CHAPTER 7

CONSTRUCTION AND CLIMATE CHANGE: OVERCOMING ROADBLOCKS TO ACHIEVING GREEN WORKFORCE COMPETENCIES

JOHN CALVERT

INTRODUCTION

The critical role of labour in addressing climate change has been neglected in recent research. While the expanding literature on climate issues has identified a wide range of measures to mitigate and, subsequently, to adapt to the projected rise in global temperatures, it has generally taken for granted that the workforce will be able to implement such measures effectively. But this is not a given. The Canadian construction sector has the potential to make a key contribution to reducing greenhouse gas (GHG) emissions and energy use. However, it has major gaps in training and skills development that compromise its ability to do so. Canada's system of apprenticeship remains focused on traditional competencies while paying little attention to providing workers with the skill sets and knowledge necessary to implement low-carbon construction in the built environment. The increasing focus of the federal government – and a number of provinces – on the traditional training needs of resource extraction industries has further impeded this transition. Rather than adopting policies to ensure that construction workers have the skills to retrofit the existing building stock, and to build new, more energy-efficient structures, industry training investments are increasingly being targeted at the trades that oil, gas, and mining corporations need.

Work in a Warming World, edited by Carla Lipsig-Mummé and Stephen McBride. Kingston: School of Policy Studies, Queen's University. © 2015 The School of Policy Studies, Queen's University at Kingston. All rights reserved.

Reversing these developments will not be easy. It will require governments to adopt a different policy agenda, one that challenges the market-driven approach currently shaping Canada's construction training system. It will also require a commitment to workforce development based on the understanding that low-carbon construction requires higher levels of training and a profound cultural change in the industry in which building workers – and the unions that represent them – view climate objectives as a fundamental part of their role in the industry.[1]

CONSTRUCTION AND GLOBAL WARMING

The construction industry is a major component of Canada's economy. It employed 1.3 million people and accounted for $113 billion of economic activity in 2012, or approximately 7.2 percent of the nation's gross domestic product (Statistics Canada 2013), and it employed 7.4 percent of the country's workforce at the beginning of 2013 (Statistics Canada 2014b). The industry and its workforce have grown considerably over the past decade despite the impact of the 2007–09 recession, and BuildForce Canada (formerly known as the Construction Sector Council, or CSC) predicts further significant expansion in the coming years.[2] However, the pattern of expansion has varied both by sector of construction and by geographic location. Much of this expansion has reflected Canada's increasing reliance on resource extraction industries, principally oil, gas, and mining, as well as related infrastructure developments. Geographically, the expansion has been most pronounced in Alberta, British Columbia, Saskatchewan, parts of the north, and Newfoundland and Labrador, with a projected total job gain of 44,000 building workers in non-residential construction in Canada by 2021. In contrast, residential construction investment and employment has remained – and is projected to remain – relatively flat, with a modest decline of 8,000 jobs by 2021 (CSC 2013).

Energy production in the tar sands and in the emerging gas-hydraulic-fracturing ("fracking") and related liquefied-natural-gas-processing industries, along with the infrastructure needed to support these activities, relies on a well-trained construction workforce. The tar sands can be described as one huge construction site. It employs large numbers of skilled building trades workers, some of whom have skills and training applicable to many different kinds of construction projects, while others have skills largely dedicated to working in the energy sector. Given their need for skilled trades workers, the large oil and gas corporations now play a major role in shaping federal- and provincial-government training priorities in the construction sector, including exercising considerable influence on many of the organizations that play a role in providing and overseeing training. They have also established strong ties with some of the key building trades unions whose members depend on employment in the resource sector.

What is perhaps most striking about these developments is the lack of concern by either the industry or governments about the long-term climate impacts of Canada's pattern of construction expansion and, particularly, the resulting qualifications profile of the construction workforce, with its growing dependency on skills used primarily in the resource extraction sector. Workforce training and skills development are being skewed toward servicing the demands of the resource industries, independent of any recognition of the need to reduce climate impacts in the one sector where gains are most promising: the built environment.[3] This is not a result of lack of information about the opportunities in the built environment. For the potential gains – both in climate change mitigation and employment creation – from aggressive investments in this sector of construction are well researched and well understood, around the world, as evidenced by the work carried out by the Intergovernmental Panel on Climate Change (IPCC), United Nations Environment Programme (UNEP), International Labour Organization (ILO), European Union, and numerous other organizations.

Domestically, BuildForce Canada, which has focused much of its attention on the needs of the energy sector, has also sponsored research on opportunities to implement low-carbon construction (CSC 2011). The construction industry's support for the provision of additional resource-focused training and skills development reflects the influence of the energy and mining corporations and their successful efforts to have the Canadian government base much of its economic strategy – and the training required to achieve this strategy – on expanding resource exports.

A fundamental transformation of Canada's construction industry focusing on green construction in the built environment is urgently needed. But this is contingent on larger changes in Canada's overall economic strategy, including reducing Canada's reliance on fossil fuel exports. In the present political climate, such changes appear unlikely, at least in the immediate future. However, in the longer term, and assuming that the scientific projections of incrementally rising global temperatures prove accurate, an economy that depends on continuous expansion of energy-intensive resource exports will be increasingly difficult to sustain. Whether sooner or later, governments – and the construction industry – will need to focus much more attention on what can be done to cut energy use and GHG emissions in the built environment.

It is the focus of this chapter to examine some of the challenges that the industry and, more specifically, its workforce currently face in making this transformation and to suggest some modest policy changes that will facilitate this process. Thus, the chapter does not address the big-picture issue of what will be needed to redirect the overall economic priorities of the federal and most provincial governments. Nor does it deal with the difficult question of how to supplant the political and economic priorities

of the fossil fuel industry with a policy framework that takes account of the real threat that global warming poses to Canada.

Rather, it focuses, more narrowly, on questions associated with what needs to be done to facilitate the implementation of a training and skills development agenda that will make it easier to implement green construction in the built environment in the coming years. Clearly, implementing this narrower agenda will be contingent on the big-picture changes noted above. But even if or, perhaps more optimistically, when these big-picture changes take place, it will still be necessary to address the practical questions of how to ensure that the construction industry and, specifically, its workforce is up to the task of implementing low-carbon construction.

The reason this chapter focuses on the built environment is because of its significant potential to mitigate climate change. Buildings produce an estimated 30 to 35 percent of GHG emissions. They also account for almost 40 percent of energy use. A recent study by the ILO, which examined the potential for reducing GHG emissions and energy use in the world's major economies, concluded,

> Of all the elements that constitute society, buildings are the biggest consumers of energy and the largest emitters of greenhouse gases. Yet, the building sector also has the highest potential for improving energy efficiency and reducing emissions. Many investments in resource-efficient buildings are cost effective and the large stocks of older and inefficient buildings, notably in industrialized countries, mean that placing greater emphasis on renovation could yield substantial environmental benefits. (ILO 2012, 127)

Of course, the built environment consists of a wide variety of different structures and buildings, including individual residences, low- and high-rise apartments, commercial premises, office buildings, factories, industrial plants, hospitals, schools, public facilities, resource extraction projects, and numerous other elements. There is no simple, cookie-cutter template for reducing its climate impact. The challenge is complex. At a minimum, cutting energy use and GHG emissions in the built environment involves designing and introducing energy conservation systems in new buildings. More significantly, it also involves developing appropriate measures to facilitate the wholesale retrofitting of the existing building stock.

Over the past two decades, since concerns about climate change began to emerge, there has been growing interest in low-carbon construction among environmentally conscious developers, architects, engineers, general contractors, policy researchers, and climate activists. However, much of this interest has focused on new construction. In the long term, given the life expectancy of most new construction, ensuring that new building projects have a much-reduced climate footprint must be a major priority. However, retrofitting the existing building stock presents much

larger opportunities for energy savings and GHG reductions in the near and mid-term time frame. In its 2007 examination of the building sector, the authors of an IPCC report on climate change mitigation noted, "Over the whole building stock the largest portion of carbon savings by 2030 is in retrofitting existing buildings and replacing energy-using equipment due to the slow turnover of the stock" (Levine and Ürge-Vorsatz 2007, 389).

This is because new construction represents only a very small proportion – about 1.5 percent – of the existing stock of buildings each year. Consequently, retrofitting existing buildings is critical to achieving effective climate change mitigation (UNEP 2009).[4] However, this is a major challenge because of the wide variations in the type, age, and quality of Canada's existing building stock. Effectively retrofitting the built environment is a particularly daunting task – one that will require ongoing investments in research, new technologies, and, from the narrower perspective of this chapter, extensive workforce training and skills development to give the industry – and its workers – the capacity to implement low-carbon construction on the job site. It will also require a major shift in public policy to facilitate a fundamental reorientation of the industry.

Of course, the focus of this chapter – implementing major changes in the skills profile of the workforce – can take place only in the context of a larger industry transformation; this involves every step in the supply chain – from the decisions made by those who commission and purchase new construction services and renovations; through the work of the architects, planners, and engineers who design (or renovate) the buildings; to the general contractors and subcontractors who oversee the projects; and, finally, to the skilled tradespeople and labourers who actually carry out the work on building sites.[5] At each stage of this process, the industry needs to implement the most effective and technologically advanced low-carbon construction innovations. And all those who work in the industry must be trained for and committed to the same objective. In the words of the IPCC report noted above, it will require "very significant efforts to enhance programmes and policies … well beyond what is happening today" (Levine and Ürge-Vorsatz 2007, 390).

CANADA'S EXISTING TRAINING SYSTEM IS INCAPABLE OF TRAINING THE WORKFORCE IN LOW-CARBON CONSTRUCTION TECHNIQUES

A major impediment to achieving low-carbon construction is Canada's fragmented, under-resourced, and poorly regulated system of construction industry training. Put simply, the current training system and, consequently, the current workforce is not up to the job. It not only lacks the capacity to provide the green skills required for low-carbon construction; it also does not have the ability to provide adequate training for much of the work currently being done in the industry. An industry that fails

to address its current training requirements is an industry that does not have a workforce capable of implementing green construction either, particularly because green construction requires higher levels of skills and training, a point to which we shall return later in this chapter.

Of course, criticisms of the construction industry's existing training system are not new. The weaknesses in Canada's training and apprenticeship system have been widely noted – not only by critics of the industry but also by many of its major players, including federal and provincial governments, developers, and numerous construction firms. It is not accidental that the industry has pushed the federal government to encourage recruitment of large numbers of skilled trades workers from other countries to fill the skills gap in Canada's construction workforce. At the beginning of 2014, for example, the BuildForce website provided no fewer than 14 publications to help employers recruit foreign trades workers – a reflection of the industry's unmet demand for skilled construction workers. (In comparison, the website provides one survey paper on greening residential construction.)

Virtually all construction in Canada, including that carried out in the built environment, is a private sector activity. The economic interests of the purchasers of construction services, the developers who commission these services, and the contractors who deliver these services shape and control virtually all aspects of what is built, who builds it, and how it is built. Even when government is the purchaser of construction services, private firms carry out the actual work.

This is not to deny that there is extensive public regulation of many aspects of construction projects. There are detailed building codes, fire safety regulations, electrical codes, plumbing standards, engineering requirements, and policies requiring the use of specific construction materials, to cite only a few of the numerous regulations in force. There is public oversight of planning and development by applying provincial and municipal zoning regulations, which influence – at least to some degree – what is built and where it is built. However, in practice, the construction industry, through the operation of the private market, exercises considerable influence over much of the public regulation that exists, ensuring that most regulation is industry friendly in that it accommodates the industry's focus on maximizing profits and minimizing regulations that would challenge this basic objective.

Consequently, widespread implementation of low-carbon objectives in new construction has been slow and erratic, depending largely on the market-driven preferences of developers and the willingness of purchasers to invest in energy conservation, helped along by modest regulatory changes brought in by various levels of government. Progress on renovating the existing building stock has been even slower, a reflection, in part, of the industry's market-based approach, which is strongly resistant to public planning and public regulation.[6]

It is true that some municipal planners, developers, architects, and engineers are attempting to introduce greener building practices. Municipalities and provinces have strengthened their building codes. There are now a variety of climate-friendly standards for the built environment, such as LEED (Leadership in Energy and Environmental Design), BOMA (Building Owners and Managers Association), Built Green, Green Globes, ISO 14001, and Passive House, to name some of the more widely used systems. But these initiatives are not mainstream. They are also voluntary. They rely on the decisions of building purchasers, owners, and developers, who, overwhelmingly, still base their choices on the perceived costs and benefits of such innovations. Moreover, being voluntary, there are also major questions about how effectively these innovative approaches are being implemented and monitored. And there are concerns that some of these innovations are little more than green sales and marketing strategies.

Regardless of the efforts of some in the industry to promote greener construction, there remains an enormous gap between what needs to be done and what the construction industry, as currently organized, can deliver. Competition, based almost exclusively on low bid, results in a race to the bottom as firms strive to obtain work by cutting corners on design, materials, technology, and, not inconsequentially, labour. Rather than upward pressure encouraging adoption of the highest environmental standards, unregulated price competition results in the opposite: pressure to adopt the minimum standards that will succeed in a competitive market (Barrett 1998; Bosch and Philips 2003; Prism Economics & Analysis 2010). While this focus may satisfy the economic interests of most of the industry as presently constituted, it does not provide the basis for low-carbon construction.[7]

Industry reluctance to implement greener construction is reinforced by a culture strongly committed to the free market and hence highly resistant to attempts by governments to introduce more directive public regulation, whether of planning, design requirements, engineering standards, tougher building codes, demolition protocols, new technologies, or mandated workforce training and skills qualifications.[8] The industry is normally willing to accept such changes only when they do not impose major costs, can be introduced with minimal disruption to its activities, and do not otherwise interfere with its profit-maximizing objectives (Bosch and Philips 2003).

Relying on free market principles means that the industry's labour market is also poorly regulated. Fluctuations in the business cycle, as well as seasonal weather changes, result in a boom-and-bust pattern of building activity and employment. These changes are much more dramatic than in most other sectors of Canada's economy, and they are exacerbated by the reluctance of governments to play a larger role in addressing fluctuations in the construction market through anti-cyclical policies. This

makes building projects risky. The way the industry deals with risk is largely through subcontracting (Bosch and Philips 2003), a practice that enables developers and contractors to reduce their exposure to cyclical fluctuations by increasing, or decreasing, the volume of subcontracts as demand fluctuates. It also enables them to reduce the risk of equipment and facilities lying idle by shifting responsibility for capital investments to smaller operators. Because they do not employ their subcontractors' workers, developers and general contractors minimize their employment obligations, transferring the costs of downturns to smaller subcontractors, their employees, and the large number of owner-operators.[9]

Labour market flexibility is achieved largely at the expense of the workers, who face periodic and unforeseen unemployment, whether directly as employees or indirectly as self-employed owner-operators. Aside from creating income and work insecurity, precarious employment undermines long-term attachment to the industry. Instead of having a career, many workers – particularly young apprentices – are forced to abandon the industry during downturns to seek work in other sectors of the economy, from which they often do not return. High labour turnover means that the industry loses valuable skills and squanders a significant part of its – and its workers' – investment in training. It is a hugely wasteful and, arguably, socially irresponsible approach to labour force development.

The extensive use of subcontracting also results in a very fragmented industry structure. While there are a number of very large contractors, especially in resource extraction, infrastructure construction, and the industrial, commercial, and institutional (ICI) sector, the industry is overwhelmingly composed of very small firms or individual owner-operators. Fully 89 percent of employers have 20 or fewer workers, and 61 percent have fewer than five (O'Grady 2005; Hamilton-Smith 2010).[10] Even in larger projects, including the tar sands, extensive subcontracting is the norm.[11]

These various industry characteristics make it difficult to provide an effective training system. Small contractors and subcontractors normally do not have the qualified journeypersons or other resources to support apprentices. Larger firms with the capacity to do so are often reluctant because of the cost and the uncertainty of future work contracts. Moreover, there is nothing preventing competing contractors who have made no investment in training from poaching newly qualified workers. As we shall discuss further in this chapter, unions have addressed this problem by reaching multi-employer agreements, while Quebec has established a statutory framework that requires employers to support training. But this is an option that most of the industry in English Canada does not support. Outside Quebec, governments have not been prepared to require contractors to support training financially. Nor have they required them to take on apprentices. Government efforts to address skills shortages have generally used indirect approaches involving carrots such as subsidies to employers or tax breaks for workers, measures that have been largely

ineffective (Hamilton-Smith 2010). Given this situation, it is perhaps not surprising that Canada's construction industry has not been very successful in developing a workforce capable of achieving the transition now required to cope with global warming.

BARRIERS TO EFFECTIVE GREEN TRAINING

While many factors have contributed to Canada's construction training crisis, it is possible to highlight three in particular that are major impediments to creating a workforce with appropriate green skills. The first is the impact of the underground economy. It drives down building standards, impedes the introduction of more energy-efficient building techniques, fails to provide workforce training, and encourages the use of unskilled labour. The underground economy is supported by the industry's extensive reliance on subcontracting, which facilitates small-scale, under-the-radar building activity. Government reluctance to regulate the underground economy allows its problematic practices to flourish.

The second factor is the inadequacy of the current training and apprenticeship system. This is an issue that the industry acknowledges but has failed to address effectively. Too many apprentices never find sufficient work to complete their training, and too many employers fail to contribute anything at all to supporting workforce training.

And the third factor is the widespread neglect of the potential role that workers and the unions that represent them could – and, arguably, should – play in the process of greening the built environment, a neglect based on a lack of interest in – or hostility to – the role of organized labour in the industry, even by many of those advocating greening the built environment.

The Adverse Effects of the Underground Economy

Canada's underground construction economy consists of a variety of practices designed to minimize labour and other costs, avoid taxes, circumvent zoning and building regulations, and, in some cases, conceal illegal activities. Its characteristics have been extensively documented in a variety of studies in recent years by both academics and government agencies (see Mirus, Smith, and Karoleff 1994; Gervais 1994; Lippert and Walker 1997; Barrett 1998; Giles and Tedds 2002; Armstrong and O'Grady 2004; Expert Advisory Panel on Occupational Health and Safety 2010; Gilbert 2010; Hamilton-Smith 2010; Prism Economics & Analysis 2010; Terefe, Barber-Dueck, and Lamontagne 2012; Commission on the Reform of Ontario's Public Services 2012). Statistics Canada estimated that in 2009, underground activity in the entire Canadian economy amounted to $36 billion, of which construction accounted for 29 percent (Terefe, Barber-Dueck, and Lamontagne 2012).

A number of interrelated factors facilitate the operation of underground construction. One is the well-documented practice of tax avoidance (Auditor General of Canada 1999; Pigeon 2004; O'Grady 2010a; Terefe, Barber-Dueck, and Lamontagne 2012). Employers, small contractors, and self-employed workers avoid taxes either by not divulging that they are receiving income from those purchasing construction services or by disclosing only part of it. By not charging customers the Harmonized Sales Tax (or, in some provinces, the Goods and Services Tax), they gain a major cost advantage over legitimate contractors. They also avoid Canada Pension Plan (CPP) contributions, Employment Insurance (EI) payments, workers' compensation premiums, and other employment-related deductions (Armstrong and O'Grady 2004). Additionally, they may not declare their work to the relevant municipal authorities, thus avoiding the costs of building permits (and the oversight of building inspectors). While workers may share in some of the immediate cost savings of underground activity because they avoid paying income tax and other statutory contributions such as CPP and EI, they also lose the significant benefits that flow from these programs as well as the statutory protections associated with a formal employment relationship.

Because many of their customers – particularly in the residential construction and renovations sector – do not have the expertise to assess whether work is being done properly, underground firms can also cut corners on materials and workmanship. These practices enable them to underbid legitimate employers and contractors by a substantial margin – normally in the range of 20 to 30 percent, but in some cases as much as 50 percent (Armstrong and O'Grady 2004; Hamilton-Smith 2010). Competition from underground suppliers puts pressure on legitimate contractors to cut corners to remain competitive, including using lower-skilled or unskilled workers wherever feasible. It thus encourages de-skilling. As price is normally the critical factor in determining who finds work, and assessing the quality of work is often difficult, underground operators have an enormous advantage.

While the underground economy adversely affects much of the construction industry, particularly in the residential and low-rise sectors, from the perspective of this chapter its impact on undermining green construction is of particular importance. Ruthless cost-cutting makes it difficult to implement new green technologies or use more environmentally responsible working practices because these tend to be more expensive – at least in the short run – than other options. They also normally require that those implementing these innovations have new and higher-level skills. Conflicting claims made by different contractors or manufacturers lead to confusion over the right technology, or standards, making it even more challenging for those who purchase construction services, a problem exacerbated by the absence of clear guidelines and regulations from government. Even when customers commission

low-carbon innovations, they may not be properly installed because of poor workforce training, the absence of quality standards, and inadequate inspection (Gleeson and Clarke 2013).

The underground economy poses a major barrier to the development of the skills needed to implement green construction. Workers receive little or no formal training and are only rarely able to obtain recognized qualifications, such as a journeyperson's ticket (Armstrong and O'Grady 2004; Hamilton-Smith 2010). Underground employers also normally do not support apprentices. They are very small operators with little or no training capacity. They often do not have the long-term contracts needed to commit to the duration of an apprenticeship. They lack supervisory skills and do not want to incur the administrative costs of a formal training program or provide release time for classroom study. Many avoid acknowledging that they even have employees as this may raise the visibility of their activities and expose them to unwanted building inspections or tax audits. Consequently, most workers in the underground sector have no pathway to formalized training because, from the perspective of the regulatory and training authorities, they do not exist.

At the same time, as a result of their precarious job security and the fluctuating incomes that come from frequent layoffs, workers face major hurdles to investing in their own training. The result is that the large underground component of the industry fails to train its workforce. This failure clearly impacts the conventional training and apprenticeship of construction workers. But it also means that there is little opportunity for construction workers to acquire the advanced skill sets necessary for implementing low-carbon construction. While remedies for fixing the underground economy are well known – and while governments have taken some limited steps to deal with issues like tax evasion – overall, governments have failed to implement many of the obvious, urgently needed regulatory changes (Commission on the Reform of Ontario's Public Services 2012).

Aside from responding to lobbying by developers and contractors, government failure to regulate the underground economy reflects a broader commitment to neoliberal principles. To a large degree, governments accept the view that the regulatory cure – tough government measures – for the problems created by the underground economy is worse than the disease of unregulated market functioning. Despite the obvious problems, supporters of the status quo, such as the Independent Contractors and Businesses Association (ICBA) of British Columbia, maintain that there is no pressing need to regulate construction more extensively because government intervention inevitably leads to greater inefficiency and undermines economic progress.[12]

While a fundamental greening of the construction industry involves much more than simply curbing the abuses of the underground economy, this clearly needs to be a major part of the process. Government options

include rigorous enforcement of the existing tax laws and comprehensive auditing of contractors, particularly self-employed owner-operators. Provincial workers' compensation boards can do more to ensure that contractors register the workers they employ and pay their assessments, while increasing the frequency of workplace inspections. Provinces can also enforce employment standards and human rights codes more vigorously (Prism Economics & Analysis 2010). And they can increase penalties for violators to a level that acts as a real deterrent, something that Quebec has done.

In Canada, only Quebec, through its Commission de la construction du Québec (CCQ), has adopted a tougher regulatory approach (Charest 2003). By providing significant funding to the CCQ, the province recovered $1.9 billion in unpaid taxes and levies during the 1997 to 2008 period. As a result of its regulatory efforts, the volume of declared work has increased much more rapidly than the growth of construction investment in the industry, indicating that more underground contractors and independent operators are complying with the law (CCQ 2014b). Quebec also requires all construction workers to be registered as a condition of working in the industry, including posting a resumé of their training and skills online. Registration also ensures that they are enrolled in the industry's pension and welfare plans.

Provinces can also license all contractors (Armstrong and O'Grady 2004). Currently, anyone can set up shop and provide construction services. However, there is no quality control, no protection for purchasers, and no guarantee that employers are following employment standards, health, and safety legislation or making contributions to EI, CPP, and other programs. Licensing would force many underground operators to acknowledge that they are providing construction services and make tax and regulatory avoidance more difficult; it would also establish a database to monitor contractor performance (Hamilton-Smith 2012). Including labour standards in public procurement contracts and requiring employers to be members of employer associations, as in Quebec, would also reduce underground activity (Charest 2003). Both provincial and municipal governments can also enforce building codes more rigorously – including hiring sufficient numbers of building inspectors – to guarantee that the work being performed meets existing standards.

Some provinces, such as British Columbia, could also expand the number of compulsory trades to ensure that only those with the appropriate qualifications are able to perform key components of construction work (Armstrong 2008). This approach to labour regulation is standard practice in a number of European countries, such as Germany. More stringent licensing of the trades would also provide a major incentive for workers to take formal training or apprenticeships given that, once they completed them, the qualifications they earned would provide greater job opportunities.

To ensure that underground contractors support training financially, governments can require all firms to contribute through compulsory levies, as imposed by some Australian state governments, California, numerous European countries, and Quebec, which has a compulsory 1.5 percent-of-payroll levy (Charest 2003; Calvert 2011; Hamilton-Smith 2012). Another major policy tool is stronger employment and labour legislation. Unionized sectors of the industry have been far more successful in achieving good training outcomes than unorganized sectors. At a minimum, as in Quebec, public policy should facilitate, rather than limit, the ability of workers to unionize. This would make it much easier to implement an effective training and apprenticeship regime in the rest of Canada.

The Industry's Inadequate Training and Apprenticeship System

A second factor that needs to be addressed if the industry is to transition to low-carbon construction methods is its approach to training. Apprenticeship is the core approach to training construction workers. In most trades, approximately 80 percent of the time is spent on the job and the remainder in formal classroom training. Blocks of formal education are normally scheduled to correspond to workers' increasing on-the-job experience. Apprentices need employment to complete their training and graduate as qualified journeypersons. However, the industry experiences wide swings in employment that reflect the business cycle, seasonal factors, and the state of the local property market. In some provinces, this is exacerbated by boom-and-bust employment patterns in major infrastructure or resource projects. When the economy is booming, construction contractors are desperate for workers. When it is in recession, workers are often laid off for months or even years at a time (Sharpe and Gibson 2005; Hamilton-Smith 2010; Coe 2011). These factors lead to high labour turnover and the corresponding loss of the skills and experience that workers have acquired.

Rather than having a national, comprehensive approach to training the construction workforce, Canada has a decentralized, patchwork quilt of apprenticeship and trades training arrangements, which reflects the constitutional jurisdiction of the provinces and territories (Sharpe and Gibson 2005; Morissette 2008; Armstrong 2008; Laporte and Mueller 2010). Although the federal government provides funding through a package of training agreements with the provinces and territories, except Quebec, and several larger urban centres such as Toronto, the training system is fragmented, inadequately funded, and poorly regulated, thereby shifting most of the costs and risks to workers. Worse, instead of supporting training in low-carbon construction, the current federal government's main interest in trades training is in response to demands from the oil,

gas, and mining sectors. This ignores both the need for training in green construction methods and the potential gains achievable in the built environment.[13]

The volatile nature of construction means that workers take significant risks when they commit to a three-to-five-year apprenticeship. Most have no guarantee that they will obtain steady employment, which they need to fulfill the on-the-job component of their apprenticeship program. As most are from working-class backgrounds, they normally do not have significant financial resources to carry them through prolonged periods of unemployment; this is an issue compounded by starting wage rates of approximately half that of a journeyperson. Absent adequate financial resources, workers are often forced to abandon their training to seek work elsewhere. The dropout rate in many trades is well over half of those starting an apprenticeship (Laporte and Mueller 2010; Hamilton-Smith 2010; Coe 2011).

Paradoxically, when there is ample work, apprentices may not return to school because of the loss of income and because they fear not finding work when they are finished the next phase of their classroom studies. This means losing their investment in training, while the industry loses the potential benefits of future skilled workers (Bosch and Philips 2003). These problems are inherent in an unregulated construction labour market and pose an ongoing challenge to maintaining a qualified workforce.

In practice, larger employers and/or unionized employers tend to be more supportive of training, and their apprentices have a much higher completion rate. For some employers, especially in the capital-intensive resource sector, the benefits of having a well-trained workforce are so substantial, and the costs of poorly performed work so significant, that investment in workforce skills makes economic sense. When employers are party to a collective agreement, they are also likely to support training through contract provisions stipulating the ratio of apprentices to journeypersons and negotiated contributions to training funds (O'Grady 2005, 2010a).

However, most construction employers are very small and do not conform to this pattern. Overall, the industry's training performance is very poor, with alarmingly high rates of non-completion (Gunderson 2013). Efforts by the federal and some provincial governments to encourage more workers to take apprenticeships over the past 15 years have largely failed (Hamilton-Smith 2010).

According to Coe and Herbert Emery,

> The large expansion in apprenticeship training registrations since 1991 has not produced a substantial increase in the number of persons completing apprenticeship programs. In 2007, there were only 3900 completions from apprenticeship programs in the building trades, up only 300 from 3600 completed

> apprenticeships in 1991. Moreover, the ratio of completed apprenticeships to the number of individuals registered in building trades apprenticeship programs fell from 7.7 percent in 1991 to 4.9 percent in 2007. (2012, 95)

Desjardins and Paquin of Statistics Canada used Canada's Registered Apprentice Information System to examine the completion rates of the 1994 and 1995 cohorts of starting apprenticeships ten years later. They found that completion rates for construction trades were, on average, much lower than non-construction trades. Admittedly, some building trades – electrician (62 percent), plumber (58 percent), and sheet metal worker (56 percent) – did much better than others. But trades such as steamfitter-pipefitter (38 percent) and carpenter (34 percent) did relatively poorly (Desjardins and Paquin 2010).[14]

Similarly, British Columbia's Industry Training Authority (ITA) admitted that the completion rate for apprenticeships after six years in its provincial program was only 40 percent in 2011 (ITA 2013). The ITA data does not provide a breakdown between union and non-union apprentices. But there is evidence that average completion rates would be considerably lower if the relatively high success rates of apprenticeships with unionized employers were excluded. The British Columbia and Yukon Territory Building and Construction Trades Council maintains that its union training programs have achieved a success rate averaging about 90 percent over the past five years (BCYT-BCTC 2013).

In his study of factors influencing apprenticeship completion rates, Coe (2011) noted that the rate was 10 percent higher for compulsory trades and concluded that a shift toward increasing the number of compulsory trades would likely increase this rate. Unions have been strong supporters of expanding the number of compulsory trades.

Even among larger employers, unionization is a key factor in apprenticeship. A 2013 survey by Katherine Jacobs (2013) of the Ontario Construction Secretariat found that 83 percent of unionized contractors supported apprentices, compared with only 42 percent of their non-union counterparts.

Greening the Built Environment Requires Enhanced Training and Skills

While Canadians have learned to live with the construction industry's dysfunctional approach to training and apprenticeship, global warming introduces an entirely different element into this equation. Canada now needs to green the built environment as a matter of urgency. Consequently, it needs a training system that prepares construction workers properly for this task.[15] Numerous studies indicate that low-carbon construction requires considerably higher levels of training and skills than those currently possessed by Canada's construction workforce

(Gleeson and Clarke 2013; Goodland 2012; Akenhead 2012). A recent ILO study concluded,

> Experience in a growing number of countries, both industrialized and developing, demonstrates that the construction of energy- and resource-efficient buildings requires competent enterprises and a skilled workforce. Poorly installed equipment and materials do not yield expected gains in efficiency and emissions reduction. Targeted investments in skills upgrading and certification of building firms, formalization – notably of small and medium-sized enterprises (SMEs) which dominate the sector – and improvements in working conditions to retain qualified workers are therefore essential components of a successful strategy. (ILO 2012, 127)

Successful green construction requires a highly trained workforce. Much of the work involves very tight tolerances and careful installation of components (Gleeson and Clarke 2013; Goodland 2012). It also involves learning about new technologies and new building methods. In retrofitting, where the largest energy savings are possible, the skilled trades must be able to handle a wide variety of different building types, erected at different times using different technologies and different materials. To do this work well, trades must have a comprehensive knowledge of many different building systems and technologies so that they are able to apply the most effective approach to each specific project. This requires the development of higher skill levels and a significant, ongoing investment in workforce training.

Decisions about what needs to be done to green the existing building stock require both an understanding of the particular attributes of individual buildings and a knowledge of the options now available to reduce energy consumption. These options must also be assessed in light of their cost-effectiveness, installation complexity, skill requirements and skills availability, and a variety of other factors. They require an understanding of the fundamentals of building construction and the possibilities arising from the new green technologies, materials, and systems now available. This requires knowledge, judgment, and a clear understanding of the challenges that have to be overcome.

Construction workers are constantly involved in problem-solving on the work site. They normally do this without close supervision. Often, on smaller projects, only one or two members of a trade are responsible for handling the work, and they are expected to do it on their own in a way that meets the professional standards mandated by the architects, engineers, or prime contractors. While there are tasks on building sites that can be performed by workers with little or no training or skills, retrofitting does not readily fit into this pattern. In reality, every project is different, and every project has its unique challenges, many of which are not predictable. Consequently, the trades have to be able to analyze

the characteristics of a wide variety of building projects and make judgments about how best to implement the objectives of these projects in a cost-effective, safe, and efficient way.

Similarly, establishing more stringent energy conservation requirements in building codes is not only contingent on having an effective enforcement system to ensure that builders comply. It also requires a workforce that knows the code requirements and is capable of implementing them on the building site. Detailed knowledge of building codes requires a training system that enables workers to acquire this information and to continually update it as green protocols are introduced. Continuing reliance on a largely unskilled construction workforce is not compatible with achieving the objectives of low-carbon construction.

The Lack of Involvement of the Skilled Trades and Their Unions in Implementing Green Construction

A third barrier to the greening of the construction industry is the limited role that building trades workers and their unions currently play in this process. Outside Quebec, less than a third of the industry is organized; union representation is concentrated in the ICI sector and primarily with large contractors. It is also uneven, varying considerably among the trades and between the trades and semi-skilled or unskilled construction workers. Although average union density in construction has remained fairly constant at just under a third of the workforce during the past 15 years in Canada, after falling significantly during the 1980s and early 1990s, this figure conceals major shifts in the pattern of unionization, with increases in Quebec offsetting declines in English Canada (Charest 2003; Galarneau and Sohn 2013; Statistics Canada 2014a).

TABLE 7.1
Construction Collective Agreement Coverage in Canada 1997–2012 (% of workforce)

Province	*1997*	*2000*	*2003*	*2006*	*2009*	*2012*
Newfoundland and Labrador	25.71	27.27	20.78	27.10	26.62	31.95
Prince Edward Island	20.59	13.79	19.35	13.95	17.95	23.68
Nova Scotia	38.16	26.97	22.78	26.40	23.98	28.99
New Brunswick	27.78	29.41	20.00	21.74	29.72	25.13
Quebec	48.48	50.11	56.25	57.69	57.80	59.30
Ontario	32.62	32.42	32.99	29.52	30.51	31.51
Manitoba	22.56	21.47	17.34	27.83	22.48	22.22
Saskatchewan	22.86	24.66	23.31	22.01	17.67	21.60
Alberta	17.19	21.04	21.67	18.78	19.29	19.38
British Columbia	31.31	31.77	30.51	25.02	20.35	21.89
All-Canada union coverage	32.39	32.53	34.19	31.67	31.23	32.76

Source: Statistics Canada (2014a).

Overall, the influence of the building trades unions – like the larger Canadian labour movement – has been on the decline. Despite this setback, some unionized trades continue to play a major role in establishing and enforcing their qualifications; such is the case with the International Brotherhood of Electrical Workers (IBEW) through its role in the National Electrical Trade Council (NETCO) (MacLeod 2012). Construction unions in Ontario have persuaded the provincial government to give them a role as members of the board overseeing the construction training and licensing component of the newly established Ontario College of Trades. And building trades unions in certain regions, such as the Greater Toronto Area, continue to organize significant numbers of workers in major commercial and industrial projects (although the residential sector remains largely unorganized).

Many unions continue to play a significant role in training and apprenticeship. In Ontario, for example, they operate over 200 trades training facilities in co-operation with unionized employers (O'Grady 2005). The building trades unions have collective agreement provisions requiring their employers to contribute part of the wage package – normally about 1 percent of payroll (in the form of a specified number of cents per hour) – to Training Trust Funds (TTFs). TTFs are jointly managed by a union and a group of contributing employers with which the union has collective agreements. They provide part, or all, of the classroom training that apprentices require, in some cases supplemented by provincial government purchases of training seats. They may also share some of the classroom training with publicly funded community colleges or purchase classroom capacity from them.

In an industry characterized by numerous small employers, few of which have the capacity to guarantee apprenticeships themselves or provide the classroom component of training, TTFs fulfill a vital industry need. Most apprentices work for a number of employers during their training, and their union affiliation provides employment continuity during this period. Because they are based on multi-employer collective agreements, TTFs tend to have stable funding, which facilitates long-term planning of courses and programs. In Ontario, they provide some training to 25 percent of building union members each year (O'Grady 2005). They also have an excellent track record of facilitating a high percentage of apprentices to actually complete their apprenticeships – a rate far higher than in the non-union sector. Union training accomplishments contrast sharply with the failure of various federal and provincial government policy initiatives, such as providing training tax credits to employers (Hamilton-Smith 2012).

In Quebec, the building trades have significantly expanded their role in training and apprenticeship, a development that reflects the provincial government's very different approach to construction labour relations and its willingness to require employers to take more responsibility

for training through its payroll levy system. The government's 1968 legislation – an *Act Respecting Labour Relations, Vocational Training and Manpower Management in the Construction Industry* – has encouraged collective bargaining in the construction sector and resulted in relatively high union density (Quebec 1968).[16] Quebec unions have been able to establish a wide network of TTFs through negotiations with unionized employers, and these continue to play a central role in trades training in the province (Charest 2003; O'Grady 2005). According to the Commission de la Construction du Quebec, its $150 million training fund supports 20,000 trainees per year for apprenticeship and continuing trades training (CCQ 2014a).

Unions have also supported training through project agreements such as British Columbia's Vancouver Island Highway Project. This was the largest construction project in western Canada during the mid-1990s. The provincial government created a public corporation to act as employer of all construction labour on the project. It negotiated a blanket agreement with 13 highway construction unions, which included commitments to local hiring, local training, and employment for members of the province's four equity groups. Union training facilities played an important role in this process, as did the commitment of union officials to provide technical and staff support for the program. In an industry in which equity group participation had been about 2 percent overall, the Vancouver Island Highway Project achieved equity participation of just over 20 percent of all hours worked during its eight years (Cohen and Braid 2000; Calvert and Redlin 2003).

That there is significant potential for unions to play a greater role in climate initiatives is evidenced by a number of other promising initiatives. One is the work of British Columbia's International Association of Heat and Frost Insulators and Allied Workers Local 118 (BC Insulators). Its members insulate water pipes, heating installations, storage tanks, and air conditioning and refrigeration systems. Normally referred to as mechanical insulation (MI), this building component is key to reducing energy use by minimizing heat and refrigeration losses. Done properly, it can often lower energy consumption in buildings by as much as half.

BC Insulators have strongly supported the development of new green building standards. But in recent years, they noted that the LEED gold, platinum, and other requirements specified by developers, architects, and engineers were not being met because of faulty workmanship by contractors and unskilled installers. They also found that too many projects did not have an integrated, comprehensive approach to energy conservation because they ignored the importance of proper MI. For example, mechanical steam piping was often being installed behind drywall with no insulation and no access to remedy the resulting problem, causing mould, respiratory hazards, and massive loss of energy.

As a result, the union commissioned a study to document the extent of energy losses and related problems commonly found in newly constructed buildings, including many that had a green designation (HB Lanarc Consultants 2010). Based on this study, the union developed a comprehensive package of new building code measures and government procurement requirements explicitly designed to reduce GHG emissions and energy consumption. The union's business manager, Lee Loftus, and staff representatives have made presentations to every major municipality in British Columbia and promoted the union's approach both nationally and at local-government conferences across the United States. The union has also lobbied the BC government for much tougher building code standards and for new provisions in public procurement that would require improved energy efficiency in public buildings (HB Lanarc Consultants 2010). According to Loftus, its 365 members have spent over $75,000 on their campaigns over the past five years (Interview, 7 June 2012).

On the training side, BC Insulators have worked closely with the British Columbia Institute of Technology to develop new climate modules to include in the classroom training program for apprentices in the insulating trade. They have also lobbied for a new program to train inspectors in MI. And they have worked extensively with both the environment committee of the BC Federation of Labour and Green Jobs BC in support of tougher climate policies.

Similarly, at the national level, the IBEW has worked closely with industry through NETCO to develop new standards and training modules for the installation of solar photovoltaic (PV) equipment and related renewable electric-vehicle technology. The union has played a central role in developing the new standards and related training modules. Qualified electricians can now add a certification in these areas to their trade qualifications (NETCO 2011).[17]

The implementation of low-carbon construction on the job site aligns well with the building trades unions' goal of maintaining high standards of skills and supporting the apprenticeship and training system (Lowe 2009).[18] True, their goal of a high-skill, high-wage industry reflects their self-interest in maintaining or improving the wages of their members as well as a desire to exercise control over the labour process. Nevertheless, most skilled trades take pride in exercising their skills and being able to adapt to a wide range of problem-solving situations – a key feature of effective climate retrofitting.

The interests of building trades unions also correspond to the need to have a more stable and permanent workforce with a long-term attachment to the industry. Their members want a career, not just a job. This, too, is a precondition for expanding and maintaining the knowledge base essential for implementing low-carbon construction. High turnover in the industry, especially among trainees who fail to complete their apprenticeships, is not conducive to effective climate programs. Construction

unions also support a workplace culture that values work well done and takes pride in learning and exercising demanding skills (Sennett 2009). The challenge of incorporating climate issues into a well-trained, stable workplace that already supports these values is far less than one that attempts to do so in a workforce that is poorly skilled, precarious, and low paid and that has little or no long-term attachment to the industry.

Despite the evidence that apprentices in unionized workplaces have a high completion rate and that unions have consistently advocated maintaining a high-quality training system, most policy-makers do not see unions as major players in the green transformation of the industry. In much of the literature on greening construction, unions simply do not exist. Some provincial governments, such as British Columbia's, have excluded unions from provincial training authorities, rewriting labour codes, and procurement policies in order to marginalize organized labour and, not insignificantly, to deny construction workers a voice in shaping industry training.[19]

Similarly, outside the specific organizations that unions and unionized employers have jointly created to promote training and workplace skills, such as TTFs in Ontario and Quebec and NETCO and its national counterparts in other trades, government policy-makers and many advocates of greening the built environment generally ignore the potential contribution of unions. The assumption is that low-carbon construction will be introduced successfully without the active involvement of workers – other than by doing what they are assigned to do.[20]

One reason is the general shift in Canada toward a neoliberal labour relations paradigm, in which the role of all unions is marginalized. The labour climate has become increasingly hostile to unions at both the federal and the provincial levels, as evidenced by regressive changes to labour legislation and the increasing tendency of governments to impose back-to-work legislation whenever unions strike. In the context of this broader anti-labour shift, arguments about the potential benefits of a greater union role in training, apprenticeship, and climate change initiatives go against the tide. Yet the evidence is clear: a highly skilled construction workforce is now needed to implement climate objectives, and unions have demonstrated that they can contribute to this process.

CONCLUSION

This chapter has identified three major problems that are impeding the ability of the Canadian construction industry to meet the challenge of global warming: the extensive and largely unregulated underground economy, fundamental weaknesses in the current training and apprenticeship system, and the failure to recognize the potential contribution of building trades workers – and the unions that represent them – in the process of greening the built environment. It does not claim that these

are the only, or the most important, impediments.[21] But it does assert that addressing these three problems is an essential part of what needs to be done.

Effective climate action requires a comprehensive approach to reducing energy consumption and GHG emissions in the built environment. Given the size of the existing stock of buildings, and the urgency of reducing GHG emissions and energy use, there is an enormous potential to create new construction jobs in energy conservation and retrofitting.[22] The development of a workforce with suitable skills and training in advanced low-carbon construction techniques is an essential part of this process.

Unfortunately, the industry's current priorities – and particularly its approach to workforce training and development – are major barriers to greening the industry. A commitment to unregulated market principles, hostility to public regulation, failure to tackle the abuses of the underground economy, reluctance to resource training and apprenticeship adequately, and opposition to a larger role for unions are important barriers to achieving a workforce capable of implementing low-carbon construction. Absent significant changes to the basic organization of the construction industry, it will continue to lack the capacity to implement the climate measures in the built environment that are now so urgently needed.[23]

NOTES

1. Some of the background research included in this chapter formed the basis for an earlier paper published in *Alternative Routes* (Calvert 2014).
2. The CSC recently changed its name to BuildForce Canada; however, the papers on its website still use the earlier name and are cited accordingly.
3. In the context of this chapter, we are defining the built environment primarily in terms of the various structures and their internal systems that use energy and contribute to global warming. However, some definitions of the built environment are much broader, encompassing the impact of neighbourhood design, transportation infrastructure, and manufactured facilities such as water and sewer systems that use energy and produce GHG emissions.
4. This is not to suggest that improving the energy efficiency of work performed in the resource sector should be ignored; clearly, there are gains to be made. However, the built environment has much more potential and, therefore, is by far the highest priority.
5. The terminology for describing general contractors varies somewhat in the industry. Another term commonly used is prime contractor.
6. This chapter focuses on construction in English Canada. As it notes in various places, the situation in Quebec differs quite substantially from that in the rest of Canada. Many of the problems identified in this chapter are far less pronounced in that province because public regulation of the industry is much more extensive. Charest (2003) provides a good analysis of the Quebec industry.

7. This is compounded by the fact that most purchasers of construction services are not knowledgeable about the details of the work and are not in a position to evaluate matters such as quality of design, materials, installation methods, or workmanship. Too often, they are not aware of the options available to reduce the carbon footprint of their buildings or the potential long-term financial benefits of reduced energy use. The classic principal-agent dilemma is characteristic of much of the industry's operation, reinforced by asymmetry of information between purchaser and contractor (O'Grady 2010b; Hamilton-Smith 2012; Goodland 2012). Additionally, when landlords do not pay the cost of heat and electricity, they often see little benefit in paying for improved energy conservation in their buildings, while tenants have no reason – or capacity – to invest in improved insulation or other energy conservation initiatives in buildings that they do not own and in which they may not reside long enough to reap the benefits (Levine and Ürge-Vorsatz 2007; UNEP 2009).
8. One of the most egregious examples of this is in the demolition of existing buildings. Because it is normally far cheaper to bulldoze an old structure than to dismantle it so that its materials can be reused, massive volumes of used materials end up in landfill sites. The industry prefers this option as it minimizes labour expenditures, which are the major cost in taking apart a building. Industry influence has largely undermined efforts by municipal governments to implement effective materials recycling as this would require extensive public regulation of demolition practices and the creation of new markets for used materials.
9. In recent years, there has been a great deal of interest in how global supply chains now involve extensive subcontracting of much of the world's manufacturing to developing countries that have low wages, minimal taxes, and little worker protection. But, in reality, this pattern has been part of the construction industry in Canada for generations. Subcontracting is the norm, with consequences that parallel what has been happening more recently in the extensive outsourcing by corporations in the developed world to subcontractors in the developing world.
10. BuildForce Canada has slightly different figures, although the basic pattern is similar: 90 percent of residential construction firms and 70 percent of non-residential firms have fewer than five workers. Only 1 percent of residential firms employ more than 50.
11. The demarcation lines between various trades are, arguably, also a contributor to industry fragmentation as they reinforce a proprietary approach to work in which control over skill sets (and the unions representing workers with these skill sets) results in occupational silos. This can impede broader worker solidarity as well as more effective integration of all work on a building site, particularly as there are significant differences in wages among various trades. In countries such as Denmark, where the wage structure is very flat, unions have been able to overcome these divisions more effectively than in Canada as demarcation issues do not significantly impact wages.
12. See, for example, the anti-government focus of the ICBA's publications for the most extreme version of this view.

13. While provinces have made significant efforts to establish national standards that are recognized across the country through the Red Seal program, there are still significant variations in provincial and territorial approaches. This is highlighted by the difference in the number of designated compulsory trades in which practitioners must have a certificate of trades qualification as a legal condition of performing a particular type of construction work. While some provinces have several dozen such trades, others have as few as three.
14. While Statistics Canada (2014c) data for 2011 indicates an increase in completions to 55,422, the number of apprentices registered in the system is also up, to 426,283.
15. This is not to imply that the industry will automatically provide jobs to workers who have acquired green skills. Absent much tougher government requirements that force industry to adopt low-carbon construction, the economics of the labour market will determine employment. However, if there are fundamental changes in the industry's support for green building techniques, then a qualified workforce will be essential.
16. The act has undergone some revisions in the intervening years. For example, in the title, the word *Manpower* has been replaced by *Workforce*. In the fall of 2013, an amendment brought in a regulation to establish the *Carnet référence construction,* a mandatory online referral service for the construction industry. Construction workers post a resumé outlining their skills and training on the Carnet's website, while employers use the site as a clearing house for finding workers; http://carnet.ccq.org/en/.
17. Carol MacLeod (NETCO executive director), interview with the author, 12 August 2013; and Andy Cleven (director of training, Electrical Joint Training Committee, Electrical Contractors Association of British Columbia), interview with the author, 12 July 2012.
18. Lee Loftus, interview with the author, 7 June 2012; Cleven, ibid.
19. The BC government's recent interest in discussing training issues with the province's building trades unions may appear to signal a change in focus under Christie Clark. However, its efforts have focused on fulfilling labour shortages in the expanding energy sector as part of the province's economic agenda of supporting energy and mining development. Retrofitting the built environment is significantly absent from its policy focus.
20. The federal government's trades training initiatives have focused on providing skills for its favoured resource extraction industries, where it needs the training expertise of a number of the construction unions. The goal is to encourage unions to address industry needs in the absence of other apprenticeship and training options that the federal government might otherwise prefer. It is arguably courting some of the major building trades unions not because it supports unionization but because it – and resource industry employers – needs them, at least for the immediate future. However, its policies are designed to enable employers, not unions or workers, to have a greater say about where public money for training will be allocated. For example, its controversial Canada Job Grant program provides no new money. Rather, it will shift $300 million per year from existing Canada Labour Market Agreement training programs to its more employer-focused approach. The federal government will provide employers with up to $5,000

per trainee, to be matched by an equal contribution by the provinces and, in theory, employers. However, these initiatives to meet the needs of employers have not been accompanied by any policies designed to expand union representation. Significantly, there is virtually no mention of unions in the various employment and training initiatives outlined in Canada's Economic Action Plan 2013 except for its Helmets to Hardhats program for veterans (Canada 2013).

21. Thus, we have not discussed issues such as the major role that publicly funded trades training colleges can play, a greater emphasis on climate issues in the education of architects and engineers, the comprehensive greening of municipal planning and building codes, and direct government financial support for training and apprenticeships, to cite a few of the more obvious areas where major climate initiatives are also needed.
22. An example of this is found in the approach that the the Danish construction unions took to the economic crisis of 2008. Recognizing that a stimulus package was needed to address the crisis, they lobbied the government (successfully) to bring forward a number of major building retrofitting programs, which they argued would both create jobs and reduce the country's carbon footprint (Calvert 2011).
23. In addition to the economic and environmental arguments in support of major change, there is a strong moral case that workers, like other citizens in a democratic society, have the right to a voice in shaping the development of our future climate policies, whether in construction or in other parts of the Canadian economy. Policy should recognize this right (Regan 2010).

REFERENCES

Akenhead, S. 2012. *Report from the 2nd Greening the Trades Consultation, Ladysmith, BC*. Commissioned by the British Columbia Institute of Technology.

Armstrong, T.E. 2008. *Compulsory Certification Project*. Toronto: Ministry of Training, Colleges and Universities.

Armstrong, T.E., and J. O'Grady. 2004. *Attacking the Underground Economy in the ICI Sector of Ontario's Construction Industry*. Toronto: Ontario Construction Secretariat. http://www.iciconstruction.com/admin/contentEngine/dspDocumentDownload.cfm?PCVID=ddcf803a-1372-0ea9-42b5-12e2ff58d034.

Auditor General of Canada. 1999. *Report of the Auditor General of Canada: Chapter 2 – Revenue Canada – Underground Economy Initiative*. Ottawa: Office of the Auditor General. http://www.oag-bvg.gc.ca/internet/docs/9902ce.pdf.

Barrett, D. 1998. "The Renewal of Trust in Residential Construction." Victoria: Commission of Inquiry into the Quality of Condominium Construction in British Columbia. http://www.qp.gov.bc.ca/condo/.

BCYT-BCTC (British Columbia and Yukon Territory Building and Construction Trades Council). 2013. "Highlights from 2012 Apprenticeship Survey." Burnaby: BCYT-BCTC.

Bosch, G., and P. Philips, eds. 2003. *Building Chaos: An International Comparison of Deregulation in the Construction Industry.* London: Routledge.

Calvert, J. 2011. "Climate Change, Construction and Labour in Europe: A Study of the Contribution of Building Workers and Their Unions to 'Greening' the Built Environment in Germany, the United Kingdom and Denmark." Working

paper presented at "Greening Work in a Chilly Climate", the Work in a Warming World (W3) Researchers' Workshop, Toronto, November 2011.
—. 2014. "Overcoming Systemic Barriers to 'Greening' the Construction Industry." In *Alternative Routes: A Journal of Critical Social Research* 25:81–118.
Calvert, J., and B. Redlin. 2003. "Achieving Public Policy Objectives through Collective Agreements: The Project Agreement Model for Public Construction in British Columbia's Transportation Sector." *Just Labour* 2:1–13.
Canada. 2013. "Canada's Economic Action Plan: Canada Job Grant." http://actionplan.gc.ca/en/initiative/canada-job-grant.
CCQ (Commission de la construction du Québec). 2014a. "Training." http://www.ccq.org/en/DevenirTravailleur/F_Formation/.
—. 2014b. "Workforce Changes." http://www.ccq.org/en/Patronales/J_ResponsabilitesEmployeur/J03_MouvementsMainDoeuvre.
Charest, J. 2003. "Canada Labour Market Regulation and Labour Relations in the Construction Industry: The Special Case of Quebec in the Canadian Context." In *Building Chaos: An International Comparison of Deregulation in the Construction Industry*, ed. G. Bosh and P. Philips, 95–136. London: Routledge.
Coe, P.J. 2011. "Apprenticeship Program Requirements and Apprenticeship Completion Rates in Canada." Working Paper 71. Ottawa: Canadian Labour Market and Skills Researcher Network. http://www.clsrn.econ.ubc.ca/workingpapers/CLSRN%20Working%20Paper%20no.%2071%20-%20Patrick%20Coe.pdf.
Coe, P.J., and J.C. Herbert Emery. 2012. "Accreditation Requirements and the Speed of Labour Market Adjustment in Canadian Building Trades." *Canadian Public Policy* 38 (1):91–111.
Cohen, M.G., and K. Braid. 2000. "Training and Equity Initiatives on the British Columbia Vancouver Island Highway Project: A Model for Large-Scale Construction Projects." *Labor Studies Journal* 25 (3):70–103.
Commission on the Reform of Ontario's Public Services. 2012. *Public Services for Ontarians: A Path to Sustainability and Excellence*. Toronto: Queen's Printer for Ontario. http://www.fin.gov.on.ca/en/reformcommission/chapters/report.pdf.
CSC (Construction Sector Council). 2011. "Green, Sustainable Building in Canada: Implications for the commercial and residential construction workforce – G2011." Ottawa: CSC.
—. 2013. "Construction Looking Forward: 2013–2021 Key Highlights – National Summary." Ottawa: CSC.
Desjardins, L., and N. Paquin. 2010. *Registered Apprentices: The Cohorts of 1994 and 1995, One Decade Later*. Research Paper. Cat. no. 81-595-M – No. 080. Ottawa: Statistics Canada.
Expert Advisory Panel on Occupational Health and Safety. 2010. *Report and Recommendations to the Minister of Labour*. Toronto: Ministry of Labour.
Galarneau, D., and T. Sohn. 2013. "Long-Term Trends in Unionization." Article: Insights on Canadian Society. Cat. no. 75-006-X. Ottawa: Statistics Canada.
Gervais, G. 1994. "The Size of the Underground Economy in Canada." Studies in National Accounting, no 2. Cat. no. 13-603E, No. 26. Ottawa: Statistics Canada.
Gilbert, R. 2010. "Harmonized Sales Tax Could Drive Contractors to Underground Economy." *Journal of Commerce* 53, 5 July. http://www.journalofcommerce.com/Home/News/2010/7/Harmonized-sales-tax-could-drive-contractors-to-underground-economy-JOC039537W/.

Giles, D., and L. Tedds. 2002. "Taxes and the Canadian Underground Economy." Canadian Tax Paper No. 106. Toronto: Canadian Tax Foundation.

Gleeson, C., and L. Clarke. 2013. "The Neglected Role of Labour in Low Energy Construction: 'Thermal Literacy' and the Difference between Design Intention and Performance." Paper presented at the W3 International Conference 2013, Toronto, 29 November–1 December.

Goodland, H. 2012. "BCIT: Greening the Trades." Rev. 4. Victoria: Brantwood Consulting.

Gunderson, M. 2013. "Completion Counts: Raising Apprenticeship Completion Rates in Ontario's Construction Industry." Toronto: Ontario Construction Secretariat. http://www.iciconstruction.com/admin/contentEngine/contentDocuments/Completion_Counts_-_Final_Report_-_OCS_2013_-_E-Version.pdf.

Hamilton-Smith, E. 2010. "Deterring the Underground Economy in BC's Residential Construction Sector Demand-Side Policy Directions." MPP Paper 827 – G100. Burnaby, BC: Simon Fraser University.

—. 2012. "Increasing Skilled Trades Employer Participation in Apprenticeship Training in British Columbia." Master's thesis, School of Public Policy, Simon Fraser University, Burnaby, BC.

HB Lanarc Consultants. 2010. "Pipes Need Jackets Too: Improving Performance of BC Buildings through Mechanical Insulation Practice and Standards – A White Paper." Vancouver: International Association of Heat and Frost Insulators and Allied Workers – Local 118. http://www.energyconservationspecialists.org/wordpress/wp-content/uploads/2011/02/White-Paper_Pipes-need-jackets-too.pdf.

ILO (International Labour Organization). 2012. *Working Towards Sustainable Development: Opportunities for Decent Work and Social Inclusion in a Green Economy*. Geneva: ILO. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_181836.pdf.

ITA (Industry Training Authority). 2013. *Your Ticket to Trade Skills: Annual Service Plan Report 2012/2013*. Richmond, BC: ITA. http://www.itabc.ca/sites/default/files/docs/about-ita/corporate-reports/ITA_AR12-13_Final.pdf.

Jacobs, K. 2013. "Ontario's Construction Outlook: Optimism Strengthens." Presentation at the 13th Annual Ontario Construction Secretariat State of the Industry & Outlook Conference 2013, Toronto, 6 March. http://www.iciconstruction.com/admin/contentEngine/dspDocumentDownload.cfm?PCVID=45f02f53-ece7-a3dd-71a9-c7e194203582.

Laporte, C., and R. Mueller. 2010. "The Persistence Behaviour of Registered Apprentices: Who Continues, Quits, or Completes Programs?" Canadian Labour Market and Skills Researcher Network Working Paper 62. Vancouver: Department of Economics, University of British Columbia.

Levine, M., and D. Ürge-Vorsatz. With K. Blok, L. Geng, D. Harvey, S. Lang, G. Levermore, et al. 2007. "Residential and Commercial Buildings." Chapter 6 of *Climate Change 2007: Mitigation – Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. www.ipcc.ch/publications_and_data/ar4/wg3/en/ch6.html.

Lippert, O., and M. Walker, eds. 1997. "The Underground Economy: Global Evidence of Its Size and Impact." Vancouver: Fraser Institute.

Lowe, G.S. 2009. "People and Performance: Building Alberta's Future Construction Workforce." Discussion Paper. Calgary: Building Trades of Alberta.

MacLeod, C. 2012. "Red Seal Electrical Trades in Canada: A Policy Framework on National Standards, Apprenticeship and Journeyperson Skills Training." Ottawa: National Electrical Trade Council. www.ceca.org/netco/NETCO%202012%20Policy%20Document.pdf.

Mirus, R., R.S. Smith, and V. Karoleff. 1994. "Canada's Underground Economy Revisited: Update and Critique." *Canadian Public* Policy XX (3):235–52.

Morissette, D. 2008. Registered Apprentices: The Cohort of 1993, a Decade Later, Comparisons with the 1992 Cohort. Cat. no. 81-004-X. Ottawa: Statistics Canada.

NETCO (National Electrical Trade Council). 2011. *National Occupational Analysis: Construction Electrician–Solar Photovoltaic (PV) Systems Certification*. Summary Report. Toronto: NETCO.

O'Grady, J. 2005. *Training Trust Funds: A Review of Their History, Legal Foundations, and Implications for Trade Union Training Strategy*. Final Report. Toronto: Canadian Labour Congress. www.ogrady.on.ca/Downloads/Papers/Training%20Trust%20Funds.pdf.

—. 2010a. *Estimates of Revenue Losses to Governments as a Result of Underground Practices in the Ontario Construction Industry: 1995–1997 Compared to 1998–2000; Updated Estimates – August 2001*. Toronto: Ontario Construction Secretariat.

—. 2010b. "The Impact of Climate Change on Employment and Skills Requirements in the Construction Industry." In *What Do We Know? What Do We Need to Know? The State of Research on Work, Employment and Climate Change in Canada*, ed. Carla Lipsig-Mummé, 167–94. Toronto: Work in a Warming World Research Programme. http://warming.apps01.yorku.ca/wp-content/uploads/2011/08/What-do-we-know-full-report-final.pdf.

Pigeon, M.-A. 2004. *The Underground Economy: Measurements and Consequences*. PRB-04-40E. Ottawa: Parliamentary Information and Research Service, Library of Parliament.

Prism Economics & Analysis. 2010. *Underground Economy in Construction: It Costs Us All*. Toronto: Ontario Construction Secretariat. http://www.iciconstruction.com/admin/contentEngine/contentDocuments/2010_OCS_Underground_Economy_Report_FULL_BOOK_for_web.pdf.

Quebec. 1968. *An Act Respecting Workforce Vocational Training and Qualification*. CQLR c F-5. http://canlii.ca/t/kncb.

Regan, K.H. 2010. "The Case for Enhancing Climate Change Negotiations with a Labor Rights Perspective." *Columbia Journal of Environmental Law* 35 (1):249–84.

Sennett, R. 2009. *The Craftsman*. London: Penguin Books.

Sharpe, A., and J. Gibson. 2005. *The Apprenticeship System in Canada: Trends and Issues*. CSLS Research Report 2005-04. Ottawa: Centre for the Study of Living Standards.

Statistics Canada. 2013. "Gross Domestic Product (GDP) at Basic Prices, by North American Industry Classification System (NAICS): Monthly. CANSIM Table 379-0031. http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3790031&paSer=&pattern=&stByVal=1&p1=1&p2=31&tabMode=dataTable&csid=.

—. 2014a. Labour Force Survey Estimates (LFS), Employees by Union Coverage, North American Industry Classification System (NAICS), Sex and Age Group, Annual. CANSIM Table 282-0078. http://www5.statcan.gc.ca/cansim/a05?l

ang=eng&id=2820078&pattern=2820078&searchTypeByValue=1&p2=35. Last modified 10 January.

—. 2014b. Labour Force Survey Estimates (LFS), Employment by North American Industry Classification System (NAICS), Seasonally Adjusted and Unadjusted, Monthly. CANSIM Table 282-0088. http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=2820088. Last modified 10 October.

—. 2014c. Registered Apprenticeship Training, Completions, by Age Groups, Sex and Major Trades Groups, Annual. CANSIM Table 477-0054. Last modified 11 June. http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=4770054&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=.

Terefe, B., C. Barber-Dueck, and M. Lamontagne. 2012. "Revisions to Its 2011 Study: Estimating the Underground Economy in Canada 1992–2008. Ottawa: Statistics Canada, Income and Expenditure Accounts Division." June. http://www.cra-arc.gc.ca/nwsrm/fctshts/2012/m09/fs120927-eng.html.

UNEP (United Nations Environment Program). 2009. *Buildings and Climate Change: Summary for Decision-Makers*. Paris: UNEP Sustainable Buildings and Climate Initiative. http://www.unep.org/SBCI/pdfs/SBCI-BCCSummary.pdf.