



VANCOUVER
ECONOMIC COMMISSION

GREEN AND LOCAL FOOD JOBS IN THE CITY OF VANCOUVER

2014 UPDATE

VEC LEAD AND REPORT AUTHOR

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ABOUT VEC

The Vancouver Economic Commission (VEC) is an agency of the City of Vancouver located in British Columbia, Canada. It works to strengthen the city's economic future by helping existing businesses grow, attracting foreign investment and promoting international trade opportunities, researching the business environment, and serving as the voice of business at City Hall. It works closely with local business stakeholders and relevant departments of all levels of government. It engages with peer organizations in the region and broad-based and sector-specific industry associations. It also collaborates with post-secondary institutions, legal, real estate and business services professionals, and others whose work affects economic development of the region. In short, the VEC connects local and international businesses to the right people.

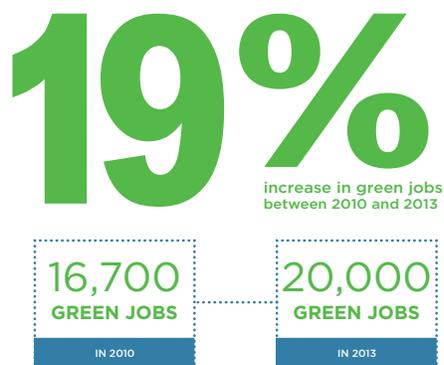
The VEC's purpose is to position Vancouver as a globally recognised city for innovative, creative and sustainable business.

EXECUTIVE SUMMARY



Vancouver's Greenest City Action Plan (GCAP) calls for doubling the number of green and local food jobs, as part of a vision for Vancouver to become the greenest city in the world by 2020. Starting in 2010, the Vancouver Economic Commission (VEC) has been evaluating the size and scale of the green economy and the potential that exists to leverage this sector for further economic development.

The green economy in Vancouver is robust and growing significantly faster than many other sectors. In aggregate, green and local food jobs in Vancouver increased from 16,700⁴ jobs in 2010 to 20,000 jobs in 2013, an increase of 19 percent over the three-year period (6 percent compound annual growth rate, CAGR). Based on employment estimates for Vancouver, green and local food jobs represent roughly 4.9 percent of all jobs in Vancouver, increasing from 4.2 percent of jobs in 2010 (see Figure 1).



METHOD As formal green economy data is neither widely available nor regularly collected by most government agencies, the VEC's work to understand Vancouver's green economy is unprecedented.

In 2010 and 2011, the VEC established a working definition of green and local food jobs along with a method to quantify the numbers of these jobs as a proxy for measuring growth in the green economy. This report, based on research completed in 2013, is an update of the VEC's earlier studies on green and local food jobs, including the VEC's 'Green Economy Working Papers' #1¹ and #4², as well as 'Working Paper #5: Local Food Jobs in the City of Vancouver'.³

DEFINITION The United Nations Environment Programme (UNEP) definition was borrowed to define the term green job. It has a focus on those activities that restore or preserve environmental quality, reduce energy, materials and water consumption, de-carbonize the economy, and minimize or altogether avoid the generation of all forms of waste and pollution.

Under this overarching framework, local food jobs require some additional clarity. In consultation with industry experts, the VEC decided to include all food produced, retail or processed in Vancouver that originated in B.C.

⁴ Adjusted baseline, see Appendix 3

¹ Vancouver's Green Economy, Hurrian Peyman, Graduate Fellow, ISIS Research Centre at the Sauder School of Business, UBC for Vancouver Economic Commission 2010

² Vancouver's Green Economy, Abhijeet Jagtap, Greenest City Scholar, Sauder School of Business, UBC for Vancouver Economic Commission 2011

³ Local Food Jobs in the City of Vancouver, James Raymond, Research Analyst, Vancouver Economic Commission 2012

Vancouver's green economy can be grouped into seven sectors:

1. Local food
2. Green building design and construction
3. Clean technology, alternative energy and green building products
4. Green infrastructure, transportation and planning
5. Sustainability services and education
6. Land and water remediation and environmental consulting
7. Materials management and recycling

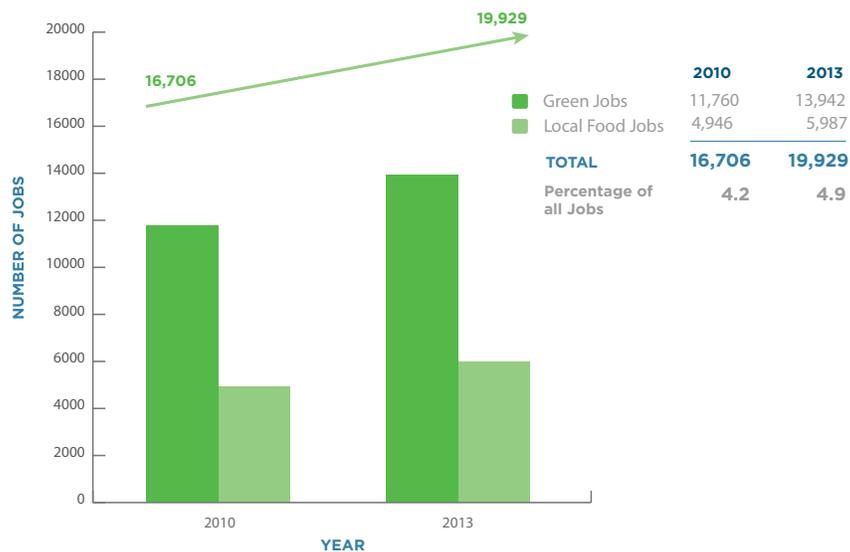
Local food is the largest of these sectors and has experienced the strongest growth. Success in this sector has been driven by strong demand by consumers, public sector procurement policies, and new sources of supply. To illustrate

this, Vancouver farmers market vendor sales grew 13 percent between 2012 and 2013, and small craft breweries saw an increase in sales of nearly 40 percent.

Green building design and construction is the second largest sector and also saw significant growth. For example, influences on this sector include green building policy and international demand for local expertise. The rezoning regulations that went into effect in Vancouver in 2010 led to a 56 percent increase in LEED-certified projects in the period 18 months before and after the regulation went into effect.

Clean technology, alternative energy and green building products grew more slowly than expected but 2013 saw a return to more optimistic growth projections. In Canada, the clean technology market is estimated at \$10.6

FIGURE 1 GREEN AND LOCAL FOOD JOBS GROWTH 2010 TO 2013



billion, with about one quarter of all companies located in Vancouver.

Of all the sectors, land and water remediation and environmental consulting was the only sector to experience a decline. One factor cited as contributing to the low rate of growth is the impact of the Canadian Environmental Assessment Act of 2012. The Act resulted in a reduction of the number of projects required to undergo extensive environmental assessments and is likely to have led to a decrease in the number of jobs in this sector.

Although materials management and recycling is comparatively small, this sector is growing quickly. There are strong recycling and waste management policies at the provincial, regional, and municipal levels. Policies include zero waste targets and extended producer responsibility programs that are the most progressive in North America. Provincial zero waste policies could contribute an additional 1,000 jobs by 2025.

The report includes three scenarios that forecast growth to 2020: the low growth scenario uses conservative growth estimates, while the moderate and high growth scenarios use more ambitious growth rates. A low growth scenario would lead to an increase in green and local food jobs to 23,900 — a 43 percent over the baseline year of 2010 by 2020 (or 4 percent CAGR averaged for all sectors). A moderate growth scenario increases the number to 29,500 — a 77 percent by 2020 (5.9 percent CAGR), and a high growth

scenario brings the number to 33,300 — an increase of 99 percent (7.1 percent CAGR), just shy of the targeted 100 percent growth and 33,400 jobs.

Significant progress has been made since 2010 with 6.1 percent average annual growth, though a shortage of skilled green workers in British Columbia (B.C.) hampered growth slightly. In order to double the number of jobs by 2020, the green and local food sectors will need to grow on average 7.7 percent each year from 2014 to 2020. To achieve this, a sustained and unprecedented effort needs to be made to create a positive climate for growth for green economy businesses, and address current and anticipated green workforce development gaps.

For all sectors, initiatives proposed in the GCAP need to be fully realized if high growth is to materialize, including a kick start program for entrepreneurs, a green innovation fund, a demonstration platform for new technologies, and a green enterprise zone.

With sustained efforts across all the sectors, from both public sector, academia and the business community, Vancouver can create an even more positive climate for growth for green economy businesses and realize the Greenest City vision—securing Vancouver’s international reputation as a mecca of green enterprise.



Saltwork's SaltMaker water treatment system treats almost any source to produce fresh water and solid salt.



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1. INTRODUCTION

Vancouver's Greenest City Action Plan (GCAP) sets a bold vision to make Vancouver the Greenest City in the world by 2020.⁵ The action plan is divided into ten goal areas, each with a specific 2020 target. The first goal is Green Economy, which aims to secure Vancouver's international reputation as a mecca of green enterprise, and calls for doubling the number of green jobs. Since local food is another one of the ten goals in the GCAP and can contribute to the vision of Greenest City, local food jobs are included in the measure of a green economy for the purposes of reporting.⁶ The Vancouver Economic Commission (VEC) holds primary responsibility for this reporting. Starting in 2010 the VEC has been evaluating the size and scale of the green economy, and the potential that exists to leverage this sector for further economic development.

As no formal green or local food jobs data are available from Statistics Canada or other traditional sources, and few common standards exist for measuring the green economy, the VEC established a working definition of green and local food jobs, and a method to provide an estimate of the number of these jobs in the city of Vancouver. Tracking this number can then act as a proxy for measuring growth in the green economy over time.

In 2010 and 2011, the VEC undertook the first study of green⁷ and local food jobs⁸

in the city of Vancouver. This included the development of a working definition for green jobs as well as local food jobs, and a telephone survey of Vancouver businesses to determine the number of jobs in each of these areas. The study included Statistics Canada Long Form census data which were used as inputs to augment and verify estimates for green and local food jobs using the VEC's analytical approach.

In 2013, the VEC appointed Ernst & Young (E+Y) to review the VEC's 2010 methodology and assist with creating a robust, replicable model. Based on E+Y recommendations, the VEC also engaged Mustel Group to undertake primary data collection and analysis. The Method section below outlines the approach taken, preceded by the findings of the study summarized in the Results section. E+Y's recommendations included moving to a new data source due to the changes to Statistics Canada's Long Form census, as well as updating other inputs to the model where more accurate data became available. As a result, the baseline as reported in the VEC's original report has been adjusted. Other changes to the approach included better documentation of interviews and the addition of new industries that have been identified as having green or local food jobs. A summary of significant changes from the original 2010 approach is provided in Appendix 2 and a summary of adjustments to the 2010 baseline can be found in Appendix 3.

⁵ A summary of the plan and the 10 goal areas can be accessed at <https://vancouver.ca/green-vancouver/greenest-city-2020-action-plan.aspx>

⁶ The Green Economy goal includes two targets: double the number of green jobs by 2020 over 2010 levels, and double the number of businesses greening their operations by 2020 over 2011 levels. The second target is still under development and is reported on separately.

⁷ Green Economy Working Paper #1 and Green Economy Working Paper #4, Vancouver Economic Commission, 2010 and 2011

⁸ Green Economy Working Paper #5: Local Food Jobs in the city of Vancouver, Vancouver Economic Commission 2011

2. RESULTS

2A. VANCOUVER'S GREEN ECONOMY

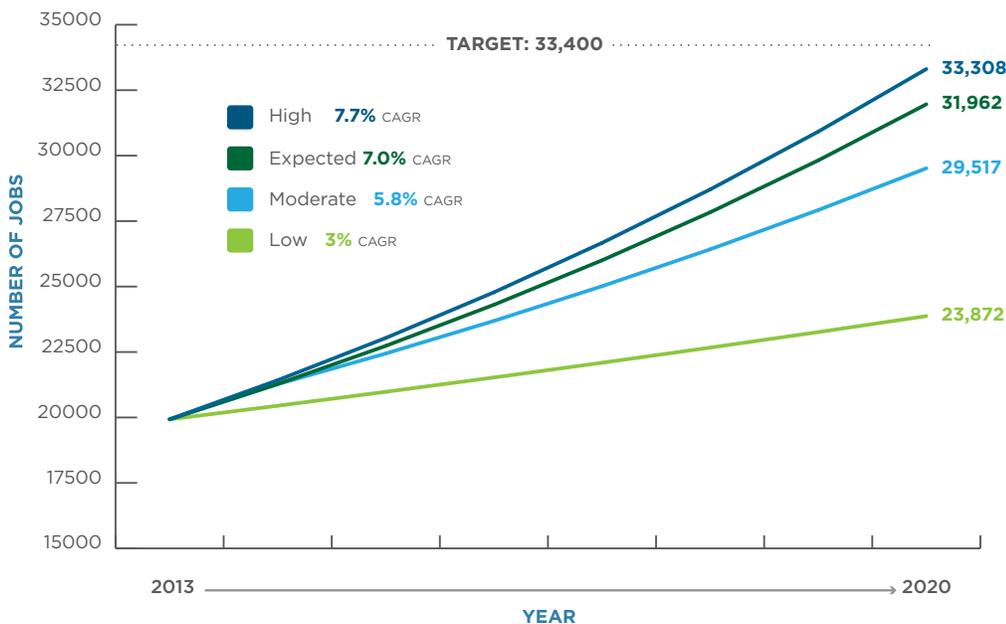
Overall, green and local food jobs in Vancouver increased from 16,700⁹ jobs in 2010 to 20,000 jobs in 2013, an increase of 19 percent over the three-year period (6 percent CAGR). Green jobs increased from 11,760 to 13,940 (6 percent CAGR) and local food jobs increased from 4,950 to 5,990 (7 percent CAGR) as shown in Figure 1 on page 3.

Based on employment estimates for Vancouver,¹⁰ green and local food jobs represent 4.9 percent of all jobs in Vancouver, increasing from 4.2 percent of jobs in 2010 (See Table 1).

2B. GROWTH AND GREENEST CITY ACTION PLAN TARGETS

The VEC developed three scenarios to model forecasted growth to 2020 (see Figure 2). The low growth scenario uses conservative growth estimates, while the moderate and high growth scenarios use more ambitious growth rates. The in-depth analysis for each sector that follows identifies whether a low, moderate or high growth scenario is expected for that particular sector.

FIGURE 2 GREEN AND LOCAL FOOD JOBS GROWTH PROJECTIONS 2013 - 2020



⁹ Revised baseline

¹⁰ Regional Context statement Vancouver City 2013 available for access at <http://www.metrovancouver.org/planning/development/strategy/REgional%20Context%20Statements/VancouverRCS.pdf>

Overall, as shown in Figure 2, a low growth scenario would lead to an increase of 43 percent over the baseline year of 2010 by 2020 (4 percent CAGR averaged for all sectors). A moderate growth scenario leads to an increase of 77 percent by 2020 (5.9 percent CAGR), while a high growth scenario leads to an increase of 99 percent (7.1 percent CAGR). Significant progress has been made since 2010 with 6.1 percent average annual growth, though a shortage of skilled green workers in British Columbia (B.C.) hampered growth slightly. In order to double the number of jobs by 2020, the green and local food sectors will need to grow on average 7.7 percent each year from 2014 to 2020.

Vancouver's Green Economy can be grouped into seven sectors:

1. Local food
2. Green building design and construction
3. Clean technology, alternative energy and green building products
4. Green infrastructure, transportation and planning
5. Sustainability services and education
6. Land and water remediation and environmental consulting
7. Materials management and recycling

Figure 3 shows growth in each sector between 2010 and 2013 based on observed data.

FIGURE 3 GREEN AND LOCAL FOOD JOBS BY SECTOR 2010 AND 2013

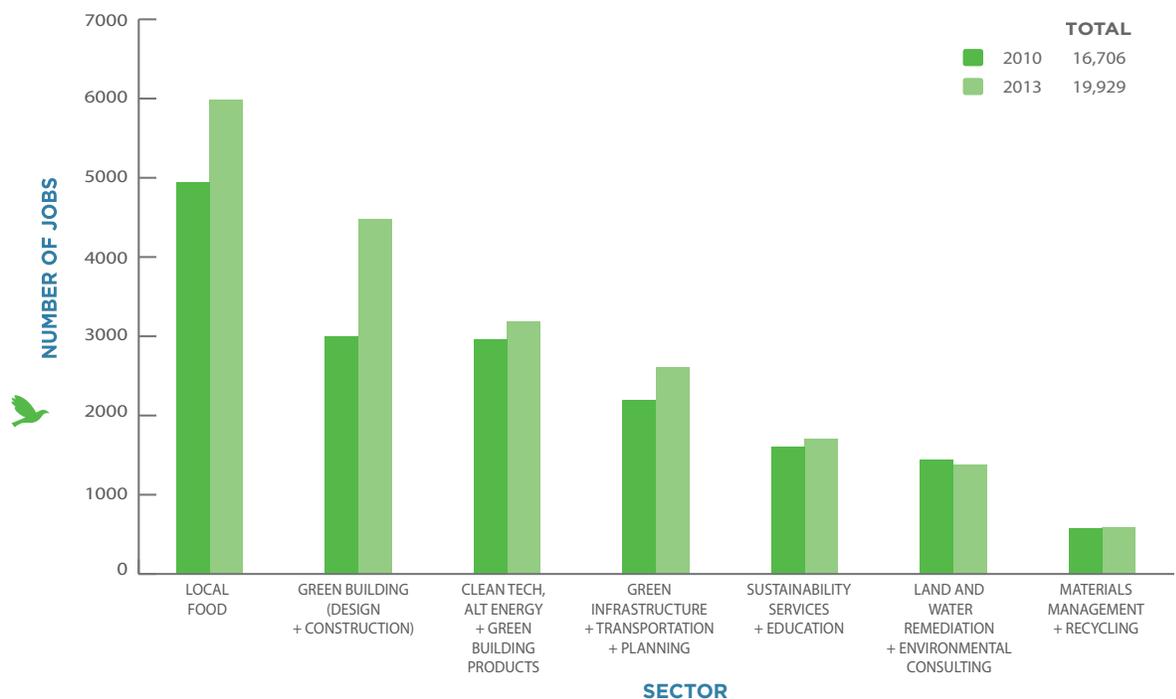


TABLE 1 GREEN AND LOCAL FOOD JOBS AS A PERCENTAGE OF ALL VANCOUVER JOBS 2010-2013 AND 2014 - 2020 PROJECTIONS¹¹

YEAR	TOTAL VANCOUVER JOBS ESTIMATE	TOTAL VANCOUVER GREEN AND LOCAL FOOD JOBS ESTIMATE	PERCENTAGE OF JOBS IN GREEN ECONOMY	
2010	399,000	16,706	4.2%	
2013	409,000	19,929	4.9%	
2016f	415,500	21,527	5.2%	LOW
		23,688	5.7%	MODERATE
		24,781	6.0%	HIGH
2020f	425,000	23,872	5.6%	LOW
		29,517	6.9%	MODERATE
		33,308	8%	HIGH

¹¹Jobs data and forecasts for Vancouver are sourced from the City of Vancouver Planning Department, as prepared for the Metro Vancouver Regional Context Statement



2C. SECTOR HIGHLIGHTS

I. LOCAL FOOD

Local food includes jobs in food production, processing, trade and service, as well as a small number of jobs in food related advocacy or policy. Jobs in this sector saw a significant increase between 2010 and 2013, largely as a result of strong demand from consumers, public sector

procurement policies, and new sources of supply such as urban farms, craft breweries, food trucks and expanded farmers markets.

The huge success of farmers markets helps illustrate the dramatic increase in

TABLE 2 LOCAL FOOD JOBS KEY DATA

	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013		
2010	4,950 ¹²			
2013	6,000	+21% / 7% (CAGR)		
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE		
Low Growth	7,350	+49%		
Moderate Growth	10,250	+107%		
High Growth	11,200	+127%		
AVERAGE GROWTH BY SUB-SECTOR (CAGR)		LOW	MODERATE	HIGH
Food Wholesale		3%	3%	5%
Food Processing		3%	3%	5%
Restaurants and Food Service		3%	8%	10%
Food Retail		3%	10%	12%
Food Production		3%	10%	12%

¹² Adjusted baseline



demand for local food from consumers. Farmers markets in B.C. have generated 147 percent more sales in 2012 than 2006.¹³ In Vancouver, the number of farmers markets increased from three in 2004 to seven summer markets and one winter market in 2013. Vancouver farmers market vendor sales grew 13 percent from \$6.3 million to \$7.1 million between 2012 and 2013. Other markets such as the Vancouver Bakers Market and the Hawkers Market also support 25 and 59 new food vendors respectively.

Vancouver's street food vending scene has experienced a similar if smaller renaissance, and the city boasted 120 carts and 42 mobile trucks in 2013, spurred on by a city program to issue more licenses. Many food trucks focus on local, high quality ingredients and provide jobs for up to four or five employees.

Domestic beer and wine sales make up a large proportion of all beer and wine sales in B.C. (80 percent and 50 percent for beer and wine respectively) and while large brewers experienced a 5.7 percent decline in sales in 2013, small craft breweries saw an increase of 39.6 percent. In fact, craft beer sales have experienced an average 20 percent growth each year since 2006.¹⁴ Vancouver has 19 breweries and four distilleries, and jobs in this sector expect to see a boost due to a relaxation of provincial legislation with respect to tasting lounges and happy hours.

LOCAL FOOD COMPANY HIGHLIGHTS

SOLE FOOD employs more than 25 employees at four urban farms on underutilized or vacant land in Vancouver. The farms produce local fruits and vegetables for sale in Vancouver, at farmers markets, retail outlets, and to local restaurants.

COMMISSARY CONNECT and **YOLK COMMISSARY** provide shared commercial kitchen space to small scale Vancouver food processors and manufacturers.

FORAGE is a restaurant committed to sustainable dining. The chef grows his own vegetables, catches his own fish, makes his own preserves, and composts all food waste. The restaurant is situated in the Listel Hotel, a sustainability leader with a zero waste policy, solar panels and its own heat recovery program.

PARALLEL 49 brews craft beer in an area of the city that is fast becoming a 'brewery district'. The brewery produced a million litres of beer in its first year, and is already targeting two million with an expansion that has doubled their square footage in less than three years of operation. Parallel 49 is expanding its reach, exporting to Alberta and U.S. markets.

VANCOUVER'S URBAN WINERY is rejuvenating the wine industry with wine on tap. Kegged wine is less resource intensive, saving on bottles and transportation weight costs.

¹³ Economic and Social Benefits Assessment, B.C. Association of Farmers Markets 2012

¹⁴ B.C. Liquor Distribution Branch Quarterly Market Review



Institutional purchasing is another significant driver of local food jobs. The University of British Columbia (UBC) is a leader in the field, with policies in place to support the institutional purchasing of local food. Approximately 48 percent of all 2010/2011 expenditures on UBC Food Services and the AMS Food and Beverage Department were on food that was local or certified organic.¹⁵ UBC's purchases for local food grew 3 percent in 2012 and 2 percent in 2011.¹⁶ The Greater Vancouver Food Bank Society purchases items such as eggs, vegetables, fruits and milk through partnerships with local farmers and grocery stores, and aims to increase the proportion that is sourced from local

suppliers from 10 percent currently to 60 percent. Other large institutions such as the Vancouver School Board and Parks Board are also actively working with the major food providers including Sysco and Gordon Food Services to increase the amount of local food they purchase.

Experts consulted for this study agreed that wider adoption of local food purchasing policies in the public sector, along with growing consumer demand and initiatives such as food trucks festivals, Buy Local campaigns and Meet Your Maker events will lead to high growth rates. Therefore, a high growth scenario is likely for the Local Food sector.

GROWTH
↑ 21%
 2010-2013

PROJECTED: HIGH
↑ 87%
 2013-2020



¹⁵ University of British Columbia STARS report. UBC defines local food as food that is raised, grown, processed or produced within 150 miles from campus.

¹⁶ VEC interview



II. GREEN BUILDING DESIGN AND CONSTRUCTION

Green building design and construction includes architects, engineers, contractors and other building professionals and trades. There was significant growth in jobs in this sector between 2010 and 2013, largely as a result of updates to the Vancouver Building Bylaw (VBBL) in 2010 and 2013. Since 2010, all large buildings, such as commercial and multi-unit residential, must be designed to strict energy consumption and greenhouse gas emission standards. Green rezoning policies require all rezoned sites to

be built to Leadership in Energy and Environmental Design (LEED®)-Gold standards.

Starting March 20, 2014, the updated VBBL also requires new one- and two-family homes to meet stricter energy-efficiency requirements and meet higher EnerGuide ratings. For example, new homes must provide for better in-home energy monitoring and allow for roof-mounted solar energy devices and electric vehicle charging. Existing buildings under renovation will also need to complete energy audits.

TABLE 3 GREEN BUILDING DESIGN AND CONSTRUCTION KEY DATA

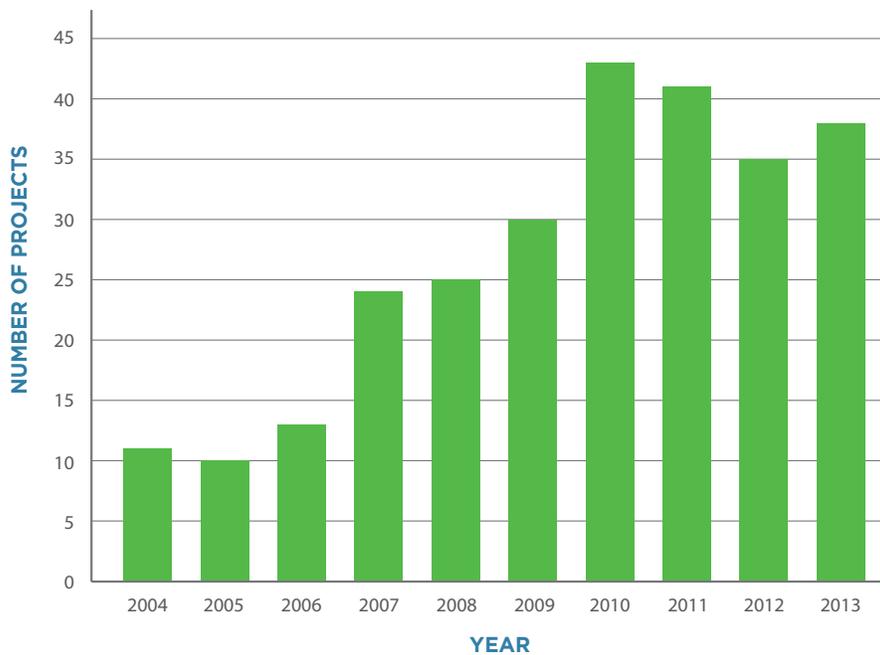
	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	3,000 ¹⁷		
2013	4,500	+50% / 14% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	5,300	+76%	
Moderate Growth	6,450	+116%	
High Growth	7,350	+146%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Professionals (architects and engineers)	3%	6%	8%
Labourers	2%	5%	7%

¹⁷ Adjusted baseline

The rezoning regulations that went into effect in Vancouver in 2010 led to a 56 percent increase in LEED-certified projects in the period 18 months before and after the regulation went into

effect (see Figure 4).¹⁸ Further updates to the VBBL are expected in 2016 and 2019 to meet the GCAP green building targets: firstly, to reduce the amount of energy consumed by existing buildings

FIGURE 4 NUMBER OF LEED REGISTERED PROJECTS IN CITY OF VANCOUVER¹⁹



GROWTH
↑ 50%
 2010-2013

PROJECTED: HIGH
↑ 64%
 2013-2020



¹⁸ Canadian Green Building Council data. One third of all confidential and therefore indeterminate projects are assumed to be in the city of Vancouver.



33 percent by 2020 and secondly, to make all new buildings carbon neutral by 2020. Projections are therefore for continued strong growth in Vancouver's green building sector between 2014 and 2020.

Fifty-one percent of design and construction firms worldwide anticipate that at least 60 percent of their work will meet a recognized green certification by 2015 — up from just 28 percent of firms with this level of green work in 2012.¹⁹ As a result of expertise developed at home, Vancouver's planners, architects, contractors, and engineers are sought around the world to deliver these green building projects. In fact, the Urban Land Institute (ULI), a real estate research and education organization with over 30,000 members worldwide, brought their annual Spring Meeting to Vancouver in 2014 — hosting this high calibre event outside the U.S. for the first time in its 78-year history.

A high growth scenario for this sector is extremely likely. Experts reported expected growth between 2013 and 2020 for professionals (architects and engineers) at 20-30 percent.²⁰ For contractors, a slightly lower annual growth rate is expected, as these jobs are more slowly impacted by changes to building codes.

GREEN BUILDING COMPANY HIGHLIGHTS

CREDIT SUISSE'S THE EXCHANGE, a \$200-million office tower in Vancouver's business district, will be completed in 2017. The 30-storey, 10-million square foot project will be Canada's largest LEED-Platinum office building, with half the energy consumption of traditional office buildings.

SCOTT CONSTRUCTION has completed LEED projects across the city and developed its own green certification system that has been adopted by other construction companies.

INTEGRAL is a leader in building systems and offers a range of services to deliver high-performance buildings such as Vancouver's LEED-Platinum Olympic Village and Telus Garden.

QUBE BUILDING SYSTEMS deliver factory-built, high rise modular apartment buildings. Using the QUBE system, entire buildings can be built within a few days and the factory setting leads to less waste during construction.

FENIX ENERGY enables geo-exchange retrofits through a sophisticated drilling technology that minimizes disruption and shortens the building project timeline by two to four months.

¹⁹ SmartMarket Report: World Green Building Trends, 2013. McGraw Hill Construction

²⁰ Dave Ramsle, Integral Group, Interview





III. CLEAN TECHNOLOGY, ALTERNATIVE ENERGY AND GREEN BUILDING PRODUCTS

Clean technology, alternative energy and green building products include a wide variety of jobs, from those at top employers like B.C. Hydro, to jobs with the upwards of 70 clean technology companies²¹ including Saltworks and Westport Innovations. GLOBE Foundation categorizes clean technology into nine distinct sub-sectors:²²

- Biofuels and Biochemicals;
- Power Generation;

- Energy Infrastructure;
- Green Building and Energy Efficiency;
- Process Efficiency and Abatement;
- Remediation and Soil Treatment;
- Transportation;
- Recycling, Waste and Recovery; and
- Water and Wastewater.

In Canada, the clean technology market is estimated at \$10.6 billion²³, with about one quarter of all companies located in Vancouver.²⁴ Power generation, energy

TABLE 4 CLEAN TECHNOLOGY, ALTERNATIVE ENERGY AND GREEN BUILDING PRODUCTS KEY DATA

	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	2,950		
2013	3,200	+8% / 3% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	3,900	+33%	
Moderate Growth	4,500	+52%	
High Growth	5,100	+73%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Clean technology, alternative energy and green building products	3%	5%	7%

²¹ KPMG B.C. Cleantech Report Card 2013

²² GLOBE Foundation

²³ 2013 Canadian Clean Technology Industry Report, Analytica Advisors and the Canadian Clean Technology Coalition

²⁴ Andrew Wilkinson, B.C.'s minister of Technology and Innovation



infrastructure, green building and energy efficiency, recycling, waste and recovery and water and wastewater are dominant activities for Vancouver clean technology companies. B.C. is also home to the second largest fuel cell cluster in the world, with 70 percent of global research and development spending occurring in the province.

There is strong support for clean technology at the policy level in Canada and in B.C., with programs such as the Sustainable Development Technology Canada (SDTC) investment fund, the Scientific Research and Experimental Development (SR&ED) federal tax credits matched by B.C., and the National Research Council of Canada (NRC) Industrial Research Assistance Program (NRC-IRAP). Vancouver is home to a wide range of start-up and business acceleration support, including organizations such as Institute B, Grow Lab, Centre for Growth, Simon Fraser University's Time Ventures, Launch Academy, Venture Labs and Foresight.

Investors were very optimistic about growth rates for clean technology in 2010, but the period 2010–2013 saw more muted growth than expected. Access to capital, lack of management talent and navigating global markets are cited as some of the challenges faced by B.C.-based clean technology companies.^{25,26}

CLEAN TECHNOLOGY COMPANY HIGHLIGHTS

SALTWORKS has a team of 45 innovators developing three desalination technologies covered by over 40 patents. Saltworks clients include NASA, the Canadian Navy and Teck Resources.

OSTARA recovers phosphorus from industrial waste streams and transforms it into eco-friendly fertilizer. Ostara has a pilot in Vancouver and six commercial nutrient recovery facilities from Oregon to Pennsylvania, and Robert F. Kennedy Junior is a board director.

URBAN STREAM designs and operates micro-scale farms in shipping containers. Urban Stream's pilot in the parking lot of Vancouver restaurant Luke's Corner, takes in food scraps to create compost, which is then used to grow food on the roof of the container.

WESTPORT INNOVATIONS is a 1000-person publicly traded company that engineers the world's most advanced natural gas engines and systems.

PALCAN is one of the first companies to commercially manufacture small consumer and commercial fuel cell applications for niche global markets.

PULSE ENERGY helps utilities to engage over 1 million commercial customers through the Pulse™ Platform, an Energy Intelligence Software solution improving energy efficiency worldwide.

DPOINT is a recognized leader manufacturing and selling membranes and heat and humidity exchangers for energy recovery in buildings.



²⁵ GLOBE Foundation

²⁶ Dallas Kachan, Kachan & Co., Interview

A return to more optimistic growth projections occurred in 2013. A global drive for resource efficiency, demand from China, the rise of disruptive technologies, and collaborative consumption are all expected to stimulate demand for clean technology, creating robust growth.²⁷ Some subsectors may return to growth more quickly than others, for example global growth of biofuels and biochemicals is expected to be in the range of 5-24 percent.²⁸

Energy efficiency and innovative applications of clean technology in traditional resource sectors such as mining, oil and gas are also expected to see sustained growth. In renewables, installed solar power capacity is expected to grow on average 8.3

percent per year till 2035, followed by 5.7 percent for wind, 3.7 percent for geothermal, 2 percent for hydropower and 1.4 percent for renewables such as wood waste, landfill gas and agricultural byproducts.²⁹ Even broad clean technology exchange traded funds (ETFs) are returning to growth.

B.C. Hydro's development of Site C dam may contribute to some job growth but only if the project is approved. Also, while smart grid development has proven to be a high growth area in other parts of the world, B.C. Hydro has seen efforts to move towards a smart grid thwarted, reducing growth potential.

A high growth scenario may materialize for this sector long term but moderate growth is likely in the short term.

GROWTH

8%

2010-2013

PROJECTED: HIGH

↑61%

2013-2020



3187

JOBS

²⁷ Cleantech Redefined: Why the next wave of cleantech infrastructure, technology and services will thrive in the twenty first century, Kachan & Co., 2013

²⁸ National Research Council Canada (NRCan)

²⁹ International Energy Outlook 2013



IV. GREEN INFRASTRUCTURE, TRANSPORTATION AND PLANNING

Green infrastructure, transportation and planning includes Vancouver-based jobs in public transit (Translink), transportation planning at the City of Vancouver and jobs with carsharing services such as Modo, Zipcar and Car2Go.

The largest share of jobs is in public transit which is experiencing slow

growth. Translink funding has been constrained and remains in question pending a referendum on governance of the organization. Construction of the Evergreen subway line, set to be operational in 2016, may add temporary jobs, although sustained significant growth in public transportation jobs in Vancouver is not expected.

TABLE 5 GREEN INFRASTRUCTURE, TRANSPORTATION AND PLANNING KEY DATA

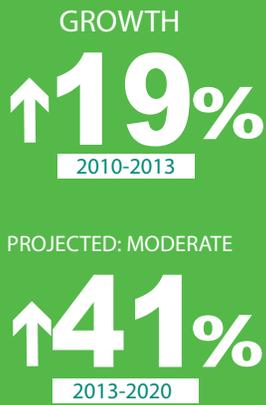
	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	2,200 ³⁰		
2013	2,600	+19% / 6% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	3,200	+46%	
Moderate Growth	3,650	+67%	
High Growth	4,200	+91%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Green infrastructure, transportation and planning	3%	5%	7%

³⁰ Adjusted baseline

On the other hand, carsharing has experienced the massive success of the sharing economy (50 percent of Vancouverites expect to see the sharing economy grow in the next 3-5 years).³¹ Across Canada, carsharing membership grew 47.5 percent in 2008 (though growth has been highly variable in this sector).³² In Vancouver, Car2Go opened in June 2011 with 225 vehicles and 2,000 members, and grew to 578 vehicles and 44,000 members by January

2014, making it the largest of its kind in North America.³³ In addition, the City of Vancouver intends to implement a bike sharing system in 2015, with 1,500 bikes and helmet-rental boxes at 125 stations.

Electric vehicles are also a promising growth area. The City of Vancouver is trialing over 70 public charging stations at community centres, shopping malls, parking stalls and curbside locations across the city. In addition, all stalls in



³¹ The Sharing Project: A report on Sharing in Vancouver

³² North American Carsharing: A 10 year retrospective, Susan A. Shaheen, Adam P. Cohen and Melissa S. Chung 2009

³³ Car2Go, March 2014



new homes in Vancouver, 10 percent of stalls in commercial buildings and 20 percent of stalls in apartment buildings must be pre-piped for electric vehicle charging.

As car and bike sharing make up a smaller proportion of this sector, growth is still more likely to be moderate for this sector.

GREEN INFRASTRUCTURE, TRANSPORTATION AND PLANNING COMPANY HIGHLIGHTS

SATURNA GREEN SYSTEMS provide a communications platform for electric bikes, scooters and motorcycles that resolves range and charging anxiety, and enables better maintenance and emergency response.

MOJIO uses a device that plugs into a car's diagnostic port, unlocks data, and feeds it to a smartphone App. The data reports in a number of ways, including updates on the health of a car's systems and whether the car is getting towed.

As a result of investment in infrastructure, Vancouver has been successful in attracting a global cluster of alternative fuel vehicle manufacturers. **MITSUBISHI** iMiEVs, **NISSAN** Leaf, **MERCEDES BENZ** F-Cell and **TESLA**'s luxury Model S all have a strong presence in Vancouver.

NOTE Bike shops are an important part of the green transportation system. HUB is a non-profit addressing cycling issues in Metro Vancouver and employs 30 staff and contractors in cycling tourism, education and events. HUB reports at least 42 bike shops in the city of Vancouver alone.

VANCOUVER SKYTRAIN

Vancouver's rapid transit use has increased almost five times in 23 years.





V. SUSTAINABILITY SERVICES AND EDUCATION

Sustainability services and education includes post-secondary education, non-governmental organizations (NGOs) and government agencies alongside businesses providing sustainability consulting, carbon finance and other environment-related services. This sector saw a reasonable increase between 2010 and 2013.

Government agencies, such as Environment Canada and the Department of Fisheries and Oceans, experienced marginal growth which is not surprising

given the recent federal job cuts and hiring freezes in order to curb spending. Charities and non-profits also saw tempered growth as government grants and donations from foundations, individuals and corporations have shrunk. The emerging social enterprise sector, having a more diversified source of income, saw some growth with 357 confirmed social enterprises in B.C. in 2012 (up from 231 in 2010, though much of the increase reflects an improved understanding and definition of the sector).³⁴ The social enterprise

TABLE 6 SUSTAINABILITY SERVICES AND EDUCATION KEY DATA

	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	1,600 ³⁵		
2013	1,700	+6% / 2% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	1,950	+22%	
Moderate Growth	2,250	+40%	
High Growth	2,700	+71%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Sustainability Services and Education	2%	4%	7%

³⁴ The 2012 Survey of Social Enterprises in B.C. Peter R. Elson, Mount Royal University Peter V. Hall, Simon Fraser University

³⁵ Adjusted baseline



business model shows significant promise, and in response B.C. has launched a new hybrid corporate model, the Community Contribution Company.

Growth in the education sector was strong. Public universities and colleges in Vancouver have robust sustainability and environmental course offerings³⁶ and enrolment in environment-related university programs in B.C. increased 39 percent between 2001 and 2008. Approximately 10.5 percent of all university enrolments and 2.3 percent of college enrolments in B.C. were in environment-related programs (2004/2005).³⁷

In 2010, Vancouver's six public post-secondary institutions³⁸ became active partners in Vancouver's GCAP initiatives via the Campus-City Collaborative (C-3). The C-3 initiative led to programs such as the Greenest City Scholar program³⁹ and City Studio⁴⁰, which further enhance green training and education opportunities in Vancouver. In fact, UBC for one reported that many green jobs

SUSTAINABILITY SERVICES AND EDUCATION COMPANY HIGHLIGHTS

THE GLOBE conference has attracted thousands of environmental business leaders, corporate environmental managers, and sustainability practitioners from around the world to meet in Vancouver every two years for the past 24 years. Guided by a principle that environmental issues are business opportunities, GLOBE explores corporate sustainability, energy, climate change and urban development. 2012 was a banner year attracting 9,000+ participants including 650 CEOs.

OFFSETTERS provides carbon offsets to help businesses reduce their climate impact, and were the first ever Official Supplier of Offsets to the Vancouver 2010 Olympic and Paralympic Winter Games. Offsetters is also the provider for North America's first Carbon neutral airline, Canada's first carbon neutral coffee company, and Canada's largest carbon neutral credit union.

CLIMATESMART uses a web-based software application and corporate training program to help businesses measure, manage and reduce carbon emissions. ClimateSmart takes a business case approach and has trained more than 550 businesses, managing over 1 million tonnes of CO₂e (equivalent to emissions from more than 200,000 cars).

CITY STUDIO is a collaborative effort to support green workforce development between the **CITY OF VANCOUVER**, the **VEC**, **BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY**, **EMILY CARR UNIVERSITY OF ART AND DESIGN**, **LANGARA COLLEGE**, **SIMON FRASER UNIVERSITY**, **VANCOUVER COMMUNITY COLLEGE** and the **UNIVERSITY OF BRITISH COLUMBIA**. In just three years, 1,616 students have worked on 53 projects, contributing 50,000 hours of research and action towards Greenest City goals.

³⁶ Skilled, Qualified & Sustainable: A Reference Guide to Green Education & Training in B.C., GLOBE Foundation 2010

³⁷ Post-Secondary Environmental Education in Canada, ECO Canada, 2011

³⁸ British Columbia Institute of Technology, Emily Carr University of Art and Design, Langara College, Simon Fraser University, Vancouver Community College and the University of British Columbia

³⁹ <http://sustain.ubc.ca/get-involved/students/greenest-city-scholars>

⁴⁰ <http://citystudiovancouver.com/>

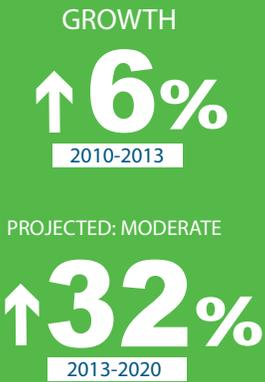


exist within their post graduate and doctoral research departments, which were not easily captured during the Mustel Group telephone survey or other efforts to collect the data. Therefore estimates for this sector are likely conservative.

On the other hand, the global market for carbon offsets has weakened, with prices for Certified Emissions Reductions (CERs) falling to EUR 0.5/t, close to the point where the value would be less than the cost of verification of the emissions reduction.⁴¹ In B.C., while requirements for carbon neutral government remain, the province's carbon offset program

has been transferred from the Pacific Carbon Trust to the Climate Action Secretariat citing cost cutting and leading to a reduction in staff. Voluntary carbon markets have shown some resilience, with an expected transaction value of USD2.5 billion by 2020 driven by organizations wishing to demonstrate their climate leadership and corporate social responsibility, while seeking efficiencies and mitigating climate change risk.

Based on the variability of growth rates for each sub-sector, a moderate growth scenario is most likely for this sector.



⁴¹ Greenhouse Gas Market 2013: Looking to the Future of Carbon Markets, International Emissions Trading Association 2013



VI. LAND AND WATER REMEDICATION AND ENVIRONMENTAL CONSULTING

Land and water remediation and environmental consulting is a mature and well-established industry in Vancouver, applying science and engineering principles to improve, remediate or restore air, land, water and ecosystems. Many of these jobs are with resource industries such as forestry, mining, pulp and paper, chemical process, fisheries, agri-food, and oil and gas to mitigate the environmental impact of their operations.

Environmental engineering is classified as a subset of civil engineering by Statistics Canada, and has an expected average annual growth rate of employment of 1.9 percent for the period 2010–2020.⁴²

One factor cited as contributing to the low rate of growth is the impact of the Canadian Environmental Assessment Act of 2012. The Act resulted in a reduction of the number of projects required to undergo extensive environmental assessments and could therefore have led to a decrease in the number employed in this sector. On the other hand, approvals required for large infrastructure projects such as the Site C generating station or liquid natural gas pipelines may offset this dampening effect.

⁴² Expected average annual growth for Civil Engineering employment in the Lower Mainland/Southwest B.C. region, accessed at <http://www.workbc.ca/Navigator/occupations/2131>



LAND AND WATER REMEDIATION AND ENVIRONMENTAL CONSULTING COMPANY HIGHLIGHTS

HEMMERA has grown from 2 people in 1994 to over 200 professionals across the country in 2013. Hemmera approaches environmental remediation in innovative ways, partnering with organizations such as Environment Canada and SOLE Food Farms to experiment with permeable reactive barrier remediation techniques and changes to the risk assessment process that allow for interim urban farming uses on contaminated sites.

Many of Vancouver's cleantech companies provide solutions deployed by this sector:

AIR PHASER's technology can oxidize and reduce airborne volatile organic compounds (VOC's) to safe, non-hazardous, non-odorous compounds using only electricity.

TERRAMERA develops plant-based biopesticides that are more effective and safer than conventional chemical pesticides.

SEMIOS helps growers adopt biopesticides through its proprietary system of remote sensors, traps, cameras, weather stations and pheromone aerosols, wirelessly connected through a central gateway.



A moderate growth scenario may materialize for this sector long term but low growth is likely in the short term.

TABLE 7 LAND AND WATER REMEDIATION AND ENVIRONMENTAL CONSULTING KEY DATA

	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	1,450		
2013	1,400	-4% / -1% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	1,450	+3%	
Moderate Growth	1,650	+14%	
High Growth	1,800	+26%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Land and Water Remediation and Environmental Consulting	1%	2.5%	4%

GROWTH
 ↓ 4%
 2010-2013

PROJECTED: LOW
 ↑ 7%
 2013-2020





VII. MATERIALS MANAGEMENT AND RECYCLING

Materials management and recycling includes jobs in collecting, sorting, processing and recycling of materials that are diverted from landfill. For the most part, recycling and waste management businesses fall under one of three major categories: upstream collection, managing waste, and downstream processing.

Vancouver sends approximately 480,000 tonnes of waste to the landfill or incinerator each year, and has set GCAP targets to halve this by 2020. Green compost bins were introduced in 2012 to collect food scraps, reducing household garbage by 39 percent. This pilot program was in preparation for a

TABLE 8 MATERIALS MANAGEMENT AND RECYCLING KEY DATA

	NUMBER OF JOBS	PERCENTAGE CHANGE 2010-2013	
2010	580 ⁴³		
2013	600	+3% / 1% (CAGR)	
2020 PROJECTIONS		PERCENTAGE CHANGE OVER 2010 BASELINE	
Low Growth	3,200	+18%	
Moderate Growth	3,650	+35%	
High Growth	4,200	+55%	
AVERAGE GROWTH BY SUB-SECTOR (CAGR)	LOW	MODERATE	HIGH
Materials Management and Recycling	2%	4%	6%

⁴³ Adjusted baseline

ban on the disposal of all food scraps and yard trimmings, which will come into effect across Metro Vancouver in 2015. Canadian company TerraCyle partnered with the City of Vancouver to launch another pilot, the Cigarette Waste Brigade®, installing 110 cigarette recycling receptacles around downtown Vancouver.

At the regional level, Metro Vancouver also has many strong directives for minimizing waste generation and maximizing the reuse, recycling, and recovery of materials. The region has a target to increase diversion rates from 55 percent (2010) to 70 percent by 2015, and 80 percent by 2020.

Provincially, B.C. has some of the most advanced policies and regulations with respect to product stewardship and materials management in the world. Under the Recycling Regulation, B.C. requires producers of designated products to provide Extended Producer Responsibility (EPR) for the lifecycle management of their products, including collection and recycling. This program applies to a wide range of products including tires, electronics and beverage containers, and is expanding to include packaging and printed paper (by 2015) and construction and demolition materials, furniture, textiles and carpet, and appliances (by 2017).

GROWTH

↑ **3%**
2010-2013

PROJECTED: HIGH

↑ **50%**
2013-2020



593

JOBS



For example, as a result of regulation Multi-Material British Columbia (MMBC) will be responsible for province-wide packaging and printed paper collection and recycling and will contract with local governments to provide curbside collection and with qualified collectors, local governments, private companies or non-profits for multi-family and depot collection.

There is evidence that the reuse, recycling and recovery of waste creates jobs in greater numbers than are displaced in disposal and landfill. Some studies suggest that 10 times more jobs are created through diversion⁴⁴ while others estimate that between 2.4 and 4.1 jobs are created for every 1,000 tonnes of waste diverted.⁴⁵

Zero waste policies in B.C. could contribute to up to 1,000 jobs province-wide by 2025⁴⁶ and a high growth scenario is expected for this sector as businesses, residents and technologies respond to changing legislation.

MATERIALS MANAGEMENT AND RECYCLING HIGHLIGHTS

The City of Vancouver supported a joint venture between **RECYCLING ALTERNATIVES** and **UNITED WE CAN** to develop a 33,743-square-foot recycling hub in Vancouver's False Creek Flats industrial area. Recycling Alternative collects, sorts, and recycles materials, employing more than two dozen staff. United We Can employs about 120 people with barriers to employment and supports another 700 recyclers daily through its bottle collection rebate program. The new hub allows the businesses to grow, increase efficiencies and branch out into new waste streams.

Both **DAVIS TRADING & SUPPLY LTD** and **NORTH STAR METAL RECYCLING** collect, sort, and re-sell scrap metal for reprocessing. Producing steel from recycled material saves 75 percent of energy compared with using virgin materials.

NOTE Second hand stores play a role in diverting materials from landfill. Second hand stores selling furniture, books or clothing are all part of the reuse sector, in turn part of the larger retail sector. The idea of a 'reuse economy' is still not well defined and these jobs were not included in the study.

⁴⁴ Recycling and Economic Development Cascadia Consulting Group, 2009.

⁴⁵ The Economic Benefits of Recycling In Ontario, AECOM, 2012.

⁴⁶ Draft Zero Waste Business Case, B.C. Ministry of Environment 2013



3. METHOD

The language used to describe and define the green economy and local food economy varies greatly in the limited number of studies that have been conducted around the world to date.⁴⁷ As a result, a method for measuring green and local food jobs needed to be created rather than emulated. This also means that comparing results with other studies conducted using a different method is challenging, though not impossible.

As no universal framework exists to classify or measure green jobs, the VEC reviewed a wide range of studies to develop a sound method and working definition to measure green and local food jobs at the local level in the city of Vancouver.

The same constraints led the U.S. Bureau of Labor Statistics (the BLS) to solicit comments for their definition of green jobs in 2010, when it began to develop and implement the collection of new data on green jobs (the Green Goods and Services Program).⁴⁸ With few exceptions, the approach used by the BLS mirrors the approach taken by the VEC, with approximately 120,000 businesses and government establishments surveyed across 333 industries.

DEFINITIONS

No formal dataset is available for green or local food jobs in Vancouver, and few common standards exist for measuring the green economy. In the absence of

definitions from Statistics Canada or the North American Industry Classification System (NAICS), the VEC began establishing its own working definition for green and local food jobs. Local food was included because Vancouver's GCAP identifies local food as a key component of a sustainable city.

The United Nations Environment Programme (UNEP) definition was borrowed to define the term green job. It has a focus on those activities that restore or preserve environmental quality, reduce energy, materials and water consumption, de-carbonize the economy, and minimize or altogether avoid the generation of all forms of waste and pollution.

Under this overarching framework, local food jobs require some additional clarity. In consultation with industry experts, the VEC decided to include all food produced, retailed or processed in Vancouver that originated in B.C.

Across all of the green and local food jobs measurements, 'employment' is taken to mean the number of jobs including both full-time and part-time work.

INTENSITY RATIOS

Since there are no standard definitions, it is perhaps unsurprising that there are also no universally accepted accounting methods for measuring green or local food jobs. Researchers and statisticians therefore make use of intensity ratios to

⁴⁷ Defining, measuring and predicting green jobs', Gürçan Gülen Senior Energy Economist, Center for Energy Economics, Bureau of Economic Geology, University of Texas at Austin

⁴⁸ More information on the BLS Green Goods and Services Program can be accessed at <http://www.bls.gov/green/home.htm>

establish credible proxy measures of the proportion of green or local food jobs in a given industry. The intensity ratio for a given industry sector is an estimate of the proportion of that sector that can be considered to part of the green economy.

Intensity ratios were used to estimate the share of green and local food employment in a given industry sector. If a business only produces green (or local food) goods or services, the intensity ratio is 1 and all employees of this business are counted as green jobs. This includes production, management, and administrative staff. Other businesses may produce some green/local food products and services but also produce non-green or non-local food products or services. For these businesses, the study creates an estimate of the percentage of revenue or total projects that are green or local food, and the intensity ratio falls between 0 and 1.

The BLS provides green intensity ratio data that is regarded as robust and definitive, and this data is used as the starting point for green intensity ratios in 2013. As there is no other source of useable, relevant data available at the Vancouver level, and the BLS data is specific to the U.S. national level, green intensity assumptions have been tested and adjusted for the local market via expert interviews.

Local food intensity ratios originated from the VEC telephone surveys in

2011 and have similarly been tested and updated for 2013.

DATA COLLECTION AND ANALYSIS

The VEC employed two data collection approaches to estimate the number of green and local food jobs for seven sectors:

1. Local food
2. Green building design and construction
3. Clean technology, alternative energy and green building products
4. Green infrastructure, transportation and planning
5. Sustainability services and education
6. Land and water remediation and environmental consulting
7. Materials management and recycling

These sectors align with standard NAICS classifications. Primary data for sectors 3-7 was collected via means of telephone surveys, while secondary data for sectors 1 and 2 was derived from Statistics Canada's Labour Force Survey (LFS).

PRIMARY DATA COLLECTION: Primary data on green employment numbers were collected via a telephone survey of businesses known to produce a green product or service. The telephone survey was conducted by Mustel Group using a database compiled by E+Y to ensure appropriate documentation and recording of interview scripts.

SECONDARY DATA COLLECTION: Data from Statistics Canada have been used to augment the primary data, specifically for the Green Building Design and Construction and the Local Food sectors. These sectors are identified as part of the green economy, but have a large number of individual businesses, making it cost prohibitive to conduct a telephone interview of the entire sector. Therefore, LFS data from Statistics Canada was used to generate a proxy for the number of jobs in the Green Building Design and Construction and the Local Food sectors.

APPROACH

Canada's standard form of industry classification is the NAICS coding system, which does not identify a green or local food grouping of industries. While developing the VEC's definition of green and local food jobs, the NAICS codes were investigated for any codes that had the potential to contain green or local food jobs.

Two approaches for measuring green jobs have emerged as best practice, the Output Approach and the Process Approach, both discussed below. The Output Approach is the primary focus of this study.

OUTPUT APPROACH The Output Approach measures jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources, or are related to local food. It starts by identifying establishments that produce

green or local food goods or services (using NAICS industry codes) and then calculates green and local food jobs based on the proportion of revenue, represented by the intensity ratio, that the establishment derives from producing these green or local food goods or services.

Green jobs are determined by the sum of all jobs in NAICS sectors that have been identified as having some level of green product or service, multiplied by the industry's green intensity ratio, which ranges from 0 to 1.

Number of green jobs =

$$\sum_{(i=1)}^n (\# \text{ of jobs by NAICS } i \times \text{Green intensity ratio } i)$$

Local food jobs are determined in a similar manner, by taking the sum of all jobs in NAICS sectors that produce, process, trade, retail or serve some level of food that is produced and consumed within B.C., multiplied by the industry's local food intensity ratio, which ranges from 0 to 1.

Number of local food jobs =

$$\sum_{(i=1)}^n (\# \text{ of jobs by NAICS } i \times \text{Local Food intensity ratio } i)$$

PROCESS APPROACH The Process Approach measures jobs in which employees' duties involve making their establishment's production processes

more environmentally friendly or use fewer natural resources. These jobs may be in traditional sectors that are not commonly associated with green goods or services, but can still be considered as green jobs.

This approach has not been applied for this study due to the cost prohibitive nature of collecting the data. Therefore, green jobs with employers in more traditional sectors that are making environmentally sustainable improvements to their operations are excluded from our results. This means that almost certainly green jobs and green jobs growth are understated.

METRO VANCOUVER ESTIMATE

The Statistics Canada data used as secondary data in this study are available only at the Census Metropolitan Area (CMA) level, which merges the data from 21 Metro Vancouver municipalities, one regional district electoral area and 17 Indian Reserves. Data for the city of Vancouver alone are not available to the level of detail required. As a result, an appropriate proxy or estimate for the portion of Metro Vancouver jobs that are located in the city of Vancouver must be generated. As per Canada's Business Register, the proportion of Metro Vancouver business establishments that were located in the city of Vancouver in 2012 was 33.7 percent (see Table 9)⁴⁹, and this ratio is used as a starting estimate for city of Vancouver employment as a proportion of Metro Vancouver employment. This starting point has been further assessed

and revised for specific sectors that may have a higher or lower proportion of establishments in the city of Vancouver (e.g. there may be a higher number of architects offices choosing to locate downtown and a lower number of subcontractors and trades).

GROWTH RATES

In 2010 and 2011, the VEC forecast green and local food jobs growth to 2020 in order to develop the GCAP target of doubling the number of green and local food jobs. To update these forecasts for 2013, E+Y produced revised tables to compare recent growth rate projections from sources such as GLOBE Foundation, the B.C. Business Council and the Brookings Institution. These data were analyzed and tested for the local market. For example, Brookings Institution data for the growth in green architecture jobs are North America-wide, while in Vancouver this sector is expected to see faster growth due to greener building codes at both the provincial and municipal level.

Based on these projections, three growth scenarios are presented:

- The low growth scenario uses the most conservative growth rates
- The moderate growth scenario presents more optimistic growth rates
- The high growth scenario uses the most ambitious growth rates

Each sector highlight section includes an estimate of whether a low, moderate or a high growth scenario is expected for that sector.

⁴⁹ Statistics Canada Business Register Data for establishment location counts, December 2012. Available for access at <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=1105>

The study provides both aggregate growth rates over a period and the corresponding implied Compound Annual Growth Rate (CAGR).

CHANGES OVER 2010 BASELINE

Adjustments were made to the original 2010 baseline for several reasons:

- E+Y's recommendation to use a new data source (Statistics Canada's Labour Force Survey data, to replace the long form Census which was altered in 2011)

- Availability of more information to better estimate local intensity ratios
- Addition of several NAICS codes where green or local food jobs were identified but which were not included in the original model
- Adjustments made for businesses the VEC had been unable to contact or verify data with during the research period for the 2010 study

All changes are discussed in Appendix 2: Summary of changes to method and Appendix 3: Adjustments to 2010 baseline.

TABLE 9 CITY OF VANCOUVER JOBS AS A PERCENTAGE OF METRO VANCOUVER JOBS

STATISTICS CANADA BUSINESS REGISTER DEC 2012	LOCATION COUNTS (BY 2-DIGIT NAICS)
Vancouver CMA	204,902
Vancouver CSD	69,154
Proportion in City of Vancouver	33.7 percent



PROCESS APPROACH TO MEASURING GREEN JOBS

To fully capture all the Process Approach green jobs in Vancouver, all of the city's roughly 70,000 registered businesses would need to be surveyed to determine whether they are making environmentally sustainable improvements to their operations. This would ensure a highly accurate count of those green jobs, but is prohibitive in terms of both time and resources.

The VEC has a separate study under development to measure a business's level of engagement in greening its operations. Upon completion, that analysis will complement the green jobs figures in this study. As such, it is important to note that this limitation means the total green jobs reported in this study do not include these process-related green jobs.





4. CONCLUSION

The three scenarios presented show a 2010–2020 CAGR ranging from 4 percent (low growth) to 7.1 percent (high growth). As growth was 6.1 percent for 2010–2013, green and local food sectors would need to grow on average 7.7 percent each year from 2014 to 2020 in order to double by 2020. Expected growth comes in close, at 7 percent per year but only a high growth rate of 7.7 percent gets all the way to the target (see figure 2). Therefore, in order to meet the target a sustained and unprecedented effort needs to be made to create a positive climate for growth for green economy businesses, and address current and future green workforce development gaps.

For all sectors, initiatives proposed in the GCAP need to be fully realized if high growth is to materialize, including a kick start program for entrepreneurs, a green innovation fund, a demonstration platform for new technologies, and a green enterprise zone. For example, the VEC is a supporter of a \$10k City Innovation prize as part of the BC Innovation Council's New Ventures BC Competition and is committed to launching a \$1 million Innovation Fund with proposed matching funds.

Planning for a green enterprise zone and clean technology demonstration platform is well underway but significant resources will be required to deliver on these projects, from collaboration

with private sector businesses and landlords to capital investment in green infrastructure and remediation.

Early market engagement is another strategy that can be considered. For instance, a reverse trade show that provides green companies advance notice of the City's green projects in the pipeline would help to align companies' research and development with the City's long term needs.

Local food is likely to experience a high growth scenario, driven by demand from both the public and private sectors. This demand can be realized by facilitating even more access to local food, and supporting local production and processing sectors. The City's support for farmers markets and brewery tasting rooms are examples of facilitating growth in this sector.

In green buildings design and construction, growth that is being driven by green codes for new construction may at some point start to peak. Instead, growth will come from transformation of the retrofit market. In order to continue to see double digit growth in this sector, policies that support greener practices in renovations will go a long way. In fact, the City has already initiated steps to require energy efficiency upgrades for renovation projects.

Growth in clean technology is being driven by access to capital, opportunities



to demonstrate new technologies and prove out innovative concepts, and by an ability to grow market share with effective sales strategies. The VEC focuses much of its efforts in supporting entrepreneurs, whether to raise capital, provide showcase and testing opportunities, or to open up markets in Asia and elsewhere. Launching a Green Innovation Hub will be a significant stride towards creating permanent infrastructure to support growth in this sector.

In green transportation, the City of Vancouver continues to support car and bike sharing as well as electric vehicle infrastructure. However, funding for Translink and regional investment in public transit are the most critical elements that need to be resolved. This is needed not only to support growth in green jobs but also for the Metro Vancouver region to continue to thrive economically, remain competitive globally, and not succumb to congestion and gridlock.

With respect to sustainability education, Vancouver's post-secondary schools are already a magnet for students wishing to study in environment-related programs, and initiatives such as CityStudio are attracting international attention globally for their innovative approaches to education and the quality of their action-based research. Solutions that make life in Vancouver

an attractive choice for young people are necessary to retain this talent, green or otherwise. Affordable housing, internship opportunities, job fairs and career opportunities are all critical to keeping human capital in Vancouver.

Technology and innovation as well as progressive policies and regulations are driving growth in the materials and recycling sectors. While Zero Waste goals and landfill bans on wood waste and organics come into effect, companies are racing to find solutions that turn the previously considered waste streams into valuable resources and cashflow. The level of experimentation and development required to find effective solutions will require new approaches to reviewing bylaws and permits that can allow innovation in what has traditionally been a dirty, slow-to-change industry.

With these sustained efforts across Vancouver's green sectors from government, academia and the business community, Vancouver can create a positive climate for growth for green economy businesses and realize the Greenest City vision—securing Vancouver's international reputation as a mecca of green enterprise.

APPENDIX

1. INPUTS AND ASSUMPTIONS

TABLE 10: SUMMARY OF INPUTS, DATA SOURCES AND ASSUMPTIONS

Data point	Source	Calculation	Notes
Green building design and construction jobs	Statistics Canada, Labour Force Survey Data by North American Industry Classification System (NAICS) Canada 2012 is used to identify industries that produce green goods and services.	$\sum_{i=1}^n (\# \text{ of jobs by NAICS } i \times \text{Green intensity ratio } i)$	NAICS codes used: 5413 Architectural, Engineering, and Related Services 541310 - Architectural services 541320 - Landscape architectural services 541330 - Engineering services 541340 - Drafting services 541350 - Building inspection services 541360 - Geophysical surveying and mapping services 541370 - Other surveying and mapping services 541380 - Testing laboratories 2361 - Residential Building Construction 2362 - Nonresidential Building Construction 2371 - Utility System Construction 2372 - Land Subdivision 2379 - Other Heavy and Civil Engineering Construction 2381 - Foundation, Structure, and Building Exterior Contractors 2382 - Building Equipment Contractors 2383 - Building Finishing Contractors 2389 - Other Specialty Trade Contractors
Local food jobs	Statistics Canada, Labour Force Survey Data by North American Industry Classification System (NAICS) Canada 2012 is used to identify industries that produce local food goods and services.	$\sum_{i=1}^n (\# \text{ of jobs by NAICS } i \times \text{Local food intensity ratio } i)$	NAICS codes used: 1111-Oilseed & Grain Farming 1112-Vegetable & Melon Farming 1113-Fruit & Tree Nut Farming 1114-Greenhouse, Nursery & Floriculture Prod. 1119-Other Crop Farming 1121-Cattle Ranching & Farming 1122-Hog & Pig Farming 1123-Poultry & Egg Prod. 1124-Sheep & Goat Farming 1125-Aquaculture 1129-Other Animal Prod. 1132-Forest Nurseries & Gathering of Forest Prod. 1141-Fishing 1142-Hunting & Trapping 1151-Support Activities for Crop Prod. 1152-Support Activities for Animal Prod. 3111-Animal Food Manufactures 3112-Grain & Oilseed Milling 3113-Sugar & Confectionery Prod. Manuf.

Data point	Source	Calculation	Notes
			3114-Fruit & Vegetable Preserving & Specialty Food Manuf. 3115-Dairy Prod. Manuf. 3116-Meat Prod. Manuf. 3117-Seafood Prod. Preparation & Packaging 3118-Bakeries & Tortilla Manuf. 3119-Other Food Manuf. 3121-Beverage Manuf. 3253-Pesticide, Fertilizer & Other Agric. Chem Manuf. 4111-Farm Prod. Whol-Distr. 4131-Food Whol-Distr. 4132-Beverage Whol-Distr. 4171-Farm, Lawn & Garden Mach. & Equip. Whol-Distr. 4183-Agric. Supplies Whol-Distr. 4191-Wholesale Electronic Markets, and Agents and Brokers 4442-Lawn & Garden Equip. & Supplies Stores 4451-Grocery Stores 4452-Specialty Food Stores 4453-Beer, Wine & Liquor Stores 4543-Direct Selling Establishments 7211-Traveller Accommodation 7221-Full-Service Restaurants 7222-Limited-Service Eating Places 7223-Special Food Serv. 7224-Drinking Places (Alcoholic Beverages) 4841-General Freight Trucking 4842-Specialized Freight Trucking 4931-Warehousing & Storage 6111-Elementary & Secondary Schools 6112-Community Colleges & C.E.G.E.P.s 6113-Universities 6115-Technical & Trade Schools 6242-Community Food & Housing, & Emergency Serv. 8132-Grant-Making & Giving Serv. 8133-Social Advocacy Organizations 8134-Civic & Social Organizations 8139-Business, Profess., Labour & Other Membership Org. 5221-Depository Credit Intermediation 5223-Activities Related to Credit Intermediation 5231-Securities & Commodity Contracts 5232-Securities & Commodity Exchanges 5242-Agencies, Brokerages & Other Ins. Related Act. 5411-Legal Serv. 5412-Accounting, Tax Prep, Bookkeeping & Payroll Serv. 5418-Advertising, Public Relations, and Related Services 5419-Other Professional, Scientific &

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Data point	Source	Calculation	Notes
			Technical Serv. 5622-Waste Treatment & Disposal
Green jobs for all other sectors	Mustel Group, telephone survey of 400+ Vancouver businesses 2013	n/a	
Green intensity ratios	U.S. Bureau of Labor Statistics, Green Goods and Services Program 2011 that survey includes approximately 120,000 business and government establishments within 333 industries	BLS data revised based on interviews with local subject matter experts	Vancouver should have a much higher ratio than BLS data, which is a U.S. national average because B.C. and Vancouver have very green building codes, greener than more than 50 percent of regions in the U.S. (comparable places to Vancouver could be California, Washington state, New York and Oregon). Vancouver is the only region outside Europe that evaluates and has regulations for energy usage intensity per square meter Intensity ratios may also be different depending on building type, though this was difficult to incorporate into the model. According to a subject matter expert: - Institutional construction is very green (80 percent), because of public mandate for green buildings - Commercial construction is less than half green (40 percent), - Residential construction is the least green (1-2 percent); Vancouver homes are much less energy efficient when compared with Europe As residential construction is about 60 percent of total construction, it reduces the overall green results for the industry as a whole
Local food intensity ratios	Vancouver Economic Commission Local Food Jobs study 2011 (collected via extensive telephone survey)	The VEC data revised based on interviews with local subject matter experts	
Employment in City of Vancouver (CSD) as proportion of Metro Vancouver (CMA) data	Statistics Canada Business Register, Location counts by 2-digit NAICS for Vancouver Census Metropolitan Area (CMA) and Census Subdivision (CSD) 2012	Proportion in City of Vancouver = (# CSD)/(# CMA) Revised based on interviews with local subject matter experts	Fewer builders are in city of Vancouver than the Vancouver CMA (should be <25 percent) because they need inexpensive land to store material and equipment For architects, more of them are in Vancouver because they need convenient locations for clients to access (should be >33.3 percent) For clean technology or manufacturing and production companies, subject matter experts suggested that head offices may be located outside of the city of Vancouver, where the land costs are cheaper
Green jobs and local food jobs growth rates	Brookings annual growth rate (2003-10) for Green Architecture & Construction and for All Green Jobs.	Data evaluated and revised for local market conditions. For example, subject matter experts suggested:	Created three scenarios based on range of growth rates expected by sector experts.

Data point	Source	Calculation	Notes
	GLOBE Foundation annual growth rate (2008-2020) for British Columbia green jobs. B.C. Stats forecast of 2013 and 2014 British Columbia annual employment growth. British Columbia Business Council (2012) Construction Sector Council (2010) Vancouver Farmers Market growth rates 2013 Data from local subject matter experts	- growth in green building would be about 2-5 percent per annum from now until 2020 - growth in the environmental remediation and water treatment sectors would stay relatively constant - waste has the potential to move more towards recycling - renewable energy production will be growing at a slower speed than the past 5 years energy efficiency will grow at a higher speed	
Number of jobs in city of Vancouver 2010 and 2013 with projections to 2020	City of Vancouver Planning Department Metro Vancouver Regional Context Statement	Data comes from Census 2011, adjusted to include UBC and to compensate for a census undercount effect	

APPENDIX

2. SUMMARY OF CHANGES TO METHOD

TABLE 11: CHANGES TO OVERALL METHOD

Area	2010/2011	2013	Impact
Primary data collection	Primary data on green employment numbers was collected via a telephone survey of businesses known to produce a green product or service. The survey was administered in house using a database compiled by the VEC.	The telephone survey was conducted by market research specialists Mustel Group to ensure appropriate documentation and recording of interview scripts. The database was compiled by E+Y. NB: E+Y suggested in their review of the methodology that future studies include a survey in written form (web, fax or mail) as a supplement to the telephone survey.	Improved documentation of methodology and process
Secondary data collection	NAICS data from Statistics Canada 2006 Census was used to augment and validate the primary data. An intensity ratio was constructed through interviews with industry experts and applied to the NAICS Census data. NAICs codes were selected based on the potential of businesses in that industry to have a green product or service. This secondary data was compared and contrasted with primary data collected from telephone interviews to validate the approach (the resulting figures for green jobs were +/- 10 percent of each other).	NAICS data from Statistics Canada Labour Force Survey 2010-2013 has been used to augment the primary data for the Local Food and Building and Construction sectors only. These sectors are identified as part of the green economy, but have a large number of individual businesses, making it cost prohibitive to conduct a telephone interview of the entire sector.	Reliance on primary data where possible, secondary data used only to augment missing data
Intensity ratios	Adopted and only minimally revised green intensity ratios from the 2010 GLOBE Foundation study for 61 unique NAICS codes. The VEC conducted telephone surveys to establish intensity ratios for local food.	The GLOBE Foundation ratios had been developed to be applied to revenues rather than jobs data. For the 2013 study, the VEC adopted and revised green intensity ratios from the U.S. Bureau of Labor Statistics (BLS) Green Goods and Services program instead. This data was developed from a survey of approximately 120,000 business and government establishments within 333 industries. Ratios were then revised for the local market based on interviews with local subject matter experts.	Updated intensity ratios reflective of the nature of industry in 2013 and local Vancouver industry characteristics

Area	2010/2011	2013	Impact
		2011 local food intensity ratios were tested and updated for 2013.	
External studies	Compared results with GLOBE Foundation's report 'B.C.'s Green Economy' published in February 2010 (which also uses the output approach).	No external provincial or regional study was available to validity check the results in 2013.	Unable to conduct external validity check against other data sources
Process approach vs. Output approach	Attempted to capture the number of Process jobs by conducting telephone interviews with businesses where it was easy to identify the presence of a large sustainability department.	Focused on Output approach only, as combining Process and Output approaches is considered to create a potential for double counting.	May underestimate green jobs as Process jobs are not included in the method.
Growth rates	Used job growth assumptions of mid-to-high single digits mostly (4-7%) based on interviews with industry experts.	Used growth assumptions based on tables compiled by E+Y comparing projections from sources such as GLOBE Foundation and Brookings Institute. Tested and revised for the local market through interviews with industry experts. Created a low, moderate and high growth scenario based on the range of expert opinion.	Changes in projections to 2020
Nomenclature		The waste management sector was renamed to materials management and recycling to better reflect the notion that waste should be seen as an asset to be utilized rather than a material to be disposed of.	Change of sector title

APPENDIX

3. ADJUSTMENTS TO 2010 BASELINE

Adjustments were made to the original 2010 baseline for several reasons:

- E+Y's recommendation to use a new data source (Statistics Canada Labour Force Survey data to replace the Long Form census which was altered in 2011)
- Availability of more information to better estimate local intensity ratios
- Addition of several NAICS codes where green or local food jobs were identified but which were not included in the original model
- Adjustments made for businesses the VEC had been unable to contact or verify data with during the research period for the 2010 study.

TABLE 12: ADJUSTMENTS TO 2010 BASELINE

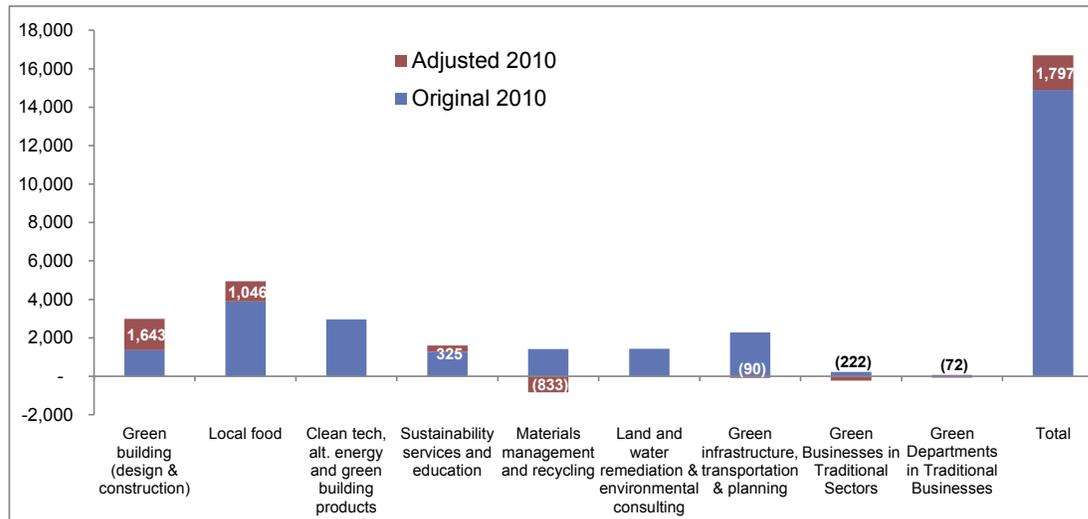
Adjustment	2010	2013	Impact
Green building design and construction			
Definition	Used eleven 6-digit NAICS codes for construction green jobs, influenced by a similar study conducted by the GLOBE Foundation in 2010 (all eleven 6-digit NAICS codes the VEC used were also found in the GLOBE Foundation study).	Added six new 4-digit NAICS codes including ones with large number of jobs such as Building Equipment Contractors and Building Finishing Contractors. NAICS codes were added because the U.S. Bureau of Labor Statistics (BLS) Green Goods and Services (GSS) study identified 333 industries with the potential to have a green product or service, including the additional codes.	+960 jobs
Statistics Canada data	Used Statistics Canada Census 2006 data. Census data is more granular, (going to the 6-digit NAICS codes level), but is less timely (updated every five years).	Statistics Canada ended the mandatory Long Form Census, making it less accurate to evaluate trends using Census data. E+Y recommended adopting Statistics Canada annual Labour Force Survey data (LFS). LFS estimates are published monthly, though only 4-digit NAICS codes are available and data is less accurate due to a smaller sample size than used with the Census.	+352 jobs
Intensity ratios	Green intensity ratios were developed using 2010 GLOBE Foundation study as basis.	New green intensity ratios were developed using a wider variety of data that has been published since 2010. This included backdated data from the U.S. Bureau of Labor Statistics (BLS) Green Goods and	+258 jobs

Adjustment	2010	2013	Impact
		Services program.	
Jobs in Vancouver as percentage of Vancouver Census Metropolitan Area	<p>Statistics Canada data that has been used is at the Census Metropolitan Area (CMA) level. For Vancouver CMA this includes 21 Metro Vancouver municipalities, one regional district electoral area and 17 Indian Reserves.</p> <p>Used Canada Business Register data to calculate percentage of Metro Vancouver business establishments that were located in the city of Vancouver. Used this as a proxy to estimate city of Vancouver portion of Metro Vancouver employment (at 33.7 percent).</p>	<p>Expert interviews determined that percentage of establishments in city of Vancouver could be higher or lower than 33.7 percent for specific NAICS codes.</p> <p>For example, construction jobs can be classified into professional jobs such as architects and engineers or manual jobs, for example, electricians.</p> <p>The city of Vancouver can expect to see a higher concentration for professionals, who tend to work for firms located downtown. As a result, the ratio for professional jobs is increased to 40 percent.</p> <p>For manual labor the ratio is revised to 25 percent, because construction firms need inexpensive land to store equipment and materials and tend to be outside the city of Vancouver.</p>	-108 jobs
Residual effect		As a result of changes to multiple inputs into the model, there is a residual effect	+210 jobs
Local food			
Statistics Canada data	<p>Used Statistics Canada Census 2006 data.</p> <p>Census data is more granular, (going to the 6-digit NAICS codes level), but is less timely (updated every five years).</p>	<p>Statistics Canada ended the mandatory Long Form Census, making it less accurate to evaluate trends using Census data.</p> <p>E+Y recommended adopting Statistics Canada annual Labour Force Survey data (LFS). LFS estimates are published monthly, though only 4-digit NAICS codes are available and data is less accurate due to a smaller sample size than used with the Census.</p>	-
Intensity ratios	Local food intensity ratios were developed using telephone survey of local food businesses	New local food intensity ratios were developed using a wide variety of data that has come to light for this sector since 2010.	-
Residual effect		As a result of changes to multiple inputs into the model, there is a residual effect	-
Total local food			+1,046 jobs

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Adjustment	2010	2013	Impact
adjustment			
Green infrastructure, transportation and planning			
Reclassification	Greyhound and Greyline intercity travel included in the survey	Greyhound and Greyline removed from definition of green jobs	-90 jobs
Sustainability services and education			
Availability of new data	Department of Fisheries and Oceans could not be reached.	New data available for Department of Fisheries and Oceans number of jobs in 2010	+325 jobs
Materials management and recycling			
Availability of new data	Addition of Statistics Canada Census 2006 data for Waste Management NAICS Inclusion of jobs with Encorp Pacific	Census data included jobs in landfill and incineration so were removed. Encorp Pacific located in Burnaby, so removed.	-833 jobs
Green jobs in traditional sectors			
Refinement of Output vs. Process approach	Telephone survey included calling businesses in traditional sectors (e.g. mining, forestry, financial services) to determine any jobs in sustainability	These jobs now categorized as Process approach jobs, to be measured using alternative approach so removed.	-294 jobs
TOTAL CHANGE TO 2010 BASELINE			+1,797 update
PERCENTAGE CHANGE			+12 percent

FIGURE 5: COMPARISON OF ORIGINAL AND ADJUSTED 2010 BASELINE



APPENDIX

4. GREEN AND LOCAL FOOD JOBS DATA

Notes: Data in red is interpolated data for years 2011 and 2012.

Data in italics is a projection.

TABLE 13: GREEN AND LOCAL FOOD JOBS 2010-2013 AND LOW GROWTH PROJECTIONS 2014-2020

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Green building (design & construction)	2,996	3,400	3,900	4,480	4,585	4,693	4,804	4,917	5,034	5,153	5,275
Local food	4,946	5,200	5,600	5,987	6,167	6,352	6,542	6,739	6,941	7,149	7,364
Clean tech, alt. energy and green building products	2,956	3,050	3,100	3,187	3,283	3,381	3,483	3,587	3,695	3,805	3,920
Sustainability services and education	1,600	1,625	1,650	1,701	1,735	1,770	1,805	1,841	1,878	1,916	1,954
Materials management and recycling	577	580	590	593	605	617	629	642	655	668	681
Land and water remediation & environmental consulting	1,437	1,390	1,375	1,378	1,392	1,406	1,420	1,434	1,448	1,463	1,477
Green infrastructure, transportation & planning	2,194	2,300	2,500	2,603	2,681	2,762	2,844	2,930	3,018	3,108	3,201
Total	16,706	17,545	18,715	19,929	20,447	20,980	21,527	22,090	22,668	23,261	23,872

TABLE 14: GREEN AND LOCAL FOOD JOBS 2010-2013 AND MODERATE GROWTH PROJECTIONS 2014-2020

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Green building (design & construction)	2,996	3,400	3,900	4,480	4,719	4,972	5,239	5,520	5,816	6,128	6,457
Local food	4,946	5,200	5,600	5,987	6,674	7,158	7,683	8,251	8,866	9,533	10,257
Clean tech, alt. energy and green building products	2,956	3,050	3,100	3,187	3,346	3,514	3,689	3,874	4,068	4,271	4,484
Sustainability services and education	1,600	1,625	1,650	1,701	1,769	1,840	1,913	1,990	2,070	2,152	2,238
Materials management and recycling	577	580	590	593	617	641	667	694	721	750	780
Land and water remediation & environmental consulting	1,437	1,390	1,375	1,378	1,412	1,448	1,484	1,521	1,559	1,598	1,638
Green infrastructure, transportation & planning	2,194	2,300	2,500	2,603	2,733	2,870	3,013	3,164	3,322	3,488	3,663
Total	16,706	17,545	18,715	19,929	21,271	22,443	23,688	25,013	26,422	27,921	29,517

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TABLE 15: GREEN AND LOCAL FOOD JOBS 2010-2013 AND HIGH GROWTH SCENARIO PROJECTIONS 2014-2020

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Green building (design & construction)	2,996	3,400	3,900	4,480	4,809	5,163	5,543	5,951	6,389	6,860	7,365
Local food	4,946	5,200	5,600	5,987	6,536	7,141	7,805	8,537	9,343	10,231	11,209
Clean tech, alt. energy and green building products	2,956	3,050	3,100	3,187	3,410	3,649	3,904	4,178	4,470	4,783	5,118
Sustainability services and education	1,600	1,625	1,650	1,701	1,820	1,947	2,084	2,230	2,386	2,553	2,731
Materials management and recycling	577	580	590	593	629	666	706	749	794	841	892
Land and water remediation & environmental consulting	1,437	1,390	1,375	1,378	1,433	1,490	1,550	1,612	1,677	1,744	1,813
Green infrastructure, transportation & planning	2,194	2,300	2,500	2,603	2,785	2,980	3,189	3,412	3,651	3,906	4,180
Total	16,706	17,545	18,715	19,929	21,423	23,037	24,781	26,668	28,708	30,917	30,388

TABLE 16: GREEN AND LOCAL FOOD JOBS 2010-2013 AND EXPECTED SCENARIO PROJECTIONS 2014-2020

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Green building (design & construction)	2,996	3,400	3,900	4,480	4,809	5,163	5,543	5,951	6,389	6,860	7,365
Local food	4,946	5,200	5,600	5,987	6,536	7,141	7,805	8,537	9,343	10,231	11,209
Clean tech, alt. energy and green building products	2,956	3,050	3,100	3,187	3,410	3,649	3,904	4,178	4,470	4,783	5,118
Sustainability services and education	1,600	1,625	1,650	1,701	1,769	1,840	1,913	1,990	2,070	2,152	2,238
Materials management and recycling	577	580	590	593	629	666	706	749	794	841	892
Land and water remediation & environmental consulting	1,437	1,390	1,375	1,378	1,392	1,406	1,420	1,434	1,448	1,463	1,477
Green infrastructure, transportation & planning	2,194	2,300	2,500	2,603	2,733	2,870	3,013	3,164	3,322	3,488	3,663
Total	16,706	17,545	18,715	19,929	21,278	22,734	24,305	26,002	27,835	29,818	31,962

APPENDIX

5. LIMITATIONS OF STUDY DATA

TABLE 17: LIMITATIONS OF STUDY DATA

Area	Limitation	Impact
Source data for green building design and construction jobs + local food jobs	The source data is the Statistics Canada Labour Force Survey, which is only available at the Metro Vancouver level and has a sample size of 53,000 households across Canada.	Study is forced to use an estimate of city of Vancouver as proportion of Metro Vancouver jobs which is an approximation. Due to the small sample size, data for some NAICS codes is suppressed and these sectors are not included in the study.
Source data for all other sectors	The source data for all other sectors is the Mustel Group survey of 400+ businesses. It was not possible to get a response from every business on the list during the study period. The list was compiled from a number of sources in order to best capture all businesses with a green product or service in Vancouver. However some businesses may not have been included in the list if they were not listed on other databases or were newly incorporated. Some organizations reported having green jobs in departments that were not easily identified as having a green product or service. For example, universities may have researchers working on green solutions in faculties such as Medicine or Law that were not captured by the study.	Jobs at some businesses may not have been included if Mustel Group was not able to identify or contact the business during the study period.
Number of jobs in city of Vancouver	The City of Vancouver Planning Department estimates jobs in the city for the purposes of the Regional Context Statement. Data comes from Statistics Canada Census which is then adjusted to compensate for the census undercount effect and to include UBC.	Number for Vancouver jobs is an approximation.
Intensity ratios	These are developed using the best available data and industry analysis.	Numbers for intensity ratios are an approximation.
Process approach jobs	The study captures only jobs at establishments that produce green or local food goods or services (output approach). A job with a business that is responsible for greening business operations is not included (process approach), though the VEC is developing a method to measure these businesses in the future.	The study provides a conservative estimate of green and local food jobs as process approach jobs are not included.



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