

Missing the Bigger Picture



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Missing the Picture

Tracking the Energy Revolution 2019

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A mountain in our midst

When it comes to our national identity, a few clichés come to mind. Hockey, timbits, unnecessary apologies. Another defining characteristic of Canadians? We love talking about energy—oil, gas, electricity prices, pipelines.

But these discussions are missing a big part of the picture. The Canadian economy—and energy in particular—includes a lot more activity that isn't getting press.

Not only is Canada's clean energy sector growing faster than the rest of the country's economy (4.8% versus 3.6% annually between 2010 and 2017), it's also attracting tens of billions of dollars in investment every year. And perhaps most importantly for the average Canadian, it's a huge, and growing, employer. In 2017, clean energy accounted for 298,000 jobs in Canada—roughly equal to direct employment in the real estate sector.

Partnering with Navius Research, Clean Energy Canada delved into Canada's clean energy sector to better understand its economic contribution and the number of jobs it provides. The result is an up-to-date, unique examination of the sector and its relevance to Canadians.

The clean energy sector is diverse and spread across the country, which perhaps has made it harder to visualize in the minds of Canadians. Put simply, it's made up of companies and jobs that help to reduce carbon pollution—whether by creating clean energy, helping move it, reducing energy consumption, or making low-carbon technologies.

The jobs in the clean energy sector are in many industries and in every province. They include the Canadians who manufacture solar panels and wind turbines, as well as those who maintain the grids that deliver increasingly clean electricity to our homes and businesses. They include train and bus drivers who help get more Canadians out of their cars, and the specific engineers and construction workers who make buildings more energy-efficient.

The clean energy sector also drives Canadian innovation. It's home to several world-leading cleantech companies, like CarbonCure, which uses recycled CO₂ to make concrete, or Enbala, which creates smart energy grids. These low-carbon solutions have won international acclaim.¹

What's more, the jobs are comparatively stable and less dependent on global economic booms and busts.

But that doesn't mean the clean energy sector doesn't have good export potential. In fact, many companies participating in the Canadian clean energy sector are primarily export-oriented.²

Despite their present success, parts of the clean energy sector have grown from more humble roots. A decade ago, wind and solar power were often regarded as expensive and inconsistent sources of electricity, while electric cars were more of an idea than a reality. But with investment and rapid advances in technology, renewables are producing more power than ever³ and fetching record-low prices,⁴ while electric cars are now on a clear course to take over Canadian roads.⁵ Meanwhile, smart energy systems, once the toys of millionaires and sci-fi movies, can now be found in almost all newly constructed residential and commercial buildings. Clean energy and the technologies to use it efficiently are becoming accessible to everyone.

Indeed, **the clean energy sector isn't just about fighting climate change—it's also about using Canadian innovation to create better and cheaper solutions for everyday life.** And as it grows, so will the opportunities to deliver products and services that make life cleaner and more affordable for all Canadians.

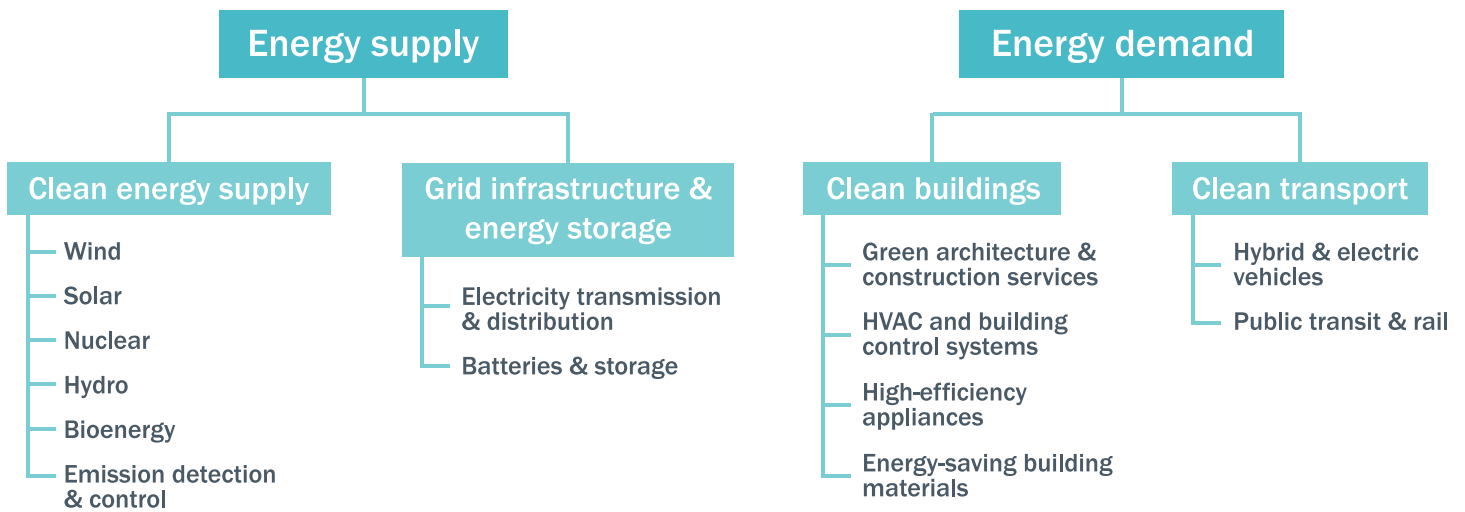
So, yes, Canada, let's talk energy, but let's talk about the whole energy picture. Because it's not just our future—it's already a big part of our present.



A handwritten signature in dark ink, consisting of a stylized 'M' followed by a loop and a trailing line.

Merran Smith
Executive Director
Clean Energy Canada

The clean energy sector



METHODOLOGY

The research and analysis in this report was conducted by Navius Research and commissioned by Clean Energy Canada. Data were sourced and inferred from existing databases, such as government statistics and industry reports. The rest of the data were determined through a survey of the clean energy sector and by sourcing financial statements. Only firms whose primary business is in clean energy were targeted, so the results represent a minimum

of clean energy activity.

The clean energy sector was first split into two categories: energy supply and energy demand. Energy supply was then broken out into clean energy supply and grid infrastructure and energy storage. Energy demand was broken out into buildings and transport. From there, further sub-industries and the jobs within those sub-industries were explored.

WHERE'S INDUSTRY?

We see “clean industry”—such as emission detection and control technology, low-carbon machinery, and industrial process improvements—as part of the clean energy sector too. However, the data were not available to quantify industry’s contribution to the clean energy sector over the period of this study (2010-2017). Industry will be included in future analysis related to the clean energy sector.

We would like to thank the following steering committee members who provided guidance and review of the technical analysis underlying this report:

- Celine Bak, *Analytica Advisors*
- Conrad Barber-Dueck, *Statistics Canada*
- Dave Sawyer, *EnviroEconomics*
- Paul Shorthouse, *The Delphi Group*
- Glen Hodgson, *economist and financial consultant*



A story of rapid growth

THE CLEAN ENERGY SECTOR GREW at a rate of 4.8% a year between 2010 and 2017 in nominal terms (which means inflation is included). Compare that to the overall Canadian economy, which grew 3.6% a year. And it's not just dominated by one or two success stories—many industries within the clean energy sector grew between 2010 and 2017.

Renewable and alternative energy supply—think hydropower and wind farms—is one of the biggest earners in the clean energy sector, accounting for almost 40% of its gross domestic product (GDP, or the value of all goods and services) in 2017.

Renewables were closely followed by clean transport—such as public transit operation and electric vehicle manufacturing—which accounted for 30% of its GDP, and clean electricity infrastructure and storage, which accounted for 25%.

In terms of employment, the number of clean energy jobs grew by 2.2% a year between 2010 and

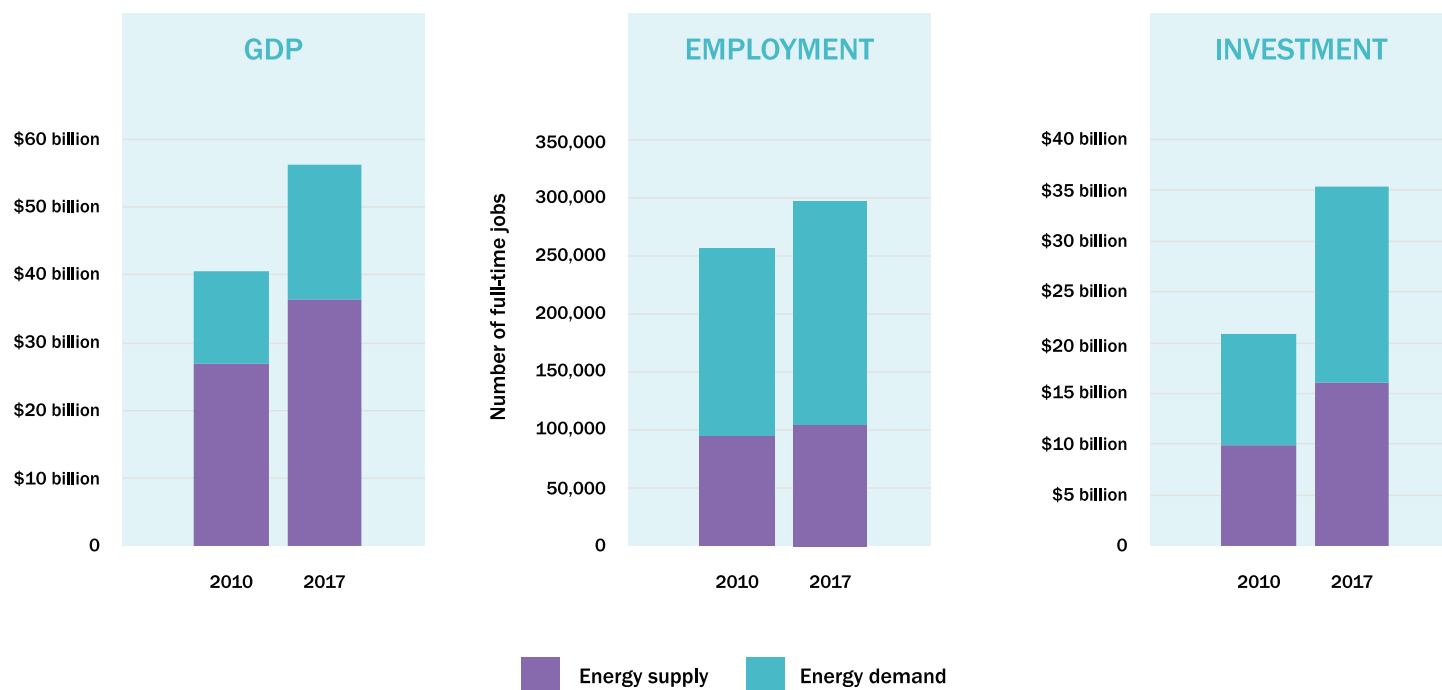
2017. Compare that to job growth across the whole of Canada, which was 1.4% annually. The clean transport industry, in particular, vrooms ahead in the jobs category, employing the most Canadians of all in the sector, largely in public transit.

The clean energy sector's impressive growth has not gone unnoticed, and companies and investors are backing it. **Overall annual investment grew from \$21 billion in 2010 to \$35.3 billion in 2017—an increase of almost 70%.**

In fact, investment in electricity infrastructure (the systems that deliver energy from where it is generated to homes and businesses) more than doubled between 2010 and 2017. Investment in clean buildings, materials, and appliances (which spans everything from insulation to energy-efficient heating systems) tells a similar story, also nearly doubling in the same period.

Wherever you look—employment, investment, or GDP—the clean energy sector is a picture of growth.

The clean energy sector is growing



A photograph of a city street scene. In the foreground, a white, two-seater electric car with 'SOLO' written in large black letters on its side is parked. Two men, one in a white shirt and one in a blue shirt, are standing next to it, looking at a smartphone. The background shows a modern building with a glass facade, a parking lot with several cars, and a traffic light. The sky is overcast.

Sector spotlight: Electric vehicles

Every day across this country, tens of thousands of Canadians are enjoying an all-electric commute. More and more people are ditching their gas cars in favour of electric versions that save on fuel and maintenance costs and improve air quality. In fact, **the number of electric cars on the road in Canada almost doubled between 2017 and 2018.**⁵ Over \$1 billion was invested in electric vehicles and charging infrastructure in 2017, over 95% of which was in Ontario, B.C., and Quebec.

But it's not just car drivers who can commute emissions-free. Canadians taking transit to work might also find themselves on board an electric bus. And if those riders looked at the bus's manufacturer, chances are they'd find it was Canadian. That's because Canada is home to a whole range of electric vehicle manufacturers. Take Quebec-based Lion Electric, which manufactures battery-powered electric buses and urban delivery trucks. Or B.C.'s Electra Meccanica, which makes the small, affordable SOLO electric car (pictured). Even Linamar, a major employer in Guelph, now supplies hybrid, electric, and fuel cell electric vehicle parts.



WINNIPEG-BASED NEW FLYER IS THE LARGEST
BUS MANUFACTURER IN NORTH AMERICA

PHOTO: NEW FLYER

How does the clean energy sector stack up?

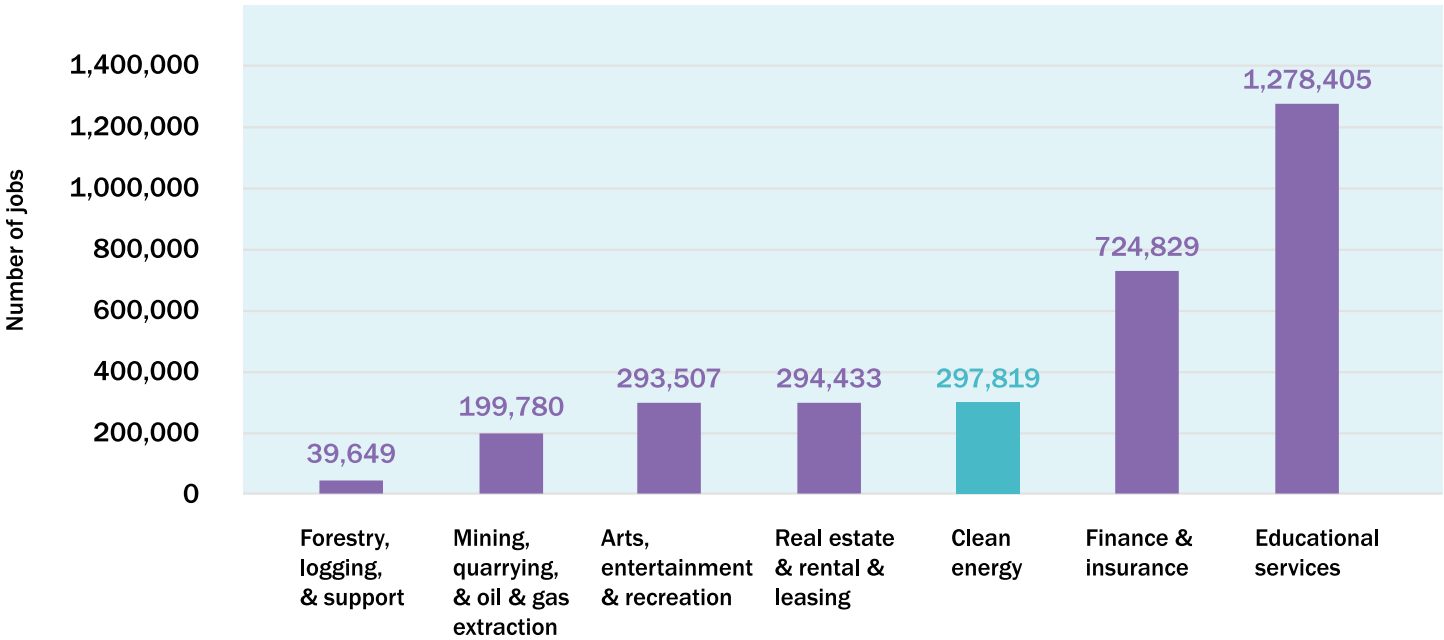
THERE ARE MANY GOOD REASONS to work in the clean energy sector. The jobs are in a growing field that benefits both people and the planet. But what are the chances of actually getting one of these jobs?

The answer is quite high, because the clean energy sector is big. **Approximately 298,000 people were employed in the clean energy sector in Canada in 2017.** Though it is not a perfect comparison, for a sense of scale consider that, according to Statistics Canada, mining, quarrying, and oil and gas combined directly employed 199,780 people in 2017. Or real estate, which

directly employed 294,433. **The number of jobs is increasing at a greater rate too.** The clean energy sector employed 16% more people in 2017 than in 2010, compared to a 10% increase across the whole of the Canadian economy.⁸

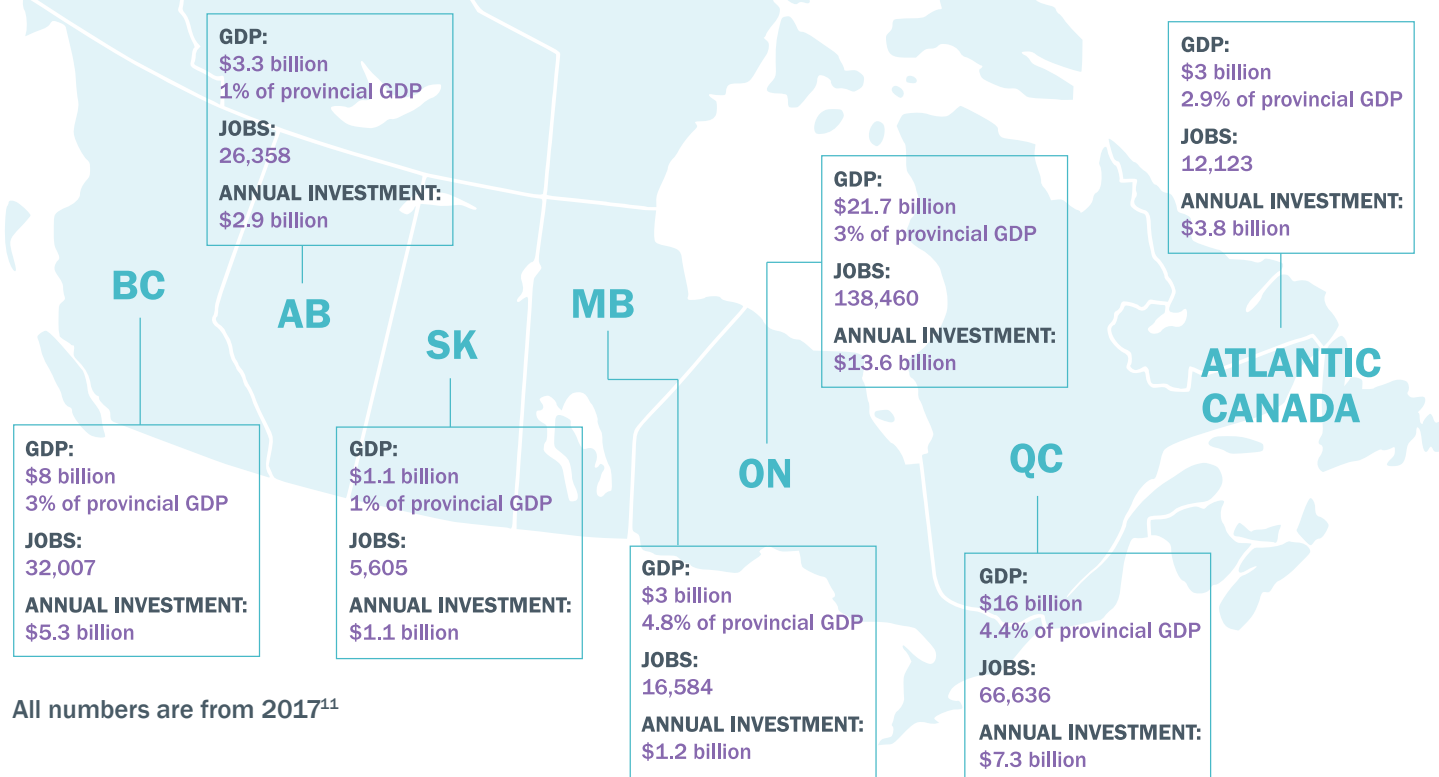
In fact, in **2017 the clean energy sector represented a significant part of Canada's GDP: 3% in total.** To put that in context, consider that the direct contribution of agriculture, forestry, fishing and hunting was 2.1%, while the hotel and restaurant industry was 2.3%.⁹

Canadian employment sectors in 2017



The comparative employment numbers in this chart are taken from Statistics Canada's "Annual Employment by Industry" dataset and are broken down by the North American Industry Classification System (NAICS) Canada 2017 Version 3.0, which employs a different methodology than the one used in our research.¹⁰

The provincial picture



All numbers are from 2017¹¹



“The clean energy transition requires significant amounts of renewable energy to be installed and integrated. This creates a great market opportunity that Hydrogenics is well-situated to address, and it provides us with opportunities for growth and to further advance our technology.”

—Daryl Wilson, CEO of Hydrogenics

*Note that 7,379 jobs (2.5% of the total jobs) and \$1.14 billion of Canada’s clean energy sector GDP (2% of the total) could not be disaggregated by province. As a result, we divided this small percentage up between the provinces and weighted it by their proportion of GDP, investment, or jobs.



PHOTO: HYDROGENICS

British Columbia

B.C. generates close to 95% of its electricity from renewable sources, with hydropower leading the way.¹² In fact, 27% of B.C.'s clean energy GDP comes from hydropower, while another 28% is from electricity transmission and distribution.

B.C. is also a cleantech leader. Half of Canada's 12 companies on the recent Global Cleantech 100 list came from B.C. The province is home to many cleantech businesses and manufacturing companies, such as Ballard, which makes hydrogen electric fuel cells for vehicles like buses and trains.

Alberta

Alberta has made some of the largest investments in emissions control technologies, with a total of \$2.6 billion between 2010 and 2017. Investment was focused on carbon capture and storage projects, particularly QUEST and the Alberta Carbon Trunk line, that capture carbon from industrial processes for use or storage elsewhere.

Saskatchewan

Saskatchewan is one of Canada's biggest investors in bioenergy, investing a total of \$900 million in the industry between 2010 and 2017. The province's strong agricultural industry and technical expertise make it well-positioned to lead in this field.

Manitoba

Manitoba is home to some of Canada's leading electric vehicle and public transit manufacturing facilities. New Flyer Industries, based in Winnipeg, is the largest bus and coach manufacturer in North America—and also now a major manufacturer of electric buses.

Ontario

Canada's biggest province also has its biggest clean energy sector, with 39% of Canada's clean energy GDP in 2017. In particular, Ontario is home to many world-leading manufacturers of clean energy generation and storage technology, such as Mississauga-based **Hydrogenics**, which makes cutting-edge hydrogen fuel cells.

Quebec

Quebec has invested heavily in renewable energy supply, including wind, which received \$7.6 billion in investment between 2010 and 2017—36% of the total investment in wind energy in Canada. It also continues to invest in its extensive hydro facilities, including building the 1,550-megawatt Romaine hydroelectric facility in Havre-Saint-Pierre.¹³

Atlantic Canada

Atlantic Canada is home to a range of clean energy activities. Power companies in New Brunswick and Nova Scotia are investing in new smart grid technology.¹⁴ **Investment in electrical grid infrastructure and energy storage in Nova Scotia more than doubled between 2010 and 2017.**

Sector spotlights



PHOTO: NRSTOR

Batteries and energy storage

With clean electricity comes the need to store it. This need has provided a big opportunity for Canada.

Take companies like Ontario-based Hydrostor and **NRStor**. These firms, and others like them, have designed business models and technologies to store large amounts of electricity—usually from renewables such as wind and solar—meaning people can get renewable electricity any time, even when the sun sets and the wind isn't blowing.

Investment in the industry has seen rapid growth increasing from \$5.9 million in 2010 to almost \$200 million only five years later. Since 2015, investment in the industry has dropped, but it still retained a significant \$115 million of investment in 2017.

Building control systems and heating, ventilation and air conditioning

The clean energy sector has given us an opportunity to control the air we breathe and the environment in which we live and work. Accordingly, it boasts thousands of specialists in energy-efficient heating, ventilation, and air conditioning, as well as manufacturers of building control systems (smart home systems that help us waste less electricity). From Vancouver-based Neurio, which produces home energy monitors, to New Brunswick's Greystone energy systems, which makes energy-efficient heating and cooling systems for buildings, there are many Canadian companies in the growing industry.

In fact, **the GDP from this type of manufacturing more than doubled between 2010 and 2017, rising to \$366 million in 2017.** The success of this industry means it's not just Canadians benefiting from excellent building control systems and highly efficient homes—the rest of the world is too. Indeed, roughly half of this industry's production is exported.



Wind energy

Wind power supplies approximately 6% of Canada's electricity⁶ while attracting a steady stream of investment. But wind energy in Canada isn't just about vast 150-turbine facilities feeding megawatts of power into the national grid. In the Northwest Territories, smaller wind farms are replacing diesel generators in remote, off-grid communities.

These often Indigenous-owned wind facilities have helped reduce dependency on shipments of diesel from external sources while alleviating concerns about replacing expensive, aging generators.⁷ Investments in new wind farms have been coupled with battery storage technology, so the communities can get reliable, emissions-free power year-round.

THE 150-MEGAWATT MASSIF DU SUD WIND FARM IN QUEBEC

PHOTO: JOAN SULLIVAN



What's a clean energy job?

NOT ONLY ARE THERE MANY JOBS in the clean energy sector, there are many different types of jobs. Whether you're an insulator, a software developer, or an electrician, opportunities abound. Clean energy jobs appear all across the country, straddling multiple regions, provinces, industries, and occupations. Some jobs are in downtown

office blocks, others in Indigenous communities, while some are at the top of 300-foot turbines.

Regardless of the province you live in, the clean energy sector exists and it is growing. Here we summarize where the hundreds of thousands of Canadians working in the clean energy sector are employed.

Clean energy supply

In 2017, there were **59,800 jobs in clean energy supply, accounting for 20% of the clean energy sector.** Clean energy supply refers to anyone working to produce clean power in Canada, from manufacturing solar panels to maintaining wind turbines to producing biofuels. Nuclear and hydro power were by far the biggest employers, making up 80% of jobs in this industry.

Grid infrastructure and energy storage

Around 16% of the Canadians employed in the clean energy sector worked in grid infrastructure and energy storage in 2017. This equates to around 47,000 Canadians with jobs such as electrician, transmission field technician, or manager of a multi-gigawatt power storage facility. The overwhelming majority (99%) of the jobs in this industry were in electricity transmission and distribution. And as more and more of us electrify our lifestyles, whether by buying an electric car or installing a heat pump, our electricity grid has a big part to play. In fact, Canada is aiming for 90% non-emitting electricity generation by 2030¹⁵, up from 81% today.¹⁶

Clean buildings

Spanning construction, temperature control, and the production of clean building materials, there were 19,600 people employed in clean buildings, making up 7% of jobs in the clean energy sector in 2017.

Note that this number only considers jobs linked to the *energy-related* construction of buildings that were certified to meet green building standards. Most of the jobs were in architecture and construction services, although many people also worked in heating, ventilation, and air conditioning. With almost all new construction of large buildings involving the use of building control systems, jobs in this industry are growing fast.

Clean transport

The clean transport industry is by far the biggest employer in Canada's clean energy sector, providing 58% of its jobs in 2017. The vast majority are employed in the public transit industry, including bus and rail services. Anyone working in public transit—from bus drivers to train operators—is considered part of the clean energy sector because their jobs are helping to reduce emissions from individual cars. A smaller number of jobs were in the manufacture and design of hybrid and electric vehicles.




Clean
transport

57.5%


Clean energy
supply

20.1%

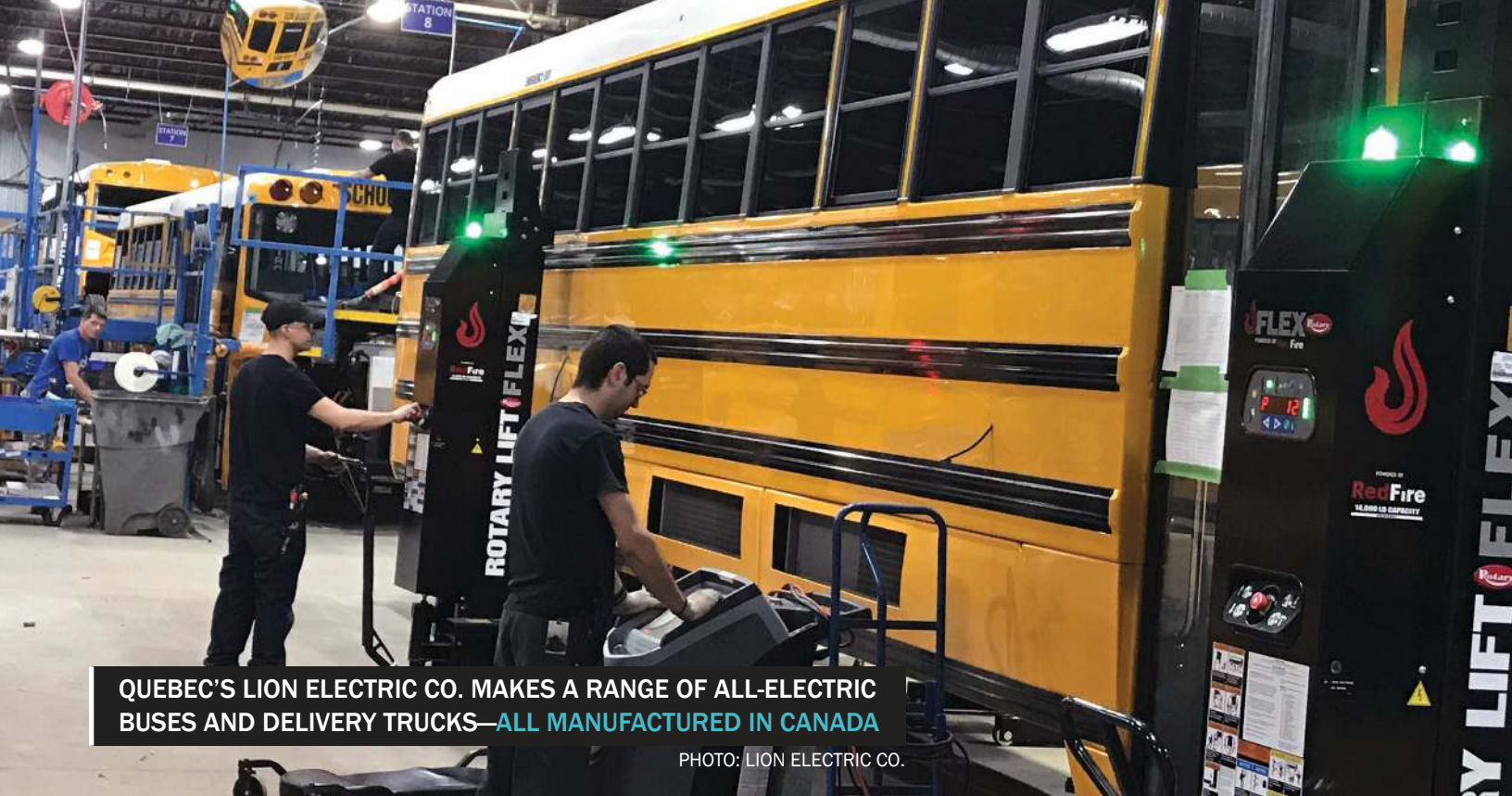

Grid infrastructure
and energy storage

15.8%

6.6%


Clean buildings

Employment breakdown



QUEBEC'S LION ELECTRIC CO. MAKES A RANGE OF ALL-ELECTRIC BUSES AND DELIVERY TRUCKS—ALL MANUFACTURED IN CANADA

PHOTO: LION ELECTRIC CO.

A bright future

ONE OF THE MOST EXCITING ASPECTS of Canada's clean energy sector is that it's already here—and it's bigger than people think.

It isn't one type of company or one type of job. It's large global companies, family-run businesses, small tech startups, and everything in between. From the electric vehicle manufacturer in Vancouver to the contractor insulating your home, hundreds of thousands of Canadians are building our clean energy sector.

And the future looks bright. If we continue on this trajectory, **growth in clean energy industries will continue to outpace many other industries in all provinces over the next decade.** Hybrid and electric vehicles will fill our roads. Wind energy and municipal waste will power our communities. Low-carbon machinery will help our natural resources and industrial companies reach new levels of energy efficiency.

But, of course, clean growth won't happen by accident. The hard-working Canadians actively building our clean

future must be joined by businesses, policy makers, and governments to ensure Canada can truly capitalize on this opportunity. **Strong policies and smart investments are needed to keep Canadian industries competitive and ready for the future, while also meeting our climate targets.**

As Canadians, who do we want to be in ten, 20, 50 years? What products and technologies do we want to adopt at home and export to the world? How do we want to make our mark in the global economy? **The clean energy sector's success to date highlights the huge opportunity on our doorstep.** It also shows us how much we could lose if we choose to shut that door.

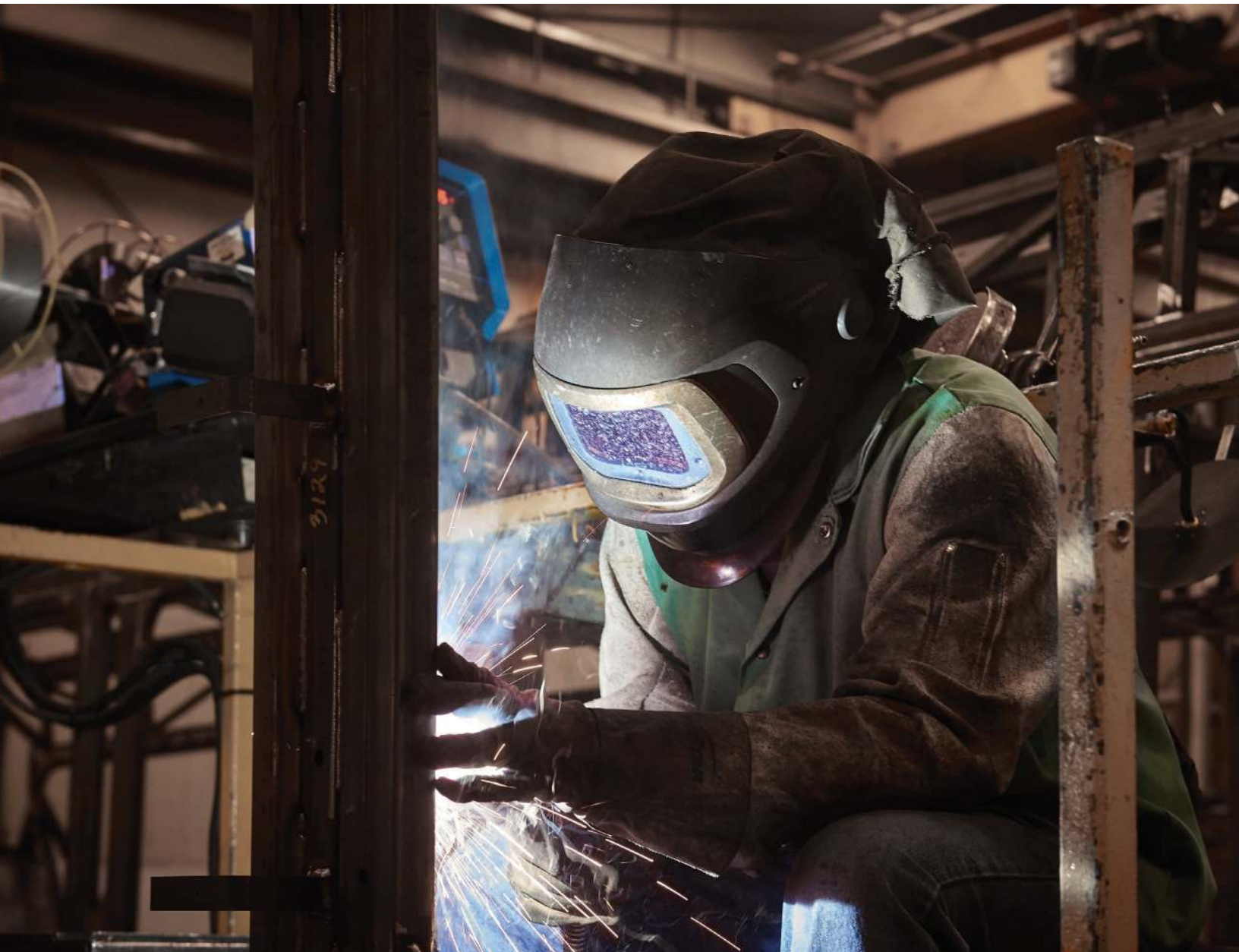
Canadians ought to add another topic to their conversations around energy, pipelines, and electricity prices: a growing and thriving clean energy sector. But it's up to governments, policy makers, and industries—and the Canadians who vote and work for them—to guide the discussion and our way forward.

Endnotes

1. Cision. "12 Canadian Companies Named to Prestigious 2019 Global Cleantech 100 List." Accessed: April 2019. <https://www.newswire.ca/news-releases/12-canadian-companies-named-to-prestigious-2019-global-cleantech-100-list-823879418.html>.
2. Analytica Advisors. Synopsis: Canadian Clean Technology Industry Report. Analytica Advisors, 2016.
3. Natural Resources Canada. "Renewable energy facts." Accessed: April 2019. <https://www.nrcan.gc.ca/energy/facts/renewable-energy/20069>.
4. *Mining and Energy*. "Alberta renewables auction record-setting success." Accessed: April 2019. https://www.miningandenergy.ca/energyinsider/article/alberta_renewables_auction_record_setting_success/.
5. *Electric Mobility Canada*. "Electric Vehicle Sales in Canada 2019." Accessed: April 2019. <https://emc-mec.ca/new/electric-vehicle-sales-in-canada-in-2018/>.
6. CanWEA. "Installed Capacity." Accessed: April 2019. <https://canwea.ca/wind-energy/installed-capacity/>.
7. Cision. "The governments of Canada and Northwest Territories invest in first Arctic Energy Fund project with Inuvik Wind Generation, creating cleaner and more reliable energy." Accessed: April 2019. <https://www.newswire.ca/news-releases/the-governments-of-canada-and-northwest-territories-invest-in-first-arctic-energy-fund-project-with-inuvik-wind-generation-creating-cleaner-and-more-reliable-energy-700422722.html>.
8. Statistics Canada. "Employment by industry, annual." Accessed: April 2019. <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1410020201#timeframe>.
9. Statistics Canada. "Gross domestic product (GDP) at basic prices, by industry." Accessed: April 2019. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101>.
10. Statistics Canada. "North American Industry Classification System (NAICS) Canada 2017 Version 3.0." Accessed: April 2019. <http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1181553>.
11. Statistics Canada. "Gross domestic product (GDP) at basic prices, by industry, provinces and territories." Accessed: April 2019. <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610040201>.
12. National Energy Board. "Canada's Renewable Power Landscape 2016–Energy Market Analysis." Accessed: April 2019. <https://www.neb-one.gc.ca/nrg/sttstc/lctrct/rprt/2016cndrnwblpwr/prvnc/bc-eng.html>.
13. Hydro Quebec. "Romaine Complex." Accessed: April 2019. <https://www.hydroquebec.com/projects/romaine.html>.
14. Cision. "Siemens Canada, NB Power and Nova Scotia Power announce \$92.7 million project to develop the electrical grid of the future." Accessed: April 2019. <https://www.newswire.ca/news-releases/siemens-canada-nb-power-and-nova-scotia-power-announce-92-7-million-project-to-develop-the-electrical-grid-of-the-future-834165669.html>.
15. Government of Canada. "Powering our future with clean electricity." Accessed: April 2019. <https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/powering-future-clean-energy.html>.
16. Natural Resources Canada. "Electricity Facts." Accessed: April 2019. <https://www.nrcan.gc.ca/energy/facts/electricity/20068>.



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