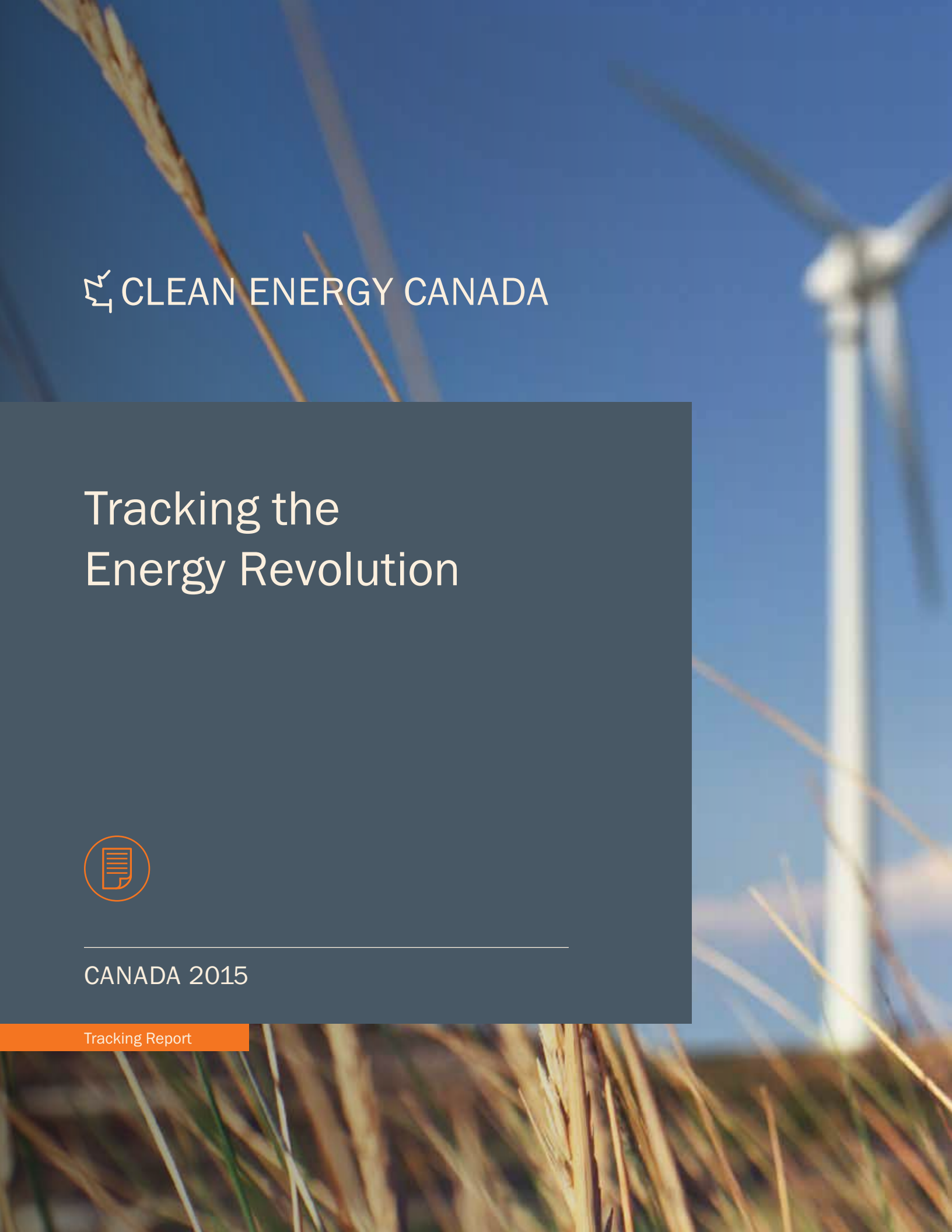

CLEAN ENERGY CANADA

Tracking the Energy Revolution

CANADA 2015

Tracking Report

SFU | CENTRE FOR DIALOGUE
SIMON FRASER UNIVERSITY

Tracking the Energy Revolution—Canada 2015

September 2015

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Clean Energy Canada (cleanenergycanada.org) is a climate and energy think tank housed at the Centre for Dialogue at Simon Fraser University working to accelerate our nation’s transition to a clean and renewable energy system.

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2015

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About This Document

We produce these reports to identify and commend domestic clean energy leadership while encouraging others to more aggressively pursue their prospects.

This report assesses provincial and regional progress on clean energy investment, employment, and generation capacity. The centerpiece is By the Numbers: Ontario Captures the Lead. This chart reveals which provinces and regions are winning in the clean energy revolution–which are out front, and attracting clean energy investment, and which have yet to pursue their opportunities.

Also inside this edition:

- Investment and Capacity: Canada Has Its Best Year Ever
- Notable New Projects: Concrete, steel, and silicon
- Moments and Milestones: The developments that defined a year
- Canadian Clean Energy Champions: Recognizing leadership, from the Twittersphere to the boardroom
- Circuits and Steel: Clean Energy Jobs Sector Outpaces All Others
- Policy Progress & Conclusions: What's new, and what needs to happen next.

Please note: This is the companion volume to *Tracking the Energy Revolution — Global 2015.*

Credits:

Clean Energy Canada is a climate and energy think tank housed at the Centre for Dialogue at Simon Fraser University. We work to accelerate our nation's transition to a clean and renewable energy system.

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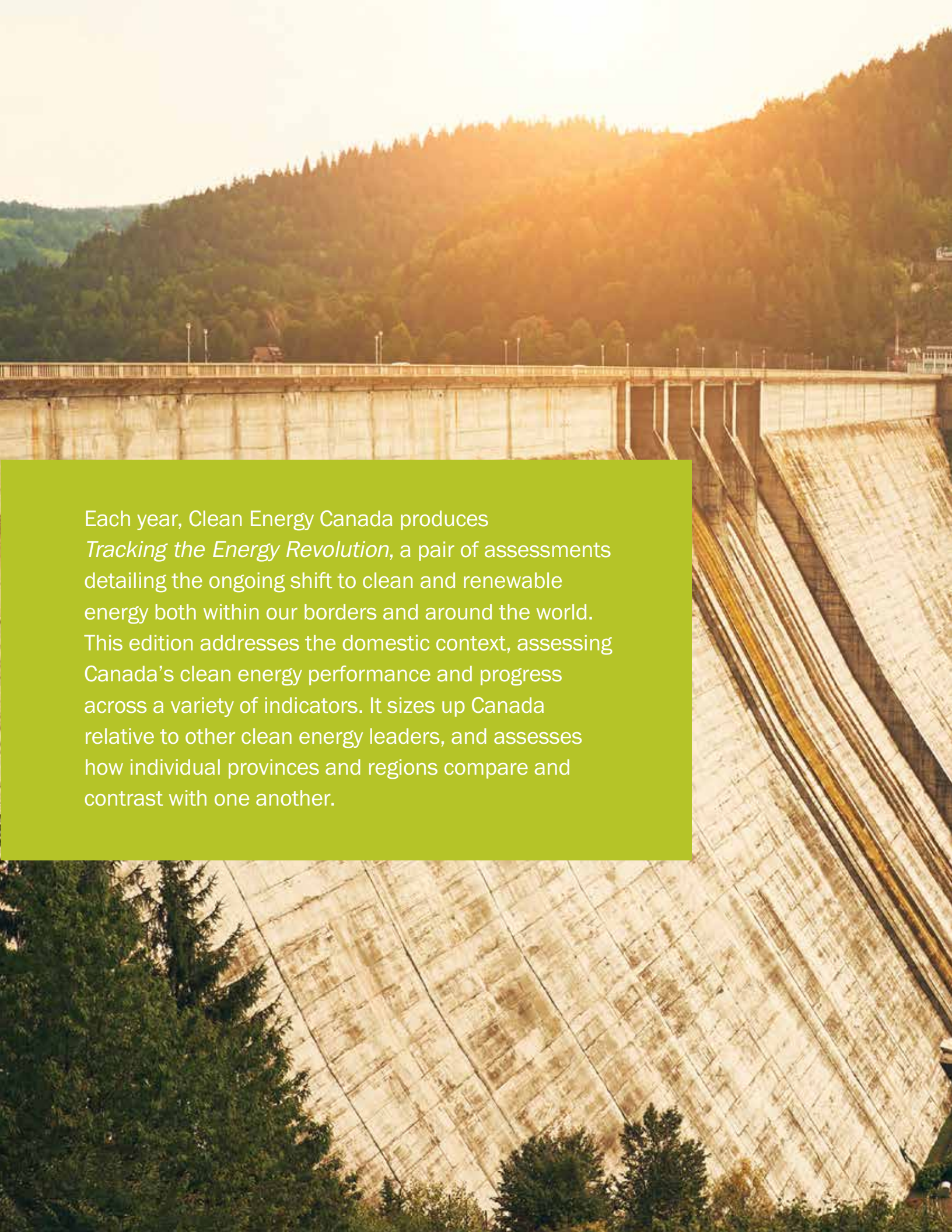


Each year, Clean Energy Canada produces *Tracking the Energy Revolution*, a pair of assessments detailing the ongoing shift to clean and renewable energy both within our borders and around the world. This edition addresses the domestic context, assessing Canada's clean energy performance and progress across a variety of indicators. It sizes up Canada relative to other clean energy leaders, and assesses how individual provinces and regions compare and contrast with one another.

Executive Summary and Top 10 Facts

Canada is falling behind. That's the message that kicked off *Tracking the Revolution — Global*, this report's preceding companion edition. Though our clean tech sector–a category that includes clean energy, among other industries–grew 17 percent in 2014, other economies grew theirs faster.

Thanks to provincial leadership, a steady stream of money flowed into projects from domestic and foreign banks.

This companion report paints a considerably brighter picture about clean energy in Canada. That's because on the home front, things are going very well. In fact, with respect to domestic clean energy investment and development, this past year proved Canada's best ever. (*cue applause*) Thanks to provincial leadership, a steady stream of money flowed into projects from domestic and foreign banks. In fact, investment in new clean-power generation approached CAD $10.9 billion–a healthy 88 percent bump over 2013.

On the ground, that cash translated into a lot of concrete and steel. The nation's utilities and developers have been steadily building vast solar and wind farms, humming hydro plants, and biofuel and biomass plants–particularly in Quebec, Ontario, and British Columbia, where favourable policy frameworks encourage them to do so. When one includes large hydro in the mix, there's now roughly 89 GW of renewable electricity capacity in Canada, ranking 4th in the world. To put this in perspective, that's enough to power more than 35 million homes.

Ontario, with its continent-leading Green Energy Act, leads the nation for new clean energy capacity and smart grid investments, while green-leaning Quebec–home of the nation's biggest wind farms–follows closely behind. British Columbia is also taking advantage of its natural geographic endowment that makes it well-suited for hydro development.

Then there's all the innovation underway. This report highlights the idea-incubation and cleantech convening work underway at MaRS, and salutes an energy-storage leader who will distribute the Tesla Powerwall north of the 49th.

While 2014 was packed with biggests and bests, only clean-energy policies will transform provincial energy systems, and

in 2014 new or strengthened policies were in short supply.

Part of the challenge is that, when it comes to policy, the provinces are doing all the heavy lifting. With the exception of Sustainable Development Technology Canada, a federally funded agency that provides critical early-stage financing to clean energy innovators, Ottawa remains largely indifferent to the opportunities of the clean energy revolution. The growth, excitement, and successes happening across the country–even in the absence of federal leadership–is testament to the efforts of provincial leaders and innovative entrepreneurs.

But it begs the question: How much more could be achieved with a supportive federal government? Hint: You'll find the answer in our conclusion.

So here's to the champions (we formally recognize five of them here) who are driving Canada's clean energy shift. Here's also to the companies and institutions that are reducing fossil fuel reliance, improving public health, and dialing back carbon pollution while creating jobs and wealth in their communities.

Don't worry, mavericks, our governments will catch up to you soon enough.

When one includes large hydro in the mix, there's now roughly 89 GW of renewable electricity capacity in Canada, ranking 4th in the world. To put this in perspective, that's enough to power more than 35 million homes.

Revolution Revelations: Top 10 Canadian Clean Energy Facts

1. In 2013, the rate of job growth in Canada's clean energy sector outpaced that of every other sector in the country.
2. Canada just had its best year ever; clean-energy generation investment jumped a significant 88 percent over the previous year.
3. Ontario welcomed more than half of the nation's clean-energy investment last year.
4. Canada now ranks sixth in the world for investment in new domestic clean energy generation projects.
5. Almost half of all new growth in solar PV capacity occurred at the residential and commercial scale, as homeowners and business owners bolted panels on rooftops.
6. Contrary to the perceptions of wind power opponents, two separate peer-reviewed studies released last year concluded that wind turbines harm neither human health nor property values.
7. About 26,900 Canadians work in clean energy, including Meredith Smith, who builds and maintains wind turbines, and whom we declared one of five Clean Energy Champions. (You go, Meredith!)
8. Last summer, Toronto's Northland Power put together the largest non-hydro renewable energy financing deal in history–a USD$5.8 billion agreement to build an offshore wind farm in the Netherlands.
9. When one includes large hydro in the mix, there's now roughly 89 GW of renewable electricity capacity in Canada, ranking us 4th in the world. That's enough to power more than 35 million homes.
10. Canada has shut down 4,600 MW worth of coal power–the equivalent of scrapping 8.7 million vehicles.

By the Numbers: Ontario Captures the Lead

Thanks to the *Green Energy Act*, last year Canada's most populous province proved rather popular with investors. Half the nation's new clean power capacity went online here.

$4.5B
representing total investment in Ontario

Last year, the province welcomed more than half of all Canadian investment in new clean energy generation. It also notched the biggest wind power stake in Canadian history (CAD$2.8 billion), and the highest solar tally (CAD$1.6 billion).[1]

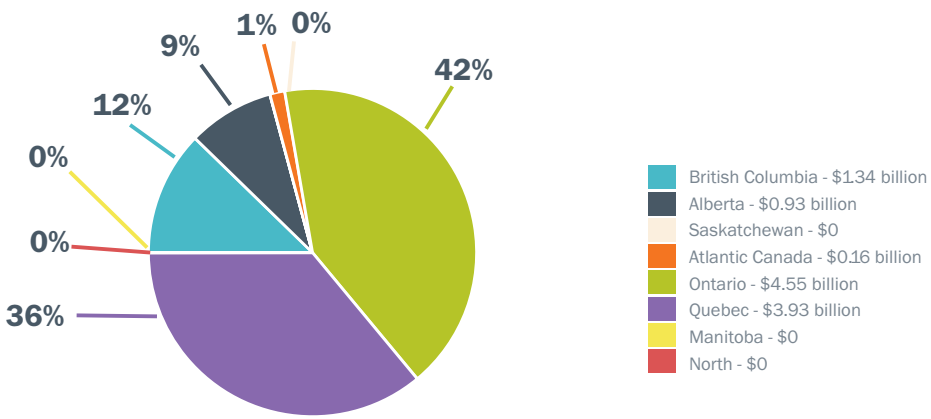
We've said it before and we'll say it again: If you want to attract clean energy investment, you need to get policy in place that will do so.

As shown below, Ontario, which introduced its *Green Energy Act* back in 2009, is way out in front of its peers. Last year, the province welcomed nearly half of all Canadian investment in new clean energy generation. It also notched the biggest wind power stake in Canadian history (CAD$2.8 billion), and the highest solar tally (CAD$1.6 billion).[1]

Of course, all that money is going straight into steel and silicon, which is why Ontario also leads in capacity–that is, the ability to produce clean power–adding 1,810 MW of clean power to the grid in 2014.[2] Runners up in order are Quebec (wind and hydro), British Columbia (hydro), and Alberta (wind).

Clean Power Generation Investment By Province, 2014

Saskatchewan, Manitoba, and the northern territories didn't add any renewable-power capacity last year, nor did they add any climate or clean energy policies.



[1] See Methodology document.
[2] See Methodology document.

About Our Provincial and Regional Rankings

We rate Canada's provinces and regions via equal consideration of the criteria below:

- **Total clean-energy investment**
- **Percentage of grid that is clean and renewable**
- **Growth in the proportion of renewable electricity on the grid**
- **Presence of supportive policy such as a feed-in-tariff or renewable portfolio standard**

We assigned points to each of these indicators based on the relative performance of each province. Though investment data is easy to rank, the same can't be said of the presence or absence of supportive policy. That's why we developed separate evaluation criteria. In the 2014 edition of *Tracking the Energy Revolution - Canada*, we found that provinces or regions leading on renewable energy share a few common characteristics. For example, they have renewable energy targets, policies to support renewable energy such as a feed-in-tariff or renewable energy standard, and they've phased out coal or are working to do so. Each of these actions earns one point, or a half-point if one of these policies has been weakened.

For our full scoring and ranking methodology, please see our methodology document, available at trackingtherevolution.ca/canada.

Below we rank the provinces based on investment, the percentage of grid that has been "cleaned" of fossil fuels, and since energy-system transformation doesn't happen overnight, the growth of proportion of clean power on the grid since 2010.

Ranking of Top Five Provinces for Clean Energy Leadership

RANK	PROVINCE	INVESTMENT (CAD BILLION 2010- 2014)	% OF GRID RENEWABLE CAPACITY (2014)	GROWTH IN RENEWABLES AS % OF GRID CAPACITY (2010-2014)	POLICY SUPPORT
1	Ontario	12.7	39%	50%	Average
2	Quebec	8.6	98%	6%	**Leading**
3	British Columbia	5.2	96%	12%	Average
4	Manitoba	1.7	95%	5%	**Leading**
5	Alberta	2.3	19%	37%	Needs Improvement

Ontario

Ontario relies more heavily on fossil fuels, particularly natural gas, than British Columbia or Quebec. Nonetheless it earned the top spot in our rankings due to the scale of investment and its relatively quick energy transition. For Ontario to keep this position, renewable investment will have to remain a key component of the government's new supply strategy.

Quebec

Steady investment, a nearly completely carbon-free grid, and a commitment to clean energy place Quebec near the top of the list.

British Columbia

The province comes in just behind Quebec, thanks to its commitment to clean energy and strong investment. It scores a bit lower on the policy outlook because of an exemption in its clean electricity requirement that allows liquefied natural gas plants to produce electricity from fossil fuels.

Manitoba

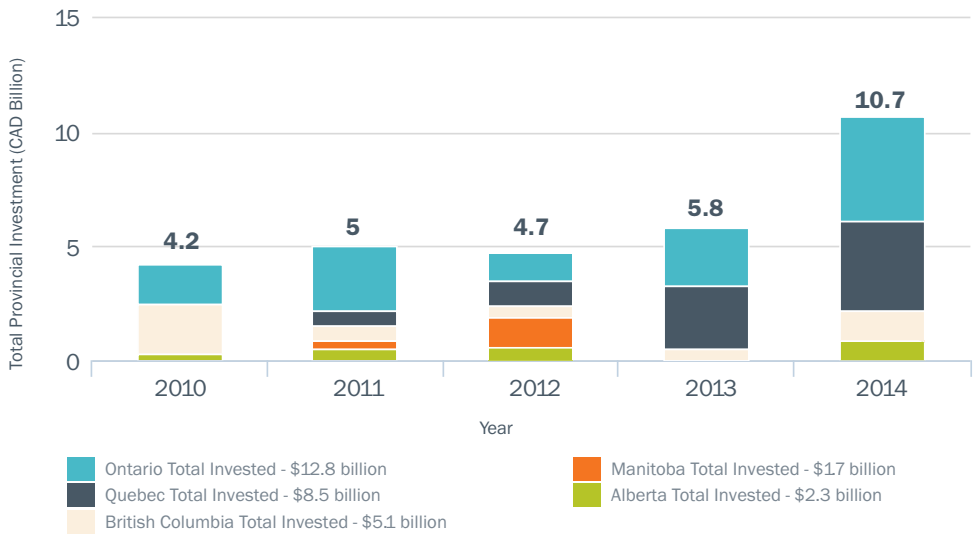
Manitoba's clean grid and commitment to renewable energy keeps it in the top five. Only its relatively low 2014 investment keeps it out of the top three. Manitoba is building several large hydro projects, which once constructed could quickly push it up the ranks.

Alberta

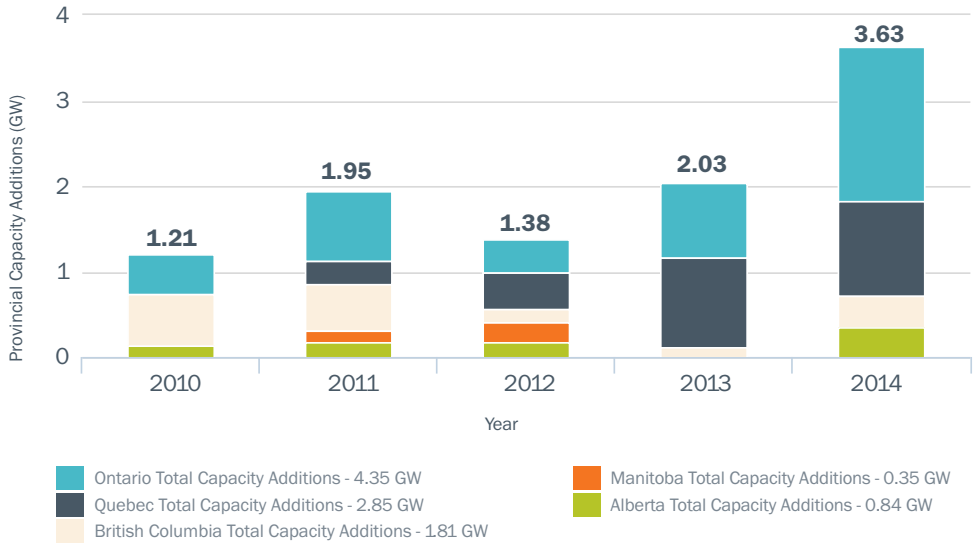
Investors have poured money into Alberta's world-class wind resource largely due to policies outside its borders that are no longer applicable. Alberta could climb quickly in the rankings with provincial policy support.

Leading Provincial Growth In Canada's Renewable Energy Sector

Leading Provincial Investment (CAD Billion)



Leading Provincial Capacity Additions (GW)



Investment and Capacity: Canada Has Its Best Year Ever

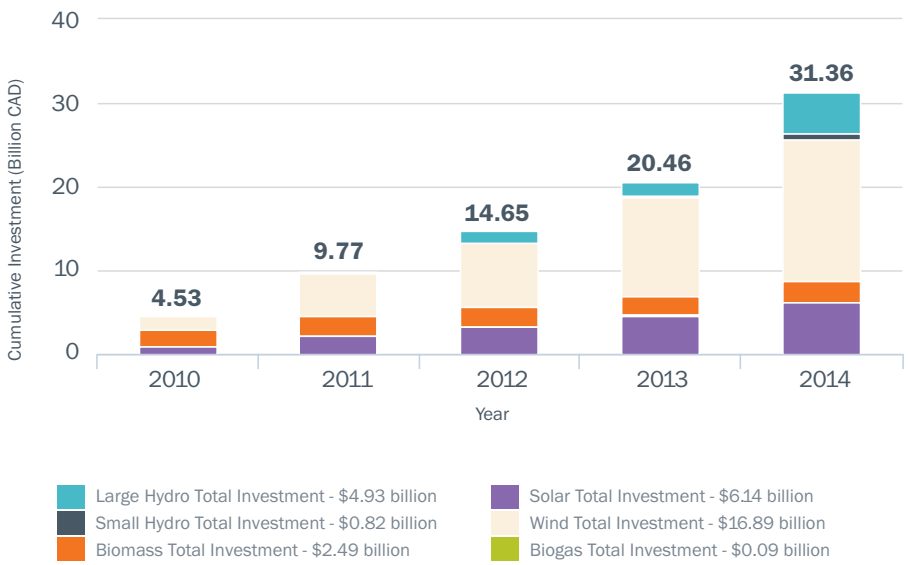
Other nations may be growing their clean energy sectors at a faster clip, but Canadians still have a lot to celebrate. When it comes to investment and boosted capacity, we just had a banner year.

With respect to domestic clean energy investment and development, this past year proved Canada's best ever.

In *Tracking the Energy Revolution — Global 2015*, we noted that Canada was trailing other nations in the global market for clean energy products and services. Though our domestic clean tech sector grew 17 percent in 2013[3], our slice of the global pie narrowed as other nations shored up their clean industries with more substantial policy.

That's the bad news. The good news is the home front looks fantastic. With respect to domestic clean energy investment and development, this past year proved Canada's best ever. Here's how the picture looks for both investment and capacity.

Five Years of Cumulative National Investment (Billion CAD)



[3] Analytica Advisors (2014) Clean Technology Industry Report.

Investment

In 2014, Canada ranked sixth in the world for investment in new domestic clean energy generation projects.[4] The final number came in at CAD$10.9 billion[5], as our nation maintained its standing from the previous year. And while we didn't move up the global ranks, dollars flowing into clean-energy generation jumped a significant 88 percent over the previous year.[6]

Crack open the spreadsheets, and a number of significant projects and deals underlie that increase. Here are three:

- **Calgary's BluEarth Renewables raised CAD$81 million of equity financing, bringing its total amount of money raised to CAD$250 million since it incorporated in 2010. The cash will support a range of small-hydro, solar, and wind projects.[7]**
- **Pattern Energy, Samsung Renewable Energy and Capital Power Corporation landed CAD$850 million for the since-completed K2 wind complex in the Township of Ashfield-Colborne-Wawanosh, due west of Toronto on Lake Huron.[8]**
- **Nova Scotia Power, Minas Basin Pulp & Power, and Oxford Frozen Foods financed the development of 102 MW Parker Mountain Community wind farm totalling CAD$200 million.**

Though the federal government is AWOL on the file, numerous Canadian provinces are putting out the welcome mat for banks by sending policy signals that they are open for business in the low-carbon economy.

Each year, consulting giant Ernst & Young ranks 40 economies[9] on how attractive they are to renewable-energy investors–based on a wide range of considerations, such as political support and stability of power grids. On this front, this past year, Canada's rank remained unchanged at seven, behind China, the United States, Germany, India, and Japan.

When it comes to fostering a business climate of clean-tech innovation, Canada is punching above its weight. Despite a lack of strong supportive federal policies, the Global Cleantech Group and the WWF also ranked Canada seventh out of 40 economies[10]–ahead of established cleantech leaders Germany and Japan. There's general innovation support and that pulls up Canada's ranking, but we're not keeping pace on cleantech-specific drivers, and that shows in a lower ranking on commercialization.

88%

Dollars flowing into clean-energy generation jumped a significant 88 percent over the previous year.[6]

[4,5,6] BNEF & Frankfurt School FS-UNEP Collaborating Centre for Climate and Sustainable Energy Finance (2015) Global Trends in Renewable Energy Investment.

[7] "BluEarth Renewables Inc. Successfully Closes Over $81 Million Equity Financing to Continue to Fuel Growth" Bloomberg New Energy Finance (2015) Country Profiles - Electricity Mix, 3 Nov. 2014.

[8] "Samsung, Pattern and Capital Power Complete $850 Million Financing and Begin Construction of K2 Wind Power Project" Samsung Renewable Energy Inc. 24 Mar. 2014.

[9] "Renewable Energy Country Attractiveness Index Archive." - EY.

[10] "The Global Cleantech Innovation Index 2014." 2014.

89 GW

When it comes to renewable electricity, Canada's up there with the big players. Largely as a result of our extensive and large hydropower facilities, as of the end of 2014, our plants boast a collective capacity of 89 GW.

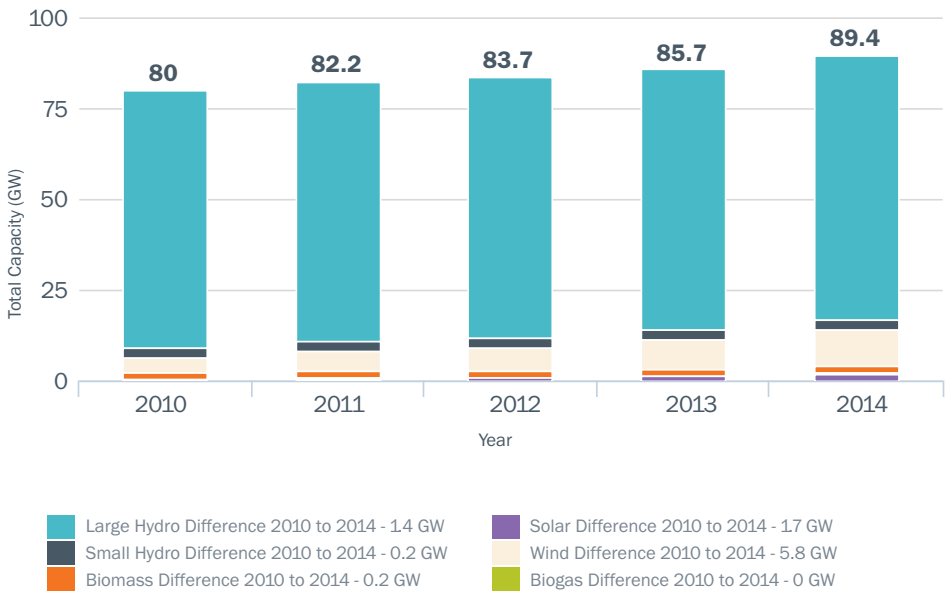
As a final note: As we saw last year, Canadian companies are also playing a leading role as deal brokers for clean energy projects beyond our borders. The best example of this is Toronto's Northland Power. In 2014 the firm inked a power purchase agreement with Dutch utility Delta[11] for its 600 MW offshore wind farm in the Netherlands, after securing almost CAD $5.2 billion for the project. This was then, and remains today, the largest non-hydro renewable energy placement ever.

Capacity

When it comes to renewable electricity, Canada's up there with the big players. Largely as a result of our extensive and large hydropower facilities, as of the end of 2014, our plants boast a collective capacity of 89 GW. That places us 4th in the world for our ability to produce pollution-free power.[12]

Here's how that breaks down, by technology.[13] Note the growth in wind and solar atop a strong hydro foundation:

Canadian Renewable Energy Capacity (GW)



[11] "RECAI | Renewable Energy Country Attractiveness Index | Issue 41." June 1, 2014.

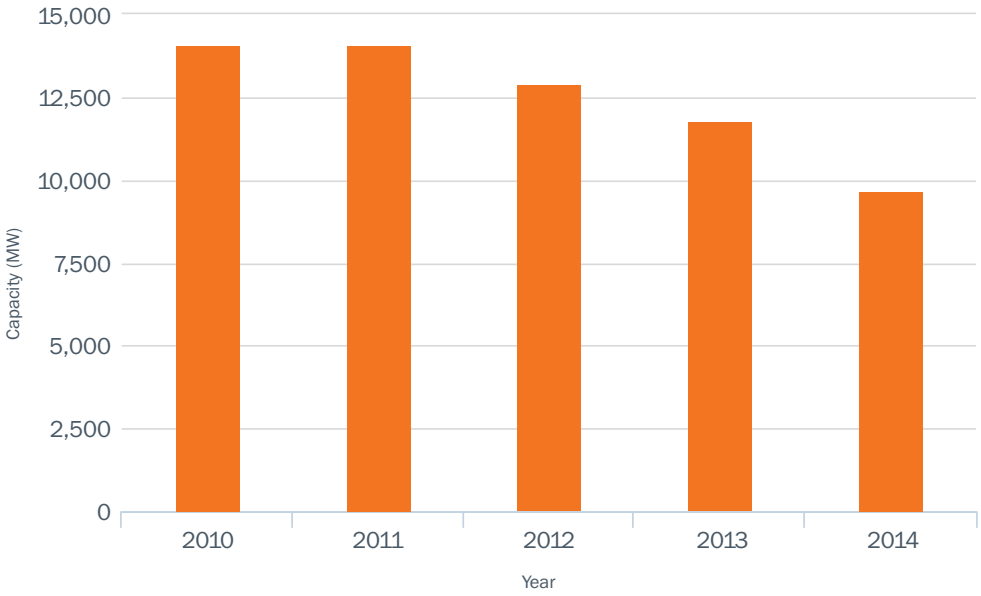
[12] BNEF Database.

[13] See Methodology document.

Coal's Flagging Dynasty

In the past five years, largely thanks to policy leadership in Ontario, Canadian utilities have shut down 4,600 MW worth of coal power plants.[14] That's the equivalent of taking 8.7 million vehicles off the nation's roads.[15]

Coal Capacity (MW)



[14] See Methodology document.

[15] See Methodology document.

Moments and Milestones: The Developments that Defined a Year

From buyouts to the bubble, here are the key events that defined a year in Canada's energy revolution.

January: Manitoba Hydro inked a deal with a major midwest-U.S. utility that will allow the Canadian utility to store excess wind energy produced in North Dakota. Manitoba Hydro's large hydroelectric reservoirs will serve as a giant "battery," banking electricity produced in midwest wind farms.[16] Photo Credit: IanChrisGraham via iStock

January: Prince Edward Island Energy Corporation commissioned a 30 MW wind farm in the province's Hermanville/Clear Springs region. Thanks to facilities like this one, wind provides the island with 30 percent of its electricity needs.[17]

Photo Credit: iStock

February: Vancouver developer Ian Gillespie acquired the company that runs the city's decades-old natural-gas-fired district energy heating system, renamed it Creative Energy, and revealed plans to convert the system to run on low-carbon biomass.[18] Photo Credit: biworld via iStock

March: Canadian Solar opened a new plant in London, Ontario to manufacture solar PV modules and power stations for solar farms. It was the fourth plant to be opened under the Green Energy Investment Agreement between Samsung and the Government of Ontario.[19] Photo credit: goldyrocks via iStock

[16] "American Wind to Be Stored in Canada." American Wind to Be Stored in Canada. January 27, 2014.

[17] "Wind Power | Prince Edward Island." The Maritimes Energy Association. 2014.

[18] Lee, Jeff. "Westbank Projects Developer Ian Gillespie Takes Control of Low-carbon Energy Program with Purchase of Central Heat." The Vancouver Sun. February 24, 2014.

[19] "American Wind to Be Stored in Canada." American Wind to Be Stored in Canada. January 27, 2014.

April: Ontario became the first jurisdiction in North America to fully eliminate coal as a source of electricity generation, as the Thunder Bay Generating Station burned its last supply of the fossil fuel. The province has replaced it with a mix of lower emission energy sources.[20] Photo Credit: pablographix via iStock

May: In a report, the Saskatchewan Citizens' Hearings on Climate Change said the province "has made no headway over the past decade" in reducing carbon emissions. The report called for immediate policy action at all levels of government. No such action has yet transpired.[21] Photo credit: justinecottonphotography via iStock

May: Toronto-based Northland Power completed an ambitious $4.2-billion deal to build Europe's 600 MW Gemini offshore wind farm in the North Sea, off the Netherlands. In terms of dollars committed, it was (and remains) the largest non-hydro renewable energy project on record.[22] Photo Credit: Robert Ingelhart via iStock

June: At an Edmonton luncheon, former U.S. Secretary of State and now Oval Office hopeful Hillary Clinton urged Canada and her country to become clean energy leaders: "We should set the global example for transitioning in some more orderly way away from fossil fuels."[23] Photo credit: Keith Kissel via Flickr. Photo take May 2, 2008

June: Clean Energy Canada and the Pembina Institute released *Power to Change*. The landmark report that found Alberta could reduce its reliance on fossil fuel power and replace that generation with a mix of mostly renewable energy sources within two decades. [24]

August: Innergex Renewable Energy–one of the nation's largest "pure-play" renewable power developers–and British Columbia's In-SHUCK-ch Nation forged a 50-50 partnership to develop a string of six run-of-river projects across the nation's traditional territory. [25] Photo Credit: Clean Energy Canada

[20] "Creating Cleaner Air in Ontario." Government of Ontario. April 15, 2014. http://news.ontario.ca/mei/en/2014/04/creating-cleaner-air-in-ontario-1.html.

[21] "The Saskatchewan Citizens' Hearings on Climate Change Final Report." Saskatchewan Citizens Hearings on Climate Change. April 29, 2014. Accessed August 27, 2015. http://skclimatehearings.org/the-final-report/.

[22] McCarthy, Shawn. "Northland Seeks to Expand Wind Farms." The Globe and Mail. May 15, 2014.http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/northland-power-closes-financing-for-big-europe-wind-project/article18676217/.

[23] Bennett, Dean. "Hillary Clinton Tells Edmonton Audience North America Can Lead on Clean Energy." The Globe and Mail. June 18, 2014.

[24] "Power To Change - Clean Energy Canada." Clean Energy Canada.

[25] "Innergex and the In-SHUCK-ch Nation Sign a Partnership Agreement to Develop Six Hydroelectric Projects in British Columbia." Innergex Renewable Energy Inc. August 12, 2014.

September: Enbridge increased its investment in a pair of Quebec wind projects to the tune of $225 million. The company now holds majority stakes in the 300 MW Lac Alfred Wind farm at the base of the Gaspe Peninsula, and the Massif du Sud project, near Saint-Philémon.[26] Photo Cred: Joan Sullivan.

September: Fondaction CSN, Desjardins, COOP fédérée, C3E and the AQME announced the launch of Coop Carbone, which aims to help help Quebec organizations reduce their fuel consumption and greenhouse gas emissions.[27]

October: Mark Carney, the former Governor of the Bank of Canada who now heads up the Bank of England, legitimized the concept of the carbon bubble by confirming that the "vast majority of [fossil fuel] reserves are unburnable" if we are to avoid dangerous climate disruption.[28] Photo credit: www.bankofengland.co.uk. via Flickr. Taken August 13, 2014

October: Canada's Commissioner of the Environment and Sustainable Development awarded Ottawa a failing grade on climate action. The federal government still isn't taking the basic steps needed to tackle the threat of climate disruption, she wrote.[29]

October: Newfoundland and Labrador launched a residential energy conservation pilot project designed to pinpoint what kinds of information residents need to increase household energy savings. The province elected 750 households to take part in the project over two years.[30] Photo credit: Liz Leyden via iStock

November: A WWF Canada and Plug'n Drive survey of electric vehicle adoption found that Canadian sales of EVs grew nearly 80 percent between September 2013 and August 2014 compared to the previous year. Meanwhile, B.C. leads the way in charging infrastructure.[31] Photo credit: iStock

[26] "Enbridge to Pay $225M for Bigger Stake in Two Quebec Wind Projects." CTVNews. September 23, 2014.

[27] "Launch of Coop Carbone." Ecotech Quebec. 8 Sept. 2014.

[28] "Mark Carney: Most Fossil Fuel Reserves Can't Be Burned." The Guardian. 13 Oct. 2014.

[29] "Mark Carney: Most Fossil Fuel Reserves Can't Be Burned." The Guardian. 13 Oct. 2014.

[30] TakeCharge. http://takechargenl.ca/.

[31] "Transportation REVolution: Electric Vehicle Status Update 2014." WWF. 2014.

November: Health Canada released the results of a $2.1 million, multi-year investigation into the alleged negative health impacts of wind farms. The findings align with 21 other reviews undertaken all over the world, in that the agency found no link between turbines and human health.[32] Photo credit: fototeller via iStock

November: Halifax energy company Emera joined two other firms to form Cape Sharp Tidal, with the goal of installing a grid-tied 4 MW tidal power array in Nova Scotia's Bay of Fundy in 2015. It will be one of the first multi-megawatt arrays of interconnected tidal turbines anywhere.[33] Photo credit: NetaDegany via iStock

December: Boston-based EnerNOC acquired Vancouver "energy-intelligence" software developer Pulse Energy for an undisclosed sum. A Canadian cleantech success story, Pulse software helped industrial and business clients reduce their energy consumption.[34] Photo Credit: Clean Energy Canada

December: A Guelph University study of thousands of home and farm sales concluded that, with isolated exceptions, wind turbines generally have little effect on the value of nearby properties. The finding contradicts views widely held among renewable energy opponents.[35]

December: A major national Environics Institute poll, commissioned by the David Suzuki Foundation, revealed that a critical mass of Canadians now appear prepared to accept a well-designed and effectively communicated carbon-pricing policy. [36] Photo credit: Wragg via iStock

December: Hydro-Québec commissioned the Romaine-2 large hydro power plant, which will produce 8 TWhr of electricity and have a total capacity of 1,550 MW once complete in 2020.[37] Photo credit: MmeEmil via iStock

December: Cascades corporation inaugurated the 1,490-square-metre Alain Lemaire solar thermal station at a pulp and paper plant in Kingsey Falls, Quebec. The facility will supply the plant with 4,400 GJ of thermal energy each year, reducing carbon emissions by 265 tonnes.[38]

[32] News, CBC. "Wind Turbine Noise Not Linked to Health Problems, Health Canada Finds - Technology & Science - CBC News." CBCnews. November 6, 2014.

[33] "OpenHydro and Emera Launch Cape Sharp Tidal to Deliver Tidal Energy Projects in the Bay of Fundy." DCNS Group. November 6, 2014.

[34] "EnerNOC Acquires Leading Customer Engagement Software Provider for Utilities." (NASDAQ:ENOC). December 2, 2014.

[35] Perkel, Colin. "Wind Turbines Have Little Impact on Property Values, Study Concludes." The Globe and Mail. December 7, 2014.

[36] McDiarmid, Margo. "Climate Change Survey Reveals Canadians' Fears for Future Generations." CBCnews. November 28, 2014.

[37] "Une Centrale Hydroélectrique D'envergure Avantageuse Pour Le Québec." Mise En Service Commerciale De La Centrale De La Romaine-2. December 18, 2014.

[38] "Cascades, the Quebec Government and Rackam Inaugurate the Largest Solar Thermal Park in Quebec in Kingsey Falls." Rackam. October 21, 2014.

Notable New Projects: Concrete, Steel, And Silicon

Some big clean-power plants came online, but so did hundreds of smaller ones, on rooftops, lawns, and parking lots.

Supported by favourable policy and riding a wave of private and public investment, last year Canadian developers and utilities commissioned a number of new generation facilities, both small and large, that harvest the power of sunshine, wind, and falling water.

- **Wind overwhelmingly delivered the bulk of Canada's added renewable-power capacity.**
- **Developers and utilities brought enough new wind power online in 2014 to meet the needs of 500,000 homes[39], surpassing the 1,600 MW added in 2013. Most of the new projects were located in Québec, Ontario, and Alberta.**
- **Beyond wind, solar, biomass, and hydro comprised the rest of the picture.**
- **Of special note, almost half of all new growth in solar PV capacity occurred at the residential and commercial scale—as homeowners and business owners bolted panels on rooftops, many of them in Ontario.**

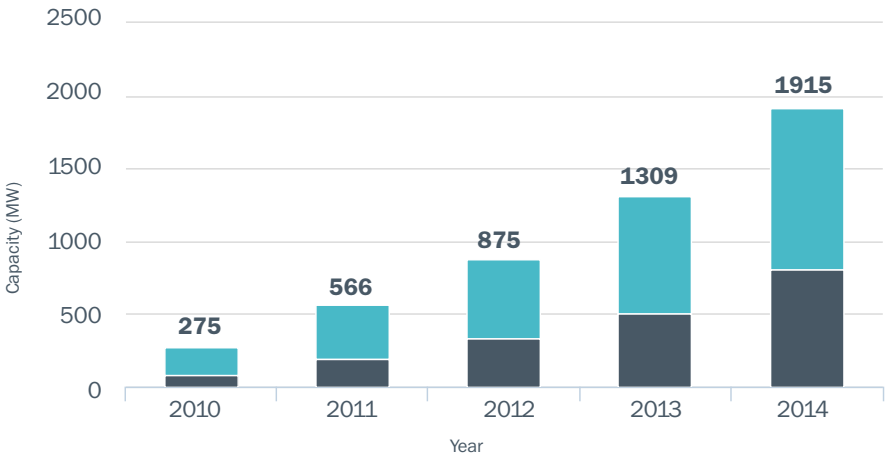
500,000

Developers and utilities brought enough new wind power online in 2014 to meet the needs of 500,000 homes[39], surpassing the 1,600 MW added in 2013. Most of the new projects were located in Québec, Ontario, and Alberta.

[39] See Methodology document.

Small is Big: The Rise of Business and Residential Solar[40]

Distributed and Utility Solar Cumulative Additions



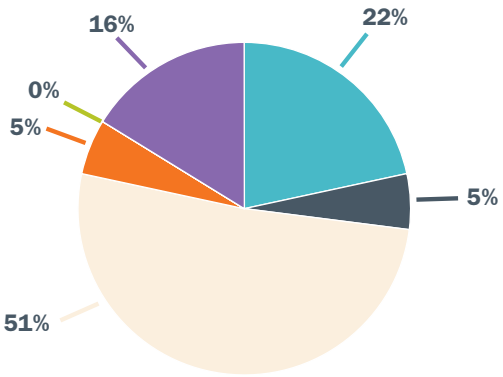
Utility Scale Solar Farms 2014 Capacity: 1105 MW
Residential and Commercial Solar 2014 Capacity: 810

With respect to large hydro, a lot of work is underway. New projects and upgrades to existing dams currently under construction and slated to become operational between 2014 and 2020 will add another 4,569 MW of capacity.[41]

Concrete is ready to flow on the La Romaine project in Québec, the Muskrat Falls project in Labrador and the Keeyask dam in Manitoba. The Province of Manitoba approved the Keeyask project in mid-2014.[42]

2014 Capacity Additions (MW)[43]

Large Hydro Capacity Addition - 0.8 MW
Wind Capacity Addition - 1.9 MW
Biogas Capacity Addition - 0 MW
Small Hydro Capacity Addition - 0.2 MW
Biomass Capacity Addition - 0.2 MW
Solar Capacity Addition - 0.6 MW



[40] See Methodology document.

[41] National Energy Board. Canadian Energy Dynamics: Review of 2014. http://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/dnmc/2014/2014nrgdnmc-eng.pdf

[42] "Canadian Energy Dynamics." National Energy Board Canada. February 1, 2015.

[43] See Methodology document.

Not to undersell the significant growth in small-scale residential and commercial solar, we've chosen three standout utility scale projects that developers commissioned this past year. We've selected them for their size, geographic diversity, and illustrative potential.

Forrest Kerr Hydro Project

Type: Run-of-River Hydroelectricity
Developer: AltaGas
Capacity: 195 MW
Location: Northwestern British Columbia
Commercial Operation Date: October 2014

Northern British Columbia is traditionally resource-extraction country, but one of the largest infrastructure projects in the region in recent memory isn't extracting anything but clean electricity. The Forrest Kerr project is not only generating enough power to light up 70,000 homes, but also creating lasting benefits for the Tahltan First Nation, a partner in the project.

The 195 MW AltaGas project borrows a portion of the flow of the Iskut River and directs it through a three-kilometer tunnel to a subterranean powerhouse, where it spins nine turbines to generate electricity. Like all run-of-river projects, there is no large reservoir, and the water is returned to the river.

Because Forrest Kerr is largely underground, the project boasts a relatively small environmental footprint. That said, it did create a relatively large economic footprint during its development. At its peak, Forrest Kerr employed 400 people, and created a decades-long positive legacy not only for the Tahltan, but to the whole region

(Source: Forrest Kerr Project Brochure) [44]

70,000

The Forrest Kerr project is not only generating enough power to light up 70,000 homes, but also creating lasting benefits for the Tahltan First Nation, a partner in the project.

[44] "Forrest Kerr Hydro Project." AtlasGas - Forrest Kerr Brochure.

Blackspring Ridge Wind Farm Project

Type: Wind
Developer: EDF EN Canada and Enbridge
Capacity: 300 MW
Location: Vulcan County, Alberta
Commercial Operation Date: May, 2014

In the absence of Alberta policy support, Calgary based Greengate Power leveraged California policy to creatively conceive Alberta's largest wind farm. The company secured a 20-year contract to sell clean energy credits to an American buyer.

In 2013, EDF EN Canada and Enbridge purchased the "construction-ready" project from Greengate, and developed the 300 MW facility. Last summer, hundreds of 49-metre blades began rotating at the project, which today cranks out enough clean renewable energy to power approximately 140,000 Alberta homes.

Blackspring Ridge produces 0.36 megatonnes less carbon pollution each year compared with a natural gas plant, the equivalent of taking more than 90,000 cars off the roads.

(Source: Media Release) [45]

Beckwith Solar Project

Type: Solar Farm
Developer: GDF SUEZ Canada
Capacity: 10 MW
Location: Beckwith, Ontario
Opening Date: February 2014

The Beckwith project is a reasonable representative of the literally hundreds of similar facilities that have sprung up around rural Ontario in recent years. The $50 million project has the capacity to produce renewable electricity for about 1,700 homes, and is expected to last decades.

The $50 million Beckwith Solar project is located about 50 kilometers west of Ottawa, and consists of 44,000 solar panels on approximately 80 acres of land.

(Source: Media Release) [46]

[45] "EDF EN Canada and Enbridge Dedicate the 300 Megawatt Blackspring Ridge Wind Project." Marketwire. July 15, 2014.

[46] "GDF SUEZ Canada Announces Start of Commercial Operation of 10MW Beckwith Solar Project in Ontario." GDF SUEZ ENERGY NORTH AMERICA. February 25, 2014.

Canadian Clean Energy Champions

Meet five largely unsung heroes who are embracing new ideas and focusing on a picture much greater than themselves.

Introducing Canada's Clean Energy Champions–our salute to the individuals who have shown exemplary leadership in working to reduce fossil fuel reliance and accelerate our nation's shift to a clean-energy economy. From a construction worker to a CEO, each champ saluted here is doing his or her part to move us closer to a better future.

Meredith Smith, Wind Warrior

Think of her as the Rosie The Riveter of Ontario's clean-energy revolution–except with a neon high-viz vest instead of coveralls.

Officially, Meredith Smith, 29, is an assistant construction manager with Surespan Wind Energy Services, a leading Canadian installer and servicer of turbines. She oversees the construction of towers and turbines all over Ontario, and regularly climbs them to keep everything running smoothly up top.[47]

Off the clock, she is a grassroots pro-wind activist–via her blog (Life Among Giants) and on Twitter via @lifeamonggiants and #prowind–and clearly has a great time doing so. She invests a lot of time debunking misinformation spread online by groups opposing renewable power.

And as a local–living with her husband in a farmhouse in Chatham-Kent, Ontario, surrounded by turbines–she is well-positioned to do so. "I remember thinking, 'This is not my experience whatsoever,'" she says, recalling some early online anti-wind vitriol.

"I thought, I am having the opposite experience. I want people to know I live here, and it's fine."

Smith is straight-shooting, funny ("sometimes my outfits match my brake fluid"), and one of the most effective advocates the sector could hope for. "We're in the midst of a huge paradigm shift," she says. "People need to embrace new ideas and focus on a picture much greater than themselves. It really is a revolution."

[47] "Wind Turbine Installers Canada | Surespan Wind Energy." Surespan Wind 2015.

Ron Dizy, Connector and Catalyst

To Ron Dizy, energy transformation isn't a technical issue; it's social.

"These are solvable problems; we have the technologies," says Dizy, managing director of the MaRS Advanced Energy Centre, which works to accelerate adoption of innovative energy technologies, then usher them into global markets.

"Ours are 'human problems'–of aligning interests, the way participants view the system, and getting incentives in place. We just need to get people pulling in the right direction."

He's in the right gig to do so. Dizy's outfit brings together different actors–utilities, entrepreneurs, non-profits, governments, academics–to open channels, wrangle issues, and lower barriers. For example, MaRS introduced a world-leading standard for open energy data. It also helped a utility join the creative planning process to transform a post-industrial site into a four million-square-foot mixed-use community.

Dizy, 50, sees his role as catalyst and connector. His team convenes "interventions" to recognize where the system isn't working and offer a better way. The three-pronged, results-oriented approach addresses policy and regulation, solutions, and capacity. Ultimately, it's a rolling stone concept: many small actions will bring about major change.

Energy is "one of those systems that needs to evolve and get smarter... It's all about alignment of vision," says Dizy, a hockey dad who spends his off days cooking big, dramatic meals. "Innovation will solve the problem. We just have to let it."

"Ours are 'human problems'–of aligning interests, the way participants view the system, and getting incentives in place. We just need to get people pulling in the right direction."

Charlotte Argue, EV Evangelist

Here's what Charlotte Argue wants you to know about electric vehicles: They're a hoot to drive. They're also many times more efficient than gas-fueled cars, and cost 90 percent less to operate compared with a traditional gasmobile.

"Transportation is one of the highest contributors of carbon emissions," says Argue, 31. "We know vehicles aren't going anywhere any time soon. So in the absence of simply not driving, EVs represent the biggest opportunity for emissions reduction. It's not a silver bullet, but it's part of the solution."

Argue is Climate Change and Air Quality Program Assistant Manger in Vancouver for the non-profit Fraser Basin Council, a public-private NGO. She spearheads green fleet initiatives, including the E3 Fleet national certification program.

Thanks in part to her efforts, British Columbia leads Canada in EV adoption–chasing global pioneers California and Norway.

Argue does much of her work behind the scenes, steering public-private coalitions such as Plug in BC. She supports building out British Columbia's charging network–now Canada's largest per capita, from five to 600 in three years–and fleet stations. Then there's the public awareness campaign, taking EVs and their owners to farmers' markets and jazz fests.

Ironically, Argue is car-less. She bikes and relies on a car share when she's not kayaking, camping or kicking around a soccer ball: "My mom just bought a Nissan LEAF, though, so it's in the family."

Annette Verschuren, Storage Pioneer

Thanks to Ontario's *Green Energy Act*, these days there's no shortage of clean electrons feeding into the province's grid.

"To entrepreneurs I say, be brave. To investors, I say be brave and courageous. To Canada, I say: We have an opportunity to lead here. It's the time to do more."

Annette Verschuren offers them a place to park.

NRStor, where she is CEO, owns, operates and develops energy-storage projects that help ease the transition to a grid that is increasingly powered by variable-output renewables. The company's holdings include a 2 MW energy storage facility that uses Temporal Systems flywheels–literally, 10 giant spinning wheels–to keep any potential hiccups off the electricity system.

The privately-held Toronto-based company is also bringing the Tesla Powerwall to Canada, and developing compressed air energy storage.

A business powerhouse, Verschuren, 59, successfully brought craft-chain Michaels to Canada and drove expansion for The Home Depot–earning the Order of Canada for her retail industry contributions and as a champion of corporate social responsibility.

"It's not easy what I'm doing," she says. "I'm trying to influence regulators and government, get commercial deals done with utilities and big energy users, and find ways to get directly to the customer. I like big challenges. When it gets easy, I get bored."

Energy storage is an emerging sector, rife with challenges and facing little policy support from Ottawa. But this is the time to take a risk or two, she says.

"To entrepreneurs I say, be brave. To investors, I say be brave and courageous. To Canada, I say: We have an opportunity to lead here. It's the time to do more."

Christopher Huskilson, The Atlantic Connection

Christopher Huskilson is pretty modest about the work he's done–"everyone is focused on cleaning up their energy system," he recently told an audience of energy-conference attendees. But 58-year-old multiple-generation bluenoser from Shelburne, Nova Scotia, isn't like everyone else.

Huskilson is president and CEO of Halifax, Nova Scotia-based Emera, a diverse energy services company that is steadily working to cut energy waste and transform the region's electricity system. Its $10 billion balance sheet includes holdings in electricity generation, transmission and distribution across Atlantic Canada, New England, and the Caribbean. It's the parent company of Nova Scotia Power.

Huskilson started with Nova Scotia Power 35 years ago, working as a software engineer trying to develop tidal power in the Bay of Fundy. In 2004, he took the company's helm. "We believed clean energy was the way forward, and we've been working on that ever since," he said. A decade later, Emera's assets have jumped $6 billion.

Case in point: The $8.6 billion federally backed Lower Churchill Project will deliver five terrawatts of hydroelectricity from Newfoundland and Labrador. Maritime Link, Emera's $2 billion portion of the project, will add 1,800 km of overland and undersea transmission and will help Nova Scotia and New England kick coal off the wires.

Huskilson is also leading the charge on Cape Sharp Tidal, a coalition working to deploy a fully grid connected 4MW tidal array in the Bay of Fundy in 2015.[48]

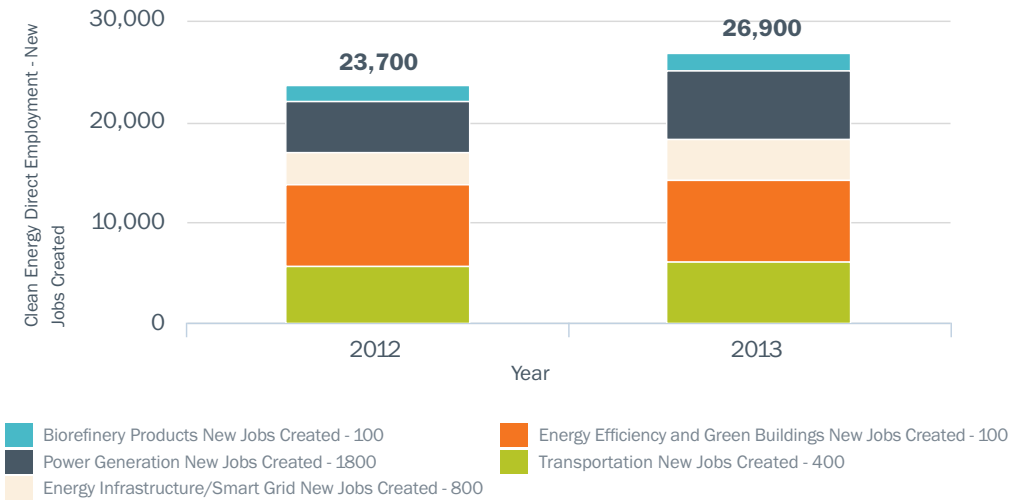
[48] "OpenHydro and Emera Launch Cape Sharp Tidal to Deliver Tidal Energy Projects in the Bay of Fundy." DCNS Group. November 6, 2014.

Circuits and Steel: Clean Energy Jobs Sector Outpaces All Others

Sure, we're missing the boat on offshore wind and geothermal, but clean energy remains an unrivalled employment success story.

Ottawa-based research firm Analytica Advisors is hands-down the best source for data on Canadian clean-energy sector employment. The firm's *Canadian Clean Technology Industry Report*, produced each year, covers the cleantech sector broadly. For our purposes, we extracted the following "clean energy" direct employment jobs for 2013–the most recent year for which data is available. Note: the full report is available by subscription only.[49]

Clean Energy Direct Employment



Put together, these sectors produced 26,900 direct jobs in 2013, up a respectable 14 percent over the previous year. This growth rate outpaced that of every other sector in 2013.[50]

[49] "Publications." Analytica Advisors.

[50] "Table 2 Employment by Class of Worker and Industry (based on NAICS1) – Seasonally Adjusted." Statistics Canada. January 10, 2014.

Canada is missing the boat on a number of clean energy sectors that could be producing jobs, such as manufacturing parts for offshore wind farms (Canadians finance these projects elsewhere, but we have yet to plunk a wind turbine in our own waves) and geothermal. That said, we have developed ample cleantech manufacturing capacity focused on energy:

90 Manufacturing Plants:

Canada boasts 90 manufacturing plants that produce key components of biofuel, biomass and waste to energy plants, as well as marine, solar, and wind turbines that are either announced, under construction, or fully commissioned.[51]

Canada is missing the boat on a number of clean energy sectors that could be producing jobs, such as manufacturing parts for offshore wind farms.

Wind Turbine Manufacturing:

Six plants manufacture towers, blades, or whole turbines, in Quebec, Ontario, Nova Scotia, and British Columbia. An additional 28 companies project-manage wind farm construction.[52]

Siemens Canada Tillsonburg Blade Manufacturing Plant

Location: Tillsonburg, Ontario
Opened: July 2013
Employees: 400
Product: Manufactures blades for Siemens Canada turbines.

Endurance Wind Power

Location: Surrey, B.C.
Opened: October 2014
Employees: 150
Product: Small wind turbines for agriculture operations, from 50kW to 225kW range.

PowerBlades Industries

Location: Welland, Ontario
Opened: Fall 2013
Employees: 136
Product: Blades for 2.05 MW Senvion wind turbines.

Solar Module Manufacturing:

Twenty-six plants manufacture solar panels for the Ontario market.

Canadian Solar London, Ontario Plant

Opened: March 2014
Employees: 200
Product: Solar PV modules and power stations for solar farms.

[51] BNEF Database

[52] BNEF Database

Policy Progress and Conclusions: What's New and What Needs to Happen Next

Some provinces added policy, others tweaked things, and Ottawa buried its head in the sand. Can we do better? Yes, we can.

Some provincial and territorial governments strengthened climate and clean energy policies in 2014, and weakened others. Meanwhile, some introduced policies that reduce emissions and spur innovation. Here's a quick scan of where things stand in Ottawa and the provinces.

Federal

Though energy is administered provincially under Canada's constitution, the federal government has a strong role to play in advancing the clean energy shift. In 2014, Ottawa remained stubbornly indifferent to this shift and the opportunities it presents, instead keeping its focus squarely on fossil fuels. The bright spot on that otherwise unfortunate landscape remains Sustainable Development Technology Canada, an arm's-length foundation that funds Canadian clean-technology development and demonstration.

- **In 2014 the foundation allocated $71.1 million to funding projects that collectively are expected to reduce equivalent greenhouse gas pollution 4.5 megatonnes in 2014. It administered two new funds: The SDTC tech fund and the NextGen Biofuels Fund.[53]**

- **Also, in September 2014, the federal government adopted the United States vehicle emissions standards for post-2016 models to reduce emissions from a sector that accounts for nearly 25 percent of Canada's greenhouse gas pollution.[54]**

[53] Sustainable Development Technology Canada Annual Report 2014

[54] "Government of Canada Takes Further Action to Reduce Greenhouse Gases (GHGs) and Air Pollution from Cars and Trucks." Government of Canada. September 22, 2014.

Here's a look at the provinces, and the climate and clean energy policies each jurisdiction either strengthened, weakened, or introduced. Note this list is intended to be illustrative, not comprehensive. Further, we were unable to identify policy changes in Alberta, Saskatchewan, Manitoba, or Canada's territories.

British Columbia

Introduced: Legislation to limit the amount of carbon pollution from the province's proposed LNG industry.[55]

Ontario

Introduced: In 2014 Ontario continued investing in electricity system infrastructure improvements through a second round of its Smart Grid Program. The province is providing $24 million to 17 new energy projects that will advance energy storage, electric vehicle integration, behind the meter two-way information exchange, micro-grids, grid automation and data analytics. Along the way it will create more than 350 jobs.

Changed: While the Ontario Power Authority awarded 100 MW worth of feed-in-tariff renewable energy contracts for 2014, it also narrowed the FIT program substantially. It now excludes facilities generating more than 500 kW, which is driving a shift to smaller projects.[56]

Strengthened: In 2014 Ontario showed the rest of North America the importance of local participation in renewable energy projects. More than 501 aboriginal partnership projects with a capacity of 814 MW as well as 292 community participation projects with capacity of 170 MW secured contracts under the Green Energy Act's feed-in tariff program.

Quebec

Introduced: To incentivize cleaner vehicles, in February 2014 Quebec introduced provincial rebates for hybrid vehicles at $500, $1,000 for low-speed electric vehicles, $4,000 for electric or plug-in hybrid vehicles, and $8,000 for electric or plug-in vehicles with battery capacity of 14 kWh or more.[57]

[55] "Media Statement: B.C. Legislates "Cleanest LNG Terminals"" Clean Energy Canada. October 20, 2014.

[56] Erion, Graham. "Ontario 2015 Renewable Energy Outlook: Procurement Update." DLA Piper. February 4, 2015.

[57] "Discover Electric Vehicles." Electric Vehicles. Accessed August 27, 2015.

Atlantic Canada

Introduced: In December 2014, Nova Scotia approved 17.5 MW of electricity from tidal sources under Nova Scotia's Developmental Tidal Feed-in Tariff program. The program aims to incentivize tidal energy developers to test and deploy their large-scale in-stream tidal energy projects in Nova Scotia.[58]

The four developers:
Minas Energy, 4.0 MW
Black Rock Tidal Power, 5.0 MW
Atlantis Operations Canada, 4.5 MW
Cape Sharp Tidal Venture, 4.0 MW

Conclusion

We opened this assessment by proclaiming this past year Canada's best ever for clean-energy investment. A full-on green power building boom is underway out there, thanks to a string of provincial governments that have unleashed it via enabling policies.

We also wondered aloud, "How much more could Canada achieve with a supportive federal government?" The answer is plain: A great deal.

As we finalize this report, Canadians are preparing to choose a new federal government. To get a sense of what's possible in Ottawa, we invite our readers to look to Washington, D.C. As is the case with Canada's provinces, south of our border energy is largely the domain of the state governments.

But the tone on the clean energy opportunity coming from the executive office is not only different than Canada's current federal approach, it's *drastically* different.

A couple months back, President Obama took what he called "the single most important step America has ever taken in the fight against global climate change," and introduced a Clean Power Plan rule intended to shut down his nation's coal plants. Included in the plan is an incentive program that, according to Bloomberg New Energy Finance, will "turbo-boost" renewable energy.[59]

The regulation, the centerpiece of his climate legacy, is just the latest in a long string of efforts supporting clean energy that go back almost a decade. In 2007, recognizing that the United States was

[58] "Developmental Tidal Feed-in Tariff Program." Nova Scotia Canada. Accessed August 27, 2015.

[59] Casey, Tina. "CT Exclusive Interview: Clean Power Plan Has A Message For Natural Gas, And It's Not Good." CleanTechnica. August 3, 2015.

falling behind in technology, Congress passed legislation creating the ARPA-e initiative. The program brings the same innovation to energy generation, storage, and usage that had been traditionally going into defense. In 2008, President Obama allocated $400 million to the agency.

Then there was SunShot, and the Department of Energy's loan guarantee program, which helped Tesla Motors get off the ground. A Renewable Energy and Energy Efficiency Export Initiative at the Department of Commerce works to help get American clean energy innovations into foreign markets, including this one.

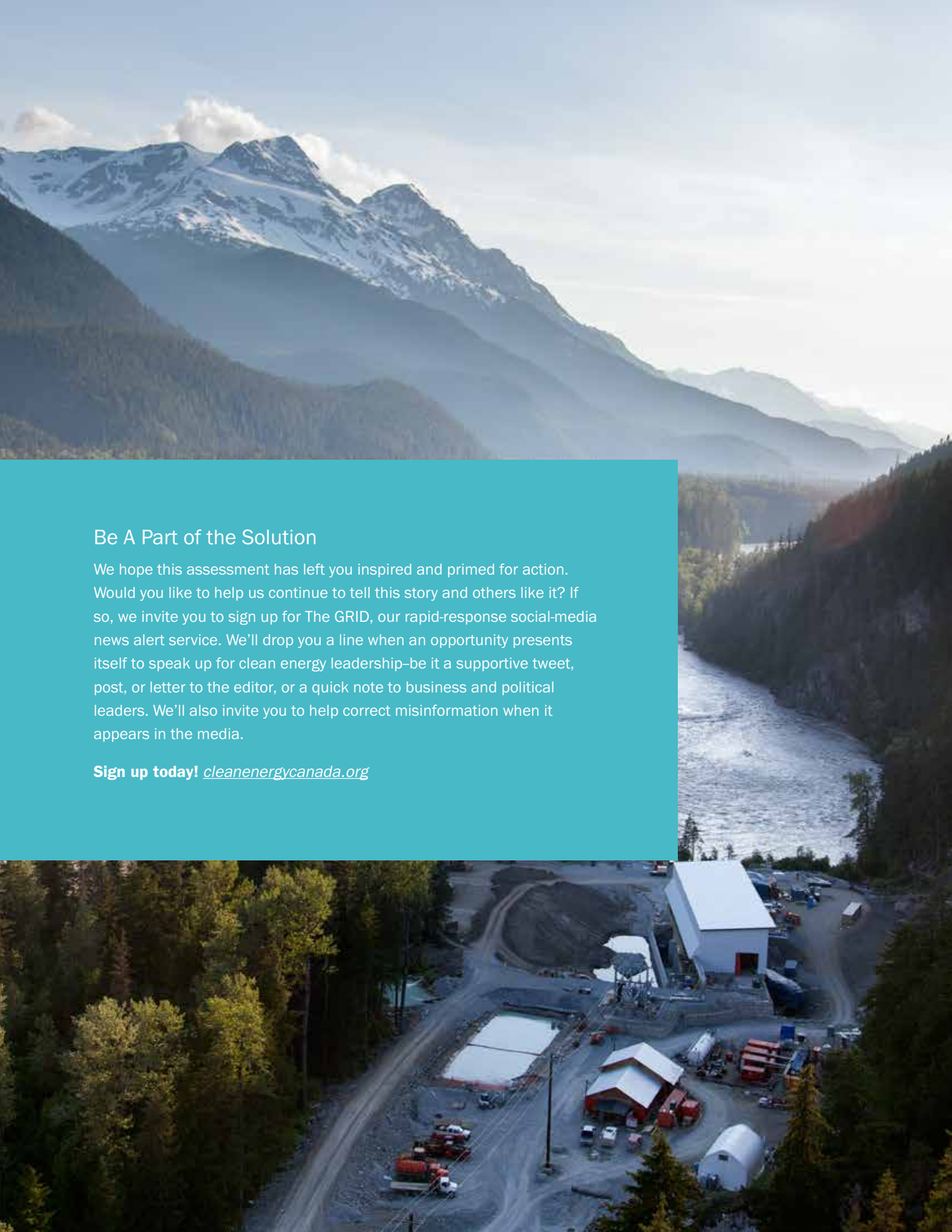
As is the case with Canada's provinces, south of our border energy is largely the domain of the state governments.

President Obama has used the bully pulpit of the White House to drive a clear and consistent message to his Cabinet, Congress, state and industry leaders, and the world: America will be a global leader in the clean-energy race. It will get the job done, and will out-innovate its competitors.

That's the kind of tone that has been sorely lacking in the House of Commons. But as the global clean energy opportunity grows larger, it is frankly getting tough to ignore.

As we said earlier, Canada's provinces–and, to be fair, cities–are presently doing almost all of the heavy lifting on clean energy. Ottawa has been focusing both its domestic and foreign policy efforts on getting Canada's fossil fuels out of the ground and to market.

With the right direction and the right support, Canada could do more than just move a few spots up the global clean energy ranks. Who knows? We might even give the Americans a run for their money.



Be A Part of the Solution

We hope this assessment has left you inspired and primed for action. Would you like to help us continue to tell this story and others like it? If so, we invite you to sign up for The GRID, our rapid-response social-media news alert service. We'll drop you a line when an opportunity presents itself to speak up for clean energy leadership–be it a supportive tweet, post, or letter to the editor, or a quick note to business and political leaders. We'll also invite you to help correct misinformation when it appears in the media.

Sign up today! *cleanenergycanada.org*

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