



The future of Canadian energy looks bright, with clean energy job growth projected to outpace losses in fossil fuels amid a shifting global landscape

# The New Reality

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## The New Reality

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**SFU**

MORRIS J. WOSK  
CENTRE FOR DIALOGUE

# A tale of two sectors

Last year saw a collapse in global energy demand brought on by the pandemic—the biggest drop since the end of the Second World War.

It might seem like a somber lead for a report about Canadian energy, but there was something unusual about the drop. While most energy sources struggled, renewable energy actually grew worldwide. Not only was it the only energy sector to do so, but it grew at its fastest pace in almost two decades, according to the International Energy Agency.<sup>1</sup> In short, when it comes to energy, there are two stories unfolding simultaneously.

A new modelling study from Clean Energy Canada and Navius Research explores the energy picture here in Canada over the next decade, revealing Canada's own diverging energy story. And if there's one thing we can be sure of, it's that Canada's clean energy sector—like global renewables—is growing fast.

Already, Canada's clean energy sector employs 430,500 people—more than the entire real estate sector—and by 2030, that number is projected to grow almost 50% to 639,200, our research finds.<sup>2</sup> At the same time, Canada's fossil fuel sector will see a 9% drop in employment. In terms of raw numbers, those **208,700 new clean energy jobs far exceed the 125,800 lost in fossil fuels.**

Beyond just renewable power, Canada's clean energy sector is made up of companies and jobs that help reduce carbon pollution, whether by generating clean energy, helping move it, reducing energy consumption in transportation, buildings, and industry, or making low-carbon technologies. It includes a whole range of jobs, from the worker assembling battery packs for new electric buses to the insulator retrofitting homes so they waste less energy.

Similarly, the clean energy sector's GDP is forecast to grow by an impressive 58% by 2030—significantly more than the 9% growth expected in fossil fuels.

What's more, the diverging stories are particularly pronounced in Canada's biggest oil-producing regions. **Clean energy jobs in Alberta are set to increase a huge 164% over the next decade**—the greatest increase of any Canadian province—while Saskatchewan will also see clean energy jobs double.

But this massive clean energy sector growth depends, in part, on policy. The jobs and GDP were modelled under the policies in the federal government's new climate plan, *A Healthy Environment and a Healthy Economy*. When the same model is run under the weaker policies that existed prior to the December plan, there are 85,000 fewer jobs in

clean energy and 17,400 fewer jobs in Canadian energy overall in 2030.

Climate action is no longer just a pollution-cutting imperative but an economic one too if we're to transform our energy economy. And around the world, leaders and decision-makers are taking action to cut pollution and build their respective clean energy sectors. **Already, 127 countries—including the U.S and Canada—representing 63% of the world's emissions have adopted or are considering net-zero targets.**<sup>3</sup>

And as those countries decarbonize their economies, they'll be looking to trade with others that can supply the low-carbon goods and services they need.

The good news is that Canada's clean energy sector is positioned to thrive, with many innovative companies already exporting their clean products. Ontario-based Li-Cycle produces and sells recycled minerals from old car batteries to international clients like LG and General Motors. B.C.-based Ballard Power and Loop Energy are supplying their hydrogen fuel cell technology to countries in Europe and Asia. Nova-Scotia-based CarbonCure, which uses captured carbon to make cleaner, stronger concrete, sells its technology all over the world.

And the opportunity extends beyond just the clean energy sector as defined in this report. Canada's mining sector also stands to benefit from the increased demand for certain natural resources—like lithium and nickel—as the world switches to electric vehicles and clean power. Many of Canada's heavy industries, like steel and cement, make cleaner products than international competitors, giving them an edge in an increasingly low-carbon world.<sup>4</sup>

The energy transition, like climate change itself, does not respect borders, and Canada has the ingredients needed to prosper in a future in which oil is no longer its largest export. As the International Energy Agency recently concluded, **if the world is to reach net-zero emissions by 2050, no new oil and natural gas exploration and development will be needed going forward.**<sup>5</sup>

Oil and gas may have dominated Canada's energy past, but it's Canada's clean energy sector that will define its new reality.



**Merran Smith**, Executive Director

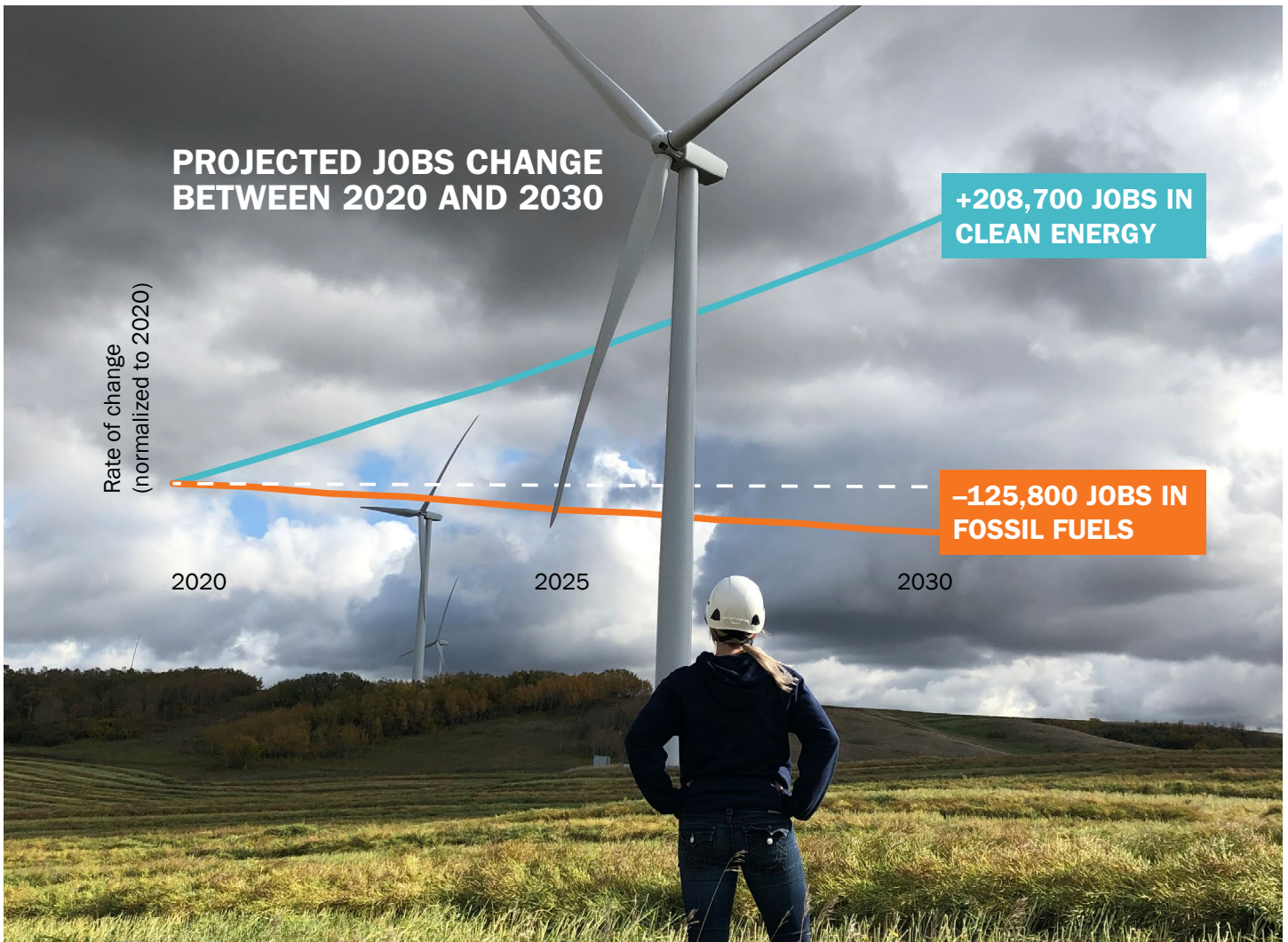


Photo: BluEarth Renewables. Learn more about BluEarth on page 11

# Canadian energy redefined

**CANADIANS COULD BE FORGIVEN** for thinking that “Canadian energy” is synonymous with “Canadian fossil fuels.” After all, tumultuous gasoline prices and pipeline predicaments have a habit of grabbing headlines. And yet our clean energy sector has been quietly expanding its share of Canadian energy jobs for many years, often absent the drama of its polluting counterpart.

If there is one thing Canada’s clean energy sector does well, it’s grow. Not only does it already employ 430,500 workers across all provinces and territories, but **between 2010 and 2017 the sector grew a third faster than the Canadian economy as a whole.**<sup>6</sup>

In many ways, the picture today is just the start. Over the next decade, Canada’s clean energy sector is on a course to grow even faster. It’s good news for Canadian energy jobs, our carbon pollution goals, and our international competitiveness.

## WHAT’S INCLUDED IN THE MODELLING?

For this study, two policy frameworks were modelled: the climate plan the federal government proposed in December 2020, *A Healthy Environment and a Healthy Economy*, as well as the policies under the preceding *Pan-Canadian Framework on Clean Growth and Climate Change*. Unless otherwise specified, all numbers in this report are based on the new plan.

Note that the values for the fossil fuel sector are greater than the oil and gas numbers reported by Statistics Canada because our definition of the fossil fuel sector is broader, in line with the clean energy definition.

For more information on methodology, differences to previous Clean Energy Canada reports, as well as industries included in the clean energy sector, **see page 17.**

**639,200**  
**CLEAN ENERGY JOBS**  
**IN 2030**

# Action on climate is action on jobs

**WHEN THE FEDERAL GOVERNMENT** released its new climate plan, *A Healthy Environment and a Healthy Economy*, it was the decision to raise the carbon price that drew the most attention. The pollution-cutting efficacy of carbon pricing is clear: economists regard it as one of the most effective and efficient ways to curb emissions. But the policy, along with the other new measures in the plan, does more than just reduce pollution.

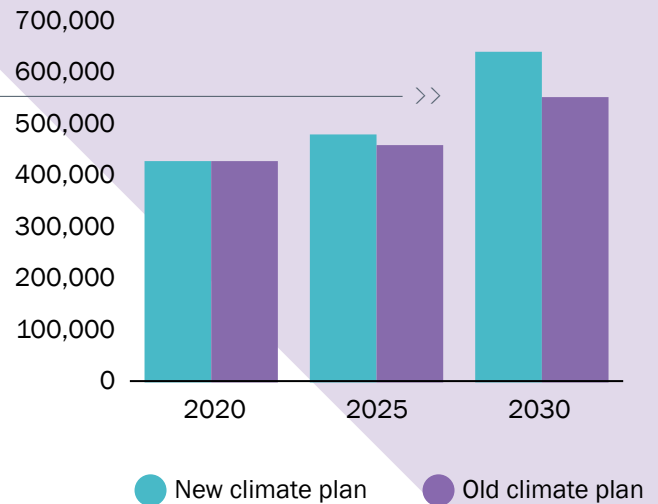
**According to our modelling, jobs in clean energy are set to increase almost twice as fast under this new climate plan than under previous policies.** The number of jobs is on track to grow 4% annually over the next decade, reaching a total of 639,200 jobs by 2030—85,000 more than under previous measures. The gains are so significant that job growth in the smaller clean energy sector even outpaces losses in the larger fossil fuel sector.

Along with jobs, the GDP of the clean energy sector is on track to grow more quickly in response to the new plan, with the sector's total value expected to grow by 58% between 2020 and 2030, relative to 40% under the old plan.

**And even if oil prices decline in line with lower forecasts, resulting in additional job losses in fossil fuels, overall Canadian energy jobs still fare better under the new climate plan due to the strong growth in clean energy jobs.**

In short, taking stronger climate action retains and adds overall Canadian energy jobs.

## MORE JOBS ARE ADDED TO THE CLEAN ENERGY SECTOR UNDER THE NEW CLIMATE PLAN



## WHAT'S IN THE NEW CLIMATE PLAN PROPOSED IN DECEMBER 2020?

- The carbon price is raised from \$50 to \$170 per tonne of CO<sub>2</sub> equivalent by 2030 (applied to all provinces except Quebec, which is expected to continue applying its California-linked cap-and-trade program).
- A Clean Fuel Standard is applied to liquid fuels (gasoline, diesel, home heating oil) that requires suppliers to gradually reduce the carbon intensity of these fuels over time.
- Multi-sectoral emission reduction funding is implemented, including:
  - » \$5.3 billion for low-carbon industrial technologies.
  - » \$4.1 billion for building envelope improvements and heat pumps.
  - » \$1.3 billion for clean electricity.
  - » \$300 million for zero-emission transport.
- Note that our model captures all of the above, though a few additional measures in the climate plan could not be modelled, generally due to a lack of announced detail.

# Preparing for change

**IN TERMS OF VALUE**, the whole of Canadian energy is on track to grow by 20% over the next decade, driven largely by huge gains in the Canadian clean energy sector's GDP.

**The clean energy sector's GDP is forecast to grow an impressive 58% by 2030**—significantly more than fossil fuels, which will grow only 9%. By 2030, clean energy will make up 29% of Canada's total energy GDP, up from 22% in 2020.

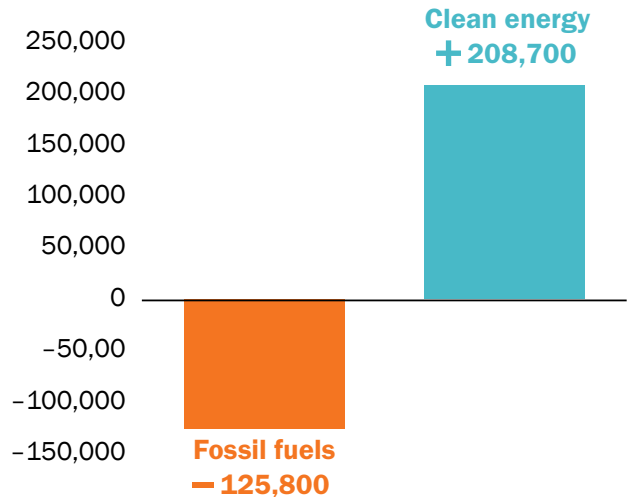
The picture is similar for jobs. **Clean energy jobs will grow almost 50%**, while jobs in fossil fuels are set to drop 9%, with 208,700 more jobs in clean energy in 2030 and 125,800 fewer jobs in fossil fuels. The outcome is that clean energy jobs make up an even bigger proportion of Canada's

energy jobs, comprising 35% of total energy-related jobs in 2030 compared to 24% in 2020.

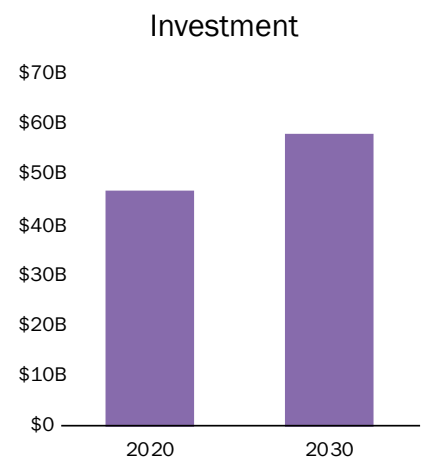
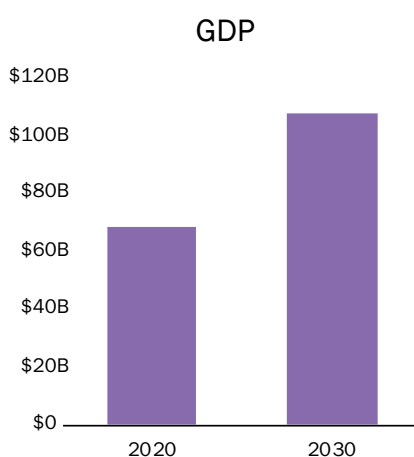
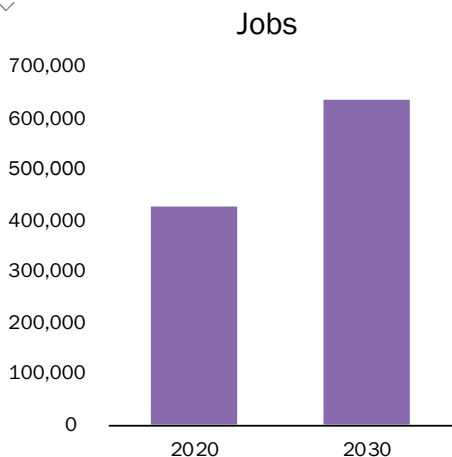
By 2030, Canada's energy landscape will look a lot different. Preparing for the shift now helps ensure that workers facing job losses are able to smoothly transition into new fields, whether it's the clean energy sector or other employment areas. Measures are underway elsewhere in the world to address this: the EU recently approved a €17.5-billion fund to help coal-dependent regions shift to clean energy, for example.<sup>7</sup> But Canada is currently lacking a plan for transitioning and preparing its labour force for the growing opportunity. After all, jobs in the clean energy sector can only grow as fast as there are workers to fill them.

**BETWEEN 2020 AND 2030, CLEAN ENERGY JOB GAINS MORE THAN MAKE UP FOR FOSSIL FUEL JOB LOSSES**

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**JOBS, GDP, AND INVESTMENT IN THE CLEAN ENERGY SECTOR ARE ALL SET TO GROW**



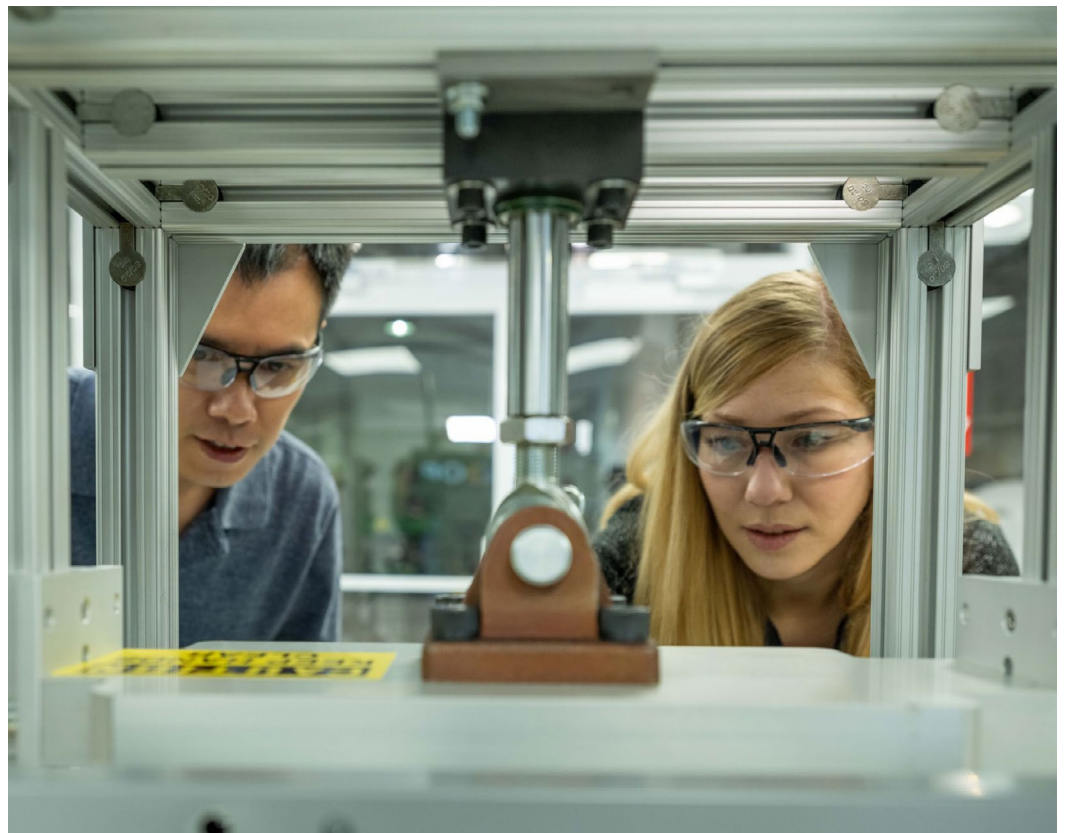
All figures in 2015 Canadian dollars

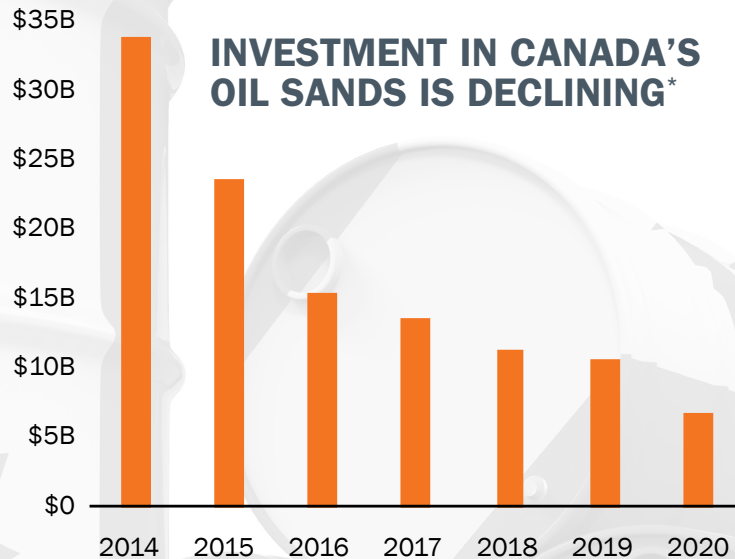
## SECTOR SPOTLIGHT



**ABOVE:** Quebec-based **Lion Electric Co.** is rarely out of the news these days. The rapidly growing company makes electric buses and trucks for the North American market, having struck a deal with Amazon to supply electric delivery vans earlier this year.<sup>8</sup> The firm recently announced it is starting to build a battery manufacturing plant and innovation centre in Quebec,<sup>9</sup> as well as a new manufacturing site in Illinois.<sup>10</sup>

**RIGHT:** B.C. is home to two hydrogen fuel cell manufacturers, **Loop Energy** (pictured) and **Ballard Power**,<sup>11,12</sup> both of which are seeing international demand for their technology. Ballard's hydrogen fuel cells are already in use around the world, from buses in New Zealand to trains in Scotland.<sup>13</sup> And Loop Energy recently signed a deal to supply 20 of its electric fuel cells to power zero-emission trucks in Germany.<sup>14</sup>





## The bigger picture

**CANADA'S CLEAN ENERGY ACCELERATION** is far from a domestic phenomenon. Around the world, clean energy is taking off while fossil fuels face slowdowns. Canada is one of 127 countries responsible for 63% of global emissions that have adopted or are considering net-zero targets.<sup>3</sup>

Reaching this carbon neutral future will mean significant changes to our energy systems. **In the International Energy Agency's net-zero 2050 scenario, new oil and gas exploration and development would cease now**, while global oil demand would never return to its 2019 peak.<sup>5</sup>

Amid diminishing demand for fossil fuel products, investors are putting pressure on oil and gas companies and financial institutions alike to redirect investment away from pollution-intensive operations.

The effects are already being felt by some fossil fuel operations, with investments in the oil sands in decline since 2014, long before any recent climate policies

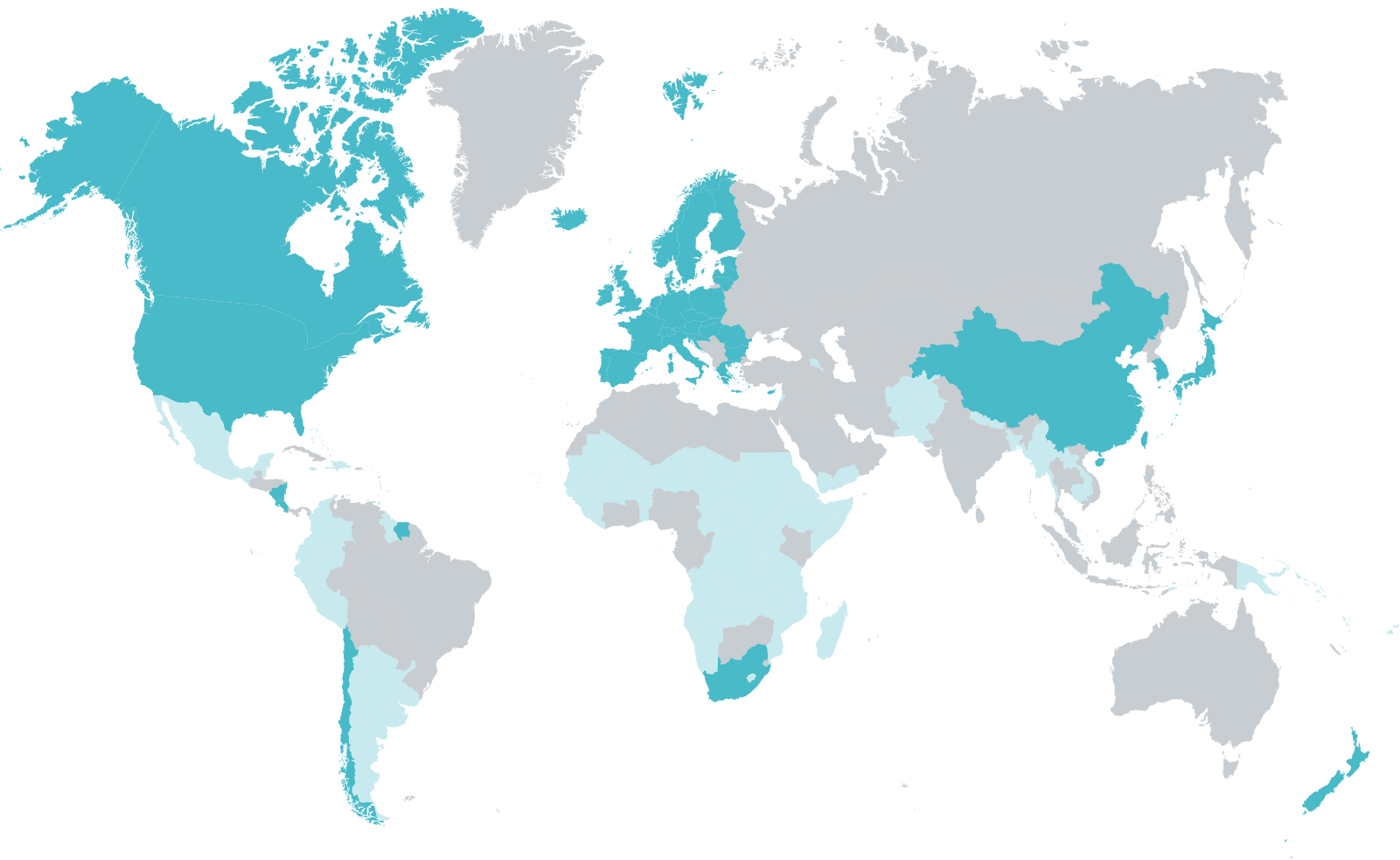
## HOW DOES THE PRICE OF OIL AFFECT CANADIAN ENERGY?

The analysis assumes an oil price of US\$64 (2015) per barrel in 2030. Additionally, a lower price of US\$34 was considered as part of a sensitivity analysis. These prices reflect various Canada Energy Regulator projections. Key findings from the sensitivity analysis include:

- With strong climate policy in place, lower oil prices are likely to increase jobs in clean energy compared to higher oil prices. Thanks to the new climate plan, *A Healthy Environment and a Healthy Economy*, clean energy jobs added under a low oil price exceed those lost in fossil fuels due to a decrease in investment and output as a result of a low oil price environment.
- The clean energy sector's GDP grows even faster under the new climate plan with a lower oil price.

\*Figures in Canadian dollars. Sources: The Canadian energy regulator, 2018, <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2018/market-snapshot-investment-in-canadas-oil-gas-sector-declined-from-2014-high.html>. Oil and gas journal, 2020, <https://www.ogj.com/general-interest/article/14092774/capp-forecasts-first-upswing-in-canadian-oil-sands-capital-spend-in-5-years>. The Canadian Association of Petroleum Producers, 2021, <https://context.capp.ca/articles/2021/article-2021-capex-forecast/>





## COUNTRIES THAT HAVE ADOPTED OR ARE CONSIDERING NET-ZERO TARGETS

Source: The Energy and Climate Intelligence Unit and the Climate Action Tracker, 2020. Countries with targets in place or proposed include those with a target in law, proposed legislation, or a policy document.

- Target in place or proposed
- Under discussion
- No target

were introduced.<sup>15</sup> The economic pressures due to the COVID-19 pandemic have deepened this trend, with investment in 2020 expected to have been the lowest in 15 years.<sup>16</sup> Some of the world’s largest financial institutions have stopped backing oil sands projects altogether.<sup>17</sup>

While the fossil fuel sector may be facing headwinds from changing global macroeconomics, the global clean energy sector’s strong tailwinds more than make up for it. According to the International Energy Agency’s net-zero 2050 scenario, **clean energy investments would create 30 million new jobs globally by 2030, offsetting the five million jobs that would be lost in the declining fossil fuel sector.**<sup>5</sup>

Many of Canada’s biggest trading partners have gotten the memo.

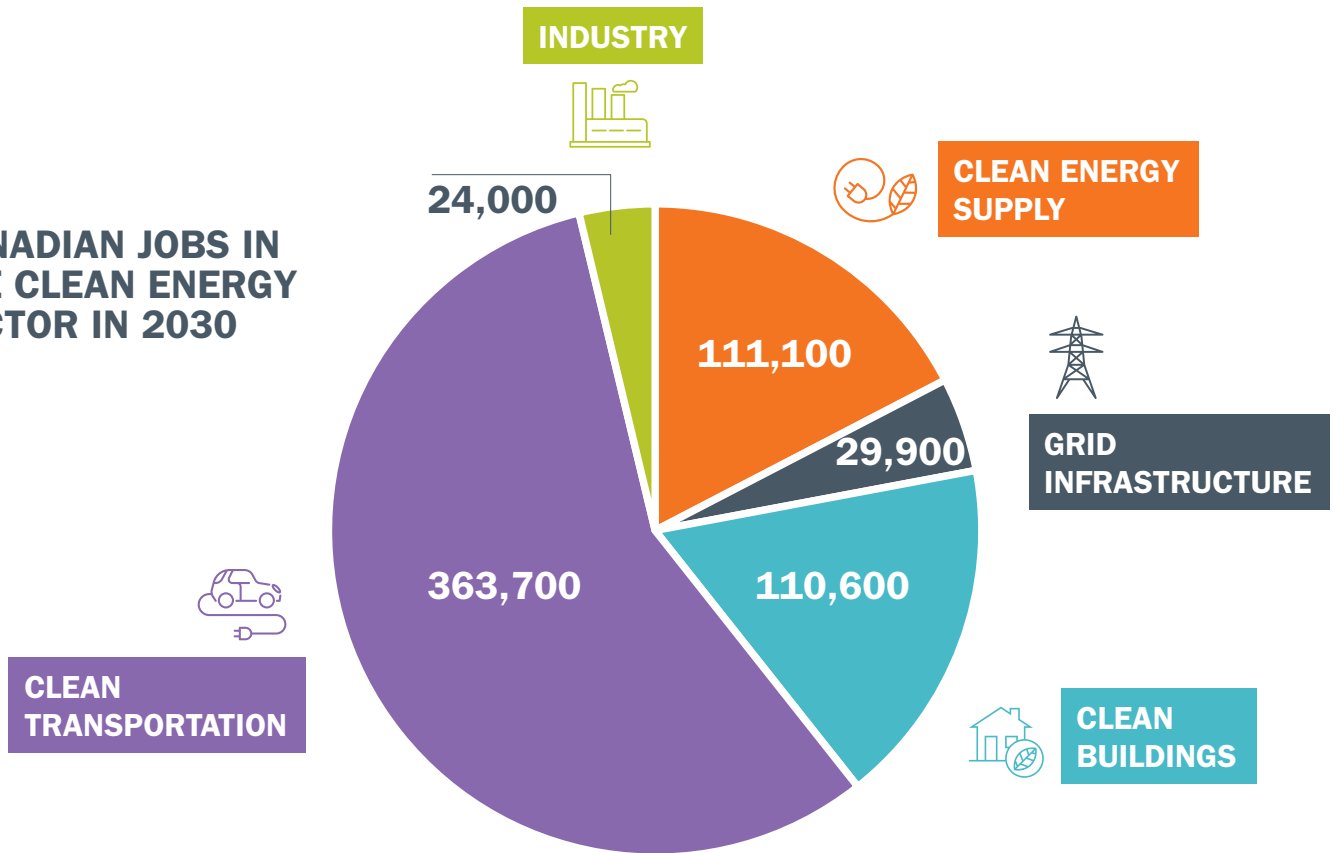
With President Biden at the helm, the U.S. recently committed to a more ambitious climate target, something that the White House says will “create millions of good-

paying, union jobs, (and) ensure economic competitiveness.”<sup>18</sup> The EU has committed to becoming the world’s first carbon-neutral continent.<sup>19</sup> Meanwhile, the U.K. has put forward a plan for a “green industrial revolution” to support jobs and “accelerate the path to net-zero.”<sup>20</sup>

And while these jurisdictions build their clean economies, they are going to need more low-carbon goods and services—things that Canada is well positioned to provide. And the opportunity extends beyond just the clean energy sector. Not only is Canada already home to some of the required natural resources and world-leading cleantech companies, but many of the products made here, like steel and aluminum, are cleaner than those of our global peers, in part thanks to our 83% non-emitting electricity grid.<sup>21–23</sup>

With the future of oil and gas increasingly dim, supporting Canada’s clean energy sector is the key to unlocking a successful energy future.

## CANADIAN JOBS IN THE CLEAN ENERGY SECTOR IN 2030



## Help wanted

**CANADA'S CLEAN ENERGY SECTOR** has many strengths. Not only does it employ hundreds of thousands of workers across every province and territory, the jobs also span a range of skills and industries, from insulators, to software developers, to electricians.

In addition, according to data from the U.S., clean energy workers typically earn more than the national median, with jobs in hydropower paying 41% better than the median wage; jobs in wind and solar offer 37% and 28% more, respectively.<sup>24</sup> Meanwhile in Canada, wages in the “environmental and clean technology workforce” are typically higher than average.<sup>25</sup>

While most industries in Canada’s clean energy sector are forecast to grow, one in particular stands out. **Jobs in electric vehicle technology are on track to grow 39% per year, with 184,000 people set to be employed in the industry in 2030—a 26-fold increase over 2020.**

Much of this growth is due to the rapid adoption of electric vehicles. With EVs set to make up 18% of all new passenger vehicle sales by 2030, more clean energy sector workers will be employed building, driving, and operating them. In reality, this percentage may be even

higher if the U.S. and Canada opt to follow the lead of states and provinces like California, B.C., and Quebec in implementing more advanced EV policies.

**Another industry expected to take off is hydrogen consumption technology, with jobs expected to grow 27% per year between 2025 and 2030,** employing an impressive 21,900 workers by 2030 (2020 data is not available). This growth is perhaps not surprising considering Canada is already home to several leading hydrogen technology companies, including B.C.-based Ballard Power and Loop Energy, all of which make and sell hydrogen fuel cells. Meanwhile, hydrogen production for transportation is set to grow even more quickly, with employment increasing 25% per year over the same period to just over 2,200 workers in a decade’s time.

Jobs in the waste-to-energy industry, which includes companies (like Quebec-based Enerkem) that turn municipal waste into usable fuels, are also expected to expand significantly with jobs set to grow by 14% per year.

Similarly, jobs in the emissions control technology industry, such as companies like Nova Scotia-based CarbonCure (which uses captured carbon to make stronger concrete),<sup>26</sup> are set to grow by 11% per year.

## SECTOR SPOTLIGHT



**ABOVE:** The **Henvey Inlet First Nation** jointly owns and operates a 300-megawatt wind power facility in Ontario. The Henvey Inlet Wind project produces enough energy to power 100,000 homes and is the largest single-phase wind facility in Canada.<sup>27</sup> Across the country, Indigenous communities have been significantly involved in over 197 clean energy projects of at least a megawatt in size. Indigenous-led clean energy projects can generate jobs and training opportunities for community members while providing revenue to meet community needs.<sup>28</sup>

**RIGHT:** Alberta-based **BluEarth Renewables** is a renewable power producer operating a number of clean power facilities across Canada and the U.S. The company's portfolio includes 513 megawatts of nameplate capacity in operation or under construction, including four solar plants in southern Alberta.<sup>29</sup>

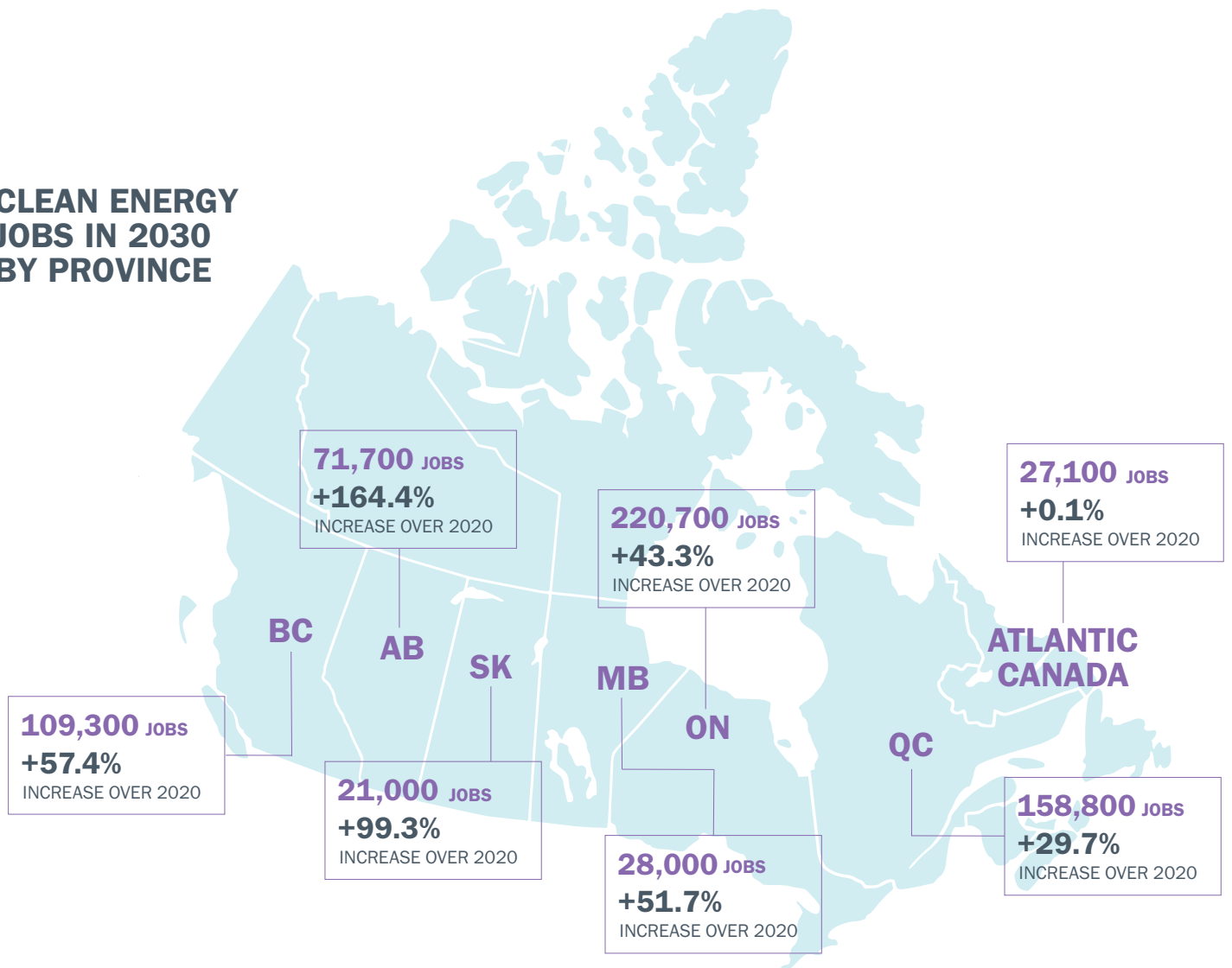




**By 2030, there will be 26 times more jobs in electric vehicle technology than there were in 2020.** Canada's auto sector is starting to shift in the electric direction. Each of the "Detroit Three" automakers—General Motors, Ford, and Stellantis (formerly Fiat Chrysler)—have announced major electric vehicle assembly investments in Canada over the past year.<sup>30-32</sup> But with more EV models on the horizon (Ford just revealed its new **electric F-150 Lightning, pictured**), Canada must take action to expand its EV manufacturing capabilities. For more on this, see Clean Energy Canada's 2020 report, *Taking the Wheel*.<sup>33</sup> Photos: Ford



## CLEAN ENERGY JOBS IN 2030 BY PROVINCE



## A pan-Canadian opportunity

**CLEAN ENERGY JOBS ARE ON TRACK TO GROW** in most regions of Canada. Perhaps most notable is the rapid job growth predicted in the Prairies, with clean energy employment set to double in Saskatchewan and more than double in Alberta.

And while some Atlantic provinces are on track to see some clean energy job losses, the share of clean energy still increases, meaning that clean energy jobs are still declining less than those in fossil fuels. Jobs in the electric vehicle technology industry are the fastest growing in most provinces, but several other industries also stand out.

### BRITISH COLUMBIA

B.C. could see more than 2,000 people employed in hydrogen consumption technologies by 2030, like hydrogen fuel cells, with jobs growing 24% per year after 2025.

### ALBERTA

As Alberta updates its fossil-fuel-heavy electricity grid, the province is on track to see a surge in wind power jobs (a 22% increase per year).



Photo: Green Energy Futures

## SASKATCHEWAN

Like B.C., Saskatchewan is also on track to see job gains in hydrogen consumption technologies, with the number of people employed in the industry growing 24% per year between 2025 and 2030.

## MANITOBA

Manitoba can expect solid growth in the construction of energy-efficient buildings, with the number of jobs growing 4.6% a year—more than twice the industry’s expected growth rate nationwide.

## ONTARIO

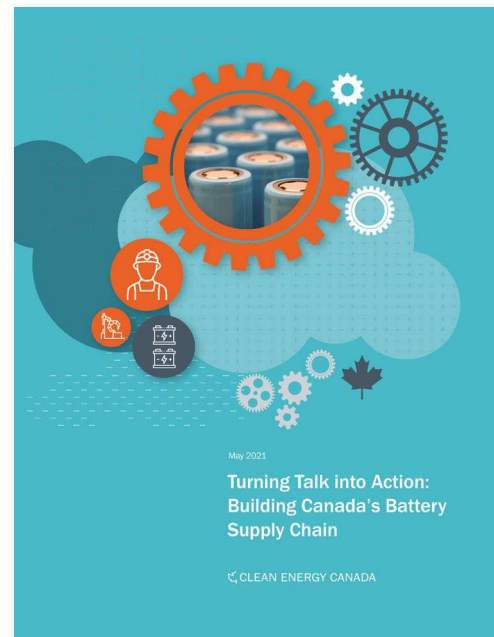
Ontario will see significant job growth in a number of clean energy industries, including greenhouse gas control technology, which is set to grow by 17% per year.

## QUEBEC

Quebec is on track to see huge job growth in several clean energy industries, including greenhouse gas control technologies, hydrogen production for transportation, and wind power. The latter is expected to grow by 28% a year, employing 4,300 people in the province by 2030.

## ATLANTIC CANADA

Nova Scotia is set to see a lot more jobs in wind power, with the number of people employed in the industry expected to more than double between 2020 and 2030. New Brunswick, meanwhile, is on track to see a 30% growth in jobs in low-carbon machinery.



## THE MINING OPPORTUNITY

The technologies needed for the world to transition to net-zero are going to require metals and minerals. A recent International Energy Agency report projects that demand for copper, lithium, cobalt, nickel, and other critical minerals is set to increase sixfold by 2040 in line with global targets mapped out in the Paris Agreement, driven largely by EVs and their batteries.<sup>34</sup>

With the required natural resources and a clean electricity grid to power operations, Canada not only has the advantage of being able to source these metals and minerals but can do so in a sustainable way—something that car makers like Tesla and BMW have said is a criterion when selecting suppliers.<sup>35,36</sup> But to make the most of it, Canada must take steps to build its battery supply chain, as pointed out in a recent Clean Energy Canada report, *Turning Talk into Action: Building Canada's Battery Supply Chain*, which summarizes the opinions of various industry stakeholders we consulted.<sup>37</sup>

Several Canadian companies are already laying the groundwork. Alberta-based E3 Metals is sourcing lithium from old oil and gas sites,<sup>38</sup> while Canada Nickel has launched a new company dedicated to producing emissions-free nickel, cobalt, and iron.<sup>39</sup>

While the production of electric vehicle batteries is included within the scope of the clean energy sector in this modelling, the mining companies that supply them are not. As a result, the growth in jobs associated with the energy transition will be even higher.

## SECTOR SPOTLIGHT



**ABOVE:** Ontario-based **Li-Cycle** recovers the critical minerals from end-of-life lithium-ion batteries and reintroduces them into the supply chain.<sup>40</sup> The in-demand company recently secured a contract with GM and LG's joint venture Ultium Cells LLC to recycle 100% of their battery manufacturing scrap.<sup>41</sup> Last month, Li-Cycle was recognized by *Fast Company's* World Changing Ideas Awards for its innovative technology.<sup>42</sup>

**RIGHT:** Canada is home to several carbon capture and storage technology companies. Nova Scotia's **CarbonCure** injects CO<sub>2</sub> into wet concrete, strengthening the material while reducing the amount of cement needed.<sup>43</sup> CarbonCure's tech is being used in building Amazon's new Virginia headquarters.<sup>44</sup> And B.C.-based Svante has designed technology that utilizes nano-materials to capture CO<sub>2</sub> directly from industrial sources "at less than half the cost of existing solutions."<sup>45</sup>





## RECOMMENDATIONS

- Take actions to grow the clean energy sector by: implementing policies and programs to accelerate the uptake of zero-emission cars, trucks, buses, and commercial vehicles; committing to 100% zero-emission electricity supply by 2035; investing more in energy efficiency and fuel switching; establishing a battery manufacturing industry in Canada using Canadian metals and minerals; and supporting innovation through R&D funding and tax incentives.
- Develop a labour transition strategy in 2021 to align the workforce of tomorrow with a net-zero world that also addresses impacted workers.
- Support Indigenous-led clean energy projects to create economic opportunities and transition Indigenous communities off fossil fuels.
- Strengthen working collaborations between the federal government, provinces, municipalities, and Indigenous governments to accelerate clean energy programs.
- Make our exports cleaner to strengthen our trading relationships, while branding Canada as a global low-carbon exporter where true.

Photo: Henvey Inlet First Nation/Pattern Canada. Learn more about this wind facility on page 11

# The path ahead

**CANADA'S CLEAN ENERGY SECTOR** is on the path to success. But it's a path that is guided by policies and decisions that, if retracted or weakened, could divert Canada in the wrong direction. Ultimately, the 85,000 clean energy jobs added by the government's new climate plan are dependent on the plan's timely and actual implementation.

And with countries powering through the energy transition, vying for a share of the lucrative global clean energy economy, there is no time to waste. Already, the economic and environmental imperative to act on climate change has resulted in several jurisdictions, including the EU, U.S., and Canada, raising their 2030 pollution reduction targets at the recent U.S. climate summit. While existing policy frameworks are aimed at meeting and exceeding our previous target of cutting emissions 30% below 2005 levels by 2030, Canada must now strengthen its policy in line with its new target of between 40% and 45%.

And the fight against climate change doesn't stop when we get to 2030. As the recent International Energy Agency

pathway shows us, if we're going to cut net emissions to zero by 2050, the clean energy sector would keep on growing while oil and gas supplies become increasingly concentrated in a small number of low-cost producers, which does not include Canada's oil sands.

Canada is undergoing an economic transition that will also require a labour transition, in which workers must take centre stage. **Canada must prepare its workforce for jobs that not only exist today but will continue to exist into the future.** That means providing training for former fossil fuel workers alongside new and young Canadians entering the workforce; it means supporting opportunities for Indigenous prosperity and reconciliation. After all, the 208,700 clean energy jobs that will be added by 2030 are more than just numbers on a page. And Canada will not be able to rise to the global clean energy opportunity without the people to power it.

Like the rest of the world, Canada faces a new energy reality. If we make the right choices today, we'll be ready for it.



## BREAKDOWN OF CANADA'S CLEAN ENERGY SECTOR

# Methodology

**THE MODELLING FOR THIS REPORT** was undertaken using Navius Research's gTech model. The gTech model is unique as it combines three different components that are typically only found in separate models. It is able to simulate technological choice (how households and firms select their technologies), macroeconomics (accounting of the economy at large, including how provinces interact with each other and the rest of the world), and energy supply (including liquid fuels, gaseous fuels, and electricity). For more information, see the corresponding technical report produced by Navius.

For this study, two policy frameworks were modelled: The climate plan the federal government proposed in December 2020, *A Healthy Environment and a Healthy Economy*, as well as the policies under the preceding *Pan-Canadian Framework on Clean Growth and Climate Change*, which is currently in place.<sup>46,47</sup> Unless otherwise specified, the modelling results for *A Healthy Environment and a Healthy Economy* are presented in this report. Vehicle emission standards under the new climate plan have been assumed to follow those in California post-2021, while they have been modelled to remain at present levels in the old plan. A full list of the policies added can be found on page 5 and in the corresponding technical report.

Note that geothermal and tidal electricity, stationary batteries and energy storage, and non-motorized transport are not included in the scope of the modelling. All GDP and investment values are reported in 2015 dollars.

### DIFFERENCES TO PREVIOUS REPORT

This report follows a related clean energy and fossil fuel sector modelling report completed in 2019.<sup>48</sup> This latest analysis is based on an updated methodology. The most important updates include the following (more detail is available in the accompanying technical report):

- Hydrogen fuel cell vehicles and hydrogen supply for transportation are now part of the model.
- Hybrid electric vehicles that cannot be charged via external plug-in are no longer included as part of the clean energy sector.
- The cost and performance of emerging technologies have been updated.



### CLEAN ENERGY SUPPLY

- Wind
- Solar
- Hydro
- Nuclear
- Bioenergy
- Waste to energy
- Low-carbon machinery
- Emissions control technology
- Hydrogen production



### GRID INFRASTRUCTURE

- Electricity transmission and distribution



### CLEAN BUILDINGS

- Building envelopes
- HVAC and building control systems
- High-efficiency appliances and lighting



### CLEAN TRANSPORT

- Plug-in electric vehicles
- Public transit and rail
- Hydrogen consumption technologies



### INDUSTRY

- Low-carbon machinery
- Emission detection and control

### DEFINING THE FOSSIL FUEL SECTOR

The values for both the economic size and number of people employed in the fossil fuel sector is greater than the oil and gas numbers reported by Statistics Canada. This is because our definition of the fossil fuel sector is broader and includes fossil fuel production, electricity generation using fossil fuels, and value added (e.g. trucking companies that rely on fossil fuels or construction activity associated with building a natural gas-fired power plant) in line with our clean energy sector definition. ♦

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