

# reducing pollution, creating jobs

THE EMPLOYMENT EFFECTS OF CLIMATE CHANGE AND ENVIRONMENTAL POLICIES



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environmental policies

Clare Demerse

March 2011

Demerse, Clare  
*Reducing Pollution, Creating Jobs*  
March 2011

Production management, Editing: Roberta Franchuk  
Cover Photos: U.S. Department of Energy; David Dodge, The Pembina Institute; Gordon Howell

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ISBN 1-897390-31-9

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## Acknowledgements



British  
High Commission  
Ottawa

This report was generously funded by the British High Commission in Canada. In particular, I would like to thank Euan Wallace and Sandra Duarte for their invaluable assistance.

The author would like to sincerely thank the reviewers inside and outside Pembina who contributed their time and expertise to this research. The paper is much stronger as a result. However, any errors, interpretations and omissions remain the responsibility of the author.

My internal reviewers were Matthew Bramley, Dan Woynillowicz, Matt Horne and Tim Weis. External review was provided by Dr. Carla Lipsig-Mummé (York University), Leslie Malone (Environment Northeast), and Andrea Peart and Andrew Jackson (Canadian Labour Congress).

I would also like to thank the Pembina team who provided so much help putting this report together: Roberta Franchuk, P.J. Partington, Julia Kilpatrick and Ed Whittingham.

# Reducing Pollution, Creating Jobs

## The employment effects of climate change and environmental policies

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# Reducing Pollution, Creating Jobs

*“Six months ago my biggest worry was that an emissions deal would make American business less competitive compared to China. Now my concern is that every day that we delay trying to find a price for carbon is a day that China uses to dominate the green economy.”*

—U.S. Senator Lindsay  
Graham, 2010<sup>1</sup>

There is a growing body of research connecting action to tackle climate change, or to improve environmental quality, with employment. And there are a growing number of leaders who present action to tackle climate change as having economic and employment benefits, by allowing their countries to play a leading role in supplying clean technologies to a rapidly growing global market.

This report reviews recent literature on green employment, which falls into two broad categories.

The first type of analysis, which is covered in Section 1, looks at approaches researchers have taken to define “green jobs.” Although no common definition currently exists, many researchers have set thresholds to determine

what kind of work can be considered “green,” and then tallied up the number of workers performing it.

For example, the Environmental Careers Organization Canada, the sector council responsible for the environment sector, estimates that over 682,000 environmental employees were working in Canada in 2010, equivalent to 4% of Canada’s total employed labour force. This makes environmental employment in Canada nearly five times larger than total direct employment in automotive manufacturing.

The studies that have tried to define green jobs have produced some valuable conclusions about the characteristics of green jobs: namely, that these jobs consist largely of familiar types of work (not brand-new job roles), and that they are geographically dispersed, so that they can provide employment to workers in all regions and types of communities.

Unfortunately, the current lack of a common definition makes the quantification of green jobs somewhat arbitrary. And as York University professor Carla Lipsig-Mummé has noted, disagreements over definitions risk becoming “a distraction from the main game” of environmental improvement.

For these reasons and others, we found a second approach to green employment to be the more useful one, particularly in a Canadian context. As described in Section 2, numerous studies focus not on determining which jobs are green, but instead on

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<sup>1</sup> Katrin Benhold, “Race Is on to Develop Green, Clean Technology,” *New York Times*, January 29, 2010, [http://www.nytimes.com/2010/01/30/business/global/30davos.html?\\_r=2](http://www.nytimes.com/2010/01/30/business/global/30davos.html?_r=2)

estimating the job creation potential from implementing climate-friendly policies. This approach typically involves using economic models to understand the employment effects of climate and energy policies, either for an individual project or across the economy.

Canadian evidence points to the likelihood of modest net job gains in Canada if we take stronger action to tackle greenhouse gas (GHG) emissions, particularly if Canada's governments choose to do so in a way that maximizes employment gains and minimizes potential job losses.

For example, a 2009 economic modelling study commissioned by the Pembina Institute and the David Suzuki Foundation found that implementing a strong package of emission-reduction policies would produce slightly slower GDP growth in Canada over the next decade. Despite this slight slowdown in GDP growth, the modellers found that employment would grow slightly faster under the climate policy scenarios than under business as usual. There are several explanations for this seemingly surprising result, including what the modellers called "a significant shift away from capital-intense (e.g. fossil fuel) to labour-intense (manufacturing and services) industries in all regions."

Section 3 of this report looks at relative job creation from climate-friendly policies in four ways.

In the electricity generation sector, we compare job creation from renewable energy and energy efficiency to fossil fuel-fired electricity. There appears to be a near-consensus in the literature that renewable energy is the pro-job (more labour-intensive) choice, creating more direct jobs than fossil-fuel alternatives.

Within a given sector, capital and labour intensities are inversely related: a higher capital intensity means a lower labour

intensity, as firms spend more of their money on infrastructure (such as buildings, machinery, equipment and vehicles) and less on employees. A 2010 ranking of Canadian capital intensity ratings concluded that the "industry with the highest reported capital intensity level is the oil and gas extraction industry with a national average of \$266.6 of capital services per hour." By that measure, investing public dollars in virtually any other sector of Canada's economy would yield more jobs per dollar than oil and gas extraction.

Next, we compared a greater emphasis on clean energy spending to the status quo in Canada's economic stimulus plan. We produced an estimate of the "employment bonus" that would have occurred had the federal government devoted 100% of its stimulus spending on infrastructure to clean energy investment, instead of the 8.3% share green energy actually received in the overall stimulus package. The result of going 100% green would be the creation of nearly three times as many jobs as the current infrastructure spending generated, for a total of over 238,000 jobs (compared to the government's total of 84,000 jobs) in the year the money was spent.

We also look at clean energy job creation relative to other countries. Many jurisdictions are taking steps to position themselves for success in competing for clean energy jobs. If Canada fails to invest in clean energy in a timely fashion, we risk losing out on the manufacturing jobs and export opportunities that a growing global clean energy market can offer.

*"While there will therefore be some short-term costs, longer-term gains arising from improved energy efficiency, and in some cases increasing access to international markets for Canada's "green"*

*technology, can be beneficial for the economy. This will help ensure the continued competitiveness of Canada's industrial and manufacturing sectors, all the while delivering reduced greenhouse gas emissions."*

— Government of Canada, 2008<sup>2</sup>

It is not possible to say exactly what Canada's potential for green jobs, or for net new jobs from climate policy, could be. That depends on how narrowly you define green work, on how ambitious Canada chooses to be in cutting GHG pollution, and on the specific policies governments choose to do so. However, it is possible to outline the kinds of policies and actions that the federal government would take if it wanted to maximize its green or "clean" job potential. They include:

- In light of the superior job and climate performance of clean energy over fossil fuels, directing public dollars away from support to fossil fuels and towards core climate change solutions such as energy conservation, energy efficiency and renewable energy.
- Publishing and implementing a credible federal plan to meet our national 2020 emission reduction target.
- Putting a price on GHG emissions, either through a cap-and-trade system or a carbon tax (or both), as the centrepiece of Canada's plan to meet its 2020 target.

- Developing a clean energy employment transition strategy for Canada. This should include skills development, training programs, certification courses, and transitional policies for workers and communities whose jobs could be lost or significantly changed by the shift to a greener economy.

Areas for further research are described in Section 5. Appendix 1 summarizes green jobs research underway in the federal government department of Human Resources and Skills Development, based on documents we uncovered through Access to Information legislation.

In conclusion, the literature on green jobs, and on job creation from clean energy policies, shows that there is little basis for concern that ambitious climate policy in Canada would cause significant job losses. Instead, the evidence from Canadian and international studies shows that we can tackle climate change while maintaining a growing economy that could employ even more Canadians than "business as usual."

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<sup>2</sup> Government of Canada, *Turning the Corner: Detailed Emissions and Economic Modelling* (Ottawa: Environment Canada, 2008), 15.  
[http://www.ec.gc.ca/doc/virage-corner/2008-03/571/tm toc\\_eng.htm](http://www.ec.gc.ca/doc/virage-corner/2008-03/571/tm toc_eng.htm)

# Introduction

When decision-makers mention “the economy,” it’s often in a discussion about GDP, growth or company profits. But employment stands alongside those financial measurements as a critical indicator of an economy’s health. Job creation is a perennial political priority, as Canada’s current Environment Minister Peter Kent affirmed in his first speech on the job, in January 2011: “That’s why our Government is continuing to focus on the economy and on creating jobs and growth.”<sup>3</sup> When implementing policies, officials think very carefully before taking decisions that could put jobs at risk. And it’s not just governments that care deeply about jobs: for most of us, finding a satisfying job is a very important goal, and few things are as demoralizing as losing a job.

There is a growing body of research connecting action to tackle climate change, or to improve environmental quality, with employment. And there are a growing number of leaders who present action to tackle climate change as having economic and employment benefits, by allowing their countries to play a leading role in supplying clean technologies to a rapidly growing global market.

U.S. President Barack Obama put it this way in his 2011 State of the Union address: “We’ll invest in biomedical research, information technology, and especially clean energy technology — an investment that will strengthen our security, protect our planet, and create countless new jobs for our people.... With more research and incentives, we can break our dependence on oil with biofuels, and become the first country to have a million electric vehicles on the road by 2015. We need to get behind this innovation.”<sup>4</sup>

In a 2010 speech, Chris Huhne, the U.K.’s Secretary of State for Energy and Climate Change, made a similar argument about the global growth in green sectors. “From electric vehicles to energy management, the global low-carbon and environmental goods and services sector is valued at £3.2 trillion a year. It is forecast to reach £4 trillion before this Parliament dissolves, growing substantially faster than world GDP. Last year, our share of that market was worth £112 billion. 900,000 people are employed in the low-carbon sector and its supply chain; by 2015, there will be at least a million. That’s a workforce — and a budget — to rival the size of the National Health Service.”<sup>5</sup>

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<sup>3</sup> Environment Canada, *Speaking Notes for the Honourable Peter Kent, Minister of the Environment: Climate Change Milestones Speech at Economic Club of Canada*, Toronto, January 28, 2011. <http://www.ec.gc.ca/default.asp?lang=En&n=6F2DE1CA-1&news=CB8B1F09-BEC2-4700-82B2-7C59463FA4E4> (accessed February 9, 2011).

<sup>4</sup> The White House, “Remarks by the President in State of Union Address” (Washington: Office of the Press Secretary, 2011). <http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address> (accessed March 2, 2011).

<sup>5</sup> Department of Energy and Climate Change, *Chris Huhne Speech to LSE: Green Growth — The Transition to a Sustainable Economy*, London, November 2, 2010. [http://www.decc.gov.uk/en/content/cms/news/lse\\_chspeech/lse\\_chspeech.aspx](http://www.decc.gov.uk/en/content/cms/news/lse_chspeech/lse_chspeech.aspx) (accessed February 9, 2011).

On the other hand, when decision-makers choose to delay ambitious action on climate change, one of the reasons they often cite is concern about the economic consequences of action. For example, here's how former Environment Minister Jim Prentice put it in a November 2008 speech, his first in the portfolio: "We will not — and let me be clear on this — aggravate an already weakening economy in the name of environmental progress."<sup>6</sup>

As a result, we wanted to investigate whether there are indeed job gains to be made by "greening" Canada's economy.

This report reviews some of the literature on green employment, which falls into two broad categories. The first type of analysis, which is covered in Section 1, looks at approaches researchers have taken to define "green jobs." Although no common definition currently exists, many researchers have set thresholds to determine what kind of work can be considered "green," and then tallied up the number of workers performing it. The studies that have taken this approach have produced some valuable conclusions about the characteristics of green jobs. Unfortunately, the current lack of a common definition renders a discussion of green job creation somewhat arbitrary — a looser definition will produce a greater number of green jobs on paper, without any associated change to the greenness of the economy. In addition, it becomes difficult to make comparisons between studies, time periods or jurisdictions in the absence of agreement on a definition.

For these reasons, we found the second approach to green employment to be the more useful one, particularly in a Canadian context. As described in Section 2, numerous studies focus not on determining which jobs are green, but instead on estimating the job creation potential from implementing climate-friendly policies. This approach typically involves using economic models to understand employment effects, either for an individual project (usually using input-output tables) or across the economy.

Perhaps even more importantly, we wanted to understand the *relative* job creation potential of green policies. In Canada, taking ambitious action to tackle GHG pollution would be a change from the status quo, which sees ongoing growth in Canada's emissions. Would this change create more jobs than business as usual? Would the jobs gained make up for the jobs lost? What are the likely employment consequences of investing public dollars in clean energy rather than fossil fuels? What jobs could Canada lose if it fails to take ambitious action on climate change and clean energy? This analysis is found in Section 3 of the report.

The paper concludes with policy recommendations (Section 4) and areas for further research (Section 5).

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<sup>6</sup> Jim Prentice, Minister of the Environment, speech to the Bennet Jones Lake Louise World Cup Business Forum, November 28, 2008, <http://www.ec.gc.ca/default.asp?lang=En&n=6F2DE1CA-1&news=0B4311D6-1E93-438D-B50E-EC21B4769703> (accessed February 8, 2011).

*“The Canadian Labour Congress rejects the notion that there is a fundamental conflict between the economy and jobs and environmental sustainability. Good economic and job creation policies must address all the indicators of a good quality of life — the economy, jobs, equality and the environment.”*

— Canadian Labour Congress, 2008<sup>7</sup>



**Greening Canada's economy can lead to job growth.**

Photo: Gordon Howell

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<sup>7</sup> Canadian Labour Congress, *Climate Change and Green Jobs: Labour's Challenges and Opportunities* (2008), 2. <http://www.canadianlabour.ca/sites/default/files/pdfs/ClimateChange-amended.pdf>

# 1. Defining and describing green jobs

The only consensus in defining green jobs seems to be there is no consensus about how to define green jobs. Luckily, there are some patterns among the various definitions that researchers have adopted.

*“Language used to describe and define the green economy varies among government agencies, industry associations, employers, and educational institutions. As a consequence, the majority of publicly available documentation lacks consistency or has limited applicability. At present, no universal or shared framework exists to consistently define or classify green jobs or green economic activity on a national scale, in a Canadian context.”*

— ECO Canada, 2010<sup>8</sup>

## 1.1 Defining green jobs

In the major national and international studies published in recent years, many researchers focus on the outcome of the work when deciding whether to classify a job as green. In this approach, if a job has an outcome that is considered environmentally beneficial, it can be considered green. For example:

- Robert Pollin and Jeannette Wicks-Lim, of the University of Massachusetts, write that “a green job is one that is contributing to fighting global warming and building a green economy.”<sup>9</sup>
- Vice-President Biden’s Middle Class Task Force defines green jobs as “employment that is associated with some aspect of environmental improvement.”<sup>10</sup>

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<sup>8</sup> ECO Canada, *Defining the Green Economy: Labour Market Research Study* (2010), 8. <http://www.eco.ca/pdf/Defining-the-Green-Economy-2010.pdf>

<sup>9</sup> Robert Pollin and Jeanette Wicks-Lim, *Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investments* (University of Massachusetts, Political Economy Research Institute, 2008), 3. [http://www.peri.umass.edu/fileadmin/pdf/other\\_publication\\_types/Green\\_Jobs\\_PERI.pdf](http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/Green_Jobs_PERI.pdf)

<sup>10</sup> Vice-President of the United States, *Green Jobs: A Pathway to a Strong Middle Class* (Middle Class Task Force, 2009), 1. [http://www.whitehouse.gov/assets/documents/mctf\\_one\\_staff\\_report\\_final.pdf](http://www.whitehouse.gov/assets/documents/mctf_one_staff_report_final.pdf)

- A landmark 2008 green jobs report from the United Nations Environment Programme (UNEP) defines green jobs as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality.”<sup>11</sup>
- Environmental Careers Organization Canada, a “sector council” focused on environmental employment in Canada, defines a green job as “one that works directly with information, technologies, or materials that minimize environmental impact, and also requires specialized skills, knowledge, training or experience related to those areas.”<sup>12</sup>

Simple as this may sound, applying these definitions gets complicated quite quickly. Putting a green jobs definition in action requires a researcher to, at a minimum, decide:

**Which sectors are green enough:** While some sectors — manufacturing the equipment needed for renewable energy, for example — could be deemed green without too much debate, others are less clear-cut. Compared to trucking, rail is a lower-emissions way to move freight. Do all rail workers thus hold green jobs? What about nuclear power, which is relatively low in GHG emissions but potentially very high in other environmental impacts? Technologies like corn ethanol or carbon capture and storage are also the subject of lively debates about their “greenness.”

**Which workers within a sector are green:** Does an energy efficiency engineer at an oil sands company hold a green job? What is the threshold for declaring that an autoworker is producing an efficient enough vehicle to be deemed green?

**What fraction of a worker’s time needs to be green to count:** Should we consider a construction worker who spent half the year building inefficient homes in the suburbs, and the other half on a state-of-the-art green office tower, as the holder of a green job?

**What quality of job is green enough:** If a scrap metal recycler working in India is exposed to dangerous chemicals in the course of her work, can that job be deemed green or sustainable? (Some analyses focus on a subset of green jobs, “green collar” jobs, a category defined as “well-paid, career track jobs that contribute directly to preserving or enhancing environmental quality.”<sup>13</sup> By that definitions, jobs with low wages or few opportunities for advancement would be excluded, even if they are green in other respects.)

Little wonder that researchers quickly start to use terms like “shades of green” or “partially green” in an effort to address these kinds of questions.

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<sup>11</sup> United Nations Environment Programme, *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* (Nairobi: UNEP/ILO/IOE/ITUC, 2008), 3. [http://www.unep.org/labour\\_environment/features/greenjobs-report.asp](http://www.unep.org/labour_environment/features/greenjobs-report.asp)

<sup>12</sup> ECO Canada, *Defining the Green Economy*.

<sup>13</sup> Kate Gordon and Jeremy Hays et al., *Green Collar Jobs In America’s Cities: Building Pathways out of Poverty and Careers in the Clean Energy Economy* (Apollo Alliance and Green For All, 2008), 3. <http://www.apolloalliance.org/downloads/greencollarjobs.pdf>

*“Pollution prevention has different implications than pollution control, as does climate mitigation compared with adaptation, efficient buildings vis-à-vis retrofits, or public transit versus fuel-efficient automobiles. These choices suggest there are ‘shades of green’ in employment: some are more far-reaching and transformational than others.”*

— United Nations Environment Programme, 2008<sup>14</sup>

The 2008 UNEP report *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* offers a useful example of how a general definition of green jobs can be applied to specific kinds of work. The authors state at the outset that, “in light of the need to dramatically reduce humanity’s environmental footprint, the bar needs to be set high” — their aim is to capture best practices, not to come up with the largest possible estimate of green jobs. The authors also point out that green is an evolving concept, where today’s leading-edge innovation could be the industry standard a decade from now.<sup>15</sup>

With those caveats in place, the UNEP researchers use a sector-by-sector approach to classify the following categories of workers as holding green jobs:

- Workers in renewable energy sectors (wind, solar, biomass, hydropower, and geothermal), for a global total of over 2.3 million workers
- Workers making incremental improvements to the energy efficiency of buildings. UNEP’s study projects that greening buildings in the U.S. and EU alone could create 2 million jobs
- Workers producing passenger vehicles that meet or beat the EU’s GHG fuel efficiency standard of 120 grams of CO<sub>2</sub> per kilometre, for a global total of about 235,000 jobs
- Workers in steel recycling, due to its energy savings of 40–75% relative to virgin steel (estimated worldwide employment is approximately 25,000)
- Workers producing aluminum from scrap, for a 95% energy saving relative to starting from scratch; the current global workforce is about 29,000
- Workers in paper recycling and non-wood pulp and paper production
- Workers in other recycling and scrap collecting (over 12 million globally)
- Certain workers in the cement, agriculture and forestry sectors.<sup>16</sup>

While this approach allows the UNEP researchers to estimate green workers within a number of economic sectors, it would be entirely possible to choose (and defend) a different set of thresholds of greenness within each of those sectors, and thus arrive at different tallies of total green jobs.

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<sup>14</sup> UNEP, *Green Jobs*, 4.

<sup>15</sup> *Ibid.*, 4.

<sup>16</sup> *Ibid.*, 3–24.

Two recent American approaches illustrate the breadth of possible definitions:

- Next 10, a California organization working on environmental and economic issues, recently assessed employment growth in California’s “Core Green Economy,” a categorization that includes providing alternatives to fossil-fuelled energy, conserving energy, and reducing pollution and waste. Using this relatively narrow definition, Next 10 calculated total employment (based on detailed, sector-by-sector tracking) of 174,000 in California, with a growth rate similar to that of software jobs since 2005.<sup>17</sup>
- The BlueGreen Alliance, a partnership of nine major unions and four U.S. environmental organizations, has adopted an extremely broad definition of green jobs, counting any job that has a green purpose as green, so that “all jobs ought to be green jobs” eventually.<sup>18</sup>

Clearly, these varied approaches to defining environmental work would lead to very different estimates of the number of people who hold green jobs. Despite the vast spectrum of potential definitions, though, there are some common features of green jobs that many researchers emphasize in their assessments of this kind of work, which are described in more detail in Section 1.2 below.

*“Steel that is produced in the United States ought to be used for green products: the tower of a wind turbine. Those steel mill jobs are then green jobs. A building janitor who cleans offices during the day, saving energy, that is a green job. A glass manufacturing plant, whose glass is used in the manufacturing of solar panels, is a green job. A teacher, who is educating children about recycling and leads such a project, is a green job. An office worker, who implements a paperless accounting system, is a green job. A bus driver, who meets the needs of a commuting work force, is a green job. A construction worker building to LEED certified standards is a green job. And a nurse, who cares for asthma patients, is a green job.”*

— Sara Letourneau, BlueGreen Alliance, 2011<sup>19</sup>

The sub-sections that follow look at three variations on the overall green jobs approach described above.

### 1.1.1 Surveying individual green sectors

A very straightforward, “bottom up” approach to determining the number of green workers is to survey individual companies operating in a sector deemed to be green. This strategy is often used

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<sup>17</sup> Next 10, *Many Shades of Green: Regional Distribution and Trends in California’s Green Economy* (San Francisco: Next 10, 2011), 4–8.

[http://www.next10.org/next10/publications/pdf/2011\\_Many\\_Shades\\_of\\_Green\\_FINAL.pdf](http://www.next10.org/next10/publications/pdf/2011_Many_Shades_of_Green_FINAL.pdf)

<sup>18</sup> Sara Letourneau in *Green/ing Jobs: Definitions, Dilemmas, Strategies* (proceedings from Work in a Warming World conference, York University, Toronto, Ontario, January 20, 2011), 3.

<http://www.yorku.ca/warming/documents/W3GreeningJobsBooklet.pdf>

<sup>19</sup> ECO Canada, *Defining the Green Economy*.

by industry associations, such as the Canadian Wind Energy Association or the Canadian Solar Industries Association.

For example, in 2008, the Canadian Solar Industries Association and the Electricity Sector Council invited 287 solar companies to participate in a survey (a sample that represented over 90% of active companies in the sector in Canada). Ninety-one firms responded, and the following results were reported:

- Total employment at the responding firms in 2008 was 1,524 full-time equivalents (FTEs)
- By 2011, these firms expected to grow their workforce to 3,069 FTEs, a 101% increase over three years
- In 2008, 41% of companies were experiencing labour shortages, with the expected shortages most acute in the areas of installation, technical areas, system design/system integration, and sales.<sup>20</sup>

While these kinds of detailed labour force surveys can provide very accurate data, they depend on maintaining an up-to-date knowledge of participation in a sector, and are unlikely to be able to provide projections more than a few years in advance.

### 1.1.2 Defining Canada's environmental sector

The federal government currently supports 34 national “sector councils,” which are defined as “national partnership organizations that bring together business, labour and educational stakeholders.” The sector councils operate at arm’s length from the government and are intended to help stakeholders in a sector “to share ideas, concerns and perspectives about human resources and skills issues,” and to collaborate on solutions to those issues.<sup>21</sup>

Environmental Careers Organization Canada, or ECO Canada, is the sector council responsible for the environment sector. Established in 1992, it is a non-profit corporation “that assists the Canadian environment sector in implementing sound human resource development policies.”<sup>22</sup>

Taking a sector-wide approach clearly requires defining what constitutes Canada’s “environmental” sector, and ECO Canada has published a series of reports that provide detailed data on environmental work in Canada.

ECO Canada defines “environmental employment” as “employed individuals who spend 50% or more of their work time on activities associated with environmental protection, resource management, or environmental sustainability.”<sup>23</sup> While the organization does not provide

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<sup>20</sup> Electricity Sector Council and Canadian Solar Industries Association, *Building Bright Futures: 2009 Labour Force Survey of the Canadian Solar Industry* (2009), 1–3. <http://www.cansia.ca/sites/default/files/ESC-CanSIA-Labour Force Survey-Final Report Mar18-09.pdf>

<sup>21</sup> Human Resources and Skills Development Canada, “Sector Council Program: Frequently Asked Questions.” [http://www.rhdcc-hrsdc.gc.ca/eng/workplaceskills/sector\\_councils/faq.shtml](http://www.rhdcc-hrsdc.gc.ca/eng/workplaceskills/sector_councils/faq.shtml)

<sup>22</sup> ECO Canada, *Canadian Environmental Sector Trends: Labour Market Study 2010* (2010), 3. <http://www.eco.ca/pdf/Canadian-Environmental-Sector-Trends-2010.pdf>. See also the overview of ECO Canada’s role at <http://www.eco.ca/public/about/eco-canada/313/>.

<sup>23</sup> *Ibid.*, 5.

rationale for its selection of definition — for example, its choice of 50% as the threshold for green employment — ECO Canada does apply its definition systematically, matching it to existing Canadian labour statistics to draw conclusions about the green workforce that allow for some comparison over time to be made.

Table 1 below outlines the types of work that fall under each of ECO Canada’s three main work categories.

**Table 1. Environmental employment<sup>24</sup> by ECO Canada’s national occupational standards<sup>25</sup>**

Environmental protection	Resource management	Environmental sustainability
Air quality	Energy	Education and training
Water quality	Fisheries and wildlife	Research and development
Site assessment and reclamation	Natural resource management	Policy and legislation
Waste management		Communications and public awareness
Health and safety		

To produce their 2010 “Profile of Canadian Environmental Employment,” ECO Canada surveyed organizations from across Canada’s economy to understand how many of their employees fit the criteria.<sup>26</sup> The organization concluded that over 682,000 environmental employees were working in Canada in 2010, equivalent to 4% of Canada’s total employed labour force.<sup>27</sup> Table 2 shows the industry sectors where these environmental workers are employed.

<sup>24</sup> Adapted from ECO Canada, *Profile of Canadian Environmental Employment: Labour Market Research Survey 2010*, 5. <http://www.eco.ca/pdf/Profile-Of-Canadian-Environmental-Employment-ECO-Canada-2010.pdf>

<sup>25</sup> National Occupational Standards are developed by sectoral “standards development committees” to describe the skills and knowledge needed to perform a given type of work. For an overview of the system, see the Human Resources and Skills Development Canada article entitled “National Occupational Standards” at <http://www.rhdcc-hrsdc.gc.ca/eng/hip/hrp/corporate/nos/occstd.shtml>.

<sup>26</sup> ECO Canada, *Profile of Canadian Environmental Employment*, 5.

<sup>27</sup> *Ibid.*, 6.

**Table 2. Industry sectors<sup>28</sup> that have environmental employment<sup>29</sup>**

Sector	Percentage of that sector's workers classified as environmental employees
Agriculture, forestry, fishing and hunting	10.8
Mining, quarrying and oil and gas extraction	4.5
Construction	7.4
Manufacturing	4.1
Wholesale trade / retail trade	3.5
Utilities, transportation and warehousing	2.0
Information, finance and insurance, real estate and management of companies	0.5
Professional, scientific and technical services	5.1
Administration and support, waste management and remediation services	5.8
Educational services, health and social assistance	3.7
Public administration	4.8
Arts, recreation, accommodation, food services	4.1
Other services (except public administration)	2.9

Based on 2010 Statistics Canada data, ECO's definition means that total environmental employment in Canada is greater than the total sectoral employment of the first two categories in the table above ("agriculture, forestry, fishing and hunting" and "mining, quarrying and oil and gas extraction") combined, whether or not the fraction of those sectors' workers doing "environmental employment" is included.<sup>30</sup> ECO Canada's findings mean that environmental

<sup>28</sup> This list of industry aggregations corresponds to broad (sectoral) categories in the North American Industrial Classification System (NAICS), which categorizes companies by the goods and/or services they produce.

<sup>29</sup> Adapted from ECO Canada, *Profile of Canadian Environmental Employment*, 13.

<sup>30</sup> Pembina Institute calculation based on 2010 "Employment by Industry" data from Statistics Canada (<http://www40.statcan.gc.ca/l01/cst01/econ40-eng.htm>; accessed January 7, 2011). Total employment in "agriculture, forestry, fishing and hunting" and "mining and oil and gas extraction" is approximately 634,400, while ECO Canada estimates environmental employment at 682,000. Once environmental employees are factored out, the remaining employees in those sectors total about 586,000.

employment in Canada is nearly five times larger than total direct employment in automotive manufacturing.<sup>31</sup>

*“In 2007, environmental employees represented 3.2% of total Canadian employment. While the methods used in the 2007 and 2010 surveys are not perfectly comparable, comparisons between the findings suggest that there is a growth in demand for environmental skills in all sectors.”*

— ECO Canada, 2010 (In 2010, ECO Canada estimated that 4% of Canadian employees do work that meets their definition of environmental employment)<sup>32</sup>

### 1.1.3 Greening existing jobs

An alternative to defining and quantifying new green jobs is to focus on the greening of existing jobs. York University Professor Carla Lipsig-Mummé, who heads the Work in a Warming World research initiative, argues that the current “proliferation” of green job definitions carries several risks, the most important of which is that it becomes “a distraction from the main game,” which should be the reduction of GHG emissions.<sup>33</sup>

Pre-existing jobs (as opposed to newly-created green jobs) represent the vast majority of jobs, so including them in a project of “greening the world of work” allows for the participation and engagement of a far greater number of workers. Prof. Lipsig-Mummé proposes to define “greening work and jobs” as being “a process of society-wide transition to jobs and work practices in the public and private sectors that steadily reduces the GHG emissions produced.” This approach allows employers and employees to measure the greenness of their work by monitoring whether the GHG emissions they are responsible for are growing or dropping.<sup>34</sup>

This approach has the merit of shifting the conversation away from what is and isn’t a green job to a discussion about what workers across the economy can do (and the kinds of skills they will need) to make their work greener. And there’s no doubt that the scale of transformation we need to tackle climate change goes far beyond any single sector or niche of the economy.

*“Growth of the green economy and green collar jobs in North America is in some ways analogous to the Information Technology revolution of the 1990s. As the IT industry grew, it brought two key changes to the labour force. First, it created new jobs to design, install, and manage IT systems. Second, it brought about changes to a large number of existing jobs that increasingly required computer skills. The revolution grew rapidly*

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<sup>31</sup> The Canadian automotive manufacturing sector directly employed over 141,000 people in 2008, according to the sector profile included in the Regulatory Impact Analysis Statement (RIAS) prepared by Environment Canada for the government’s Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. The RIAS is available at <http://www.gazette.gc.ca/rp-pr/p1/2010/2010-04-17/html/reg1-eng.html>.

<sup>32</sup> ECO Canada, *Profile of Canadian Environmental Employment*, 6.

<sup>33</sup> Carla Lipsig-Mummé in *Green/ing Jobs: Definitions, Dilemmas, Strategies*, 5–6.

<sup>34</sup> *Ibid.*

*through the late 1990s, and after the dot-com bust of 2000-2001 the sector continued to grow — both as a stand-alone sector, and within all traditional industries.”*

— Momentum (a Calgary-based community economic development organization), 2010<sup>35</sup>

## 1.2 Characteristics of green jobs

Two frequently-cited attributes of green jobs are that the workers will largely perform “familiar” kinds of work, and that they are not concentrated in a particular geographical region. Both of these characteristics likely serve to increase the appeal of green jobs: making use of existing skills in more sustainable ways means that Canada’s existing workforce is already able to take on some greener employment, and geographical diversity means that communities across the country could benefit from green job creation.

Because many green jobs involve work with relatively unfamiliar or alternative technologies, it would be easy to assume that they entail brand-new work roles. In some cases, that’s true: today’s 50-year-olds probably didn’t grow up expecting to become carbon market lawyers or photovoltaic technicians. But in most cases, green jobs feature familiar kinds of work in a more sustainable setting.

*“We show that the vast majority of jobs associated with [...] green strategies are 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.”*

— Robert Pollin and Jeanette Wicks-Lim, University of Massachusetts, 2008<sup>36</sup>

Some Canadian illustrations of this characteristic include:

- The Canadian Wind Energy Association (CanWEA) sent surveys to 274 of its member companies in 2008, receiving responses from 70% of them. Based on those responses, CanWEA produced the following description of direct employment in the wind energy workforce in Canada (it should be noted that wind energy accounted for less than 1% of electricity generated in Canada in 2008, but has almost doubled in size since then):<sup>37</sup>

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<sup>35</sup> Momentum Community Economic Development, *Green Collar Jobs: New Workforce Development Opportunities in Alberta* (Calgary: Momentum and Thrive, 2010), 18.

[http://www.thrivecalgary.org/documents/GreenCollarJobs\\_web.pdf](http://www.thrivecalgary.org/documents/GreenCollarJobs_web.pdf)

<sup>36</sup> Pollin and Wicks-Lim, *Job Opportunities for the Green Economy*, 1.

<sup>37</sup> Environment Canada, *National Inventory Report — Greenhouse Gas Sources and Sinks in Canada 1990–2008* (2010), Part 3: 35, Table A13-1. <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1>

**Table 3. Canadian wind industry by occupational category, 2008<sup>38</sup>**

Occupational category	Number of full-time equivalents
Management and supervisors	407
Engineers and scientists	598
Trades	356
Other occupations	338
Labour (assembly, welding, etc.)	464
Support staff (secretarial, customer service, accounting, call centre, etc.)	345
Other staff	72
<b>Total</b>	<b>2580</b>

- A 2006 assessment of the economic impact of building several wind turbines at a cost of \$3.9 billion in southeast Alberta found that the construction phase of the project would create 1,757 direct full-year jobs for local residents. The project developers planned to import their turbine generators from outside of Canada, but the project would require hiring local workers in construction, transportation, and accommodation, along with legal, financial and professional advisors.<sup>39</sup>
- A 2010 assessment of Calgary’s potential for green collar jobs — entry-level jobs that pay over \$12.25/hour, offer opportunities for advancement and improve environmental quality — estimated that over 8,000 workers were already employed in Calgary’s green industries in 2009. The report provides the following examples of potential green collar jobs:

<sup>38</sup> Insightrix Research Inc., *Canadian Wind Energy Economic Impact Survey* (2008), 1, 9.

<sup>39</sup> Canadian Tourism Research Institute, *Economic Impact Analysis of the Proposed Wind Development Projects in Southeast Alberta* (Conference Board of Canada, 2006), 2–9. [http://www.ontario-sea.org/Storage/28/1945\\_Economic\\_Impact\\_Analysis\\_of\\_the\\_Proposed\\_Wind\\_Development\\_Projects\\_in\\_Southeast\\_Alberta.pdf](http://www.ontario-sea.org/Storage/28/1945_Economic_Impact_Analysis_of_the_Proposed_Wind_Development_Projects_in_Southeast_Alberta.pdf)

**Table 4. Green collar job categories in Calgary<sup>40</sup>**

Green construction	
<b>Entry level</b>	insulators, installers of siding, carpenters, roofers, other trades
<b>Advanced</b>	energy auditors, blower door testers, junior site managers, site managers, other occupations
Renewable energy	
<b>Entry level</b>	construction trades, heavy equipment operators, roofers, HVAC (heat, ventilation, air conditioning) technicians, drilling technicians
<b>Advanced</b>	wind turbine maintenance technicians, master plumbers and other construction trades

(A further example of job categories for green work is available in Appendix 2.)

Along with their “familiarity,” the most frequently cited characteristic of green jobs is their geographical diversity.

For example, upgrades to increase energy efficiency can take place wherever there are buildings; in the majority of cases, the construction and installation work required to make energy efficiency upgrades is likely to be done by local workers.<sup>41</sup>

*“I visited their [British Gas] Energy Academy, where they’ve just recruited their thousandth green-collar worker. From school leavers to highly-qualified engineers, this is real green growth. Within our borders. With a long timeframe. And with no regional bias, because our homes are everywhere.”*

— Chris Huhne, U.K. Secretary of State for Energy and Climate Change<sup>42</sup>

The variety of options for generating low-impact renewable energy in Canada — including wind, solar, run-of-river hydro, biomass, tidal — mean that renewable energy generation could take place successfully across the country, with some regions having a comparative advantage in a

<sup>40</sup> Momentum Community Economic Development, *Green Collar Jobs*, 1–13.

<sup>41</sup> Geographical diversity in job creation would help to reverse a trend in Canada’s employment patterns, which sees stronger job growth in the western part of the country than in the east. As the *Globe and Mail* reported in December 2010, “Natural resources are now the fastest-growing source of employment in the country, while manufacturing — where three-quarters of the country’s activity is in Ontario and eastward — continues to tally sharp declines. Ontario and Quebec have together lost more than 75,000 factory positions in the past year.” See Tavia Grant and Richard Blackwell, “Jobless figures underline east-west divide,” *Globe and Mail*, December 3, 2010. <http://www.theglobeandmail.com/report-on-business/jobless-figures-underline-east-west-divide/article1823392/> (accessed March 2, 2011).

<sup>42</sup> Department of Energy and Climate Change, “Chris Huhne Speech to LSE: Green Growth — The Transition to a Sustainable Economy,” London, November 2, 2010. [http://www.decc.gov.uk/en/content/cms/news/lse\\_chspeech/lse\\_chspeech.aspx](http://www.decc.gov.uk/en/content/cms/news/lse_chspeech/lse_chspeech.aspx) (accessed February 9, 2011).

specific technology. Wind turbines can operate in the far North; rooftop solar panels can fit into the landscape in crowded cities. From a local or regional economic development perspective, the geographic versatility of renewable energy and energy efficiency is a very appealing feature.

Capturing the full domestic job creation potential of green investments requires not just installing, selling and operating clean energy equipment project development, but also producing and exporting its components. Green industries can create more jobs if they can find export markets for their products; conversely, the domestic benefits of investing in clean energy would be reduced if firms imported most of the components they require. (For more on manufacturing and exporting, see Section 3.4.)

*“Growth in demand for environmental goods and services drove 13.5% annual growth in environmental goods exports from 1990–2002 (exports from all countries combined)... Canada has benefited from growth in these export markets. For example, about one third of all Canadian solar panel manufacturing revenues come from global exports. However, Canada lags far behind Germany, China, the U.S., Italy, the U.K. and other countries in total environmental exports.”*

— ECO Canada, 2010<sup>43</sup>



**Green jobs can be in engineering, trades and other occupations.**

Photo: U.S. Department of Energy via Flickr

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<sup>43</sup> ECO Canada, *Canadian Environmental Sector Trends*, 8.

## 2. The employment effects of GHG emission-reduction policies

While there is certainly merit in being able to track green work, identifying a category of jobs is only one way to think about the employment effects of environmental policy. The other main approach — an approach that is used frequently in other economic sectors as well — is to assess the job creation potential of a given policy or project.

For example, an analyst could determine the number of new jobs that could be created if the government funded a new support program for renewable energy, or if a company opened up a new solar panel manufacturing plant. Job creation estimates of this kind typically track three types of labour effects:

- **Direct employment:** In the case of a solar panel company, an example of direct employment would be the electrician hired to do the wiring for new panel installations.
- **Indirect employment:** Indirect jobs are those created in industries that supply inputs to the new solar project. For example, a glass manufacturing operation might be contracted to produce products for the solar company.
- **Induced employment:** These are the jobs created when employees (direct and indirect) go out and spend their paycheques. Induced employment could mean that a local restaurant hires three new servers as a result of the solar operation.

These kinds of job calculations are often made with input-output tables and job multipliers. Input-output models delineate the relationships between consumers of goods and services and the industries producing those goods and services. Job multipliers derived from these tables allow researchers to calculate the direct, indirect and induced job creation from an increase in final demand for the products of an industry.<sup>44</sup> The increase in demand is typically stimulated by increased public or private spending on the goods or services that sector produces.

Many induced jobs would not fit even a broad definition of green employment, but they are nonetheless jobs created by green policies. Thus, the discussion of job creation from green

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<sup>44</sup> Robert Pollin and Heidi Garrett-Peltier, *Building the Green Economy: Employment Effects of Green Energy Investments in Ontario* (Political Economy Research Institute, 2009), 9.  
[http://www.greenenergyact.ca/Storage/25/1722\\_PERI\\_ON\\_Green\\_Jobs\\_Report.pdf](http://www.greenenergyact.ca/Storage/25/1722_PERI_ON_Green_Jobs_Report.pdf)

policies in this section is not directly comparable to the estimates of green job numbers found in Section 1.<sup>45</sup>

The sections below examine two approaches to estimating job creation: shorter-term, policy- or project-specific approaches (Section 2.1) and economy-wide approaches (Section 2.2).

## 2.1 Estimating the jobs created by specific climate policies with localized input-output modelling

In a 2009 study, Robert Pollin and Heidi Garrett-Peltier, from the Political Economy Research Institute at the University of Massachusetts–Amherst, applied the input-output approach to estimate the job creation potential of Ontario’s Green Energy Act (GEA).<sup>46</sup> This Act, which became law in May 2009, provides favourable rates and grid access to producers of renewable electricity.

In their study, Pollin and Garrett-Peltier compared the additional job creation from the Green Energy Act to what would have happened under a business-as-usual baseline, which they defined as being Ontario’s previously-announced Integrated Power System Plan. Under the GEA, the province of Ontario is projected to invest 153% more in clean energy than under business as usual over a 10-year period. The study’s authors divide that funding into annual spending, so that \$47.1 billion in additional spending on clean energy over 10 years produced an annual average of \$4.7 billion in spending per year. The authors then use employment multipliers to calculate that Ontario’s extra annual investment of \$4.7 billion would produce 55,000 jobs in that year. (Under business as usual, a year’s worth of energy spending in Ontario is projected to create 35,189 direct, indirect and induced jobs over the lifetime of the Integrated Power System Plan, while the total energy spending under the GEA is projected to create 90,442 total jobs per year.) In the case of the GEA, the job creation breaks down to:

- 38,430 direct
- 31,141 indirect
- and 20,871 induced jobs created.<sup>47</sup>

Table 5 below shows some of the job multipliers (direct and indirect job creation per million dollars invested) that Pollin and Garrett-Peltier used to arrive at their results.

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<sup>45</sup> The discussion in Section 2 also differs from that in Section 1 because this section focuses on climate (i.e. GHG emission reduction) policy efforts. When discussing green jobs, most researchers emphasize overall environmental sustainability, which is much broader than GHG emissions.

<sup>46</sup> Pollin and Garrett-Peltier, *Building the Green Economy*.

<sup>47</sup> *Ibid.*, 7–16.

**Table 5. Direct and indirect employment impacts of the Ontario Green Energy Act<sup>48</sup>**

Energy source	Job creation (job-years per \$1 million spent)		
	Direct	Indirect	Direct and Indirect
Conservation and demand management	9.0	5.2	14.2
Hydroelectric	8.2	6.0	14.2
On-shore wind	7.6	7.1	14.7
Offshore wind	7.6	8.2	15.8
Bioenergy	8.4	8.0	16.4
Waste energy recycling	8.2	7.9	16.1
Solar	8.2	7.6	15.8
Smart grid	7.0	7.1	14.1
<b>Average of all technologies<sup>49</sup></b>	<b>8.0</b>	<b>7.1</b>	<b>15.2</b>

Pollin and Garrett-Peltier write that three factors explain the slight differences in job multipliers between the technologies listed above. Those are:

- **“Relative labour intensity:** This measures how much of a given amount of money is spent on paying workers, as opposed to spending on supplies, rent, land, transportation and energy.
- **“Local content:** This includes the proportion of total spending for a given project that remains within the province of Ontario as opposed to being spent on supplies of all sorts outside the province.<sup>50</sup>
- **“Pay levels:** If a given amount of spending is used to pay people lower average wages, this means that this given spending level can create more jobs.”<sup>51</sup>

The Government of Ontario is also estimating the job effects of the GEA. The province’s most recent data estimates that the legislation will have created 50,075 direct and indirect jobs by

<sup>48</sup> Pollin and Garrett-Peltier, *Building the Green Economy*. For information on the methodology used in the calculation of induced jobs, see pages 12–13.

<sup>49</sup> Pembina Institute calculation; does not add up due to rounding.

<sup>50</sup> The boundary for “local content” depends on the geographical scope under consideration, which was restricted to Ontario in Pollin and Garrett-Peltier’s study. If components used in projects spurred by Ontario’s GEA are manufactured in B.C. or Nova Scotia, they of course still contribute to Canadian employment.

<sup>51</sup> Pollin and Garrett-Peltier, *Building the Green Economy*, 10.

2012. Of those, about 18% (8,941) are expected to be manufacturing jobs.<sup>52</sup> Pollin and Garrett-Peltier made a higher estimate of likely direct and indirect job creation, estimating that a year's worth of GEA spending would create 69,571 jobs (composed of 38,430 direct and 31,141 indirect jobs.)<sup>53</sup>

The Government of Ontario's estimates are not directly comparable to Pollin and Garrett-Peltier's analysis, as those researchers estimate jobs based on average annual spending, while the Government of Ontario's estimates shows cumulative job creation to 2012. However, it is not clear from the Government of Ontario's calculations whether funding is indeed being spent at an average annual rate similar to Pollin and Garrett-Peltier's estimate of \$4.7 billion/year. According to a recent media report, uncertainty about the future of the GEA — caused both by opposition to its provisions from Progressive Conservative leader Tim Hudak and by international challenges to the law's domestic content provisions<sup>54</sup> — have slowed the pace of job creation growth.<sup>55</sup>

### U.S. Clean Energy Job Creation

Recent analysis from the United States provides another estimate of the job creation potential of clean energy investments. President Obama's administration invested over US \$90 billion in various forms of support for clean energy in the 2009 American Recovery and Reinvestment Act. An April 2010 estimate from the president's Council of Economic Advisers calculates that this investment "saved<sup>56</sup> or created" 83,300 direct and indirect clean energy jobs by the first quarter of 2010, which spurred a further 20,800 induced jobs.<sup>57</sup> These estimates were generated using the Council of Economic Advisers' macroeconomic model,<sup>58</sup> which applies a "total multiplier" to different types of economic stimulus that is based on "prior empirical estimates from the macroeconomic literature."<sup>59</sup>

<sup>52</sup> Personal communication, Government of Ontario official. The methodology used to reach these estimates was not specified.

<sup>53</sup> Pollin and Garrett-Peltier, *Building the Green Economy*, 16.

<sup>54</sup> Japan, the U.S. and the EU are all challenging the domestic procurement requirements in the GEA at the World Trade Organization. See, for example, Ashley M. Weber, "Japan, US and EU Face-off Against Ontario's Renewable Energy Program at the WTO," blog post, Stikeman Elliott, December 2010. <http://www.canadianenergylaw.com/2010/12/articles/regulatory/japan-us-and-the-eu-faceoff-against-ontarios-renewable-energy-program-at-the-wto/> (accessed March 3, 2011).

<sup>55</sup> Lee Greenberg, "Political doubts stall province's green power plan: experts," *Ottawa Citizen*, February 7, 2011. <http://www.ottawacitizen.com/technology/Political+doubt+stalls+province+green+power+plan+experts/4233945/story.html> (accessed February 15, 2011). The article also raises questions about the Government of Ontario's manufacturing job creation figures.

<sup>56</sup> The May 2009 Council of Economic Advisers report defines a "job retained" as "an existing position that would not have been continued were it not for ARRA funding." See Council of Economic Advisers, *Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009* (2009), 7. <http://www.whitehouse.gov/sites/default/files/microsites/Estimate-of-Job-Creation.pdf>

<sup>57</sup> Council of Economic Advisers, *Supplement to the Third Quarterly Report on the Economic Impact of the American Recovery and Reinvestment Act of 2009: The ARRA and the Clean Energy Transformation* (2010). [http://www.whitehouse.gov/sites/default/files/image/arra %20and clean energy transformation 3Q supplement.pdf](http://www.whitehouse.gov/sites/default/files/image/arra%20and%20clean%20energy%20transformation%203Q%20supplement.pdf)

<sup>58</sup> *Ibid.*, 5.

<sup>59</sup> Council of Economic Advisers, *Economic Impact of the American Recovery and Reinvestment Act of 2009: Third Quarterly Report* (2010), 31. <http://www.whitehouse.gov/sites/default/files/microsites/CEA-3rd-arra-report.pdf>

While job multipliers analysis based on input-output tables is frequently used to make estimates of job creation, this approach also has certain important limitations.<sup>60</sup> For example:

- Input-output model coefficients are based on the relationships between one sector's outputs and another's. Those relationships are fixed in the model, meaning that the ratio remains static. In reality, those values would change over time to reflect things like changes in commodity prices, new technologies, market stability or instability, and changes in productivity.
- Input-output models also assume that there are no supply or resource constraints. In the case of the GEA, this means making an assumption that a firm seeking to hire electricians will be able to find as many available workers as needed. In reality, an electrician may already be working at another job, and would need to determine whether or not to accept the new opportunity. Firms also sometimes face shortages of skilled labour or materials that input-output models do not reflect.<sup>61</sup>

Because of these limitations, input-output models are most effective when used to examine the specific, short-term consequences of a given investment. But those analyses of a single policy option, like Pollin and Garrett-Peltier's GEA study, do not provide information about opportunity costs — for example, would another way of spending the same amount of money have generated even more jobs? — and they are not able to reflect changes that may take place in the input-output relationships in a sector over time. In addition, while they can quantify the jobs gained from a specific investment, they are not able to include jobs that may be lost as a result of a policy shift. In other words, they do not assess net jobs (jobs gained minus jobs lost.)

For this reason, some analysts avoid this kind of localized, short-run modelling, and instead work with economy-wide, longer-term models.<sup>62</sup> These include computable general equilibrium models and econometric models, such as the Canadian Economic and Fiscal Model used by Canada's Department of Finance.

## 2.2 Economy-wide analysis of job impacts from emission reduction policies

In October 2009, the David Suzuki Foundation and the Pembina Institute published a comprehensive economy-wide analysis of the effect of climate policies in Canada.<sup>63</sup> The

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<sup>60</sup> Personal communication, Nic Rivers (MKJA, Simon Fraser University), January 31, 2011.

<sup>61</sup> Govinda R. Timilsina, Nicole LeBlanc, and Thorn Walden, *Economic Impacts of Alberta's Oil Sands, Volume 1* (Canadian Energy Research Institute, 2005), 47. [www.ceri.ca/Publications/documents/OilSandsReport-Final.PDF](http://www.ceri.ca/Publications/documents/OilSandsReport-Final.PDF)

<sup>62</sup> For example, the U.S. Congressional Budget Office selected only studies that “present results for industries spanning the entire economy and that use models designed to analyze economywide policies in long-term equilibrium.” See Congressional Budget Office, *How Policies to Reduce Greenhouse Gas Emissions Could Affect Employment* (2010), 4. [www.cbo.gov/ftpdocs/105xx/doc10564/05-05-CapAndTrade\\_Brief.pdf](http://www.cbo.gov/ftpdocs/105xx/doc10564/05-05-CapAndTrade_Brief.pdf)

<sup>63</sup> 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* (The Pembina Institute and the David Suzuki Foundation, 2009) <http://pubs.pembina.org/reports/climate-leadership-report-en.pdf>. That summary is based on a technical report from M.K. Jaccard and Associates, *Final Report: Exploration of two Canadian greenhouse gas emission targets: 25% below 1990 and 20% below 2006 by 2020* (2009) <http://pubs.pembina.org/reports/mk-jaccard-gov-and-eng-climate-targets-report-oct.pdf>

modellers responsible for that study, M.K. Jaccard and Associates, used both a technology simulation model and a computable general equilibrium model in generating their results, and the results were presented at both the national and regional levels.

The study examined the economic effects of meeting two national emissions targets: the government's then-2020 target<sup>64</sup> and a more ambitious 2020 target.<sup>65</sup> The package of climate policies modelled included significant carbon prices; more stringent vehicle efficiency standards, building codes and appliance efficiency standards; regulations to require the capture of landfill gas; regulations to limit venting and flaring in oil and gas production; full cost pricing for nuclear power; and investments in electricity transmission infrastructure, public transit infrastructure and agricultural offsets funded from carbon pricing revenues. In addition, carbon pricing revenues were used to provide payments to individuals and households to compensate for energy price increases; payments to vulnerable sectors to protect against leakage; and reductions in personal income taxes.<sup>66</sup>

Under business as usual, the modellers projected that Canada's economy would grow by 2.4% per year, resulting in 27% growth from 2010 to 2020. The economy grew slightly more slowly under the climate policy scenarios: by 2.2% per year while meeting the government's target, and by 2.1% per year while meeting the more ambitious target. Over the decade from 2010 to 2020, this means GDP growth of 23–25% (see Figure 1).<sup>67</sup>

Despite this slight slowdown in GDP growth, the modellers found that employment would grow slightly faster under the climate policy scenarios than under business as usual. Under business as usual, overall national job growth was projected to be 10.4% from 2010 to 2020. Under the climate policy scenarios, national job growth ranged from 10.7–11.0% over the same period. The modellers offered several explanations for this seemingly surprising result, including:

- The effects of the specific approach the project team selected for returning carbon pricing revenue the policy scenarios generated back into the economy
- Slightly slower salary growth than under business as usual (however, due to tax cuts implemented in the policy package, employees ended up with higher take-home pay in some of the climate policy scenarios)
- And finally, “a significant shift away from capital-intense (e.g. fossil fuel) to labour-intense (manufacturing and services) industries in all regions.”<sup>68,69</sup>

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<sup>64</sup> 20% below the 2006 level in 2020. The Government of Canada changed its 2020 target in January 2010 to 17% below the 2005 level.

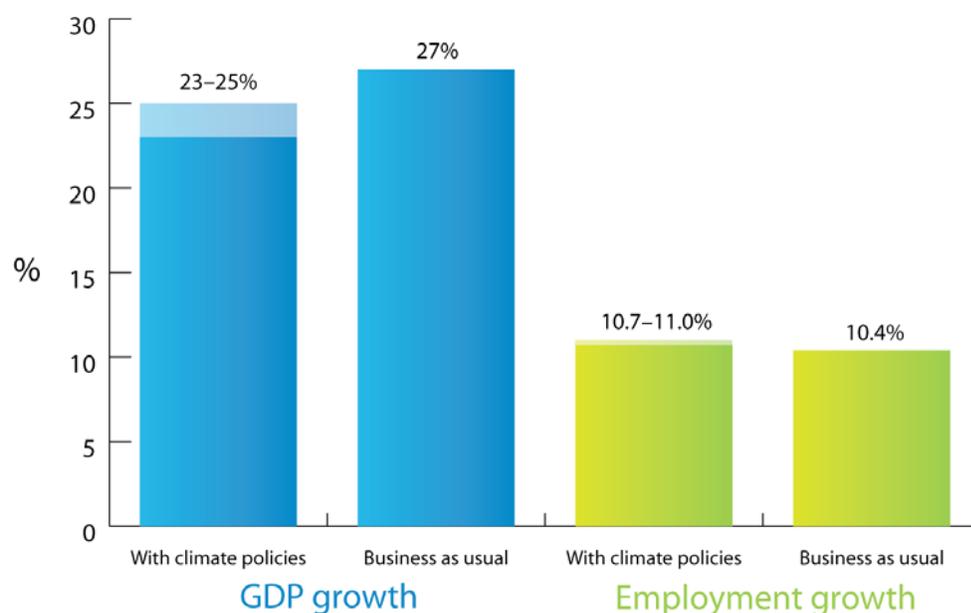
<sup>65</sup> 25% below the 1990 level in 2020, which the study refers to as the 2°C target.

<sup>66</sup> Matthew Bramley et al., *Climate Leadership, Economic Prosperity*, 11–13.

<sup>67</sup> Matthew Bramley et al., *Climate Leadership, Economic Prosperity*, iii–iv.

<sup>68</sup> M.K. Jaccard and Associates, *Final Report: Exploration of two Canadian greenhouse gas emission targets*, 9–10.

<sup>69</sup> In part, this result also reflects the model's assumptions about capital. As explained in *Final Report: Exploration of two Canadian greenhouse gas emission targets*, 10–11: “No net foreign capital is assumed to be available, i.e. all investment must be funded in the long run from Canadian sources.” Thus, while investment shifts within Canada, over the longer term, the total amount of capital investment does not change.



**Figure 1. GDP and employment growth with climate policies compare to business as usual**

As a result of that shift from fossil fuel to more labour-intensive sectors, the modellers found that the employment gains would be distributed differently under climate policies than under business as usual. For example, Alberta’s job growth would drop from 9.9% under business as usual to between 6.5–8.2% under the climate policy scenarios. In contrast, Ontario’s job growth was projected to be 14.5% under business as usual and over 15% under all climate policy scenarios.<sup>70</sup> The regional results are presented in Table 6.

**Table 6. Employment results of government GHG target<sup>71</sup>**

	BC	AB	SK	MB	ON	QC	ATL	Canada
<b>Increase in number of jobs, 2010–20 (%)</b>	11	8	10	9	16	7	3	<b>11</b>
<b>Number of net new jobs, 2010–20 (in thousands)</b>	264	163	49	58	1,049	282	40	<b>1,906</b>
<b>Number of jobs in 2020, relative to business as usual (%)</b>	0.6	-1.7	0.3	1.4	0.9	1.0	0.0	<b>0.5</b>

Note: Government GHG target is 20% below 2006 in 2020

Overall, the Canadian results illustrate two conclusions:

- The climate policies chosen would have a slight positive overall effect on Canadian employment over a decade

<sup>70</sup> Ibid. (summary report), 5–6; Ibid. (technical report), 9, 70–71.

<sup>71</sup> Ibid. (summary report), 6.

- The resulting jobs would be found in different parts of the country, and in different sectors, than they would under business as usual.

This national-level assessment for Canada aligns well with international findings summarized by the International Labour Organization (ILO) in a 2009 study. Their review concluded that “a majority of studies find that the net impact of environmental policies on employment is likely to be neutral or slightly positive. However, the distributional effects of these policies are less clear cut.”<sup>72</sup> The authors added the caveat that making job gains from environmental action “require the right policies to be in place” to smooth the transition in high-carbon sectors and support low-carbon sectors.<sup>73</sup> Indeed, numerous studies emphasize the need to design emission reduction policies well in order to maximize job gains, provide targeted protection to low-income families and vulnerable sectors, and provide transition plans for workers in high-carbon industries that will face reduced demand for their products. It’s clear that the specific policy decisions that governments make en route to meeting emission reduction targets will play a key role in determining the employment outcomes.

An assessment from three British economists (Samuel Fankhauser, Friedel Sehlleier, and Nicholas Stern) proposed a three-phase approach to understanding the impact of climate policy on jobs. In the short term, “the net effect could be job creation, as low-carbon technologies tend to be more labour-intensive.” They expect that this will change over the medium-term, as low-carbon technologies become more efficient, thus reducing their job-creation advantage over conventional energy. However, as the economy adjusts to carbon constraints, studies show that “a comprehensive package of climate change policies could create positive economic outcomes.” Over the long term, “climate change policy will unleash a wave of innovation,” as firms respond to the low-carbon policies they now face. The authors note that “growth theory has long identified technical change and innovation as a major source of economic growth.” So while the authors describe the results as “complex,” with both winners and losers created in the transition, their conclusion is that “climate change has the potential to create many more jobs than it destroys in the long run.”<sup>74</sup>

The U.S. Congressional Budget Office reached a different conclusion with its examination of three economy-wide U.S. studies, finding that total U.S. employment during the next few decades “would be slightly lower than would be the case in the absence of” policy action to reduce GHG emissions. However, the report notes that the current industry classifications used in collecting statistical data (which treats sectors like coal mining and oil refining as separate industries, but does not do the same for wind energy or advanced, fuel-efficient vehicles) make it easier to observe job losses than job gains in a clean-energy transition.<sup>75</sup>

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<sup>72</sup> International Labour Organization, *World of Work Report 2009: The Global Jobs Crisis and Beyond* (Geneva: International Institute for Labour Studies, 2009), 102.

[www.ilo.org/wcmsp5/groups/public/@dgreports/.../wcms\\_118384.pdf](http://www.ilo.org/wcmsp5/groups/public/@dgreports/.../wcms_118384.pdf)

<sup>73</sup> *Ibid.*, 97–98.

<sup>74</sup> Samuel Fankhauser, Friedel Sehlleier, and Nicholas Stern, “Climate Change, Innovation and Jobs” in *Climate Policy* No. 8 (Earthscan, 2008). <http://www.cccep.ac.uk/Publications/research-articles/Docs/climate-change-innovation-jobs.pdf>

<sup>75</sup> Congressional Budget Office, *How Policies to Reduce Greenhouse Gas Emissions Could Affect Employment* (Washington: CBO Economic and Budget Brief, 2010), 1, 11. [www.cbo.gov/ftpdocs/105xx/doc10564/05-05-CapAndTrade\\_Brief.pdf](http://www.cbo.gov/ftpdocs/105xx/doc10564/05-05-CapAndTrade_Brief.pdf).

# 3. The relative job effects of choosing clean energy

This section examines the employment consequences for Canada of choosing green policies over other options. In other words, it looks at the relative job creation potential of clean energy policies in comparison to business as usual.

## 3.1 Electricity generation

Over the past two decades, Canada's GHG emissions have grown significantly, and they are projected to continue rising.<sup>76</sup> To reverse that trend, governments and companies will need to start choosing energy conservation, energy efficiency and renewable energy over fossil fuels far more often than they have to date. What would that mean for jobs in Canada?

One Canadian study that examines this issue is a 2005 paper by the Pembina Institute for the Clean Air Renewable Energy Coalition. Drawing on analysis of 13 U.S. and European studies by the University of California–Berkeley's Daniel M. Kammen, the report concluded that, in the electricity sector, the "employment created from low-impact renewable electricity would be comparable to or greater than that created by an equivalent capacity of fossil fuel-based generation."<sup>77</sup>

*"A key result emerges from our work: Across a broad range of scenarios, the renewable energy sector generates more jobs than the fossil-fuel based energy sector per unit of energy delivered.... The renewable energy sector generates more jobs per megawatt hour of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel sector."*

— Daniel Kammen, Kamal Kapadia, Matthias Fripp, 2004<sup>78</sup>

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<sup>76</sup> Environment Canada, *Information on Climate Change — Canada's Greenhouse Gas Target and Emissions Projections*, Table 1: Canadian GHG Emissions and Government Measures (Mt CO<sub>2</sub>e) <http://www.climatechange.gc.ca/default.asp?lang=En&n=DC025A76-1> (accessed February 8, 2011).

<sup>77</sup> Pembina Institute, *Canadian Renewable Electricity Development: Employment Impacts* (Clean Air Renewable Energy Coalition, 2005), 1, 4. <http://www.cleanairrenewableenergycoalition.com/documents/Employment-Predictions.pdf>

<sup>78</sup> Daniel Kammen, Kamal Kapadia, Matthias Fripp, *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* (Renewable and Appropriate Energy Laboratory, University of California, 2004), 2, 3. <http://rael.berkeley.edu/sites/default/files/very-old-site/renewables.jobs.2006.pdf>

There appears to be a near-consensus that, in the electricity sector, renewable energy is the pro-job (more labour-intensive) choice, creating more direct jobs than fossil-fuel alternatives. Table 7 shows the results of a 2010 compilation of 15 studies (drawn from international sources) that assess the job creation potential of renewable and fossil fuel fired electricity. Coal and natural gas tie for last place.

**Table 7. Jobs years per gigawatt hour over the average lifetime of facilities**<sup>79</sup>

Energy technology	Total jobs-years per GWh	Job creation rank (where 1 is highest)
Solar photovoltaic	0.87	1
Landfill gas	0.72	2
Energy efficiency	0.38	3
Small hydro	0.27	4
Geothermal	0.25	5
Solar thermal	0.23	6
Biomass	0.21	7
Carbon capture and storage	0.18	8
Wind	0.17	9
Nuclear	0.14	10
Coal	0.11	11 (tied)
Natural gas	0.11	11 (tied)

*“Development of clean energy invests directly in people, substituting labour for fuel expenses. It is this fundamental fact that allow renewable energy technologies to provide, on average, three to six times as many jobs as equivalent investments in fossil fuels when manufacturing, installation and operations and maintenance jobs are taken into account.”*

— BlueGreen Alliance, 2009<sup>80</sup>

<sup>79</sup> Adapted from Max Wei, Shana Patadia, Daniel M. Kammen, “Putting Renewables and Efficiency to Work: How many jobs can the clean energy industry generate in the U.S.?” in *Energy Policy* 38 (2010), 922, Table 2. [http://rael.berkeley.edu/sites/default/files/WeiPatadiaKammen\\_CleanEnergyJobs\\_EPolicy2010.pdf](http://rael.berkeley.edu/sites/default/files/WeiPatadiaKammen_CleanEnergyJobs_EPolicy2010.pdf). The full table factors in capacity factors and equipment lifetimes, and includes jobs in construction, installation and manufacturing; operations and maintenance (O&M); and fuel extraction and processing in order to allow for full comparability between energy choices.

What explains these findings? One factor behind greater labour intensity of renewable energy is that it is not currently (in most settings at least) the lowest-cost choice. According to Fankhauser, Sehlleier and Stern, “not being ‘least cost’ means, by definition, that these options use up more inputs — both in terms of capital and labour — for a given amount of output. This means that installations have to be replaced almost twice as often and that [for some renewable technologies] four times as much capacity has to be installed for the same output.”<sup>81</sup> Over time, the authors argue, renewable energy technology will become more efficient, and thus its comparative labour intensity advantage will be reduced.<sup>82</sup> However, a sector’s labour intensity is, to some extent, inherent: hairdressing will always be more labour-intensive than oil refining.<sup>83</sup>

*“Electricity generation from renewable sources like wind and tidal power continue to increase at a significant rate [in Canada]. New large-scale wind farm installations helped increase power generation by 44% from 2007 and 179% from 2005. Wind and tidal generation has nearly equalled RPP-fired[refined petroleum product-fired] generation, and provincial programs for increased renewable content (from wind and other sources) in the electrical supply grid will continue to play a role in 2009 and beyond as more projects come on line. The Canadian Wind Energy Association (CanWEA) reports that Canada’s installed capacity grew to 2369 MW in 2008, an increase of 523 MW from 2007.”*

— Government of Canada, National Inventory Report 2008<sup>84</sup>

While both Table 5 and Table 7 show energy efficiency as having a comparable job creation potential to renewable energy, some U.S. analysts would put it far in front, based on taking an economy-wide approach that factors in the job creation spurred by the savings that consumers reap on their electricity bills. In a 2009 macroeconomic study of the effect of energy efficiency investments in New England, researchers at Environment Northeast concluded that the majority (81–91%) of economic impacts observed “result from the energy savings realized by households and business. Lower energy costs cause other forms of consumer spending (such dining out or discretionary purchasing) to increase. Lower energy bills reduce the costs of doing business in

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<sup>80</sup> BlueGreen Alliance, *Building the Clean Energy Assembly Line: How Renewable Energy Can Revitalize U.S. Manufacturing and the American Middle Class* (BlueGreen Alliance, 2009), 3.  
<http://www.bluegreenalliance.org/admin/publications/files/BGA-Phase-II-Report-PRINT.pdf>

<sup>81</sup> Capacity factors for different kinds of renewable energy technologies vary. For example, the International Energy Agency notes that some capacity values are as low as 10%, while concentrated solar power has a capacity factor of 90%. See International Energy Agency, *World Energy Outlook 2010* (Paris: IEA, 2010), 326.

<sup>82</sup> Fankhauser, Sehlleier and Stern, “Climate Change, Innovation and Jobs,” 423.

<sup>83</sup> The International Labour Organization offers an interesting perspective on the likely change over time in sectors’ labour intensity over time. As climate policy (particularly carbon pricing) takes effect, energy costs are expected to rise. As the ILO explains, “energy and capital are two complementary factors of production. The rises in energy price mechanically increase the cost of capital relative to the cost of labour.” Companies are likely to respond by using less capital, thus becoming more labour-intensive in response to rising energy costs. See International Labour Organization, *World of Work Report 2009*, 104–105.

<sup>84</sup> Environment Canada, *National Inventory Report — Greenhouse Gas Sources and Sinks in Canada 1990–2008*, Part 3: 27. This is the most recent national GHG data publicly available.

the region, bolstering the global competitiveness of local employers and promoting additional growth.” As a result, the multipliers they derived are considerably higher than Pollin and Garrett-Peltier’s Ontario estimate of 14.2 jobs (direct and indirect) per million dollars spent.

Environment Northeast’s study finds direct, indirect and induced employment of 46 job-years per million dollars (\$US) of energy efficiency program spending on electricity, and 50 job-years per million dollars of energy efficiency program spending on natural gas.<sup>85</sup> As these results are based on the particular economic and energy characteristics of the New England region, it is likely that Canada-specific results would provide a somewhat different result.

Table 7 shows carbon capture and storage as being slightly ahead of wind power in job creation potential, based on a sampling of international studies. However, a comparison of two industry-produced job estimates tells a different story in Canada, at least when the comparison involves the potential employment benefits from public dollars invested.

Carbon capture and storage (CCS) technology aims to reduce emissions from fossil fuel combustion by capturing carbon dioxide before it can be released into the atmosphere and storing it underground instead. In recent years, the Government of Canada and the Government of Alberta have announced significant support for this technology.<sup>86</sup> For example, the Government of Alberta plans to contribute \$431 million over the next 15 years, plus an initial \$5 million, to a TransAlta CCS project called “Pioneer,” which is expected to capture emissions from a coal-fired electricity facility and use them for enhanced oil recovery. The federal government is also contributing \$343 million to the project, for a total government contribution of \$779 million.<sup>87</sup>

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<sup>85</sup> Jamie Howland and Derek Murrow, *Energy Efficiency: Engine of Economic Growth — A Macroeconomic Modeling Assessment* (Environment Northeast, 2009), 4. [http://www.envy-ne.org/public/resources/pdf/ENE\\_EnergyEfficiencyEngineofEconomicGrowth\\_FINAL.pdf](http://www.envy-ne.org/public/resources/pdf/ENE_EnergyEfficiencyEngineofEconomicGrowth_FINAL.pdf)

<sup>86</sup> The Pembina Institute’s perspective on CCS is summarized in a memo available at <http://pubs.pembina.org/reports/pembina-perspective-ccs-feb-19-09.pdf>. In short, Pembina views CCS as one of a number of technologies that can contribute to reducing GHG emissions on the scale required to combat dangerous climate change. We believe it is critical that CCS be considered as part of a portfolio of solutions, and that adequate attention also be paid to more sustainable, low-impact energy solutions, especially renewable energy and energy efficiency.

<sup>87</sup> Government of Alberta, “Alberta advances clean coal technology through carbon capture,” news release, October 14, 2009. <http://alberta.ca/ACN/200910/2710753B62699-A95B-21BC-9EE3DD3D2FA6316F.html>

*“Many of the subsurface operations [required for carbon capture and storage] are likely to be conducted by workers who are already in the oil and gas industry, although some are technically more complex and will involve workers with a very different skill set to those found at conventional power stations. CCS can also be expected to generate employment through the construction of carbon dioxide pipeline networks. But overall, it is capital intensive, and therefore the jobs created per million dollars of investment can be expected to be low. Meanwhile, there is a danger that money spent on CCS may simply crowd out investments in renewables and other energy alternatives.”*

—United Nations Environment Programme, 2008<sup>88</sup>

The company leading the project, TransAlta, estimates that Project Pioneer will create 8,800 person-years of direct and indirect employment<sup>89</sup> through both construction and operation, over the years 2010–2023.<sup>90</sup> In comparison, an analysis by GE Financial Services found that a \$1.5 billion renewal of the federal government’s ecoENERGY for Renewable Power program, which supports renewable electricity generation through a production subsidy, would create 49,000 direct, indirect and induced full-time equivalent jobs (in full-time equivalent employment for one year) during construction of facilities, and over 1,800 jobs (again direct, indirect and induced, in full-time equivalent employment per year) during the operation phase of projects.<sup>91</sup>

Table 8 below compares job estimates from CCS and wind power to reach conclusions about the cost to the public of creating a job-year of direct and indirect employment in these two sectors.

**Table 8. Public funding provided / requested per job-year of employment in carbon capture and storage and in wind energy<sup>92</sup>**

Technology	Public funding	Job-years created	Public cost per job-year
<b>Carbon capture and storage (Project Pioneer)</b>	\$779 million (committed)	8,800 (direct and indirect)	\$88,523 (direct and indirect)
<b>Wind power</b>	\$1,500 million (requested)	35,764 (direct and indirect; full time; one year)	\$41,942 (direct and indirect)

<sup>88</sup> UNEP, *Green Jobs*, 9.

<sup>89</sup> Personal communication, TransAlta.

<sup>90</sup> Project Pioneer website, “Employment and Supplier Opportunities,” <http://projectpioneer.ca/economic-opportunity/employment-supplier-opportunities>.

<sup>91</sup> Steve Taub, *Canada’s ecoENERGY Investment in Renewables Pays Off for Taxpayers* (GE Financial Services, 2010), 3, 7. [http://www.geenergyfinancialservices.com/press\\_room/press\\_releases/2010/ecoENERGYStudyFINAL.pdf](http://www.geenergyfinancialservices.com/press_room/press_releases/2010/ecoENERGYStudyFINAL.pdf).

<sup>92</sup> Pembina Institute calculations based on TransAlta’s information (CCS) and Steve Taub’s calculations (from Table 1 of *Canada’s ecoENERGY Investment in Renewables Pays Off for Taxpayers*).

Assuming that the two companies' calculations are accurate, it is clear that the public support for wind power requested by that industry would create more than twice as many job-years per dollar invested than funding Project Pioneer. While this finding may reflect the greater capital intensity and uncertainty of CCS technology relative to wind, it may also simply be a result of the greater public support that the federal government (and Alberta's government) have chosen to provide to this technology. Recent federal budgets have seen the government opt to support CCS while failing to provide new funding for renewable energy production — despite the greater relative employment gains available to the federal government from continuing to support producers of renewable power through the ecoENERGY program for renewable power.

### 3.2 Employment and fossil fuel extraction

In 2008, electricity generation accounted for 16% of Canada's total GHG emissions, while the production, transmission and distribution of oil and gas accounted for 22%.<sup>93</sup> So in Canada, we need to examine not simply the job effect of the choices we make about the electricity sector, but also the employment effect of investing in oil and gas extraction relative to other economic development choices for Canada.

In many of Canada's peer jurisdictions, such as the U.S. or the EU, employment in fossil fuel sectors is already declining under business as usual.<sup>94</sup> In contrast, employment in Canada's energy sector is increasing. The oil and gas industry has almost completely regained the jobs it lost during the downturn of the 1990s, and direct employment in the sector is projected to continue growing. A 2010 study noted that the energy production sector as a whole (including oil, gas and electricity generation) accounted for just under 300,000 Canadian workers, or about 1.8% of Canada's total workforce.<sup>95</sup>

Within a given sector, capital and labour intensities are inversely related: a higher capital intensity means a lower labour intensity, as firms spend more of their money on infrastructure (such as buildings, machinery, equipment and vehicles) and less on employees. A 2010 ranking of Canadian capital intensity ratings concluded that the "industry with the highest reported capital intensity level is the oil and gas extraction industry with a national average of \$266.6 of capital services per hour."<sup>96</sup>

By that measure, investing public dollars in virtually any other sector of Canada's economy would yield more jobs per dollar than oil and gas extraction. Further down the supply chain, this phenomenon is compounded by the fact that not all of the materials and equipment used for oil and gas production are manufactured in Canada. For example, in the oil sands sector, 11% of

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<sup>93</sup> Environment Canada, *National Inventory Report — Greenhouse Gas Sources and Sinks in Canada 1990–2008*, Part 1: 86, 89–90; Part 3: 4.

<sup>94</sup> Marjorie Griffin Cohen and John Calvert, "Climate Change and Labour in the Energy Sector" in *What Do We Know? What Do We Need to Know? The state of Canadian research on work, employment and climate change* (Work in a Warming World, York University, 2010), 55–56.  
[http://www.workinawarmingworld.yorku.ca/documents/FINAL\\_REPORT\\_JAN\\_12.pdf](http://www.workinawarmingworld.yorku.ca/documents/FINAL_REPORT_JAN_12.pdf)

<sup>95</sup> Cohen and Calvert, "Climate Change and Labour in the Energy Sector," 54.

<sup>96</sup> Andrew Sharpe and Eric Thompson, *New Estimates of Labour, Capital and Multifactor Productivity Growth and Levels for Canadian Provinces at the Three-digit NAICS Level, 1997–2007* (Centre for the Study of Living Standards, 2010), 45 and Appendix Table 11. <http://www.csls.ca/reports/csls2010-06.pdf>

projected GDP growth, and 17% of the project employment created by oil sands activities in the 2000–2020 time period, is projected to occur outside of Canada.<sup>97</sup> (However, as Section 3.4 describes, this phenomenon can take place in low-emission sectors as well.)

*“The large scale investments in oil and gas create relatively few jobs compared to other sectors of the economy. Employment impacts tend to be concentrated in the planning, exploration, development and construction of energy projects and related infrastructure, as well as in the transportation requirements associated with building and servicing these projects. These jobs are mostly short term in nature. Long term employment in energy construction is contingent on continuing expansion of energy projects. Manufacturing linkages for materials and equipment, as well as related administrative and technical services, do provide some additional employment, particularly in Ontario and Québec. But imports also meet a significant share of the demand for manufactured goods needed in the energy sector.”*

—Marjorie Griffin Cohen and John Calvert, 2010<sup>98</sup>

Recent analysis of fossil fuel subsidies in Canada illustrates the effects of the oil and gas sector’s high capital intensity. An economic analysis of the effect of removing federal and provincial oil subsidies concluded that employment in 2020 would increase slightly — by 0.4% in Alberta and 0.3% in Saskatchewan — if current tax breaks to the oil and gas sector were reduced. This happens because of “a drop in the capital-intensive oil sector relative to government spending that tends to be more labour intensive.” The effect was observable even in the absence of using the revenues saved for any particular job-creating purpose.<sup>99</sup>

### 3.3 Employment effects of a greener stimulus

Another venue that allows for a comparison of green employment to business-as-usual job creation efforts is the Government of Canada’s 2009–2010 stimulus package, the Economic Action Plan (EAP). In a 2009 analysis of economic stimulus packages, HSBC, a major bank, found that 8.3% of Canada’s total stimulus package was devoted to green objectives; this is a slightly lower percentage than the United States, at 9.8–12.0%, and far lower than China (37.8%) and South Korea (80.5%).<sup>100</sup>

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<sup>97</sup> Timilsina, LeBlanc and Walden, *Economic Impacts of Alberta’s Oil Sands, Volume 1*, x. The employment total cited refers to the “employment generated from oil sands activities,” and thus includes direct, indirect and induced jobs.

<sup>98</sup> Cohen and Calvert, “Climate Change and Labour in the Energy Sector,” 49.

<sup>99</sup> The effect described here is fairly small: at the national level, the employment change was 0.0%. EnviroEconomics Inc., *Fossil Fuels: At What Cost?* (Global Subsidies Initiative of the International Institute for Sustainable Development, 2010), 60–62. [http://www.globalsubsidies.org/files/assets/ffs\\_awc\\_3canprovinces.pdf](http://www.globalsubsidies.org/files/assets/ffs_awc_3canprovinces.pdf)

<sup>100</sup> Nick Robins, Robert Clover, Charanjit Singh, *A Climate For Recovery: The Colour of Stimulus Goes Green* (HSBC, 2009), 2. [http://www.globaldashboard.org/wp-content/uploads/2009/HSBC\\_Green\\_New\\_Deal.pdf](http://www.globaldashboard.org/wp-content/uploads/2009/HSBC_Green_New_Deal.pdf)

Using job multipliers for clean energy spending, we can produce an approximate estimate of the outcome Canada could have achieved with a greater emphasis on green spending. It is important to note that this is only a rough approximation, as the Department of Finance's approach to estimating employment is not directly comparable to the Pollin and Garrett-Peltier multipliers we use here. With that caveat noted, however, it appears that the government's decision not to prioritize green spending in its EAP was a significant missed opportunity from an employment perspective as well as from an environmental perspective.

Under Canada's EAP, the federal government set aside nearly \$16 billion over two years to build infrastructure and thus create jobs. The infrastructure funding was used to "modernize a broad range of infrastructure including our roads, bridges, public transit, parks and water treatment facilities, and to support home ownership, help stimulate the housing sector and improve housing across Canada."<sup>101</sup> Of that spending, only the \$779 million Green Infrastructure Fund (about 5% of the total) was earmarked for green spending.<sup>102</sup> However, portions of other infrastructure funding were also used for either public transit or other green infrastructure, mainly water and wastewater.<sup>103</sup> Thus, for this comparison, we have applied the HSBC overall "green" stimulus number of 8.3% to the infrastructure spending in the EAP. The infrastructure funding is projected to have created or maintained 84,000 jobs (including direct, indirect and induced employment) by the end of 2010.<sup>104</sup>

Table 9, below, uses an average jobs "multiplier" from Pollin and Garrett-Peltier's Ontario study (see Table 5) to estimate the extra jobs that would have been created had the federal government devoted 100% of its stimulus spending to clean energy investment (the "100% scenario"), instead of the 8.3% the government did spend on green energy ("actual"). In addition, it presents employment results for a scenario where Canada matched China's level of green spending (38%; the "China scenario"). The result of going 100% green would be the creation of over 2.8 times as many jobs as the current infrastructure spending generated, for a total of over 238,000 jobs in the year the money was spent. Even increasing the green percentage to match China's would create over 60% more jobs than the actual.

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<sup>101</sup> Government of Canada, *Canada's Economic Action Plan, Year 2: A Sixth Report to Canadians* (2010), 61. <http://www.actionplan.gc.ca/grfx/pdf/ceap-paec-2010-09-eng.pdf>

<sup>102</sup> Ibid., 73. While the EAP as a whole is a two-year program, the Green Infrastructure Fund is a five-year initiative.

<sup>103</sup> Ibid., 66, 70.

<sup>104</sup> Ibid., 142, 146, 148.

**Table 9. Canadian stimulus spending and clean energy alternatives**<sup>105</sup>

Scenario	Funding allocation		Estimated jobs created	Estimated total jobs created	Difference over actual
<b>Actual</b> Federal EAP spending as of August 2010	% dedicated to clean energy	8.3	19821	84000	--
	remainder	91.7	64179		
<b>100% scenario</b>	% dedicated to clean energy	100.0	238809	238809	154809 additional jobs (284% of actual)
	remainder	0	0		
<b>China scenario</b>	% dedicated to clean energy	37.8	90270	137302	53302 additional jobs (163% of actual)
	remainder	67.2	47032		

While Pollin and Garrett-Peltier’s analysis has been critiqued as being overly optimistic about the potential job creation benefits of clean energy,<sup>106</sup> the estimates above derived from their work represent only direct and indirect job creation, while the federal government’s multipliers include induced jobs as well, while factoring out leakage to savings and imports.<sup>107</sup>

Indeed, Pollin and Garrett-Peltier’s estimate is far from being the highest available. An estimate published by the Regional Greenhouse Gas Initiative (RGGI) — a state-level cap-and-trade system for the electricity sector in the U.S. northeast — estimates that every \$1 million invested in home “weatherization,” or energy efficiency retrofits, “creates about 50 jobs in construction, and another 20 jobs in the design and manufacture of efficiency materials.”<sup>108</sup> From the construction jobs alone, RGGI’s estimate means that Canada’s \$15.75 billion in infrastructure spending could, if devoted solely to the energy efficiency of Canada’s building stock, have produced 787,500 jobs in the year it was spent — over nine times as many jobs as the actual stimulus spending is estimated to have created.<sup>109</sup>

<sup>105</sup> Ibid., 146, 148. Job multipliers use an average of the figures presented in Table 1, page 10 of Pollin and Garrett-Peltier, *Building the Green Economy*.

<sup>106</sup> John O’Grady, “The Impact of Climate Change on Employment and Skills Requirement in the Construction Industry” in *What Do We Know? What Do We Need to Know?*, 179.

<sup>107</sup> Government of Canada, *Canada’s Economic Action Plan, Year 2*, 142.

<sup>108</sup> Regional Greenhouse Gas Initiative, *Fact Sheet: Investing in the Clean Energy Economy* (undated), 2. [http://www.rggi.org/docs/RGGI\\_Proceeds\\_in\\_Brief.pdf](http://www.rggi.org/docs/RGGI_Proceeds_in_Brief.pdf). As noted above in discussing Environment Northeast’s results, these results are specific to the RGGI region; Canada-specific results could be different.

<sup>109</sup> Pembina Institute calculation.

### A Dutch Disease Comes to Canada

“Dutch disease” is a term used in economics to describe cases where “a resource boom in an economy leads to a real exchange appreciation and to the crowding out of the tradable manufacturing sector.”<sup>110</sup> In other words, a resource boom leads to a higher dollar, which makes life harder for manufacturers looking to export their products. The term was coined in the late 1970s to describe a decline in manufacturing in the Netherlands after the discovery of natural gas reserves.<sup>111</sup>

A 2009 assessment by three economists concluded that 42% of the loss in Canadian manufacturing employment from 2002 to 2007 that was due to exchange rate developments was related to the “Dutch disease” phenomenon.<sup>112</sup> This kind of assessment shows that the employment consequences of choosing fossil fuels over other forms of economic development are complex, extending beyond decisions about how to spend public money and into the economy as a whole.

## 3.4 Competing for clean energy jobs

This section looks at a different kind of “relative” job creation: in this case, relative to other countries. Many assessments of clean energy job creation note the importance of indirect jobs in the manufacturing of clean energy equipment (as opposed to direct jobs from operating it). For example, the BlueGreen Alliance stated in 2009 that about 70–75% percent of the total labour required for a typical wind turbine or solar panel is found in manufacturing the component parts.<sup>113</sup>

*“Developed nations can also benefit from the export markets they help create and the major investment opportunities that are linked to a low carbon pathway. For example, Denmark exported €8.6 billion worth of energy and environmental technologies in 2008, capturing 30 per cent of the global market in wind power products.”*

— Project Catalyst, 2010<sup>114</sup>

Manufacturing offers two important job advantages: it brings additional clean energy jobs to the jurisdiction where the energy is produced by making parts domestically that would otherwise be imported, and, conversely, it opens up the possibility of exporting clean energy technologies to other regions. Of course, winning overseas market share requires competing with other suppliers around the world.

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<sup>110</sup> Michel Beine, Charles S. Bos, and Serge Coulombe, “Does the Canadian Economy Suffer from Dutch Disease?” (Tinbergen Institute, 2009), 1. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1504565](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1504565). From 2001 to 2006, manufacturing employment in Canada dropped from a share of total Canadian employment that was greater than 0.155 to about 0.135 of total Canadian employment.

<sup>111</sup> Ibid., 2.

<sup>112</sup> Ibid., 1.

<sup>113</sup> BlueGreen Alliance, *Building the Clean Energy Assembly Line*, 10.

<sup>114</sup> Project Catalyst, *From Climate Financing to Financing Green Growth* (ClimateWorks Foundation and European Climate Foundation, 2010), 18–19. [http://www.project-catalyst.info/images/publications/101127\\_from\\_climate\\_finance\\_to\\_financing\\_green\\_growth\\_formatted.pdf](http://www.project-catalyst.info/images/publications/101127_from_climate_finance_to_financing_green_growth_formatted.pdf)

*“To achieve both environmental and full economic benefits, Canadian governments need to properly support homegrown commercialization of technologies and help develop Canadian clean-energy technology companies.”*

— Conference Board of Canada, 2010<sup>115</sup>

The construction phase of installing a turbine or solar panel is relatively brief. In contrast, the decision to open up a manufacturing plant requires a more significant commitment of time and capital. Marjorie Griffin Cohen and John Calvert report that most manufacturing in the renewable energy sector takes place in countries that have provided significant government support for it, and that have made their support part of a dedicated industrial strategy.<sup>116</sup> In other words, governments that provide policy stability — and thus allow potential manufacturers to know the “the rules of the game,” which gives them the confidence to invest — can help ensure that their jurisdiction benefits from the full clean energy value chain.

Other economists would argue for the importance of low corporate tax rates, or place their emphasis on carbon pricing. As in other industries, clean energy manufacturers tend to look for direct government support as well. Unravelling the policies most likely to spur clean energy manufacturing is complex, and falls outside the scope of this report. However, it is clear that efforts on Canada’s part to attract clean energy manufacturing, or to gain overseas market share, will take place in a competitive environment where other governments have policies in place aimed at capturing the same opportunities. If Canada fails to seize them, other countries will.

*“Countries that can position themselves as leaders in low-carbon technology may boost their export potential. This appears to be the case for Germany, where generous support for renewable energy has created a competitive export industry. Over the next decade or so, the share of exports in total sales for renewable energy has been estimated at 69%. That is, two out of three jobs in the industry could be export-related.”*

— Samuel Fankhauser, Friedel Sehleier, Nicholas Stern, 2008<sup>117</sup>

Table 10 below, taken from a 2010 global “status report” on renewable energy, lists the countries leading the world in developing specific kinds of renewable energy technologies.

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<sup>115</sup> Conference Board of Canada, *The Economic and Employment Impacts of Climate-Related Technology Investments* (2010), 34. [http://www.conferenceboard.ca/temp/92e67ef7-1170-44be-986e-8a9a3492f90f/10-256\\_EconomicImpactClimateTech-Rpt\\_WEB1.pdf](http://www.conferenceboard.ca/temp/92e67ef7-1170-44be-986e-8a9a3492f90f/10-256_EconomicImpactClimateTech-Rpt_WEB1.pdf)

<sup>116</sup> Griffin Cohen and Calvert, “Climate Change and Labour in the Energy Sector,” 53.

<sup>117</sup> Fankhauser, Sehleier and Stern, “Climate Change, Innovation and Jobs,” 425.

Table 10. Top five countries in renewable energy development<sup>118</sup>

Top five countries	1	2	3	4	5
<b>Annual amounts for 2009</b>					
<b>New capacity investment</b>	Germany	China	U.S.	Italy	Spain
<b>Wind power added</b>	China	U.S.	Spain	Germany	India
<b>Solar PV added (grid connected)</b>	Germany	Italy	Japan	U.S.	Czech Republic
<b>Solar hot water/heat added</b>	China	Germany	Turkey	Brazil	India
<b>Ethanol production</b>	U.S.	Brazil	China	<b>Canada</b>	France
<b>Biodiesel production</b>	France/Germany		U.S.	Brazil	Argentina
<b>Existing capacity as of end-2009 (absolute, not per capita)</b>					
<b>Renewables power capacity (including only small hydro)</b>	China	U.S.	Germany	Spain	India
<b>Renewables power capacity (including all hydro)</b>	China	U.S.	<b>Canada</b>	Brazil	Japan
<b>Wind power</b>	U.S.	China	Germany	Spain	India
<b>Biomass power</b>	U.S.	Brazil	Germany	China	Sweden
<b>Geothermal power</b>	U.S.	Philippines	Indonesia	Mexico	Italy
<b>Solar PV (grid connected)</b>	Germany	Spain	Japan	U.S.	Italy
<b>Solar hot water/heat</b>	China	Turkey	Germany	Japan	Greece

<sup>118</sup> REN21, *Renewables 2010 Global Status Report — Revised Edition* (2010), 13.  
[http://www.ren21.net/Portals/97/documents/GSR/REN21\\_GSR\\_2010\\_full\\_revised%20Sept2010.pdf](http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf)

*“Countries that make early changes to domestic environmental policy benefit from those policies in exports markets because domestic firms have developed technology that makes their products competitive in global markets. Germany and other EU members have this advantage because they have been among the earliest to adopt environmental protection measures.”*

— ECO Canada, 2010<sup>119</sup>

Canada appears twice in this table: in fourth place for ethanol production, and in third place for overall renewable power when large hydro is included. These rankings acknowledge two of Canada’s traditional areas of expertise: agricultural production and the extensive use of large-scale hydropower. In the case of ethanol, Canada’s federal government has taken numerous steps to encourage greater production in recent years, including through a regulatory requirement to blend it into gasoline and diesel fuel<sup>120</sup> and through production incentives for ethanol producers.<sup>121</sup>

It’s important to note that numerous environmental and agricultural organizations,<sup>122</sup> including the Pembina Institute,<sup>123</sup> have raised questions about the greenness or environmental benefit of the federal government’s ethanol regulations. Setting that aside, however, Canada’s ranking in ethanol production shows that government regulations and support can move Canada into the top tier of global producers for a given renewable technology.

Canada’s absence elsewhere in the rankings of 2009 growth in renewables shows the result when those ingredients are missing. Indeed, according to the International Energy Agency, none of the world’s top 10 solar cell manufacturers or the world’s top 10 wind turbine manufacturers (as of 2009) were headquartered in Canada.<sup>124</sup>

The federal government has chosen a leisurely approach to implementing climate policies. Coupled with its decision to emphasize other priorities over investments in low-carbon infrastructure in its stimulus (and subsequent) budgetary spending, the government’s approach could be viewed as a bet that a high-carbon, “business-as-usual” global economy will continue more-or-less as we know it today.

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<sup>119</sup> ECO Canada, *Canadian Environmental Sector Trends*, 8.

<sup>120</sup> For a summary, see Matthew Bramley, *Evaluation of the Government of Canada’s Greenhouse Gas Reduction Policies, Prepared for the Climate Change Performance Index 2011* (The Pembina Institute, 2010), 7. <http://pubs.pembina.org/reports/questionnaire-ccpi-2011-final.pdf>

<sup>121</sup> Government of Canada, *The Budget Plan 2007: Aspire to a Stronger, Safer, Better Canada* (Ottawa: Department of Finance Canada, 2007), 71. <http://www.budget.gc.ca/2007/pdf/bp2007e.pdf>

<sup>122</sup> See, for example, Resource Efficient Agricultural Production *Analyzing Biofuel Options — Greenhouse Gas Mitigation Efficiency and Costs* (brief presented to the Standing Committee On Agriculture and Agri-Food for the Study of Bill C-33, Act to amend the Canadian Environmental Protection Act, 1999, February 26, 2008), [http://www.reap-canada.com/library/Bioenergy/AAFC\\_Standing\\_Committee\\_Briefing.pdf](http://www.reap-canada.com/library/Bioenergy/AAFC_Standing_Committee_Briefing.pdf)

<sup>123</sup> Jesse Row, “Proposed Ethanol Regulations have Uncertain Environmental Benefits,” blog post, June 2010, <http://www.pembina.org/blog/342> (accessed March 3, 2011).

<sup>124</sup> International Energy Agency, *World Energy Outlook 2010* (Paris: IEA, 2010), 291–2.

If that bet proves wrong, Canada risks being caught unprepared, thus ceding the “early mover” advantage, and the export/manufacturing employment that can accompany it, to other jurisdictions. As Table 10 shows, other countries are already positioning themselves to be the suppliers of choice in other kinds of clean technology.

At the UN climate talks in Cancun in December 2010, world governments committed to take increasingly serious action to tackle climate change over the coming decade. If they follow through (or even increase their level of ambition), the global demand for clean energy technologies will only keep growing at a rapid pace.

#### Perspectives on the Growth in Green Sectors

**German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU):** Renewable energy accounted for 339,500 jobs in Germany in 2009, a 112% increase over 2004.<sup>125</sup>

**Pew Charitable Trusts:** Clean energy “has experienced investment growth of 230 per cent since 2005.... In 2009, US \$162 billion was invested in clean energy around the world.”<sup>126</sup>

**Pew Centre on Global Climate Change:** “Between 2004 and 2007, global investments in renewable energy more than doubled.... If large hydropower is included, 2008 was the first year in which renewable power generation attracted more investment than traditional fossil fuel generation.”<sup>127</sup>

**California Apollo Program:** “In 2007, as the recession took hold and overall employment dropped for the first time in five years, jobs in the clean economy grew by five percent.”<sup>128</sup>

**WWF-Europe:** “Global markets for environmental goods and services are likely to see continued strong growth. They are projected to grow from €950 billion today to more than €2,000 billion in 2020.”<sup>129</sup>

**Public Policy Forum of Canada:** “In 2007, the growth of ‘green’ jobs outpaced the growth of traditional jobs by 24%.”<sup>130</sup>

<sup>125</sup> German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), *Development of renewable energy sources in Germany 2009: Graphics and tables, Version: 15th December 2010* (2010), 46.

[http://www.erneuerbare-energien.de/files/english/pdf/application/pdf/ee\\_in\\_deutschland\\_graf\\_tab\\_2009\\_en.pdf](http://www.erneuerbare-energien.de/files/english/pdf/application/pdf/ee_in_deutschland_graf_tab_2009_en.pdf)

<sup>126</sup> The Pew Charitable Trusts, *Who’s Winning the Clean Energy Race? Growth, Competition and Opportunity in the World’s Largest Economies* (2010), 4.

[http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global\\_warming/G-20%20Report.pdf](http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf)

<sup>127</sup> Pew Center on Global Climate Change, *Clean Energy Markets: Jobs and Opportunities* (2010), 4.

[http://www.pewclimate.org/docUploads/Clean\\_Energy\\_Update\\_Final.pdf](http://www.pewclimate.org/docUploads/Clean_Energy_Update_Final.pdf)

<sup>128</sup> California Apollo Program, *Creating and Keeping Clean Energy Jobs in California* (Apollo Alliance, 2010), 1.

<http://apolloalliance.org/Downloads/TheCaliforniaApolloProgram.pdf>

<sup>129</sup> Meera Ghani-Eneland, *Low-Carbon Jobs For Europe: Current Opportunities and Future Prospects* (World Wide Fund for Nature, 2009), 9.

<http://www.wwf.se/source.php/1251673/Low%20carbon%20jobs%20for%20Europe2009.pdf>

<sup>130</sup> Jonathan Dignan, *Green Jobs: Is this the new “new economy”?* (Public Policy Forum, 2009), 5.

<http://www.ppforum.ca/sites/default/files/REPORT%20Green%20Jobs%20v3.pdf>

*“It is no secret that Canada is trailing the world on the issue of climate change. If this continues, governments must realize that the short term gain could result in longer-term pain. Regardless, the global economy of tomorrow will be considerably greener than today’s; failure to get ahead of the curve could mean that it passes Canada by, with corresponding economic consequences.”*

— Public Policy Forum, 2009<sup>131</sup>



**Public support for wind energy can create many jobs.**

Photo: David Dodge, The Pembina Institute

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<sup>131</sup> Ibid., 25.

# 4. Policy recommendations

This report has focused on the role that governments, and particularly Canada's federal government, can play in spurring greener employment and implementing climate and environmental policies. However, governments are certainly not the only actors capable of contributing to a greener economy. Municipalities, industry and sectoral groups, labour organizations, educational institutions, training centres and civil society groups can all play important roles. Individual workers are, in many cases, already choosing greener options. While all of those initiatives are important, the scope of this report's policy recommendations is restricted to policy actions that governments can adopt.

It is not possible to say exactly what Canada's potential for green jobs, or for net new jobs from climate policy, could be. That depends on both how narrowly you choose to define green work, on how ambitious Canada chooses to be in cutting GHG pollution, and on the specific policies we choose to adopt to do so. However, it is possible to outline the kinds of policies and actions that the federal government would take if it wanted to maximize its green or "clean" job potential. They include:

- **In light of the superior job and climate performance of clean energy over fossil fuels, directing public dollars away from support to fossil fuels and towards core climate change solutions such as energy conservation, energy efficiency and renewable energy.** Canada's governments should phase out tax support and subsidies to fossil fuel producers over the medium term (or sooner), as Prime Minister Harper committed to do at the 2009 G20 meeting in Pittsburgh.<sup>132</sup> And while the Government of Canada frequently asserts a need to harmonize with the United States on climate policy,<sup>133</sup> last year's budget request from the Obama administration out-spent Canada's 2010 federal budget 18:1, per capita, on renewable energy.<sup>134</sup> Unless the government takes action in

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<sup>132</sup> For more on Canada's G20 fossil fuel subsidies commitment, see <http://www.pembina.org/blog/345> and <http://www.pembina.org/blog/339>.

<sup>133</sup> Environment Minister Peter Kent summed up the policy this way, in a January 2011 speech: "Achieving our objectives requires a systematic approach of regulating GHG emissions sector by sector and, where appropriate, alignment with the United States. Canadians tend to get their hackles up whenever they hear terms like "harmonize" or "align" in the same sentence as United States. But however much we may growl about it, when it comes to meaningful work on the environment — and climate change in particular — there is no practical alternative." This January 28, 2011 speech to the Economic Club of Canada in Toronto is available at <http://www.ec.gc.ca/default.asp?lang=En&n=6F2DE1CA-1&news=CB8B1F09-BEC2-4700-82B2-7C59463FA4E4> (accessed February 13, 2011).

<sup>134</sup> Tim Weis and Leslie Malone, *Comparing U.S. and Canadian Investments in Sustainable Energy in 2010* (The Pembina Institute and Environment Northeast, 2010). <http://www.pembina.org/pub/1979>

the 2011 budget, federal energy efficiency support will lapse this year, as federal support for new renewable energy projects has already done.<sup>135</sup>

- **Publishing and implementing a credible federal plan to meet our national 2020 emission reduction target.** At present, announced government measures would see us miss the target by a very significant margin, with emissions higher in 2020 than they are today.<sup>136</sup> The lack of a plan fosters uncertainty, making it difficult for firms to move forward with clean energy investment — and potentially driving clean energy firms to pursue opportunities in other jurisdictions. Canada’s governments should lay out in detail the policies they will use to reach their emission reduction targets, and should implement those policies through binding and clear means (including legislation, regulation, and predictable spending).

*“Governments at the global, national and local levels must establish an ambitious and clear policy framework to support and reward sustainable economic activity and be prepared to confront those whose business practices continue to pose a serious threat to a sustainable future.”*

— United Nations Environment Programme, 2008<sup>137</sup>

- **Putting a price on GHG emissions, either through a cap-and-trade system or a carbon tax (or both), as the centrepiece of Canada’s plan to meet its 2020 target.** This helps to level the playing field between clean options and fossil fuels, making green development — and the associated employment growth — more feasible. A portion of the revenues generated from carbon pricing should be re-invested in further emission reductions (as outlined in the next bullet point).

*Relative to the U.S., the “job gap created by Canada’s weaker spending on renewable energy alone in the last two budgets is roughly 66,000 direct and indirect jobs.”*

— Environmental Defence and BlueGreen Canada, 2010<sup>138</sup>

- **Developing a clean energy employment transition strategy for Canada.** This should include skills development, training programs, certification courses, and transitional policies for workers and communities whose jobs could be lost or significantly changed by the shift to a greener economy. While the federal government has an important role to play in a strategy of this kind, developing and implementing it will require working in partnership with provinces, territories, municipalities, labour organizations, industry

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<sup>135</sup> For more on the ecoENERGY for Renewable Power program, see <http://www.pembina.org/blog/402>.

<sup>136</sup> Environment Canada, *Information on Climate Change — Canada’s Greenhouse Gas Target and Emissions Projections*, Table 1: Canadian GHG Emissions and Government Measures (Mt CO<sub>2</sub>e) <http://www.climatechange.gc.ca/default.asp?lang=En&n=DC025A76-1> (accessed February 8, 2011).

<sup>137</sup> UNEP, *Green Jobs*, 24.

<sup>138</sup> Gillian McEachern, Charles Campbell, Matt Price, *Falling Behind: Canada’s Lost Clean Energy Jobs* (Environmental Defence and BlueGreen Canada, 2010), 10. [http://environmentaldefence.ca/sites/default/files/report\\_files/FallingBehindReport\\_FINAL.pdf](http://environmentaldefence.ca/sites/default/files/report_files/FallingBehindReport_FINAL.pdf)

sectors, First Nations and others. (Indeed, the Minister of the Environment is currently legally required, under the 2007 Kyoto Protocol Implementation Act, to table a plan each year that includes, among other things, a description of the measures to be taken respecting “a just transition for workers affected by greenhouse gas emission reductions.”)<sup>139</sup>

*“Governments have an important role to play in helping workers to obtain these skills. Public training programmes can help workers — particularly those moving between jobs — to acquire ‘green skills.’ But they cannot do it alone and will need to work effectively with employers and vocational and tertiary education institutions in anticipating future labour demand shifts and preventing skill mismatches which could slow the transition to greener growth.”*

— Angel Gurría, OECD Secretary-General, 2009<sup>140</sup>

- **To improve transparency, publishing projections of the expected and actual employment consequences of new federal policies relevant to reducing Canada’s GHG emissions.** This data could be provided in an annual report to Parliament or as individual policies are announced. To be comprehensive, the government should present the data in a consistent and comparable way; clarify key assumptions;<sup>141</sup> and report back on actual job creation once that data becomes available, as a means of measuring the accuracy of initial projections.

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<sup>139</sup> Kyoto Protocol Implementation Act, 2007, 5(1)(a)(iii.1). <http://laws-lois.justice.gc.ca/eng/K-9.5/20110216/page-3.html?rp2=HOME&rp3=SI&rp4=all&rp5=Kyoto%20Protocol%20Implementation%20Act&rp9=cs&rp10=L&rp13=50>

<sup>140</sup> Angel Gurría, OECD Secretary-General, “Beyond the Crisis: What is the Jobs Potential of Shifting Towards a Low-Carbon Economy?”, opening remarks delivered at the meeting of OECD Employment and Labour Ministers, Paris, September 29, 2009). [http://www.oecd.org/document/63/0,3343,en\\_2649\\_33927\\_43794943\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/63/0,3343,en_2649_33927_43794943_1_1_1_1,00.html) (accessed February 9, 2011).

<sup>141</sup> e.g. Are the jobs listed direct only, or do they include indirect and induced? Are the jobs created cumulative, or are they annual job-years?

# 5. Areas for further research

Despite the rapid growth in green jobs analysis, many important questions remain. Areas that would benefit from further Canada-specific research include:

- **Assessments of Canada’s clean energy “comparative advantage.”** If Canada does choose to take ambitious action to tackle climate change, the result will be a rapid economic transformation towards a much cleaner economy. Other countries will be simultaneously taking the same steps, creating both export opportunities and competition for Canada. What clean energy technologies or skills make the most sense for Canada? Where can we be world leaders?
- **The development of Canada-specific, and ideally regionally-specific, clean energy data.** In their 2009 analysis of the employment effects of Ontario’s Green Energy Act, Pollin and Garrett-Peltier noted that “the survey data used to develop the Ontario input-output tables do not specifically recognize wind, solar, biomass or building retrofitting as industries in their own right. This is also the case for the input-output tables for Canada as a whole.”<sup>142</sup> Similarly, Statistics Canada’s annual Report on Energy Supply and Demand provides a very thorough treatment of the fossil fuel and nuclear power sectors, but does not comprehensively account for renewable energy.<sup>143</sup> In addition, users of Statistics Canada’s input-output data must make a choice between detail at the level of sectors (sub-sectoral data) or detail at the level of provinces/regions. Provincially-specific sub-sectoral data is currently not available.<sup>144</sup>
- These data gaps suggest a need to add new clean energy sub-sectors to the North American Industry Classification System, and also to develop detailed regional metrics to describe the input-output relationships in Canadian green economy sectors. Better measurements of existing and future green employment would allow for more accurate assessments of Canada’s green workforce, more locally-specific estimates of the job creation potential from clean energy investments, and better year-on-year comparisons.

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<sup>142</sup> Pollin and Garrett-Peltier, *Building the Green Economy*, 9.

<sup>143</sup> For example, the 2008 edition of this report states that “The main tables of this publication do not include alternative energy sources, although it is estimated that these sources account for more than 7% of Canada’s energy requirements.” See Statistics Canada, *Report on Energy Supply and Demand 2008* (2010), 128.  
<http://www.statcan.gc.ca/pub/57-003-x/57-003-x2008000-eng.pdf>

<sup>144</sup> Nic Rivers, personal communication. See also Pollin and Garrett-Peltier, *Building the Green Economy*, 30.

*“Governments must establish statistical reporting categories that recognize and help capture relevant employment in both newly emerging industries and green employment in established sectors.”*

— United Nations Environment Programme, 2008<sup>145</sup>

- **Detailed regional estimates of the job creation potential of clean energy policies in Canada.** Broad national or regional assessment of potential job creation from clean energy policies, while important, are not adequate. Decision-makers also need to be able to understand, and visualize, the more local and regional effects of clean energy policies.

The Pembina Institute/David Suzuki Foundation’s 2009 *Climate Leadership, Economic Prosperity* study provided a starting point by modelling the regional impact of a set of climate policies designed to reach the federal government’s target. However, the study does not provide detail about:

- » **The net job impacts of the individual climate policies modelled.** For example, how much of job change is attributable to the carbon price? How much to the investments in public transit? Ideally, these results would be presented at a regional level.
- » **The sub-sectoral employment effects of the climate policy package.** Which sub-sectors would gain and lose jobs as a result of a given policy? How large are those effects, and how long would they last?

In addition to this modelling work, a detailed map of current clean energy employment in Canada, disaggregated down to the local level, would be a useful tool for policy-makers. Bottom-up estimates compiled by clean industry sectors could be a starting point for this effort.

Finally, as seen in Table 6, the geographical distribution of job creation in Canada would look different under climate policy scenarios than under business as usual. Understanding the consequences of this shift is essential to designing climate policies that work for all of Canada, and in helping communities to capitalize on the employment potential that low-carbon work may offer.

- **Canada-specific estimates of the economic, and employment, costs of climate change itself.** While modelling studies such as the one described above can examine the economic consequences of taking action to tackle climate change, they leave aside the issue of the net economic impact of climate change itself. In some areas, climate change will impose substantial costs (in financial and employment terms) on Canadians. For example, the umbrella organization for British Columbia’s credit unions predicts the loss of over 20,000 jobs (direct, indirect and induced) in B.C.’s forestry sector in the next two decades due to a mountain pine beetle epidemic that has been sustained by warmer winters.<sup>146</sup> A more systematic study of these kinds of effects across Canada would be

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<sup>145</sup> UNEP, *Green Jobs*, 6.

<sup>146</sup> Central 1, “A long-term challenge for the B.C. Interior: The mountain pine beetle epidemic” (Vancouver: *Economic Analysis of British Columbia* Vol. 3 No. 2, 2010), 1.  
[http://www.central1.com/publications/economics/pdf/ea/ea%202010\\_02.pdf](http://www.central1.com/publications/economics/pdf/ea/ea%202010_02.pdf)

very welcome, and would help decision-makers to weigh the relative costs and risks of acting on climate change versus delaying action.<sup>147</sup>

- **A historical review of economic transitions.** Moving to a low-carbon economy will be a significant change, and like any change, it could create both “winners” and “losers.” Governments in Canada (and elsewhere) have navigated these kinds of transformations before. To prepare for the next one, researchers should review both successful and less successful transitional policies to gauge the kinds of support that is most effective for workers, communities and taxpayers.<sup>148</sup> A subset of this assessment would be a detailed examination of which sectors, regions or communities are most likely to be genuinely vulnerable to the effects of a shift to a low-carbon economy.

*“The invention of the steam engine, modern transport, computers and the internet have triggered structural changes that arguably went much deeper than the move to a low-carbon economy. However, adjustments required now could be of a similar order of magnitude.”*

— Samuel Fankhauser, Friedel Sehleier, Nicholas Stern, 2008<sup>149</sup>

- **A Canada-specific “green economy skills assessment.”** Building on ECO Canada’s detailed work, it will be important to ensure that Canada’s schools, colleges, certification programs, universities and other training centres offer skills training suited to a low-carbon economy. An inventory of the skills needed, and the existing training options, in Canada’s green sectors would help to avoid future skill shortages. Table 11 shows ECO Canada’s assessments of the fastest-growth areas in environmental employment, which provides a good starting point for understanding the skills that Canadian workers may need to possess in the future. Part of this assessment could focus on best practices in green skill training; it is also important to identify the organizations and institutions that can provide increased green skills training, and to initiate pilot projects at some of those sites in short order.

*“Countries around the world are also looking at the development and implementation of clean-energy technologies to reduce emissions. As such, there are two possible outcomes: either we become a leader in the development and commercialization of these technologies, or we rely on others to sell them to us. If the latter occurs, we will have missed an important opportunity to develop globally competitive, highly innovative clean-energy technology industries.”*

— Conference Board of Canada, 2010<sup>150</sup>

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<sup>147</sup> It appears that the National Round Table on the Environment and the Economy may be undertaking a study of this nature as part of their Climate Prosperity project.

<sup>148</sup> The Cornell University (ILR School Global Labor Institute) analysis entitled “Making the Transition: Helping Workers and Communities Retool for the Clean Energy Economy” ([http://nlg-laboremploy-comm.org/media/Events\\_Conv2010-GreenEconCornell\\_ILR\\_Making\\_the\\_T.pdf](http://nlg-laboremploy-comm.org/media/Events_Conv2010-GreenEconCornell_ILR_Making_the_T.pdf)) provides a useful example of this kind of assessment.

<sup>149</sup> Fankhauser, Sehleier and Stern, “Climate Change, Innovation and Jobs,” 427.

**Table 11. High, moderate and stable growth expectations for worker demand by environmental sub-sector<sup>151</sup>**

Emerging/very high growth	Moderate to high growth	Stable growth
Carbon and climate change mitigation	Environmental remediation	Protection of ambient air quality
Heat savings and energy efficiency	Eco-innovation and environmental R&D	Water systems design for water supply
Renewable energy resources (wind, solar, thermal, etc.)	Environmental health and safety	Waste management
Alternative fuels and alternative fuel vehicles	Protection of biodiversity and landscape	Environmental education
		Environmental policy and legislation
		Environmental communications and public awareness

*“The green influence has encouraged a heightened awareness of how things are done, what impact a business is having on the environment (i.e., its footprint) and an overall increase in environmental sensitivity. Although this shift can attract or engage employees to ‘green’ industries, other industries (i.e. businesses in the oil and gas sector) stated that difficulties emerged in attracting new candidates and in engaging the Aboriginal community because of environmental issues and negative publicity.”*

— ECO Canada, 2010<sup>152</sup>

<sup>150</sup> Conference Board of Canada, *The Economic and Employment Impacts of Climate-Related Technology Investments*, 11.

<sup>151</sup> Adapted from ECO Canada, *Canadian Environmental Sector Trends*, 7.

<sup>152</sup> ECO Canada, *Defining the Green Economy*, 29.

# 6. Conclusion

Investing in a cleaner economy is strongly supported by Canadians. In a survey of 1,669 Canadians conducted by the Gandalf Group for Climate Action Network–Réseau action climat Canada in June 2010,

- 91% of Canadians agreed with the statement that “it will benefit the economy to invest in renewable energy technology now” (72% “strongly agree,” 16% “somewhat agree,” and just 7% did not agree)
- 90% of Canadians supported the statement that “investments in green technologies can create new good jobs now” (74% “strongly agree,” 16% “somewhat agree,” and 7% “strongly disagree”).<sup>153</sup>

This review of the literature on green jobs shows that Canadians have got it right: there are opportunities in green technology, and making those investments can lead to good jobs. A comprehensive and ambitious climate policy for Canada is a clear opportunity to tap into that potential. Canadians have the ingenuity and talent to succeed in the transition to a clear, low-emission economy, but it’s going to require bolder leadership from our governments and some of our industries than we’ve seen to date.

By 2008, Canada’s GHG emissions totalled 734 million tonnes, a 24% increase since 1990.<sup>154</sup> That trend looks set to continue: even after accounting for the effects of current and proposed government policies, the federal government projects that Canada’s emissions in 2020 will be a further 7% higher than they were in 2008.<sup>155</sup>

It’s clear that Canada needs a much more effective approach if we are to do our fair share in tackling climate change — not to mention meeting the 2020 national emissions target that the government has set.

Despite the job opportunities outlined in this report, the Pembina Institute does not see job creation and industrial development as the most important reasons to take action on climate change. In our view, the most critical reason to act remains the need to prevent the potentially catastrophic consequences of climate change for people, economies and environments in Canada and around the world.

But the evidence from Canadian and international studies showing that we can tackle climate change while maintaining a strong and growing economy that could employ even more

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<sup>153</sup> The Gandalf Group, Powerpoint presentation of results to Climate Action Network–Réseau action climat Canada on “Climate Change and the Environment” (2010), slide 36. Copy available upon request from the author.

<sup>154</sup> Environment Canada, *Climate Change — A Summary of Trends: 1990–2008*, <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=0590640B-1>

<sup>155</sup> Environment Canada, *Information on Climate Change — Canada’s Greenhouse Gas Target and Emissions Projections*, Table 1: Canadian GHG Emissions and Government Measures (Mt CO<sub>2</sub>e) <http://www.climatechange.gc.ca/default.asp?lang=En&n=DC025A76-1>

Canadians than business as usual is both important to decision-makers and reassuring to Canadian workers.

We hope that providing information about the characteristics of green jobs, and about the relative employment potential of green policies, will help bolster the case for ambitious clean energy policies in Canada.



**Geothermal energy installation provides growing employment in Canada.**

Photo: Roberta Franchuk, The Pembina Institute

# Appendix 1: Green jobs research at Human Resources and Skills Development Canada

Through requests under Access to Information legislation, we have confirmed that Human Resources and Skills Development Canada (HRSDC), the federal department responsible for labour market programs, is undertaking ongoing research and analysis concerning green jobs.

For example, a September 2009 briefing note to Minister Diane Finley requested €35,000 (approximately \$55,000) to support a policy project at the Organisation for Economic Co-operation and Development (OECD) entitled *The Jobs Potential of Shifts Towards a Low-Carbon Economy*. The department recommended supporting the first phase of this research because the “results of this project will help policy development in Canada as we continue to study the impact of the low-carbon economy in a Canadian context.”<sup>156</sup> The project was deemed to “align with departmental priorities,” and the minister approved the funding.

The note also states that HRSDC “has been tracking the issue for quite some time in an attempt to better understand the labour market implications of a greening economy.” Calling green jobs “an evolving issue,” the note adds that green investments “could provide Canada with opportunities for economic growth and the creation of quality jobs (innovative, environmentally sustainable).”

According to the briefing note, HRSDC has been working to clarify the definitional questions that green jobs raise; identify ways to forecast demand for green jobs and green skills; and analyze the balance between “upskilling” existing jobs versus the creation of new jobs. The briefing note also states that the “topic of ‘green jobs’ is expected to be increasingly discussed at upcoming international meetings (i.e. G8 and G20 meetings).”

Canada also chaired a working lunch entitled “Beyond the Crisis: What is the potential of shifting to a low-carbon economy?” at the OECD on September 29, 2009. The speaking notes prepared for that session state that “there is a consensus that a ‘green job’ is work with a positive environmental impact or which reduce[s] the environmental impact of enterprises and economic sectors to levels that are ultimately sustainable.” In the notes, green job initiatives in the U.S. and South Korea are praised, and Canada’s ecoENERGY investments in energy efficiency retrofits

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<sup>156</sup> HRSDC, *Memorandum to the Minister of HRSDC: Approval of Project for the Named Grant to the OECD* (date-stamped September 17, 2009).

are described. The briefing recognizes the need for public policy to “mitigate the adverse effects” of a shift to a low-carbon economy “in communities that are dependent on fossil fuels, and notes that “active labour market policies” will be essential to ensure “a fair and smooth transition to a green economy.” Future and current labour shortages in Canada’s electricity sector, especially the renewable energy sector, are noted. The speaking notes state that the ministerial discussion is “more than simply looking at the jobs crisis through a green lens,” but instead “setting the foundation to a new approach to the labour market.”<sup>157</sup>

The OECD is currently planning to publish its Green Growth Strategy in 2011.<sup>158</sup>

Other briefing notes show that HRSDC is monitoring the U.S. federal investment of US \$500 million in green research and green jobs training<sup>159</sup> and analyzing international green job reports such as the International Labour Organization’s green jobs assessment. (Based on this report, the note concludes that “about 83,000 jobs could be created in Canada,” and suggests that “a successful shift to a green economy may require targeted support for green skills training to workers and firms in high carbon sectors”.)<sup>160</sup> Finally, a briefing note to the Senior Assistant Deputy Minister outlines a workplan of research, consultation, support for third-party events and economic modelling to better understand green jobs.<sup>161</sup>

Unfortunately, little if any of HRSDC’s efforts appear to have been made public to date,<sup>162</sup> but the analysis does help to lay the groundwork for a greater emphasis on green jobs and green skills in the Government of Canada.

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<sup>157</sup> Ibid.

<sup>158</sup> Nathalie Girouard, “The OECD Green Growth Strategy: Key lessons so far” (OECD Observer, May 2010). <http://www.oecdobserver.org/news/fullstory.php/aid/3290/>

<sup>159</sup> HRSDC, *Memorandum to the Deputy Minister of HRSD: Statement of U.S. Secretary of Labour before Senate HELP Committee on Green Skills Training* (date-stamped May 19, 2009).

<sup>160</sup> HRSDC, *Memorandum to the Deputy Minister of HRSDC: International Labour Organization Releases World of Work Report 2009: The Global Crisis and Beyond* (date-stamped January 12, 2010).

<sup>161</sup> HRSDC, *Memorandum to the Senior Assistant Deputy Minister and the Associate Assistant Deputy Minister of the Skills and Employment Branch: Public Policy Forum Conference and other SEB Activities Related to Green Jobs* (noted as 2009 HR-NHQ 010523).

<sup>162</sup> A search of “green job” on HRSDC’s website returns virtually no relevant hits, and “environment” or “green” are not included on the site’s A–Z index of topics.

# Appendix 2:

## Representative jobs from clean energy investments

The table below (adapted from analysis by Robert Pollin and Jeanette Wicks-Lim) lists representative U.S. jobs that could be generated by investment in clean energy.

**Table 12. Representative jobs from five types of clean energy investments**<sup>163</sup>

Strategies for green economy investments	Representative jobs
<b>Building retrofitting</b>	Electricians, heating/air conditioning installers, carpenters, construction equipment operators, roofers, insulation workers, carpenter helpers, industrial truck drivers, construction managers, building inspectors
<b>Mass transit</b>	Civil engineers, rail track layers, electricians, welders, metal fabricators, engine assemblers, production helpers, bus drivers, first-line transportation supervisors, dispatchers
<b>Energy-efficient automobiles</b>	Computer software engineers, electrical engineers, engineering technicians, welders, transportation equipment painters, metal fabricators, computer-controlled machine operators, engine assemblers, production helpers, operations managers
<b>Solar power</b>	Electrical engineers, electricians, industrial machinery mechanics, welders, metal fabricators, electrical equipment assemblers, construction equipment operators, installation helpers, labourers, construction managers
<b>Cellulosic biofuels</b>	Chemical engineers, chemists, chemical equipment operators, chemical technicians, mixing and blending machine operators, agricultural workers, industrial truck drivers, farm product purchasers, agricultural and forestry supervisors, agricultural inspectors

<sup>163</sup> Adapted from Pollin and Wicks-Lim, *Job Opportunities for the Green Economy*, 2.