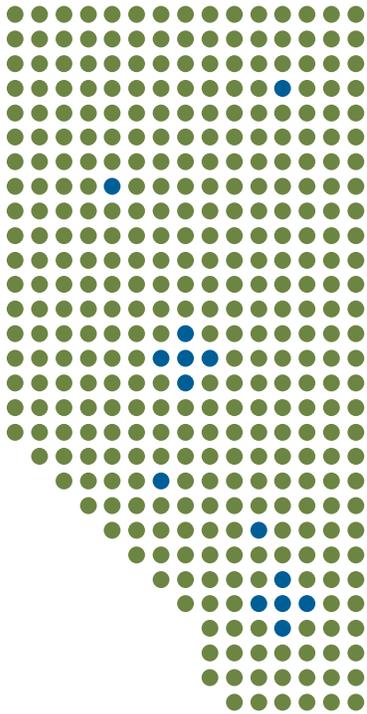# Alberta Clean Technology Sector 2016

Ready for Liftoff

A baseline study of Alberta's entrepreneurs active in novel technology-driven business opportunities that can improve environmental and economic outcomes.

ACTIA
ALBERTA CLEAN TECHNOLOGY
Industry Alliance

Deloitte.

MaRS

Alberta Clean Technology Sector 2016

Supported by:

With kind contributions from:

Alberta Clean Technology Industry Alliance

Founded in 2011, ACTia is the only multi-stakeholder, province-wide and industry-focused group working to support Albertans developing clean technology ("cleantech") — products and services that improve economic performance and reduce environmental footprint. ACTia advances Alberta cleantech by being the sector's leading voice; by fostering local and global connection between technology developers, entrepreneurs, investors and customers; and by accelerating industry development.

Deloitte LLP

Deloitte LLP, one of Canada's leading professional services firms, provides audit, tax, consulting and financial advisory services to a wide range of Canadian and international clients. Deloitte LLP is the Canadian member firm of Deloitte Touche Tohmatsu Limited, which is a network of member firms, each of which is a legally separate and independent entity.

MaRS Data Catalyst

MaRS Data Catalyst is the big-data and business transformation practice at MaRS Discovery District, North America's largest urban innovation hub. We work with major government and enterprise data holders to share data with the innovators who can best use it to turn smart ideas into reality. We also explore how the innovation economy works and how we can make it better. By tracking Ontario companies, investors, talent and markets over time, sector and location, we identify ways to strengthen the ecosystem and enable companies to scale.

Alberta Clean Technology Sector 2016

Ready for Liftoff

Contents

ACTIA

Minister Deron Bilous, Alberta Economic Development and Trade

Alberta is the energy and environmental leader the world needs for the 21st century. Working together with our industry leaders we are building a diversified economy for the future, which will create good jobs and a healthier environment.

The economy of the next 30 years will be very different than the last 30 years. Our province has incredible potential to seize new opportunities for new technology, products and services that markets all over the world are competing for.

We want to continue working to accelerate the commercialization of clean technologies, to build on our technical expertise, and attract significant financial resources dedicated to clean technology development – locally, nationally and internationally.

For example, as we move toward our target of generating 30% of Alberta's electricity from renewable sources like wind and solar — our Renewable Electricity Program is expected to attract at least $10.5 billion of investment into the Alberta economy by 2030, creating more than 7,200 jobs for Albertans.

Together we will create a more stable, diversified economy that supports good jobs in the renewable energy sector and emissions monitoring and mitigation. By building on our expertise, we can develop cleantech solutions that be can be manufactured and deployed in Alberta – and sold to the world.

The potential for business growth in cleantech is unprecedented. ACTia's initial baseline study of Alberta's entrepreneurs in novel technology-driven cleantech companies is the first step to filling a large data gap in cleantech that exists across Canada. This study shows that Alberta's cleantech sector provides good paying jobs, is an innovation engine, and offers entrepreneurial growth. In comparison with other technology-based sectors, cleantech has a higher female founder rate, a positive indicator of the increasing role that women are playing in the technology and innovation sectors.

As this report shows, Alberta is much more than a resource economy – Alberta is a place where we turn challenges into opportunities. Cleantech shows enormous potential for growing our economy. With your support and leadership we will continue to be a world leader in the industry. And as we show leadership around the world, we will also build a more prosperous, stable and diversified economy, and that makes life better for all Albertans.

Minister Deron Bilous, Alberta Economic Development and Trade

MaRS Data Catalyst

Canada has its hands on a golden opportunity. Across the map, countries are making environmental commitments that will drive demand for cleaner, more efficient technology.

If Canadian companies are to win their fair share of this highly competitive and growing market, we need to address our weaknesses through financing, export assistance, networking and mentorship, talent attraction, and proactive intellectual property protection.

To do so effectively, Canada needs consistent and comparable information to make evidence-backed investment decisions. Internationally, Data Catalyst is a founding member of the Global Entrepreneurship Research Network with leading innovation sector researchers including Nesta in the UK, the Kauffman Foundation in the U.S., and the World Bank. But we also need to work together across provincial lines.

MaRS Data Catalyst is pleased to leverage our unique data holdings on the cleantech sector and to help Alberta establish a globally credible basis for collecting rigorous and consistent cleantech sector data.

We hope that our contributions to this report can better inform ongoing conversations about how to advance the Canadian clean technology agenda.

Joe Greenwood, Executive Lead, Data, MaRS Discovery District & Program Director, MaRS Data Catalyst

Farooq Qaiser, Data Analyst, MaRS Data Catalyst

Executive Summary

Cleantech is at a tipping point. On the supply side, the combination of planet and profit motivation with new advances in materials science, machine learning, and internet of things is upending markets around the world. On the demand side, public pressure and policies are making environmental performance a rapid growth industry. The Paris Climate Accord adopted by over 190 countries sets a global ambition to reach carbon neutrality by 2100. Canada itself plans to reduce its greenhouse gas emissions by 30% by 2030. With the world set to invest around US$4-6 trillion per year between now and 2030 on infrastructure of various kinds, nearly every investment must be a low-carbon investment, or those carbon reduction commitments will not be achieved.

ACTia's vision is to make Alberta one of the world's leading destinations for cleantech venture development and investment. But success must be underpinned by good data, which is necessary to:

- establish a sector baseline and allow benchmarking with other regions,

- create the factual base needed to attract new ventures and investors, and

- provide diagnostic insight into the pressure points that – if properly addressed – will break the logjam that holds this sector back.

ACTia defines cleantech as novel services, processes, products and activities that improve economic performance and reduce environmental footprint relative to the baseline.

This study focused on Alberta's pureplay cleantech companies, which we define as companies that are based in Alberta, show technology or business model innovation, and indicate an environmental benefit as a core part of their value proposition. The study reports on the factors that the entrepreneurs behind these companies describe as affecting their growth. It does not encapsulate the entire cleantech sector in Alberta, which is considerably larger.

In spite of the tight screen we applied, we found grounds for significant optimism. Indeed, the countdown to liftoff for Alberta's cleantech sector has already begun. With at least 72 companies that meet our criteria for pure play reporting out of some 230 we initially identified, we know that this province is approaching critical mass.

Our survey shows that the sector employs more than 1,200 Albertans, possibly two or even three times that number. And we know that it could be far greater still if we included cleantech-focused research and development efforts based here in the province from companies that did not meet our criteria.

It is a young sector: roughly half of the companies surveyed were formed in the last five years. Those that have reached meaningful scale offer high-wage jobs for highly skilled individuals, paying on average just under $100,000 per year. Three of every four companies hold patents or other forms of protection for their intellectual property. Collectively, they report attracting over half a billion dollars in funding to the province. One in ten have generated over $5 million in funding. Together, they brought $307 million in revenues into Alberta in 2015, with over 65% coming from exports to the U.S.

These entrepreneurs see public mechanisms including Alberta Innovates voucher programs, Scientific Research and Experimental Development Program investment tax credits (SR&ED), Industrial Research Assistance Program financial assistance (IRAP), Emissions Reduction Alberta (ERA) and Sustainable Development Technology Canada (SDTC) funding as critical capital sources. They flag the ongoing challenge of accessing capital to grow and to prove out their technology at a commercial scale, and call for greater access to peers and mentors.

Looking forward, Alberta's clean tech leaders are optimistic: over 90% plan to grow their staff this year, and more than four in five plan to seek additional funding. The reasons for their optimism are clear. Policy is creating strong signals for environmental performance innovation, and governments at all levels are looking for ways to nurture Alberta entrepreneurs to meet that demand.

We are convinced that the cleantech industry can and will make a powerful contribution to Alberta's future, both by enhancing the competitiveness of our existing industries, and by creating the industries of tomorrow.

This province has what it takes to be a global launch pad for cleantech:

- Mega-scale inflows of capital in the natural resource sector
- Recognized brand as an international energy hub
- Skilled and trained people from around the world, and
- An innovation sector focused on tackling carbon emissions, water efficiency and bio-sector productivity

Cleantech is a play with extraordinary upside for all Albertans.
It is poised for takeoff.

Rus Matichuk, President & Jason Switzer, Executive Director – ACTia

Introduction: What is Clean Technology?

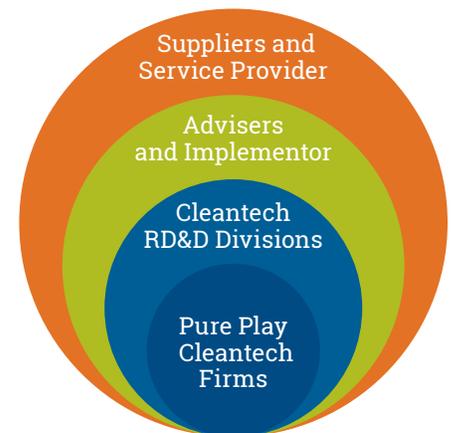## Alberta has incredible potential as a proving ground for clean technology.

With its oil sands industry having established a unique collaborative mechanism for accelerating environmental innovation, and its commitment to phase out coal-fired power matched by world-class wind, hydro and geothermal resources, this province is likely to see globally significant investment in green infrastructure.

Can we use this opportunity to transform our economy from one of technology customer to technology creator? What are our current strengths in cleantech, and where can we improve?

To better understand the current state of the province's cleantech sector, ACTia partnered with Deloitte LLP and MaRS Data Catalyst. The objectives of our collaboration are to establish a sector performance baseline for the province that will enable benchmarking with other regions, establish the factual underpinning needed to attract new ventures and investors, and provide data-driven insights into the support necessary to accelerate its growth. Our vision is to make Alberta one of the world's leading destinations for cleantech venture development and investment.

To establish a baseline and enable comparability across provinces, we present here the results for Alberta's "pure play" cleantech sector only. To be included in the results, companies had to be based in Alberta in 2015, and to indicate that they derived a majority of their revenue from a cleantech product or service. To the extent possible, value-added resellers, integrators, distributors or resellers of products manufactured by others were excluded. Firms that manufacture, service, implement, integrate, or consult solely in respect of technologies or systems developed by other firms were excluded from the results as well. This also meant that the research arms of major Alberta-based energy companies such as Suncor or Cenovus were not included. Nor did we include the Alberta-based research and development operations of national or internationally headquartered companies, such as GE or Siemens. These screens mean that this study significantly under-reports the total scale of the cleantech sector in Alberta.

This report focuses on pure play cleantech companies, and excludes the wider cleantech ecosystem in Alberta.[2]

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1. Alberta Enterprise, Alberta Technology Deal Flow Study (2016). http://www.alberta-enterprise.ca/?page_id=1150

2. Graphic and definition adapted from KPMG, Cleantech Report Card for British Columbia (2011), report with the BC Cleantech CEO Alliance. Available at http://www.ballard.com/files/PDF/Media/Cleantech_Report_Card_for_BC.pdf

Where possible, we have sought to provide relevant benchmarks in our presentation of the data. In this, we rely substantially on the Alberta Enterprise Deal Flow Study, published in late 2016 (ADFS)[1] as well as on the careful work of MaRS Data Catalyst in the Ontario technology sector.

The cleantech firms were identified through a collaborative process of reviewing and integrating several sectoral lists of firms, industry association rosters, investor lists, ACTia's email list, conference attendee lists and other inputs, with help from the partners and contributors identified in the Acknowledgements, above. We also allowed companies to self-identify, but reserved the right to exclude their response if they did not meet our definition.
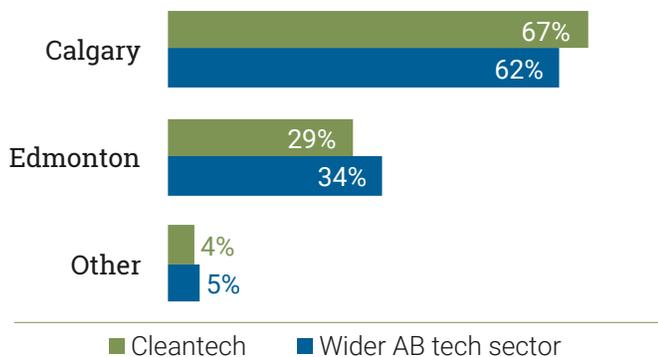
A questionnaire was developed leveraging the prior efforts of the BC Cleantech CEO Alliance and MaRS Data Catalyst for their respective provinces. A customized electronic survey was sent to all cleantech firms in our database and to a wider set of contacts across the province during the fall of 2016, with the final results compiled in late November. A workshop was hosted by Deloitte in Calgary in December 2016 to review the results with a set of key stakeholders and advisers.

In all, MaRS received 137 responses, which were validated both for content and against the criteria above by reviewing company websites and placing telephone calls. This yielded 72 responses that met our test. Assuming somewhere between 100-200 pure play clean technology companies in Alberta, we estimate a survey response rate of at least 30%, making these results a solid baseline for future use.
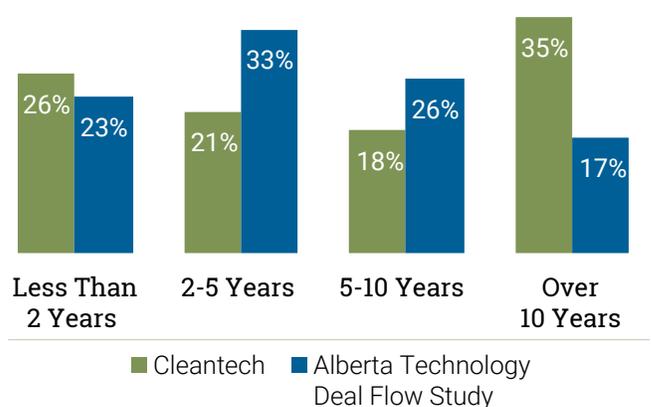
Scale, Economic Contribution, Location and Demographics

- The sector is nearing critical mass. At least 72 pure play cleantech companies were active in Alberta in 2015, compared with 775 reported across Canada in 2016.[3]

- Work local, think global. These companies report employing 1,830 people globally, and at least 1,198 in Alberta.

- CEOs are optimistic about the future: 92% plan to grow their staff, and 84% plan to seek additional funding in 2017.

- Cleantech pays well. The 71 cleantech ventures who report paying wages pay an average salary of over $99,000 per year, well above Alberta's median wage of $59,000[4] and close to the average in oil and gas of $105,000.[5]

- The sector is an engine for innovation. 70 survey respondents reported collectively over 614 patents or other form of intellectual property. 74% of Alberta's cleantech companies hold some form of IP.

- Cleantech makes a meaningful contribution to the economy. 65 survey respondents reported collectively over $307 million in annual revenues in 2015.

- Alberta's cleantech sector is dynamic. Roughly half of firms were formed in the last five years.

Location (N=70)

	Cleantech	Wider AB tech sector
Calgary	67%	62%
Edmonton	29%	34%
Other	4%	5%

■ Cleantech ■ Wider AB tech sector

Age (N=72)

	Cleantech	Alberta Technology Deal Flow Study
Less Than 2 Years	26%	23%
2-5 Years	21%	33%
5-10 Years	18%	26%
Over 10 Years	35%	17%

■ Cleantech ■ Alberta Technology Deal Flow Study

3. Analytica Advisors, 2016 Canadian Clean Technology Industry Report: Synopsis. http://analytica-advisors.com/sites/default/files/AA-2016 Synopsis english-Final.docx
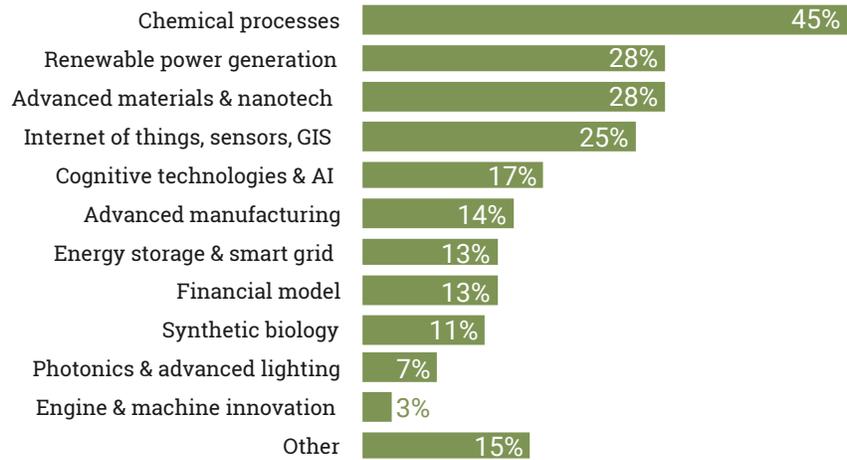
4. Assuming 52 weeks per year. Statistics Canada, "Average weekly earnings (including overtime) for all employees," Alberta. http://www.statcan.gc.ca/daily-quotidien/160225/t001b-eng.htm

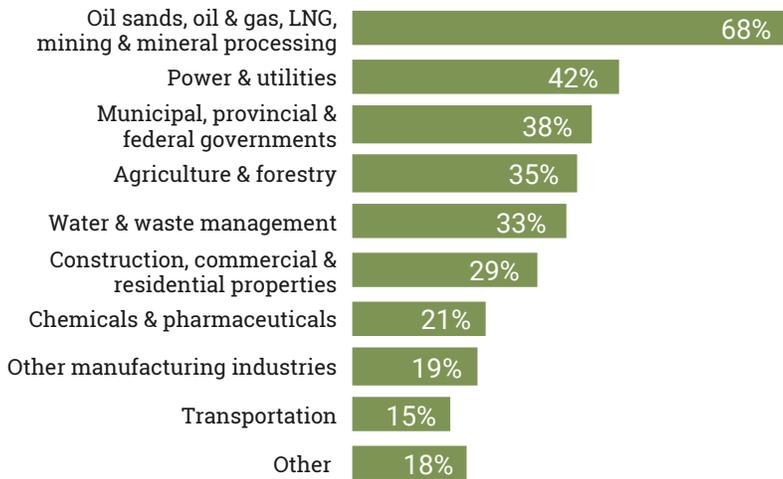5. Ibid, Mining, quarrying, and oil and gas extraction.

Source of Innovation and Target Markets

- Alberta's cleantech sector is fueled by innovations in chemical processes, followed by clean power generation, materials & nanotech, and internet of things.

- Roughly three-quarters of Alberta's ventures sell their products and services to oil, gas and mining sectors.

Breakdown of Alberta's Cleantech Businesses by source of innovation (N=71)
Respondents could indicate multiple sources.

Category	Percentage
Chemical processes	45%
Renewable power generation	28%
Advanced materials & nanotech	28%
Internet of things, sensors, GIS	25%
Cognitive technologies & AI	17%
Advanced manufacturing	14%
Energy storage & smart grid	13%
Financial model	13%
Synthetic biology	11%
Photonics & advanced lighting	7%
Engine & machine innovation	3%
Other	15%

Breakdown of Alberta's Cleantech Businesses by target market (N=72)
Respondents could indicate multiple sources.

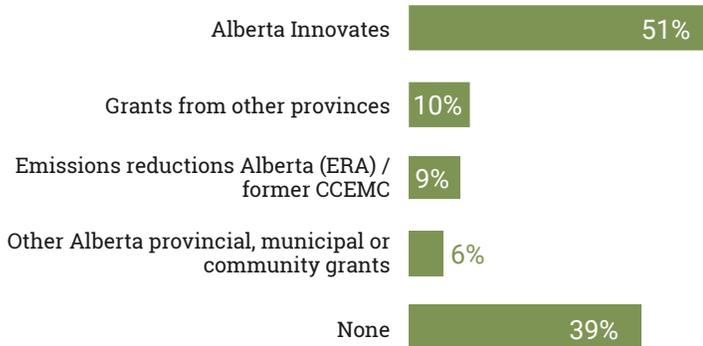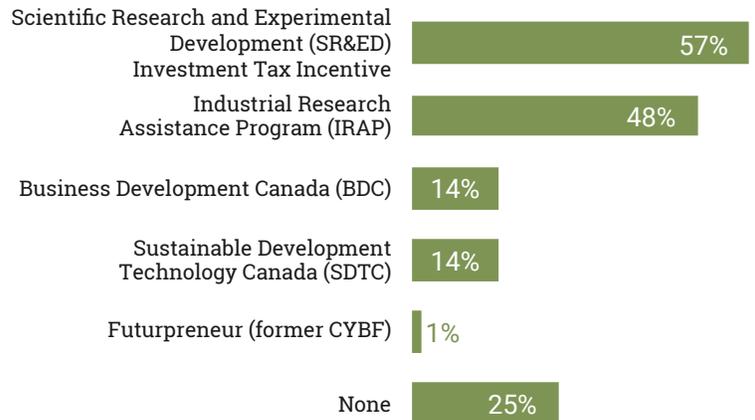| Category	Percentage
Oil sands, oil & gas, LNG, mining & mineral processing	68%
Power & utilities	42%
Municipal, provincial & federal governments	38%
Agriculture & forestry	35%
Water & waste management	33%
Construction, commercial & residential properties	29%
Chemicals & pharmaceuticals	21%
Other manufacturing industries	19%
Transportation	15%
Other	18%

Funding

Over one in 10 firms have raised over $5M, comparable to the proportion in the province's wider tech sector. Public funding comes primarily from Alberta Innovates, SR & ED Tax Incentives, and IRAP.

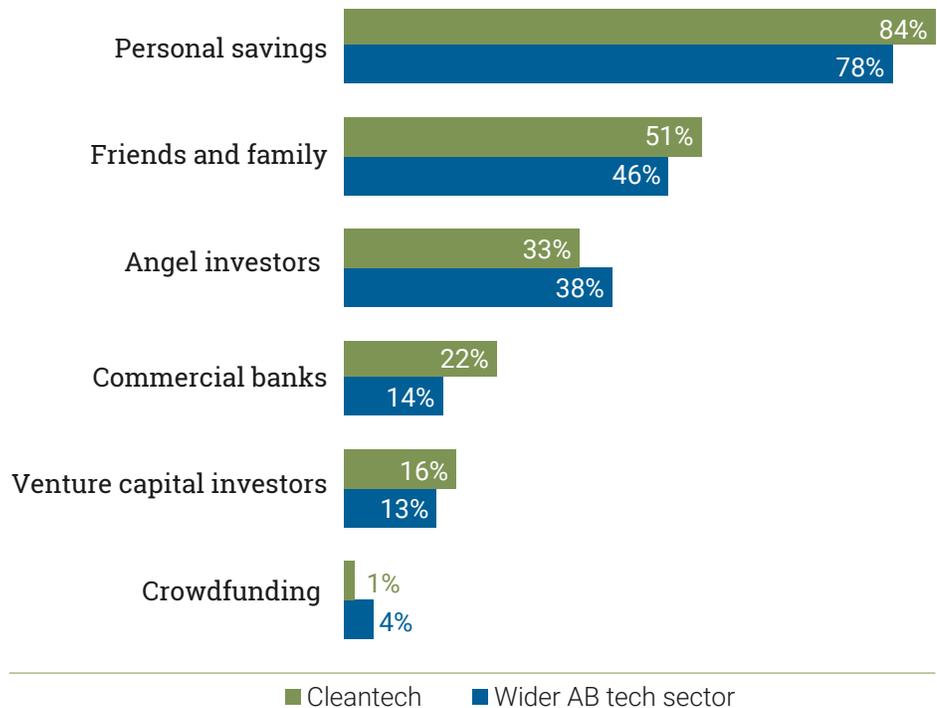Breakdown of Alberta's Cleantech Businesses by source of funding. Respondents selected all that apply.

Provincial Sources of Funding (N=69)

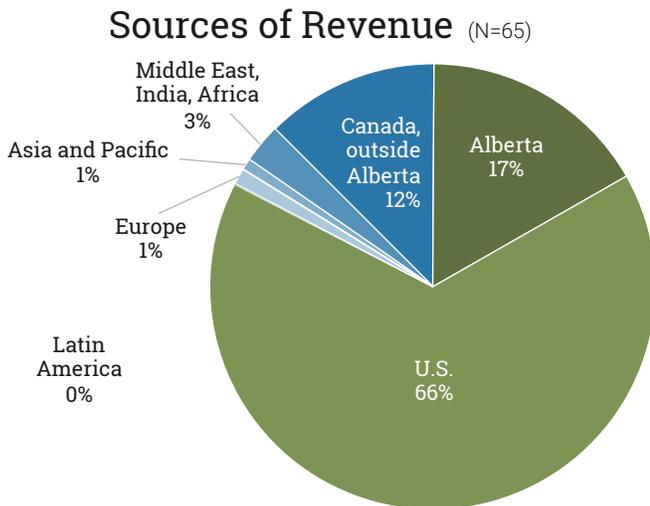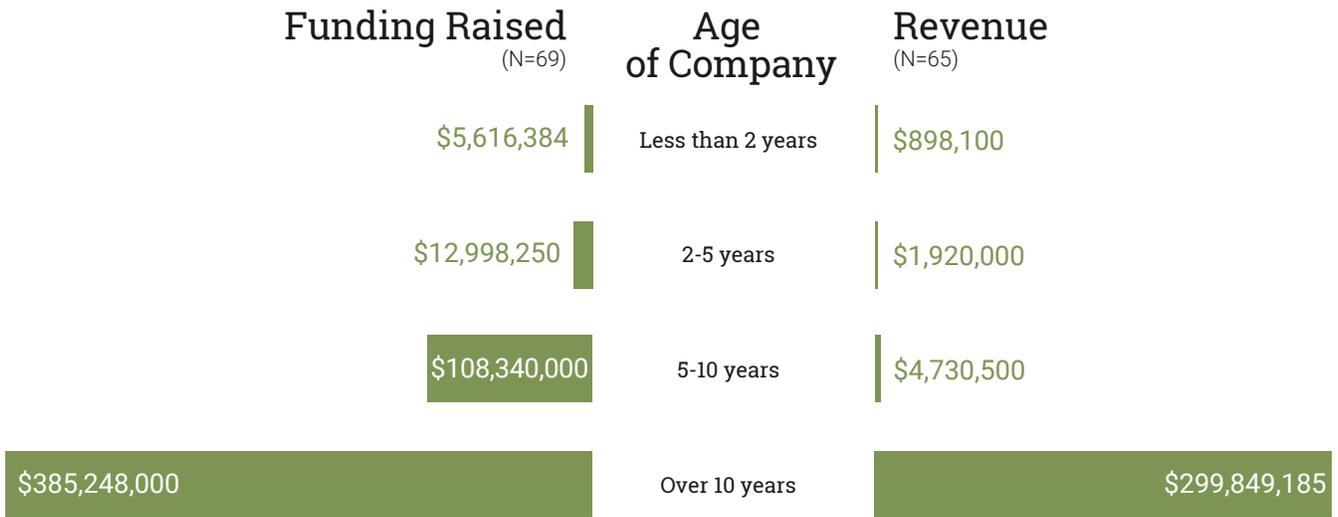| Source	%
Alberta Innovates	51%
Grants from other provinces	10%
Emissions reductions Alberta (ERA) / former CCEMC	9%
Other Alberta provincial, municipal or community grants	6%
None	39%

Federal Sources of Funding (N=69)

Source	%
Scientific Research and Experimental Development (SR&ED) Investment Tax Incentive	57%
Industrial Research Assistance Program (IRAP)	48%
Business Development Canada (BDC)	14%
Sustainable Development Technology Canada (SDTC)	14%
Futurpreneur (former CYBF)	1%
None	25%

Private Sources of Funding (N=69)

Source	Cleantech	Wider AB tech sector
Personal savings	84%	78%
Friends and family	51%	46%
Angel investors	33%	38%
Commercial banks	22%	14%
Venture capital investors	16%	13%
Crowdfunding	1%	4%

■ Cleantech ■ Wider AB tech sector

Revenue

- As a whole, the cleantech sector reports generating over **$307 million in revenues** in 2015
- Roughly **1 in 4 generate over $1 million** in annual revenue per year, vs 1 in 5 in the wider technology sector (ADFS)
- **Two-thirds** of reported revenues in cleantech come from **exports to the U.S. market**.

Funding Raised (N=69)	Age of Company	Revenue (N=65)
$5,616,384	Less than 2 years	$898,100
$12,998,250	2-5 years	$1,920,000
$108,340,000	5-10 years	$4,730,500
$385,248,000	Over 10 years	$299,849,185

Sources of Revenue (N=65)

- Middle East, India, Africa 3%
- Asia and Pacific 1%
- Europe 1%
- Latin America 0%
- Canada, outside Alberta 12%
- Alberta 17%
- U.S. 66%

Founder Stats

More than **1 in 4** cleantech companies have at least one **female founder**, compared to one in five in the wider tech sector. (N=66)[6]

9 in 10 have at least one **technical founder** (N=70)

8 in 10 have previous **startup experience** (N=66)

Two-thirds studied in an **Alberta university** (N=63)

Roughly **1 in 5 companies have U.S.-born founders** (N=58)

More than **1 in 3 have founders born outside of Canada or the U.S.** (N=61)

One in 5 have a **millennial co-founder**, compared to one in four in the wider tech sector (N=61)

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6. Alberta Enterprise, 2016 Deal Flow Study Report.
   Available at www.alberta-enterprise.ca/wp-content/uploads/2016/09/2016-Deal-Flow-Study-Report.pdf

Benchmarking Alberta and Ontario

This section compares the cleantech sectors in Alberta and Ontario.[7] Alberta's cleantech sector is broadly comparable to that of Ontario, with Alberta's weighted slightly more towards older, revenue-positive ventures, and with Ontario's ventures receiving a larger amount of capital.

Comparison of provincial cleantech sectors by number of firms and total funding (using MaRS CT sector definition)
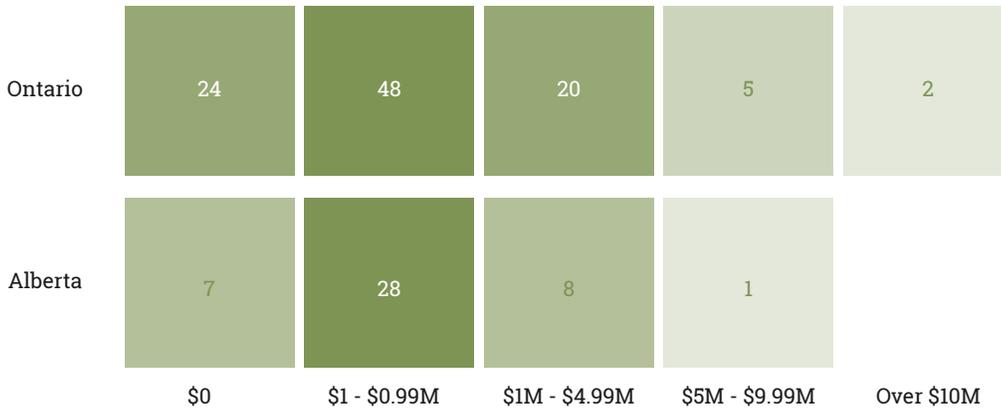
Companies $ Funding

44	Alberta	$24M
99	Ontario	$145M

In terms of funding secured, there is little difference. In 2015, the median Alberta venture raised $225,000 while the median Ontario venture raised $200,000.[8]

In Ontario, some of the sector leaders attracted significantly more funding than their counterparts in Alberta. Seven companies in Ontario were able to raise upwards of $5 million during 2015, compared to one company reaching this level of funding from Alberta.

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7.   To ensure a fair, apples-to-apples comparison, MaRS removed from the Alberta dataset those companies that had raised funds from the public capital markets, or that stated their primary customer market was forestry or mining. This left 44 companies of the 72 that responded to the Alberta survey.
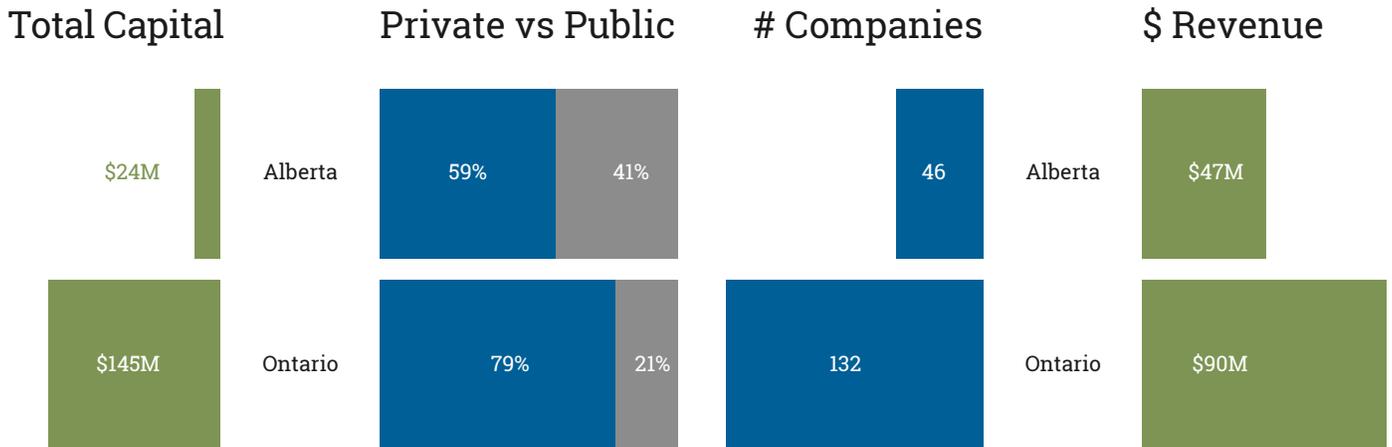
8.   The median was used (instead of the mean) because of its resilience to outliers at the top and bottom of the dataset that are typically present in innovative sectors like cleantech: one firm with a significant capital raise would transform the average.

Comparison of provincial cleantech sectors by level of funding received

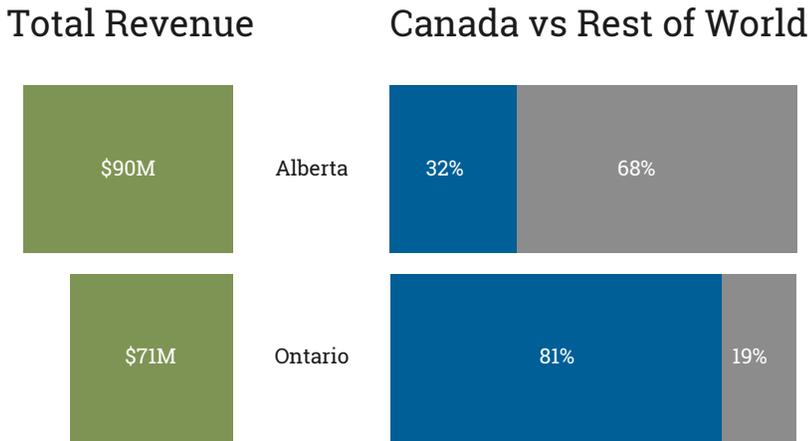|	$0	$1 - $0.99M	$1M - $4.99M	$5M - $9.99M	Over $10M
Ontario	24	48	20	5	2
Alberta	7	28	8	1	

Total funding of Alberta ventures during 2015 was less than one-sixth of the total received by Ontario firms. Forty percent of the Alberta funding came from federal and provincial sources. Private capital accounted for a larger share of the total received by Ontario-based companies.

Comparison of provincial cleantech sectors by level of public and private funding, and by total revenue.

Total Capital		Private vs Public			# Companies		$ Revenue	
$24M	Alberta	59%	41%		46	Alberta	$47M	
$145M	Ontario	79%	21%		132	Ontario	$90M	

The median Alberta cleantech venture generated appreciably more revenue than the median Ontario cleantech venture, possibly because the relatively older Alberta companies have had a longer period to develop a viable product and customer pool.

Figure 5 Comparison of provincial cleantech sectors by total revenue and geographic revenue source

Total Revenue   Canada vs Rest of World

Total Revenue		Canada vs Rest of World	
$90M	Alberta	32%	68%
$71M	Ontario	81%	19%

In the subset of Alberta companies reviewed, the majority of cleantech revenues came from sales within Canada. This stands in stark contrast to Ontario. There is likely room for Alberta's cleantech companies to better capitalize on foreign market opportunities.

Barriers and Enablers

This survey asked firms to identify the most material barriers to their success, and the organizations and programs most helpful for their growth. Respondents highlighted lack of access to capital, lack of opportunities to prove their technologies at commercial scale, and lack of regulatory drivers for novel technology adoption. They underscored the importance of public funding mechanisms including SR&ED, IRAP, Alberta Innovates, SDTC and ERA to their success.

We see signs of optimism that each of the barriers they identified is being actively addressed:

- The Alberta government has launched a pilot investor tax credit offering a 30% refund to investors who provide capital to Alberta small businesses doing research, development or commercialization of new technology. It has also established a pilot capital investment tax credit of 10% to firms to invest in machinery, equipment and buildings.

- The 2017 launch of the Alberta Carbon Conversion Technology Centre and in 2018 of COSIA's proposed Water Technology Development Centre offer examples of critically important test facilities that can reduce technology risk and amplify the growth of the sector in the province.

- Regulatory drivers are being implemented at the provincial level through Alberta's Climate Leadership Plan, and at the national level through the federal government's commitment to a carbon price and to Mission Innovation. Provincial and federal budgets announced in Spring 2017 contain specific provisions relevant to the growth of the cleantech sector.

Respondents shared their concern that cleantech in Alberta has been both enabled and challenged by the oil and gas sector. In spite of an entrepreneurial spirit, and a world-class concentration of highly qualified professionals and head offices, future commodity booms are seen as a barrier to attracting and retaining the best people. Respondents also highlighted gaps in the system: in spite of many support programs, the system is challenging to navigate; there are holes in support; and success stories are not well-known. Support is skewed to early stage ventures and to reducing technology risk. Insufficient effort is put into marketing and business model maturation. In particular, respondents pointed to the value of mentors, advisers and peer entrepreneurs in helping them succeed.

More effort is needed to accelerate the direct engagement between established industries and innovation providers. Collaborative mechanisms like the Canadian Oil Sands Industry Alliance (COSIA) and the Alberta Small Business Innovation and Research Initiative (ASBIRI) offer promising examples of how to build a bridge between entrepreneurs and customers around the latter's defined needs, and to accelerate adoption on the customer side.
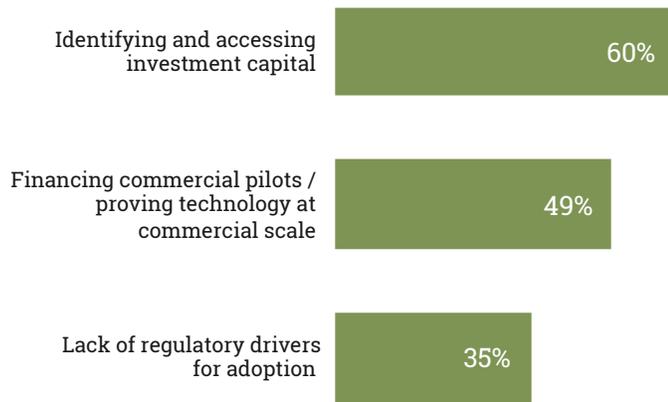
Respondents suggested that a culture shift is coming as millennials bring their expectation of digitization and their more holistic view of people, planet and profit into the workforce and leadership ranks.
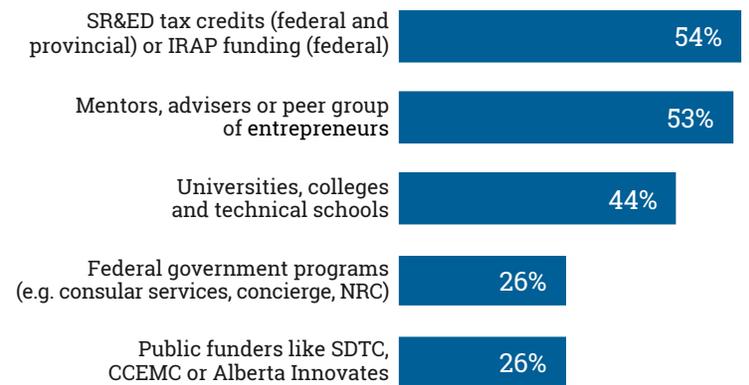
Overall, optimism is high:

- **93%** of respondents plan to grow their staff in 2017 (n=71)
- **84%** will seek additional funding in 2017 (n=69)

As a consequence, Alberta's cleantech sector is poised for takeoff – with an exciting future ahead.

3 most significant barriers to growth. Respondents selected all that apply. (N=68)

Barrier	Percentage
Identifying and accessing investment capital	60%
Financing commercial pilots / proving technology at commercial scale	49%
Lack of regulatory drivers for adoption	35%

3 most helpful organizations, programs and people to firm growth. Respondents selected all that apply. (N=68)

Organization/Program	Percentage
SR&ED tax credits (federal and provincial) or IRAP funding (federal)	54%
Mentors, advisers or peer group of entrepreneurs	53%
Universities, colleges and technical schools	44%
Federal government programs (e.g. consular services, concierge, NRC)	26%
Public funders like SDTC, CCEMC or Alberta Innovates	26%

Acknowledgements

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