Advancing Climate Literacy in Union Vocational Education and Training Programs in English Canada, Quebec, Europe and the US: Analysis, Findings and Lessons Learned

Appendix 8
Why The Construction Trades Have a Valuable Role in Meeting the Climate Challenge

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The Role of the Construction Trades in Meeting Canada's Climate Challenge

Abstract

Construction accounts for 18% of Canada's GHG emissions. There is extensive evidence that this can be reduced significantly by implementing aggressive net zero building practices. However, the way the industry is organized impedes achieving this because it fails to promote the development of a broadly based, highly qualified climate literate workforce. Successful low carbon construction requires enhancing the knowledge, skills and competencies of workers because it requires much higher energy performance standards than traditional construction practice. Yet the majority of the industry remains wedded to the current system of low bid, low quality construction practice to minimize costs. The organization of work reflects a Taylorist approach with extensive sub-contracting that relies heavily on precarious, unskilled and semi-skilled workers. Most employers avoid investing in trades' training, leaving it to governments, unions and individual workers to fund workforce development. Committed to a deregulated market with minimal government interference in their profit-making activities, most contractors oppose tougher building and energy regulations while lobbying against higher labour standards, occupational certification requirements and union organizing. To meet their net zero targets, governments must recognize that market forces are inadequate to create the well-trained, highly skilled workforce needed. Major policy interventions are required to force industry to make the necessary changes in training and employment practices – changes designed to upskill the construction workforce and give workers and unions a greater voice in the building process.

Key Words: climate literacy, net zero, apprenticeship, building emissions, construction trades

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1. Introduction: Canada's Climate Challenge in the Building Sector

Addressing climate change is the most important issue facing Canada and the world today. The latest scientific assessments by the Intergovernmental Panel on Climate Change (IPCC) paint a depressing picture of the challenge we now face, reinforcing the need for a much more concerted effort to implement climate mitigation objectives while sharply increasing investment in measures to adapt to global warming's adverse impacts (IPCC 2021; IPCC 2022). While the Paris Agreement commits governments to try to keep the increase in global temperatures below 2 degrees Celsius - ideally, below 1.5 - the prospects of achieving this objective appear increasingly slim (UNFCC 2015; Hansen et. al. 2022)

Canada is already experiencing the impact of global warming as confirmed by the alarming increase in wildfires, atmospheric rivers, heat domes, extreme temperatures, droughts, floods and melting permafrost (Bush and Lemmen 2019; CICC 2020; Commissioner of the Environment 2021; Lee and Parfitt 2022). In response to climate science and growing adverse climate impacts, the Federal Government has established ambitious emission reduction targets of 40% - 45% by 2030 and 100% by 2050 (Office of the PM 2021; Environment and Climate Change Canada, 2021a). Most provincial and municipal governments have established comparable objectives.

Establishing targets is important. But the real question is how to achieve them. Currently buildings account for approximately 18% of Canada's GHG emissions, underscoring the importance of lowering their carbon footprint. The IPCC believes that major gains building efficiency gains are feasible with existing technologies at costs that are reasonably affordable, a finding echoed by the Senate of Canada's report on emissions in the built environment and numerous environmental researchers (IPCC 2014; Senate of Canada 2018; GAGBC 2021). Other studies support this view (Kennedy et. al. 2021).

Governments are using various policy tools to make the construction industry contribute to this process (Canada 2016; NrC 2017; Canada 2021; Canada 2022; Environment and Climate Change Canada 2023). They have increased funding for climate-focused building research. They have raised standards of building and energy codes to reduce energy use in the construction process and the resulting buildings but not as fast as environmental advocates would prefer and in the face of considerable opposition from some in the industry (Haley and Lockhart 2020; Warren and Lulham 2021).

The Federal Government's goal is a 'circular economy' which considers the carbon and energy used throughout the life cycle of buildings and emphasizes conservation (Benachio, Freitas et. al. 2020). Provinces have enacted ambitious net zero targets and implemented new programs such as BC's ambitious Step Code (British Columbia 2019). Municipalities are using zoning and building approval powers to require higher standards of energy conservation. Some will no

longer approve heating and air conditioning systems (HVAC) using natural gas and have passed bylaws requiring zero GHG emissions within a decade (Vancouver 2020; Toronto 2021; Vancouver 2022).

2. Low Carbon or Net Zero Construction Practice is Different

There are fundamental differences between conventional construction as practiced before climate change became a significant concern and the new requirements of net zero construction. The latter is consciously designed to achieve measurable reductions in energy use and GHG emissions. To achieve this, all aspects of construction must meet stringent and measurable design and commissioning specifications. Work must be carried out precisely. Buildings must be considered as integrated units, not as a collection of siloed contracts. The building envelope must be properly sealed and thermal bridges eliminated. Interior services such as HVAC systems must minimize energy use and what they use should come from renewable sources. The carbon content of building materials must be minimized, and materials reused when buildings are decommissioned. Environmentally responsible recycling and waste management are now priorities. In sum, the entire construction process must be reorganized to eliminate its adverse energy and environmental impacts. (CAGBC 2019; Clarke, Gleeson et. al. 2019)

However, the connection between net zero targets and the corresponding workforce competencies needed to achieve them is too often overlooked. Government policy to lower the climate impact of buildings assumes that the way the industry currently operates - including how it organizes work and trains and employs construction workers - can meet climate goals if they establish appropriate targets, provide adequate public funding and employers commit to achieving targets. This ignores fundamental differences between net zero construction and current industry practice.

The much higher performance standards of net zero construction have important implications for the construction workforce. The key attributes needed for a climate literate construction workforce have been extensively researched (Winch 2014; Clarke et. al. 2017; CAGBC 2019; Clarke et. al. 2020). There is ample evidence that it is extremely difficult to implement net zero construction effectively without a knowledgeable, skilled, competent and strongly motivated workforce to meet its much more precise and demanding standards. It requires workers who understand climate and environmental objectives and are committed to achieving them.

Training must go beyond learning to do individual tasks or acquiring specific skills. Workers need theoretical knowledge as well as practical skills. This means knowing building science, understanding buildings as integrated units, systems thinking, teamwork, communication competencies, capacity for on-site problem solving and an understanding of the contribution of each occupation in achieving climate objectives. A climate literate workforce requires a

commitment to high quality work, responsibility for outcomes and significant worker agency. (Antinucci 2014; Clarke, Gleeson et. al. 2019; CGBC 2019, CGBC 2020; Clarke and Winch 2022).

As Clarke and Winch note:

"…(S)successful Nearly Zero Energy Building (NZEB) depends on coordination and overall project awareness, teamwork and the application of theoretical knowledge to particular circumstances… Our research has shown how comprehensive VET systems (including based on apprenticeship) and broad occupational profiles covering a range of activities, constructed and maintained through consultation and coordination with social partners and based on imparting relevant knowledge, represent the 'high road' to energy efficiency in buildings; these are best placed to respond to the challenges of climate change." (Clarke and Winch 2022 p. 87).

Based on their extensive European research, the authors argue that public policy should encourage a 'high road' approach because there is good evidence that it is the most effective way to deliver net zero construction. This focuses on a solid apprenticeship program followed by continuous upgrading of the qualifications of the construction workforce throughout their working lives. It also recognizes the important role that organized labour can play in ensuring that the training and occupational interests of workers are reflected in both government policy and industry practice as occurs in many northern European countries that follow a social partnership model (Clarke and Winch 2022).

Net zero construction requires a rigorous apprenticeship program that enables construction workers to become competent in the full scope of their respective trades. Building projects are very different from assembly line production because most projects - and most building sites - have unique characteristics. Successful production requires workers with the capacity to solve problems as they arise in the context of complex scheduling, delivery, materials, staffing, regulatory and other operational constraints. It requires workers to understand what other occupations and trades on building sites do and how their work interacts with them.

The apprenticeship curriculum and on-site working practices must view building projects from a 'whole building' perspective, rather than a collection of siloed contracts. Failure to ensure that all elements of a project fulfil their climate objectives compromises energy performance. All trades need to understand thermal bridging to avoid compromising the building envelope. Plumbers must leave room for the appropriate thickness of mechanical insulation on furnaces and duct work. HVAC installers must calibrate systems properly. Finishing trades must avoid damaging work performed by previous trades. Every component must be properly integrated with the others. (EU Build Up Skills 2011; Clarke and Gleeson 2017; CAGBC 2019; Clarke, Gleeson et. al. 2019; Clarke et al. 2020a).

This reality underlay the European Union's 2010 decision to establish Build UP Skills (BUS). It recognized that major changes in vocational education and training (VET) and workforce qualifications would be needed to achieve the EU's ambitious Energy Performance of Buildings Directive. Involving 28 EU members plus Norway and Macedonia, BUS asked each country to identify the skills required to deliver net zero construction and then analyze the capacity of its workforce to deliver it. (BUS 2011; Antinucci et. al. 2014). The process identified significant gaps in the ability of member countries' construction workforces to achieve climate targets. It then asked countries to create National Roadmaps to guide the development of their future workforce, including targets for expanding and modernizing training programs (EC 2016; European Union 2018; Clarke et. al. 2020). BUS identified the need for higher qualification standards, greater energy literacy and a deeper understanding of the principles of building science.

Achieving targets was not simply acquiring additional technical skills: it entailed recognizing that construction work was also a social endeavor requiring teamwork, knowledge of the work of others on construction sites and an understanding of the need for cross occupational communication and collaboration. In its 2018 evaluation, BUS concluded the following:

"The results show that BUILD UP Skills projects boosted education and training of craftsmen and other on-site construction workers and system installers in the building sector and increased the number of qualified workers across Europe. All projects developed and piloted new qualifications and training schemes and/or upgraded existing ones." (EC 2018, p. 4.)

The EU has continued to develop this initiative with its Horizon 2020 and subsequent LIFE Clean Energy Transition program, further deepening its capacity to improve the low carbon training and qualification systems of its member countries. (EC 2021a; EC 2021b)

3. Canada's Approach Fails to Address Systemic Barriers to a Climate Literate Workforce

Canada's approach has been different. In recent years, governments have poured substantial money into construction training. However, the focus has been largely to accommodate employer demands for workers with the skills they need to meet business priorities, in fossil fuel production, resource extraction and major infrastructure projects. Outside Quebec, provinces have been reluctant to regulate the labour market by establishing higher qualification standards for construction work such as making training and certification requirements a condition of working in the industry. Instead of measures to upskill the entire workforce, they have targeted the skills priorities identified by employers. Noting one of the key gaps in Canada's approach,

Efficiency Canada argues that it should make "…green literacy a required component of all federally funded design, construction and operations training." (Efficiency Canada 2020, p. 2.)

Despite substantial government funding, most construction workers receive no formal training. Instead, they are left to learn on their own. The numbers enrolled in VET is only a small fraction of the active workforce. (CAF 2023). Even within the formal apprenticeship system there is an alarming non-completion rate. (Meredith 2011; Coe 2013; Jin et. al. 2020). Instead of requiring employers to contribute more to support workforce training, governments have sought to fill skill gaps by generously subsidizing companies to hire apprentices, supporting industry targeted training programs, recruiting skilled foreign workers, increasing temporary foreign worker visas, and promoting micro courses that provide narrow, specific, non-transferable skills to fill short-term labour requirements. Employer priorities, not workers' occupational development and long-term career interests continue to shape government policy. (Barnetson and Foster 2017)

A major reason Canada faces significant challenges in implementing net zero is the free market economic model on which the construction industry is based. It prioritizes low bid competition to minimize labour, material and other costs. In the process, it drives down the very quality standards that are now so necessary to implement net zero construction successfully. The industry's organization is characterized by extensive sub-contracting, a preponderance of very small employers, extensive bogus self-employment, a high proportion of workers without formal qualifications, precarious jobs, exploitation of temporary foreign workers and a very large, unregulated underground economy (Meredith 2011). According to the Canada Revenue Agency, 35% of Canada's estimated $68.5 billion in underground tax avoidance is from construction. (CRA 2022, BC Federation of Labour 2022).

Extensive subcontracting limits workforce coordination and cooperation, diluting responsibility for outcomes. Economic pressures force contractors to focus, narrowly, on fulfilling the minimal specifications of their contracts cheaply and quickly so they can seek more work. This blocks adoption of a 'whole building' approach that incorporates all the factors associated with successful net zero building practice. The conventional, siloed approach to organizing construction undermines responsibility for the overall climate outcome of building projects. As a recent paper by Eco Canada notes:

"Traditional approaches to procurement include a "design-bid-build" structure, which sequences the work through separate contracts for design and construction. This approach to procurement is incompatible with integrated approaches to planning and construction that are effective for developing or retrofitting energy efficient buildings." (Eco Canada. 2021 p. 18).

Price competition, absent clearly established and enforced energy standards and worker qualification requirements privileges contractors who focus on the cheapest way to build. Too

often this means that building energy performance is far below achievable standards. Except for major industrial plant operators and large commercial building owners for whom long term operational costs are critical, most building purchasers are influenced primarily by the up-front price, rather than long term operational energy costs about which they have little information. Investors who plan to sell, lease, or rent their buildings have little incentive to limit building operational energy costs, as future owners, or tenants, will pay the bills. (Calvert 2014)

While industry is extensively promoting its commitment to addressing climate change, progress has reflected public policy, not industry initiatives. Building and energy codes, not voluntary commitments by industry are primarily responsible for the improvements implemented. Although the Federal Government has signaled its intention to strengthen building and energy codes, Canada's regulations remain significantly behind other jurisdictions, such as the EU's energy performance of buildings certification system implemented over a decade ago (Li et. al. 2019).

Much of the industry remains strongly resistant to more extensive public regulation, as this conflicts with its free-market belief system that governments should minimize regulatory intrusions and let the market determine priorities. During recent consultations on revising Canada's national building and energy codes, industry raised objections about additional costs, administrative requirements and training burdens (Haley and Lockhart 2021). Much of the conflict was over whether to use a reference-based approach and an outcome-based approach. The latter provides clear measurement standards for building energy use, which critics see as more effective in lowering building energy use (Bernhardt 2021).

True, there are progressive industry proponents of 'green' construction, such as members of the Canada Green Building Council and Passive House Canada who recognize that a properly trained, highly skilled workforce is necessary to achieve Canada's climate objectives. And industry is increasingly accepting the need for voluntary green building standards, even if these are not widely, or fully, implemented. The term net zero has become part of the vocabulary of developers and contractors. Increasingly firms are promoting their buildings as 'green' and advertising that they are meeting LEED or other environmental standards.

But the actual outcomes still constitute a tiny part of new construction. Only 248 commercial LEED buildings were built in all of Canada in 2022 (CGBC 2023), a small fraction of the 480,000 commercial and institutional buildings in place the year before, according to Environment and Climate Change Canada. (A Healthy Environment and a Healthy Economy 2020). Less than 1% of new buildings meet the nearly zero energy standard. (Haley and Lockhart 2020). There are significant criticisms about how good standards, such as LEED, can be manipulated to maximize the points awarded by including environmental features unrelated to reducing emissions. (Orr 2014; Ade and Rehm 2020; Castro and Kim 2021).

To be fair, some of Canada's largest construction firms have made significant efforts to introduce climate objectives into their operations.[1] But they normally do so when those commissioning buildings require it. And, as noted, they operate within a system that pushes down standards through the prevailing practice of low bid tendering and extensive sub-contracting. Suspicious of regulation, the mainstream industry remains reluctant to accept the detailed energy performance monitoring or workforce qualification requirements that are clearly needed to ensure new buildings and retrofits meet stringent and measurable climate standards.

4. The (Mis)organization of Construction Work

Much of the industry's inability to meet energy and GHG targets is found in its approach to labour, both in how work is organized and how the workforce is trained. There is a major tension between employer demands to keep labour costs low by maximizing the use of unskilled and semi-skilled workers and the need for the higher workforce qualifications and competencies required by net zero construction.

A key reason for the industry's inability to meet the need for qualified trades is the effort of 'open shop' companies and their associations to undermine the union role in Canada's VET system.[2] Over the past forty years these companies have campaigned to eliminate union hiring halls, reduce provincial government regulation of employers' on-the-job training practices and weaken requirements that workers have formal credentials to work in the industry. There is now less oversight of apprenticeship, a development which reflects lower union density and declining union influence in some provinces.[3] But while the open shop campaigners succeeded in weakening union training capacity, they have had nothing substantive with which to replace it, leaving much of the workforce lacking the knowledge, skills and competencies that is now urgently needed for net zero construction.

An important way the industry keeps labour costs down is through sub-contracting. Construction work is labour intensive, so wages are key to being competitive. Sub-contracting promotes low wage competition because minimizing labour costs is normally key to winning contracts. However, subcontracting fragments what should be an integrated work process and undermines the basis for communication, cooperation and teamwork among workers, key attributes of successful net zero construction practice. Sub-contracting, or individual 'self -employment',

[1] See, for example, the fall 2022 issue of Buildforce Canada's journal for examples of industry's positioning on climate change.
[2] For example, Merit Canada and its 8 provincial affiliates promote open shop campaigns on unions, apprenticeship and labour relations policies. See: https://merit-canada.ca/issues/
[3] According to Statistics Canada, construction union collective agreement coverage declined from 42.3% in 1984 to 31.6 in 2022.

promotes workforce precarity by enabling employers to avoid long-term employment commitments to all but a small core of their workforce. The adverse employment impact of seasonal fluctuations and long-term business cycles fall disproportionately on workers. (Bosch and Phillips 2003).

Extensive sub-contracting and self-employment also impede union organizing, depressing wages. Many employers fear unionization because they assume that higher unionized employment costs will put them out of business. Hence their strong anti-union stance. True, union density in construction - and employer opposition to unionization – does vary among provinces.[4] But according to Statistics Canada, excluding Quebec, just under 25% of construction workers in English Canada are union members. Most small and medium employers – and some major contractors – strongly oppose unionization. Their industry associations lobby against changes to labour codes that facilitate unionization (Bentham 2002; Merit Canada https://merit-canada.ca/). They oppose stronger employment standards legislation and improvements to workers' compensation. Their goal is a minimally regulated labour market, a view that is consistent with their opposition to government efforts to regulate the industry in other areas.

While they would not conceptualize their approach as Taylorist, most mainstream construction employers adopt many of Taylor's principles of work organization. They organize work to minimize using formally qualified workers and oppose expanding compulsory certification (compulsory trades) which require workers to have a trades' credential to perform work. They believe it is cheaper to hire workers without formally recognized, legally required qualifications. This maximizes control over the work process and enables them to use fewer formally qualified workers (Braverman 1974; Rosenfeld 2022; Vidal 2022).

5. The Training Challenge

As noted, a major weakness in the industry is that most construction workers receive no formal training. The overwhelming majority of employers do not contribute to VET. The major exception is companies that are signatories to joint union training trust agreements (O'Grady 2005). Their collective agreements require them to fund training facilities on a cents-per-hour payroll basis. As multi-employer agreements are normally with a single union, in practice labour has a strong influence on their operations. Not-for-profit organizations such as the Ontario Construction Secretariat and its counterparts in other provinces represent the joint interests of unions and unionized employers advocating more investment in trades' training.

[4] Quebec is the outlier here due to its very different model of state regulated labour relations and union density was 57% in 2022.

Except for in-house training programs by the largest companies for their core workers, the industry relies on the public college system and union training programs for its skilled workforce. There is a widespread consensus that this approach has proved inadequate, resulting in large deficits in the supply of skilled workers. To fill this gap, governments have made significant financial commitments in support of training. Through its Labour Market Development Agreements, the Federal Government extensively funds provincial training. It has amended the Employment Insurance program to support apprentices taking the classroom component of apprenticeship, while creating a range of personal tax credits for working trades and financial incentives to encourage employers to hire apprentices. To address historic under-representation of equity seeking groups and address labour shortages, it has funded initiatives to expand the pool of entrants to the industry.[5]

In its Canada Green Buildings Strategy (2023), the Federal Government notes it is working with provinces and territories to create regional workforce plans and recruitment strategies. It has established a "Clean Jobs Training Centre" to promote zero carbon skills. And has expanded the Union Training and Innovation Program (UTIP) Red Seal training, providing it with $50 million, annually. While positive, its focus avoids addressing the adverse impact of the industry's largely unregulated, free market culture which enables most employers to avoid responsibility for VET. Instead, the approach is to try to fill gaps in the system's training programs while leaving the system itself intact.

The Federal Government has responded to industry claims of major shortages of qualified workers by recruiting skilled trades from abroad and expanding its temporary foreign worker program. It funds Eco Canada's Environmental Foreign Talent Development Program to provide up to $15,000 to employers hiring and training foreign workers. Some provinces have loosened existing requirements for mandatory (i.e. compulsory) trades certification. These policies enable employers to avoid responsibility for training, while increasing labour competition, putting downward pressure on existing workers' wages.

6. Introducing Climate Change to the Red Seal System

A significant barrier to implementing climate literacy in construction is in the trades' training system itself. Canada's apprenticeship system has evolved in response to industry demands for a workforce that can deliver the building projects traditionally required in a pre-climate change environment where energy conservation and environmental objectives were subordinate to the goal of cost control. True, workers have an interest in accessing training and having their skills formally certified. But the principal goal has been to fill industry's labour requirements for

[5] The Federal Government lists many of these programs on the following web site: https://www.canada.ca/en/services/jobs/training/support-skilled-trades-apprentices.html

conventional construction. Addressing climate change was not a priority - and not even on the radar screen - until very recently.

Apprenticeship training is based on the curriculum outlined in the Standards for each trade. The curriculum is the result of negotiations among various interests, including: provincial Directors of Apprenticeship; employers; unions and colleges, facilitated by the Federal Government. Sub-committees for each trade decide what to update every four or five years. The very detailed guidelines – some over 200 pages long - identify the skills apprentices in each trade need to pass the national exam. [6] The Standards provide the template for provincial apprenticeship programs and largely determine the classroom curriculum for each construction trade used by colleges and unions.

A strength of the current Red Seal system is that it provides apprentices with the technical skills required for the practice of their individual trades. True, trades instructors often complain that there is insufficient classroom time in the 4-year program for most trades to cover the knowledge, skills and competencies that apprentices should learn. There are concerns about Standards not being updated frequently enough to address new technology, materials, working practices and other industry developments. Critics feel the system focuses too narrowly on technical skills and does not adequately cover building science. There are concerns that it does not encourage independent problem solving and worker agency and whether training individual trades separately hinders cross-trade collaboration. Some employers do not provide sufficient learning opportunities for apprentices, using them as 'cheap labour'. It is also worrisome that approximately half of apprenticeship starters never finish (Hyeongsuk et. al. 2020; CAF 2023). But apprentices who do graduate are reasonably qualified to work in the industry.

A major problem with the Standards is that they do not mention climate change. There are only a handful of references to terms such as environment or sustainability in 37 construction related trades, as evidenced by the author's word search on each of these pdf files. Even in the very few cases where climate-related terms are mentioned, the Standards focus, narrowly, on the specific skills required to implement technologies such as Solar PV, wind turbines or building standards such as ASHRAE, LEED, BOMA-BEST or R-2000. They do not link learning these skills with their broader climate change rationale or provide apprentices with an understanding of the potential of the building industry – and their work - to address global warming, knowledge of which is important as a motivator and source of job satisfaction.

Disappointingly, the Canadian Council of Directors of Apprenticeship did not identify climate change as a priority in its 2022 – 2027 five-year plan (CCDA, 2022). However, introducing climate change material into the Red Seal Standards is key to advancing climate and

[6] The detailed Red Seal Standards for each trade are posted on the organization's web site at: https://www.red-seal.ca/about/pr.4gr.1m-eng.html.

environmental awareness a point made by Efficiency Canada which recommends that "…'green literacy' (be) a required component of all federally funded design, construction and operations training" (2020a), a point that can be applied to pre-apprenticeship programs and upgrade courses for journey workers.

7. Addressing the Industry's Performance Gap

The current system's focus on employer priorities might not matter if it were delivering environmentally sound construction practices. However, only 1% of Canada's building stock of 16 million residences and 480,000 commercial and industrial buildings meets net zero building standards, a fact that underscores how much work still needs to be done (Haley and Lockhart 2020). Numerous environmental organizations, backed up by solid government funded research have raised concerns about the lack of progress in meeting Canada's Paris commitments (UNFCC 2015; Climate Action Network 2021; ECCC 2021a; AG 2021; ECCC 2023). Contractors and developers continue to build as in the past, minimally complying with building and energy codes. Those who commission buildings still seek the lowest cost options, ignoring climate concerns.

But the issue is not only that Canada is not building or renovating enough buildings to net zero standards. It is also that many buildings designed to meet low carbon standards fail to achieve their design promise. There is extensive literature documenting a substantial 'performance gap' in net zero construction. This is the gap between the specifications of sustainable buildings, or retrofits, and the energy performance of these buildings once completed. Many post construction assessments have found that new 'energy efficient' or LEED rated buildings perform no better – sometimes worse - than conventional buildings (Zero Carbon Hub 2014; De Wilde 2014; Cali et. al. 2016; Zou et. al. 2018; IPEEC 2019; Clarke et. al. 2220 (b); De Wilde 2021).

Various factors contribute to the performance gap (Van Dronkelaar 2016; Darko et. al. 2017; IPECC 2019). However, one reason is that building projects are simply not properly built. And this is often due to the failure to provide adequate workforce training (Zero Carbon Hub 2014, Gleeson 2016; Killip 2020). According to Efficiency Canada "The building sector workforce, as presently composed is not adequately equipped to deliver the scale and scope of green building construction and retrofitting that is required to meet Canada's greenhouse gas reduction targets" (2020a).

In their comparison of the performance of similar heat pump installations in the UK and Germany, Gleeson and Lowe (2013) found that the quality of training was responsible for major performance differences. This illustrates a more general point that the competency of construction workers is critical. Successful net zero construction requires carefully executed work for projects to achieve their climate objectives. (Clarke et al. 2017).

Numerous studies emphasize that workers require a solid understanding of the principles of building science and the link between high quality construction practices and achieving climate goals. Typical is a conclusion from a recent Canada Green Building Council report:

"…(O)ne of the main findings of this report is that technical skills alone will not satisfy the requirements of low-carbon buildings. Changes to the larger construction approach and acknowledgment of soft skills are necessary to deliver high-performing buildings. We therefore need to increase overall levels of "green literacy" or said another way, the ability to understand the broad implications of key building activities on the environment and the market infrastructure. This works in concert with changes to the way construction projects are undertaken. The threshold for mistakes in high-performing buildings is slim and demands a higher level of sophistication and precision for the entire project team." (CGBC 2019, p. 6.).

A related issue is the need for technical qualifications to deal with demanding climate adaptation challenges. Technical Safety BC documents growing safety problems associated with climate related damage to buildings and infrastructure, raising the alarm about the absence of legal qualification requirements for much of this work. Allowing unskilled workers to perform it puts the public and workers at risk.[7]

8. Policies to Increase the Qualifications and Proportion of Skilled Workers in Construction

In a federal state with powers divided among various levels of government, no single public policy can fully address the challenges of developing a climate literate workforce. Change requires federal, provincial and municipal governments to use their various policy tools to achieve this goal. Some tools require changes to industry practices while others target specific labour and training issues.

Stronger building and energy codes are needed urgently to raise the industry's climate performance. Codes should require legally mandated reduction targets and timelines for reaching them. Buildings should require energy performance certificates. (Efficiency Canada 2020b; Gade and Nippard 2022). The EU has good examples of what can be included for both new construction and renovations. New York's Local Law 97 has a measured energy reduction target of 40% by 2030. The City of Vancouver has a bylaw requiring large commercial buildings to be

[7] See, for example, its State of Safety report. https://www.technicalsafetybc.ca/annual-state-of-safety/2022/data-trends

retrofitted to meet scheduled reductions to net zero, with annual reporting starting in 2024 (Vancouver 2022). This approach should be expanded to include all buildings.

Tougher codes need to be rigorously enforced (Gade and Nippard 2022). Municipal governments need to invest much more in staffing building inspection programs. Strict code enforcement ensures a level playing field, reducing the competitive advantages gained by contractors who cut corners. Higher standards, properly enforced, will also raise the quality of construction work, forcing contractors to improve their building practices.

Stronger codes also provide the rationale for upgrading the qualifications of building workers to enable them to meet the complex challenges associated with net zero practice. Vancouver's example is relevant. It has partnered with BCIT to provide trades' upgrading to deliver its new step code, providing an example of linking codes with workforce training.

Government procurement is another powerful tool for raising standards. Contracts can require bidders to meet prevailing wage rates (including pensions and benefits), employ qualified construction workers, provide apprenticeships, hire members of traditionally excluded groups and promote local employment. The Federal Government has taken a limited step in this direction in its spring 2023 budget for companies using its tax credits.

Community benefits agreements (CBAs) and more traditional project labour agreements (PLAs) have shown how purchasing construction services can advance social objectives (Calvert and Redlin 2000; Bosch and Weinkopf 2017; BC Building Trades 2019; OCS 2021). US President Biden's Inflation Reduction Act illustrates how procurement can achieve progressive labour and community benefits to "create good-paying union jobs that will help reduce emissions across every sector of our economy." (White House Aug. 19, 2022)

The enormous amount of new construction work required to meet Canada's climate targets means that governments will have to invest much more in workforce training, including establishing new programs to provide access to VET to the large number of workers currently excluded from the formal training system. Governments have not grasped the scale of the transition needed and are still not planning for the scope of the training required.

Canada also needs a more worker-centred approach to VET, one which seeks to upgrade the knowledge, skills and competencies of the majority of construction workers, not just training to fill industry's immediate labour shortages or provide the limited number of highly trained workers major construction companies need. The goal should not only be to provide 'skills' – important as these are - but to provide workers with a lifelong career in the industry in which their contribution will be properly respected (Bosch and Weinkopf 2017).

Provinces should implement a mandatory registration scheme for all construction workers including self-employed, such as exists in Quebec, the UK or many European countries (Williams, 2021). Registration would close a major regulatory loophole as self-employed contractors normally avoid registering for WCB, have no health and safety training or undergone a basic orientation to construction work. Registration would require workers to document their training and experience. Canada's large, unregulated underground economy – accounting for an estimated 20% of the construction workforce in some provinces - is simply not compatible with achieving the demanding requirements of net zero construction (Prism Economics 2022). Registration would also address the widespread evasion of income tax, CCP and EI contributions. (CRA 2923).

Industry restructuring requires VET programs designed to expand workers' knowledge of the construction process and their role within it. It means including theoretical components in apprenticeship that emphasize problem solving, teamwork, collaboration and an understanding of the principles of building science and their application to net zero construction practice. It means promoting workers' occupational identity and expectation of a lifelong career in the construction industry, not just a narrow, precarious stint of employment. The notion of improving 'job quality' should be an integral part of Canada's approach (Findlay and Warhurst. 2017). This is the opposite of the simple, task specific approach characteristic of the Taylorist approach to organizing work that is the basis of much of the current focus of governments in promoting micro-skills which, perversely, can promote deskilling the workforce (Braverman 1974).

Better and more effectively enforced employment standards make it harder for employers to exploit unorganized workers, reducing the cost advantage non-union employers enjoy by paying workers less. To promote higher standards, provinces should increase the number of compulsory trades which have a much higher apprenticeship completion rate than voluntary trades (Jin et. al. 2020). Without this requirement, anyone on a construction site can perform a journey worker's job. This would also strengthen the incentive to take formal training by linking qualifications to expanded employment opportunities. Compulsory trades also facilitate unionization.

The current labour relations system makes it difficult for most construction workers to unionize. The fluctuating pattern of project-based employment, the prevalence of sub-contracting, the large underground economy, the limited number of compulsory trades, the high level of employment insecurity and the hostility of employers create significant barriers. Outside Quebec, only one quarter of the construction workforce is unionized. It is concentrated in large industrial, infrastructure and institutional projects and in some major urban areas such as Toronto. In contrast, about 57% of Quebec's workforce is unionized due to its very different labour relations system. It is not obvious why workers in Quebec are twice as inclined to be unionized as in the rest of Canada. Labour law matters. Changes to labour legislation are needed to facilitate worker

organizing, which should be its goal. Higher union density will enable unions to expand the training programs needed to deliver a climate literate workforce.

There are other reasons why governments should increase the proportion of building workers who are properly trained. First, the skilled trades perform most work on construction sites. Their contribution is essential for achieving high quality climate outcomes. The knowledge, skills and competencies of electricians, plumbers, carpenters, ironworkers, finishing trades and others are - and will remain – essential to implement effective net zero construction.

Ewart Keep makes this point in his review of factors shaping the development and effective exercise of knowledge and skills in UK workplaces:

"Research shows that a great deal of innovation within organizations in all sectors (public and private) occurs at or very close to the productive process itself. It is concerned with 'shop floor' or front-line staff being able (i.e. empowered and sufficiently skilled) and willing to make incremental adjustments in the quality, specification, design and/or utility of the good or service that is being delivered, or within the productive process through which the good or service is delivered, in order to improve productivity or quality." (Keep 2016, p. 36)

Second, the attitudes and commitment of the trades' workforce to achieving climate objectives is an important factor in successful net zero construction. Workers can - and should - be active participants in achieving climate goals. Most construction workers take pride in doing a job properly. Knowledge of how their work addresses climate change can be a significant motivator to doing work well and a source of accomplishment and personal satisfaction. Knowing that high performance construction results in buildings and infrastructure that is safer, healthier, more affordable to maintain and more comfortable for occupants reinforces the importance of doing it right. A commitment to following best net zero practices can also motivate workers to demand that the projects on which they work are built properly.

Third, at almost every stage of the construction process there are choices which impact whether a project fulfils its climate objectives. Many are made by the trades. Their training enables them to work with little supervision – often on their own - because they are well qualified. How well they handle these choices depends on their attitudes, values and motivations. Where trades understand and support the climate objectives of a project, they are far more likely to make good climate choices.

Forth, the building trades play a major role in ensuring that the building, energy, fire and other codes are properly implemented. They know whether the codes are being followed. They can ensure that site practices meet these legal requirements. Understanding the climate rationale for the codes is important because it means the codes are not viewed as simply another regulatory

burden that increases workload, but rather measures that ensure that buildings meet society's climate objectives. Supporting adherence to the codes means doing the job right.

Fifth, studies of successful low carbon construction emphasize the importance of effective cooperation, consultation and teamwork among all professionals, trades and other occupations involved in the building process. The skilled trades can play a key role in making this happen. Success is contingent on everyone contributing to – and being responsible for - the overall outcome. Each trade needs to be mindful of how careless work by one can negate project success. A commitment to climate literacy encourages working collaboratively. (Clarke and Winch 2022)

Sixth, the trades' workforce can contribute to creating a workplace culture that supports climate and environmental objectives. Being part of a shared commitment to lowering the carbon footprint of building projects can contribute positively to supporting this culture making it much easier for everyone to follow best practices.

Seventh, unions already play a large and successful role in training the construction workforce in their 195 training centres across Canada, something for which they are not given adequate credit. They could do much more. A higher proportion of starting apprentices graduate from union programs than from other apprenticeship pathways (Jin et. al. 2020). The multi-employer collective agreements funding these centres enable unions to monitor the progress of apprentices they indenture while giving apprentices the protection of the agreements. Union centres also provide pre-apprenticeship programs and ongoing journey person upgrade programs. Greater union density would enable more workers to benefit from this successful approach.

The preceding is not to ignore the fact that what skilled trades do is significantly influenced by priorities set by others in the industry. However, workers do have discretion – often considerable - about how they practice their trade on building sites. They exercise significant control over the quality of their output and hence whether work is done well. While the trades, like other workers, want steady employment and a good pay cheque, they also take pride in the competent exercise of their knowledge and skills and in ensuring that jobs are well done.

To make use of the full capacity of the construction trades' workforce, government policy must recognize the need to address the underlying structural problems in the industry – problems that constitute major barriers to effective net zero construction. Continued reliance on employer priorities and a free-market approach that eschews regulations and prioritizes low bid over quality will not achieve climate goals. Enacting and enforcing tougher building and energy codes, establishing building energy performance requirements, requiring certification of construction workers and facilitating unionization can contribute to lowering the climate

footprint. Enhancing the role of organized labour is essential in creating a climate literate workforce.

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