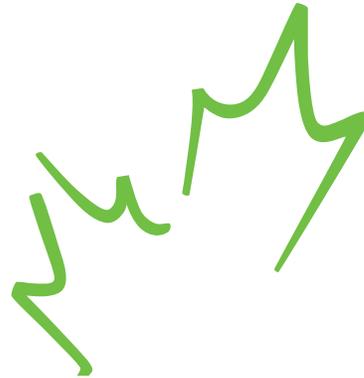


LABOUR MARKET INFORMATION

# Cleantech Defined: A Scoping Study of the Sector and its Workforce

February 2020



## About ECO Canada

ECO Canada is the steward for the Canadian environmental workforce across all industries. From job creation and wage funding, to training and labour market research – we champion the end-to-end career of an environmental professional. For over 25 years, we have forged academic partnerships, tools, and research not only to train and certify environmental job seekers, but also to help address labour and skill shortages.

Our efforts promote and drive responsible, sustainable, economic growth to ensure that environmental care and best practice is a priority.

## Environmental Labour Market Intelligence

ECO Canada investigates current environmental skills and labour trends to improve industry access and career advancement opportunities for new graduates as well as mid- to senior-level practitioners. ECO Canada’s research provides timely and valuable insights on green career trends, from top jobs to skills gaps to high-growth sectors. Our data and findings can be used to make decisions and formulate strategy within policy, business, education, and career development contexts.

ECO Canada is examining new ways of measuring environmental employment:

- Analysing job postings to identify hiring trends and skills in demand.
- Estimating labour demand and supply using secondary statistics, such as employment data from Statistics Canada. Economic drivers are also factored in to create a demand forecast for environmental employment.
- Profiling the environmental sector with in-depth research on trends and issues driving growth or decline within key environmental sub-sectors.

The complete report collection is available at [eco.ca/research](https://eco.ca/research). ECO Canada welcomes comments and discussion of all its labour market information. Contact [research@eco.ca](mailto:research@eco.ca).

## Acknowledgements

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- Statistics Canada
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- Innovation, Science and Economic Development Canada (ISED)
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- North Forge Technology Exchange
- Prairie Biosciences Canada
- CanSustain Management Solutions
- Pangaea Ventures Ltd.
- 81 Cleantech Employers (to maintain confidentiality, organization and individual names have not been disclosed)

We would also like to thank those who have provided ongoing advice and feedback regarding our Labour Market Information (LMI) through ECO Canada's LMI National Advisory Committee, which includes individuals from the following organizations:

- Bow Valley College
- Environmental Services Association of Alberta
- Environmental Services Association Maritimes
- EnviroSearch Ltd.
- General Motors
- Government of New Brunswick
- Government of Saskatchewan
- Indigenous Works
- Labour Market Information Council
- Ken Banister and Associates
- North Shore Environmental Consultants
- Royal Roads University
- Ryerson University
- SAIT Polytechnic
- Stantec
- Stratos
- Tait Human Capital

Last but not least, ECO Canada expresses its gratitude to MDB Insight for undertaking this research and developing this report.

# Disclaimer

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The opinions and interpretations in this publication are the author’s and do not necessarily reflect those held by the Government of Canada.

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## Executive Summary

Interest and investment in the clean technology (cleantech) sector have been growing. While opportunities exist in Canada's market, these are smaller in comparison to the sizable opportunities presented at an international level. The global export market for cleantech products and services amounted to \$1.150 trillion in 2015, up 76% from \$880 billion in 2008. Canada only ranked 16th globally, contributing 1.43% of the total market share in 2015.

Canada has the potential to become a market leader with the talent, educational facilities, government support, and major resource-related projects across the country. Investments in clean technology are part of the federal government's *Innovation and Skills Plan*; a multi-year strategy to build Canada as a world-leading innovation economy to create jobs and grow the middle class. The government's *Budget 2017* included more than \$2.3 billion to boost growth in Canada's cleantech space.

Ensuring an adequate supply of skilled workers is crucial to supporting the sector's growth. However, making sense of the cleantech sector's workforce requirements has been a challenge due to varied sectoral definitions in use across North America.

In response to growing interest in this sector and its workforce, ECO Canada commissioned research to:

- establish and validate a definitional framework for cleantech,
- gather relevant data and insights such as in-demand occupations, and
- identify key trends, challenges, and opportunities facing the sector and its workforce.



"Canada has what it takes to capture a big slice of the global clean innovation opportunity, but right now we're falling short. We're great at generating ideas and developing them into promising technologies. But we're behind other countries in getting those ideas to market. That means we're missing out on the jobs, business opportunities and wealth that we could be generating."

An excerpt from *The Innovation and Competitiveness Imperative: Seizing Opportunities for Growth (Report of Canada's Economic Strategy Tables: Clean Technology)*

## Cleantech, the Sector, and its Workforce Defined

Clean technology, also referred to as cleantech, is any technological process, product, or service that:

- 1) provides superior performance or lower costs than the current norm or standards,
- 2) minimizes negative environmental impacts, and
- 3) makes more efficient and responsible use of natural resources.

In other words, it is any technology that uses less material or energy, generates less waste, and causes less negative environmental impacts than the industry standard.

**The cleantech economy** includes any private or public sector organization that provides, advances, or invests in clean technologies. This broad and inclusive sector definition practically spans all industries in Canada including environmental goods and services firms, natural resource firms, not-for-profit organizations, and governments.

**The cleantech workforce** is comprised of workers that require sector-specific knowledge, skills, or training (e.g., a cleantech specialist), as well as those who may not be required to possess these, but are nevertheless an integral part of cleantech business and operational activities (e.g., an accountant working in a pure play cleantech company).



## Snapshot of Cleantech in Canada: Key Findings

Using the vetted cleantech definition and framework, 81 cleantech employers were surveyed in mid-2019. Analysis of employer responses provides several key insights including:

- **Cleantech employers come from a variety of industries.**



Natural resources



Utilities



Construction



Manufacturing



Professional, scientific and technical services



Waste management and remediation services



Educational services



Public Administration



Other sectors.

- **Support services (e.g., research and development), energy efficiency and green building materials, and waste reduction and lifecycle management represent the top cleantech market segments.**
- **Companies also come in all sizes.**
  - 51% had 1 to 100 employees
  - 14% had 600+ employees
- **Increased local demand, greater corporate environmental commitment, and overall market growth are driving cleantech revenue amongst businesses surveyed.**
  - 4% of respondents indicated that half to all their annual revenues were attributed to cleantech.
- **30% of employers indicated that half to all their workers were tied to cleantech.**
- **Cleantech employment is expected to rise in the next two years.**
  - Almost half of respondents plan to hire cleantech positions in the next 24 months, for a combined total of over 1,800 new jobs.
- **Employers are currently struggling to fill a number of cleantech positions.**
  - Engineers, drafters, designers and technicians
  - Geologists, laboratory specialists, environmental technicians, scientists
  - Project managers, directors
  - Trades (Welders, electricians, mechanics, and others)
  - Drivers, machine operators

## Implications of this Report

Canada has an opportunity to capture a large slice of the cleantech market, and increase presence and economic contributions globally. Canadians are good at generating ideas and developing them into promising technologies, but are behind other countries when it comes to getting those ideas to market. Jobs, business expansion, and wealth are opportunities that have not been fully realized in Canada.

While private and public sector investments and programs are in place to accelerate clean innovation, revenues, and jobs, survey results indicate the sector's already facing workforce needs and challenges. Some employers are implementing strategies to address labour shortages, however broader workforce solutions are needed. **Industry, government, and academia will need to work together to address these challenges and ensure a talent pipeline for this growing sector.**

This report also highlights the need for reliable sectoral data and lays the groundwork for an enhanced understanding of the cleantech sector. ECO Canada hopes to conduct a larger survey of employers in the future to produce estimates of cleantech employment and jobs and identify viable solutions.



## Introduction

The cleantech sector has been tracked globally for approximately 15 years, but it is only within the last few years that government, academia, and not-for-profit organizations have begun earnest assessments of market and industry trends. While the sector's performance has been facing economic disruption and technological shifts, it has experienced higher growth when compared to more traditional industries.

Cleantech has been inconsistently defined both in Canada and abroad thereby causing challenges for bodies organizing sectoral data. The term "cleantech" continues to find its way into the common parlance of multiple sectors, which emphasizes the need to standardize its definition and spread knowledge of the sector.

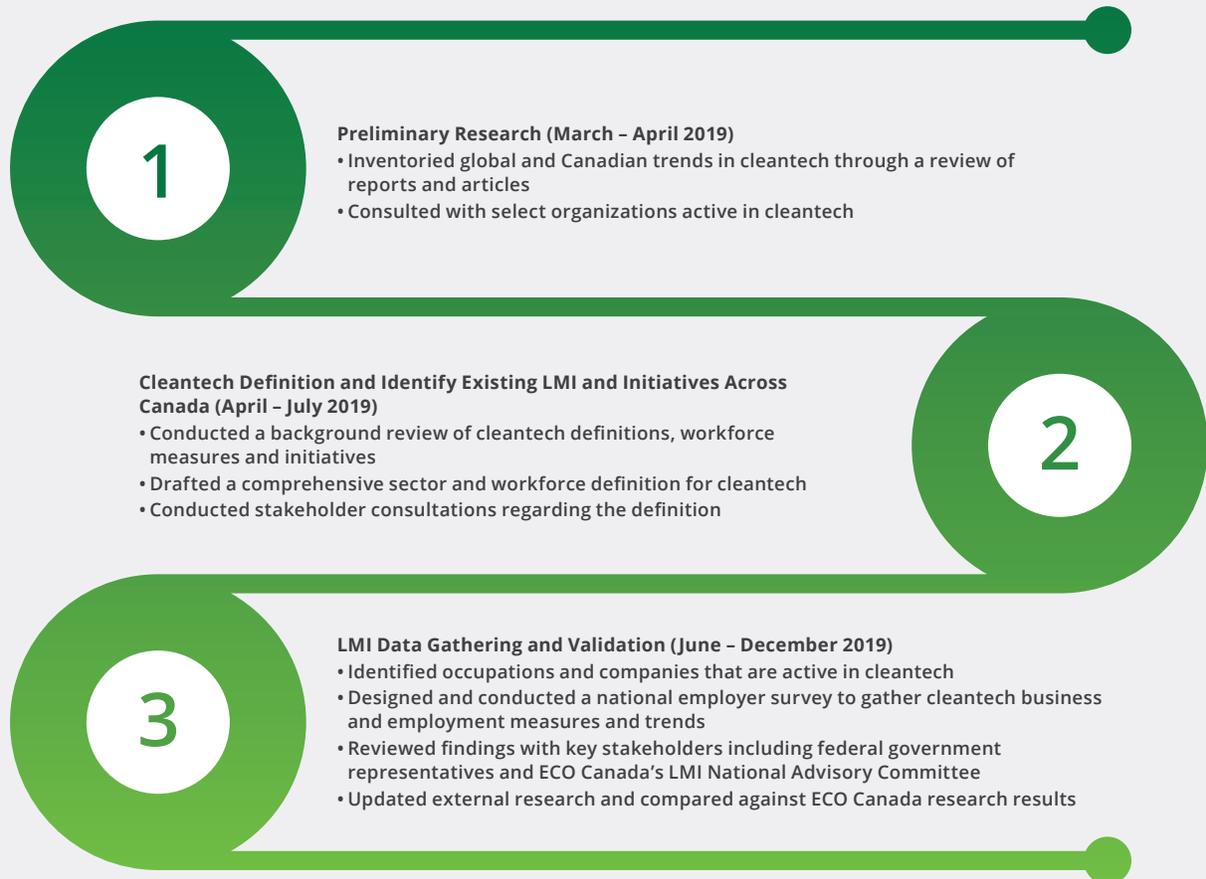
ECO Canada engaged MDB Insight to develop an overview of Canada's cleantech sector with a mutual goal of presenting a clear definition for cleantech and providing a snapshot of the sector's workforce as well as its hiring needs and challenges.



## Scope and Methodology

An overview of project timelines and research methodology is outlined in Figure 1.

**Figure 1: Research Methodology and Timelines**



This report includes:

- Global and Canadian trends in cleantech activity
- ECO Canada's definitional framework for cleantech, the sector, and its workforce
- Business and HR insights from a survey of 81 businesses that are active in cleantech
- Key considerations to address labour market opportunities and challenges for the sector

This report provides a usable definition for cleantech and presents stakeholder-validated outputs, outcomes, industries, companies, and workers that represent its economy. Insights gleaned from the research will inform the development of key workforce solutions for the growing cleantech sector through collaborative and strategic partnerships.

## Global and Canadian Trends in Cleantech

Analysis of key trends in the sector, nationally and internationally, are presented in this section. It should be noted that any external cleantech data and trends referenced in this section and in Appendices A to C should be evaluated in the context of the author’s definitional framework and methodology utilized for the sector.

### Business and Market Trends

Clean innovation is projected to be worth \$2.5 trillion by 2022, providing economic opportunity not just for the cleantech sector, but for Canada’s natural resources, energy, manufacturing, and agriculture sectors.

*Smart Prosperity Leaders’ Initiative (2018)*

The global export market in cleantech grew from \$880 billion in 2008 to \$1.150 trillion in 2015. Canada placed 16th consistently in terms of market share — at 1.62% in 2008 and slightly lower at 1.43% in 2015.<sup>1</sup>

There are opportunities abound for Canadian cleantech companies to grow and diversify their export markets. The U.S. is the primary customer of Canada’s cleantech exports, presenting a significant risk. Countries with intensive environmental regulations, ambitious climate commitments, and strong domestic demand, are increasingly open markets, while growing economies such as China and India are emerging as potentially export markets.<sup>2</sup>

“Overall, the challenges that cleantech companies face in their scaling journey may seem numerous, yet there are also significant opportunities and rewards for companies, investors, the economy, and the world associated with scaling and growing Canadian cleantech firms into global companies.”

*Flowing Investment to Scale Clean Technology*  
(2019). Globe Capital and Delphi Group.

#### Industries with relatively high rates of cleantech use within Canada (2015 to 2017)<sup>3</sup>



Pipeline transportation  
**38%**



Rail and water transportation  
**22%**



Utilities  
**36%**

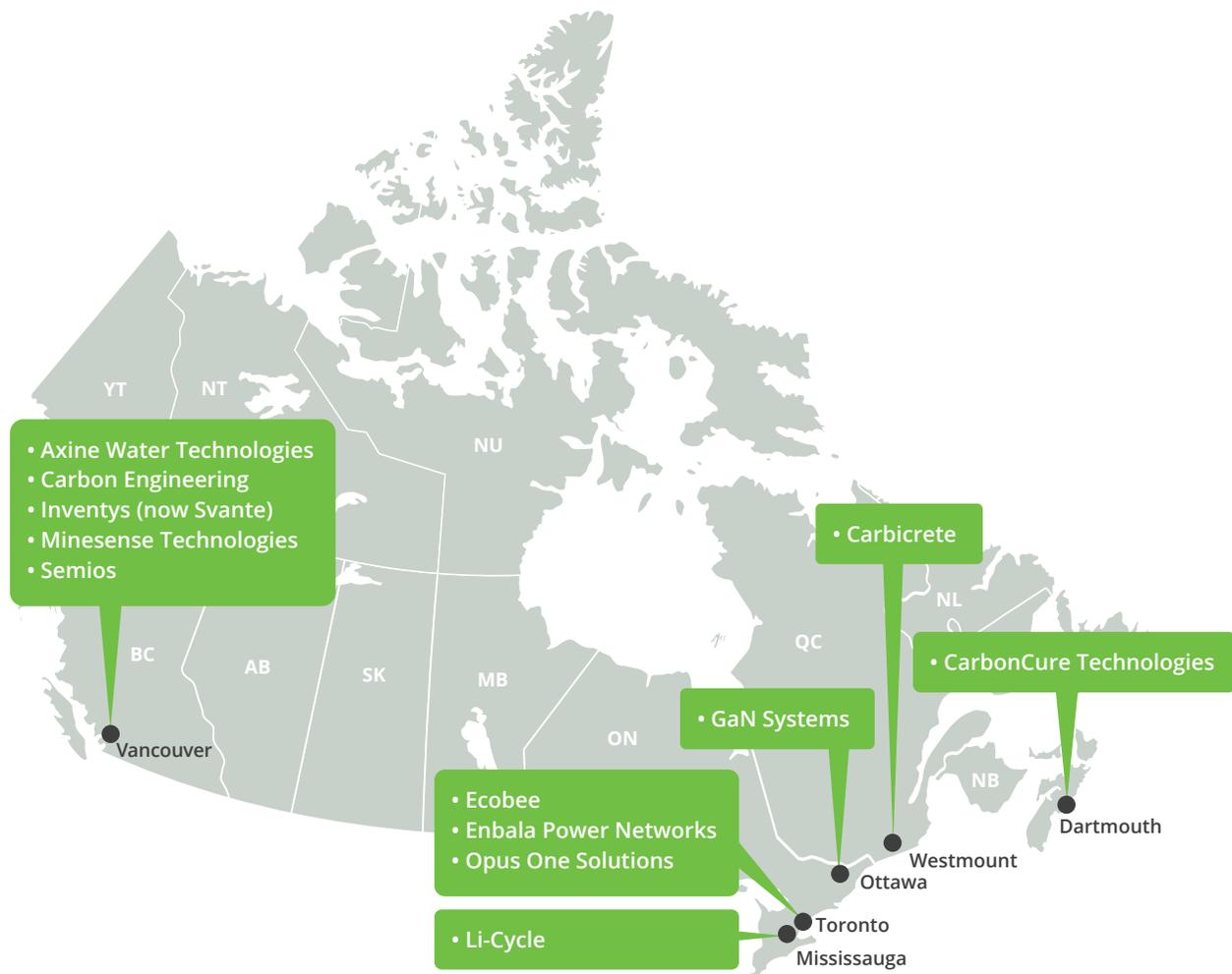


Oil and gas extraction  
**20%**

Market opportunities also exist within Canada. On average, 1 in 10 enterprises used cleantech goods and services from 2015 to 2017. While enterprises were generally less likely to use cleantech than other types of advanced technologies, a few industries such as Pipeline transportation (38%), Utilities (36%), Rail and water transportation (22%), and Oil and gas extraction (20%) reported relatively high rates of cleantech use.<sup>3</sup>

Cleantech was primarily used for environmental protection (90%), sustainable resource management (76%), and adapting goods (59%). Construction reported the highest rate in cleantech use for environmental protection (98%), while utilities primarily used cleantech to manage sustainable resources (90%).<sup>4</sup>

An estimated 850 cleantech developers and producers existed in Canada in 2015. These firms generated \$13.3 billion in estimated revenues for both domestic (49%) and export (51%) markets.<sup>5</sup> Twelve Canadian companies were included in the Cleantech Group's 2020 *Global Cleantech 100*, an annual report listing the world's top 100 companies in sustainable innovation.<sup>6</sup> These were:



## Investment Trends

Between 2006 and 2011, there was a cleantech economic bubble in Silicon Valley, which experienced an increased venture capital into the sector and a subsequent sharp decline of private investment.<sup>7</sup> At that time, “deep technology” investments in cleantech, such as new hardware or manufacturing processes, consumed the most capital but yielded the lowest returns on investment when compared to medical, software, and other technologies. In response, investors sought less risky options, which resulted in a cooling effect in venture capital for a period of about five years.<sup>8</sup> Research suggests that venture capital alone is likely a poor model for innovation in cleantech.

Recently, cleantech activity has been fueled by climate policies across the globe that have signalled the need for innovative solutions to reduce greenhouse gases or other harmful effluents or toxins. These policies and technological advances have resulted in the development of new climate solutions and economic development opportunities that “promise a sustained demand for clean technology”.<sup>9</sup> These changes have triggered a resurgence of interest in cleantech by venture capital firms, despite more recent federal administrative and policy shifts in the United States.

The Government of Canada is particularly interested in helping Canadian firms to scale and prime their organizations for international export markets. Since 2017, the Government of Canada has invested over \$2.3 billion to support the innovation, commercialization and adoption of clean technology.<sup>10</sup> This includes a \$700 million investment through the Business Development Bank of Canada, which aims to help high-potential firms succeed and compete globally. The bank provides the capital needed to hire staff, develop products, support sales, and scale-up.

**The Clean Growth Hub** is an initiative designed to guide cleantech developers and adopters navigate the federal ecosystem of programs and services available for:

- Research, development, and demonstration
- Commercialization and market entry
- Growth and scale up
- Export
- Market adoption



## Technological Trends

Innovation in cleantech has regularly been tracked by leading research organizations. For example, *Global Cleantech Innovation Index (GCII)*, is developed in partnership with several organizations. The GCII provides an index of country rankings in cleantech innovation using two lenses: inputs and outputs.

Countries topping the list in 2017 include Denmark, Finland, Sweden, Canada, and the United States. Canada demonstrated strength in cleantech investment and early-stage entrepreneurship, and ranked 1st in funding from multiple levels of government and venture capital. Late stage investment is also very strong in Canada.<sup>11</sup>

A dominant theme in today's cleantech sector is the undeniable connection with other technological areas such as big data, sensors, data management, robotics, and biotechnology. Further, there is a shift towards service-oriented innovations that create a means of using goods for a positive benefit, rather than simply creating goods.

The areas where activity in cleantech can be expected to see the most enhancements in the coming years include the Internet of Things (IoT), resource extraction, energy systems, transportation, advanced materials efficiencies, and big-data analytics.



“The more highly regarded companies today – in the eyes of many market players, those set to make a significant and disruptive impact within 5-10 years – are operating at the points of intersect between industries, technologies, and resource types, for which opportunities lie in linking previously unconnected or un-connectable things.”

Global Cleantech Top 100 (2017).  
Cleantech Group.

## Cleantech Redefined

Secondary research<sup>i</sup> and initial consultations revealed two ways organizations have defined cleantech as a sector:

**Figure 2: Two Definitions of Cleantech**



Differing definitions are a result of optics intended to position the community in a positive way. This is further complicated by the misalignment between what could be considered cleantech and the way statistical data are organized and compiled by organizations such as Statistics Canada or Canada Revenue Agency.

Variations in sectoral definitions, along with different labour demand methodologies and research objectives, have resulted in sporadic and confusing data regarding Canada’s cleantech workforce. This creates comparative challenges for the sector both nationally and across geographies.

Given the insights and learnings gleaned from the previous research, a definition of cleantech was developed and reviewed with sector stakeholders. ECO Canada engaged organizations who are actively involved in the cleantech and conducted eight phone interviews and three conference calls. Participating organizations included three federal agencies that co-led the development of the Clean Technology Data Strategy: Natural Resources Canada (NRCan), Statistics Canada (StatCan), and Innovation, Science and Economic Development Canada (ISED).

<sup>i</sup> A review of organizations and web-based publications that present definitions, and workforce measures for cleantech was conducted at the onset of the project. Select definitions gleaned from online research are presented in Appendix A while select workforce measures are outlined in Appendix B. An in-depth review of Statistics Canada’s Environmental and Clean Technology Products Economic Account (ECTPEA), specifically in terms of definitions and employment estimates, is presented in Appendix C.

The definition was further refined and vetted through a survey of 81 employers and virtual roundtable discussions with NRCan, StatCan, and ISED, as well as with ECO Canada's LMI National Advisory Committee. Most respondents agreed that the definition was a good representation of the sector with some caveats and suggestions for additional subsectors and examples.<sup>ii</sup>

### WHAT IS CLEANTECH?

ECO Canada defines clean technology or cleantech, as any process, product or service that:

- provides superior performance or lower costs than the current norm or standards,
- minimizes negative environmental impacts, and
- makes more efficient and responsible use of natural resources.

In other words, it's any technology that uses less material or energy, generates less waste, and causes less negative environmental impact than the industry standard. Examples include the development and use of energy-efficient building systems and electric vehicles; however, these technologies would no longer be considered cleantech once these are widely adopted within the economy.

### THE CLEANTECH SECTOR AND ITS WORKFORCE

Any private or public organization that uses, provides, advances, or invests in cleantech is part of the sector. This definition is broad and inclusive, practically spanning all industries in Canada including environmental goods and services firms, resource firms, not-for-profit organizations, and governments.

The cleantech workforce is comprised of:

- workers requiring specific knowledge or technical skills in cleantech (e.g., a cleantech specialist in an energy company),<sup>iii</sup> and
- workers who are not required to possess sector-specific competencies but perform integral roles in cleantech business and operations (e.g., an accountant in a pure play cleantech company).

ii Refer to Appendix D for a list of North American Industry Classification System (NAICS) codes that were used to populate a target list of employers for surveying and Appendix E for interview questions used to validate the cleantech definition.

iii ECO Canada typically refers to workers required to have environmental-specific knowledge, skills and/or training as CORE environmental workers. See our [Competencies for Environmental Professionals \(2016\)](#).

While some organizations may use cleantech as a term synonymous with the environmental or green economy, ECO Canada defines cleantech as a subset of the environmental sector and its workforce.

Cleantech activities typically occur within the following market segments:

- The sustainable use and management of natural resources
- Alternate energies
- Energy efficiency and green building development
- Sustainable transportation
- Waste reduction and lifecycle management
- Pollution control, environmental protection and conservation
- Other support services such as R&D, education, program administration, and consulting

A cleantech definition could be standardized, but it is important to note that the technologies, companies and workers considered to be part of cleantech today, may not necessarily be part of the cleantech economy in the future. Periodic snapshots of this sector are crucial to help shed light on job opportunities and their trajectory, as well as workforce challenges and opportunities.



The cleantech sector and its workforce are in constant evolution. The technologies, companies and workers considered to be part of cleantech today may not necessarily be part of the cleantech economy in the future.

## National Employer Survey

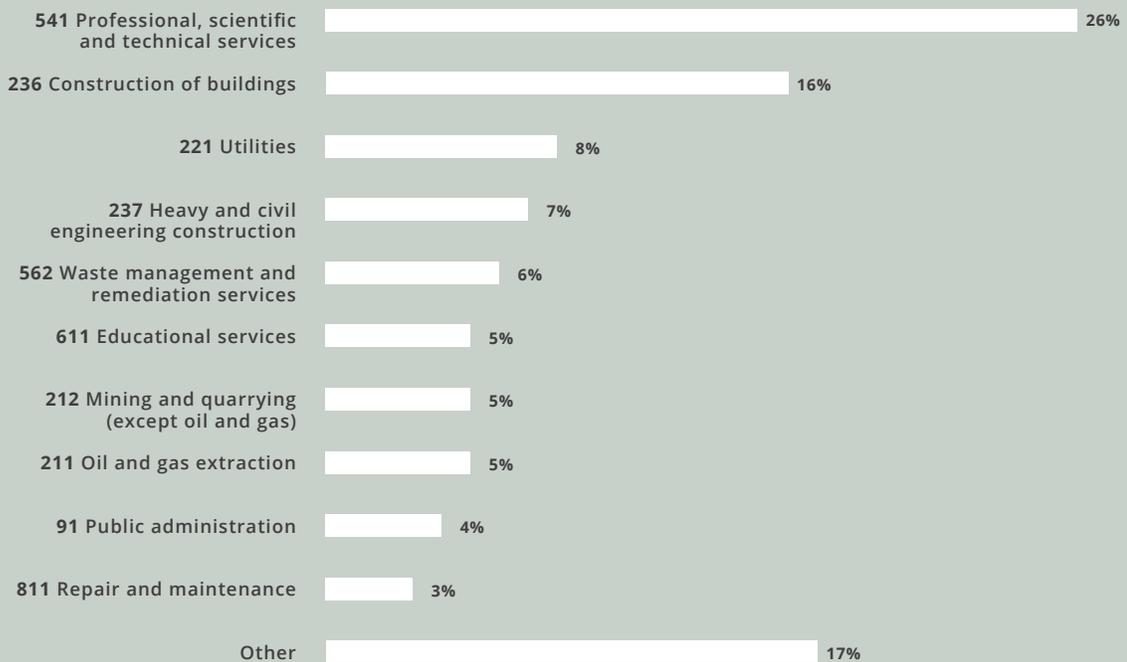
Using the NAICS listed in Appendix D, a sample of 5,600 Canadian businesses was selected from the Hoovers Business Database. The survey (refer to Appendix F) was available in both English and French and was administered via telephone and online. A total of 81 businesses responded to the survey.

This section showcases the survey results and is intended to provide a point-in-time view of the sector and its workforce.

### Profile of Businesses

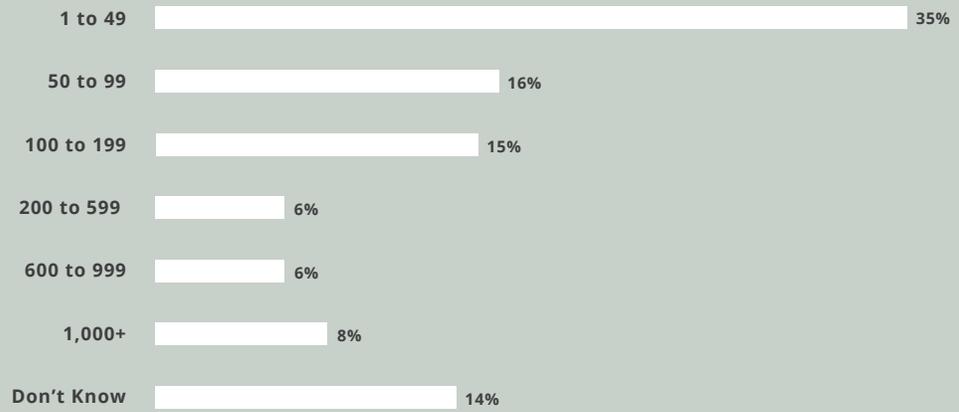
- The businesses surveyed came from a wide variety of industries and varied in size.
  - The top five industries that best represented businesses in the survey by 3-digit North American Industry Classification System (NAICS) were:
    - » Professional, scientific and technical services
    - » Construction of buildings
    - » Utilities
    - » Heavy and civil engineering construction
    - » Waste management and remediation services

**Figure 3: Percentage of Businesses Involved in Cleantech, by NAICS**



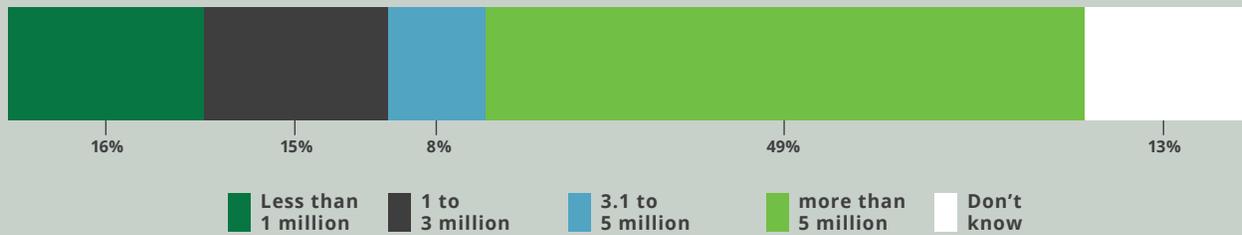
- Most employer respondents (51%) had 1 to 100 employees, while a minority (14%) employed over 600 employees.

Figure 4: Total Number of Employees



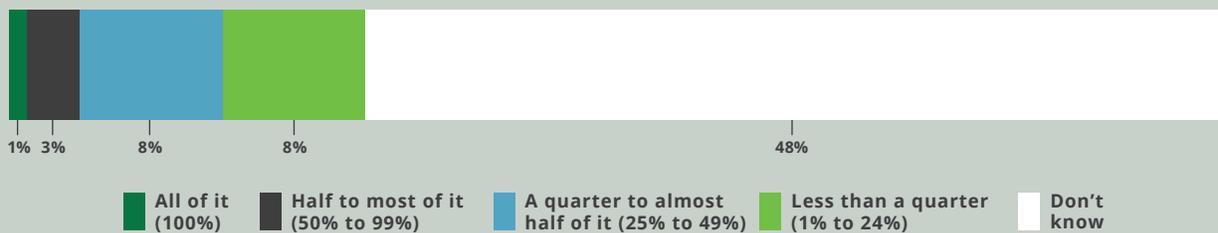
- Nearly half of the businesses surveyed (49%) had revenues over \$5 million, with nearly a quarter (23%) earning between \$1 to \$5 million and few (16%) earned less than \$1 million.

Figure 5.1: Annual Revenue



- Nearly half of the businesses (48%) were unable to share how much of their annual revenue came from cleantech, while a few (4%) indicated half to all their revenue being derived from cleantech.

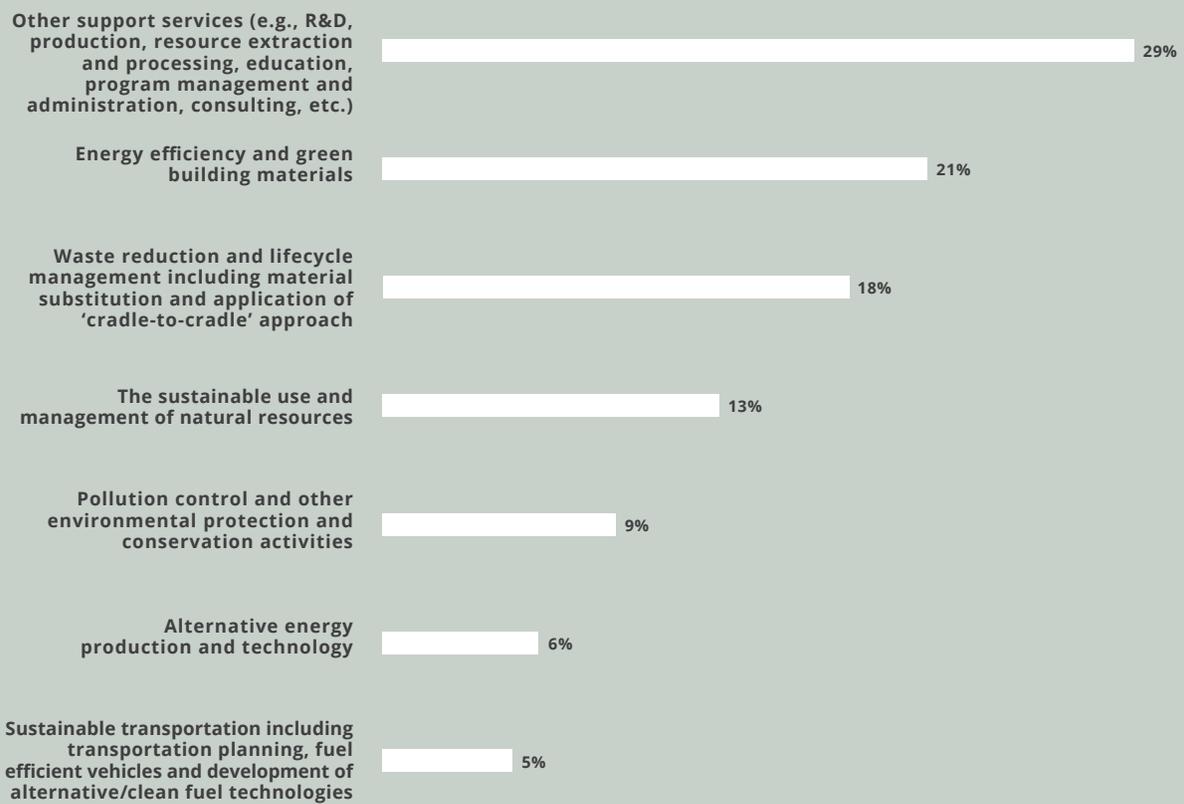
Figure 5.2: Annual Revenue Attributed to Cleantech



- The key factors identified as driving cleantech revenue were:
  - Increased local demand (26%)
  - Corporate environmental commitment (23%)
  - Growth or expansion of the cleantech market (20%)
  - Available grant funding (11%)
  - Increased exports or foreign demand (7%)

- The top three cleantech segments that best represented the businesses in the survey were:
  - Other support services (e.g., R&D, production, resource extraction and processing, education, program management and administration, consulting, etc.)
  - Energy efficiency and green building materials
  - Waste reduction and lifecycle management such as material substitution and application of 'cradle-to-cradle' approach

Figure 6: Percentage of Businesses Involved in Cleantech, by Market Segment

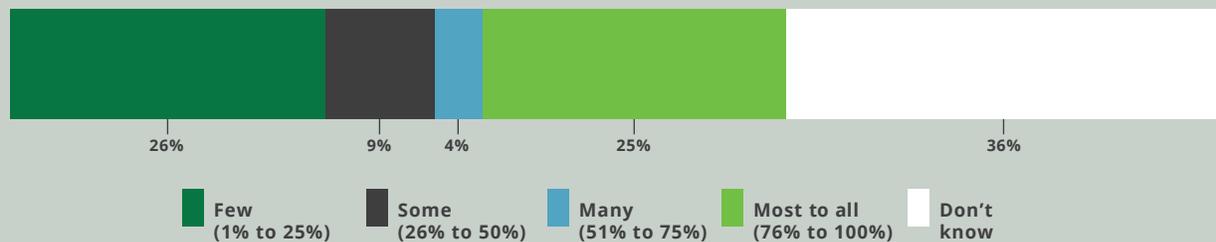


## HR Insights

The survey provided key insights into the HR practices of cleantech employers:

- The businesses surveyed widely varied in how many of their employees were tied to cleantech activity. A sizable minority (29%) indicated that half to all of their workforce is tied to cleantech while over a third (35%) indicated that less than half of their workforce is tied to cleantech.

**Figure 7: Workforce Percentage Tied to Cleantech Activity**



- Over half of the respondents (51%) indicated they hired seasonal cleantech employees.
- A number of businesses surveyed intended to hire cleantech positions within the next 12 to 24 months.
  - About 55% of respondents planned to hire cleantech personnel in the next 12 months
  - About 49% planned to hire cleantech personnel in the next 24 months, culminating to a total of over 1,800 anticipated new job opportunities
    - » About 3% of respondents indicated they planned to hire over 200 cleantech positions within the two-year period
- The most common recruitment methods were:
  - Word of mouth (19%)
  - Online (19%)
  - Social media (18%)
  - Staff referrals (16%)
- A number of occupations/skillsets were identified to be critical or difficult to recruit.

Which occupations are most critical to cleantech activities?	Which cleantech occupations/skills are difficult to hire or retain?	Which cleantech occupations will be difficult to recruit in the future?
<ul style="list-style-type: none"> <li>• Engineers, drafters, designers and technicians</li> <li>• Drivers, machine operators</li> <li>• Geologists, laboratory specialists, environmental technician, scientists</li> <li>• Project managers, directors, sales, improvement specialists, energy advisors</li> <li>• Trades (welders, electricians, mechanics, etc.), service technicians</li> </ul> <p><b>A few respondents also mentioned Environmental Health and Safety occupations.</b></p>	<ul style="list-style-type: none"> <li>• Engineers, designers (in special areas in technologies), technicians</li> <li>• Directors, managers</li> <li>• Drivers, equipment operators</li> <li>• Support staff and maintenance</li> <li>• Trades (machinists, millwrights, electricians)</li> </ul> <p><b>Respondents also mentioned:</b>                      "The challenge is finding skilled intermediate staff in the various STEM and business fields."                      "The volatility of the market we serve makes it extremely difficult to retain employees."</p>	<ul style="list-style-type: none"> <li>• Production operators, technicians, engineers</li> <li>• Truck drivers, machinery operators</li> <li>• Trades (mechanics, electricians, millwrights, welders)</li> <li>• Environmental technologists, energy auditors</li> <li>• Geologists, and geotechnology</li> <li>• Strategic jobs, directors, managers</li> <li>• Programmers and automation-related jobs</li> </ul>

Employers also expressed the need for additional training and certifications in the areas of environment, waste management and recycling, energy efficiency, alternative energy, sustainability, and health and safety . Other skills and training gaps mentioned by survey respondents include:

- Energy modelling
- Innovative lean management approach
- Science, technology, engineering, and mathematics (STEM)
- Business development and sales
- Software, new technologies for the future
- Economy of fuels and alternative transport
- Supply chain management
- Education/outreach

**In Analytica Advisor’s 2017 Canadian Clean Technology Industry Report, Cleantech companies reported that the lack of high-quality business development talent to help raise capital is one of their top barriers for success.**

## Looking Ahead: Preparing Tomorrow's Workforce

The research conducted provides valuable insights on cleantech career trends and identifies top in-demand jobs and skills gaps in this high growth sector. Industry, government, education, training, and labour supply stakeholders across Canada will need to work together to develop workforce solutions and ensure a talent pipeline for this growing sector.

This report is foundational to understanding the cleantech sector and its workforce. The goal of this research was to commence ECO Canada's endeavour to:

- Promote and maintain a cleantech definitional framework;
- Improve labour market data collection and dissemination; and
- Develop career resources and training solutions to ensure a sufficient, qualified workforce is available to support the sector's growth and build the world's leading cleantech workforce

"We are pulling people from a non-clean sector to work on clean projects."

SURVEY RESPONDENT

**Surveys across industries that help study cleantech are needed**

By studying, monitoring, and reporting on the cleantech labour market, ECO Canada can improve industry access and career advancement opportunities for new graduates as well as mid- to senior-level practitioners in the sector. Stakeholders can also use the cleantech workforce data and insights to make decisions and formulate strategies regarding policy, business, education, and careers.

### Spotlight: Cleantech Job Creation and Placement Programs

The federal government invests in youth job placement programs to help employers increase capacity and to help emerging professionals land meaningful jobs. ECO Canada administers these programs, including those that are specific to the growing cleantech sector, on behalf of Natural Resources Canada and Environment and Climate Change Canada.

"Youth employment has been a core objective for ECO Canada since 1997. Our Wage Funding Program matches young professionals, new graduates and interns in the fields of science, technology, engineering, and mathematics (STEM), with environmental employers. Funded by the Federal Government, this program pays up to 50% of salary and helps give Canada's youth a good start in a competitive market."

**Kevin Nilsen, President and CEO**  
ECO Canada

## Appendix A: Select Cleantech Definitions

Clean technology, green technology, environmental technology, low-carbon technology, climate technologies, and energy-efficient technologies are just some of the ways that governments and organizations around the world have referred to innovations oriented towards environmental protection. However, some of these terms do not encapsulate the whole potential of cleantech.

Considering the rise in cleantech as a self-defined sector, secondary research and stakeholder consultations were conducted to guide the development and refinement of a definitional framework for cleantech.

Key results from secondary research are summarized in the following table.

**Table 1: Cleantech Definitions from Select North American Organizations**

<b>Government of Canada</b>
<p>Clean technology is broadly defined as any process, product or service that reduces environmental impacts through environmental protection activities, through the sustainable use of natural resources, or through the use of goods that have been specifically modified or adapted to be significantly less energy or resource intensive than the industry standard.</p> <p>Clean technologies are:</p> <ul style="list-style-type: none"> <li>• any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage;</li> <li>• any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility.</li> </ul> <p>Their primary use, however, is not one of environmental protection.<sup>iv</sup></p>
<b>Analytica Advisors</b>
<p>Clean technology does much more than produce renewable energy. Cleantech companies are those with proprietary technology or know-how that addresses one or more of the following markets:</p> <ul style="list-style-type: none"> <li>• Upstream Sectors: Biorefinery Products; and Power Generation</li> <li>• Downstream Sectors: Energy Infrastructure/Smart Grid; Energy Efficiency/Green Buildings; Industrial Processes and Products; Extractive Processes and Products; Transportation; and Recycling, Recovery and Remediation</li> <li>• Water and Agriculture Sectors: Water and Wastewater; and Agriculture</li> </ul>

<sup>iv</sup> A Canadian clean technology taxonomy was developed by Natural Resources Canada in conjunction with partners at Innovation, Science and Economic Development Canada; Global Affairs Canada; Agriculture and Agri-Food Canada; Fisheries and Oceans Canada; Environment and Climate Change Canada; and Statistics Canada. Refer to Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide (March 2019). <https://www150.statcan.gc.ca/n1/pub/16-511-x/16-511-x2019001-eng.htm>

## MaRS

A clean technology company is one that is focused on the creation of intellectual property, new products and services that protect and/or increase efficient utilization of land, energy, water or natural resources.

## Canada Cleantech

Clean technology is new products, services and business models that simultaneously improve economic performance and reduce environmental footprint.

Sub-sectors include:

- Water
- Cleantech related to Agriculture
- Cleantech related to Oil and Gas
- Cleantech related to Mining
- Hydrogen and Fuel Cell
- Waste
- Renewable Energy and Storage
- Energy Efficiency and Smart Grid
- Green Chemistry
- Air
- Eco-mobility

## Cleantech Group

Clean technology, or “cleantech”, should not be confused with the terms environmental technologies or “green tech” popularized in the 1970s and 80s. Cleantech is new technology and related business models offering competitive returns for investors and customers while providing solutions to global challenges. Where greentech, or envirotech, represents the highly regulatory driven, “end-of-pipe” technology of the past with limited opportunity for attractive returns, cleantech is driven by market economics therefore offering greater financial upside and sustainability. The concept of cleantech embraces a diverse range of products, services, and processes across industry verticals that are inherently designed to:

- provide superior performance at lower costs,
- greatly reduce or eliminate negative ecological impact, and
- improve the productive and responsible use of natural resources.

### Export Development Canada

It's any process, product or service that reduces environmental impacts, fosters sustainability and provides goods that use less energy and fewer resources than the industry standard. Cleantech permeates all sectors of the economy, as our environmental footprint can be found in every conceivable activity. The most common applications are found in manufacturing, mining, oil and gas, transportation, power generation, water, agriculture, recycling and other energy efficiency activities.

### Delphi Group

Clean technology or Cleantech is a term used to describe products or services that improve operational performance, productivity, or efficiency while reducing costs, inputs, energy consumption, waste, or environmental pollution.

The framework includes the following high-level categories: Alternative Energies; Energy Efficiency and Clean Building Technology; Transportation; Recycling, Remediation, and Waste Management; and Support Services, Knowledge, and Conservation (includes the 'Cleantech Support' category, but also includes education and conservation).

### BC Cleantech CEO Alliance

Cleantech sector has been defined to include companies with the primary purpose of developing new technologies related to clean energy production, transmission, storage, or use; water treatment and management; and/or efficiency in energy or resource management and use.

### Alberta Clean Technology

Cleantech are novel services, processes, products and activities that improve economic performance and reduce environmental footprint relative to the baseline.

### Écotech Québec

Clean technology, also known as Cleantech, green technologies, greentech, eco-innovations, ecotechnologies and Ecotech, are part of a sustainable development outlook that includes new products, services, technologies and processes that:

- Significantly reduce negative impacts on the environment (environmentally effective)
- Offer users superior performance at a lower cost (economically superior)
- Help improve the quality of life by optimizing resource use (socially responsible)

Sectors include Renewable Energy, Green Chemistry, Energy Efficiency, Electric and Smart Vehicles, Air, Soil and Agriculture, Water, and Waste.

### Ontario Clean Technology Industry Association

Clean technology, or cleantech, includes novel services, processes, products, and activities that improve economic performance and significantly reduce environmental impacts. In general, this includes, but is not limited to, better solutions for energy use, water management, food production, and transportation.

## Appendix B: Cleantech Workforce Estimates from Across Canada

A scan of published cleantech workforce estimates across Canada also revealed varying statistics for the sector, primarily due to differences in sector definitions and estimation techniques.

### National Estimates

**Government of Canada:** In 2016, the federal government announced a joint federal-provincial-territorial Working Group on Clean Technology, Innovation and Jobs. In 2017, the government invested in a Clean Technology Data Strategy to provide the foundation to measure the economic, environmental and social impacts of clean technology in Canada through data development. As part of this strategy, Statistics Canada developed the Environmental and Clean Technology Products Economic Account (ECTPEA) to provide comprehensive measures of the supply and use of environmental and clean technology products in Canada's economy.<sup>v</sup> The recently published ECTPEA: Human resource module estimated that approximately 282,000 jobs were attributable to environmental and clean technology activity, representing 1.6% of overall employment in Canada in 2017 (refer to Appendix C).<sup>12</sup> While cleantech-specific estimates are unavailable from the HRM, several publications have misrepresented these data as employment estimates for cleantech specifically.

**Analytica Advisors:** In its *2017 Canadian Clean Technology Industry report*, Analytica Advisors estimated 55,200 direct jobs were available in the Canadian clean technology sector in 2015. This estimate represents data from 148 companies, vis-à-vis a national cohort of more than 850 clean technology firms, including many small and medium sized enterprises. The report states that these companies operate in ten sectors and in every region of the country.<sup>13</sup>

### Provincial and Regional Estimates

**For British Columbia:** According to a report published in 2016 by KPMG, British Columbia's cleantech sector included 273 businesses employing 13,000 people, including 8,000 BC-based workers.<sup>14</sup> The report identified energy generation, transportation, building efficiency, and resource-recovery and waste management as the leading cleantech sectors in the province.

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<sup>v</sup> The ECTPEA has a broader scope than the Survey of Environmental Goods and Services (SEGS) and captures economy-wide transactions in the environmental and clean technology sector, including elements such as clean energy and scrap metals. The government and non-profit sectors are also fully covered in the ECTPEA.

**For Alberta:** Alberta's cleantech sector is defined by four ecosystem tiers: 1) pure play cleantech, 2) cleantech R&D divisions, 3) advisers and implementers, and 4) suppliers and service providers. Alberta's leading pure play firms, according to Alberta Clean Technology Industry Alliance (ACTia), are in chemical processes, renewable power generation, advanced materials and nanotech, and the IoT, sensors, and Geographic Information System (GIS). A report published by ACTia estimated between 100 and 250 pure play clean technology companies were active in Alberta in 2018. The report also estimates 1,758 people were employed globally in the province's cleantech sector, based on responses from 41 pure play firms.<sup>15</sup>

**For Ontario:** In November 2019, the Ontario Clean Technology Industry Association (OCTIA) was formally launched. On its website, OCTIA presents an estimate of approximately 130,000 employed by clean technology companies in the province.<sup>16</sup> No methodology nor reference period was provided for these estimates.

**For Quebec:** Quebec's cleantech sector is defined more loosely and includes extended elements of the ecosystem. However, similar to other provinces, they hold that cleantech cuts across all or a number of sectors and acknowledge that the cleantech economy remains relatively unknown, hard to define, and challenging to measure. According to a survey conducted by EY (Ernst & Young), Quebec pure play cleantech employs nearly 9,000 people across some 350 companies.<sup>17</sup>

**For Atlantic provinces:** The Atlantic Provinces Economic Council (APEC) identified 67 clean technology firms in Atlantic Canada. In 2016, APEC estimated that 57 of these firms are pure play, and employed 1,450 people.<sup>18</sup>

## Other Estimates

Recently, several organizations have emerged across Canada that provide information on the performance of the cleantech sector and facilitate localized cleantech capacity building and growth. Examples include:

- **Calgary Economic Development:** in 2017, over 4,500 jobs in the Calgary region were directly related to cleantech for the oil and gas industry<sup>19</sup>
- **Western Economic Diversification Canada:** in 2018, over 600 businesses in Winnipeg were actively engaged in cleantech, employing over 7,000 people in the province<sup>20</sup>
- **Invest Ottawa:** over 5,500 people were employed across more than 240 companies in Ottawa (no reference period provided)<sup>21</sup>

## Appendix C: Statistics Canada's Environmental and Clean Technology Products Economic Account

As part of the federal government's Clean Technology Data Strategy, Statistics Canada maintains the Environmental and Clean Technology Products Economic Account (ECTPEA), a program designed to provide comprehensive measures of the supply and use of environmental and clean technology products in Canada's economy. Through this program, Statistics Canada has developed estimates of Production, Supply and Use, GDP, and Employment related to environmental and clean technology products. Table 2 provides the ECTPEA employment estimates from 2013 to 2017.

**Table 2: Environmental and Clean Technology Products Economic Account, Employment**

Environmental and Clean Technology Products Economic Account Industry Group	Employment (Jobs)				
	2013	2014	2015	2016	2017
Total, all industries	270,082	273,548	275,304	276,828	282,045
Electric power generation, transmission and distribution [BS221100]	55,803	56,167	54,673	55,251	59,513
Electric power engineering construction [BS23C300]	46,270	47,503	55,085	51,066	55,663
Electrical equipment manufacturing [BS335300]	4,542	4,523	3,394	3,060	3,047
Waste management and remediation services [BS562000]	36,253	36,991	37,008	37,472	37,182
Other professional, scientific and technical services including scientific research and development [BS541B00]	6,550	6,558	6,340	6,627	6,439
Water, sewage and other systems [BS221300]	374	405	279	347	334
Other industries	120,290	121,401	118,524	123,005	119,868

Source: Statistics Canada Table 36-10-0411-01, Environmental and Clean Technology Products Economic Account

For the purposes of the ECTPEA program, Statistics Canada defines “Environmental and Clean Technology Products” as:

Any process, product, or service that reduces environmental impacts: through environmental protection activities that prevent, reduce or eliminate pollution or any other degradation of the environment; resource management activities that result in the more efficient use of natural resources, thus safeguarding against their depletion; or the use of goods that have been adapted to be significantly less energy or resource-intensive than the industry standard.

Statistics Canada considers cleantech activity to be a subset of “Environmental and Clean Technology Products”, specifically:

- Any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage;
- Any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility. Their primary use, however, is not one of environmental protection.<sup>vi</sup>

Clean technology is broadly defined as any process, product or service that reduces environmental impacts: through environmental protection activities, through the sustainable use of natural resources, or through the use of goods that have been specifically modified or adapted to be significantly less energy or resource intensive than the industry standard.

Statistics Canada does not currently provide a cleantech-only breakdown of Production, Supply and Use, GDP, and Employment related specifically to the Cleantech activity portion within ECTPEA nor SEGS.

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<sup>vi</sup> A Canadian clean technology taxonomy was developed by Natural Resources Canada in conjunction with partners at Innovation, Science and Economic Development Canada; Global Affairs Canada; Agriculture and Agri-Food Canada; Fisheries and Oceans Canada; Environment and Climate Change Canada; and Statistics Canada. Refer to Statistics Canada’s Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide (March 2019) (<https://www150.statcan.gc.ca/n1/pub/16-511-x/16-511-x2019001-eng.htm>).

## Appendix D: Industries Included in ECO Canada’s Cleantech Definition

The following are the North American Industry Classification System (NAICS) that fall under the definition offered for this project:

**Table 3: NAICS Codes Assigned to Sectors**

Alternative Energies (Includes NAICS codes 22, 23, 32, 33)
<p><b>Power Generation</b></p> <ul style="list-style-type: none"> <li>• 221111 Hydro-electric power generation</li> <li>• 221113 Nuclear electric power generation</li> <li>• 221119 Other electric power generation (solar, wind, geothermal, tidal)</li> </ul>
<p><b>Energy Products/Systems Manufacturing</b></p> <ul style="list-style-type: none"> <li>• 325189 All other basic inorganic chemical manufacturing (nuclear energy)</li> <li>• 32519 Other basic organic chemical manufacturing (biofuels)</li> <li>• 33241 Power boiler and heat exchanger manufacturing (nuclear reactors)</li> <li>• 333611 Turbine and turbine generator set unit manufacturing (wind)</li> <li>• 3344 Semiconductor and other electronic component manufacturing (solar)</li> <li>• 3353 Electrical equipment manufacturing (manufacturing equipment that generates and distributes electrical power)</li> <li>• 33591 Battery manufacturing (storing energy)</li> </ul>
<p><b>Energy Systems Construction</b></p> <ul style="list-style-type: none"> <li>• 23713 Power and communication line and related structures construction (power plants, including nuclear)</li> <li>• 2379 Other heavy and civil engineering construction (hydro)</li> </ul>

<b>Energy Efficiency and Green Building Development (Includes NAICS codes 23, 33)</b>
<p><b>Building Construction</b></p> <ul style="list-style-type: none"> <li>• 2361 Residential building construction</li> <li>• 2362 Non-residential building construction</li> <li>• 2381 Foundation, structure, and building exterior contractors</li> <li>• 2382 Building equipment contractors</li> </ul>
<p><b>Energy Efficiency Building Manufacturing</b></p> <ul style="list-style-type: none"> <li>• 33291 Metal valve manufacturing (valves, plumbing fixtures and controls, etc.)</li> <li>• 3334 Ventilation, heating, air-conditioning and commercial refrigeration equipment manufacturing</li> <li>• 334512 Measuring, medical and controlling devices manufacturing (environmental controls/ regulators)</li> <li>• 3353 Electrical equipment manufacturing</li> </ul>
<p><b>Energy Efficient Products Manufacturing</b></p> <ul style="list-style-type: none"> <li>• 3351 Electric lighting equipment manufacturing</li> <li>• 3352 Household appliance manufacturing</li> </ul>
<b>Sustainable Transportation (Includes NAICS codes 23, 33, 48)</b>
<p><b>Vehicle Manufacturing</b></p> <ul style="list-style-type: none"> <li>• 333619 Other engine and power transmission equipment manufacturing (bio-diesel engines)</li> <li>• 335312 Motor and generator manufacturing (electric motors)</li> <li>• 33599 All other electrical equipment and component manufacturing (fuel cells)</li> <li>• 33611 Automobile and light-duty motor vehicle manufacturing (electric automobiles manufacturing)</li> <li>• 33631 Motor vehicle gasoline engine and engine parts manufacturing (hybrid engines)</li> <li>• 33651 Railroad rolling stock manufacturing (diesel-electric locomotives, rapid transit cars and equipment)</li> </ul>
<p><b>Transportation Systems</b></p> <ul style="list-style-type: none"> <li>• 23799 Other heavy and civil engineering construction (light rail system, subway, construction)</li> <li>• 48511 Urban transit systems</li> <li>• 48599 Other transit and ground passenger transportation (carpool, rideshare)</li> </ul>

<p><b>Waste Reduction and Lifecycle Management (Includes NAICS codes 22, 23, 31-33, 56)</b></p> <p><b>Waste Systems Construction and Utility</b></p> <ul style="list-style-type: none"> <li>• 22131 Water supply and irrigation systems (water treatment)</li> <li>• 22132 Sewage treatment facilities</li> <li>• 23711 Water and sewer line and related structures construction</li> </ul> <p><b>Manufacturing with Recycled Material</b></p> <ul style="list-style-type: none"> <li>• Businesses who manufacture with recycled materials will fall under their product NAICS code (i.e., clothing manufacturing, plastic bottle manufacturing, etc.) and, therefore, cannot be captured in the analysis.</li> </ul> <p><b>Recycling, Remediation, and Waste Services</b></p> <ul style="list-style-type: none"> <li>• 562 Waste management and remediation services</li> </ul>
<p><b>Support Services, Green Knowledge, and Conservation (Includes NAICS codes 51, 54, 61, 81, 91)</b></p> <p><b>Support Services and Technology</b></p> <ul style="list-style-type: none"> <li>• 5413 Architectural, engineering and related services</li> <li>• 54142 Industrial design services</li> <li>• 541514 Computer systems design and related services (except video game design and development)</li> <li>• 54162 Environmental consulting services</li> <li>• 54169 Other scientific and technical consulting services (energy consulting)</li> </ul> <p><b>Research and Development (Private)</b></p> <ul style="list-style-type: none"> <li>• 54171 Research and development in the physical, engineering and life sciences</li> </ul> <p><b>Education/Research and Development (Public)</b></p> <ul style="list-style-type: none"> <li>• 6112 Community colleges and CEGEPs</li> <li>• 6113 Universities</li> <li>• 6115 Technical and trade schools</li> </ul> <p><b>Conservation/Environmental Advocacy</b></p> <ul style="list-style-type: none"> <li>• 8134 Civic and social organizations</li> <li>• 8139 Business, professional, labour and other membership organizations</li> <li>• 9121 Provincial protective services</li> <li>• 9129 Other provincial and territorial public administration</li> </ul>

## Appendix E: Interview Guide for Cleantech Definition Review and Validation with Key Stakeholders

Given the rise in cleantech as a self-defined sector in many economies, ECO Canada is conducting research to guide the development of a common definition that will help standardize related occupations and sectors. This definition will form the basis of a comprehensive labour market information, thereby supporting ECO Canada's development of career directed resources and training programs for environmental practitioners in Canada. MDB Insight, a national economic development consultancy, has been engaged to develop a definition of cleantech through research and validation with key industry stakeholders.

Thank you for taking the time to contribute your perspectives and opinions to the research. Your ideas are a critical element to the success of this study.

### Questions

1. Please describe your organization/association/business and its relationship to cleantech.
2. We have crafted the definition of cleantech as follows:

#### Clean Technology:

Clean Technology, also referred to as cleantech, is any process, product or service that improves operational performance, productivity or efficiency while minimizing negative environmental impacts. In essence, it's any technology that uses less material and/or energy, generates less waste, and causes less environmental impacts than the alternative.

#### Cleantech Subsectors:

The sector includes any industry, company or worker that directly supports a sustainable business approach through research, development, provision, or adoption of cleantech. Key segments or sub-sectors include:

- The sustainable use and management of natural resources;
- Alternative energy production and technology;
- Energy efficiency and green building materials;
- Sustainable transportation including transportation planning, fuel efficient vehicles and development of alternative/clean fuel technologies;
- Waste reduction and lifecycle management including material substitution and application of 'cradle-to-cradle' approach;
- Pollution control and other environmental protection and conservation activities;
- Other support services (e.g., R&D, production, resource extraction and processing, education, program management and administration, consulting, etc.).

While we acknowledge some companies are pure play or some workers spend all of their time performing cleantech-related tasks/activities, most companies and workers have diverse business lines and tasks/activities respectively. Therefore, questions focused on only company business or worker tasks/activities that relate to cleantech.

1. What is your reaction to this definition? Are there suggested changes to the definition that you believe would bring greater clarity?
2. Are you aware of existing definitions or breakdown of cleantech (what sectors are often included, etc.) that would be beneficial to our research?
3. Do you receive requests for or gather LMI for Cleantech, if yes what data is gathered, and who is requesting it?
4. Would you find this definition useful to your work/sector?
5. Are there any final thoughts on this initiative that you would like to share?
6. Are there any other organizations you're aware of that we should connect with on this definition?

## Appendix F: National Business Survey of Cleantech Employers

Thank you for participating in this interview. Is this still a good time? As indicated, we anticipate it taking approximately 15 minutes. [BEGIN IF AGREED, OR RESCHEDULE]

The approach for these interviews is to gain a better understanding of:

Your perspective of current and future industry trends, employment patterns, and factors that might impact your ability to fill key occupations related to clean technology and find talent with the skills that are needed by your business.

This survey uses specific terms to describe various technologies and activities. If you require any definitions for clarification, please ask me at any time.

**(If needed):** The Cleantech sector includes any industry, company or worker that is directly involved in research, development/production, provision, or adoption of any process, product or service that improves operational performance, productivity or efficiency while minimizing negative environmental impacts. It's any technology that uses less material and/or energy, generates less waste and causes less environmental impacts than the alternative.

**(If needed):** Your individual responses will not be published; only aggregated information will be used in reporting the survey results.

**(If needed):** The survey should take approximately 15 minutes of your time. Approximations and estimations are fine. Your participation will help determine how investments of time and money should be made to support the industry and prepare the present and future labour pool.

### 1.1 Questions

**1. A key element of this research is to validate a clear definition for Clean Technology and the sector. Please react to the following definition:**

Clean Technology, also referred to as cleantech, is any process, product or service that improves operational performance, productivity or efficiency while minimizing negative environmental impacts. In essence, it's any technology that uses less material and/or energy, generates less waste and causes less environmental impacts than the alternative.

The Cleantech sector includes any industry, company or worker that is directly supports a sustainable business approach through research, development, provision, or adoption of cleantech. Key areas include the sustainable use and management of natural resources, alternate energies, energy efficiency and green building development, sustainable transportation, waste reduction and lifecycle management, pollution control, environmental protection and conservation and other support services such as R&D, education, program management and administration, consulting and others.

Please indicate how accurately, you feel, this defines Clean Technology and the sector:

- a. It is very accurate.
- b. It is somewhat accurate.
- c. It is not accurate at all.

**2. What, if anything, would you change, add, or remove, to more accurately define clean technology and the cleantech sector?**

**3. Based on this definition would you consider your company to be a Clean Technology Company?**

[IF NO, THANK PARTICIPANT AND END THE INTERVIEW]

- a. Yes
- b. No
- c. Not sure

**4. This sector includes any industry, company or worker that directly supports a sustainable business approach through research, development, provision, or adoption of cleantech. Please select the segment that best reflects your business. Key segments or sub-sectors include:**

- 4.1 The sustainable use and management of natural resources;
- 4.2 Alternative energy production and technology;
- 4.3 Energy efficiency and green building materials;
- 4.4 Sustainable transportation including transportation planning, fuel efficient vehicles and development of alternative/clean fuel technologies;
- 4.5 Waste reduction and lifecycle management including material substitution and application of 'cradle-to-cradle' approach;
- 4.6 Pollution control and other environmental protection and conservation activities;
- 4.7 Other support services (e.g., R&D, production, resource extraction and processing, education, program management and administration, consulting, etc.).

**5. Based on your selection in Q3, please select the Sector or NAICS that best reflects your Canadian business.**

- 113 – Forestry and logging
- 115 – Support activities for agriculture and forestry
- 211 – Oil and gas extraction
- 212 – Mining and quarrying (except oil and gas)
- 221 – Utilities
- 236 – Construction of buildings
- 237 – Heavy and civil engineering construction
- 324 – Petroleum and coal product manufacturing
- 325 – Chemical manufacturing
- 326 – Plastics and rubber products manufacturing
- 333 – Machinery manufacturing
- 335 – Electrical equipment, appliance and component manufacturing
- 481 – Air transportation
- 482 – Rail transportation
- 483 – Water transportation
- 484 – Truck transportation
- 485 – Transit and ground passenger transportation
- 541 – Professional, scientific and technical services
- 562 – Waste management and remediation services
- 611 – Educational services
- 811 – Repair and maintenance
- 813 – Religious, grant-making, civic and professional and similar organizations
- 91 – Public administration

**6. At December 31, 2018 approximately what % of your annual revenue is attributed or related to your cleantech activity?**

[RECORD %: ]

[IF UNABLE TO PROVIDE A PERCENTAGE, OFFER OPTIONS BELOW]

- 6.1 All of it (100%)
- 6.2 Half to most of it (50% to 99%)
- 6.3 A quarter to almost half of it (25 to 29%)
- 6.4 Less than a quarter (1% to 24%)
- 6.5 Don't know

**7. Please select the range that best reflects your business' annual revenue.**

- 7.1 < than 1 million
- 7.2 1 million to 3 million
- 7.3 3.1 million to 5 million
- 7.4 > than 5 million

**8. What are the key factors that are driving your revenues in cleantech?**

- 8.1 Growth/expansion
- 8.2 Increased demand locally
- 8.3 Increased exports/foreign demand
- 8.4 Program or grant funding available
- 8.5 Corporate environmental commitment
- 8.6 Other

**9. What was your total employee count FTE (full time equivalent workers) in Canada at December 31, 2018?**

[RECORD #: ]

[IF UNABLE TO PROVIDE A COUNT, OFFER OPTIONS BELOW]

- 9.1 1 to 4 employees
- 9.2 5 to 99 employees
- 9.3 100 to 499 employees
- 9.4 500 and more employees

**10. At December 31, 2018, approximately what % of your FTE's (working 30 hours or more per week) workforce is directly tied to your cleantech activity?**

[RECORD %: ]

[IF UNABLE TO PROVIDE A PERCENTAGE, OFFER OPTIONS BELOW]

- 10.1 All of it (100%)
- 10.2 Half to most of it (50% to 99%)
- 10.3 A quarter to almost half of it (25 to 29%)
- 10.4 Less than a quarter (1% to 24%)
- 10.5 Don't know

**11. Do you hire contract/seasonal employees to carry out cleantech activity within your business?**

- 11.1 Yes
- 11.2 No
- 11.3 Not sure

**12. Are there any specific occupations and/or skills related to your cleantech activities that you find difficult to hire or retain?**

[RECORD OPEN-ENDED RESPONSES]  
[RESPONSES TO BE CODED]

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**13. Are there any specific occupations that you foresee difficulties in recruiting in the future?**

[RECORD OPEN-ENDED RESPONSES]  
[RESPONSES TO BE CODED]

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**14. Which occupations have been the most critical to your cleantech activities?**

[OPEN-ENDED]

**15. Are there any educational or certification programs or training opportunities that you believe are needed to support talent development in clean technology?**

- 15.1 Yes
- 15.2 No
- 15.3 Not sure

**16. Can you offer specific examples of educational or certification programs or training programs that are needed?**

[OPEN-ENDED]

[IF YES IN Q16 ASK Q17]

**17. How many new hires do you anticipate hiring in occupations related to cleantech?**

17.1 in the next 12 months; how many?

17.2 In the next 24 months; how many?

**18. What methods do you use to recruit talent?**

18.1 Newspaper/print

18.2 Social media (website, Facebook)

18.3 On-line job boards (Indeed, etc)

18.4 LinkedIn

18.5 Staff referrals

18.6 Word of mouth

18.7 Other

**19. Would you like to receive information related to clean technology?**

19.1 Yes

19.2 No

19.3 Not at this time

**20. If yes, please provide an email address that can be used to share information. Please note that ECO Canada does not share email addresses for other use, other than that for which is was provided. ECO Canada gives utmost priority to the maintenance of member privacy and therefore strives to protect the confidentiality of any personal information that you may give us online, in a telephone conversation, in person, or on a completed printed form.**

Email: \_\_\_\_\_

**21. Is there anything else you would like to tell us that you feel would help?**

[OPEN-ENDED]

## Endnotes

1. Analytica Advisors. (April 2017). 2017 Canadian clean technology industry report. Retrieved from <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>
2. Export Development Canada. (2019). Economic insights: Shining a light on Canada's cleantech future. Retrieved from <https://www.edc.ca/en/guide/canada-cleantech-future.html>
3. Statistics Canada. (March 2019). Survey of innovation and business strategy. Retrieved from <https://www150.statcan.gc.ca/n1/en/daily-quotidien/190313/dq190313b-eng.pdf?st=PmcUHdBl>
4. Statistics Canada. (March 2019). Survey of innovation and business strategy. Retrieved from <https://www150.statcan.gc.ca/n1/en/daily-quotidien/190313/dq190313b-eng.pdf?st=PmcUHdBl>
5. Analytica Advisors. (April 2017). 2017 Canadian clean technology industry report. Retrieved from <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>
6. Cleantech Group. (January 2020). Global cleantech 100. Retrieved from: [https://www.cleantech.com/the-global-cleantech-100/?utm\\_campaign=GCT%20100%2019%20campaign%20page&utm\\_medium=Button&utm\\_source=Homepage](https://www.cleantech.com/the-global-cleantech-100/?utm_campaign=GCT%20100%2019%20campaign%20page&utm_medium=Button&utm_source=Homepage)
7. Gaddy, B., Sivaram, V., & O'Sullivan, F. (July 2016). Venture capital and cleantech: The wrong model for clean energy innovation. MIT Energy Initiative. Retrieved from <http://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>
8. Webb, K., Cruz, R., & Walsh, P. (2017). A comparative review of the role of markets and institutions in sustaining innovation in cleantech: A critical mass approach. *International Journal of Innovation and Sustainable Development*, 11(2/3), 149-169.
9. Côté, L. (2017, October 17). How can cleantech Canada compete for growing global market share? ExportWise. <https://www.edc.ca/en/blog/cleantech-canada-growing-global-markets.html>
10. Government of Canada's Clean Growth Hub. (2019). Federal ecosystem of support for clean technology. Retrieved from [https://www.ic.gc.ca/eic/site/099.nsf/vwapj/Clean-Growth-Hub\\_Federal-ecosystem-of-support-for-clean-technology.pdf/\\$file/Clean-Growth-Hub\\_Federal-ecosystem-of-support-for-clean-technology.pdf](https://www.ic.gc.ca/eic/site/099.nsf/vwapj/Clean-Growth-Hub_Federal-ecosystem-of-support-for-clean-technology.pdf/$file/Clean-Growth-Hub_Federal-ecosystem-of-support-for-clean-technology.pdf)
11. Cleantech Group. (June 2017). The Global Cleantech Innovation Index 2017 report. Retrieved from [http://info.cleantech.com/WWF-Index-2017\\_WWF-Index-2017-Submit.html](http://info.cleantech.com/WWF-Index-2017_WWF-Index-2017-Submit.html)
12. Statistics Canada (August 2019). Portrait of environmental and clean technology jobs in Canada, 2017. Retrieved from <https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2019058-eng.htm>
13. Analytica Advisors. (April 2017). 2017 Canadian clean technology industry report. Retrieved from <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>
14. KPMG. (March 2017). British Columbia cleantech. Retrieved from <https://storage.googleapis.com/production-vec-uploads/2017/09/14179-cleantech-status-report-bc.pdf>

15. Alberta Clean Technology Industry Alliance. (November 2019). Alberta clean technology sector 2019. Retrieved from [https://secureservercdn.net/198.71.233.129/237.01d.myftpupload.com/wp-content/uploads/2019/11/ACTia-Report\\_V1.8.pdf](https://secureservercdn.net/198.71.233.129/237.01d.myftpupload.com/wp-content/uploads/2019/11/ACTia-Report_V1.8.pdf)
16. Ontario Clean Technology Industry Association. (2019). Ontario's clean technology sector. Retrieved from <https://octia.ca/ontario-and-octia>
17. EY (Ernst & Young). (February 2018). Cleantech sector on the rise in Québec. Retrieved from <https://www.newswire.ca/news-releases/cleantech-sector-on-the-rise-in-quebec-674826983.html>
18. Atlantic Provinces Economic Council. (February 2018). Growing Atlantic Canada's clean technology firms. Retrieved from <https://www.apec-econ.ca/publications/view/?download=1&publication.id=352>
19. Calgary Economic Development. (2020). Clean technology. Retrieved from <https://calgaryeconomicdevelopment.com/industries/focus-areas/technology/our-technology-sectors-of-focus/>
20. Western Economic Diversification Canada. (January 2018). Diversifying Manitoba's economy by investing in clean technology and supporting francophone initiatives. Retrieved from <https://www.newswire.ca/news-releases/diversifying-manitobas-economy-by-investing-in-clean-technology-and-supporting-francophone-initiatives-668345273.html>
21. Invest Ottawa. (2017). Clean technologies by the numbers. Retrieved from [https://www.investottawa.ca/wp-content/uploads/2017/07/Clean\\_Technologies.pdf](https://www.investottawa.ca/wp-content/uploads/2017/07/Clean_Technologies.pdf)



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