



ACW Baseline Report: Built Environment

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Introduction

The overall aim of the Built Environment Working Group is to research the labour and labour process implications of transitioning to a low carbon, energy efficient building industry. This Baseline Report has the following goals: 1. To establish the current state of knowledge about the contribution of the workforce to 'greening' the construction industry; 2. To assess the potential of labour to shape the industry's carbon footprint. 3. To identify barriers to the successful participation of the workforce in developing pathways to low carbon construction and develop strategies to circumvent these barriers. 4. To identify needed modifications to employment, employment conditions, working practices and the overall organization of construction work that will improve the capacity of the workforce to implement low carbon construction (effective health and safety provisions, integrated team-based work practices, improved vocational education and training (VET), union representation and a greater say for the workforce in shaping the industry's future). 5. To examine the current and potential role of unions and professional organizations in advancing this process. 6. To analyze the workforce implications of widely used policy tools, such as energy efficiency targets, building codes and contract procurement requirements in facilitating the transition to low carbon construction. 7. To carry out research on the role of workers and the organizations that represent them in implementing specific, innovative low carbon projects which can serve as models for wider application in the building industry.

1. Why is the built environment a key area for the ACW project?

Buildings represent over one third of the total GHG emissions and energy use, on average, in Canada and internationally. (IPCC, Stern, UNEP, EU, US Dept. of Energy etc. etc.). Thus, they are a critical area for the introduction of measures to reduce carbon emissions and energy use. While finding renewable energy sources to replace fossil fuels is essential if we are to lower our carbon footprint, adopting measures that reduce our need for energy are equally important. To the extent that we can better conserve energy we can, correspondingly, reduce the volume of fossil fuels that renewables need to replace.

The buildings sector is also a critical area because there is substantial empirical evidence that major gains in energy efficiency are possible, as evidenced by the incremental progress that countries have achieved in recent years, most notably in the EU, but also in other jurisdictions as a result of their commitments to reducing the sector's GHG emissions and energy consumption. Energy conservation initiatives in buildings have already made a significant contribution to mitigating and adapting to climate change.

The sector is particularly important for the ACW initiative because construction is a major source of employment ranging from 8% to 12% of the employed labour force of most industrialized countries. Yet in a number of countries, the sector is also characterized by employment conditions that make the introduction of more effective climate measures difficult. In the liberal market economies, (the US, Canada, the UK and Australia and, though perhaps to a lesser degree, much of continental Europe) the workforce experiences a high degree of employment insecurity. Construction is cyclical with ‘booms and busts’ that result in major variations in employment levels. This encourages casualization and makes it difficult for many members of its workforce to plan a long term career in the industry.

The industry also has significant challenges in implementing vocational education and training (VET) programs due to lack of employer commitment to training, which is exacerbated by periodic unemployment and workers’ unpredictable incomes. The industry’s model of extensive subcontracting coupled with questionable self-employment further undermines workers’ opportunities to develop the skills needed to implement low carbon construction. In sum, the way labour in the industry is organized creates major barriers that prevent the workforce from contributing its knowledge and skills to the goal of successfully achieving climate objectives.

At the same time, the industry has enormous potential to play a significant role in creating new and fulfilling jobs that can – and should – contribute to reducing our climate footprint. Reducing the carbon footprint of buildings is important work. It is critical to our society’s ability to address climate change. Much of what needs to be done to implement low carbon construction – particularly in refurbishing the existing building stock to cut energy use –is also very labour intensive. The urgent need to reduce the GHG emissions of literally tens of millions of existing buildings, globally, has the potential to create large numbers of new jobs in virtually all the industry’s occupations. Addressing climate change opens the door to developing a revitalized building industry characterized by a highly skilled, thermally literate workforce that utilizes its knowledge and skills to achieve an important social objective. At the same time it also provides an opportunity to restructure the labour process to enable the workforce to have satisfying, stable employment, performing socially valuable work and the opportunity to play a key role in achieving society’s climate objectives.

2. The Central Role of the Labour Process in Reducing the Carbon Footprint of Buildings

The buildings produced by the construction industry are a major source of GHG emissions and energy use. But buildings are also a workplace. To reduce the carbon footprint of buildings, we need to change how work is done so that it achieves the much higher standards needed to cut GHG emissions and lower energy use.

Historically, the quality of construction work was an issue that primarily affected those who owned and used buildings. Now, however, poor quality workmanship has major climate impacts as well. It is no longer a strictly private matter, but one that affects our society's ability to address climate change. Quality of building outputs now matters. Low carbon construction depends on quality workmanship and a commitment to detail. It also depends on a workforce that is committed to a high standard of construction. Finally, as pointed out in the German report of the European *Buildup Skills* program, the main problem in reducing emissions is: "interfaces between trades and lack of any understanding for a house/building as one integrated system". The effective organization of the labour process in the industry is thus central to the achievement of this goal.

Every building project poses a new set of problems which the construction workforce has to solve. Dealing with the unique aspects of every new building (or one undergoing retrofitting) requires a well-trained workforce with the capacity to solve a wide range of problems on construction projects, including problems that arise daily on the worksite. The knowledge and skills of the workforce at all levels is thus a critical factor in achieving successful climate outcomes.

The ability of the workforce to do this well is significantly dependent on the industry's capacity to deliver a very high standard of professional education and VET to the members of its workforce. It has to provide all those who work on construction projects with a foundational understanding of the building process – including the importance of low carbon construction – as well as the specific knowledge and skills needed to carry out their individual occupations. The training system also needs to be properly linked with what workers are actually doing on construction projects. Training must be relevant to the jobs performed and the associated skill requirements of the workforce.

Implementing low carbon construction is also dependent on effective integration of the different tasks of the people involved. This requires all those who work on a building project to coordinate their work with that of others on the project. Building sites are constantly changing as different components of a project get started and then completed. On site implementation of construction work is also complex, involving coordination among numerous occupations, including architects, engineers, contractors, sub-contractors, skilled and semi-skilled trades, labourers, administrative staff and a host of others. Effective low carbon construction requires that the work of these people be properly coordinated and that all members of the building workforce be knowledgeable about best practices and industry standards. They must also understand how their work is linked to that of others in the project which means that they

must see themselves as members of a team that works together rather than as individual 'lone rangers' in their separate occupational silos.

Thus successful implementation of low carbon construction requires upskilling the workforce combined with a major reorganization of the labour process. This, in turn, provides an opportunity to overcome the current industry's heavy reliance on an untrained and poorly qualified workforce, many of whose members are forced to rely on questionable self-employment or insecure sub-contracting with few opportunities for training and skills development. The more rigorous quality demands associated with effective implementation of low carbon construction can – and should – provide a lever to change and improve the industry, so that the work process ceases to be fragmented, exclusive, and often hazardous to its workers. The changes required by low carbon construction can thus provide a pathway to the creation of a modern, highly trained and technologically sophisticated workforce characterized by good employment conditions in which all members of the workforce have a valuable – and valued role.

3. The Potential of Organized Labour to Promote Low Carbon Construction

Many of the initiatives to implement low carbon construction ignore the potential role of organized labour as an active participant in the process of 'greening' the built environment. In much of the climate literature dealing with the construction industry there is very little discussion about the role of the organizations that represent the workforce. Unions – and to a lesser degree professional associations – are not viewed as active participants in shaping the development of a low carbon building industry. However, while individual workers can contribute to climate objectives through their own work, it is unions that provide the workforce with the opportunity to express its collective interests and concerns. Unions provide a vehicle for the organization of the workforce and give it a voice in shaping the industry.

Many of the organizational changes needed to improve the industry's ability to address climate change require the collective voice of those who work in the industry. Improvements in working conditions, health and safety, employment security, opportunities for training and other elements of the overall employment relationship are largely dependent on the workforce having an organization which represents its interests and through which it can express its views and interests. Without representative organizations, it is much more difficult for individual members of the workforce to influence industry decisions.

Because unions represent workers at multiple work sites, they also have to have the ability to play a role in industry-wide change. In the context of an industry in which workplaces are constantly changing, for the workforce to have a say in shaping decisions outside their

individual work sites, they need a vehicle that will reflect their interests. This is particularly true if they are to have a role in shaping in the larger changes that the industry will need to undergo to meet the challenge of climate change in the coming years. Moreover, many of the changes needed to enable the workforce to play a more effective role at individual workplaces are dependent on changes to how the industry itself is organized. Improved VET systems, better knowledge of health and safety practices, the best way to introduce new technologies and many other employment and training issues require industry-wide approaches. They cannot easily be resolved on individual building projects or, for the most part, even within individual construction firms.

In the US, Canada and a number of European countries, the trade unions do play a role in providing VET or participating as social partners in the training of their members. In a few cases, unions actually develop the curriculum and oversee the VET of apprentices and other trainees, while in others they work jointly with employers or with the state to manage training programs. But their potential in promoting the development of a workplace culture that is committed to 'greening' the building process remains largely untapped and often not even welcomed.

For trade unions, the role of VET for low energy construction (VET4LEC) and conditions of employment are thus critical. The EU responded to VET4LEC demands with the Build Up Skills initiative (2011---13) addressing 'skills in relation to energy efficiency and renewable in all types of buildings' and resulting in reports from member states and ongoing initiatives. Since Europe's VET systems reflect the dominant political economy dynamic of individual member states, they range from 'employer-driven, task-based' to 'multidimensional occupational capacity' with recognized roles for employers, trade unions and educationalists.

The resulting VET systems are therefore different and lead to different strategies for engaging labour in meeting emissions targets. Similarly, employment practices vary with the dominant employment culture, exhibiting radical divergence between systems predominantly based on direct employment of qualified labour through to sub-sub-contracting, agency labour and piece-work payment. Thus organized labour has a decisive role in achieving built environment emissions targets.

Unions support many of the changes that will be needed to create the employment conditions necessary to promote climate objectives in the workplace. They encourage stable employment, effective health and safety measures, adequate incomes to deter excessive labour turnover, high qualification levels and quality standards, and the provision of VET for their members. Often too they support the broader VET programs and integrated team-working required. And they believe that workers should be able to have a long term career in

the industry, rather than a short term, insecure series of jobs. In sum, they support some of the very working conditions that are essential to the development of a workforce characterized by thermal literacy and a commitment to the high standards of workmanship that are now necessary if the industry is to meet climate targets. How workers and the organizations that represent them play a role in the development of a 'green' building industry is thus a central issue for the ACW initiative.

4. The Research Focus on the Built Environment Working Group

The preceding discussion has attempted to provide a focus for the research agenda of the Built Environment Working Group. The research will not attempt to address some of the 'big picture' issues associated with demonstrating the importance of buildings as contributors to GHG emissions or energy consumption. Nor will it focus significantly on the broad public policy and legislative issues associated with the efforts of governments to implement changes to the industry's carbon footprint. Rather its focus is on the role of labour and the labour process. It is to identify the potential role of those who work in the industry to contribute to climate change and the role of the professional associations that represent their interests in creating a workplace and employment environment that will support low carbon construction.

In the following pages we have laid out a short list of initial research questions and a somewhat more detailed presentation of several of potential research projects which our group may consider implementing. These will undoubtedly be amended as our discussions continue during the autumn. But hopefully this will provide a good starting point for the research we will undertake in the coming years. The key point will be how to select relevant, manageable initiatives that both the partner organizations and the research team believe will provide valuable insights into advancing the role of workers in implementing low carbon construction.

Finally, we have kept, as appendices, at the end of this document, the list of issues, along with a summary of the next steps in our process. The reason for this is not to forget some of the issues and concerns that members of the group raised during these discussions – issues to which we may wish to return in the near future.

Potential Research Questions

This is an illustrative list of research questions to identify major areas where we may choose to focus our activities over the coming period:

- In what ways, and to what extent is the current organization of work and employment in the industry – that is the current labour process – a barrier to lowering the carbon

footprint of buildings? (e.g. extensive sub-contracting, self-employment, poor communications, lack of team work, occupational silos, labour turnover, etc.) Note: this is a very broad question within which a number of narrower research questions could emerge.

- What are some of the key changes to the organization of work and workplaces needed to enable workers to transition to low carbon construction? In what ways can the reorganization of work and workplaces improve the ability of the workforce to achieve climate objectives?
- To what extent do workers require higher level qualifications (knowledge, skills and competence) to implement low carbon construction? (e.g. professional education, better VET systems, additional regulation/certification of the workforce)
- What are the linkages between the industry's current VET system and the experience of workers in attempting to implement the knowledge, skills and competence acquired on building projects? What barriers exist, preventing workers from applying low carbon knowledge and skills at the workplace and how can they be overcome?
- What are the linkages between improved working conditions, better health and safety measures, employment security, access to training, and increased control by workers over their work, on the one hand, and the achievement of low carbon construction outputs on the other?
- To what extent does the organization of work in the building industry lead to a significant 'energy performance gap' between the design of energy efficient buildings and the resulting performance of these buildings? If there indeed is a gap, why does it exist? How serious is it? And what might we do to address it?
- What are the current roles and future potential of the professional associations and labour unions in promoting low carbon construction? Examples?
- To what extent are the contributions of the various members of the workforce in construction projects poorly integrated and hampered by occupational silos? What are the implications of this lack of integration for the workforce's ability to implement low carbon construction? How can we promote a more integrated system of work organization that facilitates cooperation and team work and overcomes the negative effects of existing occupational silos?

- What are the linkages between government and industry targets to reduce energy consumption over time and changes to work organization and the roles of those who work in the building industry? To what extent are policy makers failing to link targets to corresponding changes to work, workplace organization and the role of the workforce itself?
- What are the linkages between energy reduction targets, the workforce knowledge and skills necessary to meet these targets and the professional education and VET systems needed to provide workers with the appropriate know – how?
- What is the role of public policy instruments, such as planning regulations, building codes and public procurement standards, in promoting the capacity of the industry’s workforce to transition to low carbon production methods? How do these policies affect what is actually happening on building projects?
- What examples do we have of initiatives by professional associations or unions in specific workplaces that demonstrate new and more promising ways for the workforce to implement low carbon construction?

Potential Research Projects

- A case study of the efforts of the BC Insulators Union to persuade local governments and the province of BC to include higher standards of heating, ventilation and air conditioning (HVAC) and other mechanical insulating requirements in their building procurement contracts and in the policies these governments implement for the overall industry. The study would document the union’s rationale for the campaign, the campaign details, the union’s interactions with governments and its impact on procurement and other government policies dealing with mechanical insulation.
- A Canadian case study of the experience of the workforce in implementing green construction objectives in one, or more, of Concert Property’s low carbon building projects. The goal would be to assess the linkage between the firm’s commitment to environmental objectives and the impact of this commitment on the role of workers on its building site(s). Does the building workforce believe that there are differences between its role at Concord and its role with previous employers? Has the organization of the work resulted in the workforce believing it has an ownership stake in the ‘greening’ of the building projects on which it works? What mechanisms have Concord and its unions put in place to give the workforce a voice in shaping the production process in an environmentally more responsible way? What is the role of the

construction unions in shaping Concord's 'green' agenda? What lessons can be learned from this experience that might be applicable to the broader industry? (Note: Concert Properties is a company established to invest union pension funds into socially progressive housing projects. It has a commitment to implementing low carbon construction in its new buildings and its refurbishments of existing buildings.)

- A UK research project to evaluate the employment and VET aspects of the Wakefield District Housing initiative. This is a UK direct labour project in which the council is providing jobs and work-based learning opportunities to members of the local community, including people normally excluded from the industry, some of whom may end up living in the housing development. Wakefield has adopted a policy of maintaining a stable workforce with decent wages and good employment conditions. It is committed, as an employer, to working with UCATT in implementing this project. It has also undertaken to provide a specialized VET programme to provide its locally based workforce with the knowledge and skills needed to work on the project. The question of whether this project is achieving its stated goals and, in particular, whether it has provided the workforce with the appropriate conditions to implement low carbon construction is clearly of considerable interest, as is the issue of what might be learned from Wakefield that could be applied to the wider industry.
- An analysis of the application of green training modules introduced into the apprenticeship program at the BC Institute of Technology on building sites where apprentices are employed. Are the new 'green' skills components of apprenticeship training being utilized effectively? What is the experience of the apprentices when they attempt to apply the green skills they have learned at the workplace? What are the factors influencing whether they are able to use green knowledge and skills effectively on the job? (e.g. those not relevant to the work, time pressures, employer indifference, lack of equipment and materials, etc.) What might be done to enable workers to make full use of the training they have received?
- An analysis of the relationship between energy reduction targets that require the construction industry to reduce the carbon footprint of buildings over time and whether these targets are resulting in corresponding changes to work organization, skill and knowledge sets, VET and the role of the workforce in implementing low carbon construction on building projects. Do the targets really change what is happening in the way the labour process is organized in the industry and, particularly, on building sites? Are they resulting in changes to employment conditions? If not, why not? And, what is, or should be, the role of the workforce in contributing to the fulfilment of targets?

- An analysis of the extent to which the education and training of architects, engineers and other professionals incorporates adequate knowledge of the labour process on building sites, including knowledge of the on-the-job working practices and roles of the various occupations responsible for implementing low carbon construction. Are there gaps in the working relationship between professionals and other members of the construction workforce? Are there knowledge and communications barriers that impede the effective implementation of building design at the work site? If so, what are those barriers and what might be done to deal with them?
- An analysis of the linkages between public regulation through planning and building codes and changes to the capacity of the building industry's workforce to implement low carbon construction, with a particular focus on the implications for the workforce, operative and professional, in terms of the VET needed to provide such knowledge and skills. How are changes to building regulations linked, or not linked, to changes to the capacity of the industry's VET system to provide its workforce with the knowledge and skills necessary to implement the regulations? What are the linkages between regulations, VET provision and what workers actually do at the workplace? (A parallel investigation could look at the role of voluntary codes such as LEED, ASHRE, Passive House and other industry established 'green' standards in promoting organizational changes to the industry and its workplaces.)
- A research project to document the experience of municipal building inspectors responsible for overseeing implementation of the new regulations included in BC government's 2014 building code on building sites. Do the inspectors consider that they have had adequate opportunities to upgrade their knowledge and skills to enable them to apply the requirements of the new code? Do they receive sufficient support and resources to enable them to carry out their work effectively? What do they believe needs to be changed to enable them to carry out their work more effectively?
- A research project to document the implementation of low carbon refurbishment project in a major redevelopment of a low income housing complex located in the CP Railway yards in the Rosemount area of Montreal. This is at a very early stage of development, but if it proceeds in the next year beyond the initial planning stage, it would provide an excellent opportunity to follow a project through its life course.
- An international research project comparing the building code standards and related VET training in the insulating trades between BC (Insulators' Union) and a comparable UK union or training institution.

Appendix A: Issues Raised by the Built Environment Working Group in Its Initial Discussions of Challenges facing the Industry in Implementing Low Carbon

Construction

1. Overview of Challenges in ‘Greening’ the Built Environment:

The Built Environment Working Group discussed the barriers and opportunities to implementing low carbon construction in both the UK and Canada. The following is a summary of the issues discussed. It flags the areas where the group felt that progress could be made.

- a) **Building Code Standards in Canada** (National, provincial and municipal, including building and development permits). There is a widespread consensus that building codes can have a significant impact in reducing the climate footprint of buildings and many jurisdictions have used this policy tool to improve the performance of buildings. However, there is also a significant debate about how to get the right balance between the use of directive, or regulatory, tools that apply clearly defined standards and the need to provide some flexibility to the industry so that it has flexibility to adopt alternative approaches that achieve the same objectives.
- b) **Building Code Standards – Canadian Issues.** One is the problem of inertia and delays in revamping the building codes to incorporate best low carbon practices. In part due to the need to achieve consensus in the context of Canada’s federal system of government, revisions to the national Building Code have historically followed a 10 year cycle. But a much shorter timeframe is now needed to ensure that new best practices, standards and technologies are expeditiously incorporated into the building codes. The requirement of consensus among federal and provincial governments imposes major delays (cycle time issue) on the adoption of new ‘greener’ national standards which provinces then incorporate into their building codes and which in turn form the basis of the codes of local governments.
- c) **Building Code Standards in the UK.** In Great Britain, the issue is different from Canada as the unitary form of government is not hampered by the need for consensus among various levels of government. The problem is that the government has often been too hasty in making revisions to the thermal requirements and has failed to provide adequate time for the industry to develop the capacity to implement the new standards properly. The UK’s issue is to ensure that changes in regulations are effectively implemented. This means ensuring a clear correspondence between new standards and industry capacity to implement them. And this, in turn, involves ensuring that outcomes are measured and

that the workforce at all levels has the training and capacity – ‘thermal literacy’ to implement and monitor these standards.

- d) **Building Code Standards: Common Problems.** Building codes and planning requirements that establish industry standards can – and do – end up becoming the ‘ceiling’ not the floor with respect to adopting of new low carbon construction technologies, materials or systems. Clearly, there are risks associated with incorporating new systems or materials that are ‘above code’ not only because in some cases they are experimental – with the resulting risks – but also because failure to comply with codes raises issues of legal liability in the event of future problems. In addition, there is now considerable confusion due to the plethora of different voluntary building standards which often differ in significant respects. This suggests that in some areas governments need to be more assertive in establishing new low carbon standards so that the industry will have a clearer sense of the best approach to meet climate objectives.
- e) **Compliance and Enforcement of Existing Building/Development Codes and Planning Regulations.** In both Canada and the UK there is a similar problem. The respective construction industries are not adequately monitored and many standards are poorly enforced due to inadequate numbers of inspection staff and lack of political will on the part of governments to hire adequate numbers or to engage in conflicts with the industry. A related issue is that building inspectors often do not have the appropriate tools and resources to do the measurements properly and, in some cases, may not have the skills and training needed to assess the work (and they may also be restricted in what they can do by the regulations and codes).
- f) **Gaps in Professional Training and Competencies:** There are also gaps in the training of engineers and architects which result in these professionals not understanding the challenges associated with implementing their work on the building site. They often do not consider the practical issues faced by building workers in trying to implement their plans. There is thus a need for building professionals to receive additional training in the ‘hands on’ aspects of work on construction sites.
- g) **Building Certification Measurement Requirements.** While there has been a great deal of interest in industry and government on the question of what new standards should be adopted, there is a major gap in the way in which these new standards are subsequently measured. Too many buildings that are certified as ‘green’ according to either code regulations or voluntary green standard systems fail to achieve the energy savings they were designed to meet. After construction is completed, buildings need to be measured at regular intervals to ensure that the certification standards continue to be met. This is

not only a problem due to faulty construction processes: it can also arise due to improper or inadequate maintenance of the systems put in place to economize on energy use. Post construction measuring systems thus need to be established and followed. Builders and owners need to have the knowledge and tools to be able to maintain the long term energy profile of their buildings.

- h) **Employment Conditions of Building Workers.** In both Canada and the UK building workers frequently experience very poor working conditions and, too often, have few opportunities to obtain training or upgrade their skills sets. The industry has a particularly bad reputation in terms of how it employs – or does not employ women. There is widespread gender discrimination and the industry as currently organized in both countries does not have a commitment to ensuring that women will be given training and employment in new green areas of construction. Building sites are also dangerous. Building workers face numerous hazards, many of which can be eliminated if there is a will to do so by the industry. In addition to these well documented problems, the introduction of new technologies, equipment, construction materials and building techniques can adversely affect workers. The introduction of these new working practices, if not carefully and thoughtfully done, can result in deteriorating working conditions and employment relations. In some cases the reorganization of work can undermine unionization, particularly if it is accompanied by the development of new skills that do not correspond to existing building trades demarcations.
- i) **Training and Skills Development:** A key to implementing low carbon construction is having a properly trained workforce. At present, there is a general failure to provide construction workers with green intelligence/knowledge to do this work effectively. In some cases there is also disconnect between what workers are taught and what they are able to implement on the job site. Workers need higher skills and a deep knowledge of the reasons for shifting to low carbon construction methods. Thermal literacy for all trades must be fully incorporated into the trades training process for all trades. However, for building workers to acquire the requisite skills, the industry must restructure its apprenticeship and skills training system. This means incorporating new ‘green’ skills modules into the training programs and providing workers with corresponding training opportunities both for new apprentices and for more experienced trades’ workers so that the latter can upgrade their skills. This also means addressing the major gaps in apprenticeship training that are widely acknowledged in both Canada and the UK.
- j) **Development of ‘Thermal Literacy’.** Another issue is the extent to which workers know how their work fits in with the larger ‘green’ agenda. This means having a wider, rather

than narrower, perspective on their role as building workers. To do this, there must be a reversal of the problematic, 'Taylorist' deskilling approach of governments and employers which, in recent years, has focused on breaking down trades into narrow, fragmented, highly specialized elements. Narrowing worker skills sets is a major barrier to the development of thermal literacy. Instead workers require a well-rounded apprenticeship or training program and the opportunity to develop an understanding of the reasons why green construction is so important in dealing with climate change.

- k) **Employer Resistance to Adopting Green Practices.** Many employers are unwilling to adopt green practices, either because they believe they are too costly or because they lack the capacity to implement such changes. Their excessive reliance on short term cost minimization comes at the expense of other key components of quality construction – components that are essential for quality green construction. They are also resistant to governments establishing tougher building codes, which they see as interference in their business operations.
- l) **Fundamental Problems with the Basic Way the Industry is Organized.** The industry is fragmented in a variety of ways. There is a lack of co-ordination among the various industry players and a lack of an overall planning framework which is needed to pursue green objectives in a comprehensive and integrated manner. The training and apprenticeship system has major gaps. Moreover, the current organization of the industry makes also development and utilization of green skills very difficult given its focus on cost cutting. There are numerous silos, extensive sub-contracting, questionable self-employment arrangements that undermine standards and training and major gaps in the planning process.
- m) **The Critical Role of Retrofitting.** Although a large part of the discussion about promoting low carbon construction focuses on new build, the reality is that this constitutes less than 2% of the total building stock each year. So the major area for reducing the climate footprint of buildings is retrofitting. But successful retrofitting is challenging because of the variety of buildings, the dates when they were constructed, the technologies and materials used and a range of other factors which mean that each building must be evaluated individually, with a retrofitting approach that takes account of its unique characteristics.
- n) **Other Challenges.** Both public and private sector procurement is too focused on 'low bid' and does not incorporate adequate green standards. Many purchasers of construction services have little knowledge of the quality of the work they are buying. Without clear regulations by government, they are inclined to go with the lowest bid in the absence of

other mechanisms to evaluate the overall value of what they are purchasing. Thus changes to the way construction services are procured are necessary if 'green' construction is to move forward. This is an area where governments may be able to provide some leadership by explicitly incorporating higher 'green' standards into their procurement policies. Governments may also be able to utilize other policy tools aside from regulation to stimulate low carbon construction, such as technical support, investing much more in training and apprenticeship, providing better quality information to consumers of construction services and other mechanisms such as BC Hydro PowerSmart and similar utility programs across Canada. The link here is to identify the extent to which the lack of appropriate skills and training is a barrier to achieving low carbon objectives.

Appendix B: A Detailed Outline of Several Potential Research Projects

Please note: At this stage these are only suggestions and several of them would need considerable more work to be formulated as sound research projects.

1. The Role of Legislated Energy Reduction Targets in Changing the Labour Process of the Industry

Governments in all major developed countries have passed legislation requiring the construction industry to reduce the carbon footprint of buildings incrementally over time. This has been done in a variety of ways, but most clearly by establishing clearly defined energy reduction targets to be met by specific dates. It has also been done by changes to building codes that require installation of technology and systems that use less energy. This research will review the role of legislated targets as a policy tool in facilitating the change to low carbon construction. (It may also look at the role of voluntary codes such as LEED, ASHRE, Passive House and other industry established 'green' standards if there is time.)

While governments have been clear about the importance of establishing clear targets, an implicit objective – at least by some governments – has been to force change in the building industry by requiring it to adopt low carbon designs, technologies, working practices and new workforce skills. At the same time, the pathways through which lower carbon construction will be implemented are often not explicitly identified, with much of the navigation left for the industry to resolve.

The research will examine the issues associated with implementing these targets on building sites with the view to identifying barriers that have (or still are) impeding achievement of climate goals. What is the linkage between targets and the changes the industry needs to implement to achieve these targets? Can a clearer understanding of the linkages lead to the implementation of supportive policies on issues such as industry re-organization, or changes to the labour process, to facilitate more effective achievement of climate objectives? How do targets impact on the industry's VET system? And how do they affect employment conditions?

2. The Impact of Building Codes and Regulations on the Labour Process in Canada

The focus of ACW is largely on the labour process and the analysis of pathways through which the workforce can contribute to more effective climate outcomes. However, what workers do is affected by the legislation and regulations that govern the building industry, as well as the voluntary standards that parts of the industry have put in place to promote low carbon construction. While there is a very substantial literature on the role of building codes and government directives in establishing the technical requirements for the industry, there is a

significant gap in the research on how these policy tools influence the organization of work, the way it is carried out at the workplace and the relationships among the various professions and occupations that contribute to the overall building process. In other words there is an important, but under-researched, link between regulatory standards and the labour process.

The research should summarize the key climate-related changes that have been incorporated into Canada's National Building Code and, subsequently, included in selected provincial/municipal codes in recent years.

The research should also examine the relationship between legislated building standards (codes and regulations) and the qualifications and training of the workforce. Professional education and VET programs incorporate the requirements of the codes. Curriculum content reflects the regulations in place. As codes incorporate higher levels of energy efficiency and other climate objectives over time, training institutions have to modify their programs to incorporate these requirements. (However, while the codes can stimulate advances they can also place limits on those advances in that they normally incorporate what governments believe is acceptable to the industry. Thus they may not include the cutting edge of climate knowledge.) The research would focus on the relationship between higher building code standards and their impact in promoting changes to professional education and the VET curriculum to provide the workforce with the skills to implement low carbon construction.

3. The Role of Higher Formal Qualifications in the Workforce in Promoting Low Carbon Construction

A central feature of the progress towards low carbon construction in northern European countries, such as Germany, has been its tough certification requirements for building workers. One reason Germany is widely seen as a leader in low carbon construction is due to the high quality of its building work. And this is a reflection of the strict regulation of building worker qualifications which define the training and competencies workers are required to have to be employed on building sites. In contrast to the UK, Canada and the US, there are very few unqualified workers on German building sites. Moreover, German regulations are also well enforced, meaning that those who carry out work on construction sites are fully qualified to do the work.

The regulation of professions is widely accepted in most countries. Governments normally require building plans to be approved by qualified engineers, architects, planners or other professionals with the appropriate qualifications. However, governments have not taken a similar view about the need for certification for many other building occupations. Instead, outside northern Europe, legal requirements that building workers have formal qualifications

are the exception. For example, in Canada, the system of certifying trades that are legally mandated to carry out specific types of construction work is far less restrictive than in Germany. At the most extreme end of the spectrum, a number of provinces only designate trades where their work directly – and obviously – affects public safety. Contractors are only required to use certified electricians, gas fitters, crane operators and a few other trades where there are clear concerns about fire hazards, gas poisoning or structural issues. In some cases, such as BC, provincial governments have actually reduced the number of designated trades in response to pressure from the industry, particularly from the non-union contracting sector that see ending designated trades as a way to reduce the level of union organizing in the industry.

However, there is considerable evidence in the research literature indicating that low carbon construction requires higher levels of skills and training, largely because the work must meet much tighter tolerances and in a far more precise manner. Successful implementation of climate objectives on building sites also requires a workforce with a high level of climate literacy which means an understanding of the overall objectives of the work and, more specifically, how their contribution fits in with the larger goals of the project.

The research question is to assess whether higher qualification requirements are needed to make an important contribution to low carbon construction. (Note: this is a separate issue from whether higher levels of VET are needed. While there can be a relationship between training and formal certification, it is not necessarily a requirement.)

4. Research Question: Role of Government Procurement in Promoting Industry Change

The public sector can play a major role in driving forward low carbon construction, both through its regulatory capacity and by example. With respect to the latter approach, a key policy tool is the use of public procurement to establish higher standards and to demonstrate their feasibility. Governments are major purchasers of buildings. They commission new buildings and engage in retrofitting the numerous structures that they own. This approach has been extensively used in the EU where higher standards have normally been implemented first in the public sector and only then applied to the rest of the building industry. It has also been applied in a more limited way by various levels of government in Canada.

In establishing higher standards for their own procurement, governments can provide leadership to the industry. They can stimulate experimentation, build knowledge about low carbon construction methods and develop best practices that can, subsequently, be used in the rest of the construction industry. Government procurement contracts thus provides a

major opportunity for including higher standards of energy and GHG emission performance in the tenders let out for public construction projects.

From a research perspective, a key question is how higher standards for public procurement contracts affect the industry's ability to deliver low carbon construction. In what ways can procurement drive change in the industry? What are the linkages between higher standards in contract tenders and the response of the industry to meeting these standards? How effective is this as a policy tool for inducing change?

From the perspective of ACW, an important component of this issue is somewhat narrower. It is whether public procurement can – or should --- be used to change the labour process in the building industry, including the organization of work and the skills of the workforce. For example, should governments be encouraged to include specific qualification and training requirements as a condition that bidders need to meet? Should it demand that bidders include commitments to training and apprenticeship in their bids or, in the Canadian context, the ratio of apprentices to journeypersons? Similarly, should bidders be required to meet employment targets for women and minorities? In sum to what extent should procurement contracts a mechanism for pushing the industry to change its approach to employment, training and the organization of work?

5. Inclusion of Low Carbon Construction in Professional Education and VET and Its Application at the Workplace

There is a broad consensus in the published literature that a highly qualified workforce is key to implementing low carbon construction. In their 2014 IPCC study of energy efficiency in buildings, Lucon et al. underline this point:

Another challenge is the need to develop the skills and training to deliver, maintain, and manage low carbon buildings. To implement the large number of energy saving projects (building retrofits or new construction) a large, skilled workforce is needed to carry out high-quality work at relatively low cost. (Lucon et. al. IPCC. Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Ch. 9, p. 719).

As this quote indicates there is a considerable body of research that asserts that the construction workforce will require new and upgraded skills in order to implement low carbon construction effectively. Responsibility for overseeing this training lies with the institutions that provide professional education and VET for the workforce. An important question, then, is to what extent have the training institutions effectively incorporated low carbon construction objectives and methods into their curricula?

This is a large question and needs to be narrowed to a manageable project such as a review of changes in the curriculum in the trades training area for apprentices and other categories of trainees. It will also review the extent to which there have been changes in the skill requirements for the trades that incorporate knowledge and skills associated with low carbon construction.

The second phase of this research will be to examine the extent to which other occupations and professions in the building sector have done the same. This will include planners, architects and engineers.

To what extent have the various stakeholders responsible for the development of Canada's building code and its provincial and municipal counterparts incorporated training and skills development into their recommendations on the implementation of low carbon construction standards? How are the various trades and professions expected to learn about the various new techniques and principles that are required to implement low carbon construction goals?

A sub-category of this question is: "What have governments done to provide provincial and municipal building inspectors with the training and skills needed for them to oversee the implementation of low carbon requirements in buildings?" More specifically: "To what extent have provinces or municipalities instituted training programs that are specifically designed to provide these skills to existing inspectors and to those currently being trained?"

6. Implementation of Green Building Training on Work Sites by Apprentices and Trainees

While the need to provide the workforce with adequate skills and training in low carbon construction is widely accepted, there remains a question concerning the extent to which the new 'green' skills components of VET are being utilized effectively on building sites? To what extent is the industry making use of the skill sets that its new entrants are acquiring in the classroom? What are the factors influencing the application of low carbon skill sets at the workplace and what might be done to enable trainees to put to work their newly acquired skills more effectively?

One way to approach this question would be to carry out a survey of a cohort of apprentices currently enrolled in a major training institution such as the British Columbia Institute of Technology. (A comparable UK institution might also be included if an international comparison were desired.)

The survey would ask about the student's classroom experience in learning about low carbon construction, including the specific applications in which he/she received instructions. It would also probe the student's understanding of climate issues and the rationale for including low

carbon construction methods in the curriculum. It would then ask the student to indicate whether the low carbon skills learned in the classroom were being applied in the on---the---job component of his/her training or apprenticeship.

One of the other areas of interest would be to find out the extent to which the student's workplace and the tasks assigned to the trainee were designed to support low carbon construction methods. In other words, to what extent was the employer or contractor supportive of this approach and how did this manifest itself in the work assigned to the student (and perhaps other workers).

The survey could take the form either of a standard questionnaire administered to a list of current students in several trades' programs. Or, it could take the form of in-depth qualitative interviews using a semi-structured interview questionnaire, but administered to a smaller group of students. For example, it might be worthwhile to survey the apprentices being trained by the BC Insulators' union at the British Columbia Institute of Technology (BCIT). The Insulators have developed and deliver the curriculum for all the insulating apprentices that are trained in BC. However, the issue of whether or to what extent the low carbon training they receive is being implemented on the job site has not been extensively explored.

The international component of this research would involve identifying a comparable VET institution in the UK (or perhaps other European countries) and comparable trade(s) so that differences/similarities in the experience of these students could be compared. This might also provide information about how the different countries' building industries were accommodating the new skills associated with low carbon construction. In the UK context, this would involve a similar survey of trainees who are learning low carbon construction skills. It would evaluate their experience once they are out in the industry carrying out the work for which they have been trained. In both the Canadian and UK cases, the research team would have to develop a survey questionnaire that could be administered to the apprentices/trainees. The development of this questionnaire would be a significant part of the research agenda on this component of the project.

7. Do Building Professionals (Planners, Architects, Engineers) Obtain Adequate Training on How Work is performed on Building Sites in their Education Programs?

Successful implementation of low carbon construction requires integration of every step in the building process from initial planning and design, through implementation on the worksite to final inspection, operation and ongoing maintenance. The plans and designs of building professionals have to be implemented by the on---site workforce, which is composed of a variety of different occupations with various skill sets. The way in which the workplace is

organized and the relationship among all those involved in the process is a vital factor in determining whether the design objectives of low carbon construction will be achieved.

If the building professionals are not fully aware of the labour process at the workplace, the skill sets and responsibilities of different occupations and the kinds of issues that the on-site building workforce faces in fulfilling their respective tasks, their architectural and engineering designs may not be properly implemented. Knowledge of the roles of the various occupations responsible for implementing low carbon construction and the challenges that the on-site workforce faces in implementing designs and plans is an important factor in ensuring that the plans get properly implemented.

The question, then, is whether the professional education offered to planners, architects and engineers provides them with the knowledge and the understandings of on-site building work – and the role of the building workforce – so that they are able to ensure that the workforce is able to implement their designs effectively. To what extent does their training provide them with an understanding of the labour process on building sites that they need to see that their plans are properly implemented?

If there is a knowledge gap, how serious is it and what might be done to address it?

Another possible approach to examining the role of professionals in low carbon construction would be to examine the extent to which professionals are incorporating the principles of LEED construction into the way in which they plan and design projects. To what extent are architects actually considering LEED as a central element of their work? As this is a large area, the key challenge is to develop a focus that is narrow enough and specific enough to provide some answers to this question.

8. A Comparative Study of Low Carbon Construction Training and Employment Systems on a Canadian and a UK Building Project

There are both differences and similarities in the efforts of organizations attempting to introduce low carbon construction in the workplace in a manner that involves unions and attempts to overcome some of the adverse labour process issues that negatively influence the broader building industry. This project would involve an international comparison between a project in Canada and one in the UK, both of whom are being implemented with significant union involvement and with a commitment to use low carbon construction building methods.

The Canadian project is one carried out by Concert Properties a developer that is funded by a number of building union pension funds. Concert Properties has an explicit commitment to

low energy housing and to using a stable, unionized and highly trained workforce to build its projects.

The Wakefield District Housing project is being developed by a local authority that is also committed to low carbon construction and which is working closely with UCATT, the major UK building trades union.

Wakefield intends that the project will be a model development that will provide VET for the workforce, some of whose members may also become tenants in the new council housing it is developing.

These projects are comparable in a number of ways. They have significant union involvement and in each case the unions are committed to the climate objectives of the projects. Both the unions and the employers share the objective of promoting training and skills development on the sites involved. The projects were also consciously designed to achieve low carbon objectives, with these objectives being built into the planning of the projects and the way work is to be conducted on the actual building sites. Finally, these are actual building projects which could be assessed by members of the ACW Built Environment group. In other words, they provide an opportunity to carry out detailed research on two interesting building projects that have not otherwise been researched and which include commitments to many of the issues that ACW has an interest in researching.

9. Silos or Integration: Relationships among Policy Tools for Promoting Low Carbon Construction

The policy literature identifies a number of different kinds of policy tools available to governments. These include regulation, finance, climate research, education, market reforms, and moral suasion, among others. Regulation can involve a variety of legislated measures such as building codes, workforce certification, planning instruments and so forth. Finance includes subsidies, tax incentives, government purchasing and paying for training. It can also encompass paying for research to identify new technologies or building innovations. Education involves popularizing the science of climate change to the building workforce. Market reforms entail changing the rules within which markets operate to achieve specific goals. Finally, moral suasion involves encouraging the industry (and the public) to do the right thing.

Policy tools are not exercised in a vacuum. They are context specific. They are also often dependent on complementary changes in related policy instruments to be fully effective. Thus raising building code standards without taking account the need to provide additional training to building inspectors may result in little real change occurring. Similarly, establishing new code requirements may only be feasible if the workforce implementing the standards has an

opportunity to acquire the skills needed for their implementation. Establishing higher building standards in one municipality may result in investors choosing to construct new buildings in an adjacent jurisdiction if its standards have not changed. The construction industry is extremely complex, so the impact of policy changes needs to be assessed in the context of a wide variety of other factors that may help, or hinder, achievement of the intended objectives.

In addition, synergies among policy instruments are often needed. This means examining a policy change in the context in which it will be implemented and then assessing whether and to what extent its success will be influenced by changes to other policies that affect the same area of construction. Lack of attention to context can result in sensible policy changes proving ineffective because adjacent policy areas fail to support or even undermine the changes.

This research would examine the relationship among some of the key policy tools used by governments to implement low carbon construction. The focus would be to try to identify how they interact and also what synergies may be needed to ensure that they complement rather than undermine climate goals.

10. A Literature Review on the Role of the Built Environment as a Contributor to Climate Change

The proposed literature review would provide an overview of the research carried out by a variety of individuals and organizations on the contribution of the built environment to climate change. We know that buildings are responsible for between one third and two fifths of final energy use and GHG emissions. This underscores both the importance of the sector and the rationale for searching for ways to reduce its carbon footprint. We recognize that there has been extensive research on the climate footprint of the built environment by governments, climate scientists and a wide variety of major national and international institutions (e.g. Stern, IPCC, UNEP, and EU etc. etc.). The proposed review would summarize what we currently know about how various elements of the built environment influence climate change, identify the components of the built environment that have the greatest impact on energy use and GHG emissions and assess the potential for reducing its climate impacts in the coming years.

Having mapped out the climate impact of the built environment, the literature review would then document the kinds of measures that have been adopted in various jurisdictions to address climate change by governments, environmentalists, builders, architects, industry organizations, and others attempting to reduce the carbon footprint of buildings. A variety of different kinds of measures have been implemented in recent years to reduce the energy consumption and carbon footprint of buildings. These include: government policies, voluntary initiatives by the industry, technological innovations, public education, whole life cycle costing

and other market-based initiatives. These various approaches need to be categorized and their impacts assessed. Of particular interest are the innovations and best practices that have (or have the potential to) significantly reduce energy consumption and GHG emissions in both new building innovations and retrofitted structures.