

WHAT DO WE KNOW? WHAT DO WE NEED TO KNOW?

The State of Research on Work, Employment and Climate Change in Canada

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EXECUTIVE SUMMARY

Carla Lipsig-Mumme

*Climate change represents an unprecedented challenge...the anticipated job gains and losses are sizeable, and no sector can afford to ignore the consequences...If the questions of employment and human resources are not more closely integrated into climate policies, we may expect them to become a major barrier to the ...transformations demanded...*¹

Introduction

Canada poses an unusual challenge in the international struggle to slow global warming. Almost alone among developed countries, Canadian national policy 'has remained largely dormant on the national scale,' according to the Climatico National Policy Assessment Report in 2009.² The Canadian public continues to rank concern about the environment at or near the top of its list of urgent priorities, but climate's impact on employment and work has been oddly neglected in policy and research. Promises that tens of thousands of diversely defined new 'green jobs' will result from major new investment in alternative energy have not yet been realized, and definitions of what a green job is have proliferated without consistency or operationalization. Adaptive training - greening - for ongoing jobs is not high on policy agendas. As McBride notes, the danger of climate policy remaining 'employment-blind', and employment policy remaining 'climate-blind', is acute.³

What do we know? What do we need to know? The Implications of Global Climate Change for Canadian Work and Employment (2010), is the first comprehensive study to examine broadly the state of knowledge about climate change and Canadian employment. It focuses on six of Canada's most significant economic sectors. Drawing on scholarly and grey literature,⁴ it surveys the evolving scope and focus of Canadian research on the climate/work interaction during the critical period from 1995 to the end of 2009.⁵ Gathering and analyzing almost 1500 documents in English and French produced by Canadian and international sources; the material is now publicly available in a bibliographic database.⁵

Understanding climate change and the steps that will be needed to mitigate or adapt to its effects are among the leading policy and research challenges of our day. The labour market is an important area,

¹ S. Dupressoir et al., 2007. *Climate change and employment: impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030* (Brussels: ETUC; Social Development Agency; Wuppertal Institute).

² Billett, S. et al. 2009. *Assessing national climate policy, November 2008 - February 2009*. (Climatico Analysis) . Retrieved from <http://www.climaticoanalysis.org/wp-content/uploads/2010/01/national-assessment-report-mar-09.pdf>.

³ Stephen McBride, McMaster University, Canada.

⁴ Grey literature is "information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing, i.e. where publishing is not the primary activity of the producing body." Cited in Perry chapter.

⁵ <http://www.workinawarmingworld.yorku.ca/>

which has largely been outside the scope of most research. There is a pressing need to develop a relevant research agenda, beginning with surveying what we do know.

Context: The International Context for Canadian Research

Pivotal to ‘the climate challenge’ is the engagement of the work world in ‘greening jobs’, transforming the labour process, training, education, and the physical environment in which work takes place, so as to reduce the greenhouse gasses produced and used. Three international research debates frame Canadian research and strategic response to the climate impact and implications for work and employment.

The first international debate develops within the international climate science community, and concerns two relationships: first, the actual and potential role of economic activity in producing and reducing greenhouse gas emissions; second, the changing relationship between mitigation and adaptation strategies.

The second debate concerns ‘bringing the state back in’: How can climate policy move beyond its current ‘employment-blindness’?⁶ The most comprehensive European research warns that ‘*if the questions of employment and human resources are not more closely integrated into climate policies, we may expect them to become a major barrier to the ...transformations demanded*’.⁷

The third debate asks: but what about the jobs? It is in reality two debates: the first concerns employment, the second concerns work. Is climate change itself a job killer? Is responding to climate change a job killer? Can responding to climate change by shifting to a lower-carbon economy create jobs? How much can we expect from ‘green’ job-creation?

In recent years, Canadian trade unions and policy makers at provincial levels have also turned towards the idea of green jobs as a means of transition to a lower-carbon economy. That ‘turn to green jobs’ is still embryonic, and still marked by the lack of a clear definition, credible projection of numbers, and clear thinking about how climate policy, training, retraining and job creation will be effectively integrated. At this time in Canada, the more dynamic strategy of ‘greening jobs’ - with its integrated and long-term approach to transitioning all employment, work practices and work organization and therefore training and credentialing - is just coming over the horizon. An argument can be made that ‘greening’ existing jobs will be crucial, because these represent a far larger number of jobs than new ‘green jobs’. Indeed, it would be a lose-lose proposition not to embark on greening existing work and employment, because adapting existing jobs will increasingly offer a way to allow these to survive as we transition to a lower-carbon economy.

⁶ The phrase was coined by Stephen McBride, McMaster University.

⁷ S. Dupressoir et al. *Climate change and employment*, p 3.

Six themes of specific relevance to Canada emerge from the burgeoning international literature about the climate effect on work and employment.

The first theme: *Climate science is a social issue.* The need to ‘socialize’ the findings of climate science emerges from climate scientists who draw attention to the lack of collaboration between climate science and social science. ‘Social climate scientists’ call for *linking climate science and social science*, in order to create effective, timely and active social policy response to climate warming.

The second theme *focuses on policy integration.* It asserts that a double *policy integration* is necessary: first, integrate transitional policies for employment and human resources management with environmental policy. Next, integrate employment and environment policies with the suite of social welfare policies necessary to cushion the geographic, community and employment dislocation that will occur. Without this double integration, there is a risk that attempts to implement policy to slow climate warming will fail.

The third theme explores *the need for strong, creative, interventionist states*, for job creation, incubation of green technologies, training for green competencies, crafting and realizing climate policy that will slow climate warming.

The fourth theme *addresses the confusion surrounding the definition of ‘green’ and ‘greening’ jobs*, as these relate to work practices, and the economy.

The fifth theme focuses on *the range of ways in which workers and workplace organizations can play an active, adaptive role* in greening the economy and the labour process. ‘Greening the economy’ is a process, a direction, and a space for active engagement by individuals, labour market organizations, businesses, communities and governments.

The sixth theme *draws attention to the difficulties in coordinating mitigation and adaptation strategies to reduce the production of greenhouse gas emissions.*

Sectoral Studies

What do we know? collected and analyzed roughly 1500 documents on intersection between the climate change, work and employment. These were produced between 1995 and the end of 2009. We categorized the literature in two ways: by economic sector, and by the origin of the source.

Six sources of origin were identified: scholarly publications, research organizations, government and para-governmental organizations, labour market actors, advocacy groups, and the popular media. Categorizing by origin allowed us to see that the majority of research on the effects of climate change on work does not originate in the traditional disciplines like industrial relations, political science, economics or

sociology, and their established journals. Rather, it originates from new journals, think tanks outside universities, governments, advocacy groups and labour market actors.

Specific bibliographies were organized around seven topics: six economic sectors and one overview. The six economic sectors are: energy, construction, forestry, postal services, tourism, and transportation equipment. These were chosen for their significance to the Canadian economy, diversity of size, work organization, size and composition of labour force, significance of their contribution to GHG emissions, and nature of their response to the impact of climate change. The seventh topic was 'Context', which includes overview documents of importance internationally and to Canada. This categorization of sources by economic sector allowed us to develop a shared set of questions for the six sectors, and to identify the particularities of each sector, as well as convergence, contradictions, overarching patterns and silences.

The evaluation of the literature - how much do we know? - is structured on two levels.

On the first level, we ask four core questions:

1. What is known about the impact of climate change on employment in each sector?
2. How is climate change likely to change the nature of work and employment in the sector?
3. What are the characteristics of the sector and of its labour force?
4. What is the policy context in which the sector operates and how influential is climate change in shaping the policy context?

On the second level we ask: what does the literature fail to address? What do we need to know? Summaries of the findings for the six sectors follow.

Climate Change and Labour in the Energy Sector⁸

Focus in this sector is on the production of energy rather than its use. The energy sector is a major source of GHG emissions, producing 37% of Canada's total GHG emissions in 2008. Within the sector, fossil fuels continue to dominate, and Canadian oil and gas production continues to expand. However, direct employment remains small: only 1.8% of the Canadian work force was employed in the sector in 2009. The labour force itself tends to be younger than the Canadian average, and dominated by white males. In oil and gas, women represent 28% of the labour force, a slight increase over the past decade. It is to be noted that union coverage in the core sectors of oil and gas is 12.3% and declining.

While oil and gas production has been decreasing in other countries, such is not the case in Canada. Instead, production from unconventional sources is expanding, and electricity use is increasing. Both developments are environmentally problematic. Employment growth in oil and gas is projected for the

⁸ Marjorie Griffin Cohen and John Calvert, chapter authors.

foreseeable future, fuelled partly by the need to replace retirements in electricity, and partly by continued employment growth in the tar sands.

Will the growth in employment be growth in green jobs? This is difficult to project, for several reasons. First, there is no accepted definition of a green job. Second, in other countries the manufacture of green technologies has been accompanied by government policy encouraging its domestic take-up, thereby creating a flow-on effect for employment. Such is not the case in Canada because governments at both federal and provincial levels have failed to link manufacture of green technologies with the creation of favourable conditions for their domestic use. Third, the labour process in green projects in the energy sector is not significantly different from labour process in conventional energy jobs. Fourth, green projects tend to overestimate the number of jobs they will create. Many are temporary jobs, and there is rarely any follow-up to monitor the number of green jobs actually created. Finally, while new production in renewable sources is more labour intensive, the sector remains very small, and therefore a minor producer of new jobs.

The demand for employment in the energy sector will continue to grow in the foreseeable future, focused in retirement replacements and continued employment growth in unconventional sources. While the demand grows, there is no indication that the way work is carried out in the energy sector will become more 'green' or more unionized. Renewable sources are more labour intensive, but they represent a small part of the market, and thus of new job growth.

While employment will grow, 'most significant for the growth of green employment is the extent to which future energy policy will be shaped by market based decisions or by pro-active government decisions that may move Canada in different directions'.

The Forestry Industry⁹

Forestry has historically been one of Canada's leading manufacturing sectors, and its largest net exporter. However the combined effect of major structural change in the industry, downturn in demand since the 'Great Recession' of 2008, the disastrous impact of climate warming on logging, processed wood and pulp and paper, have together triggered a crisis of unemployment, modifications of labour process, and reorganization of the supply chain. In the first half of 2009, British Columbia alone lost approximately 25% of its wood and pulp shipments and its newsprint shipments. This chapter of the report focuses primarily on the impact of climate warming on logging, solid wood processing and pulp and paper.

What role does climate change play? Warming is affecting where trees grow, and therefore where forest work takes place. Warming incubates disastrous pests like the pine beetle, which destroy forests. Since 2005, over 100,000 jobs have been lost, and most of that loss is permanent. Nor have the several levels of

⁹ John Holmes, chapter author.

government been forthcoming with help in bailing out the struggling industry. Since forest work and forest communities are dependent on each other, major job loss threatens vulnerable communities. 'Forests and climate warming are intimately connected'.¹⁰ Forests may be carbon sink or carbon source. With 400 million hectares of forest, Canada's forests can absorb about 20 times the annual CO₂ emissions that burning fossil fuels creates. Thus the major role of forests is to determine carbon balance.

There are three ways that climate change in the forest may impact employment. First, climate warming shifts some species of trees northward, and leads to the death of others. This shifts the geographic relationship between extraction and manufacturing. It also may distance workers from their communities. Second, new wood products are emerging, new skills and occupations are coming forward, and the transformation of traditional jobs calls both for adaptive training and employing newly skilled workers. In addition, the pressure to green production practices may well have an impact on skills and training. Yet so far, governments at every level have not provided the industry with look-forward funding. Third, trees are both carbon source and carbon sink. In a cap and trade market, Canada's trees might become more valuable left in the ground than harvested.

Yet it is difficult to untangle the precise role of climate change in relation to other stressors for the forest industry, and its impact on present and future employment. Forestry has been struggling with a cluster of vulnerabilities that affect production and marketing, including a shift from vertical to horizontal integration.

'Sound management models could go a considerable way to offsetting GHG emissions elsewhere in the economy.' From a climate change perspective, that means placing carbon storage at the forefront of forest produce use.¹¹

Finally, there is need to know what impact a move towards greener production practices would have on employment, and might have on work practices, province by province.

The Impact of Climate Change on Employment and Skills Requirement in the Construction Industry¹²

The construction industry in Canada in 2009 employed 1.2 million people, approximately 7% of the labour force. It is characterized by a preponderance of small and mid-sized businesses, and is heavily, although unevenly, unionized.

¹⁰ J. Holmes 2010. 'The Forestry Industry' in this Report.

¹¹ J. Holmes 2010. 'The Forestry Industry' in this Report.

¹² John O'Grady, chapter author.

The construction sector is responsible for 30-40% of Canada's GHG emissions, taking into account the life cycle of buildings. The review looks at the relation between climate change and employment in the construction industry from three perspectives. First, the impact of 'green principles' on skills requirements, both in new training and updating training. Second, the impact of 'green' retrofitting on employment in construction. Third, the gaps and silences in the present state of knowledge.

The review found, first, that there is little research on how large the task would be to retrofit infrastructure that might be damaged by climate warming. As a result, it is impossible to estimate employment growth to repair or replace infrastructure. Second, the industry and the postsecondary system as well as the professional associations have an excellent track record in adapting training to meet new needs. Third, estimates of the employment impact of implementing green policies cannot be relied upon. Fourth, building rating systems matter in determining the application of green construction principles to new constructions and to retrofitting. However, the influence of rating systems on choice of materials, skills and work processes is not well understood. Fifth, the trades have been slow to include 'green construction' into skills training. Sixth, the lag by some trades in integrating green training into standards is opening the door for 'greener' industries to move outside the established system, and establish their own training schemes. Seventh, for the design professions, green certification has become increasingly important.

Finally, identifying the steps needed to mitigate climate change or adapt to its effects in the subsectors of the construction industry is both a policy and a research challenge. To date, the construction labour market has been largely neglected in most research. There is a pressing need to develop a relevant research agenda.

The Transportation Equipment Industry¹³

While there is sizeable literature about the relationship between transport and GHG emissions, there has been little research about the impact of climate change on employment futures and skills requirements in the auto industry. It is important to distinguish between emissions associated with the manufacture of vehicles, and emissions arising from their use. The review focuses on manufacturing.

The auto sector is Canada's most important manufacturing industry. In the late 1990s it accounted for 1/3 of all manufacturing exports, 10% of manufacturing GDP, and employed over 150,000 workers. 85% of cars made in Canada however, are exported, mainly to the US, while 80% of cars sold in Canada are built elsewhere.

Like the forestry sector, the transportation equipment sector has been grappling with a comprehensive crisis in recent years. Restructuring ownership and the divisions of labour, auto manufacturers are also

¹³ John Holmes with Austin Hracs, chapter authors.

moving to reduce energy use and emissions. Climate change is a clear driver for technological change in vehicle design. But the literature shows that the fundamental labour process - the way cars are made - is not likely to change much as auto manufacturing 'greens'. In this, it should be noted, there are similarities between the auto industry and the energy sector.

'Efforts to reduce energy...and GHG emissions from vehicle assembly plants has been driven both by economic considerations and criteria attached to government financial aid'.¹⁴ However the shift to 'just-in-time' production over the past 20 years increases GHG emissions, as parts travel from parts-makers to factory.

What effect will climate change have on employment? In the middle distance, employment is likely to grow modestly, as compliance with government regulations on fuel efficiency and reducing GHGs make the production of each vehicle more labour intensive. 'Responding to climate change will add more content and value...and should create more auto jobs'.¹⁵

There are, however, more systemic and deeply rooted problems that will threaten employment levels in Canada. As the global auto industry continues restructuring, the interaction of responding to climate change and responding to restructuring, raise a range of challenges and questions:

- Will government regulations and longer-term changes in urban planning, lead to a shift away from cars?
- What new skills will be required to work with the new auto power-train technologies?
- How will these new skill requirements relate to the growing integration of mechanical, electrical and software engineering?

Research is needed to provide much more precise forecasts of employment trends and specific skill requirements, not only in response to new 'green' technologies, but also with regard to broader changes in the industry.

Climate Change and Work and Employment in the Canadian Postal and Courier Sector¹⁶

The postal and courier sector is a subset of the transportation sector. This review focuses on Canada Post and the courier industry. Like the other sectors, there is very little research directly linking climate change and jobs.

However the review designed a series of questions to explore the issue:

¹⁴ John Holmes with Austin Hracs.

¹⁵ John Holmes with Austin Hracs.

¹⁶ Geoff Bickerton, Meg Gingrich, Sarah Ryan, chapter authors.

- Have concerns regarding climate change inspired changes in the practices of suppliers, customers and service providers?
- How do the effects of and perceptions surrounding climate change influence demand for postal and courier services?
- Is it possible to separate the effects of climate change from other drivers of change?
- Can we identify first-order and second-order effects of climate change?
- Are the types of jobs and the technologies changing?
- What effect does the introduction of new technology have on GHG emissions in the postal and courier sector?

Canada Post Corporation is Canada's 6th largest employer, and holds almost exclusive rights to deliver the mail. With Purolator, it operates the largest vehicle fleet in the country. The Canadian courier industry is fast-growing, and worth approximately \$8 billion in sales annually.

'The major core companies in the postal sector have been consistently profitable'.¹⁷ CPC employed 80,000 people in 2008, up from 71,000 in 1997. Of these, almost half are women. The courier sector employed 47,000 in 2008, up from 33,000 in 1997.

What is the carbon footprint of the sector? The review mentions international auditing by postal services on reduction of emissions over the past decade. The interdependence of the four components of the postal mail chain is of great importance: buildings, the fleet, delivery process, and sorting processes. But 'in order to fully understand the relationship of climate change and work and employment...we need to examine the environmental consequences of the operational changes that have been, or may be, introduced into the production processes by employers'.

Tourism: Climate change and the missing worker¹⁸

'Despite an increasingly sophisticated literature on the impact of climate change on tourism employment, 'impacts' are in reality neglected, as work remains an a priori consideration with little nuance'.¹⁹ The limits to knowledge about local variations in climate change and the lack of research on local vulnerabilities, resiliency and local adaptation, make it difficult to create more generalized models of impact and response.

In addition, 'a major barrier to analysis of the impacts of climate change on tourism-related employment is the chaotic conceptualization of what actually constitutes the sector'.²⁰ The review focuses on transportation, accommodation, food services, and travel services.

¹⁷ Geoff Bickerton, Meg Gingrich, Sarah Ryan, chapter authors.

¹⁸ Steven Tufts, chapter author.

¹⁹ Steven Tufts.

²⁰ Ibid.

The review identifies first order impacts: changes to climate which affect tourism directly. These are, in the main, meteorological, and health-related.

Second order impacts arise from response to climate change. Here, the focus is its impact on the workers. Reduction of air travel CO2 emissions, reduction of emissions in ground and water transport, and greenwashing, comprise the second order impacts. Third order impacts comprise the broadest political and economic impacts, including economic contraction and political instability.

How is the tourism sector responding to the impact of climate change? The review contrasts a high road and a low road response to climate in relation to employment. The low road is Business As Usual, relying increasingly on worker ‘flexibility’, intensification of work, and greenwashing. A higher road, however, focuses on collective bargaining to negotiate environmental responsibility and climate change education. It engages state intervention to regulate employer practices and provide both infrastructure and adaptive training for green skills, the job, and the products used at work.

The review also draws attention to an important silence. Tourism-related workers and their organizations have both a positive and a normative role they *can* and *do* play in responding to climate change. Their vulnerability to climate change is great. But their wealth of expert knowledge, grounding in community, and collective organization give them unparalleled strategic resources to shape the impact of climate change: to adapt their workplaces to the effects of climate change, and to contribute to reducing greenhouse gas emissions. Understanding and engaging with the role that workers and their organizations can play in the struggle to slow global warming requires *centering* workers in the research. Given the varied nature of the tourism sector, in-depth qualitative research *bringing the workers back in*, linking mitigation to adaptation practices to changes in labour process, is urgently needed.

What do we need to know? A Research Agenda

Labour market effects of climate warming fall broadly into two categories—changes in employment patterns across industries and within industries and sectors; and changes in skill requirements. The factors which structure the ways in which a particular industry, sector or subsector responds to climate warming however, emerge from the political economy of the sector.

The principal areas and questions that should guide the setting of the next research agenda include:

1. Research is urgently needed to identify the impact of a move towards a ‘greener’ economy on employment trends and skills requirements, in industries, sectors and sub-sectors.
2. Can the impacts of climate warming be differentiated from changes in employment due to other political economic transformations?

3. In some sectors (i.e. forestry and tourism), climate warming may bring a shift in the geographic location of work. Can models that have been developed by climate science to predict regional shifts in the location of work, be used to assess the impact of such shifts on geographic patterns of employment? A review of international practices would be useful.
4. Research is needed to provide more precise forecasting of employment trends and specific skills requirements, both in relation to climate warming and linking climate warming to broader changes in sectors.
5. How important is the lag in incorporating 'green' skills into training standards?
6. How different are the jobs needed in key 'greening' sectors such as renewable energy from the jobs now required in traditional energy sectors?
7. What is the spectrum of actual response to the impact of climate warming in the workplace, among large, medium and small business in Canada? Among trade unions? Among governments at all levels? What role does the introduction of new technology play?
8. Green skills are playing an increasingly important role in occupations and professions related to construction. What impact does this have on the bodies that regulate professional practice?
9. There is need to identify international and national best practice: in government action to facilitate fast and affordable sectoral greening; and in the introduction of 'green' skills requirements.
10. Research is needed to identify provincially and nationally the organizations and resources that will mobilize community and workforce actors to develop and implement green work practices and training.

INTRODUCTION: THE INTERNATIONAL CONTEXT FOR CANADIAN RESEARCH ON CLIMATE CHANGE, WORK AND EMPLOYMENT

Carla Lipsig-Mumme

Introduction

'Creating a global economy that emits a half or a quarter of the greenhouse gases of today's economy will require wholesale changes in the way economic activities take place'.²¹

'If the questions of employment and human resources are not more closely integrated into climate policies, we may expect them to become a major barrier to the ...transformations demanded'.²²

The present and future effects of climate change²³ are of broad and deep concern for Canada today, but its implications for employment and work have been nearly absent from public policy and social science research.²⁴ Not, however, because Canadian work has escaped the volatile impact of climate change. Climate warming is already changing how we work, what we produce and where we are able to produce it.²⁵ But the climate effect is uneven, between provinces, industries, age groups and genders. It is shifting employment within and between countries, regions and communities, dislocating people and industries and futures. New occupations and professions are springing up across Canada, and the possibility of new ways of working are crystallizing. These shifts also challenge training and education, influencing in different ways, and on different levels, the school-to-work trajectories of Canadians. And while international research argues for 'bringing the state back in', foregrounding the pivotal role of interventionist governments in creating and funding active labour market pathways for workers at all stages of transition to a lower-carbon economy, such is not the case in Canada.

Canada poses an unusual challenge in the worldwide struggle to slow climate warming. The lack of Canadian national climate policy sets us apart from virtually all other developed countries. In 2009, the Climatico National Policy Monitor, comparing Canada to other

²¹ S.F. Fankhauser, F. Schelleier, N. Stern, 2008. 'Climate change, innovation and jobs', *Climate Policy* 8, p.427

²² S. Dupressoir et al., 2007. *Climate Change and employment. Impact on employment of climate change and CO2 emission reduction measures in the EU-25 to 2030*. (Brussels: European Trade Union Congress, SYNDEX, ISTAS, Social Development Agency, Wuppertal Institute), p.3

²³ By climate change we mean recent changes in climate mostly attributable to human activity.

²⁴ In Chapter 2, Elizabeth Perry quotes Balsted's article in UNESCO's *World Social Science Report* of 2010, to the effect that to date climate change has remained a small special area of research within the social sciences.

²⁵ D.S. Lemmen, F.J. Warren, J. Lacroix, E. Bush eds., 2008. *From Impacts to adaptation: Canada in a changing Climate 2007*. (Ottawa: Government of Canada).

G8 countries in terms of progress in climate policy, characterized Canada as 'largely dormant on the national scale.'²⁶

The lack of Canadian policy is paralleled by the underdevelopment of national research, and the paucity of interdisciplinary work linking climate science and social science. These silences set the objectives for the *What do we know?* study. Its objectives are:

- Assess what we do know about the climate change, work and employment relationship
- Identify what we need to know
- Disseminate existing knowledge widely, in traditional and non-traditional forms, to academic and wider publics
- Equip Canadian labour market organizations, groups and policy makers with the information to take more effective action
- Aid Canada to re-enter the international debate on strategy and action to slow climate warming

What do we know? takes Canada's strategic paralysis as its starting point. Its central question is:

What evaluation can we make of the state of knowledge concerning the complex interaction between climate change and Canadian work and employment, particularly in the domains of employment tenure and employment transitions, labour market restructuring, regulation and industry policy, and skill demands? What do we know? What do we need to know?

The study takes a sectoral focus, evaluating the state of knowledge about the climate effect on Canadian work and employment in six economic sectors: energy, forestry, transportation equipment, tourism, postal services and construction. It also sets the sectoral studies in international context. To evaluate the state of knowledge, the study analyzed approximately 1500 documents in English and French, produced by Canadian and international sources. Approximately 87% of the documents address the climate effect on Canadian work and employment. Approximately 13% address the broader international context. The documents are identified and described in a publicly accessible and searchable database,²⁷ and seven bibliographies have been constructed, for each of the sectoral studies, and for international context.

The documents were produced by a wide range of organizational sources between 1995 and 2010. They are categorized according to their publisher or responsible organization²⁸: scholarly publishers, research

²⁶ S. Billett, 2009. *Assessing national climate policy*, November 2008-February 2009. Retrieved from www.climatecoanalysis.org.

²⁷ Elizabeth Perry, Information Specialist, constructed the database, available at <http://www.workinawarmingworld.yorku.ca/>

²⁸ Elizabeth Perry's chapter in this report gives details on how organisations were categorised.

centres, government and para-governmental organizations, labour market actors, advocacy groups and the popular press.

Analyzing web-accessible documents in English and French, *What do we know?* includes grey literature²⁹ as well as traditional literature and material from labour and business as well as government, making it a more comprehensive study of the state of Canadian knowledge on the impact of climate change for work and employment than any other to date.

This chapter reviews trends and debates in international research on the climate change / work / employment relationship, setting the context for the *What do we know?* sectoral studies which follow.

Three Debates

Worldwide, the combination of globalization and global warming is creating a partial and uneven convergence of dangers.³⁰ A recent Oxfam report predicts that hunger will become this century's most brutal legacy of climate change.³¹ A recent European Commission study predicts that as many as 20% of the world's population may become 'environment migrants'.³² Among developed and prosperous countries, heat-related deaths are growing, seasons are disappearing, drought is destroying crops and agricultural futures, and extreme weather events are wreaking havoc with growing seasons. In Canada, employment is affected both directly by climate warming, and indirectly by response to climate warming. Occupations and professions confront the need to adapt training to match shifting skill demands, while constructing active labour market transitions for those struggling to remain employed. "Climate change is a threat multiplier", was the conclusion of a forum held by the International Peace Institute in June of 2009.³³ Climate change needs a response at all levels. However it is often claimed that responding to

²⁹ Grey literature is defined as 'information produced on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing, i.e. where publishing is not the primary activity of the producing body.' See Perry chapter for further discussion.

³⁰ A. Giddens, 2009. *The Politics of climate change*. (Cambridge: Polity).

³¹ Oxfam International, 2009. *Suffering the science: Climate change, people and poverty*. Oxfam Briefing Paper 130, July 6.

³² Commission of the European Communities, 2008. *A Report on climate change and international security to the European Council*, S113/08, March 14. (Brussels: European Commission).

³³ International Peace Institute, 2009. 'Climate change is a threat multiplier experts say', June 10, 2009. Retrieved from www.ipacademy.org

climate change kills jobs.³⁴ But does responding by transitioning to a lower-carbon economy necessarily kill jobs? Recent research from Australia argues that not responding to climate change is likely to destroy jobs.³⁵

The climate effect on work and employment has attracted relatively little research worldwide, and climate policy has been largely silent about its role. But pivotal to ‘the climate challenge’ is the engagement of the world of work in the struggle to slow climate warming by reducing work’s carbon footprint.³⁶

In the burgeoning literature on climate change in the past fifteen years, three international debates are of particular relevance to Canadian research and strategic response to the climate impact and implications for work and employment.

The first debate develops within the international climate science community, and concerns two relationships: first, the actual and potential role of economic activity in producing and reducing greenhouse gas emissions; second, the changing relationship between mitigation and adaptation. The debate is shaped, initially; by longstanding disagreement among climatologists as to the role human agency plays in creating climate warming. While serious science now accepts that (most or all of) the causes of climate warming are anthropogenic in origin, the language wars in the climate syntheses demonstrate the difficulty with which climatology grapples with the idea of human agency in environmental change.³⁷

What measures slow global warming, and can economic activity play a role? According to the Inter-Governmental Panel on Climate Change (IPCC), mitigation is ‘anthropogenic intervention to reduce the sources...of greenhouse gases.’³⁸ Adaptation is ‘adjustment in natural or human systems in response to a new or changing environment...which moderates harm or exploits beneficial opportunities’.³⁹ While until recently both climate science and social science focused on mitigation as the main game - reduce the production of greenhouse gases - there has been a shifting relation between mitigation and adaptation

³⁴ cf: *Synthesis report from Climate change: Global risks, challenges and decisions, Copenhagen 2009, March 10-12 (Copenhagen: University of Copenhagen)*. This pre-Copenhagen analysis of the state of thinking includes a summary of ‘6 Messages’, in which there is some reference to the impact on work and employment.

³⁵ Kelvin Thomson, 2010. “Failure to reduce carbon emissions will lead to job losses & lower...living standards” Speech to House of Representatives, Australian Parliament, Australia, June 21, 2010. Speech referring to new research study.

³⁶ B. Lim, E. Spanger-Siegrfried, I. Burton, I., E. Malone, & S. Huq, (2004). *Adaptation policy frameworks for climate change: Developing strategies, policies and measures* (Cambridge; New York: United Nations Development Program; Cambridge University Press).

³⁷ Cf Inter-Governmental Panel on Climate Change (IPCC), 2007. *Fourth Assessment Report: Climate change 2007*.

³⁸ Inter-Governmental Panel on Climate Change (IPCC), 2001. *Third Assessment Report, Climate Change 2001. Synthesis Report*, Annex B: Glossary of terms.

³⁹ Inter-Governmental Panel on Climate Change (IPCC), 2001. *Third Assessment Report, Climate Change 2001. Synthesis Report*, Annex B: Glossary of terms.

over the past twenty years. Lynch's description is instructive.⁴⁰

"A primary finding [of the IPCC First Assessment Report, completed in 1990 and updated in 1992] was that mitigation and adaptation strategies should be considered as an integrated package and should complement each other to minimize net costs. But by the early 1990's, debate over climate change focused on the political positions for and against the reduction of greenhouse gas emissions and support of adaptation implied neglect of mitigation."⁴¹

The turn against adaptation became extreme in the 1990s. Support for adaptation was seen to be support for the position that human activity causes climate warming - at that time, contested ideological terrain. Lynch quotes Al Gore (1992): 'a focus on adaptation is a kind of laziness and an arrogant faith in our ability to react in time to save our skins.'^{42 43}

Since the beginning of this century, however, support for adaptation has re-emerged. In 2007 the IPCC concluded that 'neither adaptation nor mitigation alone can avoid all climate change impacts.'⁴⁴ Developing ways in which adaptation and mitigation work together therefore becomes a necessity. This is for three reasons. First, climate warming is occurring more rapidly than expected, and continues to worsen regardless of efforts to mitigate. Second, mitigation requires government policy to effectively reduce emissions—self-regulation by private enterprise has not proven adequate. To date, few governments among the industrialized nations, outside of the EU, have crafted and implemented effective national mitigation strategies. Third, much of the poor majority of the planet's population lives in climate-exposed conditions, in nations that are not major producers of GHGs. But vulnerability to climate change is only one among their cluster of systemic vulnerabilities, which themselves have proven resistant to change.

Adaptation rather than mitigation has become the strategy of pragmatic choice for climate-vulnerable populations in the global South.

Giddens remarks that adaptation 'is a misleading term'. It implies reacting to the consequences of climate change once it has occurred.'⁴⁵ Exploring the ways in which strategies of adaptation in developed countries can work with strategies of mitigation is leading to a more precise focus on public policy and the drivers of change in economic activity. The IPCC's 2007 Synthesis Report argues that 'there is...much evidence of substantial economic potential for the mitigation of global GHG emissions...that

⁴⁰ A. Lynch, 2008. *Climate change: Mapping the context*. (Victoria, Australia: Monash University).

⁴¹ Ibid.:1

⁴² Al Gore, 1992. *Earth in the balance*. (New York: Plume). Cited in Lynch, A. 2008, p.3.

⁴³ Al Gore, 1992. *Earth in the balance*. (New York: Plume). Cited in Lynch, A. 2008, p.3.

⁴⁴ IPCC 2007a: 65.

⁴⁵ Giddens, *The politics of climate change*, 162.

could offset the projected growth of global emissions or reduce emissions below current levels'.⁴⁶ It adds: '(E)conomic mitigation potential...takes into account social costs and benefits...' [Its potential] ...is generally greater than market mitigation potential [but] can only be achieved when adequate policies are in place and [implementation] barriers removed'.⁴⁷

On the one hand, neither mitigation nor adaptation strategies have proven adequate on their own for slowing climate warming.

On the other hand, each has weaknesses in turning its core strategies into plans of action. Where mitigation is concerned, climate vulnerability caused by factors other than climate warming is growing, and strategic response has been inadequate.⁴⁸ In addition, political obstacles to implementing effective mitigation policy in a number of countries have also played a role.

Adaptation suffers from its amorphous definition and its overextended use: the term describes different practices and priorities in poor countries and prosperous countries. In the poorest countries, adaptation is a strategic response defined by its defensive pessimism. Countries and communities whose populations are at risk in their low-lying coastal regions, often face a deeply anchored cluster of vulnerabilities that includes poverty, infant mortality, unavailability of education, inaccessibility of health care, lack of electricity etc. They are also exposed to rising sea levels and climate warming. Strategies of adaptation to climate warming are therefore, often indistinguishable in these countries from strategies to alleviate poverty.

For developed countries on the other hand, adaptation describes a different strategic response entirely, currently focusing on individual consumer choice and lifestyle changes, sometimes seeming unaware that the need for jobs will not disappear. In other words, adaptation as the principal strategy of response to climate change for the poorest countries has been shaped by pragmatic or defensive pessimism in the face of a range of systemic vulnerabilities. In contrast, adaptation as a strategy of response to the climate impact in developed countries has been characterized by individualism, voluntarism and a strand of anti-industrialism. Operationalizing adaptation to make it more focused and usable for developed economies will require a two-pronged reorientation. First, focus on strategies to build community resilience and adaptive capacity, rather than individual lifestyle choices. However, the meaning of community is expanded beyond the geographic, to include communities of interest, such as communities of work. Second,

⁴⁶ IPCC 2007: 58.

⁴⁷ Ibid.

⁴⁸ Lynch, *Climate change*, 5.

if adaptation strategies for developed economies focus ‘proactively’ on transforming economic activities and the organization of work, they have the potential to significantly mitigate the emission of greenhouse gases.⁴⁹

Canadian research is already contributing to redefining adaptation strategies for developed-country use.⁵⁰ Natural Resources Canada, in its influential state of knowledge study on the impacts of climate change in Canada, titled its most recent synthesis ‘Impacts and Adaptations: Canada in a Changing Climate 2007.’⁵¹ In returning adaptation to the spectrum of strategic responses to climate warming, the report observed, ‘Although adaptation processes are not well understood, institutions and civil society will play a key role in mobilizing adaptive capacity’.⁵²

Enter, the world of work. In its largest sense the world of work is one of the planet’s most significant producers of greenhouse gases.

Fields and mines, as well as offices, factories, stores, hospitals, universities, virtual offices and studios, etc. produce goods, services and ideas, and do so within a physical environment. Each stage in the production of goods, services and ideas, including the inputs, outputs, distribution, physical environment in which the work takes place and the eventual disposal of physical products, is a producer of greenhouse gases. How might ‘proactive adaptation’ be developed to transform work practices in these varied environments? What role could trade unions and collective bargaining play in adapting work practices?

The idea that new links between mitigation and adaptation may be crafted in the world of work is promising. Yet as a recent article by Fankhauser, Sehleier and Nicholas Stern in *Climate Policy* note, there is a paucity of research on the impact of climate change on jobs, and even less research on climate change’s impact on the quality of jobs, or work.⁵³ But the need for jobs is not going to disappear - employment is essential to maintaining life, identity and social inclusion. Using the lens of environmental responsibility to actively ‘green’ education and training for the labour market, to ‘green’ work practices and work organization, to retrofit buildings to lower their environmental footprint - adaptation of work should lead to mitigation of greenhouse gases. And, according to the *Climate Policy* article cited above, it

⁴⁹ Giddens, *The politics of climate change* 163-165, sets out a series of concepts for refining ‘adaptation’ into a strategy usable in the developed world. Among these, he distinguishes between ‘proactive or pre-emptive adaptation’ and ‘reactive adaptation’; and defines resilience, adaptive capacity and vulnerability.

⁵⁰ Cf. M. Allard, 2004. *S’adapter aux changements climatiques* (Montreal: Institut Ouranos).

⁵¹ Natural Resources Canada’s knowledge synthesis report on the state of Canadian research on climate change, (*From Impacts to Adaptation, 2007*) pioneered the ideas of resilience, adaptive capacity and vulnerability in relation to adapting to climate change in developed countries in 2008.

⁵² Lemmen et al. *From impacts to adaptation*, 7.

⁵³ S.F. Fankhauser, Sehleier, N. Stern, 2008. ‘Climate change, innovation and jobs’, *Climate Policy* 8, 421-429. cf. Babiker, M., R.S. Eckhaus, 2006. *Unemployment effects of climate policy*, (Cambridge, MA: MIT Joint Program on the Science and Policy of Global Change).

should lead to a modest increase in jobs in the short term. In the long term, an effective climate policy will lead to ‘wholesale changes in the way economic activity takes place.’⁵⁴

The contribution of environmentally adapted work practices, training and employment patterns to the struggle to mitigate GHGs is potentially significant. Yet as crucial as employment and work can be in the struggle to slow global warming, the International Labor Organization’s (ILO) 2009 review of the literature on climate change and work⁵⁵ draws attention to the failure of environmental policy, worldwide, to consider employment. “*In the climate debate employment only features marginally and is regarded as merely a “co-benefit” of mitigation measures. This view overlooks the fact that the benefits for employment and development are vital for making many mitigation measures technically feasible, economically viable and socially acceptable.*”⁵⁶ The ILO paper discusses, as the Climate Policy paper does not, the large-scale job shifts - job churning - that adapting labour practices will occasion. In turn labour market restructuring in response to climate policy brings the questions of policy, political and regulatory drivers to the fore.⁵⁷

The second international debate of relevance to Canada concerns ‘bringing the state back in’: How can climate policy move beyond its current ‘employment-blindness’⁵⁸? What are the regulatory and policy drivers that could lead climate policy to include employment and work in its consideration? The most comprehensive European research warns that ‘if the questions of employment and human resources are not more closely integrated into climate policies, we may expect them to become a major barrier to the ...transformations demanded.’⁵⁹

In identifying drivers that integrate employment and environmental policy, distinguishing between climate impact on the one hand and responses to climate impact on the other is critical. Policy about climate impact maps the situation, and is essentially defensive and restorative. Policies of response to climate impact are essentially transformative, although they might include defensive measures. The most successful national policies of response, such as Germany’s, are formulated, funded and implemented primarily with the state rather than the market taking leadership.

Surprisingly, much contemporary international research in economics and political science lumps climate impact and response to climate change together. Projecting the future of employment in a climate changing world by assuming that there will be climate policies, is not an approach that is currently plausible for Canada.

⁵⁴ Ibid, 427.

⁵⁵ A. Belèn-Sanchez, and P.Poschen, 2009. *The social and decent work dimensions of a new agreement on climate change: A technical brief* (Geneva: International Labour Office), 10.

⁵⁶ Belen-Sanchez and Poschen, *Social and decent work dimensions*, 11.

⁵⁷ The UNEP/ILO 2008 report, *Green Jobs: Towards decent work in a sustainable, low-carbon world*, has been very influential in defining green jobs so that environmental and social justice criteria are inseparable.

⁵⁸ The phrase was coined by Stephen McBride, McMaster University.

⁵⁹ S. Dupressoir et al., 3.

International strategy centering on the Kyoto Protocol has focused on mitigation, setting politically negotiated goals for carbon reduction, with responding policies developed by national, regional and sub-national governments in most developed countries. In this, politics and states have been the principal drivers. However, the recent focus on cap-and-trade and related schemes, particularly in North America and the European Union, may be seen as a turn towards market-oriented strategies.

The long-term effects of the combined environmental and financial crisis of 2008 risk merging with the economic restructuring that results from climate policy.⁶⁰ Policy measures responding to these challenges will have labour market consequences. Unless the employment impacts are an explicit part of the climate change decision-making process, other criteria are likely to govern the selection of measures, with possible detrimental consequences not only for employment, but also for the political support-base necessary for responses to environmental issues in a time of economic difficulty.⁶¹

There is a danger that environmental measures will be 'employment-blind' and vice versa.

Recent research in the European Union highlights the danger, and responds to it by proposing a double integration—the integration of climate policy and employment policy (the latter including active labour market transitions); and the integration of both with a suite of social welfare policies.⁶²

The conjuncture of intense environmental pressures for structural economic change and a reconsideration of economic regulation following an economic crisis rooted, according to many observers, in market excess⁶³, may lead to new assumptions and instruments of public policy. Governmental planning or coordination⁶⁴, and new forms of partnership between public and private sectors⁶⁵ may assume an importance they have not had since the post-World War II period. In this climate, there may be an enhanced role for labour market actors including trade unions, wider circulation of ideas from international and other jurisdictions, and new techniques of administration.⁶⁶

⁶⁰ World Trade Organization, 2009. “WTO News item: Global crisis requires global solutions — Lamy”. Retrieved from http://www.wto.org/english/news_e/news09_e/tpr_13jul09_e.htm. See as well International Labor Organization, 2009. Green policies and jobs: a double dividend? Chapter 4 in *World of work report 2009: the Global job crisis and beyond*, (Geneva: ILO).

⁶¹ cf. the debate in the US on the merits of linking stimulus funds closely to green jobs. Van Jones, 2009. *The Green collar economy: How one solution can fix our two biggest problems* (New York: HarperOne). From a different perspective, Elizabeth Kolbert, 2009. ‘Greening the ghetto: Can a remedy serve both global warming and poverty? *The New Yorker*, January 12, 2009.

⁶² S. Dupressoir.

⁶³ eg. Martin Wolf, 2008. *Fixing global finance* (Baltimore: Johns Hopkins University Press).

⁶⁴ Alejandro Foxley, 2009. *Recovery: the global financial crisis and middle-income countries* (Washington DC: Carnegie Foundation).

⁶⁵ eg. Saskia Sassen, 2006. *Territory, authority, rights: from medieval to global assemblages* (Princeton, N.J.: Princeton University Press); Edgar Grande and Louis W. Pauly, eds. 2005. *Complex sovereignty: Reconstituting political authority in the twenty-first century*. (Toronto, Buffalo: University of Toronto Press).

⁶⁶ Patrick Dunleavy, et al., 2005. ‘New public management is dead—Long live digital-era governance’ *Journal of Public Administration Research and Theory* 2006 16(3), 467-494.

Proposals that include a strong role for the state in factoring employment considerations into measures designed for climate mitigation and/or adaptation have produced research of international significance, in the European Union⁶⁷, Australia⁶⁸ and by international agencies.⁶⁹

The third international debate asks: but what about the jobs? It is in reality two debates: the first concerns employment, the second concerns work. Both develop within the context of the debates about climate and the economy since the 1960s.

In their 2008 review article on jobs and climate change, Pearce and Stilwell outline ‘three waves’ in the development of thinking about climate change and the economy.⁷⁰ The 1960s were marked by concerns about environmental pollution and population growth. National policies in some countries were developed to reduce pollution, but ‘no overall impact on economic activity eventuated’.⁷¹ The second ‘wave’ began in 1988, with the establishment of the Inter-Governmental Panel on Climate Change, which became the single most important voice in the scientific debate. It was marked by intense scientific and political focus on mitigating the production of greenhouse gases, while marginalizing other strategies of response.⁷²

The third ‘wave’ began in the first years of the 21st century. The publication of the Stern Review in 2006 signaled ‘bringing the economy back in’, which occurred at the same time as interest in developing adaptive as well as mitigation strategies of response resurfaced⁷³. While the ‘second wave’ of the 1990s, focusing on politically negotiated mitigation targets, had given the state a central role, the post-Stern orientation, particularly in North America, seems to be market-driven. And while foregrounding the actual and potential role of economic activity as a driver of change, the Stern Review said very little about the role of work and employment. It did, however, open a door for others to do so.

⁶⁷ Cf Commission of the European Communities, 2010. *Europe 2020: Integrated guidelines for the economic and employment policies of member states*. (Brussels: European Commission); Commission of the European Communities, Committee on Employment and Social Affairs, 2010. *Draft Report: on developing the job potential of a new sustainable economy*. (Report # PR812974EN); ‘Europe 2020: Green growth and jobs?’ (Published: 24 February 2010/Updated: 18 May 2010, Retrieved from <http://www.euractiv.com/en/priorities/europe-2020-green-growth-and-jobs-links dossier-280116>; L. Lavecchia and C. Stagnaro, 2010. *Are green jobs real jobs? the case of Italy*. (Turin, Milan, Italy: Istituto Bruno Leoni).

⁶⁸ Cf Australian Conservation Foundation and Australian Council of Trade Unions, 2010. *Creating jobs-cutting pollution: the roadmap for a cleaner, stronger economy*. (Melbourne, Australia); S. Hatfield-Dodds, G. Turner, H.Schandl, T. Doss, 2008. *Growing the green-collar economy: Skills and labour challenges in reducing our greenhouse emissions and national environmental footprint*(Canberra, Australia: Dusseldorp Skills Foundation).

⁶⁹ cf United Nations Environment Programme 2009 *Global Green New Deal*; International Labour Organization, ‘Green policies and jobs’ in *World of Work Report 2009*.

⁷⁰ A.Pearce, F. Stilwell, 2008. ‘Green collar jobs: Employment impacts of climate change’ *Journal of Australian Political Economy*, 62, 120-136. Their conceptualisation of three ‘waves’ dovetails, in its latter two stages, with the analysis by ‘social’ climatologists.

⁷¹ Ibid, 120.

⁷² Pearce and Stilwell focus on the development of research and policy about the full range of economic activity in relation to climate change, while Lynch (2008) is particularly interested in adaptation within the wider society.

⁷³ N. Stern, (ed.), 2006. *The Economics of climate change: The Stern Review*. (Cambridge: Cambridge University Press).

For the past three decades, the focus in developed economies has been on the quantity of jobs rather than the quality of work. This has undone the considerable gains made in the post-World War II decades for worker voice in the labour process, occupational health and safety, reducing demographic and systemic inequalities, which have been part of the flow-on effects of collective bargaining. Since the mid-1980s, however, the implacable spread of precarious employment has eroded unions and voice in the workplace. As the struggle for the quantity of jobs eclipsed the struggle for the quality of work, the fragmented nature of employment and the vanishing link between identity, work and employment have reduced the ability of workers to affect decision-making by their employers, shrinking their impact in the areas of environmental responsibility.⁷⁴

In this international debate over climate and the future of jobs, the first focus is employment itself. In the employment debate, these questions are central: is climate change itself a job killer? Is responding to climate change a job killer? Can responding to climate change by shifting to a lower-carbon economy create jobs? Will there be enough new jobs to compensate for the jobs lost? What are the roles of national and sub-national governments? Depending on which policy is pursued by a country or region, are there different implications for employment? The employment debate is complicated, first, by the lack of a widely accepted definition for green work or green jobs. It is further complicated by continuing competition between mitigation and adaptation in shaping policy and strategic response. Third, even when enacted, public policy does not necessarily meet all its goals. The debate about the future of employment is both a prescriptive and a predictive debate, depending on what policy scenario is followed, and how effective it is.

There are further difficulties. The literature about Kyoto exposes obstacles to 'bringing the economy in' to mitigation strategies to slow climate warming in developed countries. First, although global warming is no respecter of geographic boundaries, fixing a regulatory role for government in relation to the market and the reduction of the production of GHGs, is still contested terrain, subject to national variations, political reversals and fundamental ideological differences. Second, there is volatile tension between national or regional regulation of GHG reduction by pro-active governments on the one hand, and competition between the developed world and the increasingly fragmented 'developing world' on the other, in terms of who mitigates, how much, and when. Third, in key developed economies, forceful intervention in politics by heavy-emitting industrial and mining interests can block, slow or adulterate the implementation of emission-reduction policy.

It has become really clear that setting climate policy is a starkly political process. Politics can override policy. Globally, we are not certain which emission reduction goals will be pursued, and how likely they are to be met, and by which countries. Without knowing what the target is, how many years it should take

⁷⁴ Denis Gregory et al., 1999, 'Industrial relations and the protection of the environment: research findings from a new policy field', *European Journal of Industrial Relations* 5, no. 2, 139 - 162.

to meet it, and how much confidence we can put in answers to both those questions, it is difficult to go beyond speculation about the future of jobs in occupations, industries, a country or a region.

The most realistic studies identify several emissions reduction scenarios for a country or region, and work through the implications of each for employment.⁷⁵ Impact on employment of climate change and CO2 emission reduction measures in the EU-25 to 2030⁷⁶ is the regional study that the European Union and member governments commissioned from ETUC and four research institutes in 2007 to examine projected employment change in the EU in the context of climate warming over twenty years. Part I of the study examines the impact of climate change on jobs in six industrial sectors, it then maps predicted industry-sectoral job movement onto three geographic regions: the Iberian Peninsula, Germany, and Scandinavia. Part II asks: what will be the ‘repercussions for employment’ of responding to climate change, in function of different emissions targets? It advances scenarios, and projects their outcomes, and concludes that,

“The measures to enable the European Union to reduce its CO2 emissions by some 40% by 2030 do not globally destroy jobs but they do substantially change the supply and demand of jobs and qualifications within and between sectors.... Job movements are likely to take place in all sectors.”⁷⁷

While the study predicts a modest aggregate job gain of 1.5%, even with climate warming of no more than 2 degrees Celsius there will be job churning. However, ‘the large-scale redistribution of jobs that will result from the implementation of climate policies will occur within rather than between sectors.’⁷⁸ Geographic dislocation, however, also presents a threat. Will new ‘green’ jobs be located in proximity to the jobs lost? How will single-industry communities fare as their industry or crop shrivels?⁷⁹

The dislocations charted in the 2007 European study - vocational, sectoral and geographic - took the study in four directions. First, “climate change is seen as a scientific issue and...as a political and economic matter. [But] it is also a social issue’.⁸⁰ Second, “the EU’s drive to reduce greenhouse gas emissions cannot continue to be built primarily on industry and the energy production sector”⁸¹. It needs to extend to other sectors. Third, trade unions need to be actively involved in crafting transition policies and designing strategies for mitigating GHGs. Fourth, the study argued forcefully for a double policy

⁷⁵ The US has also done a number of employment impact studies. See Fankhauser et al. for a reference to the muscularity of the debate. Daniel Kammen, et al., 2004. *Putting renewables to work: How many jobs can the clean energy industry generate?* Berkeley, Calif.: University of California Press, is an analysis of the results of thirteen independent reports and studies from the US and Europe.

⁷⁶ Dupressoir, *Climate change and employment*.

⁷⁷ Dupressoir, 8.

⁷⁸ Dupressoir, 8.

⁷⁹ The fate of forest product communities in British Columbia in the face may serve as case in point for the Europeans.

⁸⁰ Dupressoir, 5.

⁸¹ Dupressoir, 12.

integration: between employment and environmental policy; and between these policies and the suite of social welfare and labour market policies. The 2007 research was the first of two studies commissioned. For Canadian purposes, it is the most relevant given the early stage of our work. In 2009, however, the European Trade Union Confederation commissioned “Climate disturbances, the new industrial policies and ways out of the crisis”.⁸² The focus here is on regulation and bringing government back in.

In the wake of Copenhagen and Europe’s marginalization in key climate negotiations, the 2009 study calls for more government intervention, new regulatory measures, and an end to ‘soft law’.⁸³ It links Europe’s perceived weakening in the global climate arena to increased international competition, the threat of job loss, internal division and the possibility that climate change policy will be undermined. But the commitment to greening more industries and more occupations remains.⁸⁴

The second component of the international debate about the future of jobs concerns work and the workplace. Shifting to a lower-carbon economy is a necessity but it is by no means a political certainty. It will entail job churning, but it will also change both the nature and organization of work: the skills required as well as the labour process, not only for new ‘green’ jobs, but for the ‘greening’ of existing jobs. Greening work can reduce the carbon footprint of any and every workplace, in established and emerging sectors and professions. In the words of the 2009 EU study, ‘(A)ll work can be green’.⁸⁵

As (most) governments struggle to slow the production of GHGs, they have focused on the enterprise (private, public, mixed) as an entity, which can be regulated, taxed and/or punished. They neglect the other side of its identity: as an organizer and producer of work, employer or gatherer of workers, as a workplace or collection of workplaces, as the site for the organized voice of workers. But in Canada as elsewhere in the developed world, contemporary workplaces are major producers of greenhouse gas emissions - whether the workplace is virtual or located in a building, a field or a mine, whether it is an office, school, hotel, store, factory, university, postal sorting station, hospital, government building, farm, home office or call centre.

How do governments and labour market organizations understand the actual and potential role of work and workplaces both in producing and reducing GHG emissions? How much information, and how

⁸² Syndex, S.Partner and WMP Consulting ,2009. *Climate disturbances, the new industrial policies, and ways out of the crisis* (European Trade Union Confederation in partnership with European Metalworkers Federation and EMCEF).

⁸³ J.Decaillon, A. Panneels, 2010. ‘*Employment and climate policies in Europe*’, *Climate Change, Impacts on Employment and the Labour Market—Responses to the Challenges*. Brussels, March 25:18-29. (Brussels: European Trade Union Confederation).

⁸⁴ It is noteworthy that the University of Copenhagen Synthesis Report states that a majority of people now want more active, creative, and leading governments in the response to climate change. *Synthesis report from Climate Change, Global Risks, Challenges and Decisions*, Copenhagen 2009, 10 -12 March. (Copenhagen: University of Copenhagen), p.7. Retrieved from <http://climatecongress.ku.dk/pdf/synthesisreport>

⁸⁵ Ibid:28

good is the information labour market actors are working with? What steps are these actors taking to engage their organizations and constituencies in reducing GHGs?⁸⁶ What roles are allocated to the three key actors - government, business and labour? Who is developing new training and adaptive training for active labour market transitions to lower-carbon production of goods, services and ideas? These are among the things we need to know.

The 2008 article by Fankhauser, Sehleier and Stern in *Climate Policy* focuses on the changing quantity of jobs in response to climate policy, but draws attention to the paucity of research on 'the quality of jobs'.⁸⁷ Distinguishing between the short-, medium-, and long-term effects of shifting to lower carbon production, the authors predict that in the long term, a global economy that has been able to reduce its greenhouse gases significantly will be an economy that has fundamentally restructured 'the way in which economic activity takes place'.⁸⁸

Although defining green work has become a veritable growth industry⁸⁹, no common definition has yet emerged.⁹⁰ At least six different components of 'green' and 'work' are commonly lumped together: green jobs, green work, green economy; greening the economy, greening jobs, greening work. The six components divide into two clusters: in one, 'green' is a snapshot, which describes the work, job or economy at a point in time. In the other, 'greening' is a process of transition for the work, job or economy towards more environmentally responsible practices. The former defines a condition and provides a label of environmental responsibility. The latter describes a process of change and provides no

⁸⁶ La Confédération des syndicats nationaux (2009) has undertaken both a review of European policy and trade union engagement in setting policy, and developed orientation documentation for its bargaining teams on collective bargaining for environmental responsibility.

⁸⁷ Fankhauser, 'Climate change, innovation and jobs', 422.

⁸⁸ Fankhauser, 'Climate change, innovation and jobs', 427.

⁸⁹ See UNEP/ILO, *Green jobs: towards decent work* for definitions and recommendations that have shaped the positions of advocacy groups as well as trade unions.

⁹⁰ A partial list of current attempts to define green work and green jobs: Campaign against climate change, 2010.. *One million climate jobs: Solutions to the economic and environmental crises*. (London: Campaign against climate change, in conjunction with the Communication Workers Union (CWU), Public and Commercial Services Union (PCS), Transport Salaried Staffs Association (TSSA) and the University and College Union (UCU)); D.Parsons & Associates, 2009, *Greening the Economy: Transitioning to New Careers* (Toronto: Peel Halton Workforce Development Group; Toronto Workforce Innovation Group; Workforce Planning Board of York Region and West Gwillimbury Employment Ontario); ECO Canada, 2010.. *Defining the green economy: labour market research study* (Calgary: ECO Canada); GHK Consulting, 2009. *Thematic Expert Work on Green Jobs for DG, EMPL/D1, commissioned by European Employment Observatory* (Brussels: European Employment Observatory); Global Climate Network, 2010. *Low-carbon jobs in an interconnected world* (London, U.K.: Global Climate Network); GLOBE Foundation of Canada, 2010. *British Columbia's green economy: building a strong low-carbon future*. (Vancouver: GLOBE Foundation); M. Renner, 2008. *Green Jobs: working for people and the environment* (Washington, D.C.: Worldwatch Institute); United Nations Environment Programme (UNEP), & International Labour Organization, 2008. *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* (Nairobi, Kenya: UNEP/ILO/IOE/ITUC); United States. Bureau of Labor Statistics, 2010. Measuring green jobs website at <http://www.bls.gov/green/home.htm>; United States. Department of Commerce. Economics and Statistics Administration, 2010.. *Measuring the green economy* (Washington, D.C.: U.S. Department of Commerce); United States. Workforce Information Council Green Jobs Study Group, 2009. *Measurement and analysis of employment in the green economy: Workforce Information Council Green Jobs Study Group Final Report* (Washington, D.C.: United States Bureau of Labor Statistics).

more than a descriptor of transition and transformation - becoming greener. The reality for Canada and any other developed economy is that effective greening of existing work and occupations will, over time, provide a greater return in reducing emissions than will the 'green' jobs newly created. No surprise that putting a number to the green jobs in existence at a point in time, or to the number of green jobs that a green economy would harvest, results in widely varying estimates, and since the people making the estimates are using different definitions, the result has been confusion.

Defining green work and greening work, however, targets the dilemma. 'Work' is the process of producing or creating a physical product, or service, or idea. Restructuring how work is organized and carried out in order to make it more effective in reducing emissions, entails reconsidering both the labour process and the physical environment in which work takes place, through an environmental lens. Applying an environmental lens to the work process would also allow the world of work to become a site for integrating mitigation strategies and adaptation strategies.⁹¹ On this, however, much work is yet to be done.

PATTERNS AND THEMES

The international research and policy context discussed in this chapter provides a framework for our mapping of the state of Canadian knowledge about the climate effect on work and employment.

Eight themes emerge from the international literature.

- **Theme 1** *Climate science is a social issue.* The need to 'socialize' the findings of climate science emerges from climate scientists who draw attention to the lack of collaboration, even dialogue, between climate science and social science. 'Social climate scientists' call for linking climate science and social science, in order to create effective, timely and active social policy response to climate warming. *We found some, but few, studies of Canada in which climate science and social science worked together.*
- **Theme 2** *focuses on policy integration* and has developed principally in the European Union. It asserts that double policy integration is necessary: transitional policies for employment and human resources management need to be integrated into environmental policy. The suite of social welfare policies in developed economies need to be integrated to take account of the geographic, community and employment dislocation that transitioning to a green economy will entail. Without this double integration, there is a risk that attempts to implement policy to slow climate warming will fail. *Our research testifies to Canadian silence: federal level has policy integration, or double policy integration, crystallized.*

⁹¹ Among the industries in Canada which have already begun reducing emissions by integrating strategies of adaptation and of mitigation, are postal services and forestry.

- **Theme 3** *explores the need for strong, creative, interventionist states, for job creation, incubation of green technologies, training for green competencies, crafting and realizing climate policy that will slow climate warming. “Under most scenarios of climate policy to slow global warming, job losses and job movement will be considerable, projected job gains depend on politics, and interventionist government policies are essential”. Studies in Australia, the EU, Germany, UK foreground the need to ‘return to the state’ Canadian research is varied in this regard, but both business and labour stakeholders identify a crucial role for governments at all levels with optimism that investment will produce large numbers of ‘green jobs.’*
- **Theme 4** *addresses the confusion surrounding the definition of the ‘green’ and ‘greening’, of jobs, work practices, and the economy. In the US and Australia, optimism about a ‘green gold rush’, the number of jobs that might be created as the economy shifts to new energy sources, has taken centre-stage in labour market strategies. In the EU, the importance of analyzing job movement by economic sector proves crucial to nuancing optimism about the green jobs-creation perspective. Using the ‘turn towards green jobs’ as a way of quelling public fears of job loss contributes to the confusion of definitions of ‘green’ and ‘greening’, and muddies the task of projecting green job growth reliably. Canadian research on the greening of jobs shares the weaknesses of its international counterparts.*
- **Theme 5** *focuses on the range of ways in which workers and workplace organizations can play an active, adaptive role in greening the economy and the labour process. In the social partnership countries in the EU and in Australia, workers and their organizations tend to accord a lead role to the labour party and the state in implementing strategy which unions play a pro-active role in constructing. In the collective bargaining regimes of Canada and the US, agents and drivers of adaptation focus on the workplace and on collective bargaining, and tend to be identified with the unions and their members. ‘Greening the economy’ is a process, a direction, and a space for active engagement by individuals, labour market organizations, businesses, communities and governments. Canadian labour’s research and position papers have gained international prominence on this theme. Our research shows that what is emerging in Canada is a worker-centered approach to adapting the organization of work in order to transition existing jobs to greener methods and make work and workplaces environmentally responsible. Actual implementation, however, is uneven between economic sectors and between unions within a sector.*
- **Theme 6** *notes the prevalence of ‘grey literature’ in the approximately 1500 documents studied. 81% of the documents were produced by organizations whose primary activity is not commercial publishing, and who operate largely outside the university system. In addition, there is a dramatic paucity of publications on climate and employment in the core social science disciplines that study work. This is a global phenomenon of which Canada is a part.*

- **Theme 7** *draws attention to the contributions of advocacy groups and labour market actors to the research.* Groups like the European Trade Union Confederation, Pew Center for Global Climate Change, BlueGreen Alliance (Canada and the US), Apollo Alliance, Australian Conservation Foundation have carried out research, produced reports disseminated to a wider public as well as specialist and policy communities, and have been indefatigable in bringing the future of work and employment to public and political awareness.
- **Theme 8** *draws attention both to the difficulties in coordinating mitigation and adaptation strategies to reduce the production of greenhouse gas emissions, but also to creative new initiatives to effect that coordination.*

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RESULTS OF A LITERATURE SEARCH REGARDING THE IMPACT OF CLIMATE CHANGE ON CANADIAN WORK AND EMPLOYMENT: INDICATORS AND CONTEXT

Elizabeth Perry

Introduction

It comes as no surprise that there is an enormous, constantly expanding body of research on global warming and climate change. Isa Lang entitled her 2008 bibliographic essay about general climate change resources, “Wrestling with an elephant”, and characterized the literature as “daunting”, “vast and overwhelming”.⁹² The task of the *What do we know?* project was to examine the vast climate change literature and find intersections with the literature of the world of work, which is itself notoriously fragmented, including as it does the academic and practitioner output of economics, industrial relations, business, sociology, and public policy.

Writing in UNESCO’s World Social Science Report of 2010, Roberta Balstad states that,

*“there is a widely acknowledged need for social science contributions”, yet “social science contributions to climate change have been less than many had expected. To date, climate change research remains a small specialty within the social sciences”.*⁹³

Our results confirm this: we reveal that scholarly social science documents accounted for only 18.5 % of the documents found. Current discussion about social science research in all disciplines also points to the growth of research organizations outside the traditional academic environment. This project found many university organizations publishing without peer-review, part of a large component generally known as “grey literature”: documents produced by organizations whose primary purpose is not the publication of research.

What follows is a brief overview of the literature search for English language documents conducted for the *What do we know?* project. Tables are used to quantify and compare the scholarly and grey literature, and to present a time line. The results are discussed in light of current trends in social science research. The goal of the project was to identify and create bibliographies for each of the six sectors, and also to create a database that might be publicly available and searchable by keywords. Thus, we append a fuller

⁹² Isa Lang, 2008 ‘Wrestling with an Elephant: A Selected bibliography and resource guide on global climate change’ *Law Library Journal* vol. 100 no. 4.

⁹³ R. Balstad, ‘The interdisciplinary challenges of climate change research’ in *UNESCO World social science report*. (Paris: UNESCO and the International Social Science Council), 210.

description of the literature search, and a description and instructions about the public database of bibliographic records.

Brief overview of the literature search

The central question of the *What do we know?* project was:

What evaluation can we make of the state of knowledge concerning the complex interaction between climate change and Canadian work and employment, particularly in the domains of employment tenure and employment transitions, labour market restructuring, regulation and industry policy, and skill demands?

The literature search sought to identify whatever important research was relevant to this question, produced in or about Canada, in either English or French languages, from 1995 to December 2009. From the beginning, our interest went beyond the scholarly literature, to include the research and publications of the social actors in this issue: government, business, and labour. Different techniques and sources were required to find the publications of these social actors, published in the alternative press, government documents, public policy documents, and the organizational documents.

The literature search and the resulting database and bibliographies were organized according to six economic sectors: energy, construction, forestry, postal services, tourism, and transportation equipment. In addition, we constructed a bibliography called “Context”, which captures any overviews on the issue of climate change impacts on multiple sectors, or on jobs and work internationally. For each of these seven topics, the same search was replicated, consisting of three basic phases: 1) a search of academic literature; 2) a search of the websites of relevant stakeholders; 3) locating of documents appearing in the citations and bibliographies of documents identified in phase 1 and 2. Details of the literature search are provided in the Appendix.

Discussion

Our results revealed that, for the years 1995 - 2009, scholarly documents accounted for only 18.5% of the documents found; 81.5% was found in the “grey literature”, 227 are journal articles, 81 are books, 715 are reports, and 177 are websites. To obtain an approximate idea of how many books and reports were published in Canada, the database was searched by the names of the major cities, yielding an approximation of 350 of the 796 items. Only 81 documents were identified from 1995 to 1999; 212 from

2000 to 2004, and 829 in the most recent period from 2005 to 2009 (not all documents are dated). Of the 1414 documents identified in the database, 1312 are in English, and 102 are in French. The analysis which follows focuses on the sources in English, including sources which were translated from the French.

Although our interest was in information about Canada, the global nature of the issue requires an awareness of the international literature. Many social actors are working in collaborative arrangements, and often international collaborations. At the governmental and para-governmental level, the Intergovernmental Panel on Climate Change, the United Nations Environment Program, and such sector specific agencies as the World Tourism Council, the Collaborative Partnership on Forests, the World Energy Council are high profile examples.

Documents relevant to Canada were also produced by international collaborations among labour market actors: for example, the International Electricity Partnership (of which the Canadian Electrical Association is a member), the European Trade Union Confederation, Universal Postal Union, Global Wind Energy Council, the World Business Council on Sustainable Development. Many advocacy groups are also international – e.g. Greenpeace, Sierra Club, Worldwatch Institute.

Grey Literature

Grey Literature has been authoritatively defined as “Information produced on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing, i.e. where publishing is not the primary activity of the producing body.” (Luxembourg, 1997 - Expanded in New York, 2004).⁹⁴

The crucial feature of grey literature is the fact that it is produced outside the mainstream of commercial publishing – which renders it difficult to identify, locate, obtain, and preserve. It is frequently published in Web-only formats, which are often not archived and sometimes available only in restricted sections of websites.

Given the heavy concentration of grey literature in our database it is not surprising that there are so few documents available from the pre-2000 period. However, the increase from 32 documents in the year 2000 to 280 documents in year 2009 argues that there is also an expanding interest and awareness in the socio-economic issues relating to climate change. Based on our results, this interest is clearly coming from government agencies (461) documents, labour market actors (428 documents), and advocacy groups (154 documents).

⁹⁴ Definition used by the Grey Literature Network Service, Amsterdam and reproduced at their GreyNet website at <http://www.greynet.org/greynethome.html>. Accessed March 9, 2010.

Our literature search emphasized web searching, for two reasons: firstly, one of the project goals was to find publications that would be easily and publicly available. Secondly, our goal was to learn what the social actors and labour market actors were researching, and these groups do not normally publish through the established commercial or academic channels. Thus, one could argue that the search process itself has been responsible for the heavy concentration of grey literature. However, the results for the tourism sector, show a 58% proportion of scholarly documents, and act as a reminder that the literature search included a complete review of academic indexes and catalogues in addition to the web search. The explanation for the heavy weighting of grey literature, can be understood better by reviewing some of the current discussion about trends in social science research in general.

Table 2. Total number of documents by sector and category.

| Industry sector | Advocacy groups | Government | Labour market actors | Popular press | Research organizations | Scholarly | Total |
|------------------------|-----------------|------------|----------------------|---------------|------------------------|-----------|--------|
| Context | 25 | 62 | 46 | 4 | 22 | 28 | 187 |
| Auto | 18 | 92 | 75 | 18 | 26 | 43 | 272 |
| Construction | 19 | 41 | 50 | 5 | 17 | 3 | 135 |
| Energy | 72 | 103 | 87 | 35 | 34 | 44 | 375 |
| Forestry | 9 | 76 | 30 | 3 | 14 | 39 | 171 |
| Postal services | 4 | 15 | 51 | 8 | 1 | 7 | 86 |
| Tourism | 7 | 42 | 24 | 5 | 1 | 76 | 155 |
| Ressources en francais | 1 | 30 | 65 | 0 | 6 | 0 | 102 |
| Column Totals | 154 | 461 | 428 | 78 | 121 | 233 | 1414** |

**1414 is the total number of documents listed in the database as of September 2010. Does not balance because some documents listed in multiple sectors.

Table 3. Percentage of grey literature documents and scholarly documents by sector.

| Industry sector | Grey Literature documents | Scholarly | Total number of documents |
|-----------------|---------------------------|------------|---------------------------|
| | Number/(%) | Number/(%) | |
| Context | 159 (85%) | 28 (15%) | 187 |
| Auto | 229 (84%) | 43 (16%) | 272 |
| Construction | 132 (97%) | 3 (3%) | 135 |
| Energy | 331 (88%) | 44 (12%) | 375 |
| Forestry | 132 (77%) | 39 (23%) | 171 |
| Postal services | 79 (91%) | 7 (9%) | 86 |
| Tourism | 79 (50%) | 76 (50%) | 155 |
| All sectors | 1177 (83%) | 237 (17%) | 1414 |

Table 4. Publication of all documents by year.

| | 1995-1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | No date |
|---------------------|-----------|------|------|------|------|------|------|------|------|------|------|-------------|
| Number of documents | 81 | 32 | 32 | 41 | 49 | 55 | 76 | 108 | 145 | 247 | 321 | Approx. 200 |

Trends in climate change publication

The following themes in the current discussion about social science research can confirm and help to explain the results of our literature search.

1. A lack of interest in climate change in the traditional disciplines of management, economics, political science and sociology.
2. The development of new journals outside the traditional, core journals
3. The growth of research centres outside the traditional academic environment: think tanks and collaborative bodies.

Our results are consistent with the observations made by Balstad and O'Brien in the UNESCO World Social Science Report: academic social science research about climate change is needed but not yet well

developed.⁹⁵ More specifically, our results reflect the findings of Amanda Goodall in her analysis of the leading academic journals in the disciplines of business, management, economics, sociology, and political science.⁹⁶ Since these are the core disciplines of the field of employment relations, her work is highly relevant and her conclusions of interest.

Lack of interest in climate change amongst the traditional social science disciplines

In researching her 2008 article, *Why have the leading journals in management (and other social sciences) failed to respond to climate change?*, Amanda Goodall collected citation data from 30 leading English language management journals, from 1970 to 2006. She found that only 9 articles mentioned the terms “global warming” and “climate change” in the title, abstract or keywords. (This out of a total of 31,000 published articles). When expanding her search to all management and business journals (not just the top 30), she found 44 articles. She replicated her search in the disciplines of economics, sociology and political science, and found a similar result (Table 5). To compare to Goodall’s paper, this project searched 5 core academic industrial relations journals for the term « climate change », from 1995 to 2009 (the period covered by the *What do we know?* project).⁹⁷ Only 1 article appeared: from 2009, concerning climate change as one element in an analysis of wage developments in Australia.⁹⁸

Goodall considers the possible reasons why the core academic journals have not represented the climate change debate well – the relative newness of the issue, political bias, climate skepticism, career incentives in the discipline - but she ultimately hypothesizes that research on climate change has been “sidelined intellectually”⁹⁹ and is being reported in fields - for example, environmental studies - that are considered peripheral to the central, traditional disciplines.

⁹⁵ Balstad, ‘Interdisciplinary challenges’, 210 and Karen O’Brien, 2010, ‘Responding to the global environmental change: social sciences of the world unite!’ UNESCO World social science report 2010, 11.

⁹⁶ Amanda Goodall, 2008. ‘Why have the leading journals in management (and other social sciences) failed to respond to climate change?’ *Journal of Management Inquiry* 17(4) December 2008, 408-420.

⁹⁷ Journals searched were : *British Journal of Industrial Relations*, *Journal of Industrial Relations*, *Industrial Relations Journal*, *Industrial & Labor Relations Review*, and *Industrial Relations/Relations industrielles*.

⁹⁸ Alison Preston, 2009. ‘Labour markets and wages in 2008’, *Industrial Relations Journal* 51(3), 313-330.

⁹⁹ Goodall, *Why have the leading journals?*, 418.

Table 5. Summary of Goodall's Table 2: literature search results re climate change articles in scholarly journals of the Social Sciences ¹⁰⁰

| Academic discipline | Total number of articles published, 1970-2006 | Number of articles mentioning global warming or climate change in title, abstract, or keyword |
|----------------------|---|---|
| Business& management | 31,000 | 9 |
| Economics | 51,000 | 63 |
| Sociology | 25,000 | 40 |
| Political science | 30,000 | 11 |

Development of new journals

The new, peripheral fields that Goodall refers to are spawning new professional associations and new journals in which academics can publish. A 2009 analysis of research trends by Gert-Jan Geraeds, although mainly a summary of the bibliometric work by Gerald Stanhill about the scientific climate change literature,¹⁰¹ points out that there has been remarkable growth in climate-change related studies in the social sciences, as reflected in the launch of several specialized journals. Geraeds points to the journals *Mitigation and Adaptation Strategies for Global Change*, *Climate and Development*, and *Carbon and Climate Law Review* as examples. I would add to the list some titles that appear in this project's database: *AMBIO*, *Climatic Change*, *Climate Policy*, *Climate Research*, *European Environment*, *Global Environmental Change*, as well as discipline specific journals such as *Energy and Environment*, *Energy Economist*, *Energy Policy*, *Greener Management Journal*, *Journal of Environmental Management*, *Journal of Sustainable Tourism*, and *Renewable Energy*.

Growth of research organizations outside the traditional academic environment

On the Canadian academic scene, the Social Sciences and Humanities Research Council of Canada has funded research chairs within traditional social science disciplines: currently, Dr. Barry Smit, Canada Research Chair in Global Environmental Change at the University of Guelph; Dr. G. Cornelis van Kooten, Canada Research Chair in Environmental Studies and Climate Change at the University of Victoria; Professor Daniel Scott, Canada Research Chair in Global Change and Tourism, at the University of Waterloo Department of Geography and Environmental Management. There are no Canada Research Chairs in Industrial Relations.

¹⁰⁰ Goodall, Why have the leading journals?, 411.

¹⁰¹ Gert-Jan Geraeds, 2009. 'Tackling climate change on three fronts: politics, public opinion, and science' *Research Trends*, October 2009. Available online at http://www.scopus.com/researchtrends/archive/RT13/re_tre_13.html. The main focus of this article is to summarize the bibliometric work by Gerald Stanhill about the scientific climate change literature.

These scholars are actively researching climate change issues within the traditional academic framework, but there is also significant research and publication occurring outside the traditional peer-reviewed process. In the U.S., research organizations such as the Center on Wisconsin Strategy (COWS) at the University of Wisconsin – Madison; Center on Globalization, Governance & Competitiveness (CGGC) at Duke University in Durham, North Carolina; or Political Economy Research Institute (PERI) at the University of Massachusetts, Amherst have all produced publications relating to the economic impacts of climate change. In Canada, the Pacific Institute for Climate Studies is hosted at the University of Victoria, and brings together faculty and graduate students from University of Victoria, University of British Columbia, Simon Fraser University and the University of Northern British Columbia. Although PICS coordinates graduate student fellowship research and publishes in peer-reviewed journals and academic books, it also has a mandate to ensure that research is meaningfully transferred to government, industry and the public, and accordingly it publishes its own working paper series, briefing notes, and a news scan service.

A similar purpose is served by *Environments*, a refereed journal published by the Department of Geography and Environmental Studies at Wilfrid Laurier University and the Faculty of Environmental Studies at University of Waterloo. The stated purpose of the journal is to promote scholarship and discussion in a multidisciplinary and civic way, providing ideas and information that people might use to think effectively about the future. Helmut Anheier writes that “think tanks” have grown, especially in North America, because of their ability to respond relatively quickly and cost-effectively to the public demand for information and analysis of policy issues and current events, such as climate change.¹⁰² Anheier includes in his definition of “think tanks” those university research organizations where teaching is a minor, or non-existent function.

Conclusion

Our literature search demonstrates a growing number of valuable, well-researched documents that exist outside the established channels of publication, and just as important, outside permanent libraries and repositories. Scholarly publications represent 18.5% of the total number of documents in our database. These results are consistent with other evaluative articles regarding social science publishing on the topic of climate change.

What are the implications for public discourse? Most scholarly articles, and even some newspaper articles are available only through licensed, restricted databases – although some are available through Google Scholar. Of the grey literature - which accounts for by far the majority of information available about the effects of climate change on the world of work - most recent documents are available on the

¹⁰² Helmut Anheier, 2010. ‘Social science research outside the ivory tower : the role of think-tanks and civil society’, UNESCO World social science report 2010.

web, although some important bodies, for example, the World Watch Institute, may restrict their free access to executive summaries only. Documents before 2005 are much less certain to be available. With web archiving inconsistent among publishing bodies, even among government departments and university research organizations, there appears to be a pressing need to capture and preserve these documents before they disappear or move, so that they are available for future researchers.

Appendix 1: The Literature Search

Phase 1: A search of the academic literature using university catalogues and journal indexes was conducted. (See Chart 1 for a list of sources searched.) For each topic and for each bibliographic source, it was necessary to establish search terms appropriate to the search – for example, PAIS uses the index term “alternative fuel vehicles”, whereas Science Direct uses the index term “green vehicles”. Even within the same database, multiple index terms and overlapping terms are used: for example, the University of Toronto Library catalogue uses “solar energy” and “solar power” as well as “renewable energy” and “alternate energy”. Often hit lists were very large; it was necessary to examine at least the abstracts of documents to judge whether or not each could be relevant.

Phase 2: A search of the internet, using Google to locate relevant stakeholder organizations. Each organizational website was searched for publications, research in progress, and links to related bodies. Again, subjective decisions were made about the relevance of each document, based on abstracts, tables of contents, and/or executive summaries.

Phase 3: Using the bibliographies, footnotes, and references found in the documents from phases 1 & 2; it was possible to identify related documents and organizations. This required a return to the catalogues, databases, and most often, to the web, to locate and evaluate the cited documents.

Table 1

| Major Academic Indexes & Catalogues searched | |
|--|--|
| Canadian Business and Current Affairs | Business, management |
| Factiva | Business (International) |
| Green File | Scholarly, government and general interest titles relating to environmental issues. |
| InfoTrac Environmental Issues | International. Gale/Thomson database. |
| Policy File | U.S. foreign and domestic policy papers and grey literature. |
| Scholar’s Portal | Aggregates multiple indexes, mainly scholarly: including International Bibliography of the Social Sciences, ABI Inform, Digital Dissertations, EconLit, GeoBase, PAIS. |

Library catalogues of University of Toronto Library System, University of Toronto Centre for Industrial Relations and Human Resources, York University, the National Library of Canada, and Cornell University in Ithaca New York.

Definitions and Concepts used:

Within each of the six sectors, each document was categorized according to its publisher or responsible body. The following categories used applied:

1. Scholarly: published in the academic, peer-reviewed environment.
2. Research organizations: published by credible organizations and institutions; objective and of high intellectual quality. Includes university research centres if work is not peer-reviewed. For example, Ouranos, the Pew Center on Global Climate Change, or the Pacific Institute for Climate Studies at the University of Victoria.
3. Government and para-government: Canadian municipal, provincial, federal governments departments and agencies, such as Environment Canada, as well as those of other countries, such as the U.S. Environmental Protection Agency, and inter-governmental and international agencies such as the United Nations Environment Programme or the Institute for European Environmental Policy.
4. Labour market actors: including corporations, business associations, labour unions, professional associations, sector councils, and international labour market organizations. For example, the Canadian Union of Postal Workers, Canadian Association of Petroleum Producers, the European Trade Union Confederation.
5. Advocacy groups: established organizations which are openly advocating a position/policy, for example, the David Suzuki Foundation, Environmental Defence, Green Energy Act Alliance, Worldwatch Institute.
6. Popular press: commercial press or website news releases.

Each document was assigned to only one category, although two categories posed difficulties in the classification: – first, to assign the category “advocacy groups” required some research since some organizations do not self-identify as to their political/advocacy activities. Additionally, advocacy groups whose research was not cited by at least some other non-advocacy groups were regarded as too biased to be included. The second problematic classification was “research organizations”. This category was used for many university-based research centres throughout the world, which do not actually teach students, but perform research and publish it outside a peer-reviewed system. This is consistent with the three types of “think tanks” which Helmut Anheier¹⁰³ describes in his 2009 article, “Social Science research outside the ivory tower”. In our results, the “scholarly” classification is reserved for peer-reviewed literature, which appears in traditional academic journals and scholarly presses.

¹⁰³ Anheier, Social science research, 338.

Appendix 2: How to access the Bibliographic Database

The bibliographic database of the *What do we know?* project was constructed using RefShare, a function of the widely-used academic bibliography utility program called RefWorks. This database is hosted by York University in Toronto, Canada, and is freely available to the public as an online catalogue from the Work in a Warming World website at

<http://www.workinawarmingworld.yorku.ca/resources/index.html>.

The bibliographic database, or catalogue, can be searched by using the menu tab “Search” and selecting “Advanced”. This allows searching by up to four fields at a time – each field box provides a huge drop-down menu of all the elements possible in the database, many of which are not relevant and have not been populated. An efficient search will focus only on selected elements such as: author, descriptor, title, abstract, and pub year. The Search menu tab also offers a browsing function through the “Look up by author” or “Look up by descriptor” options. This “look-up” function provides a list of the author names or descriptors used – it is especially useful for the complicated names of organizations, government departments, labour unions, etc.

The bibliographic references can also be browsed directly, either for the entire database or for each “folder” – which corresponds to the six industrial sectors. The author/title display can be changed using the “Switch to” field at the top of the screen; the “One line/Cite view” is the briefest and easiest for browsing. Equally important, the “Sort by” field should be set to “Authors, Primary” as the sort order for display.

Whether searching or browsing, the user of the database will ultimately be able to display a full bibliographic record, which includes descriptors, abstracts or summaries of the document content, and in many cases, a URL to an online version of the document.

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CLIMATE CHANGE AND LABOUR IN THE ENERGY SECTOR

Marjorie Griffin Cohen & John Calvert

Introduction

Global warming (or climate change) will be Canada's most important environmental, economic, and public policy challenge in the coming years. A growing body of research is interested in the various ways that dealing with climate change will affect Canadians, and the possible impact on labour is gaining attention in anticipation of a shift from a carbon intensive to a different kind of economy.¹⁰⁴ These changes potentially could have both contractive and expansive effects.^{105 106} The contractive effects relate to the ways that actions taken to reduce carbon use could result in lower economic activity and, therefore higher unemployment. The expansive effects relate to new industries and jobs that may arise as a result of abatement or mitigation policies. Of particular interest is how new forms of work could lessen the negative impacts of an economy if there is a switch to greater use of renewable resources in the energy sector.¹⁰⁷

The purpose of our study is to examine what is known about the impact of climate change on labour in one sector of the Canadian economy - energy production. This sector is significant for two main reasons: the production of energy is a major source of greenhouse gas emissions in Canada, and public policy in various jurisdictions is beginning to focus on the ways that some energy production, mainly electricity, could become more reliant on renewable resources (or 'green' energy).

To explore this issue, we first examine some of the basic characteristics of the energy sector itself, including the major production trends in its various components - oil, gas, electricity and coal production - to understand output levels projected for the near future. Second, we analyze the policy context in which Canada's energy future is being determined and the role governments play and could play in determining that future. Most significant for 'green' employment in the industry is the extent to which the future will be shaped by market-based decisions or by pro-active government decisions that may

¹⁰⁴ University of British Columbia. Sustainability Office & Academic Programs Working Group, 2009. *Sustainability labour market trends: a Canadian and International perspective*.

¹⁰⁵ B. Hildebrand et al., 2006. 'The Expansion of renewable energies and employment effects in Germany' *Energy Policy* 34, 3484-3494.

¹⁰⁶ B. Hildebrand et al., 2006. 'The Expansion of renewable energies and employment effects in Germany' *Energy Policy* 34, 3484-3494.

¹⁰⁷ D. Marshall, 2002. *Making Kyoto work: A transition strategy for Canadian energy workers* (Vancouver, B.C.: Canadian Centre for Policy Alternatives).

move Canada in different directions.

Third, we examine what has been happening to the energy sector workforce to understand where people are currently employed and how this employment has changed over time. Included in this will be an examination of the characteristics of the workforce in terms of gender, age and other demographic characteristics, and the extent that the labour force is represented by trade unions. Our fourth objective is to understand how climate change initiatives are likely to change the nature of work in the industry and the characteristics of the workforce.

Our study examined a wide range of different published sources, almost all of which were produced over the past decade. It included a detailed examination of 77 scholarly publications, 80 government documents, 41 papers from industry, labour and environmental advocacy organizations, 49 non-peer reviewed papers, several dozen newspaper articles and numerous internet postings on a wide range of environmental, labour, public policy and government web sites.

Canada's Energy Production Sector

Canada's energy production sector includes a broad range of different energy sources, technologies, facilities and employment patterns.¹⁰⁸ The principal sources of energy are: oil, natural gas, coal, nuclear power, large hydro, and various renewable sources such as wind, run of river hydro, solar, biomass and geothermal. Despite the considerable attention governments have given to expanding low GHG sources of energy, in reality fossil fuels such as oil, natural gas and coal continue to dominate energy production. Also, new investments are occurring in the further exploitation of fossil fuels, particularly the expansion of the tar sands,^{109 110 111} unconventional gas, and offshore oil and natural gas.

Energy production is a major source of GHG emissions in Canada, accounting for 274.5 megatonnes of GHG emissions in 2008, an increase of slightly over 40% from the 196.7 megatonnes generated in 1990.

¹⁰⁸ The focus of this study is on the production of energy, not on its consumption or on Canada's energy conservation potential. The latter issues are also of critical importance in addressing GHG emissions and climate change, but are outside the scope of this research. The use of energy to produce oil, gas, coal and other energy products is not the same as the resulting energy output.

¹⁰⁹ The terms 'tar sands' and 'oil sands' refer to the extraction of very heavy oil, bitumen, in Alberta. The common term used is 'tar sands,' although there is an attempt by the industry to shift the name to 'oil sands'. "Green bitumen" refers to the attempt to achieve emissions reductions below that of conventional crude oil. D. McColl, *Green bitumen: The role of nuclear, gasification and CCS in Alberta's Oil Sands: Summary report* (Calgary, Alberta: Canadian Energy Research Institute).

¹¹⁰ The terms 'tar sands' and 'oil sands' refer to the extraction of very heavy oil, bitumen, in Alberta. The common term used is 'tar sands,' although there is an attempt by the industry to shift the name to 'oil sands'. "Green bitumen" refers to the attempt to achieve emissions reductions below that of conventional crude oil. D. McColl, *Green bitumen: The role of nuclear, gasification and CCS in Alberta's Oil Sands: Summary report* (Calgary, Alberta: Canadian Energy Research Institute).

¹¹¹ The terms 'tar sands' and 'oil sands' refer to the extraction of very heavy oil, bitumen, in Alberta. The common term used is 'tar sands,' although there is an attempt by the industry to shift the name to 'oil sands'. "Green bitumen" refers to the attempt to achieve emissions reductions below that of conventional crude oil. D. McColl, *Green bitumen: The role of nuclear, gasification and CCS in Alberta's Oil Sands: Summary report* (Calgary, Alberta: Canadian Energy Research Institute).

In 2008, the energy production sector contributed 37.4% to Canada's total GHG emissions, an increase from 35.6% in 1990. Currently the oil and gas sector contribute over 21% of all GHG emissions and the electricity sector over 16%.¹¹²

While conventional oil output declined in recent years from its peak in 1973, output from the tar sands has been expanding rapidly. It now constitutes more than half of Canada's oil production. The tar sands' share of total oil production is projected to increase much more in the coming years due to major new investments planned by industry to exploit an estimated 173 billion barrels of bitumen. One recent study estimates that during the period from 2009 to 2025, total investment in the oil sands alone will amount to \$373 billion.¹¹³ The National Energy Board (NEB) expects the tar sands to constitute three-quarters of the supply by 2020. Both shale and tight gas are similarly expected to increase significantly and account for two-thirds of all gas production by 2020, compared with one-third presently.¹¹⁴

The large-scale investments in oil and gas create relatively few jobs compared to other sectors of the economy. Employment impacts tend to be concentrated in the planning, exploration, development and construction of energy projects and related infrastructure, as well as in the transportation requirements associated with building and servicing these projects. These jobs are mostly short term in nature.^{115 116} Long-term employment in energy construction is contingent on continuing expansion of energy projects.^{117 118 119 120} Manufacturing linkages for materials and equipment, as well as related administrative and technical services, do provide some additional employment, particularly in Ontario and Quebec.^{121 122}

¹¹² In 1990, the oil and gas and electricity sector contributed about the same proportion of GHG to the Canadian total. Canadian Energy Research Institute, October 2009. *The impacts of Canadian oil sands development on the United States' economy: Final report* (Calgary: CERI) p. vii.

¹¹³ Canadian Energy Research Institute, October 2009. *The impacts of Canadian oil sands development on the United States' economy: Final report* (Calgary: CERI) p.vii.

¹¹⁴ Canada. National Energy Board, 2009. *2009 Reference Case Scenario: Canadian energy demand and supply to 2020* (Calgary: National Energy Board).

¹¹⁵ Communications, Energy and Paperworkers Union of Canada (CEP), 2009. *Energy Policy # 917* (Ottawa: CEP), Retrieved from <http://www.cep.ca/docs/en/policy-917-e.pdf>; B.Newcomb, August 2004. *Economic impacts of offshore oil & gas development on Nova Scotia 2001-2003 : A progress report* (Halifax: Nova Scotia. Department of Energy).

¹¹⁶ Communications, Energy and Paperworkers Union of Canada (CEP), 2009. *Energy Policy # 917* (Ottawa: CEP), Retrieved from <http://www.cep.ca/docs/en/policy-917-e.pdf>; B.Newcomb, August 2004. *Economic impacts of offshore oil & gas development on Nova Scotia 2001-2003 : A progress report* (Halifax: Nova Scotia. Department of Energy).

¹¹⁷ Communications, Energy and Paperworkers Union of Canada (CEP), 2009. *Energy Policy # 917* (Ottawa: CEP), Retrieved from <http://www.cep.ca/docs/en/policy-917-e.pdf>; B.Newcomb, August 2004. *Economic impacts of offshore oil & gas development on Nova Scotia 2001-2003 : A progress report* (Halifax: Nova Scotia. Department of Energy).

¹¹⁸ Gardner Pinfold Consulting Economists , 2009. *Economic Impact of Offshore Oil and Gas Development in Nova Scotia, 2002-2006* (Halifax: NS. Department of Finance).

¹¹⁹ Gardner Pinfold Consulting Economists , 2009. *Economic Impact of Offshore Oil and Gas Development in Nova Scotia, 2002-2006* (Halifax: NS. Department of Finance).

¹²⁰ Gardner Pinfold Consulting Economists , 2009. *Economic Impact of Offshore Oil and Gas Development in Nova Scotia, 2002-2006* (Halifax: NS. Department of Finance).

¹²¹ Canadian Association of Petroleum Producers, September 2009. *Oil sands: an important asset generating benefits across Canada* (Calgary; St.John's: CAPP).

¹²² Canadian Association of Petroleum Producers, September 2009. *Oil sands: an important asset generating benefits across Canada* (Calgary; St.John's: CAPP).

¹²³ But imports also meet a significant share of the demand for manufactured goods needed in the energy sector.

Like production of oil and gas, electricity production shows no signs of abatement and has increased significantly since 1993, with minor downturns primarily reflecting fluctuations in economic activity in the economy.¹²⁴ The major structural changes in this sector relate to the shift away from coal for electrical generation, which has affected employment related to coal production, and the general change in the electricity market itself, as it moves away from a predominately government owned utilities model, where increased production and distribution is planned to meet growing needs, toward a more market-oriented model of production.¹²⁵ Two factors have contributed to the changes in the industry: one was a response to pressures to adopt the US move towards a more market-oriented approach, and the other was pressure from private power producers to have the ability to compete in the market.¹²⁶

Also like oil and gas, Canada's electricity production is capital intensive, creating relatively few permanent jobs compared with other sectors of the Canadian economy. Total employment was 104,000 workers.¹²⁷ ¹²⁸ ¹²⁹ Canada's utilities (excluding industrial self generation output) produced 575 terawatt hours (TWh) of energy in 2009. ¹³⁰ Electricity production is dominated by large hydro (58%) with coal (17%), nuclear (15%) and natural gas (6%) playing lesser, but still significant, roles in some provinces. Despite the increasing focus on new sources of "green" energy, large hydro remains the predominant source of renewable electricity and renewable energy in Canada. (See Appendix I for figures). Some consider nuclear energy 'green' energy and this may well play an increasing role in Canada in the future.¹³¹ Nuclear generation accounts for 14.6% of Canada's electricity generation with the greatest concentration

¹²³ Canadian Association of Petroleum Producers, September 2009. *Oil sands: an important asset generating benefits across Canada* (Calgary; St.John's: CAPP).

¹²⁴ Thus economic downturns in major industries, such as pulp and paper or mining, can have a very substantial impact on energy use by industrial customers.

¹²⁵ A significant factor in the future use of coal to generate electricity will be the extent that Ontario is able to implement its commitment to phase out coal fired generation in the coming years. Canada. National Energy Board, *2009 Reference Case Scenario*.

¹²⁶ Electricity Sector Council, September 2007. *Labour market demand and transitions in the electricity industry: Final report* (Ottawa: ESC) p. 25; Canadian Electricity Association, *Keeping the future bright: 2004 Canadian electricity human resource sector study* (Ottawa: CEA) p. 12.

¹²⁷ Statistics Canada, *Electric Power Generation and Distribution, 2007*. (Catalogue no. 57-202-X) Table 7.1 retrieved from <http://www.statcan.gc.ca/pub/57-202-x/2007000/part-partie1-eng.htm>.

¹²⁸ Statistics Canada, *Electric Power Generation and Distribution, 2007*. (Catalogue no. 57-202-X) Table 7.1 retrieved from <http://www.statcan.gc.ca/pub/57-202-x/2007000/part-partie1-eng.htm>.

¹²⁹ Statistics Canada, *Electric Power Generation and Distribution, 2007*. (Catalogue no. 57-202-X) Table 7.1 retrieved from <http://www.statcan.gc.ca/pub/57-202-x/2007000/part-partie1-eng.htm>.

¹³⁰ Statistics Canada, 2009. *Energy Statistics Handbook*. 4th Quarter, 2009 (Catalogue #57-601). (Ottawa: Statistics Canada).

¹³¹ Defining nuclear energy production as 'green' is primarily because nuclear production does not produce GHG emissions. The industry itself is the primarily proponent of defining nuclear energy as 'green.' G. Timilsina et al., 2008. *The Canadian nuclear industry: Contributions to the Canadian economy: Final Report* (Calgary, Alberta: Canadian Energy Research Institute) p. 13. However, environmentalists tend to see the possibility of environmental destruction on a massive scale from nuclear accident and the enormous environmental issues associated with nuclear waste serious problems in classifying nuclear energy as 'green' energy. D. Marshall, 2002. *Making Kyoto work: A transition strategy for Canadian energy workers*. (Vancouver, B.C.: Canadian Centre for Policy Alternatives) p 34.

in Ontario, where it provides 51% of the province’s power needs. In addition to Ontario, nuclear power is also produced in Quebec and New Brunswick. According to Industry Canada, the nuclear generation industry employs about 21,000 people directly and 10,000 indirectly. The multiplier effect from direct and indirect work in the nuclear industry is about 40,000 jobs.¹³²

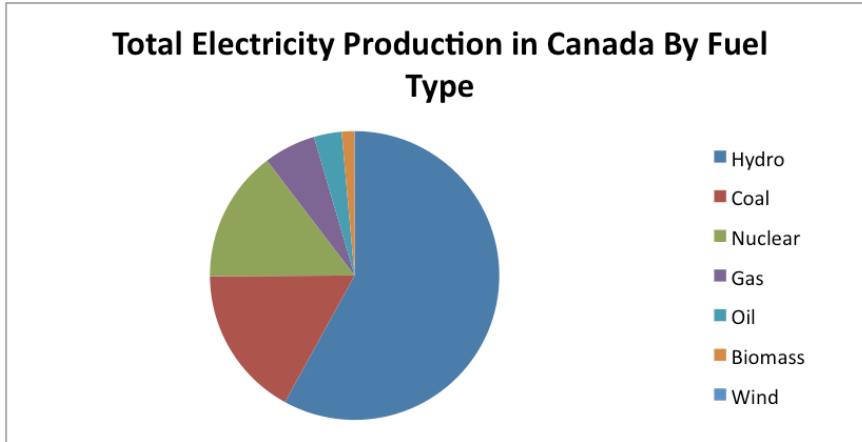


Chart 1. Source: Electricity Sector Council, 2008. *Building bright futures: powering up the future. 2008 Labour Market Information Study full report.* (Ottawa: Electricity Sector Council). See Table 1 in the Appendix for actual data.

Note: chart includes both utility and non-utility generation

Proposals for expanding the share of renewable energy sources in Canada’s energy production mix tend to focus primarily on further greening the electricity sector through the construction of new hydro, wind, solar, tidal, biomass and geothermal generating projects. So far, new renewable electricity (as opposed to existing large hydro) is still a relatively small contributor to overall energy supplies. Wind energy, the fastest growing and largest part of the renewable sector, still accounts for less than 1% of electricity output. Despite the attention given to the need to expand the role of new renewables in Canada’s energy mix, they are unlikely to make a major impact in replacing fossil fuels or nuclear generation the near future, however desirable this objective may be in reducing GHG emissions.

At present, renewable energy projects tend to be relatively more expensive per unit of energy produced compared with coal, oil and natural gas.

¹³² From the Industry Canada website at www.ic.gc.ca/eic/site/mse-epe.nsf/eng/home.

Part of the reason is that they are also more labour intensive both to construct and, in some cases, such as biofuels, to maintain and operate.¹³³ They are normally much smaller in size, reducing opportunities to benefit from economies to scale. While from an employment perspective this is beneficial, from the perspective of cost, it constitutes a major barrier to their expansion.¹³⁴ Consequently, governments wishing to expand green energy production have had to provide substantial subsidies, either by paying high prices for new renewable energy or providing tax breaks and other financial incentives to energy investors.

The Policy Context

Canada's ability to meet the challenges arising from climate change and, consequently, the nature of the labour force demands and characteristics in the energy sector will depend, in part, on the kinds of policies that federal and provincial governments follow in the coming years. The current federal government, along with most provinces, has adopted the view that the role of government is essentially one of supporting market based, private sector solutions both to energy development and to Canada's response to climate change. The Federal Government has been explicit about its commitment to the energy sector's "market orientation," which it believes will provide the most efficient guide to meeting Canada's future energy needs. An example of the federal government's policy approach is explained on the Natural Resources Canada web site.

Canada's energy policy is guided by a series of principles, agreements and accords. The main principles of our energy policy are:

- *A market orientation: Markets are the most efficient means of determining supply, demand, prices and trade while ensuring an efficient, competitive and innovative energy system that is responsive to Canada's energy needs.*
- *Respect for jurisdictional authority and the role of the provinces. Provincial governments are the direct managers of most of Canada's resources and have responsibilities for resource management within their borders.*¹³⁵

¹³³ D.M. Kammen et al., (2004, corrected in 2006). *Putting renewables to work: how many jobs can the clean energy industry generate?*. Berkeley, California: University of California, Berkeley; BlueGreen Alliance, 2009. *How to revitalize America's middle class with clean energy jobs*. (Minneapolis; Washington D.C.: BlueGreen Alliance) ; United States. Department of Energy. Energy Efficiency and Renewable Energy, 2005. *Buried treasure: The environmental, economic, and employment benefits of geothermal energy*. (Washington, D.C.: U.S. DOE),p. 12.

¹³⁴ J. Calvert, 2007. *Liquid Gold: Energy Privatization in B.C.* (Halifax and Winnipeg: Fernwood) p. 91 – 93 .

¹³⁵ The website also acknowledges that it is sometimes necessary to have government intervention: "Where necessary, targeted intervention in the market process to achieve specific policy objectives through regulation or other means: These policy objectives include issues of health and safety (e.g., pipeline regulation) and environmental sustainability." The government goes on to note that the Western Accord, the Agreement on Natural Gas Markets and Prices, the Atlantic Accords and, most significantly, the North American Free Trade Agreement effectively frame its policy orientation. Canada. Natural Resources at <http://www.nrcan.gc.ca/eneene/polpol/owevue-eng.php> downloaded June 13, 2010.

In relying on market forces and existing institutional and treaty arrangements, the federal government seems to assume that it does not need to carry out long range planning or adopt an activist policy agenda that would take Canada in a direction different from that which market forces would otherwise dictate.

The federal government seems prepared to intervene in some cases, but primarily through the support of market-based policy, while minimizing direct regulation of the energy market. The apparent approach is that national leadership will not be required to plan and shape how Canada will 'green' its energy sector. The Constitutional role of provinces/territories as resource owners reinforces the belief that national public planning should be limited to supporting private initiatives. This has led to a patchwork quilt of uncoordinated policies and a continuing reliance on the exploitation and export of fossil fuel.¹³⁶

This market-oriented method also means a continuation of the very substantial fossil fuel subsidies currently in place.¹³⁷ The tax and royalty regimes of both levels of government have been shaped by the goal of expediting the exploitation of Canada's fossil fuel resources and, in recent years, a commitment to continued private ownership of the resource.¹³⁸ Industry payments to governments are low by international standards, while environmental regulations are widely criticized as being far too industry friendly.¹³⁹ While the long-term costs of viewing the environment largely as an 'externality' are not easy to calculate, in provinces such as Alberta they are likely to be very significant.¹⁴⁰

Reliance on market forces has also meant eschewing the development of an explicit industrial strategy that would move the energy sector towards more labour intensive, green jobs. In a number of European countries such as Denmark and Germany - and, to a lesser degree in parts of the US - national and

¹³⁶ Bruce G. Doern, and Monica Gattinger, 2003. *Power switch: Energy regulatory governance in the twenty-first century* (Toronto: University of Toronto Press); O.P. Dwivedi et al., 2001. *Sustainable development and Canada: National and international policy perspectives*. (Peterborough, Ontario: Broadview Press).

¹³⁷ Clare Demerse of the Pembina Institute believes that federal subsidies to the industry now amount to approximately \$2 billion annually. (Clare Demerse, 2006, 'Leaked government document says Canada should end fossil fuel subsidies' Pembina Institute blog at <http://climate.pembina.org/blog/92>, accessed May 26, 2010); J.W. Warnock, 2006. *Selling the family silver: oil and gas royalties, corporate profits, and the disregarded public*. (Edmonton: Parkland Institute; Canadian Centre for Policy Alternatives-Saskatchewan).

¹³⁸ Neither the federal, nor the provincial governments have shown any appetite in recent years for revisiting the issue of privatizing Petro Canada or establishing a state run oil company similar to what many other countries, such as Norway, have done. The largest oil companies and the largest reserves throughout the world are owned by nation states : M.Cohen, 2006. 'Why Canada needs a national energy plan' *CCPA Monitor*, 12(8), 1, p. 14).

¹³⁹ In this regard is interesting to compare the approach of Alberta with Norway. While the timing of their respective production rates varies, both jurisdictions have produced about the same volume of oil over the past four decades. According to the Sovereign Wealth Fund Institute, as of June, 2010 Norway has over \$443 billion US in its 'rainy day' fund for future generations – a fund built up from its oil and gas revenues. In comparison, Alberta's Heritage Savings Trust Fund, which was started in 1976, had accumulated assets of \$14.4 billion as of March, 2010.

¹⁴⁰ T. Clarke, 2008. *Tar Sands showdown: Canada and the new politics of oil in an age of climate change* (Toronto: James Lorimer & Company); H. McCullum, 2006. *Fuelling fortress North America: a report on the Athabasca Tar Sands and U.S. demands for Canada's energy* (Ottawa: CCPA, in association with the Parkland Institute and the Polaris Institute).

state/provincial governments have consciously attempted to link their efforts to build a green energy sector with the development of new manufacturing and related energy service industries.¹⁴¹ They believe that employment and skills development in these sectors can make a contribution equal to, or in some cases greater than, the creation of jobs in the construction and installation of energy generation facilities. These governments view subsidization of green energy initiatives as a springboard to the development of a world-class renewable manufacturing sector.

International experience indicates that most manufacturing in the renewable energy sector occurs in countries where there is considerable government support (Germany, US (led by states), Spain, India, China) and where this support is part of a larger industrial strategy. Unfortunately, growing reliance on private sector development in Canada for green energy in all renewable energy projects reduces government leverage to encourage the domestic production of inputs.

To the extent that public pressure has encouraged governments to pursue 'green' energy in Canada, provincial governments have generally taken the lead, although the federal government has provided some limited subsidies and tax breaks to stimulate private investment in this sector.¹⁴² Where provinces, such as BC, have encouraged expansion of private 'green energy' projects, they have normally chosen not to impose local, or national, industrial offset requirements as a condition of public support.¹⁴³ Rather, using the excuse of commitments to various trade agreements (e.g., the Agreement on Internal Trade, TILMA and other provincial trade agreements), they have sought to eliminate this type of public policy tool, leaving corporations free to source components and services in national and international markets.¹⁴⁴

¹⁴¹ U. Lehr et al., 'Renewable energy and employment in Germany' *Energy Policy*, 36(1), 108.; M. Boettcher, N.P. Nielsen, & K. Petrick, K., 2009. *Employment opportunities and challenges in the context of rapid industry growth : A closer look at the development of wind, wave & tidal energy in the UK*. (Munich: Bain and Company); G. Ayee, M. Lowe & G.Gereffi, 2009. 'Wind Power: generating electricity and employment' in *Manufacturing climate solutions: carbon-reducing technologies and U.S. jobs* (Durham, N.C.: Duke University. Center on Globalization Governance and Competitiveness); D. Engel, & D.M.Kammen, 2009. 'Green jobs and the clean energy economy' *Copenhagen Climate Council's Thought Leadership Series*. Retrieved from <http://rael.berkeley.edu/sites/default/files/old-site-files/CopenhagenClimateConcill-GreenJobs-TLS-04.pdf>

¹⁴² Over the last decade various incentive programs have been initiated to promote private sector green energy development. Typically, these programs provide tax abatements, or direct subsidies, such as a 1 cent per KWh payment for energy produced from new renewable projects for a fixed time period. See for example the \$1.48 billion ecoEnergy for Renewable Power fund announced in 2010 by the Federal Government. Information downloaded from NRC web site July 9, 2010 at <http://www.ecoaction.gc.ca/ecoenergy-ecoenergie/power-electricite/index-eng.cfm>.

¹⁴³ British Columbia Energy Plans, 2002, 2007 and ; *British Columbia Clean Energy Act* (Bill 17- 2010 Legislative Session: 2nd Session, 39th Parliament.

¹⁴⁴ Ontario's agreement with Samsung to build a manufacturing plant in the province as a quid pro quo for guaranteeing to purchase energy from facilities using the company's technology is an exception to this general trend. However, it also reinforces Ontario's reliance on energy development through purchases from investor owned power plants. At this juncture it is not clear how successful the initiative will be in achieving the objectives outlined by the government, nor is it clear how expensive it will end up being in the long run, given the price premium the province has offered.

Current Employment in the Energy Sector

While the energy production sector has a major impact on Canada's economy, direct employment in the sector provides only a small share of the nation's jobs. Total direct employment is slightly under 300,000 workers, or roughly 1.8 percent of Canada's 17 million employed workforce in 2009.¹⁴⁵

Employment in the energy sector in Canada has increased steadily in the 21st century and all projections by the government and the industries indicate that it will continue to increase into the future. However, there are fluctuations in the long-term upward trend. For example, during the 1990s employment in the largest sectors, electricity, oil and gas, and services dropped dramatically. The electricity sector went from employing 112,600 workers in 1993 to 85,900 in 2000.¹⁴⁶ Oil and gas extraction employed about 32,200 workers in 1991, but dropped about 10,000 workers by 1996.¹⁴⁷ However, employment in the electricity and oil and gas industries, which account for over half of all energy sector jobs, has almost completely recovered from the economic downturns of the 1990s. The oil and gas sectors are now growing more rapidly than the electricity sector, which still has employment levels slightly below what it experienced in the early 1990s. Support services have expanded dramatically and this area is now the second largest source of employment in the energy sector, after electricity.

As can be seen in Chart II, of the entire energy sector only employment in coal mining has declined steadily since 1991 and now employs about half of what it did in 1991.¹⁴⁸ This specifically relates to changes to shifts from coal-fired electricity production to cleaner forms of energy, much of which has been driven by public policy such the Ontario government's decision to phase out its coal fired power stations.¹⁴⁹

Canada's employment growth in the oil and gas sector, for the most part, reflects an increase in non-conventional types of fossil fuel production.

These methods tend to be environmentally even more problematic than conventional oil and gas production due, in part, to the significant volumes of natural gas required to create steam for bitumen extraction, or the need to clear large areas for surface mining and tailings ponds.

¹⁴⁵ This number does not include estimates of the employment generated in the upstream transportation, manufacturing, services, government and other economic sectors.

¹⁴⁶ Electricity Sector Council (ESC), *Building bright futures: powering up the future*

¹⁴⁷ Statistics Canada. *CANSIM Table 281-00244 Employment (SEPH)*, Table 281-0024 - 4,14 Retrieved from http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=F&RootDir=CII/&ResultTemplate=CII/CII_&Array_Pick=1&ArrayId=2810024

¹⁴⁸ Figures for pipeline transportation are not available after 2001, which explains the appearance of a decline in employment in that sector.

¹⁴⁹ *Ontario Green Energy and Green Economy Act, 2009*,(Bill 150, Session 39:1 of the Ontario Legislative Assembly).

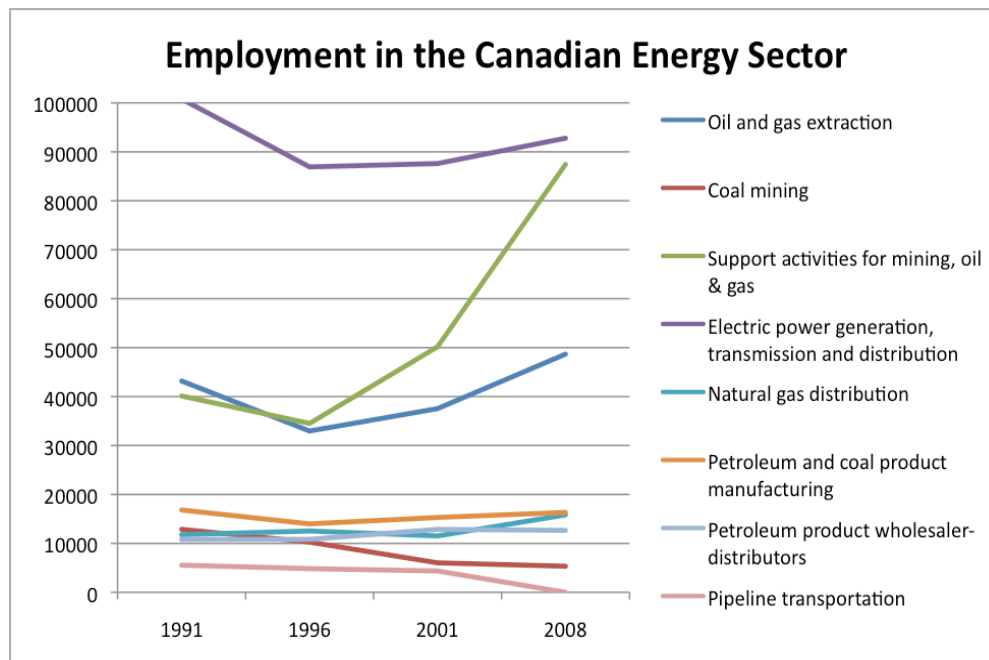


Chart 2. Note: Pipeline data is not available past 2001 to meet the confidentiality requirements of the Statistics Act. Source: Calculated from Statistics Canada, Table 281-00244- Employment (SEPH). See Table 2 in the Appendix for detailed numbers employed in each sector.

Because of the increased production of non-conventional fossil fuels, employment trends in Canada are diverging from those in the US and Europe. Unlike these jurisdictions, Canada is not experiencing overall reductions in employment in the fossil fuel (or dirty) energy sectors. In Europe and the US, job losses in fossil fuel industries reflect a decline in resource availability, rather than environmental regulations or conservation.¹⁵⁰ Like the EU and the US, Canada is experiencing a decline in conventional oil and conventional gas production remains flat.¹⁵¹ The major difference in Canada is that it has large deposits of unconventional forms of fossil fuels, such as shale and tight gas that are beginning to be developed.¹⁵²

¹⁵⁰ Kammen et al., *Putting renewables to work*.

¹⁵¹ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020* (Ottawa: PHRCC). Retrieved from <http://www.petrohrsc.ca/media/41866/supply%20demand%20analysis%202009-2020.pdf>

¹⁵² Shale gas is produced from a sedentary rock formation composed of clay minerals and other minerals. Until recently, it was difficult to extract natural gas from such formations. However, a new process, known as hydrolic fracturing, or ‘fracking,’ now enables gas producers to open up the seams in the clay, allowing the gas to escape. As a result, large new pools of natural gas can be commercially exploited. The process remains controversial due to its potential environmental impacts on water supplies. Tight gas is gas that is difficult to extract from the sand in which it is found with conventional technologies. This can be due to low pressure or low permeability of the sand or rock formation in which it is found. For a discussion of recent advances in extracting shale and tight gas, see: National Petroleum Council, 2007. *Topic Paper #29: Unconventional Gas* (Washington: The Council) July 18, 2007.

Canada is also planning to increase extraction of oil from the tar sands, including proposals for major new pipelines to export this oil. In 2009, synthetic and bitumen production (77,266 thousand cubic metres) overtook conventional oil production (70,615 thousand cubic metres) for the first time in Canada's history.¹⁵³ These new oil sources indicate that fossil fuel resource availability will continue to generate expanded labour demands in these areas.

The major drivers for employment in the electricity sector in the future will be in new infrastructure to meet growing demand (both for domestic use and exports), and replacement needs.¹⁵⁴ Given the age of much of Canada's electricity infrastructure, considerable investment will be required to replace existing transmission lines, turbine generators and aging power plants. Although Canada is a major consumer of electricity and uses more on a per person basis (at 17,307 KWh) than does the US (at 13,640 KWh), according to the Electricity Sector Council, per capita electricity consumption is not expected to decrease in the future.¹⁵⁵ As can be seen from chart III, electricity consumption is rising faster than population growth in Canada.

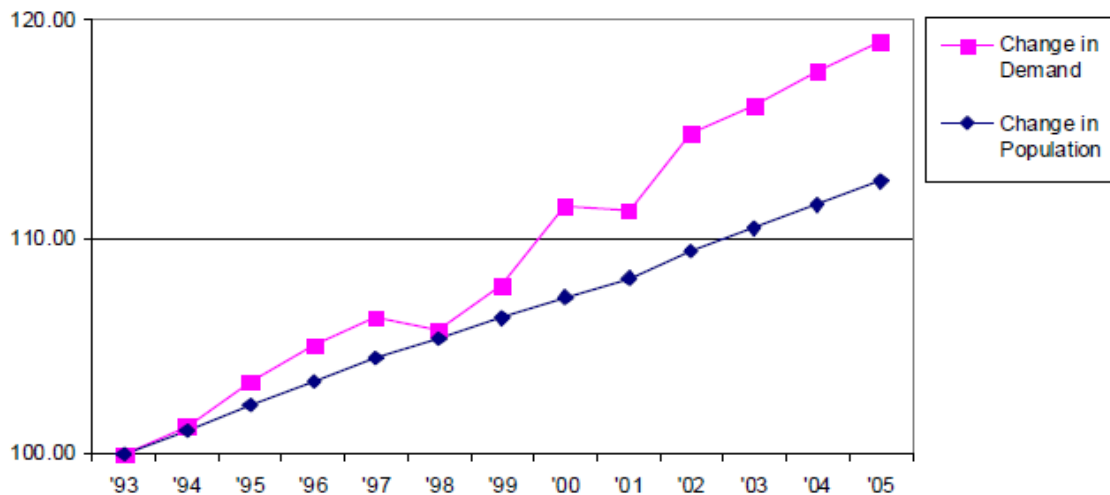


Chart 3. Changes in Canadian Population and Electricity Demand

(index: 1993 = 100). Source: ESC 2008, p. 42, from Statistics Canada, *Energy Statistics Handbook*, January to March 2007.

¹⁵³ Synthetic and bitumen production has increased by 387% since 1990. Canadian Association of Petroleum Producers, 2010. *Statistical Handbook for Canada's upstream petroleum industry (2009 data)* (Calgary; St. John's: CAPP) Tables 3.1b and 3.3a.

¹⁵⁴ Electricity Sector Council, *Building bright futures: powering up the future*, p.39; Canadian Electricity Association, *Keeping the future bright*.

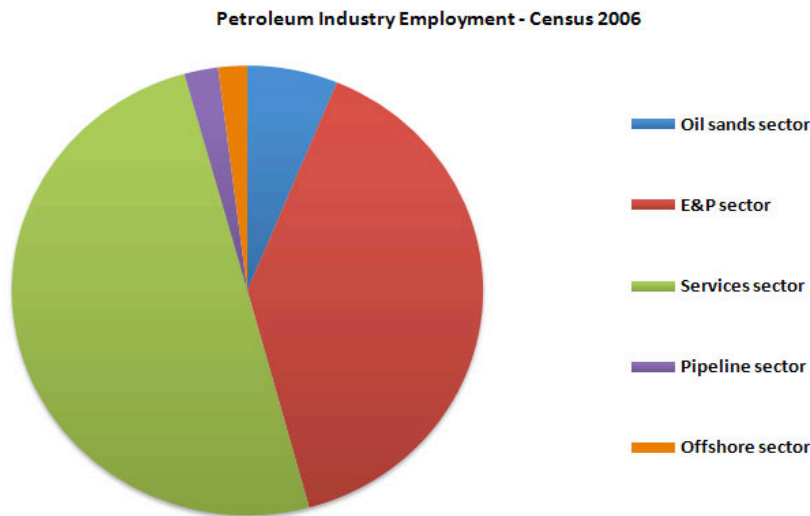
¹⁵⁵ Canada is the third largest per person consumer in the world, after two other cold countries whose electricity largely comes from hydro: Iceland and Norway; Electricity Sector Council, *Building bright futures: powering up the future*, p. 41.

According to a 2006 Natural Resources Canada (NRC) forecast, electricity consumption is projected to increase by 1.3% annually until 2020 with most growth occurring in the commercial market.¹⁵⁶ Increases in exports are likely to occur as well, since provinces like Quebec, B.C. and Manitoba rely heavily on electricity exports for provincial income and have initiated ‘clean energy’ plans with substantial export components.

Employment Trends in Oil and Gas Production

The oil and gas sector constitutes four major types of activities and 37 core occupations. The four main types of activities are exploration and production (E&P); the oil sands; services; and pipelines. E&P includes exploration and production activities associated with both conventional oil and gas reserves and unconventional reserves, such as coal bed methane, tight gas and shale gas and oil. Forty percent of the oil and gas sector workforce is employed in E&P. The oil sands include producer-operated extraction and the upgrading of bitumen and employs about 7% of the oil and gas sector’s workforce.

Services include contracted exploration, extraction and production services to the conventional E&P and oil sands sectors. More specifically, these services include well services, oilfield construction, production services, maintenance and turnaround, transportation services; drilling, and geophysical services. Workers in services account for about 50% of the oil and gas labour force. Pipelines refer to mainline transmission and employment in pipeline work and accounts for about 3% of the industry’s labour force.



¹⁵⁶ Canada. Natural Resources Canada, *Canada’s Energy Outlook: The Reference Case, 2006*

Chart 4. Source: Labour Market Information: Overview: from the Petroleum Human Resources Council at <http://www.petrohrsc.ca/council-projects/project-list/labour-market-information/lmi-overview.aspx>

The historical hiring practices in the oil and gas sector resulted in a largely white, male labour force, with an under-representation of immigrants and women. The increased demand for labour associated with expanded production in the future, coupled with an aging workforce and natural mortality rates (replacement demand) is forcing the industry to consider workers that previously had low participation rates in this industry.¹⁵⁷ According to 2006 Census figures women account for about 28% of those working in engineering, trades, and technology in the Canadian labour force, but they accounted for only about 8% of these positions in the petroleum industry. Immigrants fare slightly better, accounting for 20% of the comparable labour force, and 9% of the workers in the petroleum industry. New entrants to the labour force and aboriginal workers represent a slightly larger share of the petroleum industry’s labour force than they represent in the comparable total labour force.

Altogether women account for 28% of the employees in the oil and gas sector, an increase from 25% in 1997. Generally the labour force is characterized as being younger than the rest of the labour force, with a greater percentage of workers under 35 than in other sectors of the economy.

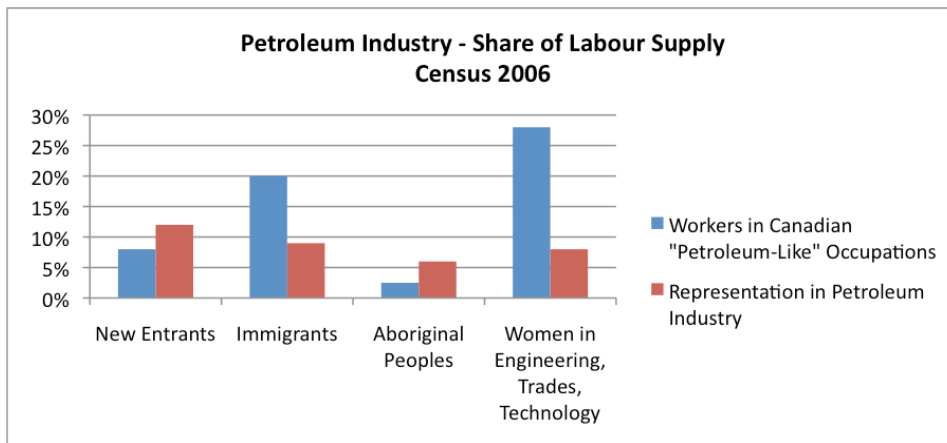


Chart 5. Source: PLMI 2009 p. 34

¹⁵⁷ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/ demand analysis 2009 – 2020* ; Alberta. Employment and Immigration, 2007. *Building and educating tomorrow's workforce: workforce strategy for Alberta's energy sector* (Edmonton, Alberta : E & I); K. Jothen, K., & R. Kunin, 2007. *Labour market needs in British Columbia's oil and gas industry. Prepared for the B.C. Innovations Council* (Victoria: B.C. Ministry of Energy, Mines and Petroleum Resources).

As can be seen from Table I union coverage in the sector is low and declining. Where 32% of the workers in Canada were unionized in 2006, only 12.3% of those in the oil and gas sector were in trade unions. Most of these unionized workers are in manufacturing and gas distribution. In the manufacturing sector about 32% of the labour force is unionized, a figure that is relatively unchanged since 1997 and in gas distribution about 45% is unionized, down from 50% in 1997. The level of unionization is very low in extraction (9.2%), and support industries (10.2%), but both have experienced about a 2% growth in unionization over 10 years.

Table I. Characteristics of Oil and Gas Labour Force.

| | All Industries | | Oil and Gas Related | |
|-----------------|----------------|-----------|---------------------|-------|
| | 1997 | 2006 | 1997 | 2006 |
| Employed | 13,706.00 | 16,484.30 | 244.7 | 297.6 |
| Self-Employed | 2,349.40 | 2,498.00 | 28.6 | 34.9 |
| Sex | | | | |
| Men | 54.5 | 52.9 | 74.6 | 71.8 |
| Women | 45.5 | 47.1 | 25.4 | 28.2 |
| Age | | | | |
| 15 to 34 | 40.1 | 36.8 | 48.8 | 44.8 |
| 35 to 54 | 50.1 | 49.1 | 45.4 | 46 |
| 55 + | 9.7 | 14.1 | 5.8 | 9.3 |
| Union Coverage* | 33.7 | 31.7 | 13.8 | 12.3 |
| Work Schedule | | | | |
| Full-time | 80.9 | 82 | 85.5 | 88.3 |
| Part-time | 19.1 | 18 | 14.4 | 11.7 |
| Avg. \$/hr | 12.92 | 16.73 | 14.8 | 20.64 |

*Excludes self-employed

Source: C. Williams, 'Fueling the economy' Table 2.

There is almost no unionization of gas station workers (4.8%) even though this sector of the industry is a major employer. Of the 74,000 gas station workers, 35% had part time jobs in 2006. Almost 60% were under the age of 35 and average hourly wage rates were only \$8.61. A much higher proportion (42%) were women as well. Employment in this sector has declined slightly in recent years as a result of rationalization of the number of service stations and a shift to greater customer self-service.¹⁵⁸

¹⁵⁸ C.Williams, 2007. 'Fueling the economy' *Perspectives on Labour and Income*, 8(5). (Catalogue #75-001). Ottawa: Statistics Canada. Table 3. Retrieved from <http://www.statcan.gc.ca/pub/75-001-x/10507/9637-eng.pdf>.

Future Employment Growth in Oil and Gas

The Petroleum Human Resources Council of Canada estimates that by 2011 100% of the Canadian labour supply growth will come from immigration and given the fierce competition that is likely to arise from a tight labour market in the future, the industry will need to diversify its workforce.¹⁵⁹ Considerable pressure will come from employee losses due to retirement and natural deaths over the next 10 years, with the greatest pressure from this in the pipeline sector.

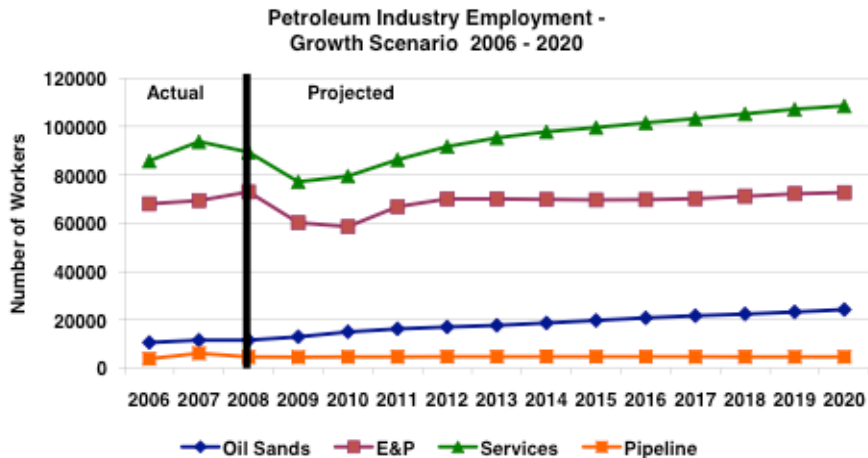


Chart 6. Source: Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020*, p. 8.

The projected expansion in new demand for workers comes primarily from the oil sands production, as new operations and production come on stream, and in the services sector. The main driver in services is the support that is required by in-situ oil sands extraction. The industry estimates that the following occupations will need the largest number of additional workers by 2020:¹⁶⁰

- oil and gas drilling, servicing, and related labourers;
- oil and gas well drillers, servicers, testers, and related workers;
- operators (steam and non-steam);
- heavy equipment operators, supervisors, oil and gas drilling and service;
- oil and gas well drilling workers and service operators;
- drilling coordinators/production managers;

¹⁵⁹ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020*, p. 34.

¹⁶⁰ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020*, p. 9.

- truck drivers; millwright and machinists;
- petroleum engineers;
- geologists and geophysicists.

The employment growth in some occupations will be very large, with mining engineers demand up 66% over the 2008 workforce. The demand for almost all core occupations is expected to rise between 30% and 50% over the same period. Altogether the petroleum industry will need to hire about 105,000 workers between 2010 and 2020 to meet replacement demand and to support new industry activity.¹⁶¹ In the short term, that is by 2011 or 2012, labour shortages are expected in five groups of the industry's core occupations: engineers, geologists and geophysicists, trades, operators (steam and non-steam), and services (drilling & geophysical workers, operators & labourers).^{162 163 164} Most of the labour market growth will occur in provinces that focus on oil and gas production: British Columbia, Alberta, Saskatchewan, Newfoundland and Labrador, and Nova Scotia.¹⁶⁵ The industries that have experienced serious economic stress and restructuring in recent years, such as forestry, pulp and paper, sawmills, and lumber manufacturing industries, are likely to be the source of potential workers, as will industries that compete for workers with technical skills, such as chemical manufacturing and mining.

Employment Trends in Electricity

As noted earlier, just over 100,000 people work in the electricity industry in Canada.¹⁶⁶ The main demand for future employment in this sector will come from retirements, which are expected to proceed at about 5% per year. The industry itself is less certain about labour needs for the future than is the petroleum sector, so presents its labour needs in both low and high growth scenarios. In the low-growth labour scenario, the supply-demand gaps in the short term (by 2012) are likely to be in the trades and other non-support positions (2,355) and for engineers (679). In the high growth scenario the supply-demand gaps will be more significant at 3,466 for trades and other non-support positions and 1,189 for engineers.¹⁶⁷ However, the industry is careful to note that this is a 'hypothetical' gap and that employers will likely have access to employment pools, such as contractors that act as a 'contingent workforce' for the electricity industry, to meet labour needs.

¹⁶¹ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020*, p. 13.

¹⁶² Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020* p. 19.

¹⁶³ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020* p. 19.

¹⁶⁴ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020* p. 19.

¹⁶⁵ Petroleum Human Resources Council of Canada, March 2010. *Petroleum labour market information supply/demand analysis 2009 – 2020*, p. 17.

¹⁶⁶ The estimates of the size of the electricity labour force range considerably, from the Electricity Industry Survey Publication (2005) of 76,498, to the Labour Force Survey of 105,500. Electricity Sector Council, *Building bright futures: powering up the future*, p. 31.

¹⁶⁷ Electricity Sector Council, *Building bright futures: powering up the future*, pp 97-98.

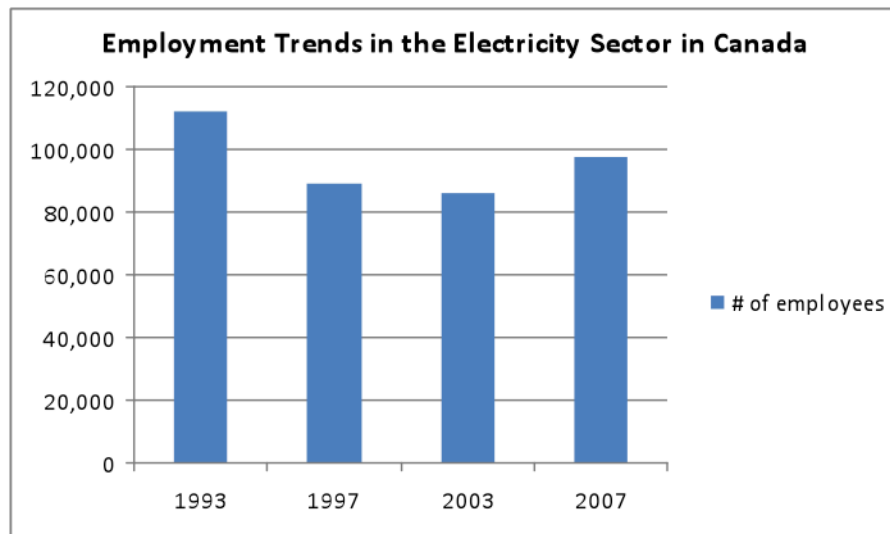


Chart 7. Source: Chart created from Electricity Sector Council, *Building bright futures: powering up the future*, p. 33, based on Statistics Canada, *Labour Force Survey*, 2007.

Due to the existence of large, relatively stable employers in the electricity sector, employment patterns are somewhat different from the oil and gas industries (with the possible exception of natural gas distribution utilities and oil refineries).

In general the electricity sector workforce is highly educated, predominantly working in full-time permanent positions, well paid, working in large organizations, and has workers who are more likely to be represented by trade unions than other workers in Canada.

A large proportion of workers in this sector (76%) have a post-secondary credential, compared with 57% for all workers in Canada. Earnings in the sector are 52% above the average in Canada. Two-thirds of workers are employed at locations with 100 or more employees, and 70% of all workers in the industry are employed in Ontario and Quebec.¹⁶⁸ A high proportion of the workers in this industry, 73%, are covered by collective agreements, compared with 32% for all workers in Canada. But there are variations in union coverage by region with the low being in Alberta (50%) to a high in Manitoba (83%).¹⁶⁹

Occupations are dominated by the trades, transport, and equipment operators group, which account for 35% of workers in the sector. Management and administration is also large, accounting for 32% of the total labour force.¹⁷⁰ According to the Electricity Sector Council, the 15 key occupations in the electricity sector are as follows:

¹⁶⁸ Electricity Sector Council, September 2007. *Labour market demand and transitions in the electricity industry: Final report* (Ottawa: CEA), pp 12 -19.

¹⁶⁹ Electricity Sector Council, *Labour market demand and transitions*, p. 18.

¹⁷⁰ Electricity Sector Council, *Labour market demand and transitions*, p. 19.

- Electrical Power Line & Cable Workers
- Power Systems & Power Station Operators
- Electrical & Electronics Engineers
- General Office Clerks Utilities Managers
- Power System Electricians
- Customer Service Information & Related Clerks
- Electrical & Electronics Engineering Technologists & Technicians
- Construction Millwrights & Industrial Mechanics (Except Textile)
- Contractors & Supervisors – Electrical Trades & Telecommunications Occupations
- Mechanical Engineers Accounting & Related Clerks
- Secretaries (Except Legal & Medical)
- Industrial Instrument Technicians & Mechanics Stationary Engineers & Auxiliary Equipment Operators
- Operators (ESC)

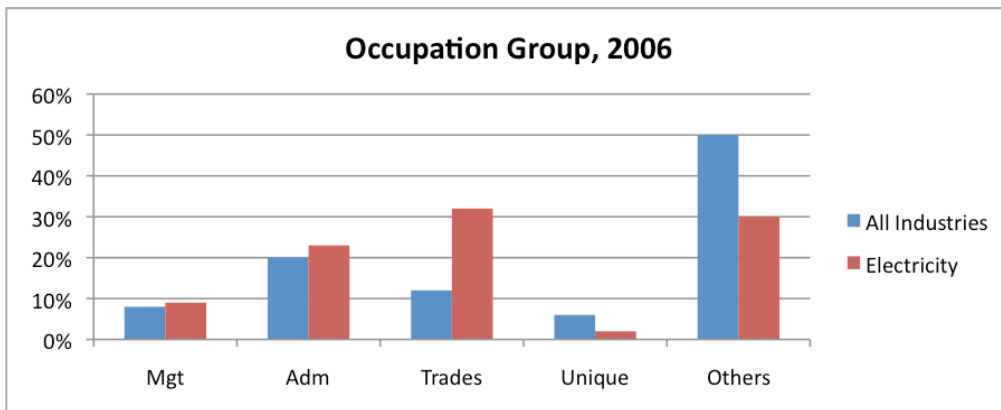


Chart 8.

Note: Groups in the graph include the following occupations: Mgt = Management; Adm = business, finance, administration; trades = trades, transport and equipment operators; unique = occupations unique to the primary sector; others = all other occupations. Source: Electricity Sector Council, *Labour market demand and transitions*, p. 20.

The electricity workforce is not one characterized by diversity, since it employs fewer women and immigrants than are represented in the Canadian workforce. In general it is largely white, male and older than average. As can be seen from Table II, women constitute only 25% of total employment in the electricity sector, considerably less than female representation in the workforce, and most of the women in electricity are employed in traditional female administrative occupations within the sector. The sector

employs about the same proportion of aboriginal persons and those from visible minorities as are represented among the employed in Canada, although it hires a considerably smaller proportion of immigrants than are represented in the workforce. The aging of the electricity sector workforce presents the largest challenge for recruitment in the near future. Seventy-four percent of the electricity sector's workforce is over the age of 40 and only 11% are between the ages of 25 and 40. The Canadian Electricity Association projects that between 2007 and 2012 a total of 28% of the sector's workforce will have retired.¹⁷¹

Table 2. Electricity Sector Employment (% of total employment)

| Group | Electricity Sector | Canadian Employment |
|-------------------------|--------------------|---------------------|
| Immigrants | 12.8 | 21 |
| Visible minorities | 7.9 | 8 |
| Aboriginal | 2.9 | 3 |
| Female | 25.0 | 51 * |
| Current workforce total | 100.0 | 100 |

*Females are 51% of those employed, but represent 47% of the labour force, which includes both the employed and the unemployed.

Source: Electricity Sector Council, *Building bright futures: powering up the future*, p. 48.

As the Electricity Council notes, workers in this sector are unlike workers in other industries in that in addition to being largely male and older than the average Canadian workers, they also are more likely to be trade union members with considerably better wages and working conditions than the average worker.¹⁷² There are several reasons for this. Canada's major electrical utilities are in the public sector where the rate of unionization is much higher than in private industry. Most workers in the sector are employed by large utilities, and large employers with stable employment patterns also tend to be more highly unionized. In addition, a significant proportion of the workers in the electricity sector are skilled trades. Line workers, electricians and other related trades - even in the private sector - tend to be more highly unionized than other private sector workers.

The future labour needs in the electricity sector will be fairly consistent with past requirements for labour. As in most areas in the energy sector, specific types of occupations are in demand. "Target occupations" are as follows:

- Power plant operators

¹⁷¹ Electricity Sector Council, *Building bright futures: powering up the future*, p. 7.

¹⁷² Electricity Sector Council, *Building bright futures: powering up the future*, p. 21; Canadian Electricity Association, *Keeping the future bright*, p.12.

- Power system operators and electricians
- Engineers: electrical and electronics, mechanical, civil
- Stationary/ substation engineers and auxiliary equipment operators
- Electrical and electronics engineering technologists and technicians
- Construction millwrights and industrial mechanics
- Utilities managers
- Contractors and supervisors
- Accountants
- Information systems analysts and consultants
- Electrical power line and cable workers

Labour Needs in Renewable Sectors

It is difficult to get a clear picture of the possibilities for ‘green jobs’ in the energy sector in Canada for several reasons. First, there is no clear, widely accepted, definition of what constitutes a ‘green’ job.¹⁷³ This issue is very important for understanding the nature of job growth in the energy sector. Second, there is a tendency to assume that the kinds of job creation that has occurred in other countries with the introduction of green technology could be transferred to Canada. And third,

there is a tendency for potential ‘green’ projects to over-estimate the total number of jobs that will be created with each project. Too often temporary construction, or assembly, jobs are treated as if they constitute permanent employment.

No standard classification exists for ‘green’ industries or ‘green’ occupations. Green jobs are defined in a number of different ways, ranging from for any job associated with the environment, to jobs dealing specifically with renewable energy. Sometimes a more strict definition is used that defines a green job as something that itself is not environmentally damaging.¹⁷⁴

In Canada the most complete accounting of environmental employment is in the *Profile of Canadian Environmental Employment 2007*. This report was funded by the Government of Canada’s Sector Council Program and produced by Eco Canada. It’s definition of environmental employment includes individuals who work in sectors of the economy related to three main areas: 1) environmental protection (air quality, water quality, land quality, waste management, restoration and reclamation, human and environmental health and safety, environmental protection management); 2) conservation and preservation of natural

¹⁷³ Global Advantage Consulting, 2009. *Building a green economic stimulus package for Canada* (Ottawa: Sustainable Prosperity); R.H.Bezdek, January 2009. *Green collar jobs in the U.S. and Colorado: economic drivers for the 21st century* (Boulder, Colorado: American Solar Energy Society); BlueGreen Alliance, June 2009. *How to revitalize America's middle class with clean energy jobs* (Minneapolis; Washington D.C.: BlueGreen Alliance).

¹⁷⁴ M. Renner, 2008. *Green Jobs: working for people and the environment* (Washington, D.C.: Worldwatch Institute).

resources (fisheries and wildlife, forestry, agriculture, mining, energy, parks and natural reserves, natural resources management), and 3) environmental sustainability (education, research and development, policy and legislation, communications and policy awareness, management for sustainable development) .¹⁷⁵ This is a definition that encompasses a very broad range of jobs, even those in environmentally damaging sectors (such as the tar sands), as long as it relates in some way to something as nebulous as ‘policy awareness’ about the attempts to clean up the environment. This means that a company in the tar sands that employs someone in advertising to publicize its new environmental contributions in tree planting would be counted as an ‘environmental worker’.^{176 177 178}

According to this report, about 3.2% of the Canadian workforce (530,414) is engaged in either full or part-time environment related work. The categories of this work are: trades and technology occupations (50%), management jobs (31%), administrative jobs (11%), and sales and service jobs (8%).¹⁷⁹ The report does not specifically look at the energy sector, but does list mining and oil and gas extraction as an industry group. In this, 23% of the establishments have at least one environmental worker.¹⁸⁰ It also says that the mining, oil and gas sector is expected to have the highest growth in environmental employment, at 2.6% per year.¹⁸¹

The most recent in-depth look at the employment effects of investment in the electricity sector was produced to examine the effects of the Ontario Government’s *Green Energy and Green Economy Act*. This research, *Building the Green Economy* that was sponsored by several environmental groups, specifically examines what level of investment would be necessary to meet the Ontario government’s goal of creating 50,000 new green jobs. But it also examines what kinds of jobs these are likely to be.¹⁸² This report based its predictions on two levels of investment, one which is relatively modest (\$18.6b over 10 years) would produce about 35,000 jobs per year, and the other on an expanded program (\$47.1b over 10 years) would produce about 90,000 jobs per year. These jobs include direct jobs in the targeted green activities,

¹⁷⁵ ECO Canada, 2007. *Profile of Canadian environmental employment 2007* (Calgary: ECO Canada; Environmental Labour Market (ELM) Research), p.5.

¹⁷⁶ See, for example, the full-page ad in the *Globe and Mail*, May 31, 2010 which is a message from Canada’s Oil Sands Producers. It features Garrett Brown, of ConocoPhillips saying “I Grew up on a farm. I know what it means to have the land restored.” The ad goes on to say that for years the petroleum producers have been planting grass and they are now beginning to plant trees, so that in a few years the forest will be re-established.

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¹⁷⁹ ECO Canada, *Profile of Canadian environmental employment 2007*, p. 8.

¹⁸⁰ It is not possible to get information about the electricity sector from the report. ECO Canada, *Profile of Canadian environmental employment 2007*, p. 18.

¹⁸¹ ECO Canada, *Profile of Canadian environmental employment 2007*, p. 24.

¹⁸² R.Pollin & H. Garrett-Peltier, 2009. *Building the green economy: employment effects of green energy investments for Ontario* (Green Energy Act Alliance, BlueGreen Canada, World Wildlife Federation).

indirect jobs associated with supplying goods and services to the targeted green industries, and induced effects, which counts the multiplier effects of the direct and indirect employment on the rest of the economy.¹⁸³ The report makes it very clear that the 35,000 or 90,000 jobs created each year cannot be aggregated for a 10-year period. This is because these jobs are largely temporary jobs related to construction, including both trades and the service activities. So, while 35,000 jobs may be created each year, 50,000 jobs may not be created in 10 years.

The more the overall level of activity is locally based, as will certainly be the case with construction, but may not be the case with manufacturing or engineering services, the higher will be the employment effect. The study is careful to point out the vast majority of jobs that will be created would be in the same areas of employment where people already work.¹⁸⁴ These jobs would include construction labourers, sheet metal workers, financial auditors, engineers, concrete-forming operators, secretaries, accounts, building inspectors, and research scientists. Most of these jobs pay over \$20 per hour. The jobs paying less than \$20 per hour are most likely to be in construction and manufacturing.

A Canadian-wide estimate for employment in renewable electricity development was provided earlier in the 21st century by a report of the Clean Air Renewable Energy Coalition. According to this report, renewable energy generation employs on average six people per 10 MW of capacity. It also estimated that increasing the capacity by 35,600 MW by 2020 would create between 12,700 and 26,900 jobs. The major assumption behind the estimates is that all parts manufacturing, development, and construction would be filled domestically. Of the three largest contributors to potential renewable electricity generation (offshore wind, small hydro and biomass) the small hydro (or run-of-river) was predicted to be the most labour intensive per MW for pre-operational work, while biomass would be the most labour intensive in the operational phase.¹⁸⁵

The estimate of job creation by the renewable industry itself is considerably higher than those cited above. Some of this needs to be treated with skepticism. For example, in BC the Sustainable Energy Association claims that the province has the potential to generate 84,250 GWH of sustainable, renewable energy. This would create over 400,000 jobs over the next 30 years.¹⁸⁶ This seems to include direct, indirect and multiplier effect job creation, but even that would not explain how BC renewable energy creation in the electricity sector could create more jobs than exist in the entire energy sector in Canada at the moment. It is very unusual for any promise of job creation in the energy sector to be monitored to compare the promise with what actually happens. One study that did examine this (although not in the

¹⁸³ R.Pollin & H. Garrett-Peltier, *Building the green economy*, p. 6.

¹⁸⁴ R.Pollin & H. Garrett-Peltier, *Building the green economy*, p. 22-23

¹⁸⁵ Clean Air Renewable Energy Coalition, 2004. *Canadian Renewable Electricity Development: Employment Impacts* (Prepared by the Pembina Institute for The Coalition) Retrieved from <http://www.cleanairrenewableenergycoalition.com/documents/Employment-Predictions.pdf>

¹⁸⁶ B.C. Sustainable Energy Association, 2005. *Sustainable energy solutions for B.C.: A contribution by the BC Sustainable Energy Association to the Alternative Energy & Power Technology Task Force* (Victoria, B.C.: BCSEA).

renewable sector) confirms that the anticipated job creation was vastly exaggerated and even with a long-term approach to job creation it could have been anticipated that the promised level would not occur.¹⁸⁷ The accounts of possible jobs to be created by the associations of renewable energy producers should, therefore, be treated with considerable caution.^{188 189 190}

Wind

As noted earlier, wind energy is experiencing the largest growth among the renewable sector. The NEB estimates that it will form 10% of installed capacity by 2020, although this could be difficult to achieve, considering that it provides about 1% of capacity in 2010.¹⁹¹ Employment in this sector, while very small, has grown rapidly from 1,000 in 2004 to over 4,000 in 2010. The government estimates that it will be 13,000 by 2012.¹⁹² Over 430 private companies who are heavily subsidized by utilities and governments undertake all activity in this sector. Most of this production relates to project development, project operation and independent power generation. Only 16% of the activity is associated with manufacturing. The manufacturing firms make wind-related components such as rotor blades, control systems, turbines, inverters, nacelles, towers and meteorological towers.¹⁹³

The government and the industry see the wind sector as having a great potential for generating energy in the future. If this does occur, its primary job potential would be in the construction stage, but even here the numbers will be fairly small in comparison with employment in the rest of the energy sector. It should be noted, however, that wind generates more jobs per megawatt hour than coal, gas, and nuclear industries.¹⁹⁴ If a substantial manufacturing sector were to develop, much greater job creation could be associated with the public investments in this form of renewable energy. Labour shortages exist in jobs

¹⁸⁷ T. Gunton, 2003. 'Megaprojects and regional development: Pathologies in project planning' *Regional Studies*, 37(5), 505-519: This study relates to the Northeast Coal Project and compares pre-project forecasts to post-project outcomes for one of the largest megaprojects ever undertaken in Canada. Less than ½ expected regional employment occurred and the project's proposal greatly over-estimated both direct employment and its multiplier effect. The project wound up having a negative effect on regional development.

¹⁸⁸ This is aside from whether the jobs themselves will be good jobs. For a test of assumptions that green jobs will be good jobs see P. Mattera, February 3, 2009. *High road or low road? Job quality in the new green economy*. (Washington D.C.: Good Jobs First).

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¹⁹¹ Canada. National Energy Board, 2009. *2009 Reference Case Scenario: Canadian energy demand and supply to 2020* (Calgary: National Energy Board).

¹⁹² Industry Canada website at ¹⁹² Industry Canada website at www.ic.gc.ca/eic/site/wei-ice.nsf/eng/00169.html

¹⁹³ A nacelle is the casing, or housing, for the electrical generator and other related mechanical components of a wind turbine.

¹⁹⁴ G. Ayee et al., Wind Power: generating electricity and employment in *Manufacturing climate solutions: carbon-reducing technologies and U.S. jobs*. (Durham, N.C.: Duke University. Center on Globalization Governance and Competitiveness); J. Harding, 2007. *Is Nuclear the answer to global warming?*. (Regina: Canadian Centre for Policy Alternatives - Saskatchewan Office); D.M. Kammen et al., *Putting renewables to work*.

related to operations and maintenance for wind turbines throughout North America and Europe.¹⁹⁵ These are specialist jobs that require training, but again, they do not constitute a large number.¹⁹⁶

Solar

The Canadian Solar Industries Association conducted a survey of employers in the industry with ESC and estimates a total labour force of 1,524 full-time job equivalents existed in 2008, but expects this labour force to grow over 100% by 2011 to 3,069. This dramatic increase is based on the belief that environmentally friendly green technologies will lead to future economic growth. The jobs expected to have the highest growth rates in the solar industries include project management (178% growth), installation (146% growth), sales (120% growth), and manufacturing (107% growth) The major constraint the industry sees to reaching these levels of growth relate to labour shortages.¹⁹⁷ Solar thermal refers to energy that is harnessed for heat and photovoltaics to convert solar energy directly into electricity. The majority of solar manufacturing jobs in Canada are concentrated in five firms whose products are primarily for export. According to one report, these firms are leading firms, internationally, but there is little Canadian demand for their products.¹⁹⁸

Biomass

The major producers of biomass energy are China, Brazil, U.S. and Germany, and nearly 1.2 million are employed in biomass energy in these four countries.¹⁹⁹ The largest use of biomass energy for electricity is in countries where labour costs are very low. Of all of the renewable energy sources, biomass is the most labour intensive in terms of production (after the construction stage). Since the devastation of BC forests by the pine beetle, considerable interest has been generated in expanding the biomass industry in that province. Biomass also has government support in Saskatchewan for the production of ethanol. Biomass currently accounts for 6% of energy demand in Canada (Natural Resources Canada), however that is not largely in a 'green' form. That is, the burning of wood for fuel, which is still extensive in Canada. It will take considerable changes in technology to convert most of this production to a clean, renewable energy source. Clean energy biomass production employs a very small proportion of the energy sector labour force and this probably will not change in dramatic ways in the future. Estimates of job creation from biomass, based on UK data, indicate that 1.27 employment/years occur per GWH of

¹⁹⁵ SQWenergy, October 2009. *Today's investment tomorrow's assets: skills and employment in the wind, wave and tidal sector. A report to the British Wind Energy Association; European Wind Energy Association.* January 2009. *Wind at work: Wind energy and job creation in the EU* (Brussels: EWEA),pp 10 – 11.

¹⁹⁶ Industry Canada, *Wind Energy*)

¹⁹⁷ Electricity Sector Council, 2008. *Building bright futures: powering up the future*

¹⁹⁸ R. McMonagle, 2005. *Job creation potential of solar energy in Canada* (Ottawa: Canadian Solar Industries Association), p.2.

¹⁹⁹ University of British Columbia. Sustainability Office & Academic Programs Working Group. 2009 *Sustainability labour market trends: a Canadian and International perspective.*

electricity produced, regardless of technology or scale of implementation.²⁰⁰ This includes direct employment related to the bioenergy plant, agricultural production and transportation, the jobs related to development and construction of the plant, and the indirect effects from upstream manufacturing and the induced economic effects from increased economic activity. On a more understandable level, a very large 25MW plant would create jobs of about 160 full-time equivalents over the lifetime of the plant, a figure considerably higher than the 20 people who would be employed at the plant.²⁰¹

Other Renewables

The largest employment in the renewable sector is with large hydro projects, although many environmental groups consider large hydro to be too environmentally damaging to be championed as a new source of renewable power in the 21st century. New projects are coming forward in this area in provinces that have typically had large hydro as the main supplier for electricity (such as BC and Quebec).

In the large hydro sector the main job creation occurs in the construction stage of the project. Smaller, micro-hydro (or run-of-river) projects are increasingly gaining popularity among private power producers and governments. The job creation associated with micro-hydro is at the construction stage, with almost no permanent direct jobs created. In Canada, there is some small tidal and geo-thermal electricity generation, but the technology associated with these forms of energy generation have not advanced to the stage that this type of production is likely to increase rapidly in the near future.

Concluding Remarks

The general assumption that policies that would bring about substantial reductions in carbon emissions would have a negative effect on employment in the energy industry in Canada is undoubtedly true.²⁰² However, Canada is unlike the US and European countries: it is not experiencing reductions in oil and gas production as is occurring elsewhere.

While conventional oil and gas production is declining, as elsewhere, Canada's production from unconventional sources is expanding.

²⁰⁰ P. Thornley, J.Rogers & Y.Huang, 2008. 'Quantification of employment from biomass power plants' *Renewable Energy*, 33(8), 1922-1927.

²⁰¹ Thornley, Rogers and Huang, "Quantification of employment from biomass", p. 1925

²⁰² M.K. Jaccard & Associates, 2008. *Preliminary Report: Exploration of a policy package to reduce Canadian greenhouse gas emissions 25% below 1990 levels by 2020* (Vancouver: MK Jaccard & Associates Inc.).

Canada's use of electricity is also increasing. Associated with this expanded energy production are government policies that encourage the growth of oil and gas production while doing relatively little to encourage reductions in consumption of either oil and gas or electricity. In the electricity sector a large proportion of generation comes from hydro-based systems with some provinces also heavily reliant on nuclear energy, both of which are renewable resources that do not contribute to climate-related emissions.²⁰³

Our review of the existing literature on employment in the energy sector concludes that the kinds of employment demands that have existed will continue for the foreseeable future. If government introduces substantial carbon-reduction policies, this may change, but this is not the current trajectory. New production in renewable industries like wind and solar is more labour-intensive than in existing electricity production, but constitutes a very small proportion of the market so far. While these industries are likely to grow considerably by 2020, their job creation potential is relatively small. It should be noted that these industries will be competing with existing generating companies for labour and since this is a sector where wages are high, the cost of labour may well be a barrier to continued expansion of these industries. This is because the kinds of jobs needed in the renewable energy sector are not markedly different from those required in the major energy sectors. While the labour force of the energy sector has traditionally been largely male from within Canada, the industry recognizes that labour shortages may force changes here. In virtually all areas of energy development, there are skills shortages and calls for additional training. These shortages cover a wide range of different occupations, from engineers and architects to skilled trades, equipment operators, technicians and even construction labourers. Skills shortages also vary, regionally and by energy sector.²⁰⁴ Most of the shortages are for jobs in conventional energy production. Although, the renewable sector is also experiencing significant shortages of qualified personnel.²⁰⁵

Other than large-scale hydro projects where several provincial governments, such as Quebec, Ontario and Manitoba, have attempted to link some of the spending with local employment or industrial offsets, public support for private green energy projects has produced fairly limited job growth outside direct construction. Even where provinces have attempted to link 'green energy' subsidies to industrial

²⁰³ As has been noted earlier, nuclear energy does have the potential to be extraordinarily damaging to the environment and many environmentalists point to other damages that occur through large-scale hydro development.

²⁰⁴ Alberta. Employment and Immigration, 2007. *Building and educating tomorrow's workforce: workforce strategy for Alberta's energy sector* (Edmonton: Alberta. Employment and Immigration); A. Lorenz, 2007. 'Competency pays! The Petroleum Competency Program Provides a win-win-win situation for employees, service companies, and producers' *Onstream* (Summer 2007) 8-12; SEC 2007b; Strategic Directions Inc. (SDI), 2003. *Labour market assessment of the oil and gas industry supply and service sector in Newfoundland and Labrador. A report prepared for the Petroleum Industry Human Resources Committee and Newfoundland Ocean Industries Association* (St. John's, Nfld.: PIHRC and NOIA).

²⁰⁵ L. Robitaille & J. Etcheverry, 2005. *Training, education, and public awareness: Key components for developing a strong and vibrant Canadian solar industry* (Solar Energy Society of Canada); SQWenergy, *Today's investment tomorrow's assets: skills and employment in the wind, wave and tidal sector*.

development, their efforts have been very modest. Since most permanent jobs related to ‘green’ energy are created through the manufacturing of green technology, the absence of a policy to increase domestic use of this technology through Canadian based manufacturing means the loss of the employment potential of renewable energy expansion. Somewhat perversely, governments in Canada now believe that many of the policy tools associated with activist industrial strategies are ‘protectionist’. If Canada is to realize the full job creation potential of green energy development, this view may have to change.

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TOURISM, CLIMATE CHANGE AND THE MISSING WORKER: UNEVEN IMPACTS, INSTITUTIONS AND RESPONSE

Steven Tufts

Introduction

For over two decades, researchers have addressed the issue of climate change and its present and future impacts on tourism-related activity as well as the contribution of tourism to GHG emissions (estimated to be approximately 5% of all emissions).²⁰⁶ Researchers based in Canada have been at the forefront of international studies on the implications for tourism as climate change inevitably affects tourist receiving and generating regions as well as the modes of travel between places.²⁰⁷ This chapter reviews recent literature on the impact of climate change mitigation and adaptation on tourism-related employment and work in Canada. Statistics Canada estimates that tourism generates over 600,000 jobs in the country and remains a growth sector (Table 1). While Canada is commonly believed to be a substantial ‘winner’ as climate change affects the global tourism market, the case is much more complex and contradictory than a simple benefit from extended warm seasons might suggest.²⁰⁸ The impacts of climate change will be experienced differently from region to region depending not only on local variations in climate change but also on changing competitive contexts. Of particular interest is the wide range of possible impacts climate change will have on employment in this diverse sector. We begin with a brief outline of the sources used and the research questions framing the chapter followed by a brief discussion of tourism-related industries and the present competitive environment. An assessment of the research on the effects of climate change on tourism-related employment and the response by labour to these changes is then

²⁰⁶ It is estimated that tourism activity is responsible for approximately 5% of emissions, but it is a growing contributor as air travel is forecast to account for over half of tourism-related ‘radiative forcing’ emissions (World Tourism Organization (UNWTO), & United Nations Environment Programme, 2008. *Climate change and tourism - responding to global challenges*. (Madrid: WTO;UNEP) .

²⁰⁷ A great deal of work has been carried out at the University of Waterloo dating back to the 1980s. Daniel Scott, Canada Research Chair in Global Change and Tourism, a lead author of the 2008 report *Climate change and tourism* published by the United Nations World Tourism Organization, is based at the University. Scott is also a co-editor of a recent special issue on tourism and climate change for the *Journal of Sustainable Tourism* (Scott and Becken 2010). Prior to Dr. Scott’s arrival, some of the earliest work on the impacts of climate change on tourism was carried out by Geoff Wall and Geoff McBoyle (also at the University of Waterloo; see G. Wall et al, 1986 ‘The implications of climatic change for camping in Ontario’ *Recreation Research Review*, 13(1), 50 - 60 and G. Wall and C. Badke, 1994 *Tourism and climate change: an international perspective*, *Journal of Sustainable Tourism*, 2(4), 193-203).

²⁰⁸ A report by Deutsche Bank Research literally mapped global winners (mostly in the North) and global climate change losers in the South : see Deutsche Bank Research, 2008. *Climate change and tourism: where will the journey lead ?*. (Frankfurt, Germany: Deutsche Bank Research). The model described the uneven affects but stress increased temperatures and the relatively smaller portion of tourism activity to GDP as a primary reason for this common pattern. Other simulations such as the work by J.M. Hamilton et al, 2005 ‘Effects of climate change on international tourism’, *Climate Research*, 29(3), 245-254. expect a general shift in international tourism toward the poles due to preferred temperatures and patterns of concentrated wealth. Scott et al (2004) use a tourism climate index in North America to show potential gains for Canada, although there is some speculation that enhanced ‘snowbird’ travel to warmer cities in the US could limit any reductions in Canada’s current tourism account deficits. See D. Scott et al, ‘Climate change and the distribution of climatic resources for tourism in North America’, *Climate Research*, 27(2), 105-117.

detailed. Despite the range of potential impacts on employment and long established research linking tourism activity to the environment, it is noted that workers have largely been absent from analysis as active agents of climate change mitigation and adaptation.²⁰⁹ This is disappointing given the importance of tourism-related employment to post-industrial economic development and developing economies in the Global South (often stated *apriori* as justification for research on the impacts of climate change). Further, there is no clear indication of whether a ‘high road’ or ‘low road’ will be followed, as labour markets adjust. The chapter concludes with a call to centre workers in tourism policy responses to climate change.

Table 1. Tourism generated employment in Canada (2004)

| Tourism-related Sector | Employment (000s) | % Total Employment |
|---|-------------------|--------------------|
| Transportation | 73.3 | 12.0 |
| Accommodation | 161.6 | 26.5 |
| Food and Beverage Services | 145.3 | 23.8 |
| Other Tourism Industries ^a | 110.0 | 18.0 |
| Other Non-Tourism Industries ^b | 120.5 | 19.7 |
| Total | 610.6 | 100.0 |

a. Other tourism industries include recreational and entertainment services, travel services etc.

b. Includes industries where employment is generated by tourism activity (e.g., motor vehicle parts, retail groceries etc.)

Source: Statistics Canada 2009 Canadian Tourism Satellite Account 2004 Catalogue no. 13-604-M — No. 063 Income and Expenditure Accounts Technical Series, <http://www.statcan.gc.ca/pub/13-604-m/13-604-m2009063-eng.pdf>

Sources

The link between tourism and the environment has been studied for over a century, dating back to the earliest recognition of the importance of specific ‘climatic assets’, which draw people toward destinations (e.g. alpine regions, warm climate sea sides).²¹⁰ Not until the post-war period, however, did researchers begin to link tourism to broader processes of environmental change. In Canada, researchers have noted the impacts of recreational activities on natural ecosystems since the 1970s. In the 1980s, the positive and negative environmental impacts of tourism were studied, paving the way for research on sustainable tourism practices and ‘ecotourism’ development in the 1990s. By the early 2000s, however, the impacts of global environmental change - including but not limited to climate change - on tourism became a major

²⁰⁹ This is the case in several ‘state of the research’ pieces in articles and books. For example, Dubois and Ceron’s (2006) article attempting to set an agenda for research on climate change and tourism completely neglects any role for workers as stakeholders and does not include the lack of knowledge on employment impacts among several of the identified research gaps. (G. Dubois & J. Ceron, 2006. ‘Tourism and climate change: Proposals for a research agenda’, *Journal of Sustainable Tourism*, 14 (4), 399-415.). Similarly, Scott and Beckman (2010) do not mention employment impacts beyond non-quantified job losses and wage reductions in D.Scott, & S.Beckman, 2010. ‘Adapting to climate change and climate policy: progress, problems and potentials’. *Journal of Sustainable Tourism*, 18(3), 283-295.

²¹⁰ S. Gossling, & C.M. Hall, 2006. *Tourism and global environmental change : ecological, social, economic and political interrelationships* (Abingdon, England: Routledge); Wall and Mathieson 2006

focus.²¹¹ In the specific case of climate change and tourism research, Daniel Scott and colleagues at the University of Waterloo, classify the scholarly evolution of the English language literature into four stages: a ‘formative stage’ in the 1960s and 1970s when only a few reports focused on the need for accurate climate data to assist recreational planning and development; a period of ‘stagnation’ in the early 1980s as the focus shifted to other areas of environmental concern (e.g., air pollution); the ‘emergence’ of research in the late 1980s and 1990s which predated the formation of the Intergovernmental Panel on Climate Change (IPCC); and lastly a recent ‘maturation’ period of more detailed research over the last decade ‘advancing understanding’ between climate change research and the complex vulnerabilities in the sector.²¹² Despite the progress made in the literature, it is interesting to note the lack of attention to employment impacts. In a search of the online bibliography produced by Scott and his colleagues, there were no citations specifically addressing employment or work.

In order to assess links between tourism employment and climate change, the literature search for this chapter collected over 200 English language references with some relationship to the research questions below. The majority of the sources (125+) were ‘scholarly’ books, chapters and journal articles. Another 50 electronically available reports from government, international authorities, industry associations, and non-governmental organizations were also collected.²¹³ The remaining sources were drawn from webpages and popular media. This chapter also uses data from Tourism Satellite Accounts and a series of recent reports on tourism-related workers produced by the Canadian Tourism Human Resource Canada (CTHRC).²¹⁴

Research Questions

There were three primary research questions directing the review of the literature on the impacts of climate change on tourism-related employment:

1. What are the present and future impacts of climate change on tourism-related employment in Canada in terms of overall job growth and geographical variations in employment?

²¹¹ S. Gossling & C.M. Hall, *Tourism and global environmental change*, p.15.

²¹² Scott et al in C.M. Hall & J.E.S.Higham, 2005. *Tourism, recreation, and climate change* (Clevedon; Buffalo: Channel View Publications).

²¹³ Such authorities include the IPCC, the United Nations Environment Program (UNEP) and the World Tourism Organization (UNWTO).

²¹⁴ The largest sources of statistical material reviewed in this chapter are reports emerging from the Tourism Satellite Accounts maintained by statistics Canada and a series of reports on tourism-related employment produced by the CTHRC which drew upon a custom tabulation from the 2006 Census. TSAs are national or regional systems of tracking the impact of tourism activity on the economy. There are variations in the way the TSA and the customs tabulation define tourism employment.

2. What are the present and future impacts of climate change on tourism related work in terms of changing labour processes, work organization, skill and training requirements, and labour market support?

3. What has been the present response by employers and workers to the risks and challenges of climate change for tourism?

The above questions were used to guide the review and analysis. Overall, the research is a rich inventory of the existing and future challenges climate change poses to tourism, but there is a paucity of research detailing the impacts of employment and work and the responses of labour. Given the lack of research addressing the specific questions, several of the findings emerge as speculative and call for future research.

Tourism and tourism employment defined

A major barrier to analysis of the impacts of climate change on tourism-related employment is the chaotic conceptualization of what actually constitutes the sector. Given the diverse inputs required to support tourism, ranging from fuel production for air travel to foodstuffs for restaurants and linens for hotels, direct and indirect tourism employment, is substantial. Further induced employment (e.g., jobs created through multiplier effects) can also be vital to tourism dependent communities and regional economies.²¹⁵ As a result, it is perhaps too complex to quantify accurately the full impact of climate change on *all* tourism employment, especially given the multiple scenarios of locally variable temperature and precipitation changes. As a result this discussion is limited to the impacts on major tourism-related sectors as identified in a range of quantitative measures, such as Tourism Satellite Accounts. The major sectors are transportation, accommodation, food services, and travel services. Other tourism-related industries which depend on both tourists and residents (e.g., recreation and cultural services) are not a primary focus here. Some indirect and induced tourism-related employment is covered in other chapters in this report (i.e., construction, transportation).

²¹⁵ Frechtling and Horvath estimated in a study of multiplier effects via tourism expenditures in Washington, DC that 18 additional jobs were created per \$1million of final visitor demand (i.e., demand generated through direct tourist expenditure and multiplier effects) (D. Frechtling & E.Horvath, 1999. 'Estimating the multiplier effects of tourism expenditures on a local economy through a regional input-output model'. *Journal of Travel Research* 37(4), 324-332). It was argued that the multiplier effect is higher than most industries as there is less economic leakage (e.g., profits sent to TNCs in other jurisdictions) - in developed tourism economies and tourism workers are more likely to spend their money locally. There are, however, important criticisms of the use of multipliers in tourism economic policy (see G.Shaw & A.M.Williams, 2004. *Tourism and tourism spaces*. (London, Thousand Oaks: SAGE) 198.

In terms of tourism employment it is also important to differentiate between tourism-generated employment, which measures employment in a sector resulting directly from tourism (international and domestic), and tourism-related employment, which quantifies all employment in sectors servicing tourists and residents.²¹⁶ For example, tourism-generated accommodation and food and beverage services employment in Canada is reported to be approximately 300,000 while total employment in these two sectors is now over 1 million (see Table 1).

Sector Profile

Climate change adaptation and mitigation are processes dependent upon several contingent factors which vary among tourism-related industries and geographical locations with different competitive contexts.²¹⁷ Overall tourism in Canada continues to contribute significantly to economic activity. Using data from Tourism Satellite Accounts, the World Tourism and Travel Council provides the following 2010 forecasts of tourism activity in Canada.²¹⁸

- Tourism directly contributes \$42 billion to the economy, approximately 2.6% of Canada's gross domestic product (GDP)
- Tourism directly generates 3.5% of total employment (596,000 jobs) and if indirect employment is included the total economic impact on employment is over 1.8 million jobs
- Canadians spend more abroad than they receive from tourists creating consistent travel deficits. Canada's travel deficit has been over \$6 billion annually since the mid 2000s. In 2004, Canada dropped out of the top 10 international tourist destinations as US tourists stayed at home. Between 1998 and 2007 day-trippers from the US decreased by almost 50% and vehicle entries declined by 40% between 2003 and 2007, largely due to border congestion and the high dollar²¹⁹

²¹⁶ See Wall and Mathieson 2006, 130-131 for a full discussion on the issue of employment categorization. A thorough critique of the tendency to inflate tourism employment internationally is offered by N. Leiper 1999 'A conceptual analysis of tourism-supported employment which reduces the incidence of exaggerated, misleading statistics about jobs', *Tourism Management*, 20(5), 605-613. Tourism and tourists are also difficult to define. The most widely used technical definition is a visit to any destination for more than one day. This is, however, problematic as it excludes 'daytrippers' which can be important sources of economic activity. Such local tourism activity will also be affected by mitigating responses to climate change such as increased fuel surcharges.

²¹⁷ For example, tourism agencies are less vulnerable to climate change as they can continue to book travel away from vulnerable areas while hotels located in such areas are not mobile. See M.C. Simpson et al, 2008. *Climate change adaptation and mitigation in the tourism sector: frameworks, tools and practices* (Paris: UNEP, University of Oxford, UNWTO, WMO).

²¹⁸ World Travel and Tourism Council (WTTC), 2010. *Travel and tourism economic impact: Canada* (London, U.K.: WTTC,) at www.wttc.org/bin/pdf/original_pdf_file/canada.pdf, last accessed August 10, 2010

²¹⁹ Tourism Industry Association of Canada (TIAC), 2009. *Tourism & travel trends 2008* (Ottawa: TIAC)

While there is regional variation in tourism performance and dependence, declines of international visitors to Canada (who largely come from the US) are a concern as tourism is an important export industry. Diminishing international tourism and shifts in tourism markets are the outgrowth of several challenges facing tourism in Canada. While overall growth is expected for the sector, there are several challenges in the current competitive environment in Canada. A full discussion is beyond the scope of the chapter, but there are some broad challenges which are directly linked to the issue of climate change. First, mass package holidays (resorts, cruises) are still a significant part of many tourist experiences, and will continue to cater to aging tourists in Western markets, but tourists are also rejecting this type of travel and are engaging in fewer return visits.

The rise of the 'post-tourist' has forced destinations to be innovative and develop multiple attractions for a segmented market as tourists seek aesthetics and experience over functional holidays.

One of the most contradictory forms of tourism continues to be ecotourism, which markets in some cases a 'sustainable' tourism experience (which is still often dependent upon GHG emitting air travel).²²⁰ There is also pressure to continue to pursue mega-events such as the 2010 Winter Olympics in Vancouver. While these are mass tourism events, there is pressure by tourists and residents to make such large-scale projects environmentally responsible.

Second, there are external 'negative events' which have also limited growth in Canada. In 2002, international travel was reduced in Canada following 9/11 and in 2003 Toronto was devastated by the issue of a World Travel Organization travel warning in the midst of the SARS outbreak.²²¹ These 'shocks' serve as test cases for tourism economies which are vulnerable to extreme weather events associated with climate change.

Third, there are competitive challenges directly linked to state regulation which are also the subject of industry lobbying efforts. First, despite the growth of GHG emissions from air travel, tourism industry associations claim that air ticket prices in Canada are too high largely due to structural costs (airport fees, excise fuel taxes, security charges etc.).²²² There is also pressure on the federal government to continue to expand the number of Open Skies agreements with the EU and other regions to increase air passenger

²²⁰ P. Nowicka, 2007. *The no-nonsense guide to tourism* (Toronto: Between the lines/New Internationalist Publications), 102-105.

²²¹ S. Tufts, 2009. 'Hospitality unionism and labour market adjustment: toward Schumpeterian unionism?' *Geoforum*, 40(6), 980-990.

²²² Tourism Industry Association of Canada (TIAC), 2008. *The Report on Canada's tourism competitiveness: A call for action for the Canadian tourism industry* (Ottawa: TIAC), Appendix p i. The report by the leading tourism industry association in Canada is itself contradictory as it also details a strategy for sustainable development (largely linked to natural parks conservation) while calling for rapid improvements in transportation volumes and border access.

travel. The Travel Industry Association of Canada (TIAC) also claims that there needs to be significant improvements in intermodal transportation in Canada including large investments in high-speed rail.²²³ The last significant challenge which involves the state, is the ‘branding’ of Canada’s international image to tourists abroad. Here, there is a direct link between the state’s climate change policy and tourism promotion efforts. As TIAC itself notes, Canada’s international image remains very much associated with the ‘pristine’ outdoors and natural landscapes. Canada’s reputation as being openly hostile to global agreements aimed at reducing emissions (e.g., Kyoto) and the development of ‘dirty oil’ in Alberta’s tar sands contradict efforts to ‘position Canada as a green and sustainable tourism destination’ promoting parks and green industry certifications.²²⁴

Snapshot of tourism workers in Canada

Despite these limitations employment in key tourism-related sectors continues to grow and labour shortages are forecasted in the future (Figure 1, Table 2). The industry expects labour shortages (even in the midst of a global recession) for certain segments of the tourism sector.²²⁵ TIAC and other industry associations (Canadian Restaurant and Foodservice Association (CRFA) and the Hotel Association of Canada) also continue to lobby aggressively for expansion of Canada’s Temporary Foreign Workers Program “to expedite processing of applications and ensuring tourism needs related to skills and seasonality is met.”²²⁶

A brief statistical profile of the five major tourism-related sectors and major occupations leads portrays a diverse, complex and segmented workforce (Table 3). In terms, of gender segmentation women dominated accommodation and food services but are less likely to be employed in transportation services which are dominated by males. Similarly, recreation and entertainment services employ relatively low numbers of females and persons born outside Canada. Younger workers are concentrated in food and beverage services where the average hourly wages are lowest and the prevalence of part-time work highest.

Differences also exist in terms of the largest occupation groups (Table 4). The occupations with the highest percentage of female worker are cashiers and light duty cleaners, while only 6.7% of taxi drivers are women. Taxi drivers and light duty cleaners are, however, more likely to be ‘visible minority’ and born outside Canada. There are also differences in education levels by occupation. A taxi driver is almost three times more likely to have a university degree than a bus driver. There are also several occupations where a high percentage of workers are attending school as they employ younger workers.

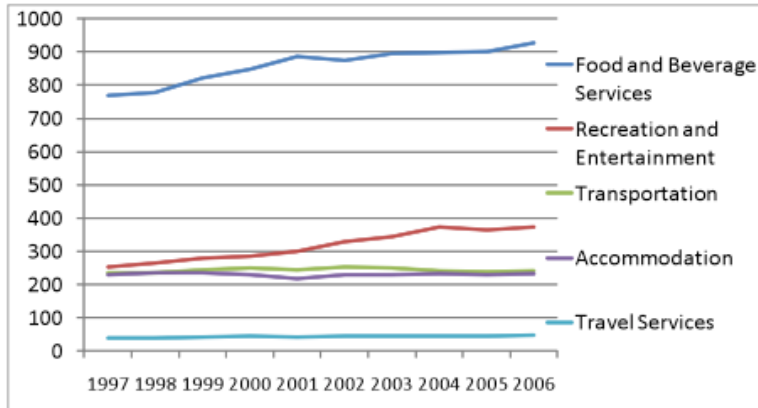
²²³ TIAC, *Report on Canada’s tourism competitiveness*, p iv.

²²⁴ TIAC, *Report on Canada’s tourism competitiveness*, pp 19-20.

²²⁵ The Canadian Tourism Human Resources Council (CTHRC) released an update to their earlier, Tourism labour supply and demand study : Canadian Tourism Human Resources Council (CTHRC), 2009. *The Future of Canada’s tourism sector: Labour shortages to re-emerge as economy recovers* (Ottawa: The Council). The report called for sustained investment in training and recruitment. These similar concerns are shared in reports on subnational labour markets, e.g., Roslyn Kunin and Associates, 2009. *Vancouver Island tourism labour market study: Final Report* (Vancouver Island Tourism Human Resources Steering Committee).

²²⁶ TIAC *Report on Canada’s tourism competitiveness*, Appendix p5.

Figure 1: Tourism-related sector employment in Canada, 1997-2006, (thousands)



Source: Statistics Canada 2008 Human Resource Module of the Tourism Satellite Account, Update to 2006. Catalogue no. 13-604-M - No. 059 Income and Expenditure Accounts Technical Series <http://www.statcan.gc.ca/pub/13-604-m/13-604-m2008059-eng.pdf>

Table 2: Forecast of Labour Demand 2025.

| Sector | Potential Labour Demand 2025 | Project Labour Shortage 2025 |
|---------------------------------------|------------------------------|------------------------------|
| Tourism Sector | 2,200,228 | 256, 669 |
| Accommodation | 293,559 | 17, 091 |
| Food and Beverage Services | 1,162,484 | 172, 258 |
| Recreation and Entertainment Services | 386,745 | 42, 795 |
| Transportation Services | 300,677 | 24,828 |
| Travel Services | 56,763 | -231 |

Sources: Canadian Tourism Human Resources Council (CTHRC), June 2008. *The future of Canada's tourism sector: long on prospects...short on people* Ottawa: The Council.

Available at http://www.otec.org/PDF/Supply-Demand%20Compilation%20Report_ENG.pdf Accessed on June 25, 2009; CTHRC 2009 *Who's Working for You? A demographic profile of tourism sector employees* (Ottawa: CTHRC) Accessed last on August 2, 2010

Lastly, there are important differences in the percentage of workers who are union members. While the transportation sector has a higher percentage than the Canadian average, all other sectors have far less union presence with food and beverage services (the largest sector) having minimal representation. The lack of organized labour is an important factor in the ability of workers to voice concerns in labour market policy, resist specific employer adaptation initiatives, and advance worker-developed alternatives.

Table 3. Profile of selected tourism-related sectoral employment by employee characteristics, Canada, 2006.

| | % Female | Age group ratio 15-44/45+ | % Born in Canada | % visible minority | % full-time | Average hourly wage (2006) | % change in hourly wage since 1997 | % union member employees ^a |
|------------------------------|----------|---------------------------|------------------|--------------------|-------------|----------------------------|------------------------------------|---------------------------------------|
| Total tourism industry | 54.6 | 2.9 | 79.6 | 18.8 | 61.4 | 17.95 | 29.2 | 11.5 |
| Transportation | 29.5 | 1.1 | 79.5 | 17.4 | 82.2 | 31.61 | 25.1 | 32.9 |
| Accommodation | 62.5 | 1.9 | 77.4 | 19.0 | 71.9 | 17.21 | 48.5 | 16.3 |
| Food and beverage services | 60.1 | 4.8 | 78.3 | 22.7 | 51.1 | 12.48 | 33.7 | 2.6 |
| Recreation and Entertainment | 48.5 | 2.7 | 87.2 | 10.9 | 61.1 | 20.58 | 20.2 | 13.1 |
| Travel Services | 68.2 | 2.0 | 65.8 | 22.9 | 80.1 | 21.56 | 34.3 | 5.0 |

Source: Statistics Canada 2008 Human Resource Module of the Tourism Satellite Account, Update to 2006 Catalogue no. 13-604-M — No. 059 Income and Expenditure Accounts Technical Series <http://www.statcan.gc.ca/pub/13-604-m/13-604-m2008059-eng.pdf> CTHRC, 2009. *Who's Working for You? A demographic profile of tourism sector employees*, (Ottawa: CTHRC) Accessed last on August 2, 2010

a. Census Data does not include unionization data. This data is taken from the Statistics Canada Labour Force Survey.

Table 4. Demographic Characteristics of Main Tourism-related Occupations, 2006.

| Occupation (NAIC) | No. of workers | % of tourism-related occupations | % female | % visible minority | % born outside Canada | % university certificate or degree | % attending school |
|--|----------------|----------------------------------|----------|--------------------|-----------------------|------------------------------------|--------------------|
| Food counter attendants, kitchen helpers and related occupations | 225,535 | 13.6% | 62.2 | 22.1 | 22.0 | 4.5 | 53.7 |
| Food and beverage servers | 177,880 | 10.7% | 79.5 | 15.1 | 25.2 | 9.0 | 41.7 |
| Cooks | 140,370 | 8.5% | 37.4 | 26.1 | 29.6 | 3.5 | 30.6 |
| Restaurant and food service managers | 91,105 | 5.5% | 47.2 | 26.6 | 36.1 | 14.8 | 9.1 |
| Bus drivers and subway and other transit operators | 66,930 | 4.0% | 36.4 | 10.3 | 18.9 | 5.5 | 5.3 |
| Cashiers | 57,770 | 3.5% | 83.4 | 31 | 27.6 | 5.5 | 52.8 |
| Light duty cleaners | 47,160 | 2.8% | 80.2 | 28.5 | 64.6 | 5.6 | 17.2 |
| Program leaders and instructors in recreation, sport and fitness | 41,725 | 2.5% | 61.3 | 9.3 | 12.1 | 19.3 | 52.1 |
| Taxi and limousine drivers and chauffeurs | 38,735 | 2.3% | 6.7 | 48.8 | 58.3 | 14.3 | 6.3 |
| Bartenders | 36,185 | 2.2% | 65.2 | 7.7 | 10.2 | 8.7 | 31.8 |

Source: CTHRC, 2009. *Who's Working for You? A demographic profile of tourism sector employees*, (Ottawa: CTHRC) Accessed last on August 2, 2010

High Roads and Low Roads: Response and Organizational Change in the Sector

Overall, tourism-related employment outperforms job growth in most industries. In terms of response to a rapidly changing competitive context there are a range of actions by firms and local communities, which have a direct impact on employment and work in the sector. In a recent review of human resources in the UK, these responses were characterized as ‘polarized’ with some evidence of increased professionalization of tourism work and skills training. At the same time, the competitive global pressures have seen the emergence of marginalized labour (often undocumented) in hotels and a de-professionalization of some occupations such as airline stewards in low cost carriers.²²⁷

Here we see parallels with competing high and low road strategies in North America’s hospitality sector. In a 2006 report produced by a Task Force commissioned by UNITEHERE Local 75, *Industry at a Crossroads*, detailed the union’s vision for Toronto’s hospitality workers. The report was commissioned following the 2003 SARS outbreak which displayed thousands of precarious hospitality workers.²²⁸ The vision was largely inspired by the Working for America Institute’s study of hotel work which similarly called for a ‘high road model’ which builds “an economy based on skills, innovation, opportunity, sustainability and equitably shared prosperity rather than on low-road practices that lower living and working standards and weaken communities.”²²⁹

In the 2006 task force report, there is a call for hospitality employers to actively partner with organized labour to develop practices which improve their competitive position via a high wage, high skilled and high value added workforce.

Major recommendations included: living wages and benefits for all hotel workers; desegregation of ethnically segmented labour markets; the right to union protection; comprehensive training opportunities; reasonable workloads; work-family life balance; and adequate social supports such as affordable housing and access to public transit.

²²⁷ See T. Baum, 2007. ‘Human resources in tourism: Still waiting for change’, *Tourism Management*, 28(6), 1383-1399 for a complete discussion of these contradictory patterns in the UK.

²²⁸ Tufts, *Hospitality unionism*, UNITE HERE, Toronto Task Force on the Hotel Industry. (2006). *Industry at the crossroads: high road economic vision for Toronto hotels*. (Toronto: UNITE HERE).

²²⁹ See Working for America Institute, 2003. *U.S. Hotels and workers: room for improvement* (Washington, D.C.: Working for America Institute); also S. Tufts, 2010. ‘Schumpeterian unionism and ‘High-Road’ dreams in Toronto’s hospitality sector’, A. C. Bergene, S. B. Endresen & H. Merete (Eds.), *Missing links in labour geographies* (pp. 83 - 97) (Ashgate) for a further discussion.

Few employers, however, are close to implementing these goals. Most tourism-related industries face structural impediments and competitive pressures which limit their ability to adopt this model.²³⁰ For example, many small and medium sized enterprises (SMEs) in the sector (e.g., restaurants, bed and breakfast operations, local tour guides) do not have the capacity to provide training. Relative ease of entry into the market also creates significant competition lowering wages. While industry and government associations are active in providing minimal training tools for employers, a primary lobbying focus seems to be on increasing the labour supply through temporary foreign workers rather than investments in skills and productivity improvements. The status quo for most of the industry seems to be some skills building capacity with a continued dependence on marginalized segments of the labour market (i.e., immigrants, grey labour, young workers, etc.)

Climate Change and Tourism: Impacts and Responses

Despite the regional specificity of climate change, economists have attempted to model the impacts of climate change on tourism flows and the national GDP, using advanced economic equilibrium models.²³¹ There is agreement that Canada (and other high latitude, developed economies) will perform well under different climate change scenarios. In fact, a map produced by the WTO depicting the regions most vulnerable to climate change does not highlight Canada at all.²³² But this depiction of Canada as ‘winner’ in the case of climate change and tourism is limited to national scale analysis. A simple review of studies and recent developments indicates several regional hotspots where tourism is threatened, even if tourism flows increase overall (see Figure 2). These hotspots range from cities and the impact of urban heat waves to rural areas and the decline in snow-covered hill and mountain slopes for skiing. Tourism-related industries will be able to exercise some capacity to adapt even in those areas that are considered most the most vulnerable. For example, technological advances in snowmaking are argued to compensate for reduced snow in even the most severe climate change scenarios mediating the impacts.²³³ Similarly, golf

230 M. Riley, A. Ladkin and E. Szivas, 2002. *Tourism employment: Analysis and planning* (Clevedon, Channel View Publications), provide a succinct analysis on structural reasons for the pervasiveness of the low-wage model in tourism employment. These include the prevalence of SMEs, the need for seasonal flexibility, high job satisfaction in some occupations, entry level status of many jobs, unregulated internal markets, and the inability to quantify service productivity.

231 Berritella et al, 2006. ‘A general equilibrium analysis of climate change impacts on tourism’, *Tourism Management* 27(5), 913-924 applied a multi-country computable general equilibrium (CGE) model to estimate changes in tourist flows to 2050 through the insertion of hypothetical ‘shocks’ to selected variables. Canada fared the best out of all countries in the simulation due to its warming climate and potential for significant productivity gains. In a similar approach Bigano et al, 2008. ‘Economy-wide impacts of climate change: A joint analysis for sea level rise and tourism’, *Mitigation and Adaptation Strategies for Global Change* 13(8), 765-791 estimated that Canada would experience only minimal loss in GDP due to a climate change when increase in sea level is considered with changes in tourism flows. It is important to note that these global comparisons only model the national economy.

232 Simpson et al, *Climate change adaptation and mitigation*.

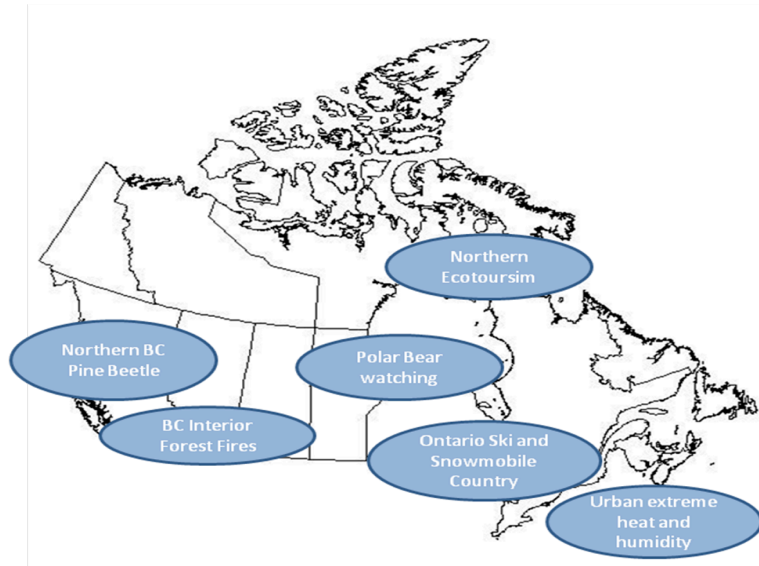
233 D.Scott, J Dawson, and B Jones, 2008. ‘Climate change vulnerability of the US Northeast winter recreation- tourism sector’, *Mitigation and Adaptation Strategies for Global Change* 13(5-6), 577-596.

courses and other summer attractions developed near ski hills will benefit from lengthened seasons, but may be stressed by competition for scarce water and increased pestilence.²³⁴

While there has been significant and increasingly sophisticated research on the implications of climate change on communities, there are too many complex and contradictory trends to make generalized statements for the entire country. Researchers are, however, confident that climate change will bring significant and localized change to tourism economies. While this makes any definitive statement on the implications for employment and work impossible, it does provide a framework for discussing the range of employment impacts. Further, the responses to these changes can follow different trajectories, some being high road and others low road.

In order to examine the implications systematically, the impacts of climate change on tourism can be subdivided into three categories: *first order impacts* are those changes that directly affect tourism activity (e.g., warmer winters); *second order impacts* are those that result from mitigation and adaptation strategies which directly related to tourism (e.g., increase in air travel taxation); and *third order impacts* are those broad aspects of climate change which affect all economic activity (e.g., declines in overall economic output reducing travel expenditures). The possible high and low road responses to these impacts are discussed. While most of these responses are presently conjectural there are a few precedents which may be relevant to future action.

Figure 2. Climate Change Tourism Vulnerability ‘Hotspots’ in Canada



²³⁴ D. Scott & B.Jones, 2007. 'A regional comparison of the implications of climate change for the golf industry in Canada' *Canadian Geographer* 51(2), 219-232.

First order impacts

First order impacts are those changes to the climate which will directly affect tourism activities. In many cases, they will be real changes, but it is important to recognize, that mere perceptual changes can be just as important, such as the belief that skiing has declined in a region when the case may be very different.²³⁵

Warmer and shorter winter seasons

Impacts of shorter winter tourism seasons are dependent firstly on the severity of the climate change scenario. Dan Scott and his colleagues have examined the potential impacts on days available for seasonal activities (skiing, water boating, golf, and hiking) under a variety of climate change scenarios.²³⁶ At the most obvious level, just as specific tourism activity is correlated to the length of the season, so is the amount of labour required to deliver the required services. The quantitative amount of labour is, however, only one consideration as there will also be shifts in the types of jobs and skill requirements. For example, in the case of winter skiing in Canada, snowmaking may become increasingly important and in some cases, new north facing slopes may need to be developed in resorts. There will also be great regional variations in these impacts as ski hills in Quebec and Ontario will be affected at different rates than larger high altitude resorts in Western Canada (which may receive more tourists arriving by air from Northeastern North America and Europe). This will require new skills ranging from mechanics to service snowmaking machines to persons with expertise in cloud seeding. There may also be shifts in the services provided at resorts and they turn to the summer season for greater revenue. Any instability will inevitably put pressure on wage rates and demand even great flexibility from an already largely precarious workforce.

Longer, hotter and wetter peak seasons

Naturally, shorter winters mean a lengthened summer season. As stated above, this can lead to greater labour demand for services such as golf courses and many other recreational activities. Longer seasons may also benefit aboriginal communities, which have increasingly engaged in tourism-related development. However, there are many other countertrends related to hotter and, in some regions, wetter summers. In hot areas with decreased precipitation, reduced water levels and water quality has significant implications for boating and other water related activities reducing the demand for marine based service labour. Other effects such as urban heat waves may also shift tourists to inside activities. If temperature changes make cities less desired locations for tourists and residents demand for tourism-related workers will expectedly decrease.

²³⁵ S. Bicknell and P. Mcmanus, 2006. 'The canary in the coalmine: Australian ski resorts and their response to climate change', *Geographical Research* 44(3), 386-400.

²³⁶ D. Scott and G. McBoyle, 'Climate change adaptation in the ski industry. *Mitigation and Adaptation Strategies for Global Change* 12(8), 1411-1431); Scott et al, *Climate change vulnerability*

In areas with decreased water levels, new skills will be required, such as groundskeepers able to care for plants requiring less water. Water conservation in resorts will require training and education of workers as to appropriate water saving strategies and awareness about water quality issues.

Extreme weather events

After the experience of SARS, the vulnerability of Canada's tourism industry to negative events was readily apparent.²³⁷ Different regions are vulnerable to extreme weather ranging from drought and forest fire prone areas in Western Canada (e.g., Kelowna, BC) with significant agri-tourism industries. Larger forest fire events can threaten infrastructure and lead to longer-term decline in demand. Similarly, increased flood events or coastal erosion due to greater storm events will have an impact even in a largely continental climate. In severe cases, extreme events can displace an entire community's tourist industry and workforce, not only from their jobs, but their homes as well.²³⁸

Of particular concern is the ability of low waged workers to 'weather storms' without adequate state support. It is unlikely tourism-related employers will be able to employ workers in a disaster environment and unemployment insurance may be inadequate in significant rebuilding of industry related infrastructure is required. Over the longer term, there is also a question raised about financial pressures on firms due to increased insurance premiums in specific destinations. Any increase will force employers to reduce other costs such as labour.

Changes in flora and fauna

As climates change there will undoubtedly be shifts in plant and animal life. Invasive species thriving in warmer climates can have a significant impact on natural parks and other outdoor tourist destinations. The Mountain Pine Beetle (*Dendroctonus ponderosae*) infestation in BC is an extreme example which has affected parks in Canada and the US. Not only does the timber kill release GHGs, but they no longer serve as a carbon sink. While infested areas may be less attractive to tourists, in some cases it may also be necessary to restrict areas to tourists in order to prevent the spread or manage the infestation through controlled burns. However, as part of the economic recovery strategy, the federal government has invested in economic diversification programs which are turning to enhanced local tourism to absorb displaced forest workers in towns such as Fraser Lake and Quesnel.²³⁹

Changes in local wildlife will also impact tourism activity. While the threats of polar bear and whale extinction are of concern to wildlife watching industries, in some regions wildlife may become more abundant. Increased productivity of fish stocks in northern Ontario for example may lead to increases in

²³⁷ See S. Tufts (2003, and S. Tufts, *Hospitality unionism* for labour's response to SARS.

²³⁸ The impact of Hurricane Katrina on New Orleans's low-wage service workers has been documented and UNITEHERE did establish a relief fund to assist displaced members.

²³⁹ Canada. Western Economic Diversification Canada, 2008. 'Renewal of Quesnel Historic Site to Bring Jobs and Training'. www.wd.gc.ca/eng/77_10410.asp, Last Accessed August 13, 2010.

angling.²⁴⁰ Infectious disease spread by insect migrations may also impact tourists and tourist workers. The continuing threat of the West Nile Virus is one example.²⁴¹ Tourism workers exposed to tourists may be particularly vulnerable to such diseases.

Second Order Impacts

Second order impacts are those arising from mitigation and adaptive responses which affect tourism workers. It is here that regulatory processes (mandatory and voluntary) are engaged. While reduction of GHGs is perhaps most often discussed in terms of reduced air travel and consequent decreased in tourism demand, this is only one of a range of second order impacts.

Reduction of air travel CO₂ Emissions

Internationally, air transport is responsible for approximately 12% of all transport related GHG emissions, less than 2% of all GHG.²⁴² Emissions related to air travel are, however, the fastest growing tourism- related emissions despite claims of significant technological advances in fuel efficiency.²⁴³

For air transportation workers, changes in air travel regulation and practices will undoubtedly affect work and employment. First, there are immediate questions around strategies which would reduced demand and/or access to air travel. It is important to recognize, however, that air travel is predicted to increase on the next 30 years, especially from regional emerging markets such as South East Asia.

Surcharges and taxation would slightly decrease demand as will mandatory carbon offsets. Proposals such the International Air Passenger Adaptation Levy (IAPAL) - emerging as a means of collecting revenues from airline ticket purchases to be distributed to climate change vulnerable regions - may increase the costs of flying, but are unlikely to reduce demand significantly if implemented. Similarly, even if largely voluntary carbon sequestering programs (e.g., carbon offsets) were regulated, it is unclear whether they would lower demand significantly, especially if airlines were able to continue their existing process of de-professionalizing the industry, shifting it toward a low cost model.

²⁴⁰ In a discussion of the impacts of climate change in northern Ontario, Browne and Hunt note the potential for increased fish productivity while stocks in southern Ontario are less certain to benefit. See S.A Browne and L.M. Hunt, 2007. *Climate change and nature-based tourism, outdoor recreation, and forestry in Ontario: potential effects and adaptation strategies*. (Thunder Bay, Ontario: Ontario. Ministry of Natural Resources; The Icarus Foundation).

²⁴¹ Ceron and Dubois, *Potential impacts on French tourism*, note the potential for the spread of West Nile and even evidence of Malaria in French airports during summer months.

²⁴² N. Stern, 2007. *The economics of climate change: the Stern Review* (Cambridge: Cambridge University Press), Annex 7.c Emissions from the transport sector; IPCC *Fourth Assessment Report* (2007). While the international percentage of GHG from air travel is similar for Canada, it is important to recognize that the country is a significant emitter of GHGs.

²⁴³ D. Scott, P. Peeters, P. & S. Gossling, 2010. 'Can tourism deliver its "aspirational" greenhouse gas emission reduction targets?' *Journal of Sustainable Tourism* 18(3), 393-408.

More radical proposals such as air travel rationing (e.g., limited number of air miles per person or region) and shifts to alternative modes of travel are less likely. First rationing alternatives would themselves become commodified as a market for flight rations develops. As for other alternatives (e.g., trans-oceanic ships, high-speed rail, and even airships), there are simply no adequate substitutes in terms of speed, costs, or fuel efficiency at this time.²⁴⁴

The likely efforts to reduce emissions will be fuel and logistic efficiencies. Air fleet renewal and the development of new fuels will be involved, but there are technological limits to such gains. If the international air travel industry is to meet its ‘aspirational’ carbon reductions targets, airports themselves will also have to find ways to gain air traffic efficiency to increase load factors.²⁴⁵ Beside the downward pressure on wages to compensate for increased climate change charges, airline and airport workers may see further intensification in their work.

Reduction of ground and water transport CO₂ emissions

While air travel is estimated to become the largest source of tourism-related GHGs, cars are presently the primary source of tourism-related emissions. Daytrips and extended travel in cars will undoubtedly continue. Again, fuel and energy efficiencies are held to be primary means of reducing emissions not only for cars, but for cruise ships as well, however real reductions will require intermodal shifts to other forms or transit. Specifically, the development of high speed rail in the main urban corridors is advocated by TIAC as well as greater develop of mass public transit in cities as key components of a sustainable tourism that reduces emissions and insulates tourism demand from external fluctuations in gas prices. The implications for workers here are again related to broader sectoral shifts away from private to public transit systems.

Increased energy efficiencies in the accommodation sector

Accommodation services and other facilities are major consumers of energy. A significant strategy for greening the accommodation sector is the refurbishment of existing properties and the development of new properties, with the most recent energy efficient systems. These range from LEEDS certified building standards to ‘smart rooms’, which reduce energy consumption.²⁴⁶ Such refurbishment has implications for job creation in the construction and engineering sectors.

There are, however, contradictory processes in hospitality and other services. These consumer spaces are becoming increasingly luxurious as tourism service providers seek to give tourists an experience that is qualitatively different from the functional bedroom in the home.²⁴⁷ Large screen TVs and sheets with a high thread count that require more energy to clean will consume greater amounts of energy. In fact, the

²⁴⁴ G. Monbiot, 2006. *Heat: How to stop the planet from burning* (Doubleday: Toronto). Note: that cruise ships are also major emitters of GHGs.

²⁴⁵ Scott, Peters and Gossling, *Can tourism deliver?*

²⁴⁶ These include rooms that automatically shut off lights (or have reduced lighting to begin with) and efficient cooling and heating systems that are used only during occupancy.

²⁴⁷ Scott, Peters and Gossling, *Can tourism deliver?*

impact of such luxuries (termed amenity creep by hotel workers unions) has already proven to increase the workload of room attendants.

Green(wash)ing and rebranding the tourism industry

The greening of the tourism industry has a long history. The emergence of ecotourism as an entire market segment in the 1990s itself is a response to demands for environmental and socially sustainable experiences. What actually constitutes ecotourism and the contradictory nature of the term has been long debated and continues in recent research on climate change.²⁴⁸ Prior to now popular certification practices, hotels were beginning to adopt energy saving programs. Most common were requests to multi-night guests to not require the daily changing of sheets. While this would have saved the firm money and labour, there is no evidence that any savings were passed on to workers in terms of absolute workload reduction.

Presently, there is significant pressure on tourism firms to pursue some sort of environmental certification. Green certification processes remain uneven and the impacts on the labour process unclear. For example the Hotel Association of Canada has recently endorsed the ‘Green Key’ certification system.²⁴⁹ Green Key is a significant certification process but is completely voluntary and privately run. Furthermore, Green Key’s tiered rating is granted after a short self-assessment by the property and the submission of an annual ‘membership fee’.²⁵⁰ Eco-certification processes by second party assessors (let alone independent third parties) are less common. Such systems will inevitably leave the industry open to accusations of greenwashing their product. While calls are made for national or even international regulatory systems, they have not yet been developed. At the same time there is job creation in environmental industries administering these voluntary offsets for travel, which must be considered as part of climate change’s creative destruction process in labour markets.

On a larger scale the ‘greening’ of the industry is related to rebranding efforts to see Canada as green destination and capitalize on decades of ‘iconography’ of Canada as a ‘natural’ location with pristine environments. It is difficult to shift the established image to one of urbanism. Failure to maintain some sense of nature in the popular image of Canada is argued to harmful to the industry and its job creation potential.

²⁴⁸ Nowicka, *The no-nonsense guide*; D. Scott and S.Beckman 2010. ‘Adapting to climate change and climate policy: progress, problems and potentials’ *Journal of Sustainable Tourism* 18(3), 283-295.

²⁴⁹ Hotel Association of Canada, 2009. News release: HAC joins the partnership for global sustainable tourism criteria. April 2, 2009.

²⁵⁰ See www.greenkeyglobal.com for an overview of their programs and rates.

Third order impacts

Broad political and economic impacts of climate change will also affect tourism in Canada. These impacts include overall declines in economic output in Canada and abroad as well as political unrest which impede tourism flows.

Economic contraction

Overall economic contraction will inevitably reduce incomes and tourism expenditures inside and outside of Canada. If resources are shifted toward food production or imports in emerging markets, there will be limits on the growth of global tourism demand. While state transfers to depressed regions may limit some of these effects, large-scale economic decline will limit its effectiveness. Massive wealth transfers from rich to poor countries in order to assist vulnerable nations are also unlikely under current political and economic systems. The result may be increased competition for a smaller than anticipated tourism market. Increased competition will also lead employers to pursue low cost labour.

Political instability and climate change migration

It is argued that the conflict in the Sudan may be the first climate change war given that decreased availability of water lead to migrations. If anticipated growth in climate change refugees in the global south occurs, there could be greater pressure to regulate borders. Any restrictions in travel will decrease the flow of tourists. Furthermore, any restrictions in the flow of migrants, threaten the tourism sectors current strategy as a major employer of migrant workers.

High Road or Low-Road Response to Climate Change?

Given the silences in the tourism/climate change literature, the above analysis of the impact of climate change on employment and work in tourism-related industries highlights the research has yet to be done. It is difficult to examine the response by labour market actors, when so little has been studied or conceptualized. UNITEHERE, the largest hospitality workers union in North America, has yet to formulate a position on climate change. Other industrial (general) unions with a presence in the sector have limited most of their policy to their core sectors (i.e., manufacturing and green industrial production).²⁵¹

Whether the sector experiences systemic instability because of climate change, or processes of adaptation to climate change create their own instability, labour market adjustment is unavoidable in the sector, and indeed is underway. A low-road approach will simply rely on ‘creative destruction’ in markets, with firms

²⁵¹ The USWA also represents several hotels in Canada as does the United Food and Commercial Workers. The Canadian Auto Workers represent workers in many sectors including transit and air travel, but they simply call for airlines to “invest in more fuel-efficient aircraft”, improved logistics and shifts to mass public transit; CAW Canada, 2007. *Climate change and our jobs: finding the right balance. Discussion paper for the CAW Canada - Quebec Joint Council. St. John's Nfld. August 2007.*

and workers exiting and entering to meet new demands (e.g., closures of ski hills and the expansion of golf courses). Even short periods of adjustment require some support for workers and the current Employment Insurance system in Canada is simply not geared toward low wage service workers who qualify for lower benefits and are forced to quickly find new employment.²⁵² In order to reintegrate tourism workers into new jobs, increased income supports and subsidies for training to acquire new tourism-related skills (e.g., snowmaking) and even skills for non-tourism-related sectors would be more reflective of a high road path.

It is possible to engage in an exercise that examines juxtaposed trajectories for the response to the challenges and impact of climate change on tourism-related work. Here, we compare ‘low road’ responses, mostly associated with ‘Business as Usual’ and the status quo, and ‘high road’ responses, which require both higher levels of state and institutional stimulus and regulation, and new sites for creative intervention on the part of the labour market actors (Table 5).

A low road approach will continue to rely on increased flexibility in a sector with already highly flexible and precarious employment relationships given the seasonal nature of tourism. Tourism sector employers are actually positioned to ‘weather storms’ and economic contractions related to climate change as they are not burdened with pension legacies or other longer-term commitments to workers as workers largely depend on state supports when displaced from their jobs. Presently, tourism-related services have integrated global low-wage supplies of labour into their human resources practices and have increasingly lobbied to increase labour supply through temporary foreign worker programs. This practice will likely intensify labour market segmentation by race and gender.

Many of the ‘green’ initiatives proposed will involve intensification of work practices (e.g., increased recycling, composting etc.), which will not be buffered without collective agreements demarcating jobs and limiting workloads.

The greening of the sector will undoubtedly continue to be pursued, but the impact of employer-directed strategies on workers will vary. Presently, the high degree of self-assessed ‘greenwashing’ and minimal instruction in sustainable environmental practices provided by third party services and industry associations will not greatly improve the skills base of the workforce.²⁵³ Human resource strategies which simply select ‘eco-champions’ in management to implement top-down strategies and indentify better practices are also less likely to find long lasting success. There is, however, some evidence that a ‘higher road’ may be taken in response to climate change. In terms of wage levels, pressures to reduce labour costs as a means of adaptation will be countered only by changes in labour supply and collective bargaining. While union density is lower than the Canadian average in all tourism-related sectors except

²⁵² See Tufts, *Hospitality unionism* on the inadequacies of EI when extreme events displace hospitality workers.

²⁵³ See for example Tourism Industry Association of Canada (TIAC), 2008. *Green your business: toolkit for tourism operators* (Tourism Industry Association of Canada; Canadian Tourism Commission; Parks Canada).

transportation, some sectors such as accommodation, have been targeted by unions and standards have likely been improved through recent union campaigns.

Table 5. High Road versus Low Road Response to Climate Change Impacts on Work.

| Climate Change and... | Low-Road Response | High-Road Response |
|---|--|---|
| Wage levels | Precarious low wage service work model High levels of anti-union firm behaviour | Living wage for tourism workers Employer neutrality in unionization campaigns Changes in state regulations to allow increased union density |
| Employment relationship and working conditions | Hyper flexibility in labour markets Intensification of work to meet 'green' standards | Employment security within sector Limit impacts of 'greening' on job levels and labour processes |
| Dependence on foreign workers | Increase reliance on temporary/undocumented migrants Persistent labour market segmentation | Pathways to normalized status for immigrant workers Equity in hiring and promotion practices Hiring halls for (re)entry of older tourism workers into the labour market and local youth training strategies |
| Skills development and 'greening' of tourism work and workers | Minimal instruction in low-emission work practices Labour-industry partnership and reliance on Reliance on third party private providers of 'green' training and curriculum Voluntary self-assessment certification (e.g., Green-Key Global) Individualization of action and selection of workplace 'eco-champions' | Advanced understanding climate change and its impacts on work for all workers Partnerships with labour-management and public post-secondary institutions Development of international standards versus voluntary CSR green labour standards Joint labour-management 'green committees' assessing skills needs and programs |
| Labour market adjustment | Unmanaged 'creative destruction' in tourism-related industries Limited EI support and programs skills upgrading programs | Income supports for displaced tourism workers Subsidized training for 'new' tourism activities and exit from the sector |
| Social investment and support for workers | Increased privatization of transit expansion Workplace commuting allowances | Increased subsidization of public transit for all workers/tourists Transferable workplace benefits |

Overall however, unions have a weak presence in the sector and will have to increase their power and presence to play a significant role in climate change adaptation and mediation. Living wage campaigns and the expansion of neutrality agreements (i.e., agreements which limit employer resistance to organizing) at national and global scales may allow this, but only in the medium to long term without change to existing labour regulations.²⁵⁴

Here, it is apparent that state intervention restructuring current immigration policy and greater equity in hiring practices will be required. Regulation of labour markets through the establishment of hiring halls which can place dislocated workers with new employers and training centres for young workers will also require greater union and state involvement to break the existing patterns and practices.

State involvement in providing public infrastructure and social supports will also be central to the adoption of a high road model. Shifts to public transit could continue to be marketized with lower subsidies. TIAC has suggested that employers give employees flexible ‘commuting allowances’, which reward carpoolers and workers who take public transit to work.²⁵⁵ In Toronto, UNITEHERE Local 75 has negotiated a subsidized transit pass program for workers which benefits workers in several Toronto hotels.²⁵⁶ A high-road approach by the state, however, would include increased subsidies for public transit for all workers and tourists.

Given the flexible nature of the sector, the state could also increase the transferability of social benefits. For example, eligibility for extended employment insurance benefits in times of crisis would benefit workers in the sector and allow employees to upgrade their skills during economic downturns resulting in higher productivity upon return.

There are also some promising avenues to integrate green skills development into ‘high road’ strategies. For example, many unions in the sector in Canada (e.g., UNITEHERE and UFCW) have negotiated education and training funds which can be allocated to climate change education. UNITEHERE Local 75 in Toronto is also establishing a union administered hospitality training centre which could provide labour and management approved climate change education.²⁵⁷ Here, there is potential to form partnerships with colleges and universities already providing climate change education dealing with tourism at academic and applied levels.²⁵⁸ As for certification and audits, there are

²⁵⁴ See S. Tufts, 2007. ‘Emerging labour strategies in Toronto’s hotel sector: Toward a spatial circuit of union renewal’ *Environment and Planning A*, 39: 10, 2383-2404.

²⁵⁵ TIAC *Green your business*.

²⁵⁶ While this program is successful it does potentially challenge transit systems as they can lead to greater ridership with lower revenues (as employer purchase passes for workers at bulk rates).

²⁵⁷ See Tufts, ‘Schumpeterian Unionism’.

²⁵⁸ Not only is sustainable tourism taught at the university level, but there are also several applied adventure, recreational and ecotourism programs in the Canadian college system.

opportunities for joint labour-management initiatives to move away from self-assessment models toward more rigorous and legitimate forms of international ‘gold standard’ certifications.²⁵⁹

The extent to which the high-road model is adopted in different communities will depend on union power and state intervention. A low-road model in response to climate change will lead to greater instability. Raising standards and retaining workers in the sector is a reasonable strategy in the face of labour shortages due to demographic changes. Unfortunately, employers will be tempted to rely on the margins of global labour markets, especially if climate change displaces greater numbers in the Global South and increases the supply of migrant labour to the North. Climate change is only one driver of change in this large and complex sector, but it does have the capacity to reproduce existing low road practices without significant intervention. The high-road will continue to be uphill.

Conclusion: Centering workers in climate change and tourism research

This chapter is largely speculative, but there are several key points which must be noted and which may be useful in informing future research on climate change and tourism-related work and employment: First, despite an increasingly sophisticated literature on the impact of climate change on tourism, impacts are neglected as work remains an ‘*apriori*’ consideration with little nuance. The limits to knowledge on local variability in climate change and vulnerabilities makes generalized models problematic, especially with the range of climate change scenarios and community capacities. Not surprisingly these limitations are applicable to discussions of climate change and work and employment. Climate change will, however, have first, second and third order impacts on tourism work and workers with complex interactions. These impacts will inevitably involve different degrees of ‘creative destruction’ in tourism-related labour markets. We require much more sophisticated models which are able to translate the impact of climate change to local levels of tourism-related and tourism-generated employment. This will be a challenge as there is barely adequate cooperation among physical and social sciences in tourism-related research and there are as yet limited resources for research into broader questions of climate change and tourism.²⁶⁰

Third, it is too early to determine whether there will be a high or low road response to various impacts, but high road initiatives will require greater labour market intervention by unions and government. We need in depth qualitative research linking mitigation and adaptation practices to changes in labour processes and a better understanding of the specific role tourism-related workers and their organizations

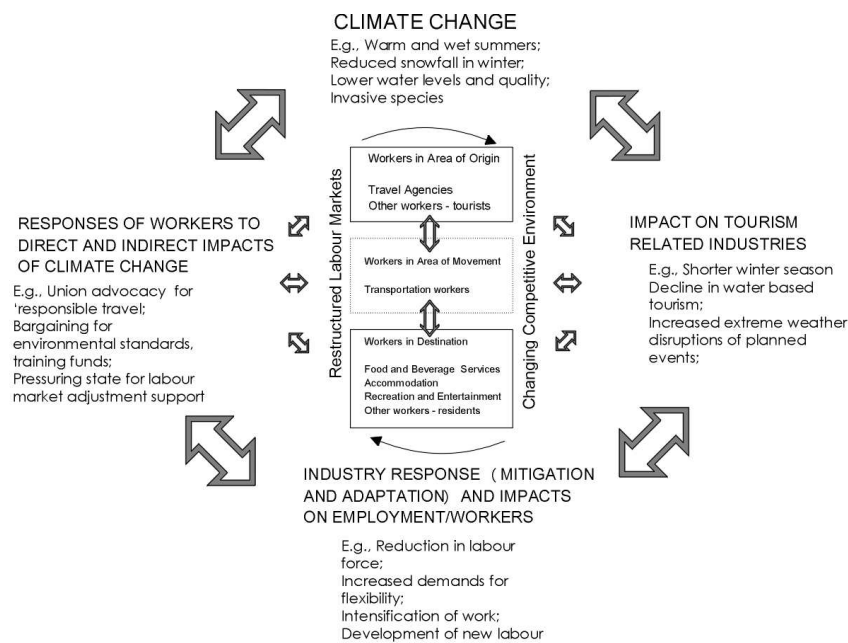
²⁵⁹ The absence of organized labour in the ‘greenwashing’ of the 2010 Vancouver Games is one example of where cooperation might have produced different outcomes. See British Columbia. Ministry of Tourism Sport and the Arts, 2008. *Green Tourism Forum II Report* (Vancouver: B.C. Ministry of Tourism, Sport and the Arts, Tourism British Columbia, and the Council of Tourism Associations of British Columbia).

²⁶⁰ See Hall and Higham, *Tourism, recreation, and climate change* for a discussion on the methodological and structural challenges to discussing the links between climate change and tourism.

play (positive) and can play (normative) in climate change mitigation and adaptation. There are, however, two barriers. First, intellectual trends in tourism studies have shifted away from political economy approaches toward culturalist understandings of the phenomena biasing consumer behaviour at the expense of service providers. More importantly, the uneven institutional capacities among labour market actors in the tourism sector impede developing research that can be turned into strategic action. Specifically, the relatively weak presence of organized labour giving voice to workers and how they might shape the response to climate change is a primary concern.

Lastly, an employment-centred framework is required to understand the specific role tourism-related workers and their organizations do play and *can* play in climate change mitigation and adaptation. Before we can begin to imagine a greater role for workers in these processes, we must centre labour in discussions of adaptation and mitigation in the tourism sector (Figure 3). Specifically, we can look at how workers in destinations, areas of origins, and the spaces of travel between, are affected by, and shape, climate change processes. This must, however, be done with consideration of existing competitive contexts and labour markets. The focus should then turn to look at not only how industry and government responses to climate change impact workers, but also how workers' actions and workplace knowledge can shape employer and state understanding of what is to be done. Clearly, this involves a shift away from approaches which tend to focus solely on the responses and power of capital and the state.

Figure 3: Centering workers in tourism and climate change research



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CLIMATE CHANGE AND WORK AND EMPLOYMENT IN THE CANADIAN POSTAL AND COURIER SECTOR

Geoff Bickerton, Meg Gingrich and Sarah Ryan

Introduction

The issue of climate change is one that is extensively studied; however there is little research regarding the impacts of climate change on employment, particularly pertaining to the postal sector. Additionally, there is a scarcity of literature assessing the effects of postal work itself on the climate. Despite the lack of previous studies, the relationship between postal work - including mail transport, energy use in postal facilities, and paper production - and climate is important. The postal sector is a crucial economic sector, providing jobs and indispensable services to Canadians, thus it is essential to analyze these connected concerns.

The following questions have guided this paper:

- What significant developments have occurred within the postal and courier sector with respect to work and employment?
- How do the effects of and perceptions surrounding climate change influence demand for and use of postal and courier services in Canada?
- Have concerns regarding climate change inspired changes in the practices of suppliers, customers and service providers?
- Is it possible to separate the effects of climate change from other drivers of change?
- Will climate change be a more significant factor influencing the sector in the future?
- What issues require more research?

For this analysis of climate change and the Canadian postal sector, more than one hundred sources were reviewed. These included eleven scholarly publications, fourteen government and para-government documents, thirty-four labour market organization documents, seven consultants' reports, and several papers produced by various advocacy groups, including labour organizations and many media articles.

This chapter examines the impact of climate change on work and employment in the Canadian postal and courier sector, which is a subset of the transportation sector and includes the processing and delivery of letters, admail (direct mail), packets and parcels to residences, businesses and public enterprises. The sector encompasses the postal service (Canada Post Corporation), major overnight courier companies, same-day car and bicycle couriers and local messenger and delivery firms.

Although it is impossible to precisely isolate the impact of climate change on work and employment in the Canadian postal and courier sector from other social, economic and technological developments that have occurred within the sector over the past two decades, there can be no doubt that climate change will increasingly affect the industry. For example, it will influence the decisions of major service providers with respect to the equipment, choice of vehicles, and procurement and design of facilities. Further, it will shape the decisions of larger corporate customers with respect to the type of paper and packaging materials used in mailings and deliveries. Finally, it will continue to define the decisions of individual postal users, potentially leading to a shift towards the use of electronic communications as an alternative to paper as a means to convey information. It is yet to be determined if environmental concerns will have a major impact on delivery modes, the production process, work schedules, and organization of the industry.

Snapshot of the Sector

The postal and courier sector comprises the processing and delivery of four major products: letter mail; admail (direct mail); periodicals; parcels and packages. Letter mail, including transaction mail (formerly known as first-class mail), and addressed advertising mail are handled almost exclusively by Canada Post Corporation (CPC) due to federal legislation providing CPC with an exclusive privilege over these services. Direct mail or unaddressed advertising mail, is delivered by Canada Post in conjunction with letter mail delivery, by many major daily and community newspapers as inserts, and by a host of small delivery companies. Periodicals are not covered by the CPC exclusive privilege, but are delivered almost exclusively by Canada Post. Parcels and packages, or courier products, are delivered by large overnight courier companies and smaller same-day couriers. This analysis will focus on the activities of Canada Post and the courier companies and will not attempt to evaluate the contribution made by newspaper inserts or independent admail delivery agents with respect to employment or product volumes.

The Postal and Courier Market - Organization of the Industry

In Canada, the delivery of letters, in both rural and urban areas, is completely dominated by Canada Post Corporation due to the provisions of the Canada Post Corporate Act that provide CPC with an exclusive privilege to deliver all but letters of an urgent nature.²⁶¹ ²⁶² ²⁶³ Besides letter mail, CPC also operates its own parcel delivery service in direct competition to the private sector. In downtown, high-density areas, CPC uses a dedicated parcel delivery workforce of approximately 2,300 employees equipped with step

²⁶¹ G Bickerton, 2006. *Postal Deregulation: Its impact on postal workers and the response of the postal union*. Paper delivered at the 14th Conference on Postal and Delivery Economics 31 May-3 June 2006, Bern, Switzerland.

²⁶² G Bickerton, 2006. *Postal Deregulation: Its impact on postal workers and the response of the postal union*. Paper delivered at the 14th Conference on Postal and Delivery Economics 31 May-3 June 2006, Bern, Switzerland.

²⁶³ G Bickerton, 2006. *Postal Deregulation: Its impact on postal workers and the response of the postal union*. Paper delivered at the 14th Conference on Postal and Delivery Economics 31 May-3 June 2006, Bern, Switzerland.

vans to pick up and deliver parcels and transport other types of mail. In suburban and rural areas, CPC uses motorized letter carriers and rural and suburban mail carriers to deliver both letters and parcels. In addition to its in-house parcel operations, CPC also owns 90% of Purolator, Canada's largest overnight courier company.^{264 265 266} Altogether CPC and Purolator operate the largest fleet of vehicles in the country.

The Canadian courier industry is estimated to be worth \$8 billion in sales, and, until the recent recession was growing at 2.6% in volume and approximately 6% in revenue annually. The courier industry is divided into two major segments: first, there are courier companies that provide overnight and later-day delivery and have a national and international scope of delivery; these companies make approximately 90% of the deliveries. The core companies in this segment are UPS (United Postal Service of America), Purolator, Canada Post Corporation, and Federal Express (FedEx) - these companies have extensive transportation networks and sophisticated delivery sequencing techniques. Their use of technology and economies of scale enable them to effectively compete on the basis of price and quality of service.²⁶⁷

The other segment of the industry is comprised of small and mostly inefficient same-day local delivery companies. This segment of the industry includes a wide variety of operations ranging from individual owner-operators and "mom and pop" operations employing 1-to-5 messengers, to large multinationals such as Dynamex, the nation's largest provider of same-day local market services.^{268 269 270} From an environmental perspective, the organization of the same day courier segment can be characterized as a complete disaster. There is little, and often no attempt to use technology to sequence deliveries to maximize delivery density. In contrast to the practices of the large parcel-delivery companies, including CPC, numerous drivers and delivery companies frequently criss-cross cities delivering in entirely different areas during a single day.

These practices result in an unnecessary use of non-renewable resources and contribute to increased Greenhouse Gas (GHG) emissions, air pollution, and traffic congestion.²⁷¹

Although there is fierce competition within the courier and admail (direct mail) industries, there is also a considerable interrelationship between the operations of many of the enterprises. It is common for most

²⁶⁴ Bickerton, *Postal deregulation*.

²⁶⁵ Bickerton, *Postal deregulation*.

²⁶⁶ Bickerton, *Postal deregulation*.

²⁶⁷ Bickerton, *Postal deregulation*.

²⁶⁸ Canadian Centre for Policy Alternatives, 2005. *Straddling the world of traditional and precarious employment: a case study for the Courier Industry in Winnipeg* (Winnipeg: Canadian Centre for Policy Alternatives).

²⁶⁹ Canadian Centre for Policy Alternatives, 2005. *Straddling the world of traditional and precarious employment: a case study for the Courier Industry in Winnipeg* (Winnipeg: Canadian Centre for Policy Alternatives).

²⁷⁰ Canadian Centre for Policy Alternatives, 2005. *Straddling the world of traditional and precarious employment: a case study for the Courier Industry in Winnipeg* (Winnipeg: Canadian Centre for Policy Alternatives).

²⁷¹ Canadian Union of Postal Workers, 2009. *Deregulation of the post office would hurt the environment* (Ottawa: Canadian Union of Postal Workers), and Bickerton, *Postal deregulation*.

major private sector couriers to contract with local courier and messenger services to perform the final delivery in small towns. Many smaller companies use Canada Post to deliver in remote rural areas.

Recently, Canada Post and FedEx have reached an agreement to have CPC perform the final delivery of FedEx parcels in rural and low-density areas. Many community newspapers rely on Canada Post to deliver their publications and the admail inserts to subscribers in small towns and rural areas where independent delivery is not feasible.

Concerning the economic aspects of the industry, the major core companies in the postal sector have been consistently profitable. Despite postage rates that are among the lowest in the industrialized world, Canada Post has been profitable each year between 1996 and 2008.^{272 273 274} UPS and FedEx do not report separate financial statements for their Canadian operations however their international operations have remained profitable throughout the 2009 recession. Purolator continues to be profitable.

Employment Patterns

Canada Post Corporation is the most significant employer of postal and courier workers in Canada. As evidenced in table 1b, CPC employed 80,000 people in 2008, growing from 71,529 in 1997. According to a CPC's 2008 social responsibility report, 49.5% of employees were women; Aborigines accounted for 2.0%; persons with disabilities 3.9%; and visible minorities 11.5% (note: these numbers do not include temporary, casual, or term employees, whereas the overall employment numbers do.^{275 276 277} Overall, CPC is Canada's sixth largest employer.²⁷⁸

Table 1a. Mail Volumes

| | 1997 | 2000 | 2005 | 2008 |
|--|----------------------|----------------------|----------------------|----------------------|
| Mail Product | Volume (in millions) | Volume (in millions) | Volume (in millions) | Volume (in millions) |
| CPC: Transaction (1 st Cl.) | 4,580 | 4,544 | 5,446 | 5,313 |
| CPC: Addressed Admail | 1,517 | 1,485 | 1,400 | 1,503 |
| CPC: Unaddressed Admail | 4,050 | 2,470 | 3411 | 4,061 |
| CPC: Parcels | 309 | 316 | 293 | 299 |
| CPC: Periodicals | 399 | 531 | 531 | 522 |

²⁷² Canada Post Corporation, 2008. *Making the connection: 2008 Annual report*. (Ottawa: Canada Post).

²⁷³ Canada Post Corporation, 2008. *Making the connection: 2008 Annual report*. (Ottawa: Canada Post).

²⁷⁴ Canada Post Corporation, 2008. *Making the connection: 2008 Annual report*. (Ottawa: Canada Post).

²⁷⁵ Canada Post Corporation, 2008. *Social responsibility report: Our environment*. (Ottawa: Canada Post).

²⁷⁶ Canada Post Corporation, 2008. *Social responsibility report: Our environment*. (Ottawa: Canada Post).

²⁷⁷ Canada Post Corporation, 2008. *Social responsibility report: Our environment*. (Ottawa: Canada Post).

²⁷⁸ Bickerton (2006).

| | | | | |
|----------------------------|-----|-----|-----|-----|
| Private Courier Parcels | 260 | 466 | 654 | N/A |
|----------------------------|-----|-----|-----|-----|

Table 1b. Employment numbers

| | 1997 | 2000 | 2005 | 2008 |
|--------------------------------------|---------------------|---------------------|---------------------|---------------------|
| Service | Number of employees | Number of employees | Number of employees | Number of employees |
| Couriers: Number of employees* | 33,433 | 33,532 | 44,193 | 47,417 |
| Canada Post: Employees** | 71,529 | 72,860 | 79,433 | 80,000 |
| Couriers: Number of Firms*** | 1,200 | 1,782 | 1,408 | 1,582 |
| Local messengers and delivery: Firms | 10,121** | 16,357 | 18,217 | 18,538 |

*Does not include 14,268 independent contractors (2006)

**Includes 8,000 temporary employees in each year and does not include 6,000 rural mail carriers in 1997 and 2000.

***1998 not 1997

****2006 not 2008

Sources: Statistics Canada, Survey of the Couriers and Local Messengers Industry, Statistics Canada, Survey of Employment, Payroll and Hours (SEPH), Canada Post Annual Reports.

As seen when looking at tables 1a and 1b, employment in the courier sector has been increasing in response to the growth of business. In the overnight/late market segment, four companies (Purolator, Canada Post, UPS and FedEx) account for the majority of the couriers employed. A study by the Canadian Centre for Policy Alternatives (CCPA) of courier workers in Winnipeg found that across the country, approximately 80% of all couriers in this market segment are employed as “employees” (also referred to as the “core” segment) with the rest being designated as independent contractors.²⁷⁹ The study asserts that employee classification gives courier workers access to legislative protections and benefits including workers compensation coverage and employer contributions to both CPP and EI. Employment in this core segment of the industry is characterized by low turnover. In most of the overnight segment, drivers are full-time employees and receive wages and benefits equal to or slightly superior to the average of industrial workers.^{280 281 282} Workers in sortation facilities are generally part-time, receive wages below that of the drivers and often are not entitled to benefits. The exception to this model is Canada Post,

²⁷⁹ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁰ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸¹ Canadian Centre for Policy Alternatives, *Straddling the world*.

where part-time employees are entitled to the same wages and benefits as full-time employees. At Canada Post, there was a steady trend towards greater use of part-time and casual employment during the period 1984 to 2000. However, as a result of contractual changes negotiated in 2000 - including a staffing ratio of full-time hours - the number of regular full-time employees increased and remained somewhat constant until the recession of 2009.

The same-day local delivery companies are at the other end of the scale. Since there is no need for large distribution networks and expensive technology, there are virtually no barriers to entry into the market.²⁸³ ²⁸⁴ ²⁸⁵ The CCPA report states “essentially anyone who can walk, has a bike, or has access to a vehicle, can participate.”²⁸⁶ Because owner-operator agreements carry no fixed labour costs for the courier company, there are no economic incentives for courier companies to place caps on hiring. This has flooded the market with an abundance of messengers, many of whom must compete on cost alone. Frequently, employees are misled about their legal entitlements. Not surprisingly, labour turnover is very high, wages are low, and benefits are virtually non-existent. Due to the highly competitive nature of the industry with easy entry and exit, the rate of unionization is very low although the CUPW has had some recent success in organizing car and bicycle couriers and is committed to continue organizing in this sector.²⁸⁷ ²⁸⁸ ²⁸⁹

Challenges and changes in the industry

Almost every business and the vast majority of individual citizens receive or send mail on a daily basis. Likewise, industries such as financial institutions, law firms, and pharmaceutical distributors use courier services on a daily basis and almost every business uses courier or local messenger services at some time or another. Thus, for much of the post-World War II period, the Canadian postal and courier sector has served as a barometer of the economic health of the nation, as volumes have been indicative of levels of economic activity.

In addition to the effects of economic fluctuations, the postal and courier sector has also evolved in large part due to technological transformations and changes in delivery practices.

The effects of various changes are diverse and have been both positive and negative. For instance, the courier industry has benefited considerably from the trend of both large and small businesses of adopting

²⁸² Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸³ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁴ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁵ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁶ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁷ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁸ Canadian Centre for Policy Alternatives, *Straddling the world*.

²⁸⁹ Canadian Centre for Policy Alternatives, *Straddling the world*.

“just in time” inventory practices. This has dramatically increased the demand for overnight and same-day services and shifted the emphasis of the industry to providing fast service for businesses instead of the less time-sensitive service for residential customers. To meet the new demand for fast overnight delivery, several courier companies established their own fleet of cargo aircraft.

Over time, volumes of letter mail and parcels have ebbed and flowed. The volume of parcel deliveries has increased enormously during the past fifteen years and letter volumes grew considerably from 1995 onward, leveling off in 2008.^{290 291 292} Presently, the outlook for letter mail is uncertain. During the last two decades, several factors - including the proliferation of facsimile machines in the 1980s and the widespread use of email in the 1990s - have provided individuals and businesses with fast, low-cost alternatives to letter mail communications that could negatively impact letter mail volumes. In contrast, the volume of other types of mail, such as addressed and unaddressed admail, continue to increase.

Rapid technological developments in e-commerce and electronic communications present the industry with both new challenges and business opportunities.

For example, the gradual acceptance of electronically signed documents and the use of encryption methods for electronic mail will likely reduce the number of deliveries of legal documents. In all probability, this loss of paper-based products will be more than offset by the steady and rapid double-digit growth of parcel and package deliveries generated by electronic retail shopping through the internet.

The Carbon Footprint of the Postal and Courier Sector

Worldwide, national postal services employ more than 5 million people and operate a global network of more than 600,000 post offices and almost one million postal vehicles, representing the planet's largest physical distribution network.^{293 294 295} To date, there is no standardized methodology used to measure the carbon footprint of postal and courier work. Common measurements include the Life Cycle.

²⁹⁰ Canada Post Corporation, *Making the connection*.

²⁹¹ Canada Post Corporation, *Making the connection*.

²⁹² Canada Post Corporation, *Making the connection*.

²⁹³ Universal Postal Union, 2006. *Post and parcel*, December 10, 2007. Retrieved from <http://postandparcel.info/20020/companies/the-upu-publishes-its-world-postal-statistics-for-2006/>.

²⁹⁴ Universal Postal Union, 2006. *Post and parcel*, December 10, 2007. Retrieved from <http://postandparcel.info/20020/companies/the-upu-publishes-its-world-postal-statistics-for-2006/>.

²⁹⁵ Universal Postal Union, 2006. *Post and parcel*, December 10, 2007. Retrieved from <http://postandparcel.info/20020/companies/the-upu-publishes-its-world-postal-statistics-for-2006/>.

Assessment, which quantifies the amount of energy used and waste generated at every stage of the mail cycle (including aspects such as the extraction of raw materials, product manufacturing, distribution, and final disposal).^{296 297 298} Researchers have used the Life Cycle Analysis (an abbreviated version of the Life Cycle Assessment) to measure carbon emissions of the United States Postal Service (USPS) ground transport, finding that electricity consumption at mail/distribution facilities was one of the greatest factors influencing emissions totals.^{299 300 301} There are drawbacks to these methodologies, such as the lack of a mechanism to weight various parts of the mail cycle to achieve a more comprehensive and accurate understanding of which aspects of the cycle have the greatest carbon impact.³⁰²

In addition to the life cycle analysis, the Universal Postal Union (UPU) - the United Nations specialized agency for postal service—is currently working on developing a harmonized methodology to measure greenhouse gas emissions and that will be available to all 191 UPU countries.³⁰³ Despite problems with harmonized methodologies, various entities have made estimates of the carbon footprint of postal and courier industry. UPU estimates that Posts generated at least 26 million tons of CO₂ in 2008 only through the operation of postal vehicles and buildings.³⁰⁴ This represents approximately 0.07% of the total 38 billion tons of greenhouse gas emissions that the United Nations Environment Programme estimates are generated annually. This estimate is similar to the conclusions reached by a comprehensive study of the energy consumption, waste generation, and pollutant emissions associated with mail in the United States conducted by SLS Consulting Incorporated in 2008.³⁰⁵ It found that the four major mail classes of USPS (letters, admail, periodicals, and packages) comprise 0.47% of the national total of CO₂-equivalent emissions and 0.6% of the nation's energy consumption.

In addition to problems with standardized methodologies, there are also no standardized systems for assessing environmental strategies to deal with the carbon footprint of the sector. In response to this, in

²⁹⁶ S.G. Lee, & X. Xu, 2005. 'Design for the environment: life cycle assessment and sustainable packaging issues', *International Journal of Environmental Technology & Management*, 5(1), 1.

²⁹⁷ S.G. Lee, & X. Xu, 2005. 'Design for the environment: life cycle assessment and sustainable packaging issues', *International Journal of Environmental Technology & Management*, 5(1), 1.

²⁹⁸ S.G. Lee, & X. Xu, 2005. 'Design for the environment: life cycle assessment and sustainable packaging issues', *International Journal of Environmental Technology & Management*, 5(1), 1.

²⁹⁹ A.Mangmeechai, & H.S. Matthews, 2007. *Life cycle analysis of energy and greenhouse gas emissions of ground shipping in the United States: US Postal Service case study*. Paper presented at the InLCA/LCM conference October 2-4, 2007, Portland, OR.

³⁰⁰ A.Mangmeechai, & H.S. Matthews, 2007. *Life cycle analysis of energy and greenhouse gas emissions of ground shipping in the United States: US Postal Service case study*. Paper presented at the InLCA/LCM conference October 2-4, 2007, Portland, OR.

³⁰¹ A.Mangmeechai, & H.S. Matthews, 2007. *Life cycle analysis of energy and greenhouse gas emissions of ground shipping in the United States: US Postal Service case study*. Paper presented at the InLCA/LCM conference October 2-4, 2007, Portland, OR.

³⁰² Lee and Xu, 'Design for the environment'.

³⁰³ Universal Postal Union, Sustainable development website. Retrieved from <http://www.upu.int/en/activities/sustainable-development/about-sustainable-development.html>

³⁰⁴ Universal Postal Union, 2010. *Greening the Post press kit*. Retrieved from <http://www.upu.int/en/activities/sustainable-development/environment/key-documents.html>

³⁰⁵ SLS Consulting, 2008. *Informing the dialogue: facts about mail and the environment*. . (Washington: SLS Consulting).

2008, a new reporting framework, called the Environmental Measurement and Monitoring System (EMMS), was introduced for the postal industry. Led by the International Post Corporation (IPC), the System will act as a common reporting framework within which post companies can declare their environmental management strategies and performance.

Additionally, the 2008 *Social Responsibility Report: Our Environment* published by Canada Post Corporation reports that CPC was responsible for 197 kilotonnes of GHG emissions in 2008, a reduction of 4% from its 2002 emissions. CPC buildings emitted 93 kilotonnes in 2008 versus 107 in 2002. The fleet emitted 59 kilotonnes of GHGs in 2008 versus 55 in 2002. Forty-five kilotonnes of GHG emissions came from rural delivery in 2008 versus 44 in 2002.³⁰⁶ The report notes that CPC's plans to modernize the delivery process by motorizing letter carrier delivery and integrating parcel and letter delivery will require in a considerable increase in our fleet size resulting in increased greenhouse gas emissions which will have to be offset by purchasing new vehicles that are more fuel efficient. It states that in the 2007 CSR Report, CPC projected a 14% reduction in CO2 emissions between 2002 and 2012. However, they assume this won't be met due to financial pressures rooted in the economic crisis.

There are no comparable figures for the global courier industry. Major corporations such as FedEx and UPS publish comprehensive social responsibility reports, but their operations are very different than many of the smaller local and regional courier companies. However, the SLS study conducted for the United States Postal Service (USPS) indicated that the greenhouse gas emissions associated with parcel delivery are 14 times greater than those associated with first class letters and seven times greater than delivery of addressed admail. The American study also found that the greenhouse emissions reported by UPS in its Corporate Sustainability Report were higher by factor of 3.6 on a per parcel basis than those reported by the USPS.³⁰⁷ This is most likely due to the more extensive use of air transportation by UPS required to meet their compressed delivery standards and the greater efficiency achieved by USPS being able to integrate parcel and letter delivery within the same delivery vehicles. It is likely that the overall greenhouse gas emissions of the courier industry are equal to or greater than that of postal administrations.

Industry Response: Tinkering at the Margins

Reading relentless optimism generated in social responsibility reports and annual statements of postal and courier companies, one might be tempted to think that concern regarding climate change is transforming the practices of the industry. While there are some changes occurring in the practices of suppliers, customers and service providers, it is not clear whether most of the initiatives are designed more to enhance profits and serve as advertising gimmicks, rather than to reduce GHG emissions.

³⁰⁶ Canada Post Corporation, *Making the connection*.

³⁰⁷ SLS Consulting, *Informing the dialogue*.

It is clear that none of the major players in the industry are at all interested in discussing an overall reform in the organization of the industry or even modest regulatory reform as a means of significantly reducing GHG emissions produced by the industry.

Even slight organizational changes, such as reorganizing call-for items so that residents could go to the nearest postal or courier outlet to pick-up their parcel or package are never considered despite their obvious environmental advantages. At every step of the way the dictates of capitalist competition trumps environmental sustainability.

Indeed, the statements of Canada Post Corporation in its 2008 Annual report portray environmental concerns as more of a threat to business than a legitimate issue that must be dealt with to safeguard the health of the planet. An excerpt from the report reads as follows:

“Growing environmental concerns pose a threat to our mail business. These concerns could impose changes to the way we do business, and could also bring a high level of attention to Canada Post as a participant in the mail value chain. If we do not manage these concerns, we could be affected in several ways, including decreased volumes (mostly Admail) and requirements to use different transportation solutions. Additionally, there may be other indirect adverse effects such as those resulting from damage to our reputation.”³⁰⁸

Instead of examining major changes in the organization of the industry which might result in significant improvements in delivery density and corresponding reductions in GHG emissions, Canada Post and most other service providers have restricted their emission reduction activities to taking some actions to lower the GHG emissions associated with their vehicles, facilities, packaging materials and modes of transportation of products.^{309 310 311} Not surprisingly, these actions are also designed to cut costs and increase profits.

In recent years, almost all postal administrations and major courier companies have taken action to reduce the fuel consumption of their vehicle fleets and are in the process of either introducing or testing the introduction of hybrid or electric vehicles. In Canada, Purolator continues to be an industry leader with respect to investment in hybrid electric vehicles (HEVs) in its curbside delivery fleet.

More than one-third of UPS-Canada’s fleet of 2,000 delivery vehicles now runs on low-carbon fuel, mainly propane.

³⁰⁸ Canada Post Corporation, *Making the connection*.

³⁰⁹ Canada Post Corporation, *Social Responsibility Report*.

³¹⁰ Canada Post Corporation, *Social Responsibility Report*.

³¹¹ Canada Post Corporation, *Social Responsibility Report*.

Postal administrations and courier companies have also been reducing the GHG footprint resulting from the operation of their facilities. FedEx has now opened three solar powered distribution centers in California and more are planned in the future.³¹² Likewise, New Zealand Post uses solar energy and has built new buildings that let in natural light throughout the day. The United States Postal Service (USPS) plans to reduce its petroleum use by replacing its older vehicles with newer, more fuel-efficient vehicles and has inaugurated a green roof on one of its main buildings in New York.³¹³ The roof is expected to reduce the amount of contaminants in storm-water runoff and generate lower heating and air-conditioning bills. In 2008, in keeping with its 2007 commitment that all new facilities would be LEED certified (Leadership in Energy and Environmental Design), a third-party certification system for green buildings - certified, Canada Post registered eight buildings across the country for LEED certification, six of which are scheduled for occupancy in 2009.³¹⁴ LEED-registered buildings include the new Winnipeg mail-processing plant and letter carrier depots in Alberta, Ontario and Quebec.

In addition to CPC, both FedEx and UPS are purchasing new planes to help reach their targets for the reduction in GHG emissions caused by their fleet of aircraft. DHL is testing a deep-sea cargo ship equipped with a giant sail to transport freight between Germany and Venezuela. Depending on the wind's force, fuel costs could be cut by 10% to 35%. Not only have various postal services tried to reduce GHG emissions through changes to their fleets and buildings, but some posts have also adopted green-purchasing policies. In 2009, in response to new legislation in the United Kingdom designed to reduce landfill waste, Royal Mail introduced a discount for green mail of 2% for products made from recycled paper and 4.7% for products that are recyclable.³¹⁵

Most posts are taking further steps by making efforts to reduce the amount of undeliverable mail, which constitutes approximately 3% of total volume. A recent study by Pitney Bowes indicates that consumers re-evaluate their negative opinions of direct marketers if they actively try to be more eco friendly by taking measures such as eliminating the delivery of undeliverable mail.³¹⁶ Ironically, Canada Post continues to require letter carriers to deliver undeliverable mail to the address even if they know the addressee no longer resides there; changing this practice would have a positive environmental effect, as fewer non-renewable resources would be unnecessarily used. All of the posts and major courier companies have introduced very impressive targets but most, like FedEx's 20/20 plan (20% reduction in CO2 emissions by the year 2020) are safely distant into the future.

³¹² Fedex, 2008. *Global Citizen Report*. Retrieved from

http://citizenshipblog.fedex.designcdt.com/sites/default/files/fedex_citizenship_2008.pdf

³¹³ United States Government Accountability Office, 2008. *U.S. Postal Service: Mail-related recycling initiatives and possible opportunities for improvement*. (Washington, D.C.: U.S. GAO) (Report # GAO-08-599).

³¹⁴ Canada Post Corporation, *Social responsibility report*.

³¹⁵ 'Royal Mail offers savings for greener junk mail' *ENDS Report*, Number 411, April 2009, 17.

³¹⁶ D.Quenqua, 2007. *The power of perception*. Retrieved from

http://media.haymarketmedia.com/Documents/1/DM_PB_Survey_525.pdf.

Canada Post: Climate Change and Delivery Modes

One issue that requires much more analysis is the impact of the delivery mode of the post on both CO₂ emissions and employment. In 1982, CPC discontinued its practice of providing door-to-door delivery to all communities when they had reached 2,000 residential points of call. Instead of delivery to the door, CPC began to introduce community mailboxes and postal kiosks where residents pick up their mail. More recently CPC has commenced a review of the location of all rural mailboxes with the result that many roadside mailboxes have been moved from the lot-line of the residence and moved to community mailboxes. In many cases the new locations are beyond easy walking distance from the residence.

This change from residential delivery to community mailbox pickup has considerable implications with respect to employment levels of letter carriers and rural route mail carriers within Canada Post. It has also occurred without any consideration or analysis of the environmental consequences of relocating the delivery point to a location, which frequently causes the mail recipient to drive to the community mailbox to obtain their mail. Nor has there been any life cycle assessment of the energy requirements and waste produced as a result of the production, location and maintenance (including the energy requirements of snow clearing, lock changes etc.) of the community mailboxes.

This issue was directly addressed in the *Report of the Advisory Panel of the Strategic Review of Canada Post Corporation* in December 2008. The Advisory Panel recommended that Canada Post specifically include in its annual report an overview on the delivery methods it uses, indicating the number of addresses served with each delivery method and the financial costs and environmental impact of each on a per-unit basis. It also recommended that the planning, approval and implementation of Canada Post's modernization plan be informed by the expectation that it will reduce Canada Post's environmental footprint and that this approach should inform existing initiatives. Further, it should be formulated as part of the modernization plan upon which benchmarks should be set and against which the Board of Directors should report progress through its annual report.³¹⁷

Canada Post, Climate Change and Admail

There are some areas where environmental concerns may have significant impact on employment levels at Canada Post. Throughout the world, there is a growing concern over the amount of CO₂ emissions and waste disposal issues associated with direct mail, or admail. This concern has manifested itself in a broad-based movement to create the establishment of do-not-mail lists and even to have unsolicited admail banned altogether, which could threaten the volumes and revenues of postal administrations. In the United Kingdom, as an example of this, the report of the Independent Review of the UK postal services sector, chaired by Richard Hooper, estimated that customers switching to other media because of environmental concerns could reduce mail market revenues by a total of 350 million pounds by 2011-

³¹⁷ Canadian Union of Postal Workers, 2008. Submission of the Canadian Union of Postal Workers to the Canada Post Corporation Strategic Review (Ottawa: Canadian Union of Postal Workers).

12.³¹⁸ This issue was also addressed in the *Report of the Advisory panel of the Strategic Review of Canada Post Corporation* in December 2008. It noted that a number of submissions expressed the view that Canada Post has an environmental responsibility, believes that admail is a misuse of paper and forest products, and that Canada Post needs to confront this issue in an environmental way.³¹⁹

Unfortunately for Canada Post, a DM News/Pitney Bowes survey on direct mail and the environment shows that consumers greatly overestimate the negative effects of direct mail on the environment.

Approximately 48% of respondents thought that advertising mail from US households counted for more than half of the country's municipal waste when it is actually responsible for 2%. Respondents also greatly overestimated the amount of carbon emitted through the delivery of advertising mail. When asked to rate the emissions from seven activities, respondents chose direct mail as the third largest emitter when it actually emitted the least.³²⁰

Similar concerns are gaining traction among the public, as evidenced in a 2008 study conducted by CPC with Harris/Decima that resulted in a white paper called *The New Environmentalism*. More than 60% of Canadian respondents said they always or often think about the environmental impact of mail and catalogues; and participants said they recycle 85% of their advertising mail. The survey also revealed that, in many cases, consumers are willing to pay more for environmentally friendly products as long as those costs are considered reasonable. Consumers state that environmentally friendly products are typically 10-20% more expensive than their rivals and many, especially baby-boomers, are willing to pay the extra.³²¹

On the brighter side there is evidence that good environmental behaviour by admailers and postal administrations will be rewarded.

According to the DM/Pitney Bowes survey, 68% of respondents said they would have a higher impression of direct mailers if they used recycled paper and cardboard. Approximately 67% would think more highly of mailers if they planted trees to offset paper production. Regarding certification, 53% said their opinion of unsolicited mail would be better if an agency green seal of approval were awarded and 67% said the same thing if a third-party issued a similar green label.³²²

³¹⁸ R. Hooper, D.D. Hutton & I.R. Smith, 2008. *The challenges and opportunities facing the U.K. postal service: Independent Review of the UK postal services sector.*

³¹⁹ Canada. Ministry of Transport, 2008. *Strategic Review of Canada Post Corporation: Report of the Advisory Panel to the Minister* (Ottawa: Ministry of Transport).

³²⁰ Quenqua. The power of perception.

³²¹ Harris/Decima and Canada Post, 2008. *The New Environmentalism: survey sponsored by Canada Post.*

³²² Quenqua, The power of perception.

The direct mail industry is responding to these environmental concerns. The United Kingdom national standards body, the British Standards Institute, has launched a new assessment and certification scheme that aims to get marketing companies to reduce waste paper and increase the recycling of direct mail. This initiative is known as the PAS 2020 Direct Marketing Environmental Performance.³²³ This is the first independent assessment and certification scheme to be launched for the marketing sector that provides environmental best practice standards.³²⁴ PAS 2020 has been developed in partnership with the Direct Marketing Association (DMA). Similar initiatives are likely to follow in North America.³²⁵

Position of the Unions

The Canadian Union of Postal Workers (CUPW) represents approximately 55,000 people, with urban operations accounting for 48,000 employees, and rural/suburban operations constituting 6600 employees. CUPW includes all of the operational workers at Canada Post and couriers and sorters at approximately fifteen private sector courier companies.³²⁶ It contends that the federal government should sponsor a thorough examination of the overall environmental impact of all postal and courier services including an environmental assessment of the different delivery modes such as door-to-door delivery and community mailboxes.³²⁷ ³²⁸ The Union also believes that such a review should examine how the industry could be re-organized to operate in a more environmentally friendly manner. In addition CUPW has called upon CPC to conduct an environmental audit to identify measures that can be taken to reduce its carbon footprint.

CUPW believes that greater competition in letter delivery, as advocated by various right wing think tanks, would create more environmental problems as there is a direct and inverse relationship between increased delivery density and environmental impact, as the decreased delivery density created by competition would lead to an increased use of fossil fuels, pollution, and traffic.³²⁹ According to the union, from an environmental perspective, it not only makes sense to maintain the letter monopoly but also to extend it to the parcel delivery market. Moreover, the union asserts that the postal service can and should be used to develop and test environmental practices that could be extended to other industries; CUPW believes this can be achieved much more easily by a publicly-run corporation, for it is easier to regulate and focus on diverse goals when profit-making is not the sole concern of the corporation.³³⁰

³²³ British Standards Institute, 2009. *PAS 2020:2009 Direct Marketing Environmental Performance Specification*. (London: BSI).

³²⁴ Direct Marketing Association, 2009. *Green Matters Special Issue: PAS 2020*. (Direct Marketing Association).

³²⁵ Direct Marketing Association UK.,2009. *GreenDM Website*. Retrieved July 7, 2009, from <http://greendm.co.uk>

³²⁶ Bickerton, Postal deregulation.

³²⁷ Canadian Union of Postal Workers, *Submission of the Canadian Union of Postal Workers to the Canada Post Corporation Strategic Review*.

³²⁸ Canadian Union of Postal Workers, *Submission of the Canadian Union of Postal Workers to the Canada Post Corporation Strategic Review*.

³²⁹ Canadian Union of Postal Workers, 2009. *Deregulation of the post office would hurt the environment*. (Ottawa: Canadian Union of Postal Workers).

³³⁰ Canadian Union of Postal Workers, *Deregulation of the post office would hurt the environment*.

In addition to CUPW, the Public Service Alliance of Canada (PSAC) represents the non-managerial white-collar workers at Canada Post and workers at Purolator in British Columbia. Before the Strategic Review of Canada Post Corporation, PSAC argued that CPC should include environmental protection criteria in all of its policy objectives. Union Network International (UNI) is the international global union that represents postal and courier workers. It argues that postal administrations must recognize that workers must be consulted and included in the changes the industry was facing regarding climate change. It also encourages unions to be involved in company approaches to climate change.

Evaluating the Research

There are many issues which require much more analysis to further our understanding of the relationship between climate change and work and employment in the postal sector. The scholarly publications addressed changing patterns in mail demand, emissions from the magazine production process, union responses to the economic and climate change crises, the segmentation of overnight and same-day courier delivery and one section of the USPS attempts to approach environmental issues. Despite all of this, there is an absence of research on the effect of climate change on jobs in the postal sector. Is the number of jobs changing? How are the types of jobs changing? Is this related to climate change or other factors? What type of training is needed to adapt to new types of jobs? This type of rigorous analysis would be helpful to more fully understand the impact of climate change on work. The studies on changes in mail demand and mail volumes fail to fully engage with the qualitative changes that are occurring in how people communicate. Econometric models fail to explain the changes that are taking place.

The scholarly publications do not address how regulation or proposed regulation might impact the postal sector, even though this may be a driver in how companies respond to the climate change crisis.

The research fails to evaluate the multiple forms of compliance programs, self-regulation and green-washed marketing that are occurring in the postal sector. Furthermore, little research has looked at how unions are responding to climate change or how they can respond. Discussions about the differences in types of technology - some eliminate jobs versus others that reduce carbon emissions - show how complicated issues like technological change can be, as specific changes determine whether there is a positive or negative impact on employment.

The para-government documents recognize that climate change plays a role in the postal sector either implicitly or explicitly however, they do not analyze the impacts of the environment and environmental change on mail volumes, how postal operators are responding, whether governments are putting in place regulation regarding climate change and how jobs are being affected. While the UPU, for example,

acknowledges that training is needed in the context of industry changes related to climate change, it fails to address more concretely how the work is changing and what kinds of training are specifically needed.

Most documents refer to the shrinking mail volumes but few evaluate whether this is linked to e-substitution for environmental reasons. There is little examination of the role of technological change in environmental impact and jobs. In terms of route optimization, few documents identify the environmental impacts of multiple postal operators or parcel of mail delivery companies delivering to the same addresses, which is integrally linked to postal liberalization and the parcel market. The studies and reports by labour market organizations incorporate environmental reporting and concerns in a wide variety of documents. Many postal companies are including environmental concerns in their annual reports in terms of risks, challenges, products and opportunities. The reports discuss the macro-trends in the postal industry and some incorporate climate regulation into their analysis - especially those companies operating in the EU. However, the reports do not tend to quantify or explore how important the environment is as a factor in electronic substitution of physical mail.

Most postal companies have recently started releasing Corporate Social Responsibility reports outlining their CO2 emissions linked to different aspects of their production chain. Though these reports tend to include a section on employees, the reports fail to link responses to climate change with employees' jobs. Furthermore, the reports all use different baselines so the emissions data is not comparable.

Industry associations - such as the Canadian Marketing Association, the U.K. Direct Marketing Association, the Envelope Manufacturers Foundation, PostEurop, or the Magazine Publishers Association - have also released documents dealing with climate change. These publications deal with a range of issues including the importance of the universal service obligation, the number of jobs linked to the industry or the economic significance of the industry; or, they provide guides for their members explaining the environmental impact of different aspects of the production chain. Furthermore, some companies are offering tools to measure the emissions associated with campaigns or environmental certification schemes.

On the whole, labour market organizations have produced the most information on climate change and the postal system. However, much of this information is geared toward the perspective of industry and minimizing the risk of negative publicity or planning for/avoiding future environmental regulation. Virtually no research has been conducted on the environmental impact of major changes that also have a significant impact on employment and work in the postal sector. Specifically, no research has examined the impact of postal deregulation on the environment. Similarly, there has been no examination of the impact on energy use and GHG emissions of changing the delivery modes from door to door delivery to centralized community mailboxes and kiosks.

A Future Research Agenda: What Do We Need to Know?

In order to fully understand the relationship of climate change and work and employment in the postal sector, it is necessary to go beyond an examination of the GHG emissions caused by the current work organization of the sector. Instead we need to examine the environmental consequences of the operational changes that have been or may be introduced into the production processes by employers. We also need to consider the impact of changes that may result from a reorganization of the sector either as a result of greater cooperation between service providers or legislative changes such as deregulation of the posts or the introduction of new regulations in the courier sector.

Some future areas of investigation could include examining:

- The environmental impact of various types of delivery services such as door-to-door delivery, centralized delivery to community mailboxes, and picking up mail at post offices in both suburban and rural settings. This would include a life cycle assessment of community mailboxes.
- The environmental consequences of postal deregulation.
- The environmental consequences of regulating the same-day courier industry to promote greater delivery density.
- The potential to use the tax system to provide incentives for courier companies to adopt more environmentally friendly practices in the processing and transportation of parcels.
- The environmental consequences of establishing a monopoly in the final destination delivery of packages and parcels to provide greater efficiency and delivery densities.
- The environmental consequences of adopting a new work organization involving the integration of letters delivery with parcels, packages and pick-ups performed by motorized letter carriers.
- The potential for postal and courier companies to use price incentives to require more environmental practices on the part of customers and suppliers.
- The environmental consequences of offering additional financial and government services and internet and printing access in postal facilities in rural communities.
- The relative use of energy in producing, delivering and disposal of catalogues as compared to the savings of energy due to online or telephone shopping and delivery by the post or courier.
- A life cycle assessment of the energy requirements and waste produced by all postal and courier products through the entire product cycle including extraction of raw materials, product manufacturing, distribution, use, maintenance/repair and disposal.
- The environmental and employment consequences of service providers pooling their resources to enable residents to obtain call-for items at the nearest possible postal or courier facility.

Conclusion

In an industry that has experienced a strong growth record with respect to overall volumes and employment it is difficult to isolate the impact of climate change on employment and work. While there has been some analysis of environmental impact of postal work, specifically as it regards the carbon footprint of the mail chain, virtually none of the scholarly studies or industry reports extends any analysis to the relationship between climate change and employment in the sector.

However, it is clear that public opinion, governmental measures designed to reduce climate change, industry changes, and actions taken by trade unions will have a direct impact upon employment levels, the work process, and the organization of the postal sector in the future. Trade unions and academic partners must play a valuable role in analyzing the relationship between work, employment and climate change within the postal and courier sector.

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THE TRANSPORTATION EQUIPMENT INDUSTRY

John Holmes and Austin Hrac

Introduction

There is an extensive scholarly and scientific literature on the links between transportation and GHG emissions and on the various technologies being developed in efforts to reduce emissions from internal combustion engines. Virtually nothing is being written, however, regarding the likely impacts of climate change on future employment and skill requirements in the transportation equipment industry.

The following questions guided our analysis of the literature:

- In what ways does the transportation equipment industry contribute to climate warming and what is the relative importance of the GHGs generated by the various sectors that comprise this industry?
- How has regulatory policy directed at the motor vehicle industry been shaped by concerns regarding climate warming and what impact have such regulations had on the industry?
- What significant developments with regard to work and employment have occurred in the motor vehicle sector and have these had consequences for climate warming?
- Have concerns about climate warming led to changes in automotive manufacturing processes?
- Will climate change be a more significant factor influencing the automotive sector in the future?
- What issues require more research?

In our analysis of the likely impact of climate warming on employment and jobs in the Canadian automotive sector we reviewed a large number of sources.³³¹ We narrowed these sources down to over one hundred items that we considered of primary importance. These included 60 scholarly publications, 35 government and para-government documents, 2 labour market organization documents, and several papers produced by various advocacy groups including labour organizations. In addition, over 100 key media articles were reviewed.

³³¹ The literature reviewed covered the period since 1995.

Before turning to a synthesis of both the issues raised and the silences in this literature, we outline our rationale for focusing on the motor vehicle segment of the transportation equipment sector and provide a very brief contextual overview of the political economy of the motor vehicle industry in Canada. As defined by Statistics Canada, the transportation equipment industry (NAICS 336) encompasses the manufacture of aircraft, ships, rail rolling stock and motor vehicles. The production of most of these products is organized around the final assembly of a wide range of parts and components and the manufacture of the latter is also included within NAICS 336. This chapter focuses on motor vehicles, and especially on automobile and light-duty motor vehicles (NAICS 3361) and motor vehicle parts (NAICS 3362) – which we will refer to as the automotive or motor vehicle industry. There are two main reasons for the focus on motor vehicles. First, the automotive industry accounts for by far the largest proportion of employment in NAICS 336 (Table 1). Second, and as a recent report observes, “rightly or wrongly, the auto industry has been singled out as a primary “culprit” in climate change debates and politicians have seized on measures affecting this industry as the centre-piece of their climate change proposals.”³³²

Table 1. Manufacturing Employment in the Transportation Equipment Industry (NAICS 336), Canada, 2004-07.

| NAICS | 2004 | 2005 | 2006 | 2007 |
|------------------------------------|--------|--------|--------|--------|
| Motor vehicles (3361) | 47,228 | 49,523 | 49,204 | 46,970 |
| Motor vehicle parts (3363) | 93,564 | 95,320 | 89,594 | 80,324 |
| Aerospace product and parts (3364) | 37,865 | 38,132 | 40,126 | 43,703 |
| Railroad rolling stock (3365) | 5,905 | 6,483 | 5,750 | 4,544 |
| Ship and boat (3366) | 8,704 | 7,803 | 7,531 | 8,231 |

Source: CANSIM Table 301-0006

Although, the actual manufacture of transportation equipment contributes in some measure to greenhouse gas (GHG) emissions, as do virtually all manufacturing processes, it is not a major source of Canada’s GHG emissions. The principal impact of transportation on GHG emissions and climate warming comes from the burning of fossil fuels to power transportation and this impact is significant. In short,

the major climate change issue associated with the automotive industry, is the use of motor vehicles not their manufacture. This distinction is important, especially so in light of the

³³² Canadian Auto Workers (CAW), 2007. *Climate change and our jobs: Finding the right balance*. Discussion paper for CAW Canada-Quebec Joint Council, St John’s August 2007 (Willowdale: CAW) , 2.

geography of the extensive international trade in automobiles, since it means that motor vehicle-related GHG emissions in Canada depend on which cars and trucks Canadians choose to purchase and drive, not on which vehicles are produced in Canada.³³³

Transportation-related emissions are second only to electricity generation as the largest contributor to global GHGs emissions. It is estimated that 14 percent of total GHGs emissions worldwide is attributable to internal combustion engines in all forms of transport (vehicle, ship, air, and rail) and that about one-tenth of global emissions are due to passenger motor vehicles alone.³³⁴ In Canada, it is estimated that motor vehicles account for over 80 per cent of the CO₂ emissions from transportation and that 50 percent of emissions are generated by private passenger vehicles (Table 2).

Table 2. GHG Emissions by Mode of Transportation, Canada, 1995 -2007.

| GHG Emissions by Aggregated Transportation Mode (Mt of CO₂e) | 1995 | 2003 | 2005 | 2007 | % of Total Transportation Emissions (2007) |
|--|-------------|-------------|-------------|-------------|---|
| Private Motor Vehicles | 74.8 | 82.7 | 83.5 | 87.2 | 50.4 |
| Commercial Motor Vehicles | 34.8 | 45.5 | 50.4 | 53.0 | 30.7 |
| Air, Rail and Marine Vehicles | 27.5 | 29.3 | 32.7 | 32.6 | 18.9 |

Source: Natural Resources Canada 2007

The Automotive Industry in Canada

The automotive industry is viewed as a critical “national lead sector” in many industrial economies and has long been Canada’s most important manufacturing industry. Historically, it has accounted for over 10 percent of Canada’s manufacturing GDP, almost one-third of all manufacturing exports and directly employed over 150,000 workers at the peak in the late 1990s. The auto industry generates a large number of spin-off jobs and is a big consumer of steel, rubber and processed aluminum as well as other commodities. Ontario, which for a period in the last decade surpassed Michigan to become the leading automotive producing jurisdiction in North America, is home to all of Canada’s vehicle assemblers and the majority of the country’s parts producers. Later, we will discuss how the industry has been wrestling

³³³ This also applies to other modes of transportation (rail, air, ships). Of course, the emissions of vehicles produced in Canada and exported still contribute to global climate change, irrespective of where they are driven.

³³⁴ World Resource Institute. <http://www.wri.org/chart/world-greenhouse-gas-emissions-2005>.

with a major crisis since the mid 2000s which has seen wide-spread plant closings and a loss of roughly 40 percent of direct automotive employment in Canada.

Over the past four decades, trade liberalization, beginning with the Auto Pact between Canada and the United States in 1965 and then deepened through the Canada-US Free Trade Agreement (1987) and the NAFTA (1994), has resulted in the production and marketing of automobiles becoming fully integrated between Canada, the United States and, more recently, Mexico.³³⁵ Over 85 percent of the vehicles built in Canada are exported, mainly to the United States. Thus, the economic health of the automotive industry in Canada is heavily dependent on the vehicle purchasing decisions of American consumers and also on corporate decisions by automakers regarding which models to source from their Canadian assembly facilities.³³⁶ Similarly, over 80 percent of the vehicles sold in Canada are manufactured elsewhere. Automotive production in southern Ontario is part of a functionally highly integrated trans-border production system that includes states such as Michigan, Ohio, Indiana and New York and generates an enormous volume of cross-border road and rail traffic.

Prior to the early 1980s motor vehicle production was centred on the Great Lakes states and Ontario and dominated by the so-called Big Three, now more generally referred to as the Detroit Three (D-3), automakers – General Motors, Ford and Chrysler. Although the industry generated numbers of skilled engineering and design jobs, shop-floor production workers were traditionally male and unskilled. The assembly sector workforce was virtually 100 percent unionized and although union density in the parts and components sector was not as high, it was still well over 50 percent. The principal unions involved in the automotive industry have been the United Automobile Workers union (UAW) (and the CAW in Canada following the 1985 split from UAW), United Steel Workers (USW) and the International Association of Machinists (IAM).

Since the mid-1980s the composition and geography of North American automotive production and Canada's position within it has changed dramatically. The Canadian auto industry is now part of a globalized and highly competitive international industry in which political jurisdictions (nation states, states and provinces and more local regions) vie for investment in new assembly plant capacity and upgrades to existing capacity.³³⁷ Governments recognize that investment in new assembly plants is frequently the catalyst for the establishment of new components production. The competition between political jurisdictions to attract new so-called greenfield vehicle assembly facilities has been fierce. It has

³³⁵ P. Kumar and J. Holmes, 1998. 'The impact of NAFTA on the auto industry in Canada,' in S. Weintraub and C. Sands (eds.) *The North American auto industry under NAFTA* (Washington D.C.: CSIS Press), pp. 92-183; J. Holmes, 2004. *The Auto Pact from 1965 to the Canada-United States Free Trade Agreement (CUSFTA)* in M. Irish (ed.) *The Auto Pact: Investment, labour and the WTO*, (The Hague: Kluwer Law International), pp. 3-21.

³³⁶ For example, in the 1980s and 1990s Canada benefited from the US consumers' love affair with minivans and pick-up trucks and the fact that these were precisely the models assigned to several Canadian assembly plants. Conversely the 2000s have witnessed the closing of Canadian truck plants and the impending closure of a plant building full-sized automobiles as rising fuel prices caused American consumers to move away from large cars and trucks.

³³⁷ See F. Roy and C. Kimanyi, 2007. Canada's changing auto industry. *Canadian Economic Observer*, 20(5): 18-28; T. Sturgeon, J. van Briesebroek and G. Gereffi, 2008. 'The North American automotive production system: Canada's role and prospects', in *Global value chains in the automotive industry*. (Vienna: UNIDO).

become common practice for competing jurisdictions to engage in bidding wars that result in extremely lucrative incentive packages to attract new automotive industry investment to a particular state or province.

A significant number of Asian and European manufacturers - so-called new domestic automakers – have been lured to establish both vehicle assembly and parts production in North America, especially in a tier of states in the southern United States and in northern Mexico.³³⁸ These plants employ a much younger and more diverse workforce than the D-3 plants and few, if any, are unionized. As the new domestic segment of the industry has expanded and exacerbated the problem of North American production overcapacity, the D-3 have steadily lost market share and been forced to close many of their manufacturing facilities in the traditional automotive heartland around the lower Great Lakes. The economic consequences of this shift for communities in Michigan and southern Ontario reliant on the D-3 or their suppliers have been devastating. Once thriving communities are now rife with economic and social decay, high unemployment rates, and little prospect that displaced autoworkers will find comparable alternative employment. In short, the geographical centre of gravity of the industry within North America has shifted southward and union density in the industry as a whole has fallen precipitously, particularly in the United States. By 2009, approximately 45 percent of North American vehicle production originated in non-union plants owned by new domestic automakers.³³⁹

From Ford's development of the moving assembly line in the early 20th century to the more recent advent of synchronous manufacturing and lean production, the North American automotive industry has been a leader in the development of new methods of manufacturing and work organization. There is a high degree of convergence between Canada and the United States with regard to production organization and work organization in automotive manufacturing facilities. Benchmarking has led to global management practices in the industry becoming standardized. In vehicle assembly plants, shop-floor technology changes rapidly as assembly lines are rebuilt every five years or so as new models are introduced. The push for higher productivity is universal and the pressure to keep abreast of the latest refinements in production methods is constant. The organization of work, the nature of individual jobs, and the skills required on the shop floor continue to evolve rapidly. This makes it difficult to single out the likely impacts on jobs and skill requirements of industry responses to climate warming. However, the strong convergence in automotive production technology and work organization between Canada and the United States noted above means that findings from U.S. studies, and especially studies in neighbouring states such as Michigan, that focus on the changing nature of employment and jobs in the automotive industry may also be broadly applicable to the industry in Ontario.

³³⁸ In Ontario, Honda, Toyota and CAMI (GM-Suzuki) have established significant assembly capacity. The growth in new domestic capacity in Canada has almost exactly mirrored the loss of D-3 capacity (Roy and Kimanyi, 'Canada's changing auto industry').

³³⁹ J. Stanford, 2010. 'The geography of auto globalization and the politics of auto bailouts'. Unpublished manuscript. (CAW).

An Industry in Turmoil

The present fragile state of the global economy in general, and the automotive industry in particular, presents a further challenge to any attempt to forecast future employment levels. After the turn of the millennium (2000), the North American automotive industry experienced deteriorating economic conditions that culminated in a major structural crisis. Over capacity, the rapid loss of market share by the D-3, and continued gains in labour productivity led to a steady decline in employment between 2000 and 2006 (Table 3). Plant closings and employment losses accelerated as the global financial crisis of 2008-2009 had a dramatic impact on the auto manufacturing industry worldwide. During 2009 alone, U.S. vehicle production fell by over one-third and Canadian and Mexican output fell by almost 30 percent.³⁴⁰ Two of the D-3 (General Motors and Chrysler) were forced to seek bankruptcy protection.

Table 3. Automotive Industry Employment, Canada 2000-2010*

| | 2000 | 2002 | 2004 | 2006 | 2008 | 2009 | 2010 |
|-------------------------|---------|---------|---------|---------|---------|---------|--------|
| Assembly Sector | 56,037 | 52,137 | 49,707 | 47,770 | 43,772 | 36,828 | 36,294 |
| Parts Sector | 97,285 | 95,782 | 97,230 | 93,039 | 82,568 | 63,916 | 58,103 |
| Total Automotive Sector | 153,322 | 147,919 | 146,937 | 140,809 | 126,340 | 100,744 | 94,397 |

Source: DesRosiers Automotive Consultants Inc.

* Employment YTD as of April

In response to the “Great Recession”, and recognizing the strategic economic importance of the auto sector, governments around the world acted quickly, but in different ways, to address the crises faced by their respective auto industries. As Stanford notes

“the auto restructuring effort in North America ... became linked, to a degree not experienced elsewhere in the world, with the corporate survival of the North American-based producers. This made it more urgent, more complicated – and much more expensive than the auto rescues in other jurisdictions. The U.S. and Canadian governments directly contributed close to \$100 billion (U.S.) to facilitate the corporate survival of General Motors and Chrysler – and tens of billions more to assist those companies, and other industry players, in a myriad of other ways.”³⁴¹

³⁴⁰ Stanford, ‘Geography of auto’ p. 18.

³⁴¹ Stanford, ‘Geography of auto’ p. 1. The government of Canada and the Ontario provincial government both participated with the U.S. in a joint rescue effort of GM and Chrysler. As a condition of their support, these governments demanded that the CAW agree to significant concessions on labour costs; requiring that GM and Chrysler hourly labour costs in their Canadian plants be to the same level as Toyota’s non-union Canadian plants.

Besides providing industry-specific financial support to firms, the U.S. and Canadian governments introduced sales incentives designed to encourage new vehicle purchases. In the U.S. sales incentives were linked to the scrapping of older, more polluting vehicles (the so-called “cash-for-clunkers” program).³⁴² In some instances, government financial assistance to companies was also linked to commitments from the company to invest in the development and production of environmentally ‘cleaner’ vehicles.

The Automotive Industry Labour Force in Canada

According to a 2008 report produced by the federally-funded Council for Automotive Human Resources (CAHR), women represent only approximately ten percent of the total workforce in motor vehicle assembly in Canada, but represent over one-quarter of the total workforce in motor vehicle parts manufacturing.³⁴³ Among parts manufacturers, there was considerable variation in gender employment patterns. With only one exception, all manufacturers surveyed for the CAHR report employed more men than women.³⁴⁴ In both the assembly and parts sectors females are consistently under-represented in the skilled trades and over-represented in office and administrative positions. With regard to the age profile of the workforce, the CAHR report estimated that approximately one-third of the workforce in motor vehicle and parts manufacturing is under the age of 35 and about ten percent is over the age of 55. If disaggregated by job classification, with only one exception (skilled trades which has a larger number of people over 55), each classification has more employees under the age of 35 than 55 or older.³⁴⁵ Although the automotive industry’s labour force is composed predominantly of white, Canadian-born workers, some segments of the automotive parts industry employ a large number of recent immigrants.³⁴⁶ A significant number of recent immigrants also occupy supervisory staff positions in some vehicle assembly plants.

Motor Vehicles and Climate Warming

The Manufacture of Motor Vehicles

Earlier in this chapter, we noted that the major climate change issue associated with the auto industry, is the *use* of motor vehicles not their *manufacture*. However, some issues related to the manufacturing

³⁴² Given the enormous improvements in fuel efficiency and ‘cleaner’ engines achieved over the last couple of decades, removing older vehicles from the road can make a significant contribution to the reduction of GHG emissions. For example federal emission regulations in 1970 required cars to produce no more than 4.2 grams of hydrocarbons, 39.6 grams of CO, and 4.1 grams of NOX per mile. Equivalent standards for 2010 model year cars are 0.055grams, 2.1 grams, and 0.07 grams respectively.

³⁴³ Council for Automotive Human Resources(CAHR), 2008. *Competing without a net: The future of the Canadian automotive industry* (Toronto: CAHR).

³⁴⁴ CAHR, *Competing without a net* p. 90.

³⁴⁵ CAHR *Competing without a net* p. 92.

³⁴⁶ CAHR *Competing without a net* p. 95.

³⁴⁶ C. Yates and S. Vrankulji, 2006. *Labour as a competitive advantage in the Canadian automotive parts industry: A study of Canada and four local labour markets (Brantford, Stratford, Guelph, Windsor)*, (Hamilton, Ontario : Labour Studies Program, McMaster University).

process are worth noting and automakers are making efforts to reduce GHGs associated with their manufacturing processes.

Efforts to reduce energy needs and GHG emissions from vehicle assembly plants has been driven both by economic considerations and by criteria attached to government financial aid provided to the automakers. For example, the Program for Strategic Industrial Projects (PSIP) was created in October 2005 by the Canadian federal government as a “special purpose program” to support the development of new technologies as well as to promote the long-term stability of the auto assembly sector and, by extension, the Canadian auto parts sector. There were three key projects supported under PSIP: the renovation of Ford’s Oakville Assembly Complex and GM’s Oshawa assembly complex, and Toyota’s construction of a new greenfield assembly plant in Woodstock, Ontario.³⁴⁷ Although the primary objective of the assistance was to strengthen the Canadian auto industry through support for the implementation of flexible manufacturing capacity at Canadian assembly plants³⁴⁸, the reduction of both energy consumption and GHGs were integral elements in each project. Besides energy consumption one of the main contributors to climate warming associated with vehicle assembly plants is the release of volatile organic compounds (VOCs) from the paint shops (this is also a significant issue in plants that produce large volumes of plastic based automotive parts and components). All three PSIP-funded projects included investment in new paint shop technologies to reduce VOC emissions. For example, Ford in revamping its Oakville Assembly Complex, funded in part by PSIP, invested in state-of-the-art technology to reduce VOC emissions. Previously fumes from the paint shop were oxidized and released into the atmosphere through the chimney. Ford’s Fumes to Fuel Project at Oakville captures the fumes from the new paint booths, filters out the particulates and then super concentrates the solvent VOCs in fluidized bed carbon concentrators to recover high-octane fuel. The high-octane fuel is then used to generate electricity for use in the plant with an internal combustion engine generator and to power a large hydrogen-based fuel cell. The project, thus, reduces GHG emissions from the manufacturing plant and reduces the plant’s reliance on the electrical grid.³⁴⁹ Ford is exploring the strong potential of a hydrogen-powered future by developing hydrogen-based technologies not only for its new vehicles, but also for its manufacturing facilities.³⁵⁰

³⁴⁷ Together these three projects received \$355 million in funding from the federal government with a similar matching amount from the Ontario provincial government.

³⁴⁸ In hindsight, the PSIP program with its focus on flexible assembly lines proved to be crucial in better positioning the Canadian assembly sector to weather the crisis that was to develop in 2008-09.

³⁴⁹ The energy savings are projected to be significant. With production volumes equal to those in 2001 it was estimated that per-unit consumption of electricity and natural gas would be reduced by 18% and 28% respectively which would reduce CO₂ emissions on a per-unit basis by 24% compared to 2001. Of course, because of the recent and ongoing global economic situation, production volumes have remained significantly (30 %+) below 2001 levels.

³⁵⁰ Hydrogen produces nearly zero emissions, delivers higher fuel economy, and can be used either in fuel cells or internal combustion engines.

The GM Beacon Project (which received PSIP support) and the more recent federal financial support to assist in the GM Canada bankruptcy restructuring included commitments from GM to invest in the development of more fuel-efficient internal combustion engines (ICEs) and the design of vehicles powered by alternative cleaner fuel technologies. Toyota's new state-of-the-art flexible assembly plant in Woodstock uses the latest Toyota manufacturing and environmental systems. The PSIP federal funds were used to support pre-production and environmental technologies in the Toyota plant and paint shop.

One element of the broader move towards lean production in the automotive industry (and, we might add, in many other sectors of manufacturing), is the outsourcing of parts and use of just-in-time delivery (JIT). This has increased the volume of GHG emissions as a result of the increased frequency of deliveries of parts to assembly plants by transport trailers operated by third-party logistics firms. This is graphically illustrated by the road congestion experienced in the Greater Toronto Area (GTA) and at the Windsor-Detroit border.³⁵¹ It is unlikely that this trend will be reversed in the foreseeable future at the intra-continental scale or within the southern Ontario-Great Lakes region. There is evidence, however, that increased fuel costs are having an impact on longer distance global sourcing patterns. For example, in the first half of the decade there was a dramatic reduction in automotive parts production in Mexico as firms moved their operations to East Asia, and especially China, in search of lower labour costs. More recently, however, this trend has been reversed due to rising transportation costs.

Some attention in the literature has focused on introducing end-of-life recycling regulations aimed at reducing the total environmental footprint of passenger vehicles.³⁵² Such regulations have been more fully developed in Europe than in North America and potentially could lead to a growth in jobs associated with the disassembly and recycling of vehicles.

The Use of Motor Vehicle

Notwithstanding the importance of the automotive sector as an economic driver, the fact remains that motor vehicle usage is a major contributor to GHG emissions and climate warming.

It is clear that serious efforts to combat climate warming must include changes in transportation and logistics industries. There are two broad ways in which the aggregate GHGs associated with motor vehicles can be reduced: a reduction in the total number of vehicles in use; and, reducing the GHGs emitted from each individual vehicle.

³⁵¹ Although it has created increased traffic and congestion along Ontario's 400 highway system, the industry's implementation of 'just-in-time' inventory systems has increased manufacturing efficiency.

³⁵² K. Bellmann and K. Anshuman, 1999. 'European response to issues in recycling car plastics', *Technovation* 19, no. 12: 721; M. Smith and J. Crotty, 2008. 'Environmental regulation and innovation driving ecological design in the UK automotive industry', *Business Strategy and the Environment* 17, no. 6: 341.

Obviously, one way to cut GHG emissions would be to drastically reduce private motor vehicle usage. Certainly, in high-density urban settings it makes sense to encourage a shift to mass public transit, than continue to rely primarily on private vehicles for urban transportation.³⁵³ Many municipalities are moving to rethink planning and zoning regulations with the goal of intensifying land use and increasing residential densities within existing urban boundaries to prevent further low-density urban sprawl. But it will take decades before benefits flowing from these policies begin to be realized. Thus, given the existing built environment in North America which for decades has been shaped by the individual automobility afforded by the privately owned motor vehicle, it is likely that the need and demand for private motor vehicles will continue well into the future. Recent studies emphasize that even in major urban areas, people living in the suburban and outer fringes of regions such as the GTA have much larger carbon footprints than those living in the inner city because of the difficulty in servicing these lower density areas with public transportation and the consequent continued reliance on the private automobile.³⁵⁴

The most immediate issue before policymakers, therefore, is how best to shape regulations to reduce GHG emissions from individual motor vehicles. The challenge for the motor vehicle industry lies in developing new technologies that will reduce the environmental footprint of individual passenger vehicles, by improving fuel efficiency and developing alternative fuel/power technologies that produce zero or, at least, much lower GHG emissions than conventional ICEs.

Government Regulation of Vehicle Emissions and Fuel Efficiency

Since 1995, governmental regulatory practice involving the automotive industry has evolved to reflect growing concerns with regard to global climate change. Vehicles produced today are certainly significantly cleaner and more fuel-efficient than those produced fifteen years ago. The regulatory environment in which the Canadian automotive sector operates has undergone substantive changes. Many of these changes are linked to the Canadian Environmental Protection Act (CEPA) of 1999, which included provisions for federal regulations limiting emissions from new cars and light trucks. In 2001, the then Canadian Minister of the Environment set out a number of policy measures designed to bring Canadian emission standards for engines and standards for fuel efficiency inline with US Environmental Protection Agency's (EPA) requirements.³⁵⁵ By 2004, Canadian emissions and fuel standards were harmonized with

³⁵³ This could entail the conversion of some automobile manufacturing plants to produce mass-transit vehicles.

³⁵⁴ Also, note the example in the chapter discussing postal services of the carbon impacts of a deregulated and fragmented parcel/package private courier delivery industry.

³⁵⁵ These regulations replaced those outlined by Canada's Motor Vehicle Safety Act of 1993. Department of the Environment <http://www.gazette.gc.ca/rp-pr/p1/2009/2009-04-04/html/notice-avis-eng.html#d110>.

the U.S. federal EPA requirements including the U.S. Tier 2 program for new light-duty vehicles, light-duty trucks and medium-duty passenger vehicles.³⁵⁶ In short, the Tier 2 program was designed to minimize vehicle emissions that negatively affect the ozone. These emissions include particulate matter, nitrogen oxides, and non-methane organic gases, consisting primarily of hydrocarbons, and volatile organic compounds. Unlike previous regulations, the Tier 2 program applied the same set of standards to all passenger cars, light trucks, and medium-duty passenger vehicles.³⁵⁷ According to the EPA, “The program thus ensures that essentially all vehicles designed for passenger use in the future will be very clean vehicles.”³⁵⁸ The complete Tier 2 program was phased in between 2004 and 2010. To help ensure compliance with these standards, both Canadian and US fuel standards have been modified. Sulphur levels in both gasoline and diesel fuels have been reduced as a result of Canada’s ‘Sulphur in Gasoline Regulations’, which came into effect in 2002.³⁵⁹ By 2007, the Canadian national average sulphur content in gasoline was determined to be 18 mg/kg; a considerable reduction from the more than 300mg/kg recorded in 2000.³⁶⁰

Besides making automobiles “cleaner”, regulations have forced automakers to improve fuel efficiency, thus reducing carbon dioxide emissions. Once again, Canadian standards have been harmonized with those of the United States under the US corporate average fuel economy (CAFE) standard.³⁶¹ By the 2011 model year, the U.S. industry-wide average fuel economy of new cars and light trucks was scheduled to be 27.3 miles per gallon (11.61 kilometers per litre). In North America, the state of California has been a leader in using regulation to induce the automotive industry to produce cleaner and more efficient vehicles. To combat smog in Los Angeles, California started regulating vehicle pollution before the U.S. Federal Clean Air Act was passed in 1970.³⁶² Subsequently, EPA rules were written to allow California to impose stricter standards for vehicle pollutants but not for fuel economy (which remained governed by the federal CAFE standards). They also permitted other US states to voluntarily adopt California's pollution standards, but prohibited the creation of their own. The stricter California standards caused significant logistical problems for the industry, as only a portion of any model line required additional modification to meet the more stringent California standards. As of 2008, 14 American states, including New York, Florida and Pennsylvania, had either adopted, or were in the process of adopting California's

³⁵⁶ The Tier 2 program and accompanying standards are both complex and lengthy documents, and as such will not be described here in detail. See Diesel Net.

³⁵⁷ National Academy of Sciences, 2002. *Effectiveness and impact of Corporate Average Fuel Economy (CAFE) Standards*. (Washington, D.C.: National Academy Press). Available from http://www.nhtsa.dot.gov/cars/rules/CAFE/docs/162944_web.pdf Accessed on August 6, 2009.

³⁵⁸ Tier 2 executive summary. Available from <http://www.epa.gov/tier2/frm/ria/exec-sum.pdf>.

³⁵⁹ These regulations for sulphur reduction set an average limit of 30 mg/kg commencing in 2005, with an interim limit of 150 mg/kg.

³⁶⁰ Environment Canada. *Sulphur in Liquid Fuels 2007*. Available from http://www.ec.gc.ca/cleanairairpur/caol/OGEB/fuels/reports/SulphurLiquid2007/sum_eng.cfm accessed March 18, 2010.

³⁶¹ CAFE was originally introduced in 1975 as a means to improve fuel economy of the United States’ auto fleet and to reduce dependence on foreign oil. See National Academy of Sciences, *Effectiveness and impact*.

³⁶² S.F. Brown, 2004. ‘California rocks the auto industry: How a state agency ruling on climate change may force Detroit to spend \$33 billion’, *Fortune* 150, no. 9. p.153.

strict emissions standards. In the same year, Quebec and British Columbia moved to enact legislation that would mirror California's emission standards.³⁶³ The size of California's market, along with the integrated nature of the auto-industry, has meant that California's standards have become the precursors to US national standards and by extension, North American standards.

In April 2010, the U.S. and Canada jointly announced new greenhouse gas emission rules for automobiles and boosted fuel efficiency standards. The new rules require cars and light trucks to get on average 35.5 miles per gallon (15 kilometers per litre) by 2016.³⁶⁴ This represents an approximate 25 percent increase over the current standards. The new rules also mandate that the average vehicle emissions will be limited to 250 grams of carbon dioxide per mile by 2016, down approximately 15 percent from 2012. Speaking about the new standards, Canada's Environment Minister Jim Prentice reiterated the importance of joint common standards given the highly integrated nature of the North American auto industry.

The new (2010) Canada and U.S. greenhouse gas emission rules for automobiles have eliminated the need for separate California standards. It is estimated that the new standards will increase new vehicle prices on average by approximately \$1,000. According to David Mondragon, Ford Canada Inc. president, this represents an improvement not only for the consumer, who will have better and cleaner cars, but also for the automotive industry that will no longer need to navigate a patchwork of competing federal and state based regulations. Commentators have also speculated that in the same way that the increasingly strict standards of the 1990s spurred technological advancements, these new and much tougher rules will force automakers to continue to invest in developing new automotive technologies.

Automotive Technologies for Reducing GHG Emissions and Improving Fuel Efficiency

Incremental improvements in fuel efficiency can be achieved from existing gasoline-fired internal combustion engine technology, through the use of lighter materials, the development of more efficient engines and transmissions and advanced electrical systems. A range of alternative fuels and fuel systems which emit less GHGs are also being developed including: clean diesel engines; biofuels, such as ethanol; hybrid power systems which combine an electric motor with a gasoline engine; all-electric vehicles; and, hydrogen-based fuel cells, which convert hydrogen into electric power while producing virtually no pollution.

Media discussions of fuel-efficiency gains usually focus on the hybrids, but wider adoption of more mundane clean-technology packages such as variable speed transmissions and clean

³⁶³ Vancouver Sun, 2008. 'Government brings in low-carbon fuel bill'. Accessed April 17, 2010 from <http://www.canada.com/vancouver/news/business/story.html?id=23c7f256-4ebc-4468-974a-c4219d78b13b>

³⁶⁴ Minister Prentice also indicated that joint Canada and U.S. standards on tractor-trailer trucks would be announced in the coming months. M. Choy, 2010. 'U.S., Canada crack down on vehicle emissions', Reuters. Accessed on April 14, 2010. From <http://www.reuters.com/article/idUSTRE6301V820100401>

diesel, many of which are already available and in widespread use in Europe and Japan, will be critical in efforts to reduce GHGs.

For example, some diesel-powered vehicles boast average fuel economies that rival some electric hybrids. However, penetration of diesel-powered vehicles into the North American market has been limited because average diesel engine emissions, particularly of nitrogen oxides, fail to meet North American emission standards.³⁶⁵

Electric hybrid vehicles are becoming increasingly popular in the North American market and are now firmly entrenched into major manufacturers' model lines. Broadly speaking, hybrids enhance fuel economy in at least three ways. First, with the addition of the secondary power source, consisting of the battery pack and electric motor, these vehicles rely less on the ICE. Second, with the power offered by the battery pack, the ICE can be turned off when idling. Third, hybrids utilize regenerative braking that captures and stores a significant portion of the energy otherwise lost while braking.³⁶⁶ Depending on the technologies and vehicle configurations, hybrids may be categorized as Micro, Mild, Parallel Non-Plug-in, Parallel Plug-in or Series (Table 4).³⁶⁷ Hybrid technologies offer the possibility of significant fuel economy and emissions enhancements; however, these improvements also come with a significant price premium of from \$5,000 to \$10,000 above the cost of a conventionally powered identical model.

Other Alternative Fuel Technologies: In addition to hybrid technologies, a range of other alternative fuel technologies are poised to potentially re-shape the entire automotive sector. In the longer term, for example, hydrogen or zinc air powered fuel-cells (Table 5) may constitute the future of the industry and the future of new jobs in the industry.³⁶⁸ Other alternative fuel technologies such as full electric, propane, bio-fuel or flex fuel represent near term and current options for carmakers and consumers (Table 6).

³⁶⁵Center for Automotive Research (CAR), 2004. *The advanced power technology dilemma: from hydrocarbons to hydrogen*. (Ann Arbor Michigan: Center for Automotive Research).

³⁶⁶ CAR, *Advanced power technology*.

³⁶⁷ Centre for Education and Research in Environmental Strategies (CERES), 2008. *Submission to the review of Australia's automotive industry: Battery electric vehicles (BEVs)*. Available from <http://www.innovation.gov.au/automotivereview/Documents/19%20CERES%20170408.pdf>. Accessed on September 1, 2009.; CAR *Advanced power technology*.

³⁶⁸ For an analysis of the fuel cell industry in Canada and its links to the auto industry see M. A. Molot, 2008. 'The race to develop fuel cells: Possible lessons of the Canadian experience for developing countries', in L. Mytelka and G. Boyle (eds.) *Making choices about hydrogen: Transport issues for developing countries* (Tokyo and Ottawa: UNU Press/IDRC) and M.A. Molot and L. Mytelka, 2007. 'Do clusters matter in a globalized industry? Hydrogen fuel cell clusters and the auto industry in Canada', Paper presented at the International Studies Association Conference, Chicago, March 2007.

Table 4. Classification of Hybrid Vehicle Technologies

| Technology | Identifying Features |
|--|--|
| Micro Hybrid | <ul style="list-style-type: none"> • Incorporate an idle-stop or start- stop system to save fuel while the car is stopped • Approximately 3-5% fuel economy gains • Approach used by Mazda3 I-Stop |
| Mild Hybrid | <ul style="list-style-type: none"> • Drivetrain powered only by conventional engine; battery provides power boost only • Electric motor-generator located in the vehicle transmission at the engine crankshaft • Approximately 10% fuel economy gains • Approach used by Honda Civic, Honda Accord and BMW 7 series hybrids. |
| Parallel Non-Plug-in Hybrid | <ul style="list-style-type: none"> • Both the conventional engine and electric motor can power the drivetrain • Under the right conditions, these vehicles may be driven exclusively by the electric motor • Approximately 40% fuel economy gains • Approach used by Toyota Prius, Lexus HS250 |
| Series Hybrid or Range Extended Electric Vehicle | <ul style="list-style-type: none"> • Only the electric motor can power the drivetrain directly; ICE engine powers generator connected to electric motor • The generator only provides additional power to the batteries • Approach used by the GM Chevy Volt. |

Source: Derived from <http://www.hybridcars.com/types-systems/where-are-micro-hybrids-26042.html>; Miller, John. 2006. Hybrids; <http://www.chevrolet.com/pages/open/default/fuel/electric.do>

Table 5. Longer Term Alternative Fuel Technologies.

| Technology | Advantages of the technology | Drawbacks or challenges with the technology |
|--------------------|---|---|
| Hydrogen Fuel Cell | <ul style="list-style-type: none"> • The consumption of hydrogen in a fuel cell releases water vapour rather than carbon dioxide | <ul style="list-style-type: none"> • Hydrogen is currently derived from natural gas or coal, with an associated release of greenhouse gases to the atmosphere • Hydrogen is highly unstable and volatile in nature, which is problematic for the storage and distribution • Would require a complete new network of refueling stations |

| | | |
|--------------------|--|---|
| Zinc Air Fuel Cell | <ul style="list-style-type: none"> • Twice as efficient as a traditional ICE • Superior range; can travel 400–550 km before needing to be refuelled • Quick refuel times (ten minutes) • Zinc used in process this 100% recyclable | <ul style="list-style-type: none"> • Commercial costs are very high • Zinc recovery equipment is also inherently inexpensive • Thus far applications have been reserved for the military |
|--------------------|--|---|

Source: Derived from Centre for Education and Research in Environmental Strategies (CERES), 2008. *Submission to the Review of Australia's Automotive Industry: Battery Electric Vehicles (BEVs)*, Available from <http://www.innovation.gov.au/automotivereview/Documents/19%20CERES%20170408.pdf>. Accessed on September 1, 2009; W.W.Clark II, E. Paolucci, and J. Cooper, 2003. 'Commercial development of energy-environmentally sound technologies for the auto-industry: the case of fuel cells', *Journal of Cleaner Production* 11, no. 4, pp. 427-437.

Table 6. Current or Near Term Alternative Fuel Technologies

| Technology | Positive features of the technology | Drawbacks or challenges with the technology |
|--|--|---|
| Lithium-ion Electric Battery | <ul style="list-style-type: none"> • Zero carbon emissions emitted from vehicle • Easily recharged from common electric outlets • Electric engines exhibit excellent acceleration and performance | <ul style="list-style-type: none"> • Limited range • Source of electricity may be produced by burning fossil fuels • More expensive than traditional ICEs |
| Bio Fuel, generally in the form of Ethanol | <ul style="list-style-type: none"> • Made from biomass • Can have a lower carbon footprint than traditional fuels • Potentially renewable source of fuel • Competitively priced | <ul style="list-style-type: none"> • May have higher carbon footprint than traditional fuels since vehicles need proportionally more biofuel than gasoline to produce the same combustion levels • Vehicles still emit CO₂ |
| Motor Fuel Propane (Liquefied Petroleum Gas) | <ul style="list-style-type: none"> • Lower vehicle maintenance costs • Lower emissions than vehicles using traditional fuels • Competitively priced | <ul style="list-style-type: none"> • Vehicles need proportionally more propane than gasoline to produce the same combustion levels • Vehicles still emit CO₂ |
| Flex fuel engines | <ul style="list-style-type: none"> • Vehicles can use entirely ethanol or gasoline as fuel without engine modification • Ethanol- Diesel engines are also available | <ul style="list-style-type: none"> • Vehicles still emit CO₂ |

Source: Derived from: Tesla motors. 2010. Webpage; Fu 2003. Life cycle assessment of bio-ethanol; Consumer Energy Center. 2010. LPG - PROPANE as a transportation fuel. Accessed April 17, 2010 From http://www.consumerenergycenter.org/transportation/afvs/lpg_propane.html; Center for Automotive Research 'Beyond the big leave'

Bio-fuel, most commonly ethanol which is made by fermenting the sugar components of plant materials, is viewed as a potential alternative to gasoline. Both bio-fuel and electric powered vehicles are popular because they offer a significant reduction in carbon emissions. However, studies have shown that the potential for these alternative fuels to reduce greenhouse gas emissions is particularly sensitive to the source of energy used to produce either electricity or the alternative fuels. Therefore,

it is important to consider the carbon footprint of the entire life cycle of the vehicle's fuel source.

For example, on the one hand, if the electricity used to charge a vehicle's batteries is derived from nuclear power then its total emission reduction potential is high.³⁶⁹ On the other hand, if the electricity is generated by burning fossil fuels such as coal, then its overall emission reduction potential is low. Similarly, in the case of ethanol bio-fuel, if the ethanol is produced using bio-fuel to generate the steam for breaking down the feedstock then the ethanol will ultimately produce less greenhouse gases than traditional gasoline. However, if fossil-based electricity is used in ethanol production, gasoline is likely more climate friendly. Moreover, bio-fuel feedstock cultivation is also a greenhouse gas contributor. Here, the emissions are due mostly to nitrogen, methane and carbon dioxide released during the production of fertilizers and pesticides.

Changing Nature of Employment and Jobs in the Automotive Industry

How has work and employment in the automotive industry changed since 1995, and how might employment levels and job design change in the future, especially as the industry responds to the challenges posed by global climate warming? There are few recent studies of changing patterns of employment and skill requirements in the North American automotive industry. Of these studies, only two, both published in 2008, are worth discussing at length and they only very tangentially address the issue of climate change and work. The Canadian study, 'Competing without a Net', was commissioned by the Council for Automotive Human Resources (CAHR) with the primary objective of identifying human resource challenges facing the automotive manufacturing sector in Canada. The second study, 'Beyond the Big Leave' was produced by the Centre for Automotive Research (CAR) to assess the future prospects for the automotive industry in the state of Michigan and, especially, the impending challenges related to automotive human resources.³⁷⁰ Although focused on Michigan, this report underscores the changing labour needs in the North American automotive sector in general. For reasons outlined earlier, the issues facing the industry in Ontario are likely to be very similar to those encountered in Michigan.

³⁶⁹ S. Dupressoir et al., *Climate change and employment: Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030*. (Brussels: ETUC, Social Development Agency; Wuppertal Institute).

³⁷⁰ Center for Automotive Research (CAR), 2008. *Beyond the big leave: The future of US automotive human resources*. (Ann Arbor: Center for Automotive Research).

All five major auto-makers who participated in the CAR study reported that they did not expect there to be *major* changes in the nature of automotive work in the near future. In other words, they did not expect the way that motor vehicles are presently manufactured to change in a fundamental way. This is not to say that production processes and work organization remain static. Over the last decade, the industry's traditional distinction between "skilled" and "non-skilled" work has become increasingly blurred. No longer can any job in a modern automotive assembly or parts facility be considered "unskilled". The incorporation of 'lean' production practices has increased the responsibilities of employees on the shop floor; with production workers assuming more and more responsibility for "...organizing their own work teams, monitoring their own product quality, performing routine maintenance, and managing the business case for the work they do."³⁷¹

The continuing trend towards higher levels of automation in the production process has certainly changed the demands on production workers by reducing the physical aspects of jobs (manual dexterity and physical strength) and increasing the technological content of the work. Proficiency with computer-based automation and manufacturing related software packages is currently a requirement for *select* auto production workers, but in the future is expected to be a requirement for *all* workers since "the ability for workers to troubleshoot software problems is going to be key..." and this will continue to intensify the need for "...computer skills and technical literacy in the workforce."³⁷² The positions occupied by skilled trades workers and maintenance associates are undergoing considerable change. Technological change in the industry is driving the D-3 auto-makers to reduce skilled job demarcations by increasing cross-training and shifting towards combined mechanical and electrical training.

The Impact of Climate Warming on Work and Employment in the Transportation Equipment Industry: What Do We Need to Know?

As noted earlier, very little has been written regarding the likely impacts of climate change on employment and skills requirements in the transportation equipment industry. At best, what is available provides only broad-brush estimates of employment change.³⁷³ Although few in number, these reports reflect a consensus that neither incremental efficiency improvements nor longer-term technological changes in response to climate change concerns threaten the viability of the motor vehicle industry for the foreseeable future. In this context,

whilst climate warming is clearly the principal driver of technological change in vehicle design, and especially powertrain design and engineering, it is not seen as fundamentally changing the way in which motor vehicles are built.

³⁷¹ CAR, *Beyond the big leave*, p. 37.

³⁷² CAR, *Beyond the big leave*, p. 48.

³⁷³ For example, Dupressoir, *Climate change*; CAW, *Climate Change*; A. Baum and D. Luria, 2010. *Driving Growth: How Clean Cars and Climate Policy Can Create Jobs*. Natural Resources Defense Council; United Auto Workers; Center for American Progress.

Moreover, the reports argue that compliance with government regulations that mandate improvements in fuel efficiency and reductions in GHG emissions will involve “greater labor content per vehicle and higher employment across the fleet. This will include new investment in a host of incremental improvements to conventional gasoline powered internal combustion engines, from new controls for valves and timing, to variable speed transmissions and advanced electronics. It will also include entirely new systems like hybrid drive trains and advanced diesel engines.”³⁷⁴ In short,

*responding to climate change concerns will add more content and value to automotive production; content which, in turn, should require more engineers and workers to design, manufacture and assemble and, other things being equal, should create more rather than fewer automotive jobs.*³⁷⁵

As one study concluded “re-engineering the U.S. automobile fleet to use energy more efficiently will require new investments in advanced technology, increasing the demand for skilled labor. Instead of presenting a threat to the auto industry, reigning (sic) in reliance on oil and cutting pollution from fossil fuels can demonstrably create jobs, accelerate innovation, and increase demand for advanced manufacturing.”³⁷⁶ Thus,

it seems likely that, at least for the foreseeable future, factors other than climate warming, such as the perennial problem of industry overcapacity and instability in the global capitalist economy, will have a more significant impact on overall employment levels in the industry.

Even if one accepts the argument that improving the fuel economy and reducing vehicle GHG emissions will create more jobs,

much more detailed research is required to assess the impact of green policies on employment trends and skill requirements in the automotive industry. For example:

- will government regulations on fuel efficiency and emissions and longer-term changes in urban planning regulations lead to a modal shift from private vehicles to public transportation and reduced demand for automobiles?
- what will be the impact on employment trends in the automotive industry of meeting the new 2016 fuel economy and emissions standards?

³⁷⁴ Baum and Luria, *Driving growth*, p. 3.

³⁷⁵ Of course, all other things are never equal. For example, during the 1990s substantial increases in labour productivity in the automotive industry greatly increased output with only modest increases in employment.

³⁷⁶ Baum and Luria, *Driving Growth*.

- what specific new engineering and manufacturing skills are required to develop and work with some of the more radical new automotive powertrain technologies such as all-electric or hydrogen fuel-cells?
- how do these skill requirements mesh with other skill needs associated with a shift towards increased integration of mechanical, electrical and software engineering? Given the global nature of the automotive industry, another important and currently unknown employment related question is which nations and/or regions will most likely capture the jobs and economic benefits associated with the shift to a more fuel-efficient North American vehicle fleet? For example, although the technology for lithium-ion batteries used in plug-in hybrids and electric vehicles was largely developed in North America, battery production is currently dominated by Japan, China and Korea. Similarly, “.both Europe and Japan have substantial leads in hybrids, diesels, DDI, and turbochargers. Most of these technologies have high value-to-weight ratios, making them eminently shippable. Nearly all of the key components in Nissan, Honda, Toyota, Ford, and Mercury hybrids sold in the United States are made in Japan.”³⁷⁷ The report, however, goes on to note that while Europe and Japan have a lead in a number of these new powertrain technologies, their focus is on applications of the technologies in small cars, rather than the larger vehicles that dominate the North American market. The same report underscores a concern from a Canadian perspective. Most of North America’s high-volume engine and transmission plants are located in the United States. This is even truer for advanced vehicle R&D and testing capacity. Thus, it will be a challenge for Canada to secure a share of the new jobs created in the industry as a result of meeting the new 2016 fuel economy and emissions standards

In conclusion, there is little extant literature that explicitly addresses the nexus between climate warming and employment and jobs in the automotive industry. Research is required to provide much more precise forecasts of employment trends and specific skill requirements not only in response to the development of new “green” technologies but also with regard to broader changes in the industry including shifting workforce demographics, changing skill requirements in response to other technological changes (such as the rise of mechatronics), and the “big question” regarding the likely future size of the industry in Canada. As the recent CAW Discussion Paper observes “We need to carefully analyze how proposed measures (such as regulated improvements in vehicle fuel efficiency) will affect Canada’s auto industry, and seek ways of supporting and strengthening the fight against climate change that also strengthen (rather than undermine) this crucial sector of our economy.”³⁷⁸

³⁷⁷ Baum and Luria, *Driving growth* p. 6.

³⁷⁸ CAW, *Climate change*, p. 2.

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THE FORESTRY INDUSTRY

John Holmes

Introduction

Historically, the forest products industry has been one of Canada's leading manufacturing sectors and its largest net exporter. It has been a major component of the industrial structure and employment base in regions across the country but especially in Québec, northern Ontario, and British Columbia. In 2009, according to the Forest Products Association of Canada (FPAC), it accounted for 11.1 percent of manufacturing GDP, exports of \$23.6 billion and direct employment of 238,200.³⁷⁹ In close to 200 communities across Canada, more than 50 percent of workers are directly dependent on forest products for their livelihood.

The forest sector consists of several well recognized subsectors: primary forestry activities including harvesting (logging) (NAICS 113); woodlot management and silviculture (NAICS 115); solid wood processing in sawmills to produce lumber, shakes and shingles, wood chips, and pulp-related materials (NAICS 321); the pulp and paper subsector producing products such as pulp, newsprint, printing papers, packaging papers and paperboard as well as value-added paper products like tissue, napkins, and other consumer paper products (NAICS 322); and, the manufactured wood products subsector producing commodities such as dimensioned lumber and panels as well as the higher value-added engineered products such as doors, windows, kitchen cabinets, manufactured housing and flooring. This chapter focuses primarily on the impact of climate warming on logging, solid wood processing and pulp and paper.³⁸⁰

The challenge of assessing the impact of climate warming on the industry is compounded by the fact that Canada's forest products sector has undergone major structural change since 2004. Factors driving the restructuring include: a general downturn in demand for structural lumber; the persistent high value of the Canadian dollar against the US dollar, which has made Canadian forest products less competitive in one of their principal markets; increased competition from overseas producers; and, the impact of the "Great Recession" of 2008-09, which saw the collapse of US housing starts and a significant decline in the demand for paper used in advertising. In fact, the impact of the "Great Recession" on the Canadian forest sector has been catastrophic. During the first half of 2009, British Columbia, for example, witnessed a 26.3% decline in lumber production, a 14% decline in pulp shipments, and a 26.6% decline in

³⁷⁹ Forest Products Association of Canada (FPAC), 2009. *Key Economic Facts – Canada's Forest Products Industry 2009*.

³⁸⁰ Note the numerous links between the forestry sector and other sectors in our broader study. For example, in the postal sector the link between advertising flyers and the production of paper; in the construction sector the increased use of engineered wood products; in the energy sector the move toward biomass energy and the development of bio-refinery-pulp mills.

newsprint shipments. Forest products exports for the province in the first half of 2009 were down by 27.1% for solid wood products, and down by 25.8% for pulp and paper products compared to the same period in 2008.³⁸¹ Overall, Canada's forest products sector's workforce has been significantly downsized, losing in excess of 100,000 jobs over the last five years (Table 1 and Table 2).³⁸² In sharp contrast to the automotive industry, the Canadian forestry sector has received little assistance, and especially financial assistance, from the federal and provincial governments to facilitate restructuring and help the industry respond to the crisis. Although there are now (July 2010) some signs of recovery in the solid wood sector, research suggests that a significant number of the most recent layoffs are likely permanent, as the industry continues to restructure. Thus, transitioning displaced workers from an ageing workforce is currently the foremost human resource challenge confronting the industry.³⁸³

Table 1: Forestry Employment by Region, 2004-2009 (thousands)

| Employment | Region | | | | | |
|--------------------|----------|--------|---------|----------|-------|--------|
| | Atlantic | Quebec | Ontario | Prairies | BC | Canada |
| 2004 | 29.8 | 84.1 | 45.8 | 23.6 | 72.3 | 255.6 |
| 2005 | 28.2 | 76.3 | 44.1 | 21.2 | 70.4 | 240.1 |
| 2006 | 22.6 | 67.5 | 39.2 | 18.5 | 70.0 | 217.8 |
| 2007 | 23.3 | 53.5 | 33.8 | 18.5 | 72.3 | 201.4 |
| 2008 | 21.1 | 52.6 | 32.7 | 21.0 | 53.7 | 181.1 |
| 2009(estimate) | 15.1 | 52.3 | 27.5 | 17.4 | 40.4 | 152.7 |
| % change from 2004 | -49.3 | -37.8 | -40.0 | -26.3 | -44.1 | -40.6 |

Source: R.A. Malatest and Associates, Analysis and assessment, p. 17. Based on Statistics Canada Labour Force Survey.

³⁸¹ R.A. Malatest and Associates 2010. *Analysis and assessment of labour market transition programs for laid-off forest products workers*, Report for the Forest Products Association of Canada (FPAC), p. 12.

³⁸² These tables, taken from R.A. Malatest and Associates, *Analysis and assessment*, are based on direct employment estimates from the Labour Force Survey data collected by Statistics Canada.

³⁸³ R.A. Malatest and Associates, *Analysis and assessment*.

Table 2: Forestry Employment by Sub-sector 2004-2009 (thousands)

| Sector | | | | |
|-----------------|------------------------------|----------------------------|----------------|-------|
| Employment | Primary Forestry and Logging | Primary Wood Manufacturing | Pulp and Paper | Total |
| 2004 | 72.1 | 114.4 | 69.2 | 255.7 |
| 2005 | 69.5 | 106.3 | 64.3 | 240.1 |
| 2006 | 63.0 | 92.7 | 62.2 | 217.9 |
| 2007 | 60.5 | 87.7 | 53.3 | 201.5 |
| 2008 | 54.1 | 67.1 | 59.8 | 181.0 |
| 2009 (estimate) | 44.3 | 54.0 | 53.7 | 151.9 |

Source: R.A. Malatest and Associates, Analysis and assessment, p. 16. Based on Statistics Canada Labour Force Survey.

Forests and climate warming are intimately connected. At different times and depending upon external conditions, forests may act as either a carbon sink or a carbon source and, as such, forests are a key element in the global carbon cycle which helps to regulate climate. As a sink, forests store large amounts of carbon in the trees and soil by removing carbon dioxide, the major greenhouse gas (GHG), from the air and storing the carbon as biomass (wood, leaves and roots). Canada's 400 million hectares of forest represent an enormous carbon sink,³⁸⁴ absorbing up to 20 times Canada's total annual CO2 emissions from the burning of fossil fuels.³⁸⁵ As forests are logged, burned or simply decay, however, they switch from being a significant carbon sink to become a carbon source. When trees are harvested, some carbon is released through soil disturbance and the decay of waste left on logging sites.³⁸⁶ Pest attacks or diseases that kill large numbers of trees both increases the stock of dead trees that release CO2 as they decay and elevate the risk that such forests may burn releasing carbon into the atmosphere. Climate warming is widely expected to accelerate both pest infestations and the risk of forest fires.

In analyzing the likely impact of climate warming on employment and jobs in the Canadian forestry sector we reviewed a large number of sources.³⁸⁷ We narrowed these sources down to those that we

³⁸⁴ In total, Canada's forests cover 402 million hectares and represent 10% of the world's total forest cover including about 30% of the world's boreal forest and more than 25% its temperate rainforest. For carbon accounting purposes the Canada's managed forest is defined as covering 236 million hectares. http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

³⁸⁵ E. Humphreys et al.,2006. 'Carbon dioxide fluxes in coastal Douglas-fir stands at different stages of development after clearcut harvesting', *Agricultural and Forest Meteorology*, 40, pp. 6-22.

³⁸⁶ Note that if the harvested trees are converted into solid wood products, the latter continue to store carbon until such time as the wood products are burnt or decay. This is an important point that we shall return to later.

³⁸⁷ The material reviewed covered the period since 1995.

considered of primary importance. These included 39 scholarly publications, 58 government and para-government documents, 32 labour market organization documents, and several papers produced by various advocacy groups including labour organizations. In addition, a large number of key media articles were reviewed.

Given the major role played by forests in determining carbon balances, it is not surprising that there is a very extensive scholarly and scientific literature on the links between forests, GHG emissions and climate change.

From a social science perspective, there are studies that focus on assessing the broader vulnerability of forest-based communities to climate change and a few recent studies of the major labour market adjustment challenges facing the Canadian forestry industry due to the current deep structural crisis within the industry. However, even the few existing studies which focus on the forest industry labour market make only scant reference to the likely impact that measures designed to mitigate climate warming will have on the future of employment and jobs in the industry.³⁸⁸

The following questions guided our review and analysis of the literature:

- What role do forests play in the global carbon cycle and climate warming? What are the implications of this for the forest products industries?
- How has government policy directed at the forestry industry been shaped by concerns regarding climate warming and what impact has such policy had on the industry?
- Have concerns about climate warming led to changes in forestry practices and manufacturing processes? What are the implications of these changes for skills development and training?
- Will climate change be a more significant factor influencing the forestry sector in the future?
- What issues require more research?

Before turning to these questions, we begin with a brief contextual overview of the political economy of the forestry industry in Canada.

³⁸⁸ For example, Wood Manufacturing Council, 2005. National human resource sector study for the advanced wood products manufacturing sector (Wood Manufacturing Council). Retrieved from a link at <http://www.wmc-cfb.ca/reports>; R.A. Malatest and Associates, *Analysis and assessment*.

The Forestry Industry in Canada³⁸⁹

The forestry industry is an extractive industry that traditionally has relied on local sources for its basic resource input, raw wood, usually in the form of harvested logs. Wood is a low-value, high-volume commodity that incurs substantial transportation costs. Consequently, wood typically was logged from regions with abundant natural forests, and the early stages of processing, such as the production of sawn lumber or wood pulp for paper, was located close to the wood supply. Since historically large areas of Canada were covered by natural forests, several regions of the country became major producers of forest products with many small communities in relatively remote locations dependent upon the local sawmill or pulp mill. Canada's forest products workforce is characterized by older workers. Based on the 2006 Census, 45.4% of forest products workers were 45 years of age or older, compared to 39.7% of the overall Canadian labour force. The workforce in the mills and involved in logging is predominantly male with a wide range in education and skill level from hard physical manual labour, through the highly valued tacit knowledge and skill of paper machine operators, the formal skills of maintenance tradesmen, to the highly educated production managers and forestry professionals.³⁹⁰ In British Columbia it is estimated that six out of ten people working in forestry are in occupations unique to primary industries, such as operators of logging machinery, chainsaws and skidders and silviculture and forestry workers.

The industry in Canada has traditionally been highly unionized with a complex history of regionally-based unions, US-based international unions, union breakaways and subsequent mergers.³⁹¹ Some of the principal unions involved in the industry over the last quarter-century have been: the Canadian Paperworkers union (CPU);³⁹² the Pulp, Paper, and Woodworkers of Canada (PPWC) centred primarily in British Columbia; the Fédération des travailleurs et des travailleuses du papier et de la forêt (FTPF-CSN) representing a segment of forestry workers in Québec; and the International Woodworkers of America union (IWA-Canada), now merged into the Steelworkers union (USW) which represents sawmill workers in western Canada³⁹³. The relatively high union density in the industry, especially in the mills,

³⁸⁹ Although some are now a little dated there are a number of excellent analyses of the political economy of forestry in Canada, especially of the industry in British Columbia. See, for example, P. Marchak, 1984. *Green gold: the forest industry in British Columbia* (Vancouver: UBC Press); M. Howlett, 2001. *Canadian forest policy: Adapting to change* (Toronto: University of Toronto Press); R. Hayter, 2000. *Flexible crossroads: the restructuring of British Columbia's forest economy* (Vancouver: UBC Press); T. Barnes and R. Hayter (eds.) 1997. *Troubles in the rainforest: British Columbia's forest economy in transition*. (Victoria: Western Geographical Press).

³⁹⁰ For a comprehensive list of occupations by NOCS codes for the forestry industry see R.A. Malatest and Associates, 'Analysis and assessment', p. 4.

³⁹¹ See G. Hak, 2007. *Capital and labour in the British Columbia forest industry: 1934-1974* (Vancouver and Toronto: UBC Press) and B. A. Sweeney, 'Comparing employment relations in a cross-border region: The case of Cascadia's forest products industry', unpublished PhD dissertation, Queen's University, Kingston, Ont. (2010).

³⁹² The CPU was formed in 1974 when Canadian workers broke away from the US-based United Paperworkers International Union (UPIU). The CPU later merged with other Canadian unions to form the Communication, Energy and Paperworkers union (CEP). Today, the CEP represents many pulp and paper workers in Canada.

³⁹³ In 1987 the international IWA split along national lines. In 2004 the Industrial, Wood and Allied Workers of Canada (IWA Canada) merged with the United Steelworkers union (USW).

produced production jobs that are relatively well-paid in comparison to many other manufacturing jobs.³⁹⁴

Much of the forest products labour force is located in small- to medium-sized communities far removed from larger urban centres and heavily dependent on forestry-related industries as their primary source of economic activity. This raises a number of labour market issues.

For example, if a mill is downsized or closed it is very difficult for mill production workers to find alternative employment within the community and certainly finding employment with comparable pay and benefits is virtually impossible. The isolated nature of many of these communities usually precludes the option of commuting to another job in a different location. For the same reason accessing training and education is also a challenge.

In recent decades, forest-based industries in North America have experienced profound changes due to economic globalization and technological change. Beginning in the 1980s traditional North American regions of production such as Québec, New England, the Great Lakes, and Cascadia (BC, Washington, Oregon) began to experience restructuring, job losses and mill closures due to growing international competition and falling commodity prices. These regions' proportion of global production decreased as existing firms and new entrants sought lower labour and raw material costs elsewhere. Most new investment in the forest products industry since 1980, and especially in the pulp and paper sector, has been concentrated in the southeast United States, the Iberian Peninsula, Brazil, Chile, and Southeast Asia; regions which provide competitive advantages due to lower labour costs, lower tax rates, and cheaper sources of wood fibre produced in plantation forests.³⁹⁵

Biotechnology has been applied to produce trees that grow and can be harvested more rapidly and that yield wood with the desired characteristics for industrial products. Innovations in silviculture have reduced the reliance on existing natural forests such that today intensively managed, planted forests have become a major source of harvested wood. Technological developments in pulping technology have allowed the use of different tree species. As a consequence, the traditional ties between forest processing industries and regions with abundant natural forests have been eroded. For example, in the United States there has been a dramatic shift in forestland ownership and production locations with major US-based forest corporations in the past 25 years divesting themselves of almost 50 percent of their US holdings of timber rights whilst at the same time purchasing offshore forest assets.³⁹⁶ Within North America, there

³⁹⁴ Although before the 'Great Recession' some mills in the BC interior were finding it difficult to attract new young workers due to competition from the high wages being generated in the oil and gas industry in Alberta and northern BC.

³⁹⁵ P. Marchak 1997. 'A changing global context for British Columbia's forest products industry' in T. Barnes and R. Hayter (eds.) *Troubles in the rainforest: British Columbia's forest economy in transition* (Victoria: Western Geographical Press.) pp. 149-64.

³⁹⁶ R.A. Sedjo and D. Bael, 2007. *The impact of globalization on the forest products industry*. (Pittsburgh: Sloan Industry Studies Association). WP-2007-36.

has been a significant shift in the production of forest-products away from the old-growth forests of the Pacific Northwest towards new managed timber resources in the southern United States.³⁹⁷

Sedjo and Beal suggest that globalization has had a greater impact on the pulp industry than on the structural wood industry in North America.³⁹⁸ Until the recent collapse of the US housing market, companies whose major products were solid and structural wood (with pulp and paper as secondary products) thrived on the strong US housing market and their principal products, such as structural wood and panels, were less impacted by globalization. On the other hand, North American companies focused on pulp and paper have been forced to restructure their assets due to the pressures of globalization. The restructuring has been characterized by a number of trends including a rapid and extensive change in ownership patterns in the industry. Historically, many of the large players in the North American forestry industry, such as Weyerheuser, MacMillan Bloedel, and Crown Zellerbach, were highly integrated across a number of the forestry subsectors. Their own logging crews would harvest the wood and waste from their solid wood mills would be used as feedstock for their pulp and paper operations.³⁹⁹ Over the last two decades, this kind of vertical integration has given way to horizontal integration and a shift from integrated firms to separate specialized firms engaged in each subsector. Within each subsector consolidation has occurred through an almost continuous process of mergers and buyouts. Many of the formerly large players in the solid wood and pulp sectors have divested their timberland holdings, especially in the United States.⁴⁰⁰ Other challenges to the profitability and sustainability of the Canadian forest products industry in recent years have included: the amplification of commodity price cycles; trade disputes over softwood lumber with the United States; and, pressures from environmental lobbies both at home and abroad for government policy to preserve the dwindling supply of old-growth forests.

Forests and Climate Change

Forests, GHG and the Carbon Cycle

As noted earlier, forests are a key element in the global carbon cycle which helps to regulate climate. As a sink, trees remove carbon dioxide from the atmosphere and convert it to wood, leaves and roots. As a source, they release stored carbon into the atmosphere when they decompose or burn.⁴⁰¹ As trees decay, carbon is emitted slowly back into the atmosphere. Forest fires cause rapid and significant emissions of carbon dioxide and also release other and more potent GHGs such as methane and nitrous oxide.⁴⁰²

³⁹⁷ This shift had a significant impact on forestry in British Columbia since several US-based forestry companies divested themselves of their assets in BC to concentrate production in the southern US.

³⁹⁸ Sedjo and D. Bael *The impact of globalization*

³⁹⁹ This provided firms with supply chain security and allowed them to shift fibre resources across their operations in response to counter-cyclical lumber and pulp commodity prices

⁴⁰⁰ For a comprehensive account of the changes in the structure of the industry and ownership patterns see Sweeney, 'Comparing employment relations', Chapter 5.

⁴⁰¹ In Canada's Boreal forests the soils and wetlands also store significant amounts of carbon.

⁴⁰² The area burnt by forest fires varies considerably from year to year. But the GHGs released by fires can be very significant and can exceed removals of carbon by forest growth. For example "In extreme fire years, like 1995, direct emissions from

These removals and emissions are not determined solely by natural processes—forest management activities such as harvesting, tree planting, and efforts to fight fires and insects all have a significant impact. When trees are harvested, some carbon is released through soil disturbance and the decay of waste left on logging sites. However, if the woody biomass is captured in solid wood products, the latter not only continue to store carbon, but also generate far fewer GHGs in their production than do other common building materials like concrete, brick, glass and steel.⁴⁰³ Only when wood products are incinerated or decompose do they release their carbon into the atmosphere.

Changes in forest carbon balances, whether from human or natural processes, contribute to climate change by altering the amount of carbon dioxide in the atmosphere. In turn, a changing climate will affect forest carbon storage as a consequence of changes in forest productivity, decomposition, regeneration, and succession, as well as changes to species, species communities and their geographical distributions. The eventual net outcome is not immediately obvious. On the one hand, for example, a warmer climate can increase the rate of carbon sequestration by speeding up the growth of vegetation while, on the other hand, the same climate warming is likely to significantly reduce carbon storage by accelerating decomposition and increasing the risk of forest fires and insect infestations. As a result of mild winters over the last decade it is estimated that the severe mountain pine beetle infestation in central British Columbia has killed almost 1 billion m³ of lodgepole pine.⁴⁰⁴ Unless rapidly logged for use in sawmills or chipped to feed pulp mills, these dead pine trees represent a huge source of future GHG emissions since much of their stored carbon will be released back into the atmosphere as they decay. Besides general climate warming, another concern regarding contemporary climate change is an increase in extreme weather events and Canadian forests may well become subject to more frequent, severe storms and wind damage.

Impact of Forest Industries on Net Carbon Balances in Canada

On balance, are Canadian forests a net sink or source of carbon and what is the contribution of logging and forestry related activities in Canada to GHG emissions? The scientific evidence is mixed and estimates of forestry related GHG emissions vary significantly. Two major, independent modeling exercises of Canada's forest carbon balance demonstrate that the source/sink balance of Canada's has

wildfires in the managed forest have represented up to 45% of Canada's total greenhouse gas emissions”
http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴⁰³ A recent Statistics Canada report noted that wood products manufacturing has the lowest GHG intensity of nine primary material processing sectors. Statistics Canada 2009. Energy and GHG Intensity by Industry, Canada 2004. Pulp and paper, however, has a much higher intensity.

⁴⁰⁴ D. Konkin and K. Hopkins, 2009. 'Learning to deal with climate change and catastrophic forest disturbances' in A. Perlis (ed.) *Adapting to climate change: Unasylva* 60 (231/232) (Rome: FAO).

fluctuated over time.⁴⁰⁵ The CBM-CFS3 model developed by the Canadian Forest Service (CFS)⁴⁰⁶ estimates that Canada's managed forest has been a sink for most of the past 70 years and that between 1990 and 2005 it was an overall sink in all but five years.⁴⁰⁷ The recent trend towards a more negative carbon balance is thought to be mainly the result of a recent upswing in fire and insect disturbances combined with increased temperatures and an aging forest. The forest area harvested by logging each year remained fairly stable during the 1990–2005 period and, therefore, it is unlikely that timber harvesting was a cause of the higher incidence of annual negative carbon balances. The independently developed Integrated Terrestrial Ecosystem C-budget (InTEC) model has been used to model carbon balances in Canada over the past 100 years. The InTEC analysis suggests that Canada's forests as a whole were a small carbon source in the period 1895–1905 due to large disturbances near the end of the 19th century; a large carbon sink in the period 1930–1970 due to forest regrowth in previously burnt over areas; and a moderate carbon sink in the period 1980–1996.⁴⁰⁸ Both models point to significant regional variation in carbon balances across Canada.⁴⁰⁹

NRCAN estimates that “from 1990 to 2005, harvesting in Canada's managed forests resulted in an average of about 43 million tonnes of biomass carbon in branches, roots, and leaves being left in the forest each year and the transfer each year of about 41 million tonnes of biomass carbon from the forest ecosystem to the forest products sector.”⁴¹⁰ Some authors equate the GHG emissions in Canada from logging with those from cars and trucks. For example, Stewart Elgie is quoted in a 2007 interview as stating that “logging in Canada releases more than 150 million tonnes of carbon per year; by comparison all of Canada's cars and trucks emit about 145 million tonnes. In other words, logging is as serious a culprit in releasing carbon as all of the country's cars and trucks, at least in the short term.”⁴¹¹ However, as the NRCAN webpage points out:

“... the timing of the biomass carbon emissions is quite different than that of the car and truck emissions, which occur immediately. The biomass left in the forest decomposes slowly, while the biomass carbon that is transferred out of the forest (equivalent to about 150 million tonnes of carbon dioxide each year) is emitted over time according to the use made of the wood. From 1990 to 2005, biomass

⁴⁰⁵ For a comprehensive review of literature estimating forest carbon balances in Canada see C. Henschel and T. Gray, 2007. ‘Forest carbon sequestration and avoided emissions’, background Paper for the Canadian Boreal Initiative/Ivey Foundation Forests and Climate Change Forum, Kananaskis, Alberta, October 2007. <http://www.forestsandclimate.org/background.pdf>.

⁴⁰⁶ http://carbon.cfs.nrcan.gc.ca/CBM-CFS3_e.html.

⁴⁰⁷ http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴⁰⁸ J. Chen et al., 2000. ‘Annual carbon balance of Canada's forests during 1895–1996’, *Global Biogeochemical Cycles*, 14(3), pp. 839–849.

⁴⁰⁹ Forest areas in the Prairie Provinces have become a large carbon source due to recent fire activity; a large forest sink exists in eastern Ontario/western Quebec due to a mid-aged forest, while in recent years large areas of British Columbia's forests have been carbon neutral (it is too early yet for the trees killed by the pine beetle to begin to decay and release carbon.), see J. Chen, *Convergence of various estimates of Canada's forest sinks and remaining challenges*. Presentation retrieved from <http://www.davidsuzuki.org/files/Conservation/Conference/Chen.pdf>.

⁴¹⁰ http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴¹¹ S. Rushton, 2007. ‘The economy and the environment: Working hand in hand’ *Research Perspectives*, May 2007. (University of Ottawa). Retrieved from <http://www.research.uottawa.ca/perspectives/10202>.

carbon equivalent to about 65–75 million tonnes of carbon dioxide was stored in products that last for decades, such as lumber used in housing, while an amount equivalent to about 35–45 million tonnes of carbon dioxide was stored in less-durable products (including paper) and was emitted to the atmosphere in the first few years after harvest. Much of the remaining carbon was released shortly after harvest from the burning of wood waste or biofuel as a renewable source of energy.⁴¹²

NRCAN argues that reducing timber harvesting would not have a large impact on CO₂ emissions from Canadian forests since due to sustainable forest management less than 0.5% of the managed forest is harvested in any given year. Furthermore, the harvested areas regenerate to forest and so in any year there is renewed sequestration of carbon occurring on the previously logged areas and, as well, a significant proportion of the carbon removed from the forest continues to be stored in durable forest products like lumber.⁴¹³ The length of time that forest products remain a source of carbon storage depends on a number of factors including the efficiency with which the logged trees are converted into forest products, the longevity of the product, and how it is ultimately disposed of (e.g. incinerated, recycled, landfilled). For example, only about 50 percent of the harvested log is converted into dimensioned lumber (although much of the waste is either chipped and used as pulp feedstock or burnt as biofuel) while the harvested wood-to-product ratio is estimated to be 85 percent for pulp and paper. Research suggests that wood carbon stored in landfills has a much larger residence time than tree biomass in a forest.

This underscores the importance of analyzing greenhouse gas emissions over the full life cycle of forest products. The Heinz Center, with several industry partners, produced a comprehensive study of GHG emissions over the entire supply chain from forest harvest to waste disposal and product decomposition for two magazine chains and a dimensional lumber chain.⁴¹⁴ Consistent with other studies, the Heinz Centre study found that forest management operations accounted for less than 1% of total greenhouse gas emissions from the supply chain. In the magazine supply chain the highest percentage (61 to 77 percent depending on the mills) of greenhouse gas emissions came from paper manufacturing at pulp and paper mills with transportation being the second highest contributor of GHG emissions (between 5 and 9 percent). Thus, the study concluded that the potential to significantly reduce GHG emissions for the magazine supply chain lay with improving energy efficiencies in the pulp and paper manufacturing process.⁴¹⁵ Since 94 percent of the GHG emissions associated with the dimensional lumber supply chain was generated by the transportation of the lumber from the sawmill to the retail outlets, the real opportunity for reducing GHG emissions in this supply chain lay with the use of more fuel efficient transportation modes. The study also emphasized that the final disposal method for unrecovered

⁴¹² http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴¹³ http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴¹⁴ S.T. Gower et al., 2006. Following the paper trail: The Impact of magazine and dimensional lumber production on greenhouse gas emissions: A case study. Washington D.C.: The H. John Heinz III Center for Science, Economics and the Environment.

⁴¹⁵ The pulp and paper industry has made significant progress in reducing GHG emissions from mills – see Forest Products Council of Canada, *Sustainability Report 2009*.

magazines and waste dimensional lumber (landfilled, incinerated or recycled) can potentially have a large effect on the carbon footprint of the magazine and dimensional lumber chains.

At present, a significant volume of logs is exported from Canada to the United States and Asia to be processed into solid wood products. A recent pamphlet argues that in the overall value chain, the amount of carbon generated when logs are exported for processing rather than being processed domestically rises by over 50 percent due to the GHG's generated by the extra transportation required.⁴¹⁶

Potential Growth Areas for Forest Products: Engineered Wood Building Products, Wood-Fired Energy Generation, and Biofuel Refining

With increasing concern regarding GHG emissions and climate warming, attention has turned to increasing the use of wood as a building material and for wood-fired energy generation. The Intergovernmental Panel on Climate Change has identified changes in the design, construction and operation of buildings as one strategy to significantly reduce GHG emissions. Although lumber has long been used as a framing material in the construction of single family homes in Canada, its use in the construction of multi-storey residential and commercial buildings has been very limited, in part, by building codes. Recently (January 2009), British Columbia, in an effort to assist the province's beleaguered forest industry moved to raise the limit on wood-frame construction from four to six stories. The speed skating oval for the 2010 Vancouver Winter Olympic Games near Vancouver was used as a showcase example of building with wood. One million board feet of sawn wood, mostly from beetle-killed trees, was used in the construction of the 2.6 ha roof. In Québec City, the new headquarters building for the CSN union federation was completed with all the structural elements being made from wood rather than steel or concrete. Not only is wood a product which stores carbon and is durable but it also requires significantly less fossil fuel to produce than other building materials; Parfitt, for example, reports that it takes "2.9 times more fossil fuel energy to produce the equivalent amount of concrete slabs, 3.1 times more energy to produce the equivalent amount of clay bricks, and 17.3 times more energy to produce the equivalent amount of steel studs as it does softwood lumber."⁴¹⁷ More research is now being directed to the development of a wider and more sophisticated range of engineered wood products to be used in building construction in order to reduce the life-cycle carbon footprints of buildings.⁴¹⁸

Many forest product mills already have co-generation projects which burn waste wood fibre to produce both heat and electricity for use in the mill. There are now planned projects to build large wood-fired electrical generating plants in BC and to build bio-refineries to produce bioethanol and synthetic biodiesel from wood in Québec. Williams Lake, BC already has one of the largest wood-fired electrical generating facilities in North America. Owned by EPCOR, the facility initially used sawdust and wood chips from

⁴¹⁶ United Steelworkers, 2010. 'Raw log exports: Bad economics, bad for the planet', (Vancouver: USW District 3).

⁴¹⁷ B. Parfitt, 2010. *Managing BC's forests for a cooler planet: Carbon storage, sustainable jobs and conservation*, (Vancouver: Canadian Centre for Policy Alternatives), p. 14.

⁴¹⁸ See chapter on the building and construction industry

sawmills in the Williams Lake region to burn and spin turbines to produce 66 megawatts of electricity. Much of the over 600,000 tonnes of wood that is now fed into the EPCOR plant comes from dead lodgepole pine killed by the mountain pine beetle. Although burning the wood for power generation releases GHGs, the dead pine trees would also over time release greenhouse gasses if left to decompose in the forest.

Wood-fired bioenergy both provides an alternative revenue stream for beleaguered forest industry firms and is promoted as so-called green energy. Although GHGs are released when wood is converted to energy, it is argued that if new trees are planted eventually the carbon sequestered by the new trees will potentially offset such emissions. However, industry-watchers have urged caution before moving to large scale energy generation from biomass.⁴¹⁹ The call for ‘green’ power projects issued by BC Hydro in March 2009 focused on wood as an energy source but also implied that logging on new forest tenures could be used to directly support electrical power generation. As Parfitt observes “this marked a radical departure from the norm, wherein the “fallout” or byproduct from sawmills — wood chips and sawdust — became the feedstock for the pulp and paper industry, wood pellet producers, wood boilers, and the occasional wood-fired electrical generating facility. It raised the alarm of the province’s pulp and paper industry, which worried about increased competition for finite wood supplies.”⁴²⁰

In Québec, a province that has suffered a large loss of employment in the pulp and paper sector, a company recently announced that it planned to build five large-scale wood-fired biorefineries, each at a cost of \$1.2 billion and each capable of producing 630 million litres of biodiesel fuel per year.⁴²¹ When burned the biodiesel would produce 90 percent fewer CO₂ emissions than conventional diesel. Parfitt raises a number of questions regarding this project, however, noting that “there is no mention of the number of trees that would be required to produce so much “green” fuel. What would the CO₂ emissions associated with converting all those trees to fuel be? How long would it take a new generation of trees to sequester the carbon stored in the first batch of trees?”⁴²²

Forestry and Carbon Credits

This raises the broader question of the role that Canadian forests can play in helping Canada reach its GHG emission reduction targets and in carbon credit trading schemes. When the Kyoto Protocol was being negotiated Canada pushed hard to ensure that countries who signed on to the Protocol could elect to include forest management in their calculations when accounting for GHG emissions and removals. It was argued that this would provide an incentive for countries to adopt sustainable forest management practices designed to reduce GHG emissions and increase carbon sequestration in forests. At the time, it was also thought likely that this would likely work to the benefit of Canada with its huge area of managed forests. Although this option was built into the Kyoto Protocol, Canada ultimately elected not to include

⁴¹⁹ For example, see Parfitt, *Managing BC's forests*

⁴²⁰ Parfitt, *Managing BC's forests*, p. 21.

⁴²¹ K. Yakabuski, 2009. “Inside this building technology exists that could transform the forestry sector”, *The Globe and Mail* June 18, 2009.

⁴²² Parfitt, *Managing BC's forests*, p. 23.

forest management in Canada's carbon accounting because a subsequent study conducted by the Canadian Forest Service (CFS) indicated that although Canada's managed forests have usually been a carbon sink in the past, there was a greater than nine in ten chance that they would be a net source of GHGs in the period 2008–12, due in part to fire, insect damage and the age of the forests.⁴²³

The Western Climate Initiative was launched in 2007 by a partnership between British Columbia, California and a number of western US states and subsequently expanded to include Manitoba, Ontario and Québec. A key element in the Initiative is to increase the planting of trees in order to later sell their carbon storing capacity in a market for tradable carbon credits (a so-called cap and trade system). Once a market is created for carbon, Elgie argues that “in many places the carbon values will begin to approach or even exceed the timber values in our northern [Boreal] forests — and that’s at a price of \$15 per tonne of carbon. As the global warming problem becomes more pressing and demand for carbon storage rises, most experts think we will see carbon trading at \$30 to \$50 per tonne within a decade. If carbon gets up to that price, many of our northern forests will be worth far more for carbon [credits] than for timber.”⁴²⁴ However, many technical questions regarding carbon-trading markets remain. There is a continuing debate regarding the development of a comprehensive accounting system for forest credits in such a future market.⁴²⁵

The Impact of Climate Warming on Work and Employment in the Forest Products Industry: What Do We Need to Know?

As remarked earlier, literature that addresses the likely impacts of climate warming on employment and jobs in the forestry sector is at best sparse. Understandably, recent writing on human resource issues in the industry has focused on the sharp contraction in employment experienced over the last few years and how best to respond to the needs of laid-off forest workers. Furthermore, a recent report emphasizes that:

“...the kinds of structural changes that are predicted to result from climate change will occur alongside a host of other changes that are simultaneously affecting markets for forest products. Technological changes, trade disputes, changes in exchange rates, interest-rate changes, and changes in consumer tastes and preferences are just a few examples of the changes that will be occurring at the same time as the market effects of climate change. It may, therefore, be difficult to isolate the effects of climate change from other market influences, and

⁴²³ http://carbon.cfs.nrcan.gc.ca/FAQ_e.html#5b.

⁴²⁴ Rushton, *The economy and the environment*.

⁴²⁵ Parfitt, *Managing BC's forests*, p. 26.

it may be difficult to develop and implement specific adaptation measures in response solely to the market impacts of climate change.”⁴²⁶

*We conjecture that there are at least two major ways in which climate warming will impact employment. First, and over the longer term, climatic changes could lead to a shift in the geographical range of different forest species and hence the location of commercially viable wood harvesting and processing.*⁴²⁷

Parfitt notes that “an increasing number of scientists [is focusing] on how certain trees will fare in the face of higher temperatures and dramatically altered precipitation patterns. Some tree types will adapt better, and continue to occupy their ecological niches. Others will “migrate” - move south to north or from lower to higher altitudes. And still others will be extirpated, or face localized extinctions.”⁴²⁸ Over time it is expected that the boreal forest in Canada will advance northward into the tundra and that its southern limit may also shift as a result of drier and warmer conditions. Climate warming is likely to lead to increased risks of forest fires and insect infestations that could also have a significant impact on the distribution of commercially viable supplies of wood fibre for the industry. It will also impact logging operations.⁴²⁹ A significant portion of the forest harvest in Canada occurs in the winter when the ground is frozen. This allows for access to wetlands, reduces soil disturbance, and decreases the costs of delivered wood. In short, climate warming could change the geographical distribution of jobs in the sector, lead to the establishment of new forest-based communities further north and the economic demise of some more southerly mill-based communities. While there is a climate science literature which seeks to model likely regional shifts in the geographical range of different forest species,⁴³⁰ the literature is silent on the impacts of such shifts on future patterns of employment in the forest products industry.

Second, and although the production of traditional wood and paper products will remain important for the foreseeable future, emergent new wood-based products, production methods and processes associated with the shift to a “greener” economy have the potential to transform the forest products sector and have a significant impact on jobs and skill requirements.

⁴²⁶ T.B. Williamson et al, 2009. *Climate change and Canada's forests: from impacts to adaptation*, (Ottawa and Edmonton: Natural Resources Canada, Canadian Forestry Service Northern Forestry Centre and Sustainable Forest Management Network). p. 46.

⁴²⁷ S.N. Aitken et al.,2008. ‘Adaptation, migration or extirpation: climate change outcomes for tree populations’, *Evolutionary Applications*, 1, pp. 95-111.

⁴²⁸ Parfitt, *Managing BC's Forests* p. 12.

⁴²⁹ Williamson et al *Climate change*.

⁴³⁰ Williamson et al *Climate change*.

Currently, the forest products sector employs people in a wide range of skilled occupations and professions including machinists, mechanics, electricians, carpenters, steam engineers, millwrights, foresters, forest technicians and technologists, chemists, engineers, biologists, economists, administrators and marketers.⁴³¹

These jobs will continue to be required in the continued and traditional processing and manufacturing of lumber, panels, and pulp and paper products. However, the introduction of new wood products and processes will generate new skilled employment opportunities.⁴³² The development of more sophisticated engineered wood products for building construction, the use of wood as an input for bioenergy generation (either wood-fired heat and electricity generation, or production of biofuels such as ethanol), and the use of cellulose fibre in a range of new products will all have consequences for training and skill development in the industry:

“The transition currently underway on the manufacturing side of the industry will have a significant impact on the skill sets required by the forest industry of tomorrow. As the focus on emerging technologies in areas such as bioenergy, bioproducts and building systems increases, the industry will require highly trained individuals with the appropriate skills to process this next generation of forest products.”⁴³³

At the same time, the further introduction of computer-based technologies into all aspects of the forest industries - from the use of GPS technology in forest management, through the use of laser guided technology to optimize dimensional lumber and minimize the waste in saw mills, to computer controls on paper machines – continues to transform the content of many traditional jobs and to replace formerly low-skilled manual work with more skilled work.⁴³⁴ A report issued just prior to the onset of the “Great Recession” concluded that:

“The sector faces the problem of an aging worker population and the high demand for skilled workers within the forestry sector and other sectors. What is more, there are not enough graduates from university forestry programs, which creates mounting problems in recruiting skilled workers. The forest industry must also overcome the hurdle of a negative image that dispels young, skilled workers from wanting to work in the sector. Viewed as a low-tech, dying sector with minimal opportunities and with minimal concern for environmental issues

⁴³¹ See R.A. Malatest and Associates *Analysis and assessment of labour market*, p. 4 for a full list of National Occupational Classification (NOC) codes for forestry related occupations.

⁴³² R.A. Malatest and Associates, *Analysis and assessment of labour market*

⁴³³ <http://www.canadaforests.nrcan.gc.ca/article/forestworkers>

⁴³⁴ For an early discussion of the transformation of work within pulp and paper and the replacement of workers’ tacit knowledge with more codified technical knowledge see S. Zuboff, 1988. *In the age of the smart machine*. (New York: Basic Books).

people often overlook the technological and innovative advancements made in the forest industry.”⁴³⁵

Another more recent study stressed that “clearly the key challenge to the sector is going to be in striking a balance between the need to lay off its workforce during these trying economic times, while remaining a viable option as a career choice for skilled workers.”⁴³⁶

Recognition of the potential importance of well-managed forests to act as net carbon sinks which, in turn, represent potential carbon credits that could be used in a cap and trade system has been growing. In Canada, and especially in British Columbia, there is increased pressure from alliances of environmental activists and unionized workers in the logging, pulp and paper and solid wood processing industries for a new model of forest management based around management techniques that maximize carbon storage both in the forests and in forest products. Recently (May 2010) a landmark Canadian Boreal Forest Agreement was co-signed by firms represented by the Forest Products Association of Canada (FPAC) and a number of environmental groups.⁴³⁷ Under the Agreement FPAC members “commit to the highest environmental standards of forest management” and conservation groups “commit to global recognition and support for FPAC member efforts.” Logging is suspended on nearly 29 million hectares of boreal forest to allow development of conservation plans and the “do not buy” campaigns waged by environmental activist groups will be suspended.

Sound management models could go a considerable way to offsetting GHG emissions elsewhere in the economy; at the same time, capturing the value of CO₂ in the forest sector could create a stronger, more diversified and more sustainable forest economy. As a recent report from the CCPA concluded “where logging does occur, it is vital that society gets the best possible environmental and economic returns. From a climate change perspective, that means placing carbon storage at the forefront of forest product use.”⁴³⁸ Moving to such a model will require much more sophisticated forest management techniques and likely increased employment in silviculture and forest management. The increased focus on forest management could also help offset the negative image of the industry held by younger workers. In a recent report, an industry stakeholder was quoted as follows:

“Youth are less interested in jobs in the forest products sector. Intensive information campaigning in the 1980s and 1990s portraying the forest products sector as a clear-cutting, environmentally destructive industry has tainted the image of the industry in the eyes of young Canadians. However, the current reality of the forest products industry in Canada is one of ever-greener practices

⁴³⁵ "Forest workers: the new generation." 2007. from Natural Resources Canada website at <http://canadaforests.nrcan.gc.ca/articletopic/120>.

⁴³⁶ R.A. Malatest and Associates, 'Analysis and Assessment' p. 28. Also see 'A workforce strategy for Alberta's forest industry', 2008. Edmonton: Alberta Employment and Immigration.

⁴³⁷ <http://www.canadianborealforestagreement.com/>

⁴³⁸ B. Parfitt, 2010. *Living assets" are key in the fight against climate change*. CPPA Factsheet Online.

<http://www.policyalternatives.ca/publications/commentary/living-assets-are-key-fight-against-climate-change>.

and increasing environmental stewardship. New, innovative practices and products such as biomass products and bio-energy are providing green, carbon neutral, forest-based alternatives to traditional carbon-positive fossil fuel-based energy and forestry stakeholders are looking at ways to expand the interest of the sector in these new directions. This reality needs to be communicated to young Canadians.”⁴³⁹

In summary, there is virtually no existing research that focuses on the potential impact that climate warming will have on employment and jobs in the Canadian forest products industry. Recent labour market research which focuses on the forest products industry is preoccupied with managing the consequences of the serious contraction that has occurred in the industry in the last few years. Research is urgently required to identify the impact of the move towards a “greener” economy on employment trends and skill requirements in the forest products industry. Areas in which research is required include:

- What will be the impact of the move towards 'greening' in the various sub-sectors of the forestry products industry (forest management; logging; solid wood processing; pulp and paper; and, manufactured wood products) on both employment levels and skill requirements, province by province?
- Can such impacts be easily differentiated from changes in employment due to other political economic transformation?
- Can models developed in the climate science literature to predict regional shifts in the geographical range of different forest species be used to estimate the impacts of such shifts on future regional patterns of employment in the forest products industry?
- What examples of best practice exist in Canada and internationally, concerning the funding, implementation and outcomes, of 'greening' skills requirements in the sectors of the forestry products industry?
- What international and Canadian examples exist for aiding forestry communities in adapting to the restructuring of the industry?

⁴³⁹ R.A. Malatest and Associates, *Analysis and assessment of labour market*, p. 29.

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THE IMPACT OF CLIMATE CHANGE ON EMPLOYMENT AND SKILLS REQUIREMENTS IN THE CONSTRUCTION INDUSTRY

John O'Grady

Introduction

This chapter reviews published sources on the construction industry and climate change from two perspectives. The first is the impact on employment trends in the construction industry of investments that may be required to upgrade or replace infrastructure that will be stressed, or made obsolete, by climate change. The second is the effect on skill requirements of 'green construction' principles, i.e., construction methods and design principles that increase the resource efficiency of the built environment and, in particular reduce the built environment's 'carbon footprint'. The chapter focuses on four occupational groups that are central to the construction industry: engineers, architects, technicians and technologists, and skilled trades. The sources relied on comprise mainly studies or reports that were commissioned by governments, international bodies, research centres, advocacy organizations, professional associations, and trade unions. The web sites of professional associations and regulatory bodies have also been consulted.

While there is an extensive and growing literature on the implications of climate change for the design and engineering of the built environment, there has been relatively little research on the implications of 'green construction' for skill requirements. There is a greater body of research that endeavours to estimate the employment implications of alternative energy and retrofitting investments that would mitigate the emission of greenhouse gases (GHG). As will be discussed, however, these employment effect models are of limited value to the governments, employer organizations, unions, training and educational institutions, and professional associations that make human resources planning decisions.

Section 1 provides a brief description of the key institutional features of the construction industry and a review of the data and literature dealing with the contribution of both the built environment and the construction industry to GHG emissions. This section also examines the literature on the impact of climate change on infrastructure, i.e., roads, bridges, harbours, water distribution systems, etc. The focus of this review is on what can be derived from the literature about the employment effects of the major infrastructure investments that adaptation to climate change may require and whether the Canadian construction industry has the planning capacity to respond to these demands.

Section 2 reviews the literature on the employment impacts of 'green construction', principally on retrofitting the existing building stock to meet higher energy efficiency standards. This section also discusses how the literature interprets the impact of 'green construction' on the skill requirements of both the design professions and the construction trades.

Section 3 offers concluding observations on the gaps in our understanding of the impact of climate change on human resources in the construction industry.

Section 1: The Construction Industry and GHG Emissions

Overview of the Construction Industry

In 2009, Canada's construction industry⁴⁴⁰ employed approximately 1.2 million persons, or just under 7.0% of the labour force. Around 73% of persons working in the construction industry are employed in trades occupations, while the remainder work in managerial, professional or administrative roles. This does not include the majority of architects, engineers, and technicians and technologists whose work is wholly or substantially tied to construction, but who are classified by statistical systems as working in the 'architectural and engineering services industry'. In 2006, the 'architectural and engineering services industry' (NAICS 5413) employed approximately 209,400 persons. Half or more of these individuals were likely linked to the construction industry.⁴⁴¹ Others who might be included, but whose numbers cannot be accurately estimated, are persons employed by governments to administer the application of building codes and official development plans.

The construction industry comprises several distinct sub-sectors. These include: residential construction (which is further divided between low-rise and high-rise construction), non-residential building construction (also known as industrial-commercial-and-institutional construction, or ICI), civil or engineering construction (infrastructure and power generation and distribution), pipeline construction, residential renovation, and ICI repair work. Figure No. 1 shows the approximate share of these sub-sectors, based on the estimated value of construction output for 2008. These shares vary significantly across regions and also over the business cycle.

⁴⁴⁰ The construction industry (NAICS 23) comprises both the 'contract construction industry', *i.e.*, companies that provide construction services to other businesses or households, and 'own account construction'. The latter is construction work that is undertaken by the construction division of a company or public authority for its own purposes. Statistics Canada estimates that in 2002, own account construction represented about 13% of total hours worked in the construction industry.

Maintenance work that is undertaken on an 'own account' basis is not considered construction work. However, maintenance work that is provided on a contract basis is likely to be included in estimates of construction work since these services are usually provided by companies whose primary business focus is on construction. See (1) Statistics Canada, *What is produced in Canada*, Retrieved 12 March 2010 and (2) Industry Canada, *Canadian Industry Statistics: Definition Construction (NAICS 23)*, Retrieved 12 March 2010 from <http://www.ic.gc.ca/cis-sic/cis-sic.nsf/IDE/cis-sic23defe.html>

⁴⁴¹ Not all persons employed in NAICS 5413 are linked to the construction industry. Many engineering consultancies are focused on manufacturing, telecommunications, information technology, *etc.* Based on Statistics Canada, *2006 Census*.

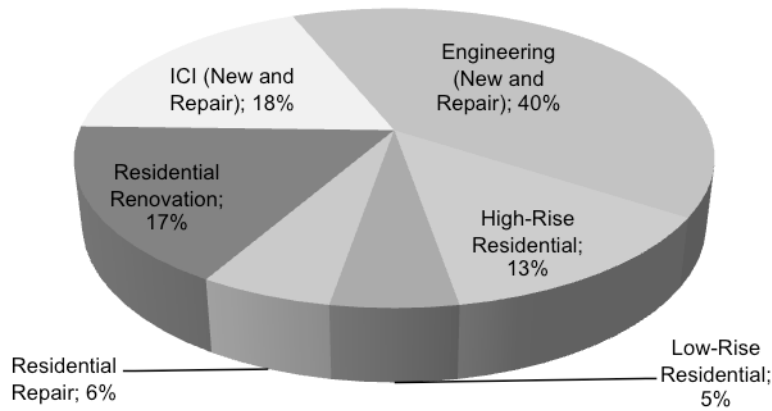


Figure 1. Approximate Shares of Construction Output, 2008
(Statistics Canada, CANSIM)

The contractors and workers who undertake construction have only limited influence on design decisions and the specification of materials. In the main these decisions are made by owner-developers on the basis of advice from architectural and engineering professionals. In turn, this professional advice on design and engineering is strongly shaped by the regulatory environment.⁴⁴² As will be noted later in this chapter, over the past ten years, proprietary building rating systems, such as LEED, have also come to play an important role in design decisions. The acceptance of these rating systems is a function of both regulatory decisions and market pressures. Liability also plays an important role in the construction industry. Architects, engineers, and contractors are financially liable for the performance of the structures they design and build. This liability can extend over many years. Liability instills a high degree of conservatism in the construction industry. The industry is slow to abandon engineering and architectural solutions, building materials, and construction methods that have worked in the past. There are significant risks associated with new engineering and architectural approaches and with new building materials and construction methods. In the main, these risks are borne by the construction industry.

Unionization rates in trades occupations vary both by province and by sector. Quebec has a distinct labour relations model which results in an overall, construction industry unionization rate of approximately 40%. In the rest of Canada, unionization in the construction industry is approximately

⁴⁴² The traditional construction model involves an owner-developer retaining an architect and consulting engineers, then tendering the construction of the project to a general contractor, who in turn, sub-contracts components of the construction process to trade contractors. Trade contractors may further sub-contract portions of the work. This traditional model still predominates, but has been joined by other procurement models. In some cases, a general contractor acts only as a project manager, that is to say, as an agent of the owner-developer. In other cases, the general contractor may be engaged on a design-build basis, whereby the owner-developer selects a general contractor based on a design proposed by that general. In still other cases, the general contractor may be engaged on a design-build-maintain basis, whereby the selected general contractor designs and builds the project and also is committed to maintain the project for a period of time.

29% on a labour force basis.⁴⁴³ The engineering and ICI sub-sectors of construction (and especially the industrial segment of ICI) generally have much higher rates of unionization. Low-rise residential construction is predominantly non-union in most parts of Canada, with the exception of the Greater Toronto Area. Repair and renovation work is predominantly non-union. In the construction industry, unions are generally, though not always, organized on a craft basis. Outside of Quebec, unions affiliated to the AFL-CIO Building Trades Department predominate. In British Columbia and Alberta, ‘merit shop’ contractors operate on a non-union basis, but provide benefits and skills training on a multi-employer basis. In these provinces, the Christian Labour Alliance (CLAC) also has a significant membership in the construction industry. Most construction bargaining is conducted under right-to-strike conditions. However, in some jurisdictions, some trades have opted for voluntary arbitration.⁴⁴⁴ CLAC generally pursues a non-strike policy. In the Greater Toronto Area, low-rise residential construction is subject to compulsory arbitration if there is no negotiated settlement.

In the construction industry, the majority of employers are small and medium-sized enterprises. In 2009, approximately 51% of construction workers classed as employees were employed in establishments with fewer than 20 employees.⁴⁴⁵ This measure, however, understates the importance of small units of production in the construction industry. Self-employment is also a significant factor in the construction industry. On a national basis, in 2009, more than 40% of workers in the construction industry are classed as self-employed.⁴⁴⁶ The self-employed share would have been substantially higher in residential repair and renovation, but lower in ICI and civil construction.

Sector-based, or multi-employer, human resources planning is strongly rooted in the construction industry and arises from the need to ensure an adequate supply of skilled labour in an industry that is dominated by small employers and specialized skills. At the national level, the Construction Sector Council provides highly detailed estimates of future trade requirements. In Ontario, the statutorily-based Ontario Construction Secretariat supports the unionized ICI. The most highly developed sectoral management of construction is found in Quebec where the Commission de Construction du Quebec (CCQ) is mandated by statute to oversee labour relations, training, and human resources planning.

In the unionized sector, construction work is generally organized along trade lines with tasks parceled out according to ‘jurisdictions’ established by regulation, agreement or tradition. Construction crews comprise journeyperson, apprentices, and, in some cases, helpers or labourers. In the unionized sector, forepersons are members of the bargaining unit. In the non-union sector, employers use a greater

⁴⁴³ These estimates are based on Statistics Canada, *Labour Force Historical Review*, 2009 Cat. No. 71F0004XVB. The labour force basis measures the share of the labour force in an industry that is covered by a collective agreement. An alternative measure is ‘market share’ which estimates the union and non-union share of construction work, measured either by the value of that work or the estimated hours of direct labour. In some province, union members may work for non-union contractors. Consequently, the market share of unionized contractors is probably lower than the union share measured on a labour force basis.

⁴⁴⁴ For example, the electrical trade has bargained under a protocol providing for final offer selection in the ICI sector since 1992.

⁴⁴⁵ Based on calculations from Statistics Canada, *CANSIM*, Table No. 282-0076.

⁴⁴⁶ Based on calculations from Statistics Canada, *CANSIM*, Table No. 282-0012.

proportion of semi-skilled workers – often described as ‘helpers’ or ‘installers’ - and comparatively fewer journeypersons.⁴⁴⁷ The majority of craft unions operate dispatch services (historically known as ‘hiring halls’) whereby the unions supply skilled workers to employers who, in turn, are required by collective agreements to hire only workers dispatched by the union. Dispatch priority is based on length of unemployment and the requisite skills. In contrast with other sectors, seniority rules play little or no role in the construction industry.

Most craft unions operate training programs for their members. Many of these programs are delivered through well-equipped training centres that are owned by unions or by trustee funds. Training is typically financed by negotiated contributions to ‘training trust funds’ which may be operated by the union or jointly with employers.⁴⁴⁸

In all provinces, most or all construction trades are regulated occupations. A trade qualification (TQ) is issued by the provincial government or a provincial training authority following completion of trade examinations. Most, but not all, TQ-holders complete an apprenticeship before taking examinations. Apprenticeships consist of a period of on-the-job learning and classroom-based learning (‘trades school’). Both the duration of apprenticeship training and the amount of trades school training vary by trade. For trades such as, electrician and plumber, apprenticeships are typically 7,200 to 9,000 hours, with three periods of trades school, each of eight-weeks duration. In Canada, occupational regulation is in provincial jurisdiction. Most construction trades, however, are ‘red seal’ trades, meaning that the provincial standards adhere to a common national standard established by the Canadian Council of Directors of Apprenticeship. For ‘red seal’ trades, these occupational standards are based on a National Occupational Analysis (NOA) which is undertaken by the federal government in cooperation with industry and the Canadian Council of Directors of Apprenticeship. The role of NOAs is critical, since it is these analyses which are the basis for changes in trade standards and skill requirements.

Construction trades may be compulsory or voluntary. In compulsory trades, work that is encompassed by a trade regulation can only be performed by a TQ-holder or a registered apprentice. In Quebec, most trades are compulsory. In the rest of Canada, only a minority of construction trades require a worker to hold a trade qualification or be registered as an apprentice. British Columbia has adopted a strategy of making specific ‘skill-sets’ compulsory, rather than trades *per se*. The functions of some trades may also be regulated by technical standards authorities, some of which are stand-alone bodies, while others are divisions within provincial ministries.

Both engineers and architects are licensed professions in Canada regulated by professional associations that are statutorily recognized. Licensure means that only persons with a license can hold themselves out

⁴⁴⁷ Clinton C. Bourdon, and R.E. Levitt, 1980. *Union and open-shop construction: Compensation, work practices and labor markets*. Lexington Mass.: Lexington Books.

⁴⁴⁸ Training trust funds are described in Prism Economics and Analysis, 2005. *Training Trust Funds: A Review of their history, legal foundations and implications for trade union strategy* commissioned by the Canadian Labour Congress. The study estimated that in 2002-02, these training trust funds provided training to approximately 51,000 workers. A more detailed description of training activities by construction unions in Ontario is presented in Ontario Construction Secretariat, 2008. *Building on a foundation of investment in construction trades apprenticeship and skills training*. (Ontario Construction Secretariat).

to be members of the profession and ‘stamp’ construction drawings. Persons without a license may work in a subordinate position to a licensed professional who must assume professional responsibility (and liability) for their work. Admission to both the engineering and architecture professions requires a professional degree from an accredited university programme, the completion of additional courses and examinations specified by the professional associations, and the completion of specific types and amounts of practical experience under the supervision of a licensed professional. For engineers, the professional degree is an undergraduate engineering degree. For architects, the professional degree is at the master’s level. In both professions, university programs must be accredited by the profession to be recognized for licensure qualification. This gives the professions significant leverage over the content and quality of professional education.

Experience requirements are integral to licensure in both the engineering and architectural professions. Experience requirements for Professional Engineers range from three to four year, depending on the province. For architects, the requirement is approximately three years. In both professions, however, additional time may be required to meet the specific experience requirements. Non-Canadian experience and additional graduate qualifications can be applied against a portion of the experience requirements. Most professional associations in engineering, and all associations in architecture, require their members to undertake continuing professional development to maintain their licensure status.⁴⁴⁹ In addition to professional associations that regulate admission to the profession, there are also a range of discipline-specific technical associations that develop technical standards and offer continuing professional development training.

Technicians and technologists occupy applied science occupations for which the usual qualification is a community college certification. However, many technicians and technologists also hold university qualifications. Professional associations also accredit college technology programs. In every province, the professional associations have statutorily recognized rights to restrict use of occupational titles using the term ‘registered’. Associations confer the right to use restricted occupational titles based on academic qualifications and experience. One study estimates that approximately 17-20% of technicians and technologists are certified. Certification rates tend to be higher in the public sector and in the consulting sector.⁴⁵⁰

The Built Environment as a Source of Greenhouse Gas Emissions:

Environment Canada’s *National Inventory Report* estimates the contribution of various sectors to GHG emissions. Based on these data, the Pembina Institute estimates that, in 2006, the ongoing operation of

⁴⁴⁹ For engineers, the role of continuing professional development is discussed in Prism Economics and Analysis, 2009. *Trends in continuing professional development*, commissioned by Engineers Canada and the Canadian Council of Technicians and Technologists.

⁴⁵⁰ Prism Economics and Analysis, 2009. *Trends in licensure and certification*, commissioned by Engineers Canada and the Canadian Council of Technicians and Technologists. In some provinces, architectural technologists are governed by architectural professional associations rather than by professional associations of technicians and technologists.

residential and commercial buildings accounted for 5.5% and 4.6% of CO₂ emissions respectively.⁴⁵¹ The preponderance of these emissions pertained to heating and cooling needs. These estimates, it should be stressed, apply only to the *operation* of buildings; they do not reflect emissions caused by the manufacture of construction materials or by the construction process. When these factors are included, a significantly different view emerges. Cement, for example, is one of the most GHG-intensive construction materials, as well as one of the most widely used, accounting for 5% or more of GHG emissions internationally.⁴⁵² Demolition and removal also add to emissions, as well as waste management challenges. To determine the total impact of the built environment on emissions, many studies use a life-cycle model which takes into account the emissions involved in the manufacture of construction materials, the construction process itself, the operation of buildings, and the ultimate demolition and removal of buildings following the end of their usable life. These broader accounting frameworks put the contribution of buildings and the construction industry at around 30-40% of total GHG emissions. For example, the Commission for Environmental Cooperation, cites estimates using a broader framework indicating that buildings are responsible for 35% of GHGs emitted in Canada.⁴⁵³ This is consistent with the United Nations Environmental Programme (UNEP), which estimates the contribution of buildings to GHG emissions at 30-40%.⁴⁵⁴ Given these estimates, it is not surprising that the Intergovernmental Panel on Climate Change identified changes in the design and operation of buildings as providing the greatest opportunity for reducing GHG emissions.⁴⁵⁵

Measures to mitigate the effect of the built environment on GHG emissions are focused on the application of environmentally sensitive standards.

*Twenty-one countries, including most OECD jurisdictions have established at least one green rating system for new construction.*⁴⁵⁶

Building rating systems are central to efforts to mitigate the impact of the built environment on the natural environment. The Canadian Urban Institute summarizes five of the most widely used systems of rating buildings that currently operate in Canada:

⁴⁵¹ P.J. Partington and M. Bramley, 2010. *Canada's main sources of GHG emissions*, (Drayton Valley : Pembina Institute). Retrieved 25 March 2010 from <http://climate.pembina.org/pub/1966>

⁴⁵² Claudia Kruse, 2004. *IIGC Briefing Note: Climate change and the construction sector*, (London: ISIS Asset Management PLC)

⁴⁵³ Commission for Environmental Cooperation, 2008. *Green building in North America*, Secretariat Report to Council under Article 13 of the North American Agreement on Environmental Protection, (Montreal : CEC), p 22. A still broader accounting approach would factor in the impact of urban planning decisions on commuting patterns and modes of transportation.

⁴⁵⁴ United Nations Environmental Programme (UNEP), 2006. *Buildings and climate change: Status, challenges and opportunities*, (Paris: UNEP SBCI). It should be noted that the estimates generated by broader accounting frameworks are strongly sensitive to building materials used. In much of the world, concrete is the dominant construction material. While concrete is used extensively in Canada, it is still less predominant in Canada (and North America more generally) than in many other parts of the world.

⁴⁵⁵ Intergovernmental Panel on Climate Change, *Climate Change 2007 Synthesis Report*, based on Fig 4.2 at p 59.

⁴⁵⁶ UNEP, Buildings and climate change, p 137-138.

Figure No. 2. Building Rating Systems⁴⁵⁷

| System | Description | Rating Levels |
|---|--|---|
| Leadership in Energy and Environmental Design (LEED) ⁴⁵⁸ | Canada Green Building Council Evaluates new buildings and major renovations on the basis of five performance categories: site sustainability, water use efficiency, energy and atmosphere, materials and resources, and indoor environment. Points are awarded under each category. | LEED Platinum: 52-70 points LEED Gold: 39-51 points LEED Silver: 33-38 points LEED Certified: 26-32 points |
| Green Globes | Existing Buildings: Building Owners Management Association New Buildings: ECD Jones Lang LaSalle Green Globes evaluates building environmental performance in seven categories: project management, site, energy, water, resources, emissions and effluents, and indoor environment. The Green Globes system is derived from standards originally developed by the Canadian Standards Association. | Properties receiving a rating above 35% receive certification of one to four 'green globes'. |

⁴⁵⁷ Canadian Urban Institute, 2008. *Sustainable building: Canada on the move*, (Toronto : Canadian Urban Institute), based on Table 2, p.20. In addition to these rating systems, the International Standards Organization (ISO) is also developing standards for assessing the environmental performance of buildings. Information from International Standards Organization web site is available at: www.iso.org

⁴⁵⁸ In the US, the Green Building Council has established an urban planning standard – 'LEED for Neighbourhood Development (LEED-ND) which endeavours to operationize concepts of 'smart growth' and 'new urbanism', as well as green building principles to encourage sustainable land-use planning. This includes factors such as: proximity to existing infrastructure, brownfield remediation, and reduction of automobile dependency. The Canada Green Building Council intends to introduce a version of this standard in Canada on a pilot basis in 2010. Canada Green Building Council, Retrieved, 15 March 2010 from <http://www.cagbc.org/>.

| System | Description | Rating Levels |
|---------------|--|--|
| BOMA Go Green | <p>Building Owners Management Association</p> <p>Building performance is evaluated in ten categories: energy use, water use, construction waste, recycling, hazardous waste, material selection, ozone depletion, indoor air quality, HVAC maintenance, and tenant awareness.</p> | <p>Properties that meet all requirements receive Go Green certification.</p> |
| Built Green | <p>Built Green Society of Canada</p> <p>Evaluates sustainability based on: energy efficiency, indoor air quality, resource use (including waste management), and overall environmental impact. Relies on EnerGuide criteria for houses.</p> | <p>Platinum: 120 points Gold: 77 points Silver: 74 points Bronze 72 points</p> |
| Energy Star | <p>Natural Resources Canada</p> <p>Energy Star is an international energy efficiency standard that is administered in Canada by NRCAN. In construction, the objective is to improve energy efficiency in heating and cooling systems, ducts, windows, walls, ceilings and ventilation.</p> | <p>Energy Star homes exceed building code requirements for energy efficiency by approximately 30%.</p> |

LEED is perhaps the most widely publicized of the rating systems. A recent study of the cast-in-place concrete industry reported comments from the design sector that, in the near future, it would be impossible to obtain approval for a major commercial development that was not LEED certified. The study also reported that most of the leading engineering and architectural consultancies either had LEED

Accredited Professionals in their senior ranks or were in the process of securing accreditation.⁴⁵⁹ Public Works Canada now requires new federal buildings to be constructed to the LEED Gold standard or higher. Since 2001, the Canada Green Building Council has accredited more than 10,000 professionals.

The impact of building rating systems and current levels of 'green construction' should not be exaggerated. As of 2009, there were only 1,727 LEED-certified buildings in Canada. In 2009, the Canada Green Building Council certified 587 projects. Approximately two-thirds of these buildings were in the public sector.⁴⁶⁰ In 2009, the public sector accounted for approximately 37% of non-residential building construction. There are no estimates of the overall impact of rating systems on new construction in Canada or on the existing stock of buildings. However, in 2008, the Commission for Environmental Cooperation reported estimates that "green building currently accounts for about 2 percent of the new non-residential building markets in the United States and is expected to grow to between 5 and 10 percent by 2010. The estimates for green residential buildings are even smaller, at 0.3 percent of the market." The Commission commented that "in Canada, green building trends generally are considered to be similar to those in the United States."⁴⁶¹ Notwithstanding the current low levels of green construction, there are reasons to believe that the trend could change significantly in the near future.

One estimate suggests that applying green standards to new building construction and renovating existing buildings to green standards at the rate of 2.5% per year would raise three-quarters of the total building stock to green standards within 20 years.⁴⁶²

The Canadian Urban Institute confirms this conclusion. In a 2008 study, the Institute portrays the movement to green construction in Canada as approaching a 'tipping point': "In Canada... there are indications that the market for sustainable buildings is finally reaching a critical mass... decades of effort on the part of government policy makers and academia to establish new benchmarks for efficient buildings systems and codes are paying off."⁴⁶³ The potential impact of green construction on GHG emissions, therefore, is significant as would be the implications of green construction on both employment trends and skill requirements in the construction industry.

⁴⁵⁹ Prism Economics and Analysis, 2007. *Environmental scan of the Ontario concrete forming industry*, commissioned by the Ontario Cast in Place Concrete Development Council. (Toronto : Prism Economics).

⁴⁶⁰ Canada Green Building Council, Database of LEED Certified Projects. Retrieved 20 March 2010 from www.cagbc.org/leed/leed_projects/index.php

⁴⁶¹ Commission for Environmental Cooperation, *Green Building in North America*, p 17

A similar estimate for the United States is cited in United Nations Environmental Programme (UNEP) and ILO, 2008. *Green Jobs: Towards decent work in a sustainable, low-carbon world*. (Nairobi, Kenya: UNEP/ILO/IOE/ITUC) p 11. The report cites a study by the American Solar Energy Society which concluded that only 3 percent of building in the United States qualified for LEED certification.

⁴⁶² Robert Woodbury, Lyn Bartram, Ray Cole, Rosamund Hyde, Douglas MacLeod, David Marques, Thomas Mueller, Dana Vanier, 2008. *Buildings and Climate Solutions*, (Victoria, B.c. : Pacific Institute for Climate Solutions) p 5.

⁴⁶³ Canadian Urban Institute, *Sustainable building: Canada on the move*, p 4.

Construction Activity as a Source of Greenhouse Gas Emissions:

Environment Canada has published estimates of GHG emissions by sector. For the construction industry, these estimates consider only the impact of construction activity. That is to say, the estimates do not attribute to the construction industry the GHG emissions arising from either the manufacture of building materials or the operation of buildings. Figure No. 3 summarizes these data.

Figure No. 3 Greenhouse Gas Emissions by Source, Canada 1990 and 2006⁴⁶⁴

| | GHG Emissions | | GHG Emission Intensity | |
|-----------------------|-------------------|-------------|-------------------------|-------------|
| | Megatonnes of CO2 | | Kilograms of GHG/\$ GDP | |
| | Equivalence | | | |
| | <u>1990</u> | <u>2006</u> | <u>1990</u> | <u>2006</u> |
| Total | 592 | 728 | 0.84 | 0.66 |
| All Industries | 123 | 113 | 0.68 | 0.44 |
| Construction Industry | 3.78 | 3.11 | 0.08 | 0.05 |
| Construction Share: | | | | |
| Of Industry | 3.1% | 2.8% | | |
| Of Total | 0.6% | 0.4% | | |

As can be seen from Figure No. 3, in 2006, the construction industry accounted for approximately 2.8% of industrial emissions of GHGs and 0.4% of total emissions from all sources (including non-industrial). The construction industry's emission intensity was substantially lower than the average for industry as a whole. Moreover, intensity declined by 41% between 1990 and 2006. Estimates for the United States attributed a somewhat higher share of GHG emissions to the construction industry.⁴⁶⁵ These higher estimates may reflect the choice of base year, differences in estimation procedures, and (most importantly) differences between the economic structures of Canada and the United States along with differences in the cost fuel to operate vehicles and equipment.

To reduce GHG emissions caused by the construction process, the U.S. Environmental Protection Agency (EPA) places the greatest emphasis on more efficient use of energy in operating construction machinery. The principal steps recommended are: reduced idling of equipment, improved maintenance

⁴⁶⁴ Canada. Environment Canada, 2008. *Canada's greenhouse gas emissions: Understanding the trends, 1990-2006*, , Table 1 and Table 3, Retrieved 4 March 2010 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2008_trends/trends_eng.cfm#toc_2_4

⁴⁶⁵ U.S. Environmental Protection Agency, 2009. *Potential for reducing greenhouse gas emissions in the construction sector*, (Washington, D.C.: U.S. EPA), p 3. The report comments that "In 2002, the construction industry produced approximately 1.7% of total U.S. greenhouse gas emissions. Equivalent to 6% of total U.S. industrial-related greenhouse gas emissions, this quantity places construction as one of the top emitting sectors."

and driver/operator training, switching to biodiesel fuels, and improving energy conservation.⁴⁶⁶ The EPA also urges greater recycling of building materials, chiefly steel. While these measures have some implications for training of on-site construction workers, in the main, EPA's recommendations are focused on construction contractors and their front-line management.

Climate Change, Infrastructure and Human Resources Planning in the Construction Industry:

Among the more potentially profound impacts of climate are its possible effects on sea levels, the stability of the permafrost, the frequency of severe weather conditions, the water table, and natural drainage systems. There is a substantial Canadian and international literature on the potential impact of these consequences of climate change for both buildings and infrastructure. Much of this literature has been collected by the Public Infrastructure Engineering Vulnerability Committee, which is jointly funded by Natural Resources Canada and Engineers Canada.⁴⁶⁷

Climate science is an imprecise science. There is, therefore, no certainty about the scale, severity or timing of environmental developments.

Consequently, there can be no certainty about the scale, severity, or timing of the impact of climate change for on roads, bridges, harbours, water distribution systems and other infrastructure. It is impossible, therefore, to assess the labour market implications of these investments. On the basis of some scenarios, the requirements to upgrade and replace infrastructure would put considerable strain on the economy and would increase significantly the size of the construction industry and its labour force. Other scenarios imply more manageable pressures, similar to those that arise whenever there is a large bloc of construction work undertaken in a short period of time, e.g., construction for the Olympics or for the Pan-American games.

The effects of climate change on infrastructure investment are not easily separated from the broader need to upgrade and expand infrastructure. In the 1980s and 1990s, Canadian governments at all levels deferred infrastructure investments as they struggled to restore fiscal balance to the public sector. This underinvestment led to what many observers have termed an 'infrastructure deficit'.⁴⁶⁸ Over the past ten

⁴⁶⁶ U.S. EPA, *Potential for reducing greenhouse gas emissions*, p 29.

⁴⁶⁷ Public Infrastructure Engineering Vulnerability Committee maintains a website. Public Infrastructure Engineering Vulnerability Committee, Retrieved 10 January 2010 from www.pievvc.ca. Engineers Canada is the national confederation of the provincial and territorial professional associations that regulate the practice of engineering. Engineers Canada, Retrieved 12 January 2010 from www.engineerscanada.ca.

⁴⁶⁸ S. Mirza, 'Canada's Infrastructure Deficit a Sad Legacy for Future Generations,' *Municipal Leader*, Winter 2009. Other sources that deal with the accumulated infrastructure deficit include:

- Canadian Council for Public-Private Partnerships: www.pppcouncil.ca/issues_infraDeficit.asp
- Association of Municipalities of Ontario: www.amo.on.c
- Federation of Canadian Municipalities: www.fcm.ca
- Residential and Civil Construction Alliance of Ontario: www.rccao.com

years, most governments have significantly increased the resources they allocate to infrastructure investment. As a result, the share of engineering construction in total construction has increased from less than 30% twenty years ago to approximately 40% today. The construction industry accommodated this significant increase in infrastructure spending without apparent difficulty. This should be taken as evidence of the industry's capacity to adapt to changed demand conditions as long as those changed conditions can be forecast within the planning horizon that is required to recruit and train skilled labour and design professionals.

From a human resources planning perspective, the key question is whether the labour market demands arising from increased infrastructure investment can be anticipated in time for planning measures to prevent serious bottlenecks from undermining investment plans.

There are reasons to answer this affirmatively. As a result of work undertaken by the Construction Sector Council,⁴⁶⁹ Canada is now the recognized, international leader in monitoring and forecasting labour requirements in the construction industry.⁴⁷⁰ As well, two decades of investments in training centres have significantly increased the capacity of the construction industry to respond to changing demand conditions. In light of this planning capacity, it is unlikely that even a large increase in infrastructure investment would shock the labour market and put the supply of skilled construction labour under unsustainable pressure. The same is likely to be the case with engineering profession. Current enrolment trends in engineering, together with immigration of internationally trained professionals, means that the current supply of engineers is likely greater than the current needs of the Canadian economy.⁴⁷¹

From the perspective of human resources planning, the principal challenge will not be to meet labour supply requirements *per se*, whether for skilled trades or design professionals. Rather, the challenge will be to meet the specific skill needs that arise from adopting 'green construction' methods and principles. It is to this topic that we now turn.

Section 2: The Potential Impact of 'Green Construction' on Employment and Skills

⁴⁶⁹ Construction Sector Council. Information on the council is available at: www.csc-ca.org

⁴⁷⁰ The Construction Sector Council's labour requirements tracking system is described in a study by Douglas Watt, 2005. *The Labour Market Information (LMI) Program: Acting on human resource information to build and maintain capacity in the Canadian construction sector - Case study*, (Ottawa : The Conference Board of Canada). Retrieved 1 March 2010 from www.conferenceboard.ca/documents.aspx?did=1435

⁴⁷¹ Evidence of underemployment of engineering graduates and internationally educated professionals is discussed in Prism Economics and Analysis, 2009. *The Engineering and technology labour market – Final Report*, commissioned by Engineers Canada and the Canadian Council of Technicians and Technologists, (Toronto : Prism Economics).

Employment Implications of Retrofitting:

No studies were identified which explored whether ‘green construction’ principles *per se* increase or reduce labour requirements for *new* construction. Ultimately the determinants of employment in the construction industry, for a given level of investment spending, are the selection of building materials, the degree to which pre-fabricated components are used, and the degree to which on-site tasks are mechanized.⁴⁷² ‘Green construction’ principles affect employment through these factors. While it would be useful to the industry to better understand how ‘green construction’ principles might affect both the overall demand for construction labour and the trade-specific demand, this remains, to date, an unexplored issue.

Much more attention has been directed to the employment effects of retrofitting the existing building stock to meet higher energy efficiency standards. It should not be assumed, however, that significant amounts of retrofitting are currently being undertaken. With reference to the U.S., Joel Rogers comments that “the amount of retrofitting that goes on is tiny.”⁴⁷³ Rogers cites nine barriers that must be addressed before a significant increase in retrofit investments can be anticipated. These include: lack of access to capital, the muted incentives inherent in commercial tenancies which typically pass operating costs through to tenants, and alternative uses for capital (including public capital). Several studies estimate the employment impact of proposed incentive programs. Among the more widely cited studies is the estimated employment impact from a notional \$100 billion ‘green recovery program’, as advocated in a study published by the Center for American Progress.⁴⁷⁴ The study concluded that \$100 billion invested in a range of green initiatives, including building retrofitting, would create just under 2.0 million jobs. Roughly 50% of these jobs would be directly created, while the remainder would be indirect jobs (*i.e.*, jobs in supplying industries) or induced jobs (unrelated jobs created by multiplier effects).

A second U.S. study, prepared by Global Insight for the United States Conference of Mayors and the Mayors Climate Protection Centre projected that ‘green jobs’ would increase over the next 30 years at a rate of just slightly less than 6% per year.⁴⁷⁵ Between 2008 and 2018, growth would be at a rate of approximately 13% per year, albeit from a low base. The study concludes that ‘green jobs’ will account for 10% of new job growth over the next 30 years. Roughly 30% of this job growth arises from the

⁴⁷² Prism Economics and Analysis, 2004. *The Impact of Technology on the construction labour market*, commissioned by the Construction Sector Council, (Toronto: Prism Economics).

⁴⁷³ Joel Rogers, 2007. *Seizing the Opportunity (for Climate, Jobs and Equity) in building energy efficiency (Madison, Wisconsin : Center for Wisconsin Strategy)*, p1.

⁴⁷⁴ Robert Pollin et al., 2008. *Green Recovery: A Program to create good jobs and start building a low-carbon economy* (Amherst, Mass.: Washington, D.C.: University of Massachusetts. Political Economy Research Institute; Center for American Progress). A related study estimates ‘green job’ creation potential by occupation. See, Robert Pollin and Jeannette Wicks-Lim, 2008. *Job opportunities for the green economy: A state-by-state picture of occupations that gain from green investments* (Amherst, Mass.: Political Economy Research Institute at University of Massachusetts, Amherst).

⁴⁷⁵ Global Insight, 2008. *Current and potential green jobs in the US economy - green jobs in US Metro areas*, commissioned by The United States Conference of Mayors and the Mayors Climate Protection Center, p.17. Growth estimates are derived from Table 1.4.

construction of renewable power generating capacity. Retrofitting accounts for only 2% of the job creation. The European Trade Union Confederation (ETUC) modeled the employment effects of a range of policies to reduce GHG emissions. Construction was among the sectors studied. Unlike the previous studies, the ETUC examined only direct employment effects. The policies modeled range from compliance with current policy directives to the adoption of an aggressive plan to reduce 75% of GHG emissions in the residential sector. The direct employment effects on the construction industry are under 1% for the current policy option and over 10% for the aggressive retrofitting option.⁴⁷⁶

In Canada, the Federation of Canadian Municipalities cites an unspecified federal government report that investing in municipal building retrofits generates full-time equivalent jobs at the rate of one job per \$50,000 expended.⁴⁷⁷ The nature of the retrofit renovations is not described. Given that non-labour inputs account for around 50% of repair costs, this estimate could be high.⁴⁷⁸

The trades which are generally seen as benefiting disproportionately from retrofit investments are carpenters, electricians, plumbers and pipefitters, sheet metal workers, general labourers, insulators, and refrigeration and air conditioning mechanics.⁴⁷⁹ Mattera stresses that it should not be assumed that 'green jobs' will be good jobs. He stresses the need for 'green investment' to be linked to employment standards.⁴⁸⁰ A similar point is made in the UNEP study, *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*, which introduces the notion of a 'just transition' to a low-carbon world.⁴⁸¹

The foregoing canvass of employment impact assessments highlights the challenges in estimating the labour market effects of GHG mitigation investments.⁴⁸² Advocates of these investments often seek a high number. They may make aggressive, though arguably defensible, assumptions to achieve those numbers. Given the importance of understanding employment impacts, especially if labour market planning decisions are to be based on such forecasts, it may be helpful to review the complex issues that a credible forecast must address. The employment effects of investments in retrofitting depend on three

⁴⁷⁶ S. Dupressoir et al., 2007. *Climate Change and Employment: Impact on Employment in the European Union-25 of Climate Change and CO2 Emission Reduction Measure by 2030*, (Brussels: ETUC; Social Development Agency; Wuppertal Institute) p 146-159. Chapter Six focuses on the construction industry.

⁴⁷⁷ Federation of Canadian Municipalities, undated. *Municipal building retrofits: The business case*, Retrieved 10 March 2010, from http://gmf.fcm.ca/files/Capacity_Building_MBRG/MBRG_thebusiness_case_En.pdf

⁴⁷⁸ Based on W-level input-out tables for the Canadian economy, the non-wage share of input is 50%, where wages are deemed to include supplementary labour income, mixed income and other operating surplus. Statistics Canada, Input-Output Tables, 2006.

⁴⁷⁹ Penney, J. et al., 2007. *Skills for energy efficient construction: A Report on trades training for energy efficient buildings in the Greater Toronto Area*. (Toronto: Clean Air Partnership, Canadian Urban Institute, Toronto Training Board), p 18. See also in United Nations Environmental Programme (UNEP), 2008. *Green jobs: Towards decent work in a sustainable, low-carbon world*, Nairobi, Kenya: UNEP/ILO/IOE/ITUC. p 140.

⁴⁸⁰ Phillip Mattera, 2009. *High Road or low road? Job quality in the new green economy. A Report by Good Jobs First*, commissioned by Change to Win, Sierra Club, LIUNA, and Teamsters, (Washington, D.C.: Good Jobs First).

⁴⁸¹ Matera, *High road or low road?*. See especially Figure 1-1.1, p 40.

⁴⁸² A sharply critical assessment of the methodologies and conclusions used in a number of studies discussed above can be found in David Tuerck, Benjamin Powell, and Paul Bachman, 2009. *Green collar job creation: A critical analysis*. Boston: Beacon Hill Institute at Suffolk University.

classes of variables. The first of these are macroeconomic variables, most importantly the discount rate that is used to translate future cost savings into present values. The discount rate reflects assumptions about long-term interest rates and energy prices. Retrofit investments are only undertaken when the present value of future savings exceeds the cost of the investment. A second class of variables comprises assumptions about the breadth and intensity of retrofitting. The breadth of retrofitting is the amount of building space that is subject to retrofitting. The intensity of retrofitting refers to the types of renovations that are undertaken. At one end of the spectrum, retrofitting may be limited to caulking and sealing of air leaks. More intensive retrofitting may entail upgrading or replacing insulation. More costly still, is replacing or upgrading fenestration systems. And lastly, electrical and mechanical systems may be upgraded or replaced. Such measures could involve installing more efficient heating, cooling and ventilation systems or even installing such 'green technologies' as photovoltaics and water capture systems. The employment implications, both overall, and on a trade basis, depend on what types of renovations are undertaken and the scale of those renovations across the existing stock of buildings. And finally, a third class of variables includes assumptions about wage rates, labour productivity, the take-up rate on government incentives, and whether the retrofitting work is undertaken by the construction industry, by in-house maintenance staff of building owners, or by homeowners on a do-it-yourself basis. Some employment impact models also estimate multiplier effects, that is to say, jobs that are indirectly created by spending on retrofitting. In many cases, these multiplier estimates do not allow for the likelihood that spending on retrofitting is, to some degree, diverted from spending on other purposes. Hence, the multiplier effects are often larger than more cautious approaches would allow.

A study commissioned by the Green Energy Act Alliance, Blue Green Canada, and the World Wildlife Fund-Canada illustrates the complexities of forecasting employment impacts and the caution that should be exercised before accepting the conclusions.⁴⁸³ The purpose of the study was to estimate the job creation effect of Ontario's *Green Energy Act*. The study projects that the legislation will create 90,442 jobs. Almost 60% of these jobs are the result of multiplier effects. The directly created construction jobs are assumed to earn wages from \$17.84 per hour for construction labourers to \$24.56 for electricians. In 2009, the union rates for these occupations were more than double these amounts. The report also assumes civil engineers can be hired for \$31.37 per hour, which is significantly below the billing rate for a consulting engineer and also below the effective hour rate for an experienced staff engineer. Using less aggressive multiplier assumptions and more realistic wage assumptions would necessarily reduce the projected employment effects, perhaps significantly. Forecasts of this type may play an important role in policy debates. However, they are of little value to those engaged in human resources planning.

⁴⁸³ Robert Pollin and Heidi Garrett-Peltier, 2009. *Building the green economy: employment effects of green energy investments for Ontario*, sponsored by Green Energy Act Alliance, Blue Green Canada, and World Wildlife Fund Canada. The 1.5 multiplier is similar to that assumed in the U.S. by the Obama administration in estimating the employment effects of stimulus spending under the American Recovery and Reinvestment Act.

Skill Implications of 'Green Construction'- Design Professions:

In a 2002 article in *Canadian Architect*, Peter Busby notes the significant impact of construction on GHG emissions and concludes: “8,000 architects and 20,000 engineers control most of these processes. We can have an impact!”⁴⁸⁴ The skill implications of ‘green construction’ raise two questions. First, are design professionals taking up the additional professional training that is required to apply green building rating systems? And second, are the curricula of college and university programmes responding to the need for greater understanding of green design principles and green building rating systems on the part of design professionals?

For design professionals, one of the key implications of ‘green construction’ is the need for competence in the application of building rating systems and an understanding of the principles that inform those systems. Since these rating systems are evolving rapidly, there is also an implicit need for continuing professional development to maintain acquired competence. The need for competence in green rating systems is over and above the need for design professionals to be fully knowledgeable of mandatory standards, such as building codes and environmental regulations. Familiarity with mandatory standards is already a key component of professional licensure requirements. For technicians and technologists, the implications of ‘green construction’ are similar, though members of these professions ‘stamp’ a more limited range of technical drawings. Most low-rise, residential construction does not require a licensed architect to ‘stamp’ drawings. Consequently, much of the design work in this segment of construction – which accounts for 20-30% of total construction activity – is undertaken by architectural technicians and technologists. Increasing the impact of building rating systems on low-rise, residential construction necessarily involves achieving greater purchase for those systems in the technician and technologist segment of the design professions.

As noted earlier, there are already more than 10,000 Canadian professionals who are LEED Accredited Professionals (AP). This suggests a high degree of accessibility to accreditation. LEED AP status requires enrolment in a credential maintenance programme of 15-30 hours every two years. Recently, the Canada Green Building Council, which administers the LEED programme in Canada, has opted to apply an international standard for LEED certification. These new standards are structured into three tiers. At this time, the examinations are only available in English.⁴⁸⁵

The professional associations that regulate licensure for architectural design all require continuing professional development (CPD) as a condition for remaining licensed. CPD requirements typically

⁴⁸⁴ Peter Busby, 2002. “Building Kyoto: The design professions and the construction industry have much to contribute to meeting Canada’s Kyoto commitments”, *Canadian Architect*, January 7, 2002. Retrieved 11 February 2010 from <http://www.canadianarchitect.com/issues/story.aspx?aid=1000116244&type=Print%20Archives>

⁴⁸⁵ Canada Green Building Council website, as at April 8, 2011. Retrieved 8 April 2010 from www.cagbc.org

specify core topic areas for training. These include ‘energy and the environment’. In Ontario, the professional association has designated ‘sustainable design / green architecture’ as a core topic area.⁴⁸⁶ In Canada, the engineering profession is regulated on an all-disciplines basis. Consequently, the profession does not prescribe specific topic areas for CPD, in the manner of architectural associations. Moreover, while continuing competence is a professional requirement in all jurisdictions, some jurisdictions do not have specific CPD requirements. Nevertheless there is a range of CPD training that is accessible to engineers. The Engineering Institute of Canada is a federation of technical associations which promote CPD and designates quality providers.⁴⁸⁷ Additional research on engineering and policy issues is undertaken by the Canadian Academy of Engineering⁴⁸⁸, and more recently by the Ontario Centre for Engineering and Public Policy (OCEPP), which was established by Professional Engineers Ontario. Several recent editions of the Centre’s flagship publication address environmental issues.⁴⁸⁹ The Public Infrastructure Vulnerability Committee has examined the implications of climate change for engineering curricula.⁴⁹⁰

Within colleges and universities there has been a broad move to incorporate appropriate curriculum to equip graduates with the necessary knowledge of green design principles. In 2008, the Canadian Urban Institute commented that “having found willing partners within industry and the design community to devise and implement whole building rating systems, the public sector is now beginning to focus on creating capacity within the education system – both post-secondary and continuous professional learning – to ensure that there is proper follow through over the long term as well as an ability to translate theory into practice.”⁴⁹¹ Based on this canvass of published sources, it can be inferred that the systems of professional regulation and post-secondary education for the design professions are responsive to changing environmental norms. Further, the design professions are actively engaged in public discussions on the future direction of policy.

Skill Implications of ‘Green Construction’- Construction Trades:

For the skilled trades, the skill implications of ‘green construction’ primarily stem from engineering and architectural decisions on how buildings are to be constructed. Principally this affects the selection of building materials, the specification of electrical and mechanical systems, and the design of roofing systems and building envelopes. Energy conservation also has implications for the efficient sealing of the building envelope. The elimination of landfill waste has been a regulation-driven priority for the construction industry for some time, under the reduce-reuse-recycle principles which underpin

⁴⁸⁶ Royal Architectural Institute of Canada and various provincial architectural associations. Retrieved 10 April 2010 from www.raic.org

⁴⁸⁷ Information provided on the Engineering Institute of Canada. Retrieved 1 April 2010 from www.eic-ici.ca

⁴⁸⁸ Information provided on Canadian Academy of Engineering. Retrieved 10 April 2010 from www.acad-eng-gen.ca

⁴⁸⁹ Information provided on Ontario Centre for Engineering and Public Policy. Retrieved 12 April 2010 from: www.ocepp.ca

⁴⁹⁰ Jeff Walker, 2007. *Developing Engineering Curriculum Needs: Climate Change and Infrastructure*, commissioned by Infrastructure Canada.

⁴⁹¹ Canadian Urban Institute, “Sustainable Building: Canada on the Move”, p 4.

environmental regulations. There is awareness in the construction industry of the growing importance of environmental issues and environmental regulations. A survey reported by the Daily Commercial News, a Canadian construction industry publication, found that climate change was among the leading concerns of the plumbing industry.⁴⁹² A survey of residential heating and ventilation contractors in Canada found that 69% of employers were having difficulty recruiting workers who were familiar with environmental requirements.⁴⁹³ Some discussions of the skill implications make no mention of the role of the trades in construction. For example, a Canadian study comparing education benchmarks for homebuilders makes only passing reference to environmental factors and no mention of the new trade skills that might be necessary.⁴⁹⁴ The Canadian Urban Institute study, “Sustainable Building: Canada on the Move”, is similarly silent on the issue of trade skills, although, as noted, it commented on the need for appropriate green design skills.⁴⁹⁵ A special issue on sustainable building and construction in UNEP’s *Industry and Environment* makes only passing references to trade skill requirements.⁴⁹⁶ Other studies comment on the possibility of skill shortages in the construction trades acting as a constraint on ‘green construction’. For example, the Commission for Environmental Cooperation notes that “one impediment cited repeatedly by many during the Secretariat’s green building consultations, but not explored well in the literature and research, is rapid industry expansion threatening to compound the problem of the lack of experienced workers and thus increasing the risk of inexperienced or untrained service providers entering the green building market in search of a premium on their services.”⁴⁹⁷ The Commission, however, did not make any recommendations to address this gap in our understanding of the labour market implications of green construction. The view that the trade skill implications of green construction are poorly understood is also voiced by the European Trade Union Confederation, which comments that, with reference to residential retrofitting, that “the questions of human resources, underestimated by the majority of professionals concerned, are a significant hindrance to the transformation of the residential sector into distinctly less of a CO₂-emitting sector.”⁴⁹⁸

A study for the U.S.-based Apollo Alliance comments that “retrofitting American cities... requires not ‘green construction workers’, but rather workers with traditional construction skills who also have up-to-date training on energy-efficient construction.”⁴⁹⁹ The study argues against creating what it terms

⁴⁹²Patricia Williams, 2008. “Survey finds licensing, climate change among top concerns of worldwide plumbing industry”, *Daily Commercial News*, 6 October 2008, Retrieved 3 March 2010 from <http://www.dailycommercialnews.com/article/id30811>. Ten percent of survey respondents were Canadian contractors.

⁴⁹³ Prism Economics and Analysis, 2007. *A Labour market investigation of the HVACR Sector*, commissioned by the Construction Sector Council (Toronto : Prism Economics), Figure No. 25.

⁴⁹⁴Holmen Enterprises Inc., 2006. *Recommended national education benchmark for new home builders and renovators and assessment of provincial courses against the recommended benchmark*, commissioned by the Canadian Home Builders’ Association .

⁴⁹⁵ Holmen Enterprises Inc. *Recommended national education benchmark* .

⁴⁹⁶ Jill Wells, 2003. “Social aspects of sustainable construction: an ILO perspective”, *Industry & Environment*, Vol. 26, No. 2/3, p. 72-75. Special issue on Sustainable building and construction. Retrieved 18 October 2009 from http://www.unep.org/media/review/vol26no2-3/vol26_no2-3.htm

⁴⁹⁷ Commission for Environmental Cooperation, *Green Building in North America*, Secretariat Report to Council under Article 13 of the North American Agreement on Environmental Protection, 2008, p 56.

⁴⁹⁸ Dupressoir et al, *Climate change and employment: impact on employment in the European Union-25*, p 159.

⁴⁹⁹ Sarah White and Jason Walsh, 2008. *Greener pathways: jobs and workforce development in the clean energy economy*, Center on Wisconsin Strategy, The Workforce Alliance, The Apollo Alliance, p.16.

“boutique’ programs divorced from broader workforce development efforts.”⁵⁰⁰ A similar view is advocated in a study by the GHK consultancy for the European Employment Observatory. The authors comment that green jobs in the construction trades, will entail “the same generic skills of those already in the building sector... but jobs will require an ‘add-on’ in terms of *e.g.*, renewable energy knowledge, installation, [and] diagnostic techniques.”⁵⁰¹ This is consistent with the view expressed by UNEP that “many existing jobs (especially such as plumbers, electricians, metal workers, and construction workers) will simply be redefined as day-to-day skill-sets, work methods and profiles are greened.” The report continues: “It goes without saying that this last aspect is by far the hardest to document and analyze, and the hardest for which to foresee the full implications.”⁵⁰²

B.C.’s Residential Construction Industry Training Organization, which operates under a mandate from the province’s Industry Training Authority, states in its current *Service Plan* that “green building will be a major component of residential construction in the next decade.” The *Service Plan* comments on the “need to address ‘green building’ competencies within our apprenticeship programs.”⁵⁰³

There are two dimensions to introducing “green construction” training to the construction trades. The first is incorporating ‘green construction’ principles and methods into the training standards for apprentices. The second is providing upgrade training to persons who have completed their trades training.

Training for apprentices is governed by training standards that are based on a National Occupational Analysis (NOA), which is undertaken by the industry with federal government support. The focus of an NOA is on the job tasks and skills that are broadly needed by members of the trade. An important consequence of this approach to establishing trade standards is that the standards can be slow to accommodate emerging skill requirements, since these often lack the ‘critical mass’ to warrant a change in the NOA.⁵⁰⁴ This conservatism in the process of establishing and amending trade standards has led some ‘green industries’ to pursue training and certification strategies outside the framework of the established construction trades. An important example of this in Canada is solar photovoltaics where the industry has

⁵⁰⁰ White and Walsh, *Greener pathways*, p 47.

⁵⁰¹ GHK Consulting Inc., 2009. *Thematic Expert Work on green jobs for DG, EMPL/D1* (Brussels: European Employment Observatory), p. 33.

⁵⁰² United Nations Environmental Programme (UNEP), *Green jobs: Towards decent work*, p 43.

⁵⁰³ Residential Construction Industry Training Organization, 2007. *Service Plan 2007/08 – 2009/10*, (RCITO) p. 3, Retrieved 11 March 2010 from www.itabc.ca/AssetFactory.aspx?did=583

⁵⁰⁴ One study notes that: “Apprenticeship training is based on an analysis of current skill requirements. The analysis is oriented toward representative or typical skill requirements. Emerging skills do not have the breadth of current usage to meet the test of a ‘current skill requirement’... By the time an emerging skill requirement becomes sufficiently widespread to be a commonly required skill, five to ten years of new entrants into apprenticeship will have passed through the system without training in those skills.” John O’Grady, “Apprenticeship in Canada: Issues and Problems”, remarks *to Annual Conference on Vocational and Technical Education, Canadian Vocational Association*, 19 October 1977, Retrieved 20 November 2009 from: www.ogrady.on.ca

developed training and industry-based certification outside the established trades system and delivers training through private trainers and colleges.⁵⁰⁵

A Toronto study, sponsored by the Clean Air Partnership Fund, the Canadian Urban Institute, and the Toronto Training Board, reflects the tension between incorporating ‘green construction’ skills into existing trades or establishing ‘niche trades’ parallel to, or outside, the established trade system. The study was based on a canvass of construction industry members.⁵⁰⁶ The study noted that “anecdotal reports suggest that some energy efficient building designs fail to perform as predicted, and that some of the shortfall may be due to inadequate knowledge and skills among the trades who execute the designs or operate the systems that have been installed.”⁵⁰⁷ In the main, the study concluded that the most appropriate training strategy was one that built on existing trade skills, rather than one which endeavoured to displace the construction trades with new ‘green trades’.⁵⁰⁸ However, the study acknowledged that new trades were emerging which are related to green construction strategies. These include: external insulation finishing systems mechanics, solar installers, geothermal installers, and green roof specialists. To some degree, the emergence of these ‘niche trades’ reflects a failure of the established trades to adequately address the new skills required by green technologies. The study commented that “rather than struggle to get the training system to integrate these skills, associations such as the Canadian Solar Industries Association and the Canadian GeoExchange Coalition have begun their own training and certification programs.”⁵⁰⁹

For the established construction trades, the Toronto study identified two types of skill requirements. The first is a general overview of energy efficient and sustainable construction and how these green construction strategies can contribute to reducing the threat from climate change. The second requirement is for skills that are trade-specific and often task-specific. The study also commented on “the dearth of training for building maintenance and operations staff in Ontario.”⁵¹⁰

The Toronto study found that energy efficiency training was delivered through a number of channels, including colleges, union training centres, private trainers, and technology suppliers. The study noted the lack of recognized standards and certifications. At the same time, the study also commented that “the major barrier to expanded energy efficiency training for the trades is that the demand for energy efficient buildings is not yet sufficient to trigger the requisite changes in the training systems.”⁵¹¹ The Toronto study raises important questions about the role of policy in driving the adoption of energy efficient technologies in buildings and the equally important role of policy in establishing appropriate competency

⁵⁰⁵Canadian Solar Industry Association, Retrieved 2 November 2010 from www.cansia.ca

See also the website of the Solar Academy. Retrieved 2 November 2010 from www.solaracademy.ca

⁵⁰⁶ Penney, *Skills for Energy Efficient Construction*.

⁵⁰⁷ Penney, *Skills for Energy Efficient Construction* p7.

⁵⁰⁸ A similar conclusion was reached by another Training Board. See Elgin-St. Thomas Labour Force Development Strategy – Final Report, February 26 2010, p. 11, Retrieved 5 April 2010 from [www.localboard.on.ca/localboard/english/Labour Market Information/Elgin Labour Force Development Strategy.pdf](http://www.localboard.on.ca/localboard/english/Labour%20Market%20Information/Elgin%20Labour%20Force%20Development%20Strategy.pdf)

⁵⁰⁹ Penney, *Skills for Energy Efficient Construction* p 19.

⁵¹⁰ Penney, *Skills for Energy Efficient Construction*,p 20.

⁵¹¹ Penney, *Skills for Energy Efficient Construction*, p 5.

standards and certifications for tradespersons and contractors. In a similar vein, a U.S. study undertaken by the Sierra Club and a consortium of unions advocates that access to government monies for retrofitting be linked to support for labour standards, training and apprenticeships thereby linking green construction spending to broader trade union goals.⁵¹² A number of construction unions are developing upgrade training to provide addition 'green construction' skills to their members. The International Brotherhood of Electrical Workers (IBEW), for example, has introduced a 75-lesson course on 'green building' fundamentals. Among the topics addressed in the course are: energy efficiency principles, photovoltaics, wind systems, programmable logic controllers, fuel cells, power quality and building automation. The union has established a dedicated web site to address issues arising from "work green".⁵¹³ In the piping trades, the International Association of Plumbing and Mechanical Officials (IAPMO), the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada (UA), and Green Plumbers are collaborating on the development of training programs and accreditation. The UA also maintains a dedicated website to address 'green construction' issues.⁵¹⁴ In addition to training delivered through union training centres, colleges are also developing and delivering a range of courses on 'green construction' methods. A 1997 study shows that the colleges have been responsive to the need for 'green construction' skills for a considerable period of time.⁵¹⁵

The manner in which skills are certified – whether trade skills or professional skills – is an important issue for public policy. A U.S. study has identified occupational certification as one of the important trends in the contemporary labour market.⁵¹⁶ While skill certification has a broader labour market importance, it is also relevant to any discussion of the labour market implications of strategies to mitigate climate change.

Section 3: Gaps in Our Understanding of the Impact of Climate Change on Employment and Skills Requirement in Construction

The preponderance of the literature on climate change deals with its potential consequences for arable land use, the sustainability of resource-based industries, the vulnerability of the built environment to increased occurrences of extreme weather conditions, and the risks to coastal settlements of rising sea levels. The potential implications for the labour market of measures to adapt to climate change or

⁵¹² Mattera *High Road or Low Road?*

⁵¹³ IBEW, *Welcome to Working Green*, Retrieved 10 October 2009 from www.ibew.org/workinggreen/index.htm.

⁵¹⁴ UA, *The UA's Green Initiative*, Retrieved 9 November 2010 from www.ua.org/green.asp.

⁵¹⁵ Prism Economics and Analysis, 1997. *A National inventory of training resources for carpenters*, commissioned by the National Industrial Adjustment Committee of the Carpentry Craft, March 1997. The study identified 392 courses in emerging or technology-related areas pertinent to the carpentry trade. Of these 85 were described as 'green construction' courses.

⁵¹⁶ Morris M. Kleiner, 2006. *Licensing occupations ensuring quality or restricting competition* (Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research). There are two distinct modes of certifying occupation. Licensure restricts practising an occupation to a person who is licensed by a body statutorily mandated to regulate an occupation. Restricted title allows only persons certified by a professional body to use a particular designation. This may be protected by copyright law or by specific statute. Kleiner estimates that the proportion of the U.S. labour force covered by occupational certification systems increased from 4.5% in the 1950s to approximately 20% by 2006.

mitigate its effects have only recently drawn the attention of researchers. The potential labour market effects of climate change depend to a large degree on policy decisions, especially those labour market effects that arise from efforts to mitigate climate change. Labour market effects fall broadly into two categories – changes in the pattern and trajectory of employment across and within industries or sectors and changes in skill requirements. The human resources planning problems pertain to the capacity of institutions to adequately gauge changes in employment trends and skill requirements and to respond to those changes with appropriate adjustment programs and human capital investments.

The first key finding of this review is that relatively little research has been undertaken on the magnitude of public and private investments that may be required to update or replace infrastructure that could be stressed or made redundant by climate change. A consequence of this is that relatively little is known about the potential consequences of such investments for employment trends in the construction industry. That being said, the review noted that the Canadian construction industry is the international leader in managing technical systems that support informed human resources planning. The industry also has a highly developed capacity to design and deliver training that will meet its requirements for skilled labour. Similarly, both the post-secondary system and professional associations in architecture, engineering and technology have responded to changing professional competency needs in these fields.

The second key finding is that currently available estimates of the employment impacts of green policies, including retrofitting, fall significantly short of the rigorous validation that is required to support properly informed human resources planning decisions.

The third finding is that building rating systems play an important role in shaping how ‘green construction’ principles are applied to new construction projects and, to a lesser degree, to retrofitting. The link between these building rating systems and their implications for the selection of construction methods and materials and the resulting skill requirements has been insufficiently investigated. It may also be important to study the institutional characteristics of building rating systems and the degree to which appropriate accountability and validation standards are maintained.

The fourth finding is that while some construction trades have taken steps to incorporate the skill implications of ‘green construction’ into trade standards and trade skills, this trend is limited. More work along these lines appears to have been done in the U.S., though the Canadian affiliates of international construction trades unions are able to draw on this work. Part of the reason for the lag in introducing ‘green construction’ skills into mainstream trade standards is that the current demand for such skills is still a ‘niche market’. Credible insights into how the demand for such skills is likely to unfold would be helpful. The college system has been an early introducer of programs to meet emerging needs for ‘green construction’ skills.

The fifth finding, and it is potentially important for some construction trades, is that the lag in incorporating ‘green construction’ skills into trade standards is prompting some ‘green industries’ to

establish training and certification outside the mainstream trade system. From a policy and research perspective, the issue is when changes in skill requirements should be accommodated within existing occupations and certifications and when they should lead to the creation of new occupations and new certifications.

A sixth and related finding is that green certifications are playing an increasingly important role in professional qualifications in the design professions. This raises questions about the relationship of those certifications to the bodies which are mandated by statute to regulate professional practice and how certifying bodies should be accountable for their standards and their administration. It would also be useful to have an international context in which to review emerging Canadian trends.

Understanding climate change and the steps that will be needed to mitigate it or adapt to its effects are among the leading policy and research challenges of our day. The labour market, and in particular, the construction labour market, is an important area which has largely been outside the scope of most research. There is a pressing need to develop a relevant research agenda.

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CONCLUSION: WHAT DO WE NEED TO KNOW? A RESEARCH AGENDA

Carla Lipsig-Mumme

Labour market effects of climate warming fall broadly into two categories - changes in employment patterns across industries and within industries and sectors; and changes in skill requirements. The factors which structure the ways in which a particular industry, sector or subsector responds to climate warming however, emerge from the political economy of the sector.

The principal areas and questions that should guide the setting of the next research agenda include:

1. Research is urgently needed to identify the impact of a move towards a 'greener' economy on employment trends and skills requirements, in industries, sectors and sub-sectors.
2. Can the impacts of climate warming be differentiated from changes in employment due to other political economic transformations?
3. In some sectors (i.e. forestry and tourism), climate warming may bring a shift in the geographic location of work. Can models that have been developed by climate science to predict regional shifts in the location of work, be used to assess the impact of such shifts on geographic patterns of employment? A review of international practices would be useful.
4. Research is needed to provide more precise forecasting of employment trends and specific skills requirements, both in relation to climate warming and linking climate warming to broader changes in sectors.
5. How important is the lag in incorporating 'green' skills into training standards?
6. How different are the jobs needed in key 'greening' sectors such as renewable energy from the jobs now required in traditional energy sectors?
7. What is the spectrum of actual response to the impact of climate warming in the workplace, among large, medium and small business in Canada? Among trade unions? Among governments at all levels? What role does the introduction of new technology play?
8. Green skills are playing an increasingly important role in occupations and professions related to construction. What impact does this have on the bodies that regulate professional practice?
9. There is need to identify international and national best practice: in government action to facilitate fast and affordable sectoral greening; and in the introduction of 'green' skills requirements.
10. Research is needed to identify provincially and nationally the organizations and which resources that will mobilize community and workforce actors to develop and implement green work practices and training.

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