

2018

# cleantech directions

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## SPOTLIGHT ALBERTA

Policy, funding and market drivers align to spur cleantech growth

### INSIDE

- Coal phase-out
- Emissions reduction targets
- Role of renewables
- Mentoring cleantech start-ups

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**PLUS:** Results from the  
Cleantech Directions  
national business survey



**E**missions Reduction Alberta (ERA) partners with government, industry and innovators to accelerate development of technologies that reduce GHG emissions. This report provides an insightful snapshot of Canada's cleantech landscape based on input from a cross section of stakeholders in the sector. It identifies opportunities for growth, as well as barriers and key drivers of innovation in the Canadian economy.

Canada is well positioned to become a global cleantech leader. We are consistently ranked as one of the top G20 countries to do business in, with a highly skilled and educated workforce, excellent post-secondary system, and a stable regulatory regime. We offer tremendous opportunity for technology developers.

Policies to reduce GHG emissions are in place. The federal government has made funding commitments to support cleantech and innovation. In Alberta, we have a strong foundation with our own Climate Leadership Plan, including a levy for large industrial emitters. Innovators, industry and governments are building a shared understanding of the power of "and." We are all working together to advance the technologies that we need to reduce GHG emissions and grow our economy. We are advancing innovation and creating jobs.

Still, innovators face barriers to scale-up. This year's *Cleantech Directions* survey identifies that a lack of financing or investment capital remains the top barrier cited by cleantech developers. Other challenges innovators identify include appropriate policy, and government incentives. The inability to secure a partner for demonstration projects, and tellingly, low customer demand, or the lack of a ready market for their technology also figure prominently.

Interestingly, nearly 40 per cent of technology developers who participated in this year's survey indicate that they are not actively trying to commercialize their technology when it is at the research, pilot or demonstration phase. About 10 per cent are waiting for the right opportunity and about the same proportion plan to sell or licence their technology to others.

Turning the tables, and getting more Canadian cleantech to market, requires complete solutions. Complete solutions include not only technology and financing, but also an entire suite of tools that include the policy, regulatory, program and business innovation components required to successfully deploy new technologies.

The only way to succeed is by working together.

By collaborating on shared objectives, we can accelerate development of the technologies we need to deliver the right economic, environmental and social benefits.

Together, we will put in place all of the conditions for success that make it clear to investors and inventors, and all the players in between, that Alberta and Canada are the best places in the world to turn ideas into products, and products into companies.

**Steve MacDonald**

CEO, Emissions Reduction Alberta



## Roundtable participants

Welcome to *Cleantech Directions*, focused on clean technology growth trends, market drivers, barriers and opportunities. This report contains highlights from a survey of cleantech businesses and demand-side organizations in Alberta and across Canada, along with a summary of a conversation held in Edmonton in June 2017. The roundtable discussion involved clean technology entrepreneurs, funding and finance stakeholders, government and industry representatives, who shared insight on the key policy, economic and social developments shaping and defining Alberta's clean technology sector.

(Back row, from left)

**John Brown** | Assistant Deputy Minister, Science and Innovation Division, Economic Development and Trade (EDT), Government of Alberta

**Steve MacDonald** | CEO, Emissions Reduction Alberta (ERA)

**Brad Johns** | Partner, Yaletown Partners Inc.

**Sheila Schindel** | VP, Sustainable Energy Solutions and Strategy, RII North America Inc.

**David Bressler** | Professor, Agricultural, Life and Environmental Sciences, University of Alberta; Lead Scientific Advisor of Forge Hydrocarbons Inc.

**Joseph Kuhach** | CEO, Nsolv Corporation

**Jackson Hegland** | Executive Director, Methane Emissions Leadership Alliance

**Dan Wicklum** | Chief Executive, COSIA (Canada's Oil Sands Innovation Alliance)

**Kate Chisholm** | Senior Vice-President, Legal and External Relations, Capital Power Corporation

(Front row, from left)

**Audrey Mascarenhas** | President and CEO, Questor Technology Inc.; CEO of ClearPower Systems Inc.

**Laura Kilcrease** | CEO, Alberta Innovates

**Russel Matichuk** | Chairman, ACTia (Alberta Clean Technology Industry Alliance).

**Apoorv Sinha** | CEO, Founder of Carbon Upcycling Technologies, zEroCor Tubulars Inc.

**Joanne Pawluk** | Director, Policy, Planning and External Relations, Western Economic Diversification Canada, Alberta Region.

Missing from photo:

**Chris Van Tighem** | Senior Director of Integrated Science and Research Initiatives, Alberta Economic Development and Trade

—Group and candid photography by *Ryan Patrick Kelly Photographs*



# All systems go

**Policy, funding and market drivers combine to set the stage for cleantech growth**

Articles by David Kennedy

Advancing clean technologies is a balancing act. Most businesses and policy makers aim to avoid unintended consequences that might negatively impact traditional industries and markets.

That's certainly the case in Alberta, with its capital-intensive, natural resource-based economy, an electricity grid heavily reliant on coal-fired generation and a number of traditional, risk-averse industries.

But for the first time, a clear alignment is shaping up between cleantech funding, environmental regulations, a skilled workforce and technology innovation, leading Alberta to the brink of a significant breakthrough in cleantech advancement.

Belt-tightening and razor-thin margins in the energy sector since the precipitous

slide in crude oil prices in 2014 have posed challenges to many businesses in Alberta and other provinces, but the situation has also had a galvanizing effect — amplifying calls for Alberta to diversify its economy through innovation.

Alberta's government and a large number of its businesses have already mobilized to take cleantech innovation to the next level, with the goal of affecting meaningful change in a host of industries, from agriculture to software.

The province passed landmark climate change legislation last year, committing to phase out emissions from coal-fired power plants by 2030 while introducing a broader carbon levy, which went into effect on January 1, 2017. Also included were commitments to increase renewable energy capacity, methane emissions reductions and a cap on oil sands emissions.

Many Alberta businesses, including the major oil sands players, have been there every step up of the way, consulting on the best ways to reduce emissions across sectors, without stifling growth.

It was against this backdrop that a group of cleantech entrepreneurs, funders, investors and government representatives sat down in an Edmonton boardroom June 27 to discuss how Alberta is managing the shift to a cleaner economy and what obstacles still loom large on the road ahead.

## Building momentum

While the experts around the table acknowledged there have been some inevitable early stumbles, they said the province has already taken a number of steps in the right direction. The consensus: Alberta is well on its way to shaping



When we look at cleantech, there's a natural tendency here to look at just what comes out of our oil and gas industry...We have multiple layers of cleantech economic opportunity here—whether it be water, emissions, new materials, or carbon capture.”

— Laura Kilcrease, CEO, Alberta Innovates

an environment that encourages emerging cleantech companies to put down roots while allowing traditional businesses enough breathing room to adjust to the new normal.

“I think this is the right place, and we're in the right position to really make this happen,” said Dan Wicklum, the chief executive of Canada's Oil Sands Innovation Alliance, better known as COSIA. “The yardstick's moving, but we're really moving hard on the innovation system to get us there and to get it right.”

COSIA is an innovation alliance of the 10 major oil sands producers, representing over 90 per cent of the oil sands. It focuses on developing environmental and clean technology that will ensure development and future growth in Alberta's oil sands sector will be sustainable. The organization is an example of how the country's energy producers are looking to the future by collaborating on technologies to solve environmental challenges.

And while the oil and gas sector is sure to play a major role in Alberta's economy for decades, Laura Kilcrease, CEO of government-funded innovation

hub, Alberta Innovates, said it's also important to acknowledge the many other cleantech areas where the province will find an equal measure of success.

A newcomer to Alberta, Kilcrease spent more than two decades in Austin, Texas, where she worked to diversify the city's economy beyond traditional energy. Credited as being one of the key figures in transforming the city into a bustling high-tech hub, she's aiming to bring about a similar technological boom in Alberta.

“When we look at cleantech, there's a natural tendency here to look at just what comes out of our oil and gas industry... We have multiple layers of cleantech economic opportunity here—whether it be water, emissions, new materials, or carbon capture,” she said.

“I'm just naming a few, but there are multiple choices within the cleantech space that probably should be looked at separately as they have different markets, different customers and different adoption rates.”

David Bressler, a professor at the University of Alberta, agreed, adding Alberta already has a strong international cleantech brand that will give it

an added boost as emerging companies work to open up new markets.

“Globally our products are accepted as having a good land-use framework, a good impact—all of that is part of the sustainability argument, which goes hand in hand with cleantech,” he said.

Bressler, who's also the technology founder of biofuel firm Forge Hydrocarbons Inc., said it's through bringing together different sectors and developing multidisciplinary approaches that Alberta can truly shine.

“We have strength in [agriculture] and forestry, we have two great schools with great histories in energy and engineering and very strong know-how,” he said.

With stricter climate regulations, businesses pushing ahead with countless new clean technologies and an experienced, tech-savvy workforce, Alberta is fertile soil for a cleantech boom.

But that doesn't necessarily mean the transition will be easy, or painless.

### The first big shift

As John Brown, assistant deputy minister for science and innovation with Alberta Economic Development and



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—David Bressler, Professor, University of Alberta



“ Alberta has had the benefit of time to watch all the things that went wrong in Ontario [with renewables],” Chisholm said. “They were a first-mover and suffered all the disadvantages of that.”

— Kate Chisholm, Senior Vice-President, Legal and External Relations, Capital Power Corp.

Trade said, “the challenge will be in the transition.

“We are trying to encourage the development and adoption of technologies that will result in a lower carbon economy, but will also provide opportunities in that economy for business growth,” he said.

For Alberta, the first big transition is already underway.

Currently, coal plants account for about 40 per cent of the province’s 16 gigawatts of installed electricity capacity.

But by 2030—or sooner—all of Alberta’s 14 remaining coal power stations will be closed or potentially converted to lower-emitting sources, and the province’s installed coal capacity will drop to zero.

The coal transition was among the many tenets of the province’s Climate Leadership Plan of 2015, which built on past Alberta climate plans, ranging back to 2002.

“I think it was a tough, but necessary decision,” said Kate Chisholm, senior vice-president of legal and external

relations at Edmonton-based power firm Capital Power Corp.

The major policy shift will slash the province’s greenhouse gas emissions, as well as make way for new renewable capacity and other alternatives, such as the expansion of Alberta’s natural gas industry. Today, cleaner-burning natural gas provides about two-fifths of Alberta’s electricity capacity, while hydro, wind and biomass make up approximately 19 per cent.

While Chisholm noted the capital-intensive shift will present some challenges for the province, she gives the Alberta government credit for making the decision—and making it at a time when it won’t cost ratepayers dearly.

That somewhat ignominious distinction goes to Ontario, which was a first-mover on eliminating coal-fired generation and adopting renewables, and wind power in particular.

“Alberta has had the benefit of time to watch all the things that went wrong in Ontario,” Chisholm said. “They were a first-mover and suffered all the disadvantages of that.”

Economies of scale and advances in wind technology have drastically reduced wind power costs since Ontario introduced the Green Energy Act in 2009. By today’s standards, the 20-year power purchase agreements Ontario signed early in its transition are exorbitant. Between 2006 and 2014, electricity prices in Ontario rose 70 per cent, leading to significant popular backlash, and ultimately a mea culpa from the province’s Liberal government.

Unlike Ontario, Alberta is in a position to get it right, Chisholm said.

“The Alberta government has watched all of that and learned from it and isn’t going to make the same mistakes,” she said.

Along with starting its clean energy transition at a time when renewable power has become more affordable, Chisholm said the province has taken the proper steps to ensure its coal retirements will roughly coincide with new cleaner capacity coming online and knows to keep any potentially market disrupting changes to the supply and demand balance to a minimum.



“ We are trying to encourage the development and adoption of technologies that will result in a lower carbon economy, but will also provide opportunities in that economy for business growth.”

— John Brown, Assistant Deputy Minister, Science and Innovation Division, Economic Development and Trade





In Alberta, it's absolutely critical that these projects, these ideas have a global opportunity. No one's going to invest in a company that only fits a certain niche that's only Alberta."

— Brad Johns, Partner, Yaletown Partners Inc.

As in many other jurisdictions, the opportunity to clean up the electricity grid offers Alberta an early win in its shift to a cleaner economy.

But with the power grid accounting for only 16 per cent of the province's overall GHG emissions, doing away with coal is just one aspect of the province's climate plan.

Alberta's carbon levy, which went live earlier this year, is expected to raise \$5.4 billion for a range of climate-related initiatives over the next three years. Along with rebates for low-income families and small businesses, the funds will help pay for new green infrastructure, 5,000 megawatts of new renewable power capacity by 2030 and energy efficiency programs designed to curb overall energy consumption.

Since 2007, levies on large greenhouse gas emitters have also been helping fund emerging technologies. Since 2009, for instance, Emissions Reduction Alberta (ERA), formerly known as the Climate Change and Emissions Management Corp. (CCEMC), has supported more than 120 projects with approximately \$320 million in investment.

Unsurprisingly, about 35 per cent of ERA funding is supporting new technologies that could be put to use in the oil sands, which account for about one-quarter of Alberta's total emissions. Advancing these technologies to commercialization will be integral to meeting the province's emissions reduction targets as well as its goal of capping total oil sands emissions at 100 megatonnes per year.

"The bridge between economic development and meeting climate change

goals is technology," said ERA CEO Steve MacDonald.

According to Natural Resources Canada, the oil sands contributed about 9.3 per cent of Canada's total GHG emissions in 2014. More efficient processes to extract and process bitumen will be needed to continue ramping up crude production in Alberta while reducing emissions.

Alberta's oil sands industry also doesn't exist in a bubble.

Many of the technologies innovators are working on across the province can be implemented worldwide. Commercializing and selling these new technologies presents the province with a great opportunity to build on its export-oriented energy industry as world markets begin to demand energy sources with lower carbon intensity.

"As we've seen over many years, most diversification efforts have been rooted where our strengths are," said Joanne

Pawluk, director of policy, planning and external relations for Alberta at Western Economic Diversification Canada.

She pointed to oil and gas and agriculture as areas where the province has found the most success, and thinks the two sectors will continue to power the Alberta economy.

"That's where we would see the most potential," she said.

Kilcrease agreed, acknowledging the province has to concentrate its resources at least in the short-term.

"We can't do everything," she said. "So let's concentrate on the areas where we have a distinct opportunity to excel."

Building on experience in Texas, however, Kilcrease said the long-term cleantech plan should be ambitious.

Instead of focusing on oil and gas and agriculture ad infinitum, Kilcrease thinks the province should build up its momentum in those key sectors and then branch out in other areas of the economy. **CT**



# Cleantech company snapshot

*Cleantech Canada* and partners gathered insight from 470 businesses across Canada via an online survey conducted in August, 2017. The survey focused on the growth experience of clean technology companies, and market drivers on the demand side. Of the total responses, 285 represented clean technology companies, defined for the purposes of this report as “primarily providing products, services or processes to address climate, waste or resource challenges; or develops or deploys technologies that reduce greenhouse gas emissions.” Alberta-specific trends were also noted in the study.



Only **28%** got help from academic organizations or facilities to develop their technology.

**11.7 years:** Average age of cleantech companies in Canada



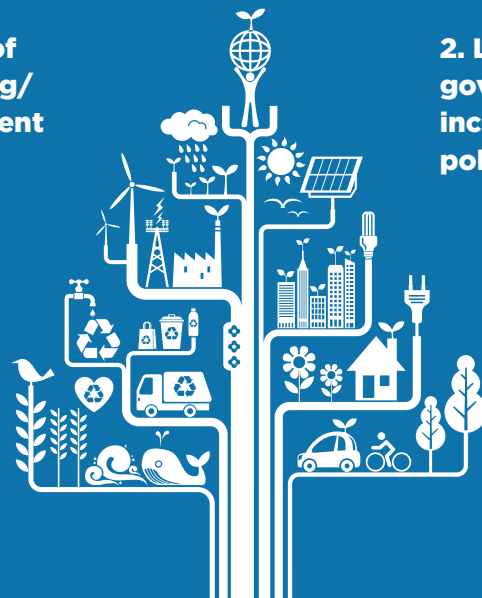
**41%** of commercialized cleantech companies export (35% in Alberta).

**7.3 years:** Average length of time it takes to commercialize a new technology

## Top three challenges to cleantech growth

**1. Lack of financing/ investment**

**2. Lack of government incentives/ policies**



**3. Low customer demand/ No market**

In Alberta, “Low customer demand” dropped to fifth place, and “Unable to secure industrial partner” was cited in third place.

### Customers and markets


- Only 42% of cleantech companies in Canada are significantly dependent upon an existing government policy or incentive (47% in Alberta); and only 6% are significantly dependent upon a single customer (5% in Alberta).
- Oil and energy, including the oil sands, is the main target market for Alberta cleantech com-

- panies (39%), followed by consumers and the public (18%), power utilities/ generation (13%) and agriculture/ forestry (6%), among others.
- 65% of cleantech companies said “legislation, regulation or government policy changes associated with climate change” has increased interest in their technology or demand for their products (68% in Alberta).



### Finance and funding

- Government grants/ subsidies is the most important source of funding or finance for cleantech companies (23%), followed by revenue from sales (21%), self-funding/ family investment (18%), private domestic investors (11%), industry partners (7%), organizations such as SDTC, ERA (6%), bank loan/credit (4%), venture capital/ angel investors (2%), overseas investors (1%).
- The majority (57%) have experienced difficulty accessing financing.
- The top reasons companies had trouble accessing financing are: technology is viewed as high risk/ unproven (41%), insufficient secured cash flow/ assets (36%), lack of ability on the part of banks/ lenders to evaluate clean technology (31%).

**5.6%** Average annual growth rate of expanding cleantech companies. 



Only **30%** said their investor pitch is “very effective and resonates well.”

**85%** are confident they will reach the next milestone or goal for their business or technology within the next two years.



**40%** said their technology is patented.



**52%** of cleantech companies have a strategic business plan taking into account the steps to scale up.



**59%** are commercialized or generating revenue

**57%** of companies in earlier stages are actively trying to commercialize.



**57%** both develop and deploy technology

### Alberta cleantech companies' primary line of business:

• Oil & gas (conventional)	<b>23%</b>
• Renewable energy	<b>13%</b>
• Emissions management/ reduction	<b>7%</b>
• Energy efficiency	<b>7%</b>
• Forestry and agriculture	<b>6%</b>
• Water and wastewater	<b>6%</b>
• Hydrocarbon recovery/ utilization	<b>5%</b>
• Environmental remediation	<b>5%</b>
• Construction	<b>3%</b>
• Transportation and supply chain	<b>2%</b>
• Biochemicals	<b>2%</b>
• Biofuels	<b>1%</b>
• Biochemicals	<b>1%</b>
• Green buildings	<b>1%</b>

# THE WIDER VIEW

**Shifting forces add sense of urgency to cleantech advancement**

From the swearing in of a new U.S. president in January, to the international community's banding together after Donald Trump stood in the White House Rose Garden in June to announce the U.S. would quit the Paris climate agreement, 2017 has been a year of mixed results for the cleantech industry.

On the one hand, the Trump administration's pausing or dismantling of many of former U.S. president Barack Obama's climate initiatives represents an abrupt U-turn on emissions policy at the U.S. federal government level.

Yet the group of cleantech businesses, government and association representatives gathered for a roundtable discussion in June commented that the changes made by the Trump administration have only strengthened resolve

to forge on with emissions reduction; among many U.S. businesses and state-level governments.

2017 overall has demonstrated the remarkable resilience of the climate change movement. Unlike the Kyoto Protocol two decades earlier, which languished following the U.S. government's refusal to ratify the treaty, it appears the Paris climate accord will still be standing long after Trump leaves office.

Despite the setback in the U.S., there's still a pervasive sense that the momentum can no longer be stopped. While the cleantech experts around the table in Edmonton acknowledged Trump's outspoken politics may create a more polarized debate around climate change in the U.S., the general sentiment was the president will not halt the global march toward cleaner technologies.

As Audrey Mascarenhas, president and CEO of Alberta-based Questor Technology Inc. noted, state and municipal governments are already picking up Washington's slack.

"Even though it looks like Trump has decimated the Environmental Protection Agency...there is such strength in each of the states to continue on the course," she said, during the discussion.

Mascarenhas pointed to Colorado as one prominent example. She said new state rules around methane emissions have allowed Questor to significantly ramp up its business south of the border.

And the Rocky Mountain state isn't alone. A number of other states—many of them blue as opposed to red—such as California, Massachusetts and New York, are flouting Trump and blazing their own trail on climate change.



“It’s an abdication of the U.S. government taking a leadership position on climate... Now it’s giving businesses a shot. I think you see a lot of businesses still moving forward in that direction.”

— Joseph Kuhach, CEO, Nsolv Corporation

Joseph Kuhach, meanwhile, said the U.S. federal government’s putting climate on the backburner is giving businesses a chance to step up. The CEO of Nsolv Corp., Kuhach leads a team working to commercialize an innovative technology that could replace the steam-assisted gravity drainage (SAGD) process currently used to extract bitumen throughout much of Alberta’s oil sands.

“It’s an abdication of the U.S. government taking a leadership position on climate,” he said. “Now it’s giving businesses a shot. You see a lot of businesses still moving forward in that direction.”

Indeed, there’s little question big-name U.S., Canadian and international businesses will keep pushing the clean economy forward. Companies calling on Trump to abide by the Paris accord earlier this year ran the industrial gamut—from tech giants Apple Inc. and Google parent Alphabet Inc. to traditional economy players such as Ford Motor Co., Exxon Mobil Corp. and Wal-Mart Stores Inc.

Many others have committed to meeting stricter emissions targets and climate goals in spite of the lack of American legislation.

With so much international support and the backing of countless companies

and sub-national governments within the U.S., the Trump administration’s decision to quit the Paris accord may have little impact for the cleantech industry.

### Canada’s opportunity

The loss of momentum in the U.S. could be Canada’s gain. In the days following Trump’s retreat from the Paris accord, Prime Minister Justin Trudeau lined up calls with five of the other G7 leaders to reaffirm Canada’s commitment to the deal and map the way forward without the U.S.

Trudeau has remained a stalwart supporter of cleantech and innovation since his 2015 election and Budget 2017 was no exception; Ottawa announced billions of dollars in support for clean technology over the next five years with funds for energy storage, smart grids and electric vehicles. The budget also included tens of billions more for green infrastructure and set aside \$400 million to replenish Sustainable Development Technology Canada’s tech fund.

The extra funding comes at an important time for Canadian cleantech. According to Ottawa-based research organization Analytica Advisors, Canada’s low-carbon renaissance is “very much on the ropes.”

The firm’s most recent report, released this April, shows while revenue across the Canadian cleantech sector rose eight per cent between 2014 and 2015 to \$13.27 billion, Canada’s slice of the world market is slipping.

Canada currently ranks 16th globally on the list of largest cleantech exporters—the same as it did in 2008—but its share of the trillion-dollar market has slipped 12 per cent to 1.4 per cent from 1.6 per cent.

Still, Analytica Advisors found plenty of good news for the sector in its latest analysis as well, including that a large percentage (78 per cent) of cleantech companies are shipping goods or services overseas and that firms are investing more back into their business through higher research and development spending. Based on Analytica Advisors’ research, the industry also now directly employs more than 55,000 people across every province.

While the research speaks to potential missed opportunities for Canadian cleantech, the roundtable group agreed the right policy levers and interest from investors could quickly turn things around.

In Alberta, that’s exactly what policy makers have in mind. **CT**



“Even though it looks like Trump has decimated the Environmental Protection Agency...there is such strength in each of the states to continue on the course.”

— Audrey Mascarenhas, President & CEO, Questor Technology Inc; CEO of ClearPower Systems Inc.





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# BUILDING ALBERTA'S CLEANTECH INDUSTRY

Regulations, scale-up funding and the path to commercialization

**T**raditionally, the Alberta government has not been in the business of being in business, said David Bressler a professor at the University of Alberta, during a roundtable discussion among cleantech stakeholders in Edmonton in June.

That's not expected to change, but Bressler, and the other cleantech experts around the table, still think the provincial government has a major role to play if Alberta is to establish itself as a cleantech powerhouse.

"Historically when we look at economic diversification it's get a whole bunch of minnows, talk to the big fish and then release the little fish and ask the big fish to take care of the little fish," he said.

The results have been predictable and unsatisfactory, he added.

"Come back in five years and there's only... big fish."

For the Alberta cleantech space to succeed, the experts in Edmonton said young companies need ongoing guidance to make it through the various stages of their growth.

## Changing the rules of the game

Bringing in new regulations is one of the few tried and true methods for driving innovation.

Alberta's new regulatory regime is no exception. But while the province's climate plan is designed to trim emissions and spur growth for cleantech and environmental firms, it also presents a challenge for traditional businesses forced to adjust to a new set of rules.

Putting a price on carbon is one prominent aspect of the plan—another is the Alberta government's commitment to reduce methane emissions in the oil and gas sector by 45 per cent by 2025.

A potent greenhouse gas, methane is approximately 25 times more damaging to the environment over 100 years than carbon dioxide.

With the province's oil and gas sector alone accounting for about 70 per cent of Alberta's total methane emissions in 2014—and leaks, venting or flaring of methane amounting to about 25 per cent of the industry's overall upstream emissions—methane is a major contributor to the province's GHG emissions profile.

Until now, said Jackson Hegland, executive director of the Methane Emissions Leadership Alliance, it's been mostly larger companies that have had the foresight and the money to reduce methane emissions. But as Canada and Alberta firm up methane legislation, this is certain to change.

"As we transition from that phase of social benefit into a compliance framework, which we're entering into now, you've got the smaller and mid-size organizations," he said. "They are certainly moving along the path, but they're focused on a compliance approach."

The government is moving cautiously on the legislation, but cleantech firms with methane reduction technology, such as the members of the Methane Emissions Leadership Alliance and Questor Technology Inc. of Calgary—also represented at the roundtable—will eventually benefit from the new rules.

Despite the cost of compliance, most members of the oil and gas industry are also on-board with the new methane regulations. The Canadian Association of Petroleum Producers (CAPP), for instance, has voiced its support for the 45 per cent reduction in methane emissions below 2012 levels by 2025. It's also collaborated with the government to create realistic regulations the industry can meet without flat-lining growth.

The methane regulations are just one example of how the government can make the regulatory ecosystem more welcoming to new companies while striving to avoid driving out the native inhabitants.





We are working to put in place the conditions for success that make it clear to inventors and investors, and all the players in between, that Alberta is a place to turn ideas into products, and products into companies.”

— Steve MacDonald, CEO, Emissions Reduction Alberta (ERA)

### Ideas aren't the issue

Supportive regulations are one aspect of a healthy cleantech sector. Early- and mid-stage funding for promising companies is another.

With a healthy crop of talented engineers and strong entrepreneurial drive, bright ideas for new technologies have never been Alberta's problem.

“The challenge for us isn't on the creation—on the ideas side—it's on the scale-up side,” said Steve MacDonald, CEO of Emissions Reduction Alberta (ERA).

As an organization, ERA is focused on funding technologies that reduce GHG emissions. Like private-sector technology incubators, it has the tough task of evaluating technologies and judging whether or not they might succeed in the commercial market.

Unfortunately, MacDonald said, even a good idea isn't always enough. “We are working to put in place the conditions for success that make it clear to inventors and investors, and all the players in between, that Alberta is a

place to turn ideas into products, and products into companies,” he said.

He noted a long list of factors that determine commercial success, such as regulatory push, market demand, proper financing and effective management.

“The big challenge for ERA is both technology readiness and commercial readiness,” he said.

Between funding from organizations like ERA, Alberta Innovates and federal funding from agencies such as SDTC, the experts agreed Alberta cleantech firms have good access to capital early on.

When scaling-up, however, funding gets tighter.

Part of the issue, according to COSIA's Dan Wicklum, is the capital-intensive nature of the natural resource sector—especially when you compare it to the software-focused tech industry.

“That drives you to approach innovation in fundamentally different ways,” said Wicklum, chief executive of COSIA (Canada's Oil Sands Innovation Alliance). “That programmer can make their program for literally the cost of the

personal computer they are working on.”

“That can't happen here,” he added, pointing to new oil sands technologies that could literally cost hundreds of millions from conception to testing. After testing, the cost of full commercial implementation can run into the billions. With this amount of money at play, companies take a very deliberate approach to innovation and technology implementation to make sure they get it right.

With this in mind, Alberta companies may need a little more assistance.

According to Sheila Schindel, vice-president of sustainable energy solutions and strategy at RII North America Inc., for instance, the government help gets companies to the point where they're “almost bridging that gap,” but investment often dries up when it comes to pushing a technology over the commercialization finish line.

The real trick is getting private capital involved.

Schindel, who's a former senior manager of large investments at SDTC, said even after doing early pilot testing and then a pre-commercial demonstration, companies are often significantly challenged in securing private investment to take the next step. They also often don't meet the strict criteria to qualify for financing or loan guarantees from government agencies such as Export Development Canada or Business Development Bank of Canada.

There's still an area of the financing ecosystem that's “not quite there” when it comes to supporting the small entrepreneur, Schindel said.







It's sometimes harder for the small companies to swallow that they might need the help—they've been going it alone for a while. But on the other side, imagine how much more prosperous they could be with a little bit of guidance."

— Sheila Schindel, VP, Sustainable Energy Solutions and Strategy, RII North America Inc.

MacDonald also acknowledged the province's partially-built ecosystem still has plenty of room to improve, but pointed out if companies want government agencies to take on more risk, owners will need to be willing to give something in return.

### Putting the pieces together

Like MacDonald and Schindel, the chairman of the Alberta Clean Technology Industry Alliance, or ACTia, sees fine-tuning Alberta's overall cleantech ecosystem as a key step in advancing the industry.

To complement funding, Russel Matichuk said the scale-up process needs to include connecting entrepreneurs to the right groups of investors, customers and experienced business managers at the right time.

"The pivots are the problem," said Matichuk.

"In a technology evolution there are a plethora of potential pivots," he said. "I think back to some of my technology background—I can draw a line in the sand where there were some really obvious ones that I didn't make and some ones that I did. The young entrepreneur doesn't have the benefit of

knowing which one is the right one."

Matichuk thinks the Alberta government and incubators should, at the very least, be helping guide companies through the scale-up process by connecting them with business leaders or other mentors who've been there before.

Going further, Schindel said encouraging start-ups to bring on an experienced manager to help lead the company while the founder—who often developed the original technology—focuses on getting the product or service ready for the commercial market could drastically improve performance.

"It's sometimes harder for the small companies to swallow that they might need the help—they've been going it alone for a while. But on the other side, imagine how much more prosperous they could be with a little bit of guidance," she said.

With a seasoned manager or consultant who's been around the block several times before, the company can also take on a more strategic outlook, targeting longer-term goals like exporting.

And it's through exporting that Brad Johns, a partner at venture capital firm Yaletown Partners Inc., thinks young

companies can truly distinguish themselves and attract private-sector investors.

"In Alberta, it's absolutely critical that these projects, these ideas have a global opportunity," he said. "No one's going to invest in a company that only fits a certain niche that's only Alberta."

With a population of just over four million, the math just doesn't work out for province-centric ideas, he added.

Johns said his firm is particularly interested in the new wave of cleantech—a group of businesses he refers to as Cleantech-2.0, or Cleantech-light. Instead of physical products, this type of cleantech company focuses on technology, eliminating high start-up costs that create larger risks for investors.

There's a long list of emerging software-based cleantech firms taking advantage of this new wave of investment in energy optimization and cloud analytics, such as sub-metering companies and smart grid firms.

### Cost is still king

Ultimately though, lining up private-sector investors—often one of the stepping stones or roadblocks to reaching

*Article continues on page 18*

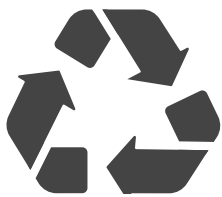


In a technology evolution there are a plethora of potential pivots... The young entrepreneur doesn't have the benefit of knowing which one is the right one."

— Russel Matichuk, Chairman, ACTia (Alberta Clean Technology Industry Alliance)

# What buyers want — Cleantech demand drivers

Of the 472 responses to Cleantech Canada’s national business survey, 289 identified as being a cleantech company (see page 8). The remaining respondents (181) represent businesses who are potentially using, buying or evaluating clean technologies. The findings below illuminate their perceptions and plans around investing in cleaner technologies, products and solutions.

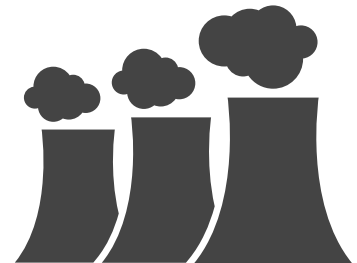


The top cited cleantech initiative companies have invested in over the past two years is “adopting or improving waste management and recycling systems” (50%).

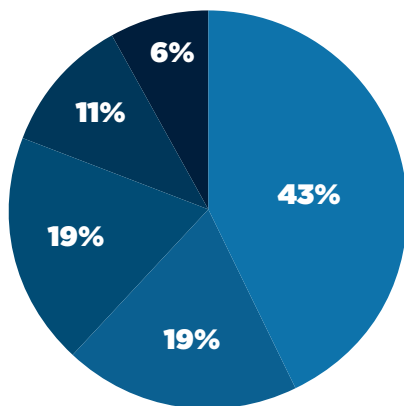


“Energy efficient technology” is the second most important area of investment (41%) followed by “water management/ conservation” (36%) and “building design” (31%). “Making changes to facility to address climate change impacts” was cited by 25% but by a significantly higher number in Alberta (38%).

**37%** expect their total expenditure on sustainability initiatives to increase over the next 12 months. 47% said it will stay the same. Only 2% said it will decrease.



Respondents were asked if they’re investing in clean technologies simply to comply with regulations or to tap into a potential new revenue source for their business. 30% said “a combination of both,” while 23% cited “compliance” as their main motivator. Only 8% cited “new revenue source” as the primary reason.



### Where buyers plan to find solutions

- 43%** = Combination of in-house and external sources
- 19%** = External small, mid-sized providers
- 19%** = Large established external providers
- 11%** = Produced or built in-house
- 6%** = Other

### Other areas of investment

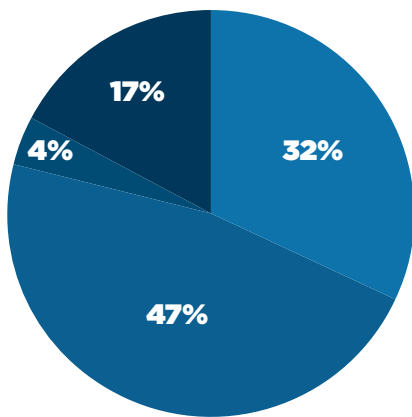
- Air emissions management **(24%)**
- Greener IT (eg. servers) **(19%)**
- Reducing fleet and transportation emissions **(17%)**
- Adopting clean or alternative energy **(17%)**
- Capturing and reusing waste heat for power **(13%)**
- Sustainable supply chains/transportation **(13%)**
- Use of biochemical alternatives/formulations **(9%)**
- Greener product design **(9%)**
- Use of biocomposites or other biomaterials **(6%)**

**38%** cited brand and reputation enhancement as a reason to invest, followed by corporate sustainability programs (32%).



“Cost savings or efficiencies” is by far the top reason businesses cited for investing in cleaner solutions (62%; and 66% in Alberta)

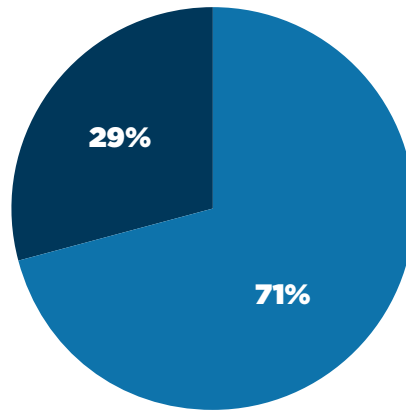
**70%** agree: “My company will only invest in innovative new technologies that match or exceed the performance of traditional solutions, if they’ve been proven or are well established.”



Do companies engage in any form of public reporting of corporate social responsibility, sustainability or clean technology investments and performance?

- 32%** = YES
- 47%** = No
- 4%** = No, but plan to start
- 17%** = Don't know/ not applicable

**62%** agree: “My organization will invest in cleaner or innovative new technologies, but only if they don't cost more than traditional products/ services.”

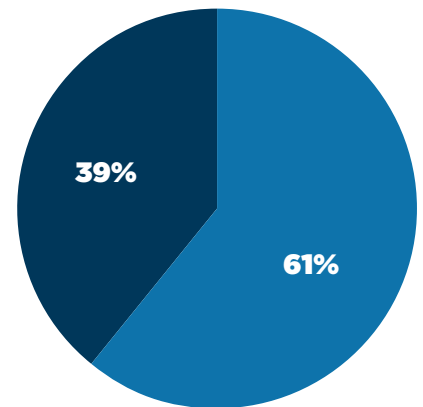


How important are clean or green certifications when sourcing technologies?  
**71%** = Important  
**29%** = Unimportant

**43%** agree: “The main reason my company is investing in innovative new clean technologies is because of government policy direction.”



Regulatory compliance is the second biggest driver (behind cost savings) for buying cleantech at 39%; 46% in Alberta.



How important is it for suppliers to demonstrate the amount of greenhouse gas reduction associated with products being evaluated?  
**61%** = Important  
**39%** = Unimportant

**What are the top barriers to investing in clean technology?**

- Low rate of return on investment **43%** (51% in Alberta)
- Lack of capital budget or financing **41%** (45% in Alberta)
- Unacceptable payback periods **29%** (41% in Alberta)
- Prefer to focus on operational savings **27%** (27% in Alberta)
- Technology too risky or unproven **26%** (37% in Alberta)
- Don't have a clean technology investment strategy **24%** (20% in Alberta)
- Not an executive priority **19%** (21% in Alberta)
- Uncertainty of product supply **14%** (8% in Alberta)
- Don't have green purchasing policies **13%** (8% in Alberta)





“As a result of the NRG COSIA Carbon XPRIZE, Alberta is going to be host to the Alberta Carbon Conversion Technology Centre, one of the few places on the planet where carbon conversion technologies can be tested.”

—Dan Wicklum, Chief Executive, Canada’s Oil Sands Innovation Alliance (COSIA)

the commercial market—is all about economics. Being good for the environment is one piece of the puzzle, but like traditional companies, cleantech firms need a winning value proposition to attract investors and sell their products.

Calgary start-up Carbon Upcycling Technologies Inc., doesn’t exactly fall into Johns’s Cleantech-2.0 category, but CEO and founder, Apoorv Sinha operates the start-up under a couple of key principles that are fundamental to success.

“Cleantech needs to be sustainable environmentally and successful economically,” he said.

The young entrepreneur repeated the mantra several times during the discussion. It may be a simple lesson, but hammering home the fact that cost is still king is an important one for any cleantech company.

Sinha went on to explain that Carbon Upcycling has found traction for its products not necessarily because it’s found a way to use waste CO<sub>2</sub>, but because of the effectiveness of its end products and its price point.

The company was originally founded in 2013 in response to ERA’s Grand Challenge—which aims to find a use

for carbon dioxide emissions—but has since moved past the competition into the commercial market. It has developed technology that takes gaseous carbon dioxide and converts it into a portfolio of carbon nanoparticles that can be used for a number of different applications.

Having struck a deal with a major U.S. precast concrete company, it’s already earning revenue within 2.5 years of starting operations while pursuing a number of other applications for its technology.

And Sinha’s not alone; Alberta cleantech is slowly coming of age.

According to a 2016 ACTia report, there are now at least 72 pure-play cleantech companies across the province, roughly half of which were formed in the past five years. The sector also directly employs no fewer than 1,200 people, and likely many more.

Contests like the Grand Challenge, it seems, have done their work.

“The benefits of these prize competitions are not usually to pick the silver bullet, to say ‘that’s going to save the world,’—it’s to create an ecosystem,” Dan Wicklum said.

“As a result of the NRG COSIA

Carbon XPRIZE, Alberta is going to be host to the Alberta Carbon Conversion Technology Centre, one of the few places on the planet where carbon conversion technologies can be tested.”

By offering clear incentives, they create a “critical mass of support and critical mass of focus” on important climate issues, he said.

With the Canadian and Alberta governments establishing the regulatory framework that will put Alberta on course to cut its GHG emissions and the province tweaking its cleantech investment ecosystem, the industry is only expected to grow in the coming years.

“A lot of people have been doing a lot of work without a compass for a number of years and now we’re starting to build that compass,” Chris Van Tighem, senior director of integrated science and research initiatives with Alberta Economic Development and Trade, said. “Maybe it’s backwards—maybe we should have built the compass first—but that’s the way some of these things happen.”

Starting from friendly territory in the oil and gas and agriculture industries and expanding out from there, Alberta cleantech is poised to boom. **CT**



“Cleantech needs to be sustainable environmentally and successful economically.”

—Apoorv Sinha, CEO, Founder of Carbon Upcycling Technologies, zEroCor Tubulars

## About Cleantech Directions

Now in its fourth year, *Cleantech Directions* is a culmination of a national survey of cleantech businesses and demand-side organizations, with highlights from a roundtable discussion of industry insiders. The survey was fielded in July and August 2017, and drew more than 470 responses.

The research delved into the experience of cleantech businesses in Alberta and the rest of Canada, as they strive to grow and commercialize. Insight was also collected from organizations potentially evaluating and buying clean technologies, to gauge their motivations, obstacles and planned areas of investment.

This year's report focuses in greater detail on cleantech growth opportunities in Alberta. Forty-four per cent the respondents (206) represented Alberta-based companies and organizations. The online survey was conducted by RK Insights, a third-party professional research firm in Toronto.

The roundtable discussion was hosted in Edmonton in June 2017 by *Cleantech Directions*.

### This report was made possible by:



ERA works with government, industry and innovators to accelerate development of innovative technologies that reduce GHG emissions. We are helping Alberta transition to a lower carbon future with a stronger, more diversified economy. [www.eralberta.ca](http://www.eralberta.ca)

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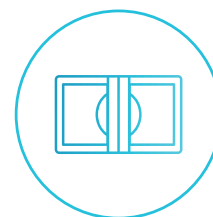


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Emissions Reduction Alberta works with innovators, industry and government to accelerate development of new technologies that reduce GHG emissions, generate jobs and build a diversified, lower carbon economy for Alberta.

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BY 2030:  
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CO<sub>2</sub>e**



JOB CREATION IN  
ALBERTA BY 2021:  
**15,000+  
PERSON-YEARS<sup>1</sup>**

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