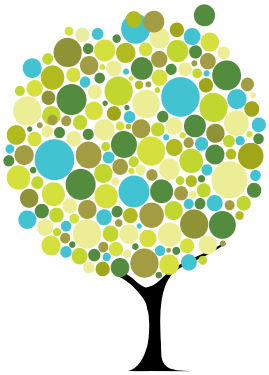
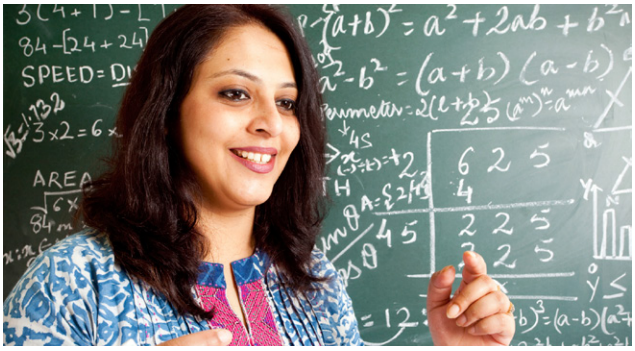
Climate Justice Project

Climate Justice, Green Jobs and Sustainable Production in BC





by Marc Lee and
Kenneth I. Carlaw

SEPTEMBER 2010

CCPA
CANADIAN CENTRE
for POLICY ALTERNATIVES
BC Office

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by Marc Lee and Kenneth I. Carlaw

September 2010

Climate Justice, Green Jobs and Sustainable Production in BC is part of the Climate Justice Project, a research alliance led by CCPA-BC and the University of BC. The Climate Justice Project studies the social and economic impacts of climate change and develops innovative green policy solutions that are both effective and equitable. The project is supported primarily by a grant from the Social Sciences and Humanities Research Council through its Community-University Research Alliance program. Thanks also to Vancity and the Vancouver Foundation.

Copyedit and design: Nadene Rehnby and Pete Tuepah, www.handsonpublications.com

ISBN: 978-1-926888-17-0

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ACKNOWLEDGEMENTS

This paper benefited immensely from comments made at a draft stage from Michael Byers, Bob deWit, Alan Durning, Tom Hackney, Brendan Haley, Chris Higgins, Matt Horne, Seth Klein, Monica Kosmak, Richard Lipsey, Josha MacNab, Wayne Peppard and Kevin Washbrook, as well as three anonymous reviewers. Any opinions and errors are the responsibility of the authors.

Summary

TO FIGHT AGAINST CATASTROPHIC CLIMATE CHANGE, BC needs to reduce greenhouse gas (GHG) emissions to near zero by mid-century at the latest. This amounts to a new, green industrial revolution that will have transformative impacts on work in the province. In addition, the need to adapt to inevitable climate change impacts will also have employment implications.

Reducing emissions to near zero by mid-century amounts to a new, green industrial revolution for BC.

With this report, we hope to contribute to a growing conversation about industrial and employment strategies the BC government can use to transition to a sustainable economy and create a new generation of well-paying green jobs.

Past industrial revolutions have caused great upheaval and hardship, with some sectors of society bearing a terrible burden. If this green industrial revolution is to occur in a just manner, we need to help workers make the transition to new employment, and provide economically marginalized people with new opportunities to secure decent work and economic security. Creating green jobs allows us not only to confront climate change, but also to achieve *climate justice*.

GREEN JOBS: THE BC CONTEXT

At the broadest level, green jobs are the work done in a sustainable economy. That is, at the end of a successful green industrial revolution, all jobs would be inherently green. For our purposes here, green jobs are well-paid, decent jobs that contribute to a reduction in greenhouse gas emissions, produce no or low environmental impact, and/or help the economy or society adapt to the impacts of climate change.

Currently, four-fifths of BC's commercial and industrial GHG emissions (that is, non-household emissions) come from a handful of sectors: mining, oil and gas, transportation and manufacturing. A few hot spots stand out for having high levels of GHG emissions *per*

worker: mining, oil and gas extraction, electricity generation, transportation and agriculture. The biggest culprit is the oil and gas industry, which provides very little direct employment in return for its substantial emissions. The oil and gas industry also includes the top two individual sources of CO_2 emissions in the province, and five of the top 12 emitters (all of these owned by one company, Spectra Energy).

BC's emissions profile is rooted in its history as a "staples economy" driven by the extraction and export of unprocessed or semi-processed raw materials. The BC government's industrial policies support the resource sector by providing transportation infrastructure (roads, bridges and ports), tax breaks and low-cost electricity. These industrial policies have been extremely successful in economic terms, but are often in conflict with climate policies.

A key challenge is that many of the jobs that have high levels of GHG emissions per worker are highly paid unionized jobs. While many decent jobs are not green, service sector jobs often show the opposite pattern: they have a small carbon footprint, but are low paying and provide little job satisfaction. For a green industrial revolution to truly fulfill its potential, green jobs must be synonymous with decent work.

Green jobs are well-paid, decent jobs that contribute to a reduction in greenhouse gas emissions, produce no or low environmental impact, and/or help the economy or society adapt to the impacts of climate change.

Leadership from the BC government is needed to implement more coherent and integrated climate, industrial and labour market policies—including "just transition" plans that support workers as they change careers—if a green industrial revolution that decarbonizes BC's economy is to occur without major social friction. A smooth transition also necessitates the creation of a wide range of new job opportunities actively engaged in greening the economy.

INVESTING IN GREEN JOBS

Green job creation is a natural outcome of rebuilding BC's physical infrastructure—buildings, communities, transportation systems and energy sources—to be more sustainable. Many public service jobs (civil service, health care work or early childhood education, for example) could also be considered a major source of inherently green jobs. These green investments create many more jobs than investments in fossil fuel industries.

Green jobs should also be actively linked to gains for traditionally disadvantaged populations, including women, visible minorities, immigrants and Aboriginal people, as well as low-income households in general. Commitments to support households in the transition will also be required to guard against adverse equity impacts on low-income households, as well as stoking the demand for investments in energy efficiency and low-emissions transportation.

New Building Construction and Retrofits

The concept of net zero energy buildings is considered an ideal for green residential, commercial and institutional buildings in the future. A major gap, however, is a need for funding of coordinated education and training programs to develop BC's knowledge capital in this area and ensure a supply of skilled workers. There are also opportunities to develop local green jobs in the production of equipment like hyper-efficient windows, heat pumps and other parts currently imported from Europe and Asia.

While net zero is an ideal for new buildings and housing development, the reality is that housing stock takes a very long time to turn over. A key green jobs strategy, therefore, is to start with retrofits of existing buildings. Because so many buildings need energy efficiency upgrades, and this is local, labour-intensive work, building retrofits are the low-hanging fruit of green job development. Specific policy actions to stimulate the demand for retrofits and increase the supply of skilled workers include: home and business financing reform, rising marketplace standards, coordination with post-secondary institutions and apprenticeship and training programs, and deterrents to natural gas conversion.

A bold apprenticeship program could provide an excellent opportunity to train economically disadvantaged groups (such as women, Aboriginal people and recent immigrants) in the skills that will be in high demand when the province undertakes a large-scale green capital plan.

Zero-Emission Transportation

A massive expansion of public transit should form a major part of a green jobs plan. Expansion of transit capacity is directly linked to new green jobs: the creation of new transit lines and transit vehicles will produce employment gains in construction and green manufacturing.

Because so many buildings need energy efficiency upgrades, and this is local, labour-intensive work, building retrofits are the low-hanging fruit of green job development.

Over the long run, a zero-emission transportation system must be rooted in more complete communities, where high-density housing is located close to public and private services and amenities. Without the need for long commutes, walking and biking could eventually encompass half of all trips, supplemented by transit, taxis and car-sharing, all of which would be powered by clean electricity.

For freight movement, reducing GHG emissions requires shifting from high-GHG transportation modes like airplanes and trucks to low-emission modes like trains and ships. Technological developments such as electric engines (and perhaps biofuel or hydrogen fuel cell) for trucks will eventually enable switching away from fossil fuels. Perhaps more importantly, freight emissions would be reduced by decreased consumption and less resource extraction for export.

Green Manufacturing

BC needs a strategic framework to make existing manufacturing operations more environmentally friendly, develop new local manufacturing capacity to reduce our dependency on imported goods, and work toward "closed-loop" production processes that exploit BC's abundant clean hydropower, and recycle and re-use wastes. Opportunities to green existing manufacturing operations can be realized through carbon pricing and other incentive mechanisms, but also by encouraging ideas for changes in workflow and production processes from the shop floor.

Closing the loop will provide new opportunities for green jobs if BC recycles waste products locally instead of exporting them to other jurisdictions. Processing recycled materials requires dramatically less energy than processing raw materials, and thus produces fewer emissions. Extended Producer Responsibility programs (which require manufacturers to assume responsibility for recycling their products) are a good model to build on, and should be harmonized with municipal blue box programs and local processing of waste materials.

Research into New Technologies

Long-term economic and employment strategies must also consider the development of new technologies. These may be necessary for the final percentage points of GHG reductions that take BC to zero emissions. The future path of any technology is impossible to predict, of course, but the decades to come offer the potential for major breakthroughs in areas like biotechnology, nanotechnology and quantum computing, all of which have massive potential for implementation in a green industrial production system. For example, advances in nanotechnology could support the development of hydrogen-powered vehicles and more efficient solar power generation. BC should be positioned to adopt and adapt green applications of these technologies.

Adaptation Planning

Beyond mitigation of GHG emissions, there will be new work related to adapting to a warmer province. We can develop strategies that improve our resilience to climate change in a way that creates green jobs, builds physical infrastructure and reinvigorates social networks. Adaptation-related jobs could include reinforcing dykes in low-lying areas, planting trees in areas decimated by the mountain pine beetle and upgrading storm sewers and water treatment facilities.

Fear of job loss could have a paralyzing impact on progress towards GHG emissions mitigation. But on balance, there will be a net increase in jobs—if public and private investments can be leveraged to develop green jobs.

Climate impacts on regions and communities will be diverse and variable, and require planning processes that identify major risks—e.g., fires, floods, droughts and landslides. The development of more localized, sustainable food systems is a key aspect of resilience planning, as climate change may affect global food supply chains, and conventional agriculture is highly dependent on fossil fuels. Beyond food, a planning framework that focuses on ensuring basic needs should also address water, housing and electricity at regional and community levels.

A Green Social Contract

Fear of job loss could have a paralyzing impact on progress towards GHG emissions mitigation. With the development of new green jobs in BC, there are likely to be job losses within certain industries like oil and gas. But on balance, there will be a net increase in jobs—if public and private investments can be leveraged to develop green jobs. In the vast majority of cases, skills will be readily transitioned to other needed work that will be created in green industries.

The term "social contract" is generally used to describe the agreement, written or assumed, between a government and the citizens it governs. A "green social contract" would guide a government to prioritize both the environment and the well-being of its citizens in any decision-making process, and would include strategies for helping workers transition to green jobs and protect against widespread unemployment. "Just transition" packages should include education and training, income support and mobility allowances for workers who need assistance in changing careers. A coordinated strategy should bring in secondary, post-secondary and training/apprenticeship programs to ensure appropriate skills development.

Carbon Transfer

The principle that prices should tell the truth about costs of production (e.g. that environmental costs should be factored in) is fundamental to the shift to a sustainable economy, but doing so poses a huge transitional problem for low- to middle-income families who spend a higher percentage of their incomes on energy and necessities. Ensuring that carbon pricing or higher energy prices do not have net detrimental impacts on low-income households is important to ensuring sufficient demand for green goods, services and investments. We propose a "carbon transfer" system that would be designed similarly to the income transfers for Old Age Security and the Canada Child Tax Benefit. These transfers have a maximum amount for the lowest income families, and phase out slowly over the income distribution, so that a very high proportion of families get something.

RECOMMENDATIONS

In the near term, we recommend the following steps be taken by the provincial government:

1. COMMIT TO ZERO FOSSIL FUELS by 2040 at the latest, with all energy requirements met by clean electric sources, plus some biofuels and hydrogen fuel cells where alternatives are required. All remaining non-fossil-fuel GHG emissions should be eliminated by 2050.

2. ENACT A MORATORIUM ON NEW FOSSIL FUEL EXTRACTION unless 100% of emissions can be captured and stored underground permanently.

3. ESTABLISH A TEN-YEAR RAPID ACTION PLAN on climate change, funded by a mix of carbon tax, increased natural gas royalties, and eliminated subsidies for fossil fuel industries, as well as from reallocating existing expenditures on unsustainable activities (e.g. highway expansion).

4. DEVELOP A COMPREHENSIVE PROVINCIAL GREEN INDUSTRIAL STRATEGY, including green jobs and capital plans, with priority focus on the following areas: green building construction and retrofitting; transportation; green manufacturing and waste management; and adaptation planning. The strategy must be coordinated across business, trade unions, secondary and post-secondary institutions and all levels of government, and should actively engage traditionally disadvantaged populations.

5. PUSH THE CONSTRUCTION INDUSTRY TO "NET ZERO" NEW BUILDINGS as quickly as possible. A major expansion of the LiveSmart program for building retrofits is also in order, with special attention paid to low- to middle-income households, older housing stock and coverage of multi-unit buildings.

6. IMPLEMENT A NEW TRANSPORTATION PLANNING FRAMEWORK that focuses on building complete communities and shifting to more sustainable modes of transportation (such as walking, biking and transit, rather than just on electric vehicles).

To pull off an industrial revolution in the span of decades will require careful planning and clarity of the ultimate objective of eliminating fossil fuels in the economy.

7. TAKE ACTION ON WASTE by expanding Extended Producer Responsibility programs and developing processing capacity to recycle materials in the province.

8. SUPPORT RESEARCH AND DEVELOPMENT OF NEW TECHNOLOGIES with green economy applications through direct government funding, direct or indirect support for commercialization and production, and support for learning and diffusion of knowledge and technology.

9. PLACE LIMITS ON OFFSET PROJECTS in order to focus on real emission reductions. Offsets should not be granted for projects outside of BC, and should be limited in time and scope.

10. DEVELOP ADAPTATION PLANS focused on the security of basic needs in areas such as food, water, electricity and housing.

11. LAUNCH A BROAD-BASED PARTICIPATORY EXERCISE aimed at defining the parameters of a new "green social contract" that ensures no one is left behind in the transition to a sustainable economy.

12. DEVELOP A FRAMEWORK FOR A NEW "CLIMATE TRANSFER" GRANT TO HOUSEHOLDS that would, minimally, be equivalent to existing energy expenditures (and ideally more) to insulate low- to middle-income households from increases in energy and carbon prices, funded from revenues from those sources.

From Business as Usual to Green Industrial Revolution

CLIMATE CHANGE IS A BY-PRODUCT of a global economic system based on cheap fossil fuel energy that powers our vehicles, homes, offices and factories. Summaries of climate science and modeling, such as those undertaken by the International Panel on Climate Change, tell us that a business as usual trajectory of rising greenhouse gas emissions (or even maintaining emissions at current levels) threatens the very survival of humans, not to mention countless other animals and plants. The effects of an altered climate are already evident in retreating glaciers, shrinking polar ice, and floods, droughts, and extreme weather events all over. In the case of BC, the impact on the province's forests due to the mountain pine beetle is perhaps the most compelling local example of climate change and the need for action.

Fully responding to the climate challenge will require changes in how we live, work and play, which means rethinking and questioning "business as usual" practices and our assumptions about how our economy works.

In spite of this, political support for climate action remains weak. Fully responding to the climate challenge will require changes in how we live, work and play, which means rethinking and questioning "business as usual" practices and our assumptions about how our economy works. While the BC government has enacted some important climate action measures, these remain first steps and are contradicted by industrial policies aimed at enhancing fossil fuel extraction, and transportation policies seeking to expand ports, bridges and highways. The BC government has legislated a target of 33% reduction in greenhouse gas emissions by 2020, but does not have a plan to achieve that target, much less consider the carbon footprint of the province's exports and imports. Resolving the contradictions between climate and industrial policies is central to breaking from "business as usual."

A strategic and systemic approach to green job creation that integrates climate, industrial and employment policies is vital to the political success of climate action. In this paper we seek to construct a preliminary, integrated framework for analysis of a sustainable economy, and to launch a dialogue about strategies the BC government can undertake to accelerate the transition to such an economy by creating a new generation of well-paying "green jobs." We assemble some baseline information about green jobs in the BC context, and associated

justice dimensions, including decent work, opportunities for traditionally disadvantaged populations and the development of a green social contract that ensures no one is left behind.

The principal challenge for BC and other jurisdictions around the world is to de-couple the economy from fossil fuels. This amounts to a new, green industrial revolution that will have transformative impacts on the nature of work and employment. In addition, there are important employment implications as to how we respond or adapt to climate change itself. Strategic thinking about employment and industrial policies is thus required to guide a transition that supports a high level of employment in jobs that are intrinsically green, while creating others that directly facilitate the move to a low-carbon and potentially much warmer (or, at least, significantly climate changed) province.

BC stands to benefit from acting now rather than waiting, and as a wealthy jurisdiction needs to demonstrate leadership.

While our focus is on solutions for BC, we recognize that BC is one province of a larger political entity. Canada's federated structure means that certain policy levers are not available at the provincial level, and that certain policies are best accomplished on a national basis. We further recognize that BC's transition to a sustainable economy must be accompanied by climate action in other jurisdictions around the world. Some "no regrets" policies can be pursued that are beneficial irrespective of this broader context (conservation programs, for example) but we assume that international cooperation on climate action (eventually) will occur. BC stands to benefit from acting now rather than waiting, and as a wealthy jurisdiction needs to demonstrate leadership.

PART 2

Sustainable Production and Green Jobs

THE TERM "GREEN JOBS" OR "GREEN-COLLAR JOBS" has been increasingly used in recent years to describe a new generation of employment opportunities that are sustainable, well-paid and secure. In this section, we seek to better understand what makes a job green, then in subsequent sections turn to the BC context, the role of "green jobs" as a core theme of a provincial economic strategy, and what this means for integrated and effective industrial, climate and labour market policies.

A sustainability framework includes two cycles of production that are closed-loop systems in which "waste is food." In the organic cycle all wastes are biodegradable (and become soil or fuel) while in the technological cycle non-organic, non-biodegradable, man-made items are re-used, re-manufactured or recycled.

The production of goods and services and their consumption by households are ultimately anchored in, and dependent on, ecological systems. Ecological economics recognizes that the economy is a sub-set of the biosphere, and places its emphasis on the inflows of materials and energy, and the outflow of wastes, into production and consumption activities. To be sustainable, (1) materials and energy inputs must be harvested in a way that does not deprive future generations, meaning use of resources that are renewable (e.g. wood from trees, energy from sun and wind) and recyclable (e.g. metals, paper); and (2) wastes (pollutants in the water, land and air, including greenhouse gases) must be within the "sink" functions of the Earth to process them naturally. A sustainability framework includes two cycles of production—organic and technological—that are closed-loop systems in which "waste is food." That is, in the organic cycle all wastes are biodegradable (and become soil or fuel) while in the technological cycle non-organic, non-biodegradable, man-made items are re-used, re-manufactured or recycled.[1]

Unfortunately, the scale and form of modern production and consumption have vastly exceeded ecological limits. In the case of climate change, the primary concern is the emission of greenhouse gases (GHGs) as a by-product of production processes and a wide range

1 See, for example, William McDonough and Michael Braungart, "The NEXT Industrial Revolution," *The Atlantic Monthly* 282 (4) (October 1998): 82-92.

of energy services (heating, mobility, powering gadgets) demanded by consumers. Climate change is arguably one symptom of extensive environmental degradation—to make matters worse, the problem is global and systemic. A transformational shift towards sustainable systems of production and consumption is urgent, and this requires collective action led by governments.

Fossil fuels burned in homes, businesses and factories, plus those combusted in various forms of transportation, account for about four-fifths of BC's GHG emissions.[2] Achieving a clean energy system means phasing out fossil fuels entirely, unless 100% of emissions can be captured and stored underground permanently (the intuition behind carbon capture and storage, or CCS). Reducing the use of fossil fuels, and eventually eliminating them, is no small challenge because they have underwritten a high standard of living. Fossil fuels have high concentrations of energy per unit of mass, and when processed into purer forms, are highly portable. In addition to emissions from the combustion of fossil fuels, there are GHG emissions associated with certain industrial processes (e.g., production of aluminum and cement being two major ones for BC) and emissions from agricultural practices, waste disposal (landfills) and deforestation.

Climate change is arguably one symptom of extensive environmental degradation—to make matters worse, the problem is global and systemic.

Mitigation efforts—the reduction of emissions over time—should ultimately lead to something close to zero emissions by mid-century. The last few per cent of emissions may be very difficult to eliminate, and may challenge our ability to get completely to zero, although much will depend on the evolution of technology in the coming decades. Some very small amount of emissions that can be absorbed by oceans, forests and soils is compatible with a sustainable economy. But for all intents and purposes, a green industrial revolution seeks to reduce emissions to zero.

This generalized understanding of a green industrial revolution is picked up in a number of common themes in work on sustainable production and green jobs.[3] *Aggressive conservation efforts* to reduce energy demand are generally less costly than building new supply. These can include efforts to improve the energy efficiency of vehicles and appliances, but also absolute reductions in the consumption of GHG-intensive goods and services. Dramatic improvements in the energy efficiency of residential and commercial buildings are currently possible, including new construction and retrofitting existing structures. Beyond efficiency measures, conservation also requires changes in the amount and composition of consumption.

Fuel switching from fossil fuels to alternatives, such as electricity, hydrogen and biofuels, will also be required. Hydrogen and biofuels are both inefficient from an energy-use perspective, and have challenges that limit their use over the whole economy. Biofuels, or fuels derived from organic matter, have proven problematic due to conflicts with other potential land uses, in particular agricultural land needed for food production. Hydrogen faces the critical problems of a lack of supportive infrastructure, and because it does not exist in raw form, how it can be produced cleanly. Use of hydrogen and biofuels will likely be restricted to niche applications. Instead, zero-emission electricity will likely be the principal source of

2 Government of BC, *British Columbia Greenhouse Gas Emissions Inventory Report 2008* (2010), www.env.gov.bc.ca/cas/mitigation/ghg_inventory/index.html. Figure includes net deforestation.

3 United Nations, *Green Jobs: Towards decent work in a sustainable, low-carbon world* (International Labour Organization, United Nations Energy Program, International Organization of Employers, and International Trade Union Confederation, September 2008), www.unep.org/labour_environment/features/greenjobs.asp; Robert Pollin and Jeanette Wicks-Lim, *Job Opportunities For The Green Economy: A State-By-State Picture Of Occupations That Gain From Green Investments* (Amherst: Political Economy Research Institute, University of Massachusetts, June 2008).

energy in a zero-carbon economy. This includes hydro, solar, wind, geothermal and tidal energy, although all new supply options have some environmental cost, including GHG emissions in manufacture and construction. In addition, capture of waste heat and energy (for example, in district heating systems) can also displace fossil fuels.[4]

Over a longer period of time, *land use and urban form changes* are key to deep, long-run emission reductions, in particular shifts to lower emission modes of transportation and more compact communities. In transportation this means shorter trips, greater transit use, and more biking and walking, rather than just replacing internal combustion engines with electric ones. For buildings this means hyper-efficient design, increases in density, and mixed-use, mixed-income neighbourhoods where homes are closer to transit, jobs, stores and public services. These areas are also where important co-benefits are to be found that address a number of other equity and environmental objectives (such as reductions in other pollutants, health improvements and community economic development).

Green manufacturing efforts seek to reduce the footprint of all industries through a mix of electrification, technology substitution and changes in processes. Concepts such as zero waste and closed-loop systems embody this idea of sustainable production, much of which is already viable with existing (or near-term) technologies. In addition, research into *new fundamental technologies* will lead to innovations in energy and production practices that may be hard to envision today.

Green jobs are the work done in a sustainable economy. That is, if we undertake a green industrial revolution, by mid-century (or earlier) all jobs would be inherently green.

The shift to a zero-carbon economy is facilitated by *capital stock turnover*—the ongoing replacement of appliances, vehicles and buildings over time—if accompanied by minimum emissions standards and increases in the cost of emitting greenhouse gases (carbon pricing). However, given the urgency of the climate challenge, a more aggressive approach than relying on natural rates of capital stock turnover is appropriate. Efforts to accelerate this turnover should be made, for example, through accelerated capital cost allowances, and investment tax credits for new capital investments that meet thresholds for emission reductions.

GREEN JOBS AND DECENT WORK

In the face of climate change, the concept of "green jobs" or "green-collar jobs" has become a major focus for policy makers, albeit a vaguely defined one. At the broadest level, green jobs are the work done in a sustainable economy. That is, if we undertake a green industrial revolution, by mid-century (or earlier) all jobs would be inherently green. There are two general or "in principle" definitions of green jobs that are useful in moving forward. In a detailed study, the United Nations defines green jobs as:

> *[W]ork in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.*[5]

4 Other Climate Justice research projects underway on conservation and clean electricity generation, household energy efficiency, and transportation take up these issues in greater detail than can be provided here.

5 United Nations 2008, *supra* note 3.

From a more activist perspective, the US-based Apollo Alliance, a coalition of labour, business, environmental and community leaders working to catalyze a clean energy revolution, builds on this definition to include a notion of decent work:

> *Green-collar jobs … are well-paid, career track jobs that contribute directly to preserving or enhancing environmental quality. Like traditional blue-collar jobs, green-collar jobs range from low-skill, entry-level positions to high-skill, higher-paid jobs, and include opportunities for advancement in both skills and wages. Green-collar jobs tend to be local because many involve work transforming and upgrading the immediate built and natural environment—work such as retrofitting buildings, installing solar panels, constructing transit lines, and landscaping. Green-collar jobs are in construction, manufacturing, installation, maintenance, agriculture, and many other sectors of the economy.*[6]

Interestingly, many service sector jobs that have a small carbon footprint would not fit a modified definition of green jobs that includes some concept of decent work. While "services" covers a vast range of work, many service sector jobs in BC are those less desirable food service, cleaning, trash removal and other forms of service that pay low wages and have less desirable working conditions. Inclusion of decent work, along with low or no environmental impact, is, in our view, a fundamental justice and equity dimension of a green job.

Low income among workers is not a trivial concern. An analysis by Statistics Canada found that in 2004, 12.4% of full-time workers in BC were "working poor," defined as earning less than $10 per hour (in 2001 dollars).[7] An alternative measure developed by researchers at Human Resources and Social Development Canada found that in 2001, 10.2% of workers in BC were considered "working poor" (defined as working more than 910 hours per year with income below the low income threshold as measured by the Market Basket Measure).[8]

In a broad sense decent work is a well-paying job that is secure and safe, with some measure of personal autonomy and flexibility that enables one to raise a family, and to save for retirement—although there may be trade-offs among these characteristics (some may take on risk for the reward of far-above-average wages).

In a broad sense decent work is a well-paying job that is secure and safe, with some measure of personal autonomy and flexibility that enables one to raise a family, and to save for retirement—although there may be trade-offs among these characteristics (some may take on risk for the reward of far-above-average wages). From research on life satisfaction, we know that in addition to the income to purchase goods and services, work also provides people with a means for contributing to wider society, which has a value above and beyond income. There are large and negative well-being implications of unemployment; thus, work is also central to social cohesion in advanced societies.[9]

Decent work is facilitated by the private and public creation of stimulating work, with supportive labour market institutions, such as employment standards, minimum wages, hours of work provisions and health and safety regulations. Decent work is also more likely to be found in an environment that is an outcome of the collective bargaining process that leads

6 Apollo Alliance, *Community Jobs in the Green Economy* (Oakland: The Apollo Alliance, 2007).
7 Statistics Canada, *Low Wage and Low Income*, Table 5 (Cat. no. 75F0002MIE—No. 006, 2006).
8 Dominique Fleury and Myriam Fortin, *When Working is Not Enough to Escape Poverty: An Analysis of Canada's Working Poor*, Table 4.1 (Human Resources and Social Development Canada, Working Paper SP-630-06-06E, August 2006).
9 Richard Layard, *Happiness: Lessons from a New Science* (New York: Penguin Press, 2005).

to higher wages, greater non-wage compensation (employer-provided benefits packages), expansive pension plans, and better job security and working conditions.[10]

Thus, green jobs, for the purpose of this paper, are those that provide decent work while either contributing to a reduction in greenhouse gas emissions or producing no or at least low environmental impact, and jobs that specifically help the economy or society adapt to the impacts of climate change. For a green industrial revolution to truly fulfill its potential, it must incorporate decent work into the transition, and consider that work to be a core part of a new middle class.

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10 These features are often but not exclusively earned through higher levels of productivity in unionized companies. This may be due to the pressure on employers for paying higher wages and benefits creating an incentive for employers to invest more in new equipment and technology, but part of the explanation may also be better labour-management relations and discussion of workplace problems (see Andrew Jackson, *Work and Labour in Canada, 2nd Edition* [Toronto: Canadian Scholars' Press, 2009]). While many take the view that unions have negative impacts on growth and job creation, a detailed study from the World Bank finds little support for this view (see Toke Aidt and Zafiris Tzannatos, *Unions and Collective Bargaining: Economic Effects in a Global Environment* [Washington: The World Bank, 2003]).

PART 3

Greenhouse Gas Emissions and Green Jobs in BC

As we move forward there may be some conflicts between work that is "decent" and work that is "green," which speaks to the need for a "green social contract" and "just transition" programs.

PUTTING NUMBERS TO EXISTING AND FUTURE GREEN JOBS is no small challenge, as data collected at the industry or occupational level generally do not distinguish between work that is green and that is not. A study by ECO Canada estimated the number of "environmental employees" (defined as "employment activities that seek to manage the use of, impact on, and enhance the sustainability of the environment"), which encompasses environmental protection; conservation and preservation of natural resources; and, environmental sustainability. By its count, BC had 93,462 environmental employees in 2006.[11]

More recently, a report for the provincial government by the Globe Foundation estimated 117,160 direct jobs in BC's green economy in 2008, equivalent to 5.1% of provincial employment. The report cited five major areas of existing green jobs: environmental protection (32,732 jobs); energy management and efficiency (24,821); clean and alternative energy (21,743); green buildings (21,029); and knowledge industries (16,060).[12] Green job estimates involve some guess work, and were derived by estimating the ratio of "environmental revenues" to overall revenues for a sector. Nonetheless, these figures demonstrate, at a minimum, that there are many environmentally-oriented businesses in BC.

In the remainder of the section, we look more closely at green jobs as they relate to climate change by looking at BC's industrial mix in terms of both GHG emissions and employment. The results in Table 1 include all industrial and commercial emissions in BC (65% of total emissions)—that is, we do not include personal transportation or residential emissions, in order to focus on emissions from industry. Data limitations mean the analysis is for broad

11 ECO Canada, *Profile of Canadian Environmental Employment* (2007), cited in "Measuring Green Collar Jobs in British Columbia," *Environmental Statistics* (BC Stats, January 2010).

12 *British Columbia's Green Economy: Building a Strong Low-Carbon Future* (Vancouver: The Globe Foundation, February 2010).

industry categories only. Figure 1 shows our estimate of emissions per worker, an approximation of the carbon footprint associated with work in different industries.

Table 1 shows that four-fifths of BC's commercial and industrial GHG emissions come from a handful of sectors: mining, oil and gas, transportation and manufacturing. In terms of GHGs per worker, the "hot spots" include: mining and oil and gas extraction, electricity generation, transportation and agriculture. These sectors employ 8% of BC workers, but comprise 68% of the industrial and commercial emissions in the table, and 44% of total BC emissions. If we add manufacturing to the mix, 91% of these emissions come from industries that employ just 17% of workers.

A key challenge for decent work is that many of the goods-producing jobs that have high levels of GHG emissions per worker also tend to be high-paying unionized jobs, whereas the greenest jobs in the service sector comprise many low-paying jobs that are not decent work. Thus, as we move forward there may be some conflicts between work that is "decent" and work that is "green", which speaks to the need for a "green social contract" and "just transition" programs (a topic we return to later in the paper).

In BC's commercial and industrial sector, 90% of emissions come from industries that employ just 17% of workers.

Mining and oil and gas industries (including natural gas distribution), in particular, have a striking emissions profile (almost one-third of emissions) compared to every other industrial sector, and contrasting sharply with its relatively small number of workers (about 1% of BC

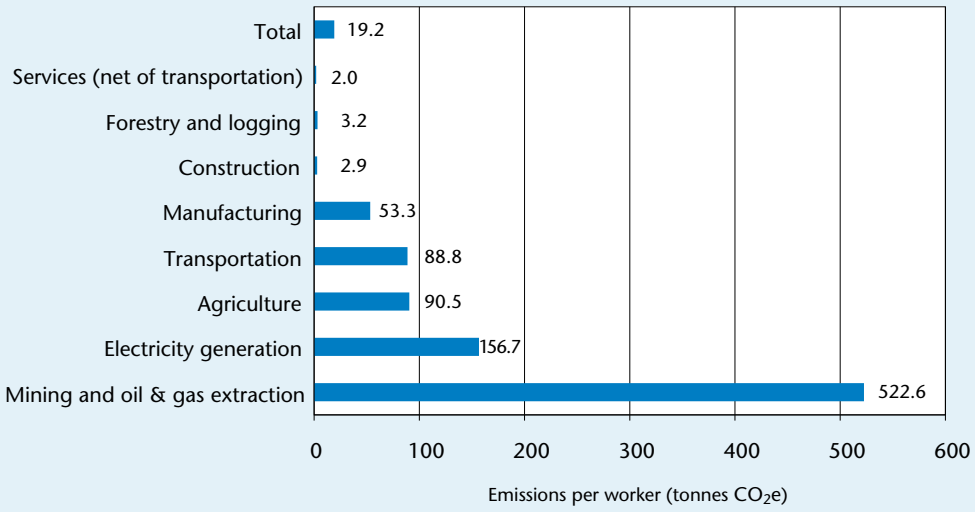
Table 1: Industrial GHG Emissions and Employment, BC, 2008

Industry	GHG emissions (kt CO_2e)	% of GHGs	Employment (thousands)	% of total employment
Agriculture	3,249	7.3%	35.9	1.6%
Forestry and logging	56	0.1%	17.4	0.8%
Construction	643	1.4%	220.8	9.5%
Electricity generation	1,520	3.4%	9.7	0.4%
Mining and oil and gas	14,685	33.1%	28.1	1.2%
Manufacturing	9,995	22.5%	187.4	8.1%
Freight and transportation industry	10,857	24.5%	122.3	5.3%
Services	3,374	7.6%	1,692.7	73.1%
Industry total	44,378	100%	2,314.3	100%

Notes: Agriculture employment includes fishing, hunting and trapping; GHG data include additional emissions from energy use on farms, based on estimates by Lee et al. (2010), *supra* note 14. Forestry and logging does not include forest products manufacturing, which is included under manufacturing. Construction includes half of cement production emissions; the other half of cement production exported to the US (http://dcnonl.com/article/20050630800) is under manufacturing. Electricity generation employment includes utilities employment less 2,300 jobs for natural gas, which are included under mining and oil and gas, and 2,200 jobs in water and sewer utilities, included under services (www.guidetobceconomy.org/major_industries/utilities.htm). Under freight and transportation, we remove personal transportation emissions, emissions attributed to agriculture, and pipelines (attributed to mining and oil and gas extraction). Transportation services are counted under freight and transportation Industry. GHG estimate for services is equivalent to emissions associated with commercial and institutional buildings.

Sources: BC Ministry of Environment, *BC Greenhouse Gas Inventory Report 2008* (2010), www.env.gov.bc.ca/cas/mitigation/ghg_inventory/index.html; BC Stats, *British Columbia Employment by Industry* (www.bcstats.gov.bc.ca/data/lss/labour.asp); Marc Lee et al., *Every Bite Counts: Climate Justice and BC's Food System* (Vancouver: CCPA–BC, forthcoming).

Figure 1: GHG Emissions per Worker, BC, 2008



Source: Authors' calculations based on Table 1.

employment). The biggest culprit is the oil and gas industry, which is actually much worse, with very little direct employment (2,200 jobs in 2008, although this had grown to about 3,000 by 2009) but most of the emissions in this category. The emissions profile of both coal mining and oil and gas extraction and processing is even worse when we consider exports. By accounting convention, only emissions from the combustion of these fossil fuels in BC are counted in the province's GHG inventory. But emissions from these two export sectors combusted in other jurisdictions (primarily, the US, China and Japan) are more than double BC's emissions from combusting fossil fuels.[13]

The biggest culprit is the oil and gas industry, which is actually much worse, with very little direct employment, but most of the emissions in this category.

The significant emissions from electricity generation are associated with a relatively small share of total generation capacity that is derived from natural gas (about 90% of generation is from hydro power). Even this small amount of electricity generation from fossil fuels leads to high emissions per worker. However, the province is transitioning away from gas-fired electricity towards exclusively clean sources. BC's existing reserves of hydropower are a huge asset in the transition to a sustainable economy by acting as storage capacity for intermittent renewable sources (like wind, run-of-the-river or solar-generated electric power).

Agriculture is an unlikely culprit. In addition to the direct emissions from farm animals and fertilizers counted in the official GHG inventory, we include emissions from energy use on the farm.[14] BC also imports about half of the food consumed in the province, with emissions on a household consumption basis much higher as a result. Food issues around self-reliance, mitigation and adaptation with a climate justice lens are taken up in another Climate Justice Project research paper.[15]

13 Marc Lee, *Peddling GHGs: What is the Carbon Footprint of BC's Fossil Fuel Exports?* (Vancouver: CCPA–BC, July 2010).

14 Marc Lee et al., *Every Bite Counts: Climate Justice and BC's Food System* (Vancouver: CCPA–BC, forthcoming).

15 Ibid.

Table 2: BC's Top 39 Point Source Emitters (>50 kt CO_2e), 2008, Summarized by industry

	Number of facilities	Greenhouse gas emissions (kt CO_2e)	Share of BC top emitters
Oil and gas	13	5,330	40.7%
Cement and lime	4	2,132	16.3%
Mining	8	2,029	15.5%
Forest products	10	1,287	9.8%
Aluminum	1	1,205	9.2%
Electricity generation	3	1,121	8.6%
Total	39	13,104	100.0%

Source: Authors' calculations based on Environment Canada, *Facility GHG Emissions by Province/Territory* (2008), www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=DF08C7BA-1.

The broad service sector employs almost three-quarters of British Columbians while producing 8% of GHGs, and therefore has a very small GHG footprint per worker (we include emissions from commercial and institutional buildings, and do not count transportation services). While the operations of many service sector jobs are low in carbon intensity, they also rely on imported machinery and equipment that have embodied GHG emissions (related to production abroad and transportation to the domestic market). A full life-cycle approach would count these emissions. Commuting to work is another large source of emissions not counted in our estimates.

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Some finer details about BC's industrial emissions profile are available from data on emissions by specific facilities. Table 2 breaks down emissions by industry based on a list of the province's 39 top point-source emitters in 2008, each of which individually exceeded 50 kt CO_2e, and which together accounted for about 30% of the industrial emissions in Table 1.[16]

Notably, two-fifths of the emissions on this list of top emitters derive from oil and gas processing facilities (i.e. before we consider the combustion of those fuels in homes, buildings and vehicles, whether in BC or export markets). This includes the top two emitters in BC and five of the top 12 emitters (all of these owned by one company, Spectra Energy). This further raises questions about the long-term status of this industry given legislated GHG emission reduction targets, as well as the wisdom of further expansion of oil and gas as an industrial strategy.

For other industries, large point-source emitters are also notable for their contribution to BC's overall emissions inventory: in aluminum, the emissions are from one plant in Kitimat; for cement, three facilities; and lime, one facility. Electricity generation emissions include the bulk of emissions listed in Table 1, and arise from two BC Hydro thermal generation plants and one private cogeneration facility on Vancouver Island.

16 Environment Canada regulations required only facilities with greater than 100 kt of emissions to report, a threshold that was lowered to 50 kt CO_2e in 2009. In late 2009, BC tabled regulations that would require reporting by all facilities with greater than 10 kt of emissions per year, with verification for those with more than 25 kt. The top 39 includes four facilities with emissions between 50 and 99 kt in 2008, the year before the threshold was lowered. The list may be incomplete as a result.

PART 4

Climate and Industrial Policies: Resolving the Contradictions

In 2010, BC has much more diversified industrial production than in the past. But it retains a dependence on the export of basic commodities, and this legacy still permeates the thinking of business and government in the province.

BC IS A CLASSIC CASE of what Canadian economic historian Harold Innis termed a "staples economy"—one driven by the extraction and export of unprocessed or semi-processed raw materials. The BC government's industrial policies in support of the resource sector include the provision of infrastructure for transportation (roads, bridges, ports) and electricity. On the latter, a key motivation for the formation of BC Hydro as a Crown corporation in the 1960s was to deliver low-cost electricity to industrial customers by building hydro dams throughout the province. Current hydro rates in BC are among the lowest in North America, with industrial rates about half the rates for residential customers. Natural gas pipeline infrastructure was developed through BC Gas, a subsidiary of BC Hydro that was privatized in the 1980s (assets currently owned by Terasen).

In 2010, BC has much more diversified industrial production than in the past. But it retains a dependence on the export of basic commodities, and this legacy still permeates the thinking of business and government in the province. Moreover, the BC government's recent push for massive oil and gas expansion and new "clean electricity" exports demonstrate that resources are not an "old economy" relic. Provincial budget expenditures on social programs are aided by royalty revenues from resource industries. Thus, resource industry interests are weaved into the economic and social fabric of the province.

What *has* changed is the nature of the social contract vis-a-vis resource industries. The provincial government historically implemented labour market policies tied to industrial development in the resource sectors. One major example is the linkage of employment to resource access in the forestry sector (appurtenancy provisions) that were removed in 2003. Another is a labour market framework friendly to union organizing as a means of improving

wages and working conditions. Like many other jurisdictions, BC industrial policy in recent years has emphasized passive, supply-side policy measures that seek to reduce operating costs for businesses in order to make them more "competitive" and to attract new foreign investment. Examples of such policies include corporate income tax reductions, reductions in royalties, deregulation and weakening of employment standards. These policies have arguably had a negative impact on decent work in BC, and have contributed to entrenching the low-value-chain resource mindset that dominates provincial economic policy-making.

The context for resource industries is undergoing a new change due to the rise of climate action as a new priority, one that sits in direct conflict with expansion of the resource sector. As the previous section notes, capital-intensive resource industries are important contributors to BC's inventory of GHG emissions, and coal and natural gas exports extend BC's carbon footprint in unsustainable ways.[17] Historically, the size of the provincial economy and the scale of resource extraction were such that environmental concerns were not actively considered, or were localized challenges (such as air or water quality). The limiting factors for resource industries were merely the amount of labour and capital equipment that could be brought to bear. This is no longer the case.

Leadership from the BC government is needed to implement more coherent and integrated climate, industrial and labour market policies if a green industrial revolution that decarbonizes BC's economy is to occur. While almost everyone agrees business as usual is not acceptable from a GHG perspective, most policy work does not think beyond business as usual, and may also be compromised due to vested interests. To date, climate action in BC has comprised a number of worthwhile first steps, including new requirements for reporting emissions from industrial users, an onus on communities to develop plans, some energy efficiency subsidies and a greener building code.

Leadership from the BC government is needed to implement more coherent and integrated climate, industrial and labour market policies if a green industrial revolution that decarbonizes BC's economy is to occur.

BC's Climate Action Plan is estimated to take the province three-quarters of the way to its 2020 legislated target of a one-third reduction from 2007 GHG emission levels. However, since the plan was tabled in 2008, no further initiatives have been launched to get all of the way to the target, and no plans have been announced for meeting the 2050 target of an 80% reduction. Nor does the Climate Action Plan fundamentally challenge the root causes of GHG emissions in the province. If anything, the plan puts an additional onus on the public sector relative to the private sector by requiring carbon offsets to be purchased for public sector emissions (see *To Offset or Not to Offset* on page 26).

Much of the attention of the Climate Action Plan has been on the BC carbon tax, which is $20 per tonne of CO_2 (or equivalent) as of July 2010. It is widely agreed that carbon pricing is an essential component of a transition strategy, by creating a price signal that leads to greener investments and decisions by households and businesses. However, there are important design considerations in how carbon pricing is implemented, and the existing carbon tax has a number of shortcomings:

- The tax is scheduled to rise to $30 per tonne in July 2012, but no further price path has been specified. According to a recent study, carbon prices in Canada

17 Exports also provide income for imported goods and services. Consumption of GHG-intensive imports is tantamount to outsourcing of these emissions to other jurisdictions. One of the difficult problems in the attribution of GHGs is created by global trade. Is the culprit the source point of production or consumption of the good or service in question? We focus here on production as a source point, but note the open question of attribution.

need to reach $200 per tonne by 2020 to be consistent with GHG reductions that keep global temperature increase under 2 degrees Celsius.[18]

- The tax compensated low-income households in line with their average tax when the tax was introduced, but since then the low income credit has increased by only 15.5%, compared with a doubling of the tax. As of July 2010, the tax and recycling regime for BC's carbon tax became regressive.
- The tax currently covers only 70% of BC's GHG emissions, and does not cover emissions in key industrial areas, in particular process emissions associated with cement, lime and aluminum production, and venting and pipeline leakages in the oil and gas sector.
- The tax does not apply to exports, which, as noted above, have a large carbon footprint when combusted in other jurisdictions.
- Revenue neutrality means that most of the tax revenues currently finance personal and corporate income tax cuts, rather than targeted investment incentives or public expenditures that would reinforce climate action.

In contrast to even these limited climate actions, further development of BC's fossil fuel industries has continued unabated.

Actions outside provincial borders may lead to deeper changes in BC's industrial structure, such as a cap-and-trade system at a North American or regional level. In the case of the latter, the Western Climate Initiative held out the promise of a regional cap-and-trade system, but this has been largely abandoned by US state legislatures. Even the negotiated agreement among seven US states and four Canadian provinces was arguably a weak deal, with watered-down timelines and large provisions for the purchase of offsets to meet targets.

In contrast to these limited climate actions, further development of BC's fossil fuel industries has continued unabated. The auction of $404 million worth of shale gas exploration rights in 2010 is a case in point.[19] Royalty regimes for oil and gas extraction have been developed without any consideration of climate impacts—indeed, the BC government created a stimulus package for the oil and gas industry in August 2009 that reduced royalties in order to induce more investment in the province.[20] Numerous subsidy mechanisms employed by the government averaged about $265 million per year between 2006/07 and 2009/10. In addition, the public cost of building road infrastructure and foregone revenues to the provincial treasury of allowing flaring instead of ensuring that natural gas goes to market are indirect subsidies to the sector.[21]

Resolving this contradiction requires that, in the short term, these subsidies should be rescinded, and a moratorium on all new oil and gas development should be imposed, until carbon capture and storage (CCS) systems that capture and permanently store 100% of emissions can be implemented. Embedded in CCS is the (correct) idea that if our fuel comes

18 Modelling by Mark Jaccard and Associates for Matthew Bramley, Pierre Sadik and Dale Marshall, *Climate Leadership, Economic Prosperity: Final report on an economic study of greenhouse gas targets and policies for Canada* (David Suzuki Foundation and the Pembina Institute, 2009).

19 David Ebner, "B.C. shale gas gets jump-start with $404-million land auction" (*The Globe and Mail*, June 24, 2010), www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/bc-pulls-in-404-million-for-gas-rights/article1616371/.

20 BC Ministry of Energy, Mines and Petroleum Resources, "Oil and gas stimulus to boost provincial economy" (news release, August 6, 2009).

21 Ben Parfitt, *Foot Off the Gas: Regulating BC's Oil and Gas Industry as if the Environment Mattered* (Vancouver: CCPA–BC, 2007).

from underground, it must be returned underground or it is not sustainable. It is not clear whether CCS would be able to contain anything close to 100% of emissions on a life-cycle basis. Nonetheless, all existing operations should be required to implement CCS or otherwise become carbon neutral sometime between 2020 and 2030.[22]

Similar to oil and gas, mining exploration and development already receive substantial public subsidies through flow-through share credits and treatment of exploration expenditures. The direct emissions from these operations in BC are much smaller than exported emissions. In the case of coal, about as large as emissions from fossil fuel combustion within BC.

Forestry is another case where industrial policy is in conflict with climate policy, with bioenergy being promoted as a new resource development activity. In a report for the Climate Justice Project, Ben Parfitt proposes a framework to reconcile carbon management, conservation and economic uses of forest resources. He proposes a "hierarchy of uses" that considers carbon storage as a key consideration, ranging from pure conservation to forest products to bioenergy. Moreover, he recommends a new method, the Carbon Cut Calculation, as an alternative to the Allowable Annual Cut to formally integrate carbon storage capacity into land use decision-making.[23]

In addition to sector-specific policies, the BC government also provides supports in the form of infrastructure, with transportation and electricity the key areas of past investment that have facilitated GHG-intensive resource extraction. Redeveloping and repurposing infrastructure as part of a climate action strategy can lead to long-term GHG reductions, but so far infrastructure decisions have been wedded to business as usual.

Port, highway and bridge expansion as part of the Gateway program is alleged to improve the flow of goods movement and commuter traffic. But these new investments serve to further lock in enhanced movement of goods by trucks and an auto-dependent suburban culture that are fundamentally unsustainable.

In the case of transportation, highway and bridge expansion is a top priority in the Lower Mainland and other parts of the province, while new investments in public transit are sorely needed. Port, highway and bridge expansion as part of the Gateway program is alleged to improve the flow of goods movement and commuter traffic. But these new investments serve to further lock in enhanced movement of goods by trucks and an auto-dependent suburban culture that are fundamentally unsustainable.

With its new Clean Energy Act, the BC government is trying to position the province as a leading exporter of clean electricity through projects like Site C in the Northeast. This is a continuation of the same resource extraction mindset of the past, rather than attempting to build a value-added industrial strategy around an abundance of clean electricity. Moreover, the province is simultaneously maintaining low electricity prices for GHG-intensive industrial users, and is even building a new transmission line to the Northeast to support the energy appetites of new mining or oil and gas operations.[24] Indeed, in the case of Site C, "clean energy" may be used to facilitate shale gas extraction nearby that would then be pipelined to Alberta to process tar sands into product for the US market—perhaps the ultimate conflict between industrial and climate policies.

22 For a discussion, see Lee 2010, *supra* note 13.

23 Ben Parfitt, *Managing BC's Forests for a Cooler Planet* (Vancouver: CCPA–BC, January 2010).

24 Marvin Shaffer, "Green in a Different Sense" (*Policy Note* blog, October 2, 2009), www.policynote.ca/2009/10/02/green-in-a-different-sense/.

To Offset or Not to Offset

The benefit of offsets is as an alternative financial mechanism to drive new investments in GHG reductions. The downside is that offsets prop up business as usual burning of fossil fuels, ultimately delaying actual emission reductions from major polluters.

Offsets are an increasingly popular means of "meeting" emission reduction targets by purchasing credits from third parties who are engaged in other mitigation activities. These tend to be in the areas of fuel substitution (e.g. from coal to natural gas), tree planting, shifts in agricultural practices, and emissions capture in landfills, although there is pressure to expand the scope of such projects. The benefit of offsets is as an alternative financial mechanism to drive new investments in GHG reductions. The downside is that offsets prop up business as usual burning of fossil fuels, ultimately delaying actual emission reductions from major polluters.

Offset projects can be domestic or international, regulated or unregulated, but are almost always problematic. It is difficult to tell what investments funded by offsets are in fact "additional"—whether they would have happened anyway. This means projects need to be verified, measured and monitored over long periods of time. There are many challenges in methodology but also in achieving high standards and independent verification in achieving this task. For example, it does not make sense to offset one year's industrial emissions by planting trees that will not sequester carbon until several decades in the future, and only then if the trees survive and are not burned or cut down.

One widely cited study found that 40% of international offset projects (through the UN's Clean Development Mechanism) did not meet the additionality test.[a] In addition, the asset created by offset mechanisms, the carbon credit, can then be traded and speculated on.

a Lambert Schneider, *Is the CDM fulfilling its environmental and sustainable development objectives? An evaluation of the CDM and options for improvement* (prepared for the World Wildlife Foundation, 2007), www.oeko.de/files/forschungsergebnisse/application/octet-stream/download.php?id=622&PHPSESSID=hnitro11f6hhhhh1qktfct7vp1.

A recent enquiry into international offset projects found numerous conflicts of interest and uncertainties in the process that make the system an elaborate shell game.[b]

Minimally, offset projects outside BC should be avoided entirely in order to keep capital in the province and facilitate GHG reductions (rather than financing mitigation elsewhere). Most existing offset projects ought to be done anyway, and should simply be required of businesses by government. If we accept zero emissions as a long-term target, *all offset projects are additional*—emissions would have to be reduced at some future point anyway,. Planting trees only sequesters CO_2 that had been previously been released when those trees were cut down. Technically, the only true offset is to capture CO_2 and store it permanently underground.[c] To the extent that offsets are permitted, they should be limited in time, quantity and scope, and acknowledged as short-run measures that transfer capital to facilitate GHG reductions.

In the case of contributions to the Pacific Carbon Trust required of the public sector, public institutions are effectively paying a much higher carbon tax of $45 per tonne of CO_2 compared to $20 in the private sector (as of July 1, 2010). While there is good cause for governments to take a leadership role with regard to mitigation—and public sector institutions (universities, in particular[d]) are indeed responding to this price signal—PCT funds are not currently available to the public sector for mitigation projects. Flowing back PCT funds to support projects that reduce GHG emissions in the public sector could include supporting urban agriculture projects on school property or solar panel and water heating systems on rooftops. This would avert the flow of funds from the public sector to private sector via the PCT.

It is difficult to tell what investments funded by offsets are in fact "additional"—whether they would have happened anyway.

b Mark Schapiro, "Conning the Climate: Inside the carbon-trading shell game," *Harper's Magazine* (February 2010): 31-39.

c Speech by Mark Jaccard to Global Civic Forum, June 9, 2010, quoted in "Mark Jaccard's Dismal Conclusion," *PriceTags* (June 26, 2010), http://pricetags.wordpress.com/2010/06/26/marc-jaccards-dismal-conclusion/.

d A June 2010 conference in Vancouver hosted by the Pacific Institute for Climate Solutions featured a panel of engineering managers from BC's main universities, who described initiatives underway, mostly using district energy systems.

PART 5

Growing Green Jobs

A key focal point for green jobs is in rebuilding BC's physical infrastructure: the buildings in which we live and work, how those buildings connect together as communities, the ways in which we move ourselves, and how we get and use energy.

BC'S CAPACITY TO ACT is somewhat constrained by what happens federally, in the US and in jurisdictions around the world. Nonetheless, while the state of global climate politics is rather grim we assume that the nations of the world will get their act together at some point, and therefore more aggressive action in BC will be needed. But more importantly, we argue that BC can derive substantial economic advantages from aggressive climate action.

In what follows we focus on areas where employment opportunities can be created through public policy or investments that move BC closer to a zero-carbon economy. They build on the broader reconciliation of industrial and climate policies in the previous section, and will be needed if BC is to transition quickly off of fossil fuels and find new sources of economic prosperity other than resource extraction.

A key focal point for green jobs is in rebuilding BC's physical infrastructure: the buildings in which we live and work, how those buildings connect together as communities, the ways in which we move ourselves, and how we get and use energy. We also focus on some key elements of a new social infrastructure for a green economy that supports the demand side of BC's economy with purchasing power, through incentives and a "green social contract" to facilitate change.

The more robust a green jobs program in delivering new employment opportunities, the smoother will be the transition. A recent study of green jobs in the US context notes that they are already "in the same areas of employment that people already work in today, in every region and state of the country. For example, constructing wind farms creates jobs for sheet metal workers, machinists and truck drivers, among many others. Increasing the energy efficiency of buildings through retrofitting relies, among others, on roofers, insulators and building inspectors."[25]

We recognize that there is an important difference between existing jobs and potential jobs, however dirty the former and green the latter are. That real people in real communities may be adversely affected by climate policies may politically trump promises of new, green

25 Pollin and Wicks-Lim 2008, *supra* note 3.

jobs that do not currently exist. Planning for a smooth transition, however, underlines the need for proactive public investments and industrial policies that create new employment opportunities across the economy.

BUILDINGS: RETROFITS AND NEW CONSTRUCTION

The concept of "net zero" buildings is considered an ideal for green residential, commercial and institutional buildings in the future. In practice, it means siting the building to take better advantage of the winter sun, along with improvements to building envelopes to better facilitate lighting, heating and cooling, and the use of more energy efficient equipment and appliances within homes. With on-site clean electricity generation (such as solar panels) and/or neighbourhood-scale energy systems (including waste heat recapture) supplying any energy gaps, such buildings would greatly reduce reliance on fossil fuels.

The BC government is already in the process of setting progressively higher standards for building efficiency, with an updated Building Code passed in 2008 (requiring, for example, an EnerGuide 80 rating for new home construction starting in 2011) and new standards are currently in development. Housing Minister Coleman has mused about net zero buildings as a requirement by 2020,[26] a recommendation made by advisory bodies to the BC government (Climate Action Team) and the City of Vancouver (Greenest City Action Team).

There is also interest in low-energy buildings from consumers, and this is reflected to some extent in market demand for green construction (LEED standards have become increasingly widespread as an indicator of green building). The City of Vancouver's Southeast False Creek is a example of green building innovation (including one net zero building), with a Neighbourhood Energy Utility that captures waste heat from sewers to meet more than 70% of the energy needs of the housing development. Other neighbourhood or municipal-level utilities could be developed as new construction takes place.

A major gap, however, is a need for funding of coordinated education and training programs to develop BC's knowledge capital in this area and ensure a supply of skilled workers. There are also opportunities to develop green jobs in the supply of equipment that will be needed for net zero buildings, such as hyper-efficient windows, heat pumps and other parts currently imported from Europe and Asia. In addition, independent analysis of on-site performance is required; its absence can be a shortcoming of programs like LEED (which is not an explicit energy performance standard). Installation of components needs to be monitored, enforced and performed by certified, skilled workers, or buyers may be faced with problems due to shoddy work.

Because so many buildings need energy efficiency upgrades, and this is local, labour-intensive work, building retrofits are the low-hanging fruit of green job development.

While net zero is an ideal for new buildings and housing development, the reality is that housing stock takes a very long time to turn over. A key green jobs strategy, therefore, is to start with retrofits of existing buildings. Because so many buildings could use energy efficiency upgrades, and this is local, labour-intensive work, building retrofits are essentially the low-hanging fruit of green job development. Policy actions are required to stimulate the demand for retrofits by homeowners and the supply of skilled workers.

26 BC Ministry of Housing, Building and Safety Standards Branch, *Energy Performance of Part 9 Housing* (March 2010), presentation at www.housing.gov.bc.ca/building/docs/greening_energy_performance.pdf.

Employment Impacts of Green Investments

Estimates of employment (and GDP) impacts of new investments are based on input-output models that map the flow of materials, labour and income through the economy. On this basis, we can estimate that an additional $1 million of output in a particular sector of the economy leads to a certain number of jobs. Those jobs are broken down into *direct jobs* in the sector where the investment is made, *indirect jobs* as part of the supply chain, and *induced jobs*, those created when workers spend their incomes in the local economy.

Some industries are very capital intensive, and require a large outlay in order to generate the same number of jobs as a smaller investment in another sector. Oil and gas extraction, for example, creates relatively few jobs in BC in spite of billions of investment, whereas service sectors that are much more labour-intensive can generate far more jobs per dollar of investment.

Recent estimates from the United States have put some broad numbers to the potential impact of new green economy investments. Based on the work of Robert Pollin at the University of Amherst (shown in Table 3), green economy investments in building retrofits, transportation and alternative energy all yield much larger numbers of jobs per million dollars of output than fossil fuel industries.[a] Another estimate for the US found even greater employment gains for investments in building retrofits and mass transit, with $1 million creating about 25 jobs.[b]

In BC, the provincial government's economic multiplier model is tailored to the specifics of the provincial economy. Job creation numbers tend to be smaller because, as a small, open economy BC experiences greater leakage of investment dollars out of province to suppliers from other parts of Canada or other countries, or leakages of profits to shareholders who live outside of the province. The industry categories in the model do not neatly align with the priority areas for green jobs (and due to confidentiality reasons, some industry areas are suppressed). Nonetheless, the lower part of Table 3 presents some indicative sectors to show an estimated impact of green investments.

Like the US, investments in fossil fuel industries create fewer jobs than the green economy investments we contemplate in this section. For building retrofits, we can look at the impact of a $1 million increase in construction, which creates about 13 jobs. But because retrofitting is arguably more labour intensive, we also include repair and maintenance, which would create 23 jobs for the same investment (a figure closer to the US estimates)—nearly 10 times the jobs that would be created in the oil and gas industry.

In transportation, the key category of interest, urban transit systems is suppressed. But we note 13.6 jobs in transportation and warehousing overall, and 9.9 jobs in transportation equipment manufacturing, for a respective $1 million increase in production. Green manufacturing and alternative energy investments are harder to assess, but we include some categories that are more closely related to the type of investments we envision.

In addition, many public service jobs (civil service, health care or early childhood education, for example) could be considered a major source of inherently green jobs. We do not address this in the remainder of the section, but note a very high employment impact of investments in that area.

The total amount of investment (public and private) clearly matters, and further research would be required to define detailed plans and green investments for specific sectors in BC. Stimulus packages in the US and other countries in response to the 2008–10 recession have been a recent focus for new green investments, and in general Canada has fared poorly compared to other countries on the share of stimulus dollars going to green investments, and green investments per capita.[c]

One notable assumption made in these models is that new investments lead to new jobs for unemployed workers, whereas in practice there will be gaps in certain areas due to labour supply and skills shortages that must be addressed through education and training programs. Thus, estimates should be considered potential jobs that can be realized only through good labour market (including "just transition") policies.

Table 3: Employment Impact of $1 million in Additional Output

	Direct job creation	Indirect job creation	Induced job creation	Total job creation
US ESTIMATES		(number of jobs)		
Fossil fuels				
Oil and natural gas	0.8	2.9	1.5	5.2
Coal	1.9	3.0	2.0	6.9
Green investments				
Building retrofits	7.0	4.9	4.8	16.7
Mass transit/freight rail	11.0	4.9	6.4	22.3
Wind energy	4.6	4.9	3.8	13.3
Solar energy	5.4	4.4	3.9	13.7
Biomass energy	7.4	5.0	5.0	17.4
Note: Estimate of induced jobs = 0.4 (direct + indirect jobs).				
Source: Pollin, Heintz and Garrett-Peltier, 2009 (see note "a" below).				
BC ESTIMATES				
Fossil fuels				
Oil and gas extraction	0.26	1.65	0.72	2.63
Mining (includes oil and gas extraction)	1.20	1.78	1.28	4.26
Petroleum and coal products	0.50	1.77	0.85	3.12
Green investments				
Construction	6.46	3.54	2.98	12.98
Repair and maintenance	15.93	2.58	4.53	23.04
Transportation and warehousing	6.49	3.77	3.36	13.62
Transportation equipment manufacturing	5.14	2.17	2.59	9.90
Printing and related support activities	7.88	2.64	3.54	14.06
Miscellaneous manufacturing	9.14	1.94	2.84	13.92
Waste management and remediation services	6.73	3.51	3.22	13.46
Professional, scientific and technical services	11.04	3.49	4.39	18.92
Education services	24.29	2.82	4.95	32.06
Health care and social assistance	14.48	2.01	3.78	20.27
Source: Garry Horne, *2004 British Columbia Provincial Economic Multipliers and How to Use Them* (Victoria: BC Stats, 2008).				

a Robert Pollin, James Heintz and Heidi Garrett-Peltier, *The Economic Benefits of Investing in Clean Energy: How the economic stimulus program and new legislation can boost U.S. economic growth and employment* (Amherst: Political Economy Research Institute, University of Massachusetts, 2009).

b Trevor Houser, Shashank Mohan and Robert Heilmayr, *A Green Global Recovery? Assessing US Economic Stimulus and the Prospects for International Coordination* (Peterson Institute for International Economics and World Resources Institute, policy brief PB09-3, February 2009).

c United Nations Energy Program, *Global Green New Deal: An Update for the G20 Pittsburgh Summit* (September 2009). The UNEP report draws on and updates an earlier report by Nick Robins, Robert Clover and Charanjit Singh, *A Climate for Recovery: The colour of stimulus goes green* (HSBC Global Research, February 25, 2009).

A BC strategy could build on the existing LiveSmart program with a major increase in new funding, and special attention placed on older housing stock (that is much less energy efficient). Rethinking the program to make it more effective for low- to middle-income households is also needed. Additional challenges apply to retrofits for multi-unit buildings, which are not covered by the existing LiveSmart program, although the BC government has begun to retrofit social housing units. An upgraded program should aim for other multi-unit buildings, including non-profit housing, rental properties and condos, where retrofitting must grapple with multiple owners and/or renters. Commercial buildings and offices likewise represent GHG emission reductions, with BC Hydro playing a lead role in incentive programs.

To enhance effectiveness and ensure that all households can benefit, BC needs an integrated strategy to reduce barriers to advancing building retrofits:[27]

- *Reform the financing of retrofits*. Models such as on-bill financing that would avert upfront costs by amortizing them onto a BC Hydro (or property tax) bill should be implemented. This approach links costs and benefits to a specific property rather than a particular individual or family, and would lower hydro bills overall since electricity savings would outweigh financing costs.[28]

A BC strategy must go beyond individual buildings to a community-level context, in particular changes in neighbourhood density and the development of more compact communities (mixed use, mixed-income developments aligned with transportation investments and the creation of walkable spaces).

- *Ensure that pricing policies do not disadvantage low-income households*. New sources of clean electricity are leading to higher prices for consumers, as reflected in BC Hydro's two-tier pricing structure. While higher energy rates make retrofitting more economical, a portion of revenues should support energy efficiency programs geared to renters and low-income households that are constrained from making costly new investments.

- *Mandate high and rising standards for furnaces, hot water heaters and other appliances*. Marketplace options that do not meet minimum efficiency standards should be eliminated, and subsidies provided only to best-in-class options.

- *Avoid perverse incentives to switch from electricity to fossil fuels*. Programs like LiveSmart should focus on clean sources of power, and not promote switching to natural gas (gas use should be phased out altogether over time). Electric heat pumps are much preferred in terms of performance compared to inefficient (and common) electric baseboard heaters. Carbon taxes should increase faster than any electricity price increases to avert these perverse incentives.

- *Include de-construction activities in green jobs plans and link to zero waste objectives*. While much attention is paid to green construction, tearing down structures in a way that harvests materials for re-use and recycling can also be a valuable source of employment that contributes to closed-loop production cycles (see Green Manufacturing below).

- *Work with colleges, apprenticeship programs and unions to ensure clear and consistent credentials and certification standards*. Developing career paths that lead to higher wages is essential for workers.

27 We draw inspiration from a similar plan in Alan Durning, Jennifer Langston, Lisa Stiffler, Roger Valdez, Avi Allison and Jesse Burns, *Green-Collar Jobs: Realizing the Promise* (Seattle: Sightline Institute, October 2009).

28 The City of Vancouver's Greenest City Action Team recommended such "on-bill" financing strategies. Greenest City Action Team, *Vancouver 2020: A Bright Green Future* (report to the City of Vancouver, October 2009).

This shift must also go beyond individual buildings to a community-level context, in particular changes in neighbourhood density and the development of more compact communities (mixed use, mixed-income developments aligned with transportation investments and the creation of walkable spaces).

ZERO-EMISSION TRANSPORTATION

Transportation is another area where there are large gains to be had in green job creation and in GHG reductions, with two-fifths of BC's emissions generated from transportation. But even if climate change were not cause for urgent action, BC's reliance on fossil fuels for transportation leaves it vulnerable to price shocks of the type seen in 2007–08 and likely to occur again. Economist Jeff Rubin's peak oil scenario points to oil prices of $200 per barrel oil in the next economic expansion, a development that would drive economies back into recession, then perhaps $300 to $400 a barrel of oil in the subsequent expansion.[29] It would be prudent for BC to plan for such risks, and such dynamics may just be a matter of time.

A massive expansion of public transit should form a major part of a green jobs plan. In 2008, there were 18,700 jobs in transit and ground passenger transportation in BC. Expansion of transit capacity is directly linked to new green jobs, and creation of new transit lines and transit vehicles point to large potential gains in construction and green manufacturing.

There is pent-up demand for new infrastructure to speed up transit connections. Indeed, if existing funding to expand roads and bridges were instead put to transit expansion, a more efficient, much higher capacity network could be built out within a decade.

In Metro Vancouver, the 2010 Olympics demonstrated very clearly the untapped potential of existing transit infrastructure should funding be available and accompanied by measures that discourage private vehicles by reducing available road and parking space. In addition, there is pent-up demand for new infrastructure to speed up transit connections. Indeed, if existing funding to expand roads and bridges were instead put to transit expansion, a more efficient, much higher capacity network could be built out within a decade.

While parts of Metro Vancouver already point to reduced auto-dependency, retrofitting suburban areas (redevelopment of malls into town centres, for example) will be required to affect a similar transformation. Outside of Metro Vancouver, larger centres like Victoria, Kelowna and Prince George would also benefit from greater transit service, especially if accompanied by urban redevelopment at key nodes and high streets. Expansion of inter-city transport within BC should also take place along the main corridors connecting larger urban centres.

Over the long-term, large reductions in emissions from transportation will stem from changes in land use patterns toward more complete communities (aka smart growth), where increases in density, mix of use, proximity of public and private services and amenities act as structural factors that make the behavioural change required easier. In redesigned urban places walking and biking could eventually encompass half of all trips, supplemented by transit, taxis and car-sharing, all of which would be powered by clean electricity (although a limited amount of biofuels and hydrogen may need to play a role in transportation).

29 Jeff Rubin, *Why Your World is About to Get a Whole Lot Smaller* (Toronto: Random House, 2009).

Approximately two-thirds of transportation emissions are from personal transportation, with the remainder from the movement of goods and freight. Similar strategies around fuel-switching to clean electricity are relevant to goods movement. Technological developments, such as the application of electric engines (and perhaps biofuel or hydrogen fuel cell) to trucking, will eventually enable fuel-switching away from fossil fuels. Reducing GHG emissions from freight transportation includes shifting from high-GHG transportation modes, like air and trucks to use of low-emissions transportation modes such as rail and ships. Expansion and electrification of rail in particular has great promise as rail freight has declined in recent decades while trucking has increased.

Perhaps more importantly, freight emissions would be reduced by decreased consumption, and in BC's case, resource extraction for export. Additional operations that source more goods locally, from food to manufactured goods, will also reduce emissions associated with large global supply chains (only some of which are captured in BC's GHG inventory).

GREEN MANUFACTURING

BC needs a strategic framework that greens existing manufacturing operations, develops new manufacturing capacity where goods are currently imported, and aspires for "closed-loop" production by recycling and reusing wastes.

Manufacturing is a critical aspect of any industrial strategy, but perhaps the most challenging to implement in the real world. BC's manufacturing sector is relatively small, with a large concentration of activity in the processing of raw materials, rather than the production of goods for household consumption. BC needs a strategic framework that greens existing manufacturing operations, develops new manufacturing capacity where goods are currently imported, and aspires for "closed-loop" production by recycling and reusing wastes.

Opportunities to green existing manufacturing operations are being realized where economic considerations are favourable. The pulp and paper sector, for example, now generates a large share of its electricity needs by burning its wood waste. A steadily rising carbon tax that increases the costs of burning fossil fuels is an example of a policy that creates economic incentives for change over time, and could be accompanied by targeted tax credits and accelerated capital cost allowances for energy efficient investments (as opposed to across the board corporate income tax cuts favoured by the current carbon tax recycling regime).

Innovative climate policies should also look to create spaces where ideas for changes in workflow and production processes can come from within. Research on technological innovation finds that half of the gains of innovation are from gradual improvements in the application and use of technologies, as opposed to the development of new technology itself. By tapping the knowledge of workers on the shop floor, operations could be reorganized to reduce GHGs and energy. This requires working closely with unions and implementing safety net provisions that guard against job losses.

A more sweeping vision of green manufacturing, however, would examine how BC can be a pioneer in an ecological approach that closes the loop on production cycles. Concepts such as "zero waste" speak to a vision of an economy where non-organic wastes are either re-used, remanufactured or recycled and organic materials are composted. Together with ensuring renewable sources of energy and materials, expanding the re-use and recycling of non-renewable materials shifts toward a closed-loop economic system.

Closing the loop provides new opportunities for green jobs. The City of Vancouver's Greenest City Action Team, for example, recommends the creation of re-use centres, in partnership with social enterprises, that would reclaim materials that would otherwise go to landfills (emulating a model in Portland, Oregon). The focus of waste management has been to divert more of the waste stream away from landfills or incinerators (and to reduce those wastes in the first place). Capturing methane from landfills is now required in BC, but would not be necessary if organic materials were addressed in separate composting facilities.

In addition, BC needs to prioritize the recycling of wastes within the province, rather than exporting them to the US or Asia. Processing recycled materials leads to a dramatic reduction in energy use (and thus GHGs) compared to raw (virgin) materials.[30] But because market prices for recycled materials fluctuate greatly, private recycling operators in BC have struggled or gone out of business. Development of a Crown recycling corporation would be of interest as an alternative approach to streamlining and coordinating the creation of new materials for local use from the waste stream.

BC needs to prioritize the recycling of wastes within the province, rather than exporting them to the US or Asia. Processing recycled materials leads to a dramatic reduction in energy use (and thus GHGs) compared to raw (virgin) materials.

Developing a robust technological cycle also includes re-use and remanufacturing of processed and manufactured goods, a process that can be integrated with notions of Extended Producer Responsibility (EPR). This approach puts the onus on producers for post-consumer recycling of materials, rather than governments, and creates incentives to build longer-lasting products and ensure they can be recycled when returned. This approach is common in Europe, and increasingly in BC (considered to be a leader in North America in EPR programs), for beverage containers, tires, used oil, computer components, and some toxic wastes. The program is being expanded to cover lead acid batteries and antifreeze (in 2011), small and large appliances and other electronic equipment (phased in between 2010 and 2012).[31] These programs have been successful in recycling items that are collected; they employ approximately 1,600 direct full-time employees, and are estimated to have reduced annual GHG emissions by 267 kt CO_2e.[32] However, collection rates from consumers are low as they are not integrated with municipal blue box programs, and like those programs much of the processing of recycled materials is done outside of BC.

Perhaps the biggest challenge is the development of new industries to produce BC goods. The status quo emphasizes imported goods, and a passive industrial policy framework to attract foreign investors to produce in BC for global markets (with much of that investment in resource extraction). Availability of clean electricity is a major advantage for green manufacturing in BC (with additional green jobs potential if new generation supply is created). Currently, a large portion of BC's low-cost "heritage" electricity goes to resource extraction activities, a negative environmental trend that will accelerate with new transmission capacity and the Site C dam in BC's Northeast. If electricity at a preferential price is made available to industry, it should be to facilitate green manufacturing. BC is already blessed with abundant raw materials and processing plants, though some gaps remain in the manufacture of metals like steel. A thorough input-output evaluation of BC's potential to develop a closed-loop economic system needs to be developed that identifies such gaps and strategies for addressing them.

30 United Nations 2008, *supra* note 3; see also *Recycling and Climate Change* a backgrounder from the Recycling Council of BC (undated), http://rcbc.bc.ca/files/u3/add_Recycling_and_Climate_Change.pdf.

31 Ministry of Environment, *Product Stewardship* web page at www.env.gov.bc.ca/epd/recycling/.

32 Gardner Pinfold Consulting, *Economic Impacts of the BC Recycling Regulation* (prepared for Ministry of Environment Environmental Quality Branch, August 31, 2008).

To shape a closed-loop manufacturing strategy will require a more aggressive public sector presence. This could include joint ventures or strategic partnerships as they relate to BC's needs for alternative energy (e.g. Danish wind turbine manufacturers) and transportation infrastructure (e.g. Bombardier was induced to manufacture cars in BC for the Millennium Skytrain line). In other cases, alternative organizational forms may need to be deployed (e.g. Crown corporations or community-owned cooperatives). The overarching context for BC manufacturing should be to produce more of what is currently imported at home (import substitution) and to ensure better design so that all waste is eventually diverted to re-use.

This raises a host of issues that are beyond the scope of this paper and that require further research: To what extent can BC's demand for manufactured goods be produced within the province? What gaps exist that would need to be filled by imports (for example, semiconductors and sophisticated electronics production that rely on economies of scale not available at the provincial scale alone)? Where there are opportunities, how should resources be mobilized to realize them in a cost-effective manner? Notwithstanding these issues, there is great potential to develop an integrated system for BC that links waste management with green manufacturing.

BC will want to be positioned to adopt and adapt green applications of new technologies. Policy tools exist at three levels: direct government funding of R&D, direct or indirect support for commercialization and production, and support for learning and diffusion of knowledge and technology.

RESEARCH IN NEW FUNDAMENTAL TECHNOLOGIES

Much of the preceding analysis is based on already existing technologies, with some anticipated improvements in performance and price. In addition, long-term economic and employment strategies must also consider the development of new advanced technologies. These may be necessary for the final percentage points of GHG reductions that take BC to zero emissions.

New technology developments occur under much greater uncertainty, and because of spillovers there is a strong case for federal leadership on technology research and development. Nonetheless, the BC government can contribute by substantially increasing its investment in research at the university level and by providing additional financing for organizations that support green technology development in the private sector (e.g. GreenAngel Energy Corp., BC Innovation Council, New Ventures BC). That public role can be enhanced by more direct engagement in demonstration projects that implement new technologies at urban or neighbourhood scales (in Denmark, a competition among regions was held for public renewable energy funds). In all cases a strategy is needed to ensure that BC has the human capital required to adopt and adapt these technologies to applications in BC industries.

There are a number of foreseeable technologies that could play a role in a future green industrial production system. In the case of the first technology—fusion[33]—BC has some opportunity to take the lead in creating the breakthrough required for abundant green energy. Another potential BC breakthrough is in the application of hydrogen fuel cell technologies.[34] However, there is still a potential breakthrough to be made in scaling down the technology so that is can be used in automobiles.

33 To be slightly more accurate, the technology is magnetised target fusion being developed by General Fusion, a BC venture research company.

34 Ballard Power Systems has already proven the technology in application to large public transport vehicles such as transit buses.

The future path of any technology is impossible to predict, and technologies also have negative applications and unintended consequences, but the decades to come offer the potential for major breakthroughs in biotechnology, nanotechnology, and quantum computing technologies, all of which have massive potential for implementation in a green industrial production system. Nanotechnology is regarded as a "platform" technology that will help support and improve the development of other green technologies such as efficient hydrogen-powered vehicles, enhanced and cheaper solar photovoltaics, and the development of a new generation of batteries and supercapacitors.[35] It is possible that nanotechnologies will also serve a fundamental platform for developing green materials, smart buildings and clean water systems.

BC will want to be positioned to adopt and adapt green applications of these technologies. To do so will require a strategic framework to coordinate the complex inter-relations and develop the required complementary innovations to make the technologies productive, including technology policy tools at three levels: direct government funding of R&D, direct or indirect support for commercialization and production, and support for learning and diffusion of knowledge and technology.[36]

ADAPTATION PLANNING

Climate impacts on regions and communities will be diverse and variable, and require planning processes that identify major risks (e.g. fires, floods, droughts, landslides). Developing and implementing resilience strategies will lead to green jobs that build physical infrastructure and reinvigorate social networks.

Beyond mitigation of GHG emissions in BC, there will increasingly be new work related to adaptation to a warmer province. Climate impacts on regions and communities will be diverse and variable, and require planning processes that identify major risks (e.g. fires, floods, droughts, landslides). Developing and implementing resilience strategies will lead to green jobs that build physical infrastructure and reinvigorate social networks.

A wide spectrum of work is possible, from reinforcing dykes in low-lying areas, planting trees (also mitigation) to accelerate forest recovery after the mountain pine beetle, and implementing other infrastructure upgrades to storm sewers and water treatment facilities. On the social side, adaptation may include reinforcing the role of social agencies, supporting non-profit service providers, and developing various engagement processes. Less well-understood are the social networks that bind a community together and ultimately matter most from the perspective of resilience.

The development of more localized, sustainable food systems is a key aspect of resilience planning, as climate change may affect global food supply chains, while at the same time conventional agriculture is highly dependent on fossil fuels, and is a contributor to a warming planet. Revitalizing a local, sustainable food system can be developed by building on farmers' markets to expand the linkages between local farmers and urban institutional buyers such as schools, universities, hospitals, non-profit housing units and hunger programs, as

35 See Miguel Esteban, Christian Webersik, David Leary and Dexter Thompson-Pomeroy, *Innovation in Responding to Climate Change: Nanotechnology, Ocean Energy an Forestry* (Japan: United Nations University Institute for Advanced Studies, 2008), www.ias.unu.edu/resource_centre/Innovation%20in%20Responding%20to%20Climate%20Change_UNU-IAS%20Report.pdf.

36 John Alic, David Mowery and Edward Rubin, in their report to the Pew Centre on Global Climate Change (*U.S. Technology and Innovation Policies: Lessons for Climate Change*, 2003) and Richard Lipsey, Kenneth Carlaw and Cliffard Bekar, in *Economic Transformations* (Oxford University Press, Chapters 16 and 17, 2005) develop such frameworks for policy development.

recommended by another Climate Justice study on BC's food system.[37] Moreover, sustainable agriculture is generally thought to be more labour-intensive than conventional practices. While most people may not think of agriculture as a green job, training programs to assist potential new farmers get started (especially young urbanites) are also part of a green jobs strategy.

Beyond food, a planning framework that focuses on ensuring basic needs should also address water, housing and electricity at regional and community levels. These core areas will require public coordination that integrates sustainability, security and equity objectives. A spectrum of possible interventions is possible, ranging from: direct delivery of services (through Crown corporations or other public agencies); public insurance models (especially for agriculture and extreme weather events); developing buffer stocks; other complementary regulation; provision of infrastructure; and finally, engaging citizens to ensure support for climate policies and that effective interventions are made.

A GREEN SOCIAL CONTRACT WITH WORKERS

We have argued that there are substantial green job gains in traditional sectors that are already considered "green," from bus drivers to engineers, and positive impacts on total labour demand in some areas. Strategies that promote job creation in areas like health care, child care, education and other public services may also be important contributions to the "greening" of work.

Overall, there is no reason to believe that the transition will have large, negative impacts on employment, although there will likely be redistribution of employment across and within jurisdictions, and across sectors of the economy.

On the other hand, there are likely to be job losses within certain industries that are so inherently unsustainable or vulnerable to climate impacts themselves (irrespective of mitigation strategies), including forestry, fisheries, and tourism. A robust green jobs strategy is needed to ensure jobs gained will be larger than jobs lost, and certainly policy actions will have some bearing on this outcome. Overall, there is no reason to believe that the transition will have large, negative impacts on employment, although there will likely be redistribution of employment across and within jurisdictions, and across sectors of the economy.

Nonetheless, fear of job loss could have a paralyzing impact on progress toward, and acceptance of, GHG emissions mitigation. We thus propose a new social contract based on the concept of "just transition" programs that deal fairly with workers in industrial areas that cannot be greened.

The term "social contract" is generally used to describe the agreement, written or assumed, between a government and the citizens it governs. A "green social contract" would guide a government to prioritize both the environment and the well-being of its citizens in any decision-making process.

In the vast majority of cases, we believe that skills will be readily transitioned to other needed work that will be created in green industries. However, a just transition package should include education and training, income support and mobility allowances. Coordination with secondary, post-secondary and training/apprenticeship programs to ensure appropriate "green" skills development will be necessary.

37 Lee et al., forthcoming, *supra* note 14.

The concept of green jobs has often been linked to potential gains for traditionally disadvantaged populations, including women, visible minorities, immigrants and Aboriginal people, as well as low-income households in general. The work of Van Jones (and his organization, Green for All) shows the power of bridging the greening of the economy with pathways out of poverty for groups who need economic opportunities (in his case, young people in Oakland, California leaving prison).[38] In BC, apprenticeships and training programs already exist upon which green jobs can be developed, but explicit policy attention must be paid to the creation of opportunities for disadvantaged groups, leading to new well-paying jobs. The experience of BC's Island Highway project in the 1990s shows a useful model for skills and capacity development among local women and Aboriginal people in the construction of a large highway.[39]

Denmark's "flexicurity" model offers a real-world case study for what a just transition program could look like. Flexicurity began in the mid-1990s as a model for labour markets that accepts change in the nature and types of work, but promotes income security and active retraining through large public investments. That is, in a dynamic economy sometimes workers will lose work, and the state underwrites the transition to new work with time, income and skills training. As a result, Denmark spends substantially more than Canada on income support, education and training (and is notably more advanced in greening its workforce and economy).

We propose a new social contract based on the concept of "just transition" programs that deal fairly with workers in industrial areas that cannot be greened.

CARBON TRANSFER

Inevitably, any successful approach to reducing GHGs will result in higher prices for consuming goods and services that emit them. In addition, new energy supplies, including clean electricity, will be in greater demand than current supplies, which will be reflected in price increases. The principle that prices should tell the truth about costs of production is fundamental to the shift to a sustainable economy, but doing so poses a huge transitional problem for low- to middle-income families who spend a higher percentage of their incomes on energy and necessities. Ensuring that carbon pricing or higher energy prices do not have net detrimental impacts on low-income households is important to ensuring sufficient demand for green goods, services and investments.

In the absence of broad-based solutions to address inequality, like raising the earning power of low-income workers or income transfers to households, we are left with "second-best" solutions that try to fix regressive impacts on an issue-by-issue basis (a credit here, a subsidy there, and an ugly patchwork everywhere). This is already a well-known policy problem: above about $20,000 to $25,000 per year, low-income credits and subsidies phase out for the low-but-not-lowest-income workers, meaning they face high marginal tax rates on new income earned. With the BC carbon tax and the HST, the same dynamic has been exacerbated with low-income credits that phase out early and quickly.

We propose a more coherent "carbon transfer" system that would instead be designed more like the income transfers for Old Age Security and the Canada Child Tax Benefit. These

38 Van Jones, *The Green Collar Economy: How One Solution can Fix our Two Biggest Problems* (New York: HarperCollins, 2008).

39 Marjorie Griffen Cohen and Kate Braid, *The Road to Equity: Training Women and First Nations on the Vancouver Island Highway: A Model for Large-Scale Construction Projects* (Vancouver: CCPA–BC, 2000).

transfers have a maximum amount for the lowest income families, and phase out slowly over the income distribution, so that a very high proportion of families get something. Such a design will also likely lead to a better political outcome for aggressive climate policies, and will have positive economic and employment impacts from additional spending by low- to moderate-income households.

In the case of a carbon tax or auctioned permits under a cap-and-trade system, a revenue source is readily available to fund such a transfer (it would require revisiting commitments to reduce personal and corporate income taxes, however). In addition, where possible revenues should also be used to directly fund the alternatives we desire. Some of the carbon tax revenues should flow to expansion of public transit and other mobility options. Thus, a carbon tax and recycling regime could be restructured to over-compensate low-income families through income transfers and new public services.

Ensuring that carbon pricing or higher energy prices do not have net detrimental impacts on low-income households is important to ensuring sufficient demand for green goods, services and investments.

There are many possible variations on this theme. A twist on a cap-and-trade system known as "cap-and-dividend" could also be implemented, where upstream producers of fossil fuels must buy permits for their emissions, with the proceeds redistributed to households. They would also have to contend with higher prices passed on from those sources, but would experience a net saving if they reduced their consumption of fossil fuels.[40] At a household level, authors like George Monbiot argue for a similar rationing system; a form of per capita *carbon quotas*.[41] In such a system, emission rights are allocated as equal per capita amounts. Redistribution is inherent in this model, as intensive emitters (primarily the rich) would have to pay low emitters (mainly the poor) in order to emit more than their allocated share. Elaborate versions of this idea exist that essentially create a new quasi-currency based on GHG emission rights, with a digital infrastructure similar to debit card transactions.

Finally, a related fiscal move to make prices tell the truth should be to remove implicit subsidies for sectors that are GHG intensive. This includes subsidies and tax breaks, and cheap electricity for the oil and gas and mining sectors.

40 James Boyce and Matthew Riddle, *Cap and Dividend: How to Curb Global Warming While Protecting the Incomes of American Families* (Amherst: Political Economy Research Institute, November, 2007), www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_101-150/WP150.pdf.

41 George Monbiot, *Heat: How to Stop the Planet Burning* (London: Penguin Books, 2006).

PART 8: CONCLUSION

Wrestling with History

THE PRIMARY CHALLENGE facing a sustainable production and green jobs strategy is the legacy of BC's industrial past—resource development predicated on cheap energy, for export markets, with high GHG emissions. BC needs to decouple from a historical paradigm that has been extremely successful for generating wealth in the province. BC's boom in employment from 2001 to 2008 was built largely on strong resource industry performance due to high commodity prices and the policy response to the mountain pine beetle, and perhaps more importantly, a large increase in jobs in the construction sector. Such "staples" dynamics and building booms are all too familiar in BC's history.

BC's industrial legacy is based on resource development predicated on cheap energy, for export markets, with high GHG emissions.

Climate change poses challenges to BC's industrial production structure in several key areas, including the secure, sustainable and equitable provision of food and agricultural products, transportation and energy. Indeed, climate change itself could be considered a massive economic threat that could destabilize a wide range of ecosystem services we take for granted. The Stern Review on the Economics of Climate Change estimates that the cost of such disruptions could rise to 20% of GDP or more, and recommends expenditures on 1% of GDP going forward on mitigation measures.[42] In BC's case, 1% would amount to $2 billion per year, though higher expenditures would be justified for a more rapid transition.

It is critical to articulate in advance a set of desired objectives that we seek to achieve with industrial and employment policy. For example, if technological substitution is sought there may be tension created because of reductions in consumption and demand for traditional products. In the process of mitigating and transitioning to climate change, jobs and even communities will be created and lost with the usual social friction that accompanies such processes. Because of these tensions it is also critical to place desired objectives in the appropriate hierarchy of importance so that the objectives do not conflict with each other.[43] For example, economic growth and wealth creation must be accomplished via carbon neutral,

42 Nichoas Stern, *The Economics of Climate Change: The Stern Review*, report to the UK Chancellor of the Exchequer (Cambridge University Press, 2006).

43 See Lipsey, Carlaw and Bekar 2005, Ch. 16, *supra* note 35.

sustainable practices; income equity and decent work must occur via green jobs. In some cases we might choose a model of full public provision of these goods and services (as we currently do with health care); in others we may wish to set the infrastructure and regulatory incentives such that private firms and individuals are willing to provide them.

The framework proposed here is a starting point for the creation and implementation of industrial and employment policy changes designed to mitigate and adapt to climate change. In our assessment there are many more inherently green jobs relative to the smaller share of BC jobs (industry) that account for a large share of emissions. In addition there are desirable jobs that could be created in the public sector, such as in the expansion of early childhood development programs or not-for-profit housing development, that would not normally be considered as part of a green job package.

To pull off an industrial revolution in the span of decades will require careful planning and clarity of the ultimate objective of eliminating fossil fuels in the economy. The largest single barrier to achieving this is not technology, but the embeddedness of vested interests from BC's resource extraction past into government decision-making.

BC desperately needs to ensure that it coordinates across government to ensure integrated, coherent and consistent climate, industrial and labour market policies. While much of the emphasis of action has been at the individual level, in fact many of the broad changes that dramatically reduce emissions are structural in nature, and thus require a holistic approach. To pull off an industrial revolution in the span of decades will require careful planning and clarity of the ultimate objective of eliminating fossil fuels in the provincial economy. The largest single barrier to achieving this is not technology, but the embeddedness of vested interests from BC's resource extraction past into government decision-making.

RECOMMENDATIONS

In the near term, we recommend the following steps be taken by the provincial government:

1. COMMIT TO ZERO FOSSIL FUELS by 2040 at the latest, with all energy requirements met by clean electric sources, plus some biofuels and hydrogen fuel cells where alternatives are required. All remaining non-fossil-fuel GHG emissions should be eliminated by 2050.

2. ENACT A MORATORIUM ON NEW FOSSIL FUEL EXTRACTION unless 100% of emissions can be captured and stored underground permanently.

3. ESTABLISH A TEN-YEAR RAPID ACTION PLAN on climate change, funded by a mix of carbon tax, increased natural gas royalties, and eliminated subsidies for fossil fuel industries, as well as from reallocating existing expenditures on unsustainable activities (e.g. highway expansion).

4. DEVELOP A COMPREHENSIVE PROVINCIAL GREEN INDUSTRIAL STRATEGY, including green jobs and capital plans, with priority focus on the following areas: green building construction and retrofitting; transportation; green manufacturing and waste management; and adaptation planning. The strategy must be coordinated across business, trade unions, secondary and post-secondary institutions and all levels of government, and should actively engage traditionally disadvantaged populations.

5. PUSH THE CONSTRUCTION INDUSTRY TO "NET ZERO" NEW BUILDINGS as quickly as possible. A major expansion of the LiveSmart program for building retrofits is also in order, with special attention paid to low- to middle-income households, older housing stock and coverage of multi-unit buildings.

6. IMPLEMENT A NEW TRANSPORTATION PLANNING FRAMEWORK that focuses on building complete communities and shifting to more sustainable modes of transportation (such as walking, biking and transit, rather than just on electric vehicles).

7. TAKE ACTION ON WASTE by expanding Extended Producer Responsibility programs and developing processing capacity to recycle materials in the province.

8. SUPPORT RESEARCH AND DEVELOPMENT OF NEW TECHNOLOGIES with green economy applications through direct government funding, direct or indirect support for commercialization and production, and support for learning and diffusion of knowledge and technology.

9. PLACE LIMITS ON OFFSET PROJECTS in order to focus on real emission reductions. Offsets should not be granted for projects outside of BC, and should be limited in time and scope.

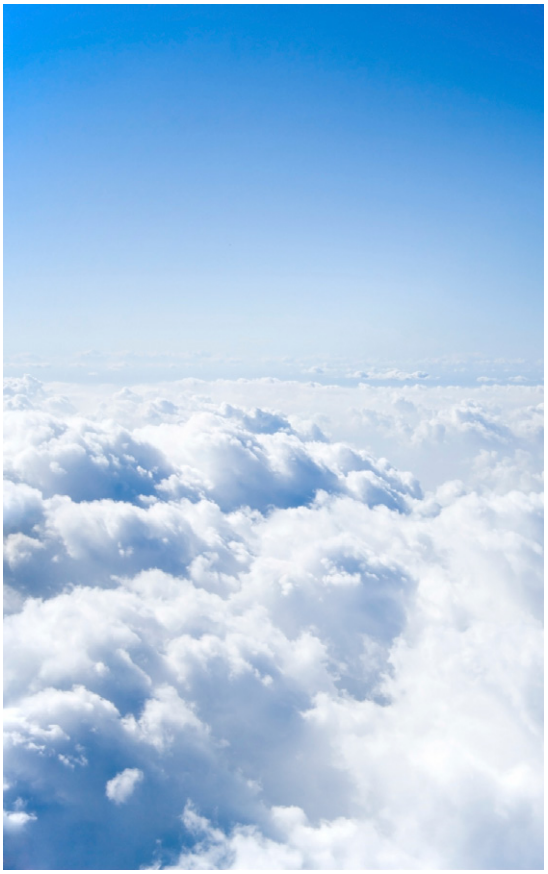
10. DEVELOP ADAPTATION PLANS focused on the security of basic needs in areas such as food, water, electricity and housing.

11. LAUNCH A BROAD-BASED PARTICIPATORY EXERCISE aimed at defining the parameters of a new "green social contract" that ensures no one is left behind in the transition to a sustainable economy.

12. DEVELOP A FRAMEWORK FOR A NEW "CLIMATE TRANSFER" GRANT TO HOUSEHOLDS that would, minimally, be equivalent to existing energy expenditures (and ideally more) to insulate low- to middle-income households from increases in energy and carbon prices, funded from revenues from those sources.

THE CLIMATE JUSTICE PROJECT

The Climate Justice Project is a multi-year initiative led by CCPA and the University of British Columbia in collaboration with a large team of academics and community groups from across BC. The project connects the two great "inconvenient truths" of our time: climate change and rising inequality. Its overarching aim is to develop a concrete policy strategy that would see BC meet its targets for reducing greenhouse gas emissions, while simultaneously ensuring that inequality is reduced, and that societal and industrial transitions are just and equitable.



CCPA
CANADIAN CENTRE
for POLICY ALTERNATIVES
BC Office

The Canadian Centre for Policy Alternatives is an independent, non-partisan research institute concerned with issues of social and economic justice. Founded in 1980, it is one of Canada's leading progressive voices in public policy debates. The CCPA is a registered non-profit charity and depends on the support of its more than 10,000 members across Canada.

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