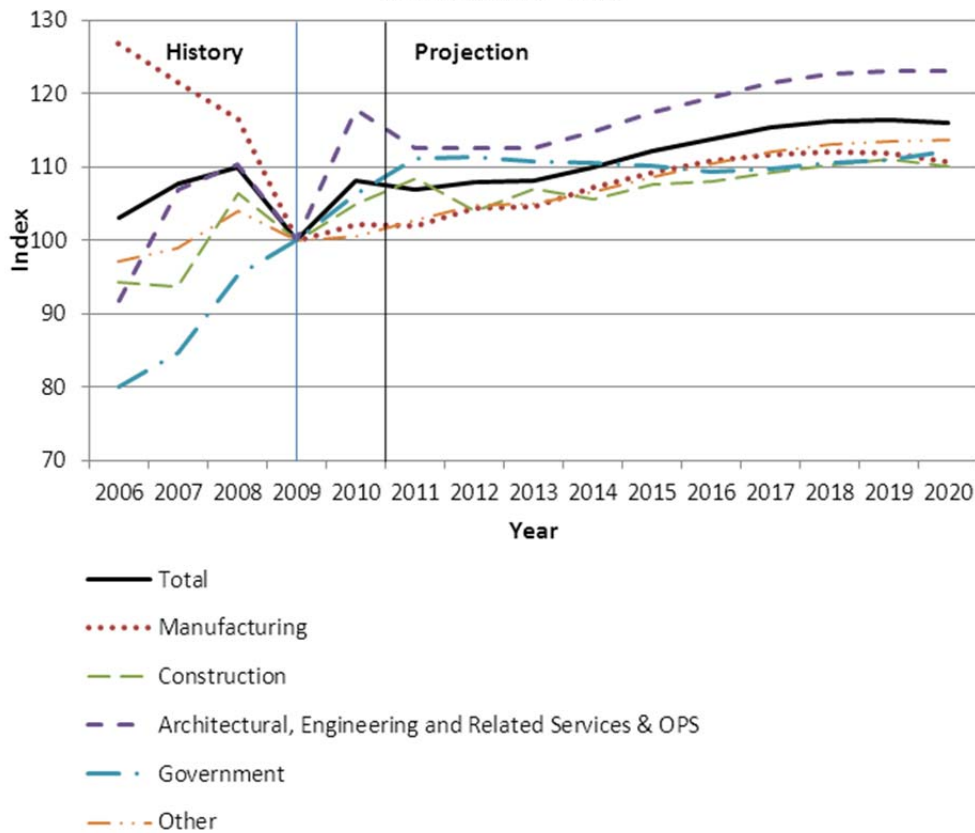
### Exhibit E.1: Engineering Work Force Estimates 2011, Ontario

Work Force Estimates	2011
Total PEO membership	75059

Employment	2011
Civil engineers	18436
Mechanical engineers	18700
Electrical and electronics engineers	16038
Chemical engineers	4008
Industrial and manufacturing engineers	9223
Metallurgical and materials engineers	919
Mining engineers	1149
Geological engineers	583
Petroleum engineers	518
Aerospace engineers	2223
Computer engineers (except software engineers)	15800
Other professional engineers, n.e.c.	868
<b>Total</b>	<b>88465</b>

Source: Professional Engineers of Ontario, Statistics Canada

**Exhibit E.2 - Ontario Engineering Employment Growth by Industry (Expansion Demand)**  
Index 2009 = 100



Source: Prism Economics & Analysis, C4SE

Index numbers with 2009 = 100 are shown in Exhibit E.2; tracking the cumulative growth in all engineering employment by industry in Ontario.

#### Key Points:

- Engineering employment declined by 9.0 % in 2009 and had a strong rebound of 8% in 2010.
- Limited growth in 2011 left unemployment above levels from the last decade
- Estimates of volatility in engineering employment from 2008 to 2011 may overstate annual changes but the underlying trend leaves employment lower and unemployment higher in 2012
- Construction activity has been growing and hits a high plateau from 2014 to 2016 and grows moderately later
- Resource, infrastructure and utility projects are planned across the scenario; adding jobs for engineers
- Resource activity in mining and other areas contributes to overall gains for engineers
- Manufacturing is a leading driver but note that gains, even by 2020, do not raise employment back to previous peaks.
- Government employment growth is the lowest

- Expansion demand gains momentum in 2013 and 2014 and markets tighten quickly in resource related areas
- Employment growth is weak -- cumulative growth is less than 10% from 2011 to 2020

**Exhibit E.3: Ontario Market Rankings**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	3	3	3	4	3	4	4	4	3
Mechanical engineers	3	3	3	3	3	3	3	3	3
Electrical and electronics engineers	3	3	3	3	3	3	3	3	3
Chemical engineers	2	2	2	2	2	2	2	2	2
Industrial and manufacturing engineers	4	3	4	4	4	4	4	3	3
Metallurgical and materials engineers	2	2	2	3	2	2	2	2	2
Mining engineers	4	3	4	4	4	4	3	3	3
Geological engineers	2	2	3	3	3	3	3	3	3
Petroleum engineers	3	2	3	3	3	3	3	3	3
Aerospace engineers	4	3	4	3	3	3	3	3	3
Computer engineers (except software engineers)	3	3	3	4	3	3	3	3	3
Other professional engineers, n.e.c.	3	3	3	3	3	3	3	3	3

Source: Prism Economics & Analysis

#### Key Points:

- Ontario markets face the long term imbalances described for the industry in general; rankings of 3 leave a need for change in most situations
- Stakeholders observe that;
  - rankings in 2011 may be too low; overstating the impact of a modest change in employment and
  - \*graduates in electrical and related areas have been in demand by international employers – local conditions understate market pressures
- A rising trend in enrolments in engineering programs, from 2007 to 2011, has not led to a rise in degrees awarded
- Immigration has been declining since 2006 and will settle at 2011 levels to 2020
- High and increasing replacement demand far exceeds expansion demand
- Rising replacement demand drives rankings higher later in the scenario as the population profile ages
- Rankings reflect relative strength in resource and utility employment
- Many engineers, resident in Ontario, are licensed in Saskatchewan; suggesting that Ontario consultants are active in the west and
  - These jobs may appear as employment in either province
- Registrations in engineering programs continue to rise until 2013; following demographic trends

- Graduates entering the workforce after 2013 balance supply and demand in general but do not resolve other imbalances including a split in labour requirements and the needs for experienced engineers
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills. New graduates from engineering programs have difficulties finding jobs

**Exhibit E.4: Ontario - Replacement Demand and Supply Side Measures**

<b>Occupations</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Average 2011 to 2020</b>
<b>Civil</b>					
Enrolment in Post-Secondary Programs	712	750	874	939	809
Graduates Entering the Labour Force	429	455	440	456	545
Permanent and Temporary Immigration	285	260	200	208	198
Replacement Demand	822	869	828	913	1005
As a % of the Labour Force	4.5	4.6	4.6	4.6	5.0
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	1265	1330	1481	1565	1391
Graduates entering the Labour Force	509	560	565	498	636
Permanent and Temporary Immigration	618	573	390	450	315
Replacement Demand	895	904	851	890	992
As a % of the Labour Force	4.4	4.4	4.4	4.4	4.7
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	1295	1313	1267	1275	1329
Graduates Entering the Labour Force	801	661	735	792	776
Permanent and Temporary Immigration	488	390	335	365	268
Replacement Demand	660	686	655	694	817
As a % of the Labour Force	3.9	3.9	3.9	3.9	4.6
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	605	669	685	840	740
Graduates Entering the Labour Force	338	350	375	413	512
Permanent and Temporary Immigration	125	110	93	95	73
Replacement Demand	122	124	121	129	156
As a % of the Labour Force	2.9	2.9	2.9	2.9	3.5
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	184	177	158	157	183
Graduates Entering the Labour Force	234	117	114	111	129
Permanent and Temporary Immigration	235	183	153	193	143
Replacement Demand	440	433	401	405	478
As a % of the Labour Force	4.0	4.1	4.1	4.1	4.6
<b>Metallurgical and materials engineers</b>					
Enrolment in Post-Secondary Programs	129	118	87	92	128
Graduates Entering the Labour Force	69	77	116	105	90
Permanent and Temporary Immigration	43	38	28	33	23
Replacement Demand	30	31	29	29	37
As a % of the Labour Force	2.9	3.0	3.1	2.9	3.6
<b>Mining engineers</b>					
Enrolment in Post-Secondary Programs	90	101	100	115	118
Graduates Entering the Labour Force	33	33	34	46	51

Occupations	2007	2008	2009	2010	Average 2011 to 2020
Permanent and Temporary Immigration	25	23	13	13	23
Replacement Demand	32	35	35	38	49
As a % of the Labour Force	3.0	3.0	3.1	3.0	3.6
<b>Geological engineers</b>					
Enrolment in Post-Secondary Programs	40	40	43	44	39
Graduates Entering the Labour Force	23	24	22	26	27
Permanent and Temporary Immigration	10	13	10	20	18
Replacement Demand	17	18	16	19	23
As a % of the Labour Force	3.0	3.0	3.0	2.9	3.5
<b>Petroleum engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	10	13	13	19	25
Replacement Demand	14	15	14	17	22
As a % of the Labour Force	3.0	3.0	3.0	3.0	3.9
<b>Aerospace engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	25	18	15	25	25
Replacement Demand	69	68	62	63	89
As a % of the Labour Force	2.7	2.7	2.7	2.7	3.5
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	1159	970	708	532	855
Graduates Entering the Labour Force	926	773	799	679	460
Permanent and Temporary Immigration	285	273	250	220	190
Replacement Demand	451	474	472	482	532
As a % of the Labour Force	2.8	2.8	2.8	2.8	3.0
<b>Other professional engineers, n.e.c.</b>					
Enrolment in Post-Secondary Programs	853	895	993	959	944
Graduates Entering the Labour Force	402	372	366	476	497
Permanent and Temporary Immigration	50	55	45	43	38
Replacement Demand	25	26	26	28	34
As a % of the Labour Force	3.0	3.0	3.0	2.9	3.5

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Québec Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Québec is expected to grow by 1.8 percent in 2012 and 1.9 percent in 2013, driven primarily by increasing business investment expenditures. Growth will continue to average around 1.8 percent a year from 2012 to 2020. The recession placed a strain on the provincial budget position; this coupled with an aging population will prove a large constraint on the Québec economy. Government investment is expected to decline over the medium term as the government realigns its expenditures with overall economic growth. These declines are anticipated to be significant at around 4.8 percent a year in the medium term.

The construction sector will experience close to zero growth during the medium term. The slow growth is due to a declining residential sector and lower government investment. In the long run, construction industry activity should grow by an average 1.8 percent a year as both residential and government investment increase.

A number of electric power projects have been scheduled by Hydro Québec including nuclear upgrades, transmission lines in various regions, wind farms and hydroelectric projects. Manufacturing investment is boosted from investment by Alcoa as it pursues modernization at its smelters.

The provincial government experienced deterioration in its budget position and it will be necessary for them to show restraint in their spending policies. As a result the government services sector will decline by an average 0.2 percent a year in the medium term before returning to growth in the long run at 1.1 percent a year.

Employment will grow by 0.6 percent in 2012, growth is expected to remain at this level for a couple of years before accelerating at the end of the medium term as the economy picks up. Growth is expected to average 0.8 percent a year for the medium term as a whole before decelerating to 0.7 percent a year in the long run, in line with slower economic growth and increasing productivity gains. The unemployment rate is expected to stabilize at 7.6 percent in 2012 before declining to 5.4 percent across the remainder of the scenario as the labour force is unable to meet continued growth in employment.<sup>15</sup>

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<sup>15</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

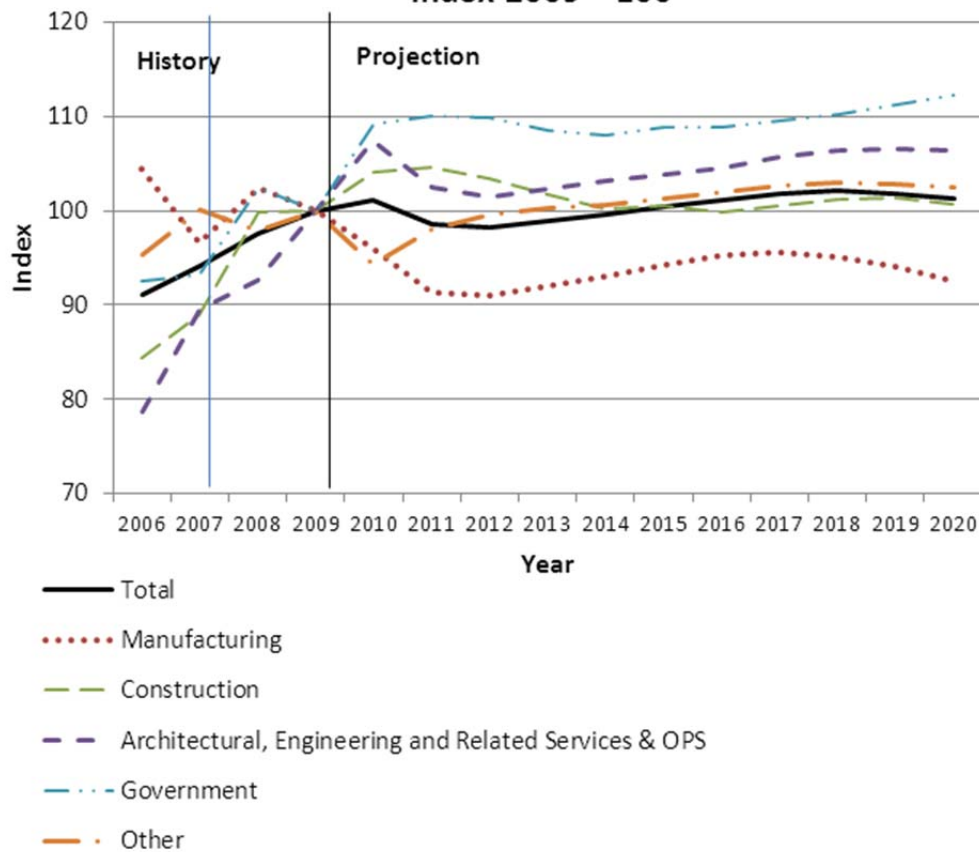
### Exhibit F.1: Engineering Work Force Estimates 2011, Québec

Work Force Estimates	2011
Ingénieurs	41872
Ingénieurs juniors / ingénieurs stagiaires	13914
<b>Total</b>	<b>55,786</b>
Employment	2011
Civil engineers	10475
Mechanical engineers	6358
Electrical and electronics engineers	8231
Chemical engineers	1562
Industrial and manufacturing engineers	5310
Metallurgical and materials engineers	559
Mining engineers	349
Geological engineers	152
Petroleum engineers	69
Aerospace engineers	2389
Computer engineers (except software engineers)	5400
Other professional engineers, n.e.c.	870
<b>Total</b>	<b>41724</b>

Source: Ordre des ingénieurs du Québec, Statistics Canada



**Exhibit F.2 - Québec Engineering Employment Growth by  
Industry (Expansion Demand)  
Index 2009 = 100**



Source: Prism Economics & Analysis, C4SE

Index numbers, with 2009 = 100, are shown in Exhibit F.2; tracking the cumulative growth in all engineering employment by industry in Québec.

**Key Points:**

- Engineering employment grew steadily through the 2009 recession period and then declined in 2010 - 2011
- Year to year fluctuations in employment growth balanced out from 2007 to 2010 allowing markets to balance.
- Resource activity in mining and other areas is captured in “other” where growth is steady after 2010
- Manufacturing is a lagging source of jobs
- Construction employment has been growing and peaks in 2011 remaining close to that level to 2020

- Future activity will be concentrated in resource and infrastructure projects
- Government employment grew steadily to 2010 and remains at that peak to 2020
- Activity is concentrated in municipal infrastructure projects
- Employment growth is very weak -- cumulative growth is less than 5% from 2011 to 2020

**Exhibit F.3: Québec Market Rankings**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	2	3	3	3	3	3	3	3	3
Mechanical engineers	2	3	3	3	3	3	3	2	2
Electrical and electronics engineers	2	2	2	2	2	2	2	2	2
Chemical engineers	2	2	2	2	2	2	2	2	2
Industrial and manufacturing engineers	2	3	3	3	3	3	3	2	2
Metallurgical and materials engineers	2	2	2	2	2	2	2	2	2
Mining engineers	3	2	3	3	3	2	2	2	2
Geological engineers	2	2	2	2	2	2	2	2	2
Aerospace engineers	3	3	3	3	3	3	3	3	3
Computer engineers (except software engineers)	2	3	3	3	3	3	2	2	2
Other professional engineers, n.e.c.	2	3	3	3	3	3	3	3	3

Source: Prism Economics & Analysis

#### Key Points:

- Very limited expansion demand leaves markets soft
- Rising replacement demands can be met from the existing workforce
- Enrolment and degrees awarded in undergraduate engineering programs from 2007 to 2011 has lagged behind national trends
- Enrolment and degrees awarded in graduate programs have both increased at very high rates from 2007 to 2011 – led by the participation of visa students
- Registrations in engineering postsecondary programs remains largely unchanged to 2014 and then decline moderately as demographic trends reduce the population under 34
- Graduates entering the workforce are sustained slightly below current levels to 2020
- The current level of entering graduates will create weak market conditions for entry level jobs, but
  - Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills.

**Exhibit F.4: Québec - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	668	715	738	820	672
Graduates Entering the Labour Force	283	342	396	401	472
Permanent and Temporary Immigration	148	158	163	150	143
Replacement Demand	411	435	462	480	548
As a % of the Labour Force	4.2	4.2	4.2	4.2	4.9
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	900	897	919	882	832
Graduates entering the Labour Force	396	388	386	455	420
Permanent and Temporary Immigration	183	170	173	175	238
Replacement Demand	188	194	202	202	234
As a % of the Labour Force	2.9	2.9	2.9	2.9	3.4
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	759	765	743	729	760
Graduates Entering the Labour Force	484	450	448	508	493
Permanent and Temporary Immigration	255	250	260	213	205
Replacement Demand	285	291	302	303	373
As a % of the Labour Force	3.3	3.4	3.4	3.4	4.2
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	223	248	244	235	218
Graduates Entering the Labour Force	161	174	154	156	166
Permanent and Temporary Immigration	65	58	58	58	68
Replacement Demand	46	50	51	51	62
As a % of the Labour Force	3.0	3.0	3.0	3.0	3.7
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	268	250	249	256	270
Graduates Entering the Labour Force	198	224	209	169	193
Permanent and Temporary Immigration	95	93	100	93	110
Replacement Demand	176	181	185	183	212
As a % of the Labour Force	3.1	3.1	3.1	3.1	3.7
<b>Metallurgical and materials engineers</b>					
Enrolment in Post-Secondary Programs	84	78	65	64	68
Graduates Entering the Labour Force	27	65	78	50	52
Permanent and Temporary Immigration	13	15	15	11	28
Replacement Demand	19	19	19	19	23
As a % of the Labour Force	3.1	3.1	3.2	3.1	3.8
<b>Mining engineers</b>					

Occupations	2007	2008	2009	2010	Average 2011 to 2020
Enrolment in Post-Secondary Programs	37	63	72	70	55
Graduates Entering the Labour Force	19	23	22	26	38
Permanent and Temporary Immigration	2	5	4	6	10
Replacement Demand	12	12	12	11	15
As a % of the Labour Force	3.1	3.1	3.1	3.1	3.7
<b>Geological engineers</b>					
Enrolment in Post-Secondary Programs	46	61	56	59	56
Graduates Entering the Labour Force	38	30	30	25	35
Permanent and Temporary Immigration	13	8	13	6	6
Replacement Demand	5	5	5	6	7
As a % of the Labour Force	3.5	3.5	3.5	3.4	4.1
<b>Aerospace engineers</b>					
Enrolment in Post-Secondary Programs	*	*	*	*	*
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	23	103	123	130	193
Replacement Demand	86	95	100	95	100
As a % of the Labour Force	3.3	3.4	3.4	3.4	3.8
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	707	513	342	259	474
Graduates Entering the Labour Force	296	465	529	393	244
Permanent and Temporary Immigration	165	153	165	158	158
Replacement Demand	129.0	129.1	132.8	136.9	193.1
As a % of the Labour Force	2.3	2.4	2.3	2.4	3.3
<b>Other professional engineers, n.e.c.</b>					
Enrolment in Post-Secondary Programs	163	154	188	207	154
Graduates Entering the Labour Force	96	100	97	94	118
Permanent and Temporary Immigration	93	98	88	83	65
Replacement Demand	25	27	28	29	35
As a % of the Labour Force	2.9	3.0	3.0	3.0	3.7

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## New Brunswick

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

New Brunswick is expected to grow 1.3 percent in 2012, down from 1.6 percent in 2011. Growth averages 1.8 percent per year over the medium term and slows to an average of 1.2 percent per year in the long term. In the long term provincial growth is consistent with slowed growth in New Brunswick's major trading partners and continued slow population and labour force growth.

Plant and equipment investment continues its strong growth of above 10 percent in 2012. However, slower export growth and slower consumer expenditure growth result in lower GDP growth than in 2011. Growth in plant and equipment investment continues in the medium term averaging 6.4 percent per year. With a lack of large major projects coming on board over the forecast, plant and equipment investment declines on average by 0.9 percent per year over the long term.

Both the provincial and federal governments are expected to reduce expenditures in order to eliminate budget deficits. On average the construction industry records weak growth over the medium term in line with declining residential investment. In the long term, the construction industry remains weak as plant & equipment investment slows and residential investment remains relatively flat. In the mining sector, the Potash Corp. of Saskatchewan mine and mill, under construction since 2008, is expected to be completed near the end 2014. An additional potash mine is anticipated to begin construction in 2015. The Irving biodiesel plant has been cancelled. Investment in the manufacturing sector includes an expansion at Irving Pulp and Paper, and various other Irving projects. In addition, a fertilizer plant is expected to begin construction this year.

Employment in New Brunswick is expected to increase by 0.4 percent in 2012. As productivity growth eases from a high of 2.6 percent in 2011, employment numbers are expected to stabilize in the medium term with moderate increases. New Brunswick's natural population growth rate remains below 0.1 percent over the medium term and turns negative in 2016. As the population continues to age and retirements from the labour force rise, the unemployment rate is projected to fall from over 9.0 percent in 2011 to an average of around 6.0 percent in the long term.

Economic conditions in Prince Edward Island are expected to be moderately stronger than in New Brunswick with GDP rising 2.2% in the short term and 1.4% in the longer term. Employment gains will exceed 1.4% in each year in the near terms and then drop to 0.4% in the long term. Machinery and equipment spending lead overall growth.<sup>16</sup>

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<sup>16</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

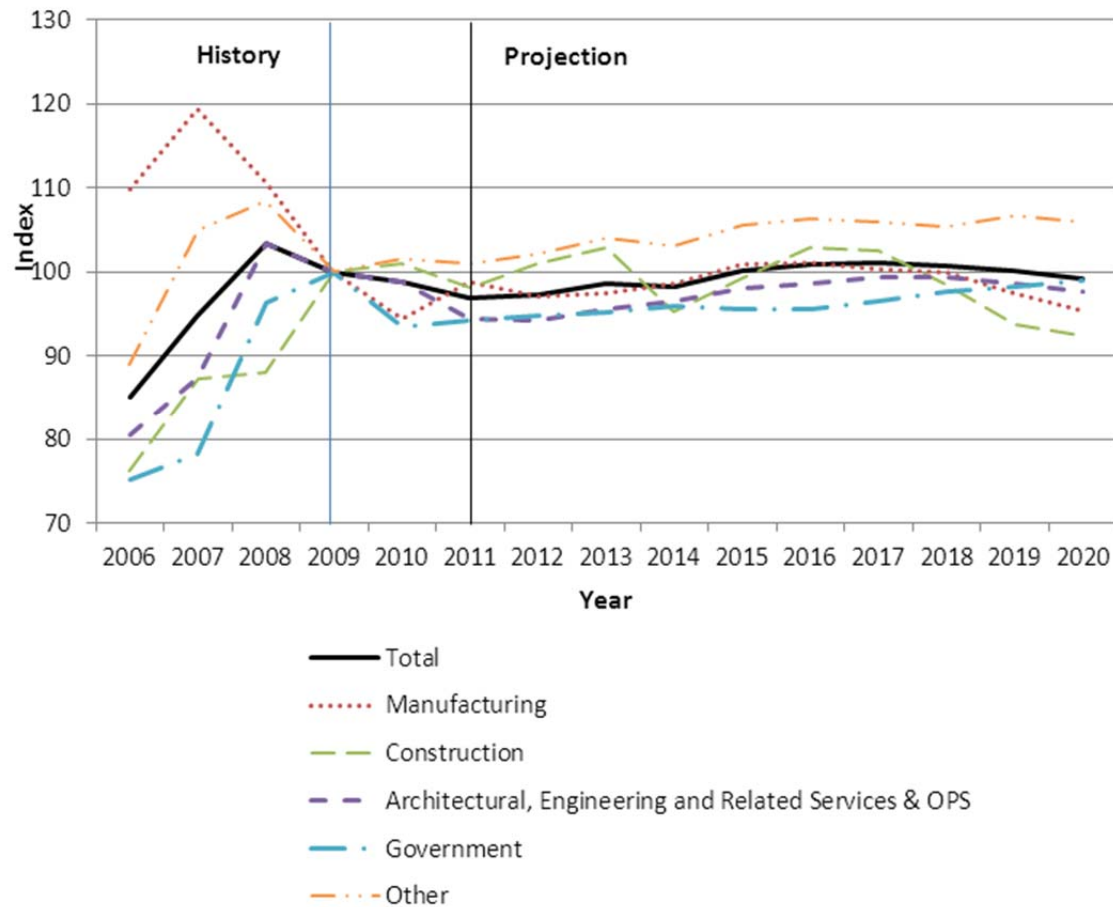
### Exhibit G.1: Engineering Work Force Estimates 2011, New Brunswick

Work Force Estimates	2011
Professional Membership	
Engineering in Training	
<b>Total</b>	<b>5,873</b>

Employment	2011
Civil engineers	1258
Mechanical engineers	583
Electrical and electronics engineers	409
Chemical engineers	141
Industrial and manufacturing engineers	195
Metallurgical and materials engineers	23
Mining engineers	33
Geological engineers	19
Petroleum engineers	23
Aerospace engineers	13
Computer engineers (except software engineers)	219
Other professional engineers, n.e.c.	12
<b>Total</b>	<b>2928</b>

Source: Association of Professional Engineers and Geoscientists of New Brunswick. Statistics Canada

### Exhibit G.2 - New Brunswick Engineering Employment Growth by Industry (Expansion Demand) Index 2009 = 100



Source: Prism Economics & Analysis, CS4E

Index numbers, with 2009 = 100, are shown in Exhibit G.2; tracking the cumulative growth in all engineering employment by industry in New Brunswick.

#### Key Points:

- Other employment includes mining and other primary industries where new jobs are added
- Engineering employment declined only modestly through the 2009 recession period and then on to 2011
- Very limited employment growth reflects the Provincial outlook
  - Stakeholders provided evidence that New Brunswick engineers are participating in the job gains in Saskatchewan and these jobs may be recorded as employment in either province
- Employment growth is very weak -- cumulative growth is less than 5% from 2011 to 2020

### Exhibit G.3: New Brunswick Market Ranking

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	3	3	2	4	3	3	3	3	3
Mechanical engineers	2	2	2	2	2	2	2	2	2
Electrical and electronics engineers	2	2	2	2	2	2	2	2	2
Chemical engineers	2	2	2	3	2	2	3	3	2
Industrial and manufacturing engineers	3	3	3	4	4	3	4	3	2
Computer engineers (except software engineers)	2	2	2	2	2	2	2	2	2

Source: Prism Economics & Analysis

#### Key Points:

- While immigration is expected to be very low, new entries from postsecondary programs will rise until 2014, reflecting recent gains in registrations
- Employment growth is very weak - cumulative growth is less than 5% from 2011 to 2020
- The continuing high level of entering graduates will create weak market conditions for entry level jobs , but
  - Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills
- Rankings for PEI are limited to civil engineers where market conditions tend to be tighter, and
- This is related to the higher than average age profile and the absence of Post-Secondary programs to supply the local labour market



**Exhibit G.4: New Brunswick - Replacement Demand and Supply Side Measures**

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	87	103	117	118	89
Graduates Entering the Labour Force	26	30	28	42	58
Permanent and Temporary Immigration	9	6	3	2	1
Replacement Demand	54	62	63	63	75
As a % of the Labour Force	4.4	4.4	4.5	4.5	5.5
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	91	110	135	141	107
Graduates entering the Labour Force	32	33	33	55	62
Permanent and Temporary Immigration	14	9	14	5	9
Replacement Demand	24	27	26	26	30
As a % of the Labour Force	4.1	4.0	4.1	4.1	4.7
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	79	101	124	118	94
Graduates Entering the Labour Force	29	37	41	60	72
Permanent and Temporary Immigration	6	6	5	6	3
Replacement Demand	19	20	19	19	22
As a % of the Labour Force	4.4	4.4	4.4	4.4	5.0
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	23	43	53	71	59
Graduates Entering the Labour Force	18	17	12	18	35
Permanent and Temporary Immigration	6	2	8	5	2
Replacement Demand	5	5	5	5	6
As a % of the Labour Force	3.1	3.1	3.1	3.1	3.7
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	7	6	7	3	0
Graduates Entering the Labour Force	2	2	1	4	1
Permanent and Temporary Immigration	6	5	6	1	5
Replacement Demand	6	6	6	6	7
As a % of the Labour Force	2.6	2.6	3.0	3.1	3.5
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	29	24	29	22	24
Graduates Entering the Labour Force	9	15	11	14	12
Permanent and Temporary Immigration	4	2	6	6	5
Replacement Demand	8	7	7	8	9
As a % of the Labour Force	3.2	3.2	3.2	3.6	3.7

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Nova Scotia Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

Nova Scotia is projected to grow at a rate of 1.1 percent in 2012, in line with a decline in the level of residential investment in the province, as well as weak government expenditure growth. In 2013, the province is projected to grow at a rate of about 1.6 percent, in line with strengthening plant and equipment investment. The projected average annual growth rate for the province over the forecast as a whole is 1.5 percent. The impact of the recently announced federal ship building project on Nova Scotia has not been included in the forecast, as sufficient data are not available to produce an accurate assessment.

Strong growth in plant and equipment investment continues over the next two years as various major projects are underway or expected to begin in the short term in the mining, transportation and warehousing, and utilities sectors. Plant and equipment investment declines hereafter as a number of major projects are completed, and the province begins to rely on consumer and government expenditures and a recovery in residential investment to sustain growth over the long term. Government investment rises this year in line with the commencement of investment projects at the Halifax Harbour, and generally declines over the remainder of the medium term, back to pre-stimulus spending levels.

Real industry GDP growth is driven in the medium term by the primary sector, as production from Deep Panuke gas field is expected to begin this year. More than 13 percent growth is projected for the sector in 2012. Growth in the primary sector is weak in the long term in line with declining gas activity.

The manufacturing sector is expected to decline this year, and will strengthen thereafter, making the sector one of the fastest growing in the province over the medium term. This growth is due in part to the completion of several Imperial Oil refinery projects and a recovery in U.S. growth. Growth will continue near 1.5 percent per year for the manufacturing sector in the long term.

There is an upswing in employment in 2013 and growth remains steady to the end of the medium term with a few major projects scheduled to begin construction. With mostly non-labour-intensive projects planned thereafter, employment levels remain weak in the long term averaging less than half a percent on average over the forecast period as a whole. The unemployment rate continues to decline over the forecast period, from 9.0 percent in 2011 to less than 6.0 percent in the long term, caused by an aging population and the resulting retirements from the labour force. On average, the labour force declines 0.4 percent per year in the medium term and grows 0.2 percent per year in the long term.<sup>17</sup>

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<sup>17</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.

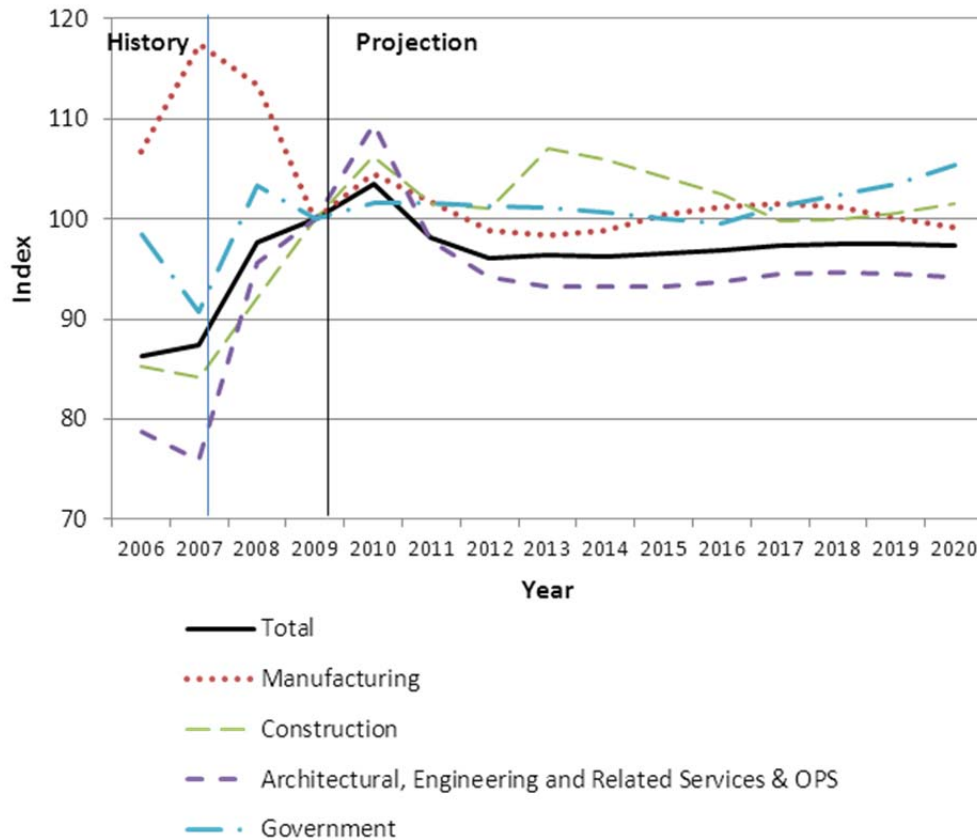
### Exhibit H.1: Engineering Work Force Estimates 2011, Nova Scotia

Work Force Estimates	2011
Professional Membership	3221
Engineering in Training	548
<b>Total</b>	<b>3,769</b>

Employment	2011
Civil engineers	1263
Mechanical engineers	561
Electrical and electronics engineers	778
Chemical engineers	160
Industrial and manufacturing engineers	246
Metallurgical and materials engineers	19
Mining engineers	36
Geological engineers	37
Petroleum engineers	120
Aerospace engineers	138
Computer engineers (except software engineers)	333
Other professional engineers, n.e.c.	208
<b>Total</b>	<b>3899</b>

Source: Engineers Nova Scotia, Statistics Canada

**Exhibit H.2 - Nova Scotia Engineering Employment Growth by  
Industry (Expansion Demand)  
Index 2009 = 100**



Source: Prism Economics & Analysis, C4SE

Index numbers, with 2009 = 100, are shown in Exhibit H.2; tracking the cumulative growth in all engineering employment by industry in Nova Scotia.

**Key Points:**

- Engineering employment increased at a moderate pace through the 2009 recession period and into 2010. A sharp decline was reported in 2011
- Weak provincial economic growth limits job opportunities in most sectors
- No measures have been added for jobs in shipbuilding as there are not yet details available for new Federal contracts
- Employment growth is very weak 2011 to 2020

### Exhibit H.3: Nova Scotia Market Rankings

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	2	3	3	3	3	4	4	4	4
Mechanical engineers	2	3	3	3	3	3	3	3	3
Electrical and electronics engineers	1	2	3	3	3	3	3	3	3
Chemical engineers	1	2	2	2	2	3	3	3	2
Industrial and manufacturing engineers	1	2	2	2	2	3	2	2	2
Computer engineers (except software engineers)	2	2	3	3	3	3	3	4	4
Other professional engineers, n.e.c.	2	3	3	3	3	4	4	4	4

Source: Prism Economics & Analysis

#### Key Points:

- Low rankings reflect a persistent excess supply – especially in entry level jobs
- Nova Scotia post-secondary programs for engineering have consistently led the nation for enrolment growth and degrees awarded
- The continuing high level of entering graduates, after 2012, will create weak market conditions for entry level jobs, but;
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills.

### Exhibit H.4: Nova Scotia - Replacement Demand and Supply Side Measures

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	65	64	61	65	57
Graduates Entering the Labour Force	24	33	44	40	39
Permanent and Temporary Immigration	9	13	18	11	11
Replacement Demand	51	56	63	65	73
As a % of the Labour Force	4.6	4.5	4.5	4.5	5.5
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	92	79	74	79	79
Graduates entering the Labour Force	34	40	45	36	33
Permanent and Temporary Immigration	13	11	11	18	31
Replacement Demand	21	23	25	26	27
As a % of the Labour Force	3.9	3.9	4.1	4.1	4.6
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	62	71	71	52	58
Graduates Entering the Labour Force	34	34	44	54	35

Occupations	2007	2008	2009	2010	Average 2011 to 2020
Permanent and Temporary Immigration	8	15	14	14	24
Replacement Demand	31	36	37	40	39
As a % of the Labour Force	4.4	4.4	4.4	4.5	4.9
<b>Chemical engineers</b>					
Enrolment in Post-Secondary Programs	43	43	43	36	35
Graduates Entering the Labour Force	20	25	24	33	26
Permanent and Temporary Immigration	4	4	5	3	5
Replacement Demand	5	5	6	6	7
As a % of the Labour Force	3.1	3.1	3.7	3.6	4.2
<b>Industrial and manufacturing engineers</b>					
Enrolment in Post-Secondary Programs	26	30	30	30	27
Graduates Entering the Labour Force	18	16	18	18	19
Permanent and Temporary Immigration	6	9	2	4	5
Replacement Demand	7	8	8	8	9
As a % of the Labour Force	2.6	3.0	3.0	2.9	3.4
<b>Computer engineers (except software engineers)</b>					
Enrolment in Post-Secondary Programs	25	13	16	11	6
Graduates Entering the Labour Force	1	30	41	18	10
Permanent and Temporary Immigration	5	4	4	1	4
Replacement Demand	11	11	13	13	12
As a % of the Labour Force	3.2	3.2	3.4	3.4	3.5
<b>Other professional engineers, n.e.c.</b>					
Enrolment in Post-Secondary Programs	88	96	106	150	142
Graduates Entering the Labour Force	17	29	49	67	75
Permanent and Temporary Immigration	2	2	5	10	10
Replacement Demand	8	8	8	8	9
As a % of the Labour Force	3.6	3.5	3.5	3.5	4.1

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers Canada, Prism Economics & Analysis

## Prince Edward Island Overview

### **The Economy**

- Economic measures for PEI show moderate growth from 2012 to 2020 – but ahead of Nova Scotia and New Brunswick,
- Industry growth is led by agriculture, other primary, utilities, construction and manufacturing,
- Government and professional and scientific services (including engineering consulting) grow more slowly,
- Limited growth in education is driven by a declining school age population,
- Overall demographic trends restrict growth in the labour force and reduce long term trends in unemployment and
- Net in migration is needed to increase the labour force to meet employer needs.

### **Engineering**

- Engineering employment declined from 2006 to an estimated at 344 in 2011
- Expansion demands will add 7.6% or 26 new jobs to 2020
- Replacement demands will take 166 or more engineers out of the labour market, from 2011 to 2020 due to retirement and mortality
- Engineers PEI reports 576 members including;
  - 233 active
  - 82 Engineers in Training
  - 19 retired

### **Labour Markets**

Labour market balances cannot be measured for the island by itself;

- The local labour supply can be adjusted by
  - Post-secondary programs that supply the local market from other provinces
- New programs in PEI will add new engineers in the future
- Mobility among provinces is the crucial factor for PEI engineers

Labour market conditions in New Brunswick and Nova Scotia;

- Have mostly a excess of supply over demand from 2012 to 2015
  - Offering limited work opportunities for engineers in PEI and
  - Bringing in competition for work
- Have older age profiles for engineers that add to replacement demand and would limit the available work force with specialized skills and experience

## Newfoundland and Labrador Overview

### **The Economy**

*This section introduces provincial results for major engineering labour markets from 2012-2020. Labour market conditions for engineering occupations will depend on key economic factors. A brief summary of expected conditions is presented here.*

The province of Newfoundland and Labrador is projected to continue experiencing strong rates of economic growth in the short term driven by large increases in plant and equipment investment. About 2.0 percent growth is projected for 2012 and just above 3.0 percent in 2013. The province is expected to average above 2.1 percent growth per year over the medium term as a whole. Strong growth of more than 18 percent in plant and equipment investment was recorded in 2011 and nearly 6 percent is expected in 2012 despite weakness in other components of economic growth this year.

Most components of economic growth strengthen in 2013 with plant and equipment investment growth just below 45 percent. Investment remains at this level as construction of Muskrat Falls and of several oil and gas related projects is expected to begin. The booming growth in plant and equipment investment in the medium term is due, for the most part, to construction of the Churchill Falls hydroelectric development project, oil and gas projects at Hebron, White Rose, and Hibernia, and the Voisey's Bay nickel processing facility. Over the remainder of the medium term, plant and equipment investment declines with a lack of major projects on board which are large enough to maintain such a high level of growth.

The construction sector continues to lead industry GDP growth for the province in the medium term of this projection, with average growth just above 9 percent per year, reflecting a sharp rise in major project investment. Construction GDP grows near 36 percent in 2013 with the commencement of several oil and gas projects, and the Muskrat Falls hydro project. As construction is completed on the Lower Churchill hydro development in the long term, the utilities sector takes the lead in GDP growth, averaging near 8 percent per year.

In 2012, employment growth slows to just below 1.0 percent following a nearly 3.0 percent increase in growth last year, and continues to be very strong in 2013 at about 3.0 percent once again. Toward the end of the medium term employment weakens as major project construction slows, projecting average employment growth for the medium term as a whole at about 1.5 percent.

The Province's unemployment rate is expected to fall by more than 2.0 percentage points over the next two years from 12.6 percent in 2011 to just above 10 percent in 2013 and then rise back towards 12 percent to the end of the medium term as major project construction slows. Although there is a significant rise in net in-migration over the medium term, average population growth for the term is 1.0 percent per year as the natural rate of population growth for the province remains near or below zero.<sup>18</sup>

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<sup>18</sup> Source; Center for Spatial Economics, January 2012 Provincial Economic Outlook.



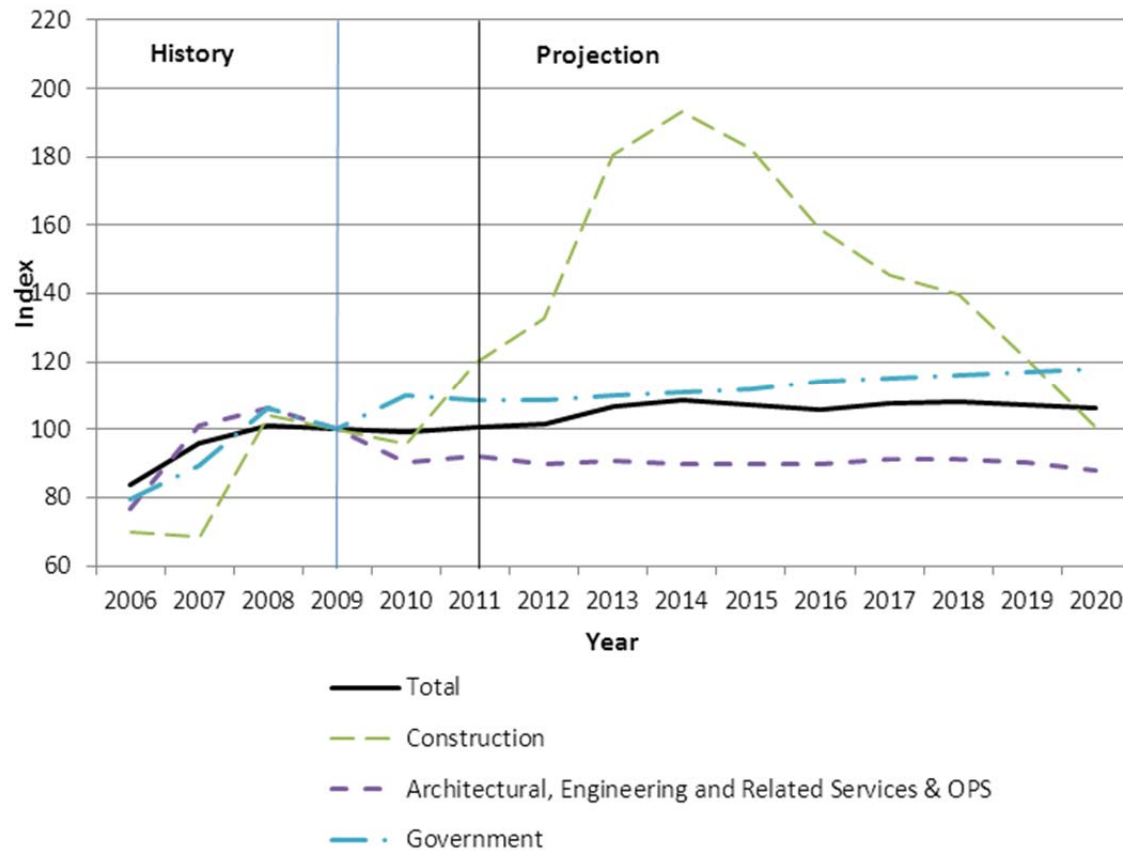
**Exhibit I.1: Engineering Work Force Estimates 2011, Newfoundland and Labrador**

Work Force Estimates	2010
Professional Membership	2397
Engineering in Training	359
<b>Total</b>	<b>2,756</b>

Employment	2011
Civil engineers	787
Mechanical engineers	491
Electrical and electronics engineers	345
Chemical engineers	97
Industrial and manufacturing engineers	120
Metallurgical and materials engineers	28
Mining engineers	62
Geological engineers	0
Petroleum engineers	424
Aerospace engineers	23
Computer engineers (except software engineers)	97
Other professional engineers, n.e.c.	96
<b>Total</b>	<b>2570</b>

Source: Professional Engineers and Geoscientists Newfoundland and Labrador, Statistics Canada

**Exhibit I.2 - Newfoundland & Labrador Engineering  
Employment Growth by Industry (Expansion Demand)  
Index 2009 = 100**



Source: Prism Economics & Analysis, C4SE

Index numbers, with 2009 = 100, are shown in Exhibit I.2; tracking the cumulative growth in all engineering employment by industry in Newfoundland and Labrador.

#### Key Points:

- Engineering employment was rising at a strong pace prior to the 2009 recession but has slowed since that time
- A relatively strong outlook for resource and infrastructure projects is expected to increase engineering employment in general – but the major focus is on construction related activity
- There is a strong peak in activity in 2014
- This analysis assumes that a large portion of the engineering done for the major projects is contracted out to engineers in other provinces or outside of Canada (see [Risks and Alternative Scenarios](#))

### Exhibit I.3: Newfoundland and Labrador Rankings

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Civil engineers	4	5	4	3	2	3	3	2	2
Mechanical engineers	3	4	3	2	2	2	2	2	2
Electrical and electronics engineers	2	3	3	2	2	2	3	2	3
Petroleum engineers	3	2	3	3	4	4	3	3	3

Source: Prism Economics & Analysis

#### Key Points:

- Strong cycles in resource and infrastructure projects creates swings from currently strong markets to weaker ones after 2015 - 2016
- This analysis assumes that a large portion of the engineering done for the major projects is contracted out to engineers in other provinces or outside of Canada (see *Risks and Alternative Scenarios*)
- Replacement demand is strong as the engineering population has an older age profile
- Registration in Post-Secondary programs has been high and growing
- Stakeholders report plans for the expansion of post-secondary programs in Newfoundland and Labrador
- Numbers of new graduates entering the workforce continue to rise to 2014
- Labour markets are divided with ongoing shortages and recruiting challenges for engineers with 5 to 10 years of experience or specialized skills.

### Exhibit I.4: Newfoundland and Labrador - Replacement Demand and Supply Side Measures

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Civil</b>					
Enrolment in Post-Secondary Programs	57	59	59	53	44
Graduates Entering the Labour Force	29	23	25	36	31
Permanent and Temporary Immigration	3	3	6	11	29
Replacement Demand	33	37	38	37	50
As a % of the Labour Force	4.4	4.4	4.5	4.5	5.4
<b>Mechanical</b>					
Enrolment in Post-Secondary Programs	92	87	144	196	164
Graduates entering the Labour Force	32	30	34	45	60
Permanent and Temporary Immigration	8	6	11	20	13
Replacement Demand	21	22	23	22	26
As a % of the Labour Force	3.9	4.1	4.1	4.1	4.6

Occupations	2007	2008	2009	2010	Average 2011 to 2020
<b>Electrical and electronics engineers</b>					
Enrolment in Post-Secondary Programs	47	46	110	171	135
Graduates Entering the Labour Force	26	27	27	32	58
Permanent and Temporary Immigration	4	6	8	9	5
Replacement Demand	17	17	18	17	20
As a % of the Labour Force	4.4	4.4	4.4	4.4	4.9
<b>Petroleum engineers</b>					
Enrolment in Post-Secondary Programs	0	0	0	0	0
Graduates Entering the Labour Force	0	0	0	0	0
Permanent and Temporary Immigration	13	8	26	16	14
Replacement Demand	12	13	15	17	18
As a % of the Labour Force	3.1	3.1	3.3	3.3	3.8

\* Data was not available

Source: Citizenship & Immigration Canada, Engineers  
Canada, Prism Economics & Analysis

## Part 5      Conclusions

Painted in broad strokes, current trends in the supply of engineers across Canada from 2011 to 2020 will leave moderate market pressures and shortfalls given expected requirements. There are several sources of “imbalances” in markets. For example, requirements are heavily skewed to replacing retiring workers with fewer new jobs related to expansion demands. Also, expansion demands are focused on resource, utility and infrastructure projects and many are in the west. It is not clear how the rising numbers of new enrolments in post-secondary programs will find their way into the labour market. In numerical terms, projected new entrants to the workforce from post-secondary programs meet a large proportion of the requirements and current levels of immigration are more than sufficient to fill the balance.

In many markets because skills and experience, available from the new workforce, do not match specialized employer needs. This is most apparent as retiring engineers take valued skills out of the market and these cannot be replaced by new graduates. The concentration of new jobs in the west and in resource and infrastructure projects is also mismatched with supply trends.

Applying long term projections and detailed analysis of this type to human resource planning or industry HR policy involves risks. Alternative scenarios in the report consider some of the risks that drive market rankings under different conditions. Three alternative scenarios are available to test key assumptions.

Differences between the alternative scenarios and the base case suggest that;

- If patterns of “limited retirements” are removed, replacement demands decline and significant supply constraints are avoided -- especially in the west,
- Allowance for discouraged youth limiting enrolment in postsecondary programs has a very limited impact on market balances as few of the new students will actually enter the labour markets and the existing student population determines short term trends in graduates.
- A rising share in increasing international opportunities for engineering consulting for Canadian firms will add to expansion demands and to significant supply pressures.

These assessments are based on a simple extrapolation of trends. Results point to adaptations that will better match supply and demand. For example, the findings imply that markets will function better if human resources planning for engineers includes;

- Retaining older engineers in the workforce longer and
  - Adapting access to pension benefits
  - Building mentoring, leadership training and other succession plans
- Adapting the temporary foreign worker, Provincial Nominee Programs and other immigration options
- Adapting post-secondary programs to these changing conditions by;
  - Promoting the interprovincial mobility of young engineers,
  - Adding to programs to accelerate the on-the-job learning of new graduates, including

- Expanded engineers in training, coop programs and related initiatives
- Adapting post-secondary programs to meet the specialized needs of employers by,
  - Adding specialized programs in universities and community colleges
    - Examples include new programs in mechatronics and biomedical electronics engineering
  - Recognizing undergraduate engineering degrees as foundation education that is linked to post graduate specializations
- Increasing the supply of engineers in the west, through post-secondary programs and immigration, and
- Added flexibility and portability of specialized engineering services across regions and specialities.

These conclusions and implications are examples of more detailed and practical outcomes related to the 2012 Update of the Engineering Labour Market system. Over 50 Engineers from across Canada participated in validation meetings and webinars during August 2012 that reviewed these findings and led to added comments and changes to the projections and rankings. Engineers Canada extends its appreciation to the participants in these sessions and invites comments from all readers.