Alberta Clean Technology Sector 2019

The definitive survey of Alberta's entrepreneurs active in novel technology-driven businesses that improve economic and environmental outcomes.

ACTIA
ALBERTA CLEAN TECHNOLOGY
Industry Alliance

Alberta Clean Technology Sector 2019

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Foreword

ARC Energy Research Institute

Like any commercial concern, oil and gas isn't immune to disruption. To be competitive going forward, Alberta's oil and gas producers will need to continuously strive to lower costs, improve productivity and be leaders in environmentally responsible development. Innovation will be essential to future success.

What is now called Clean Tech, Clean Technology or Cleantech, has been around for over 20 years. Clean Tech is knowledge-based products or services that improve operational performance, productivity or efficiency, that reduce costs, as well as inputs like water or energy, and that minimize waste or pollution. In the mid-to-late 1990s there was a lot of momentum in this space, focused on wind and solar, fuel cells, flywheels, super capacitors, and other hardware-based technologies in the energy sector.

> Alberta may be at the forefront of applying the next wave of Clean Technology innovations to oil and gas

In addition to private money, President Obama committed over US $90 Billion to green innovation and renewable energy project development as part of the $1 Trillion emergency financial stimulus during the global financial crisis[1]. That money drove down the cost of renewables, batteries and other technologies such that many of them are now cost competitive with incumbent sources of power generation, such as combined cycle natural gas.

Unfortunately, that first wave of investment petered out because it did not achieve cost-competitiveness in time to reward investors. Research by MIT shows that venture capital funds lost a lot of money in the Clean Tech space between 2006 and 2011[2]. Firms spent over $25 billion funding clean energy technology, and generally lost over half their money, with some losing much more.

Collectively, these prior investments helped fund the learning curve such that the economics of these technologies are now compelling. Bloomberg reports that over US $300 Billion was invested in the renewable energy and Clean Technology in 2018, for the fifth year in a row[3]. Trend-setting investor Warren Buffett has made some big investments, including in Chinese electric car maker BYD and in renewable energy, including with Alberta wind power investment in 2019[4]. Clean Tech is going mainstream.

In 2018 and 2019, **Alberta's FluxOCR**, **Interface Fluidics**, **Terrapin Geothermics** and **SeeO2** become four of only 20 ventures globally inducted into the Norway-based Techstars Energy accelerator run in partnership with Equinor, with Interface securing $6M in Series A investment by Equinor afterwards[v].

Impressive as the quantum of Clean Tech investment capital sounds, it is less than half the total invested in global oil and gas supply over the same period. The world is diversifying into renewables at an impressive pace; but the data is also still clear on the competitive resilience of fossil fuels. Roughly 80 percent of our energy is still from fossil fuels[6]. The market share of oil and gas on an energy equivalent basis has remained unchanged at 60% for decades[7]. The question is not how much oil the world is going to consume or produce. The real question is who is going to supply that oil and gas in an increasingly-responsible lower-carbon manner. An even better question is, "Who do we want as responsible suppliers of oil and gas in future?"

Alberta may be at the forefront of applying the next wave of Clean Technology innovations to oil and gas, as this report starts to document. We are home to a new crop of businesses that are emerging that are working to clean up the fossil fuel and natural resources business. Our multinational oil companies and independents are starting to spend more and more on being part of the climate change solution by reducing the carbon intensity of their upstream product or by adding value to those products in novel ways. In the last few months, we are starting to see those early success stories of adoption that are necessary for more-widespread use. This area is set for real growth. The Bloomberg study quantifying the capital invested in Clean Tech neglects most of the investment by the petroleum sector in this kind of innovation, to its detriment.

Entrepreneurs are going to see a growing tide of money come into this space

Either directly through cleaning up emissions or indirectly through more efficient processes, industrial automation and data science, new technology companies are emerging that reduce methane emissions, energy use or waste, or that increase efficiency in the natural resources sectors. These entrepreneurs are going to see a growing tide of money starting to come into this space not only here in Canada but also from the United States and other countries, making the oil and gas industry far more efficient going forward. As the ideological blinkers fall away about how to bend the curve on global emissions, Alberta could become one of their first ports of call.

By the 2020s, a lower-carbon hydrocarbon product is where the competitive game is going to be played. Companies that don't get on the better product at lower cost bandwagon are going to be the ones that can't keep up. The free market is starting to respond to this. It is responding to the public narratives and it is responding to the technology.

This makes it a very exciting time to be in Alberta's Clean Tech sector.

– Jackie Forrest and Peter Tertzakian

In 2017, Edmonton's **SBI Bioenergy**, a leader in drop-in biofuels, secures an exclusive development agreement with Royal Dutch Shell, the world's largest distributor of biofuels[viii];

Foreword

MaRS Data Catalyst

As part of a three-year initiative, Data Catalyst is on the forefront of understanding pure play clean technology companies. The project we have developed has the goal of evolving a consistent set of insights coast-to-coast throughout Canada. Our team is embedded in MaRS Discovery District, the largest innovation hub in Canada at over 1.5 million square feet, as well as being a business incubator that works with hundreds of clean technology ventures a year. As such, we are well-positioned to gain deep insights into this growing sector.

The first phase of our data collection project included developing a metrics framework and common set of definitions. During that first year we worked with a select group of regions, including Alberta, Ontario, and the Atlantic provinces. For the second and third phases, in 2019 onward, we have extended our relationships with other regional groups to fill in the gaps and enable our data collection efforts to be truly comprehensive.

There is inadequate data on Canada's clean technology capacity and potential

We developed this project in tandem with the Government of Canada's commitment to invest in clean growth as part of the transition toward a low-carbon economy. We are one of the key players who work with Statistics Canada in order to track the progress and growth of clean technologies through the establishment of a baseline national dataset that is current, relevant and accessible.

We intend to meet the challenge described in the Pan-Canadian Framework on Clean Growth and Climate Change which states that 'there is inadequate data on Canada's clean technology capacity and potential'. This data gap hinders strategic decision-making, limiting the public sector's ability to provide impactful policies and programs. We are complimentary to the Clean Technology Data Strategy that was proposed by Canada's First Ministers to integrate data from multiple sources and drive a better understanding of clean technology.

I would like to personally extend my thanks to the team at ACTia, The Delphi Group, GLOBE Series, Natural Resources Canada, Statistics Canada and our other regional and federal partners in making this project a continued success. If you want to participate and learn more, please reach out to the MaRS Data Catalyst team, as we would love to hear from you.

– Joseph Lalonde, Senior Data Manager, MaRS Data Catalyst

In 2019 Albertan agtech ventures **Livestock Water Recycling** and **First Pass Technologies** are two of the 8 finalists selected for the $1.25M Nutrien Radicle Growth Challenge Canada, established to transform the speed of agriculture innovation.

Acknowledgments

ACTia wishes to thank MaRS Data Catalyst, JWN Energy and Delphi Group for their contribution of time, insight and intellectual support to the develop and distribute the survey, encourage responses, provide input on the interpretation of the results, or otherwise make it a success. Our thanks to:

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- Technology Alberta (Gail Powley)
- Nanocluster Alberta (John Murphy, Keith Gylander)

Executive Summary

The Bet on Clean Technology is Starting to Pay Off for Alberta

Alberta has a consistent record of making bold and successful bets on innovation.

The establishment in 1974 of the Alberta Oilsands Technology Research Authority (AOSTRA) with $1 Billion of public funding delivered over $217 Billion in investment in oilsands development[9] [10]. Similarly, beginning in 2003, Alberta's government made $45 Million in strategic investments to support what has become the Alberta Machine Intelligence Institute, now among the world's top five institutes for AI and machine learning[11].

Clean technology could represent a C$3.8 trillion economic opportunity by 2030, according to McKinsey, the same scale as the global financial and construction industries are today[12] [13].

Given Alberta's track record of success in supporting disruptive new technology opportunities, is this province on a path to building a world-beating clean technology ecosystem?

In late 2018, the Alberta Clean Technology Industry Alliance and MaRS Data Catalyst, with Delphi Group and a constellation of partners, took an updated snapshot of the province's 'pureplay' clean technology ventures, companies developing novel services, processes, products and activities that improve economic performance and reduce environmental footprint relative to the baseline.

From 291 survey responses we distilled insights from 78 respondents who met our criteria: based in Alberta, with proof of technology or business model innovation, who indicate an environmental benefit as a core part of their value proposition, and who derive a majority of their revenues from those specific products or services. And we compared this to the similar study we undertook in late 2016, to assess the trends.

Alberta's clean technology sector is distinct from Alberta's broader tech sector generally, and from clean technology sectors in other jurisdictions. Nearly two-thirds of the province's clean technology ventures identify their primary market as oil, gas and mining. Half of ventures are 'deep' innovation plays, developing solutions based on novel chemical processes or advanced materials, with longer commercialization cycles and higher capital costs than software-based startups. And over one in three has a female founder, whereas female participation in tech startups is about 13% nationally.

Dr. David Manz, inventor of the biosand filter, the most impactful clean technology invention in Canadian history, is recognized in 2018 with the Alberta Order of Excellence[xiv]. Over 2 Million biosand filters have been implemented around the world, providing safe drinking water to more than 6.5 million people.

We find a strong case that Alberta's clean technology ecosystem has improved materially since 2016. While employment reported by the sector held roughly steady at 1,758 people, the median salary rose by 7.4% to $80,000 per year. Over three quarters of companies seeking funding in 2017-18 were able to secure it. And each dollar of public funding that was reported generated $2.50 from private sources. Nearly 80 percent of the over $385M in reported revenue came from sales in the United States, showing the importance of export-led growth.

In spite of these encouraging signs, Alberta remains an emerging clean technology centre: Only half of founders have previous startup experience, compared to nearly three quarters in Alberta's wider tech sector. A key indicator of high performing technology ecosystems is the pace of creation of "unicorns", billion-dollar companies by valuation at Initial Public Offering or Buyout. Only two of the respondents reported exiting through IPO, private equity buyout or acquisition, both over 10 years since founding.

We find a strong case that Alberta's clean technology ecosystem has improved materially since 2016.

Based on open-ended responses, we found that Alberta's clean technology leaders value Alberta's culture of cooperation across the innovation ecosystem exemplified by efforts like Rain Forest Alberta, as well as the province's skilled and hard-working people and affordability. They encourage government's continued support of accelerator programs, of Alberta Innovates and of the Alberta Investor Tax Credit.

Attracting investment dollars remains their dominant concern. Moving from pilot to commercial product remains challenging, with domestic enterprise slow to adopt new technology, with regulatory drivers uncertain or absent, and with venture scale-up funding lacking.

Respondents called on government agencies to work together to reduce administrative burden and timing mismatch in accessing public funding; to widen its availability beyond oil and gas-focused efforts; to mobilize procurement Provincially and Federally as 'first adopter'; and to provide specific support for companies that are scaling. They urged Canadian corporations to engage directly with innovators through accelerator programs, venture arms and sectoral innovation networks.

In spite of their concerns four or five responding innovators are optimistic about the coming year and 9 in 10 plan to bring on additional staff in 2019-20. In short, the bets on clean technology are starting to pay off.

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

In 2019, **Calgary** is ranked one of the world's **top 15 clean technology startup ecosystems** by Startup Genome[xv]

Is Alberta Building a world-class clean technology ecosystem?

Clean Technology is novel processes, products or services that reduce environmental impact

"Clean technology" is the development and commercialization of novel processes, products or services that reduce environmental impact and improve economic performance relative to the baseline. For our purposes that means ventures formed to develop new kinds of wind turbines, as an example, rather than those building wind power projects. Clean technology could represent a C$3.8 trillion economic opportunity by 2030, according to McKinsey , the same scale as the global financial and construction industries are today.

In 2016, ACTia and MaRS Data Catalyst undertook our first study of the state of Alberta's clean technology sector, establishing a baseline in terms of the number of ventures, their economic and intellectual contribution, markets and level of optimism. Since that time, the Federal and Provincial governments have made historic new financial commitments to support access to capital and markets for clean tech ventures. Has Alberta made progress in building a world-class clean technology ecosystem? What are our emerging strengths in clean technology, and where can we improve?

ACTia and MaRS Data Catalyst conducted a second survey of Albertan clean technology ventures in fall 2018, with support from Globe Foundation. Its objectives were to compare the industry to the 2016 baseline, and to provide data-driven insights into the gaps and points of leverage for accelerating growth. New this year, we also collected anecdotes of Alberta's venture successes over this period.

As with the study we undertook in 2016, we present here the results for Alberta's "pure play" clean technology sector only. To be included in the results, companies had to be based in Alberta in 2018, and to indicate that they derived a majority of their revenue from a clean technology 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 enable us to compare our clean technology sector with those of other provinces and jurisdictions. But these screens mean that by design this study significantly under-reports the total scale of clean technology sector activity in Alberta – this is just the centre of the onion.

Alberta's software-enabled agriculture sector carbon offset developer **Carbon Credit Solutions** wins the 2018 Deloitte Technology Fast 50 program award, is ranked 140th fastest growing company in North America.

Where possible, we have sought to provide relevant comparative indicators to provide context for the state of Alberta's provincial clean tech sector, including data from Alberta's wider technology venture sector and from our own 2016 survey results.

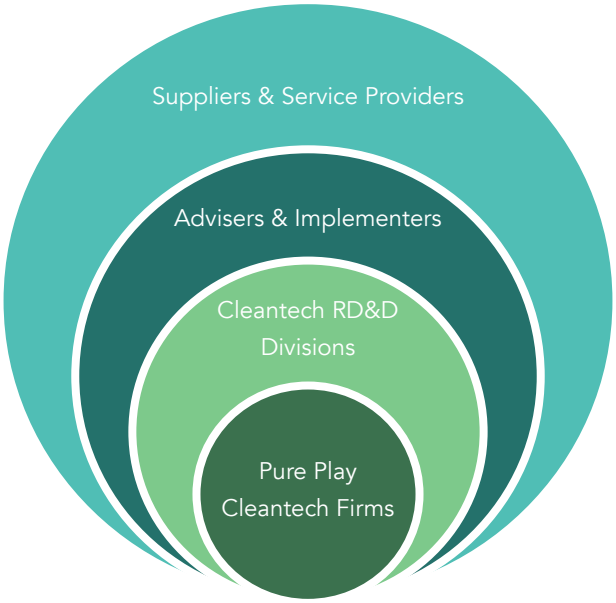
Alberta's pureplay clean technology firms were identified through a collaborative process of reviewing and integrating several sectoral lists of firms, industry association rosters, investor lists, ACTia's email list, conference attendee lists, previous respondents, and other inputs, with help from the partners and contributors identified in the Acknowledgments, 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 our prior efforts as well as those of the BC Cleantech CEO Alliance, Ecotech Quebec and MaRS Data Catalyst for the clean tech sectors in their respective provinces. A customized electronic survey was sent to all clean technology firms in our database and to a wider set of contacts across the province during the summer of 2018, with the final results compiled in late September. A workshop was hosted with MaRs Data Catalyst in Calgary in October 2018 to review the results with a set of key stakeholders and advisers.

> By design this study significantly under-reports the total scale of clean technology sector activity in Alberta

In all, MaRS Data Catalyst received 291 responses, which were validated both for content and against the criteria above by reviewing company websites and placing telephone calls. This yielded 78 responses that met our test. Thirty-two firms responded in both 2016 and 2018, enabling meaningful trend analysis to be drawn across that two-year interval. Assuming somewhere between 100-250 pure play clean technology companies are active in Alberta, we estimate a survey response rate of 30-70%, making these results statistically representative.

Chart 5.1 Clean technology sector layers, with pure-play clean tech ventures at the heart of the "onion"[18]



Carbon Upcycling is named one of ten finalists in 2018 for the Carbon XPRIZE's $20M prize, one of ten ventures inducted into LafargeHolcim's inaugural building technology accelerator, and in 2019 one of six winners of the New York-based 76West venture clean energy commercialization competition, with up to $1M in support[xix]

About Alberta's Clean Tech Companies

- Our clean technology sector is growing. 78 pureplay Alberta-based clean technology companies responded in 2018, compared to 72 in 2016, roughly half under 5 years old. This represents roughly 10% of the total number of clean technology ventures estimated to be in Canada in 2016[20].
- The number of people employed globally by Alberta's clean technology sector in 2018 was reported to be 1,758 people, roughly even with reported employment in 2016, while the median salary rose by 7.4%, to $80,000 (N = 41).
- Companies are optimistic about the future, with over 80% saying they have a moderately or substantially better outlook for the coming year (N = 67), and 93% expecting to hire an estimated 1,000 new staff in 2019/20 (N=70).
- Over half of Alberta's clean technology ventures seek to sell to the **oil, gas and mining** sectors; one in three to **power and utilities**; and one in five to the **agriculture and food processing** sectors (N = 69).

For the second year in a row, Edmonton-based food sustainability label software venture **Localize** is honoured in 2018 as a Best-for-the-World BCorp, among the top 10% of over 2,500 BCorps worldwide[xxi].

Chart 6.1 Distribution of Alberta's clean technology companies by HQ location N = 74

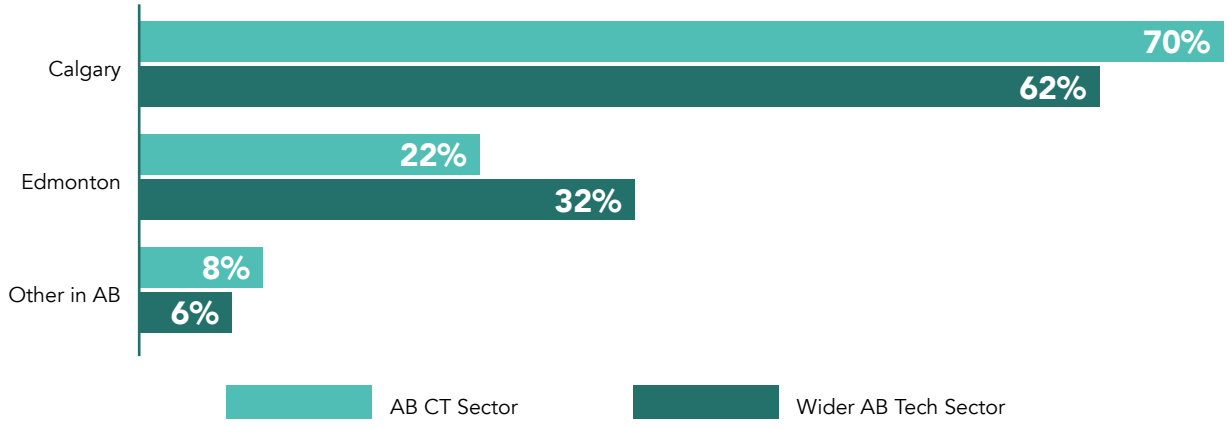


Chart 6.2 Breakdown of ventures by age, compared to Alberta's wider tech sector

N = 74

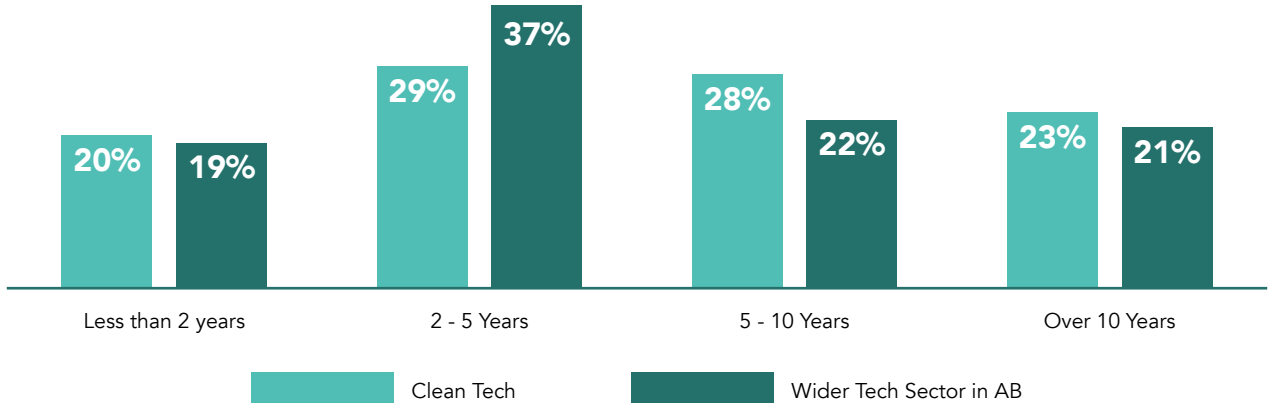
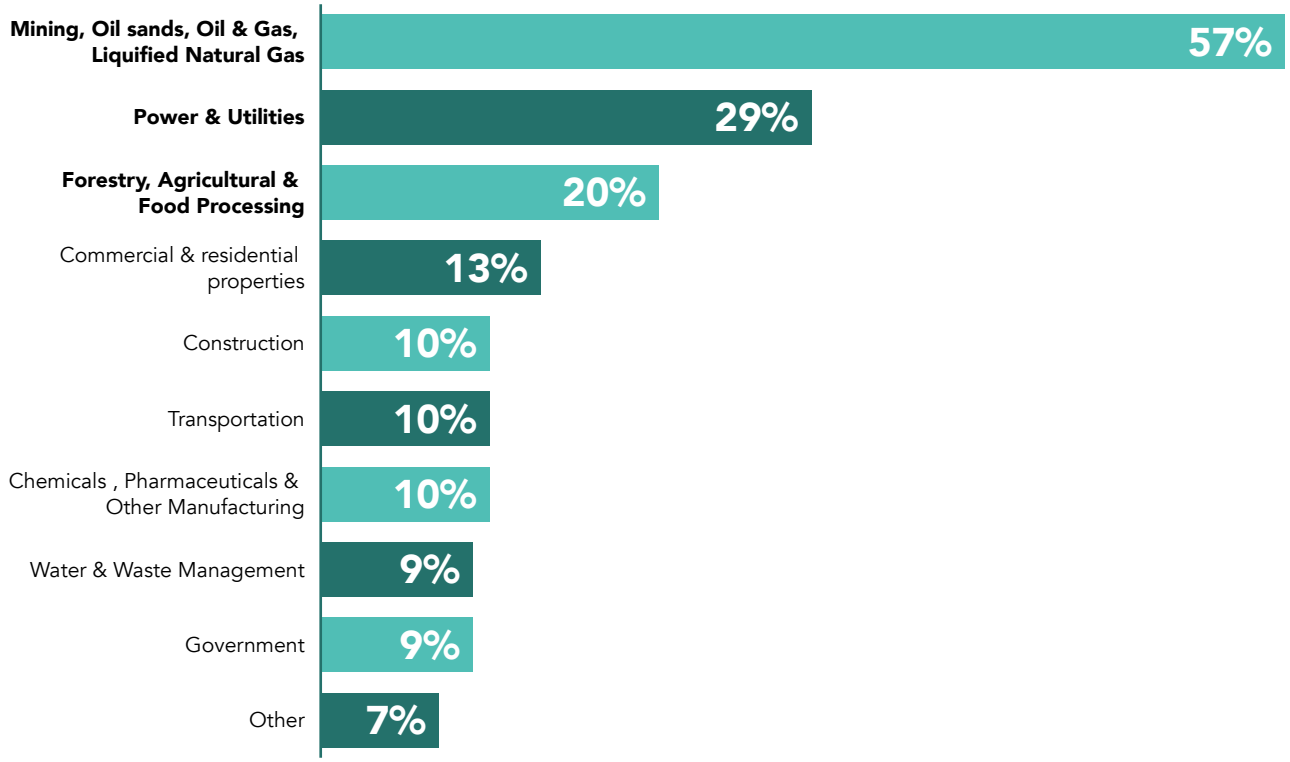


Chart 6.3 Target industrial sector market (respondents could select up to 2)

N = 69

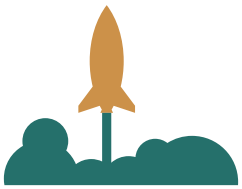


Calgary-based micro-CO2 capture and utilization play **CleanO2** wins 2019 JWN Energy Excellence Award and 2019 Nature Inspiration Award from the Canadian Museum of Nature, supplies customers including Lush Cosmetics, FortisBC, Pacific Northern Gas, ATCO, and Union Gas.

Founder Stats

1 in 3 had a **female founder** (34%) compared to roughly 1 in 7 tech founders globally (N=70)

Nearly all founder teams include someone with experience in their **target industry** (86%, N=70)



Nearly **half** of Founders have previous **Startup Experience** (45%, N=70)

5 of 8 founders had a **STEM degree**, with roughly 70% graduating from Universities in Alberta (N=69)

4 in 5 companies reported having a **Canadian born founder** (84%) (N=70)

1 in 5 have a **millennial founder** (21%, N=70)

Alberta lithium brine recovery plays secure significant validation: **Summit Nanotech**'s CEO, Amanda Hall, is named to the National Women in Cleantech accelerator in 2018 and the company is recognized as a National Angel Capital Organization Top 30 Startup in 2019[xxiii]. **E3 Metals** secures a $5M development partnership in 2019 with Livent Corporation, the world's largest pure-play lithium producer.

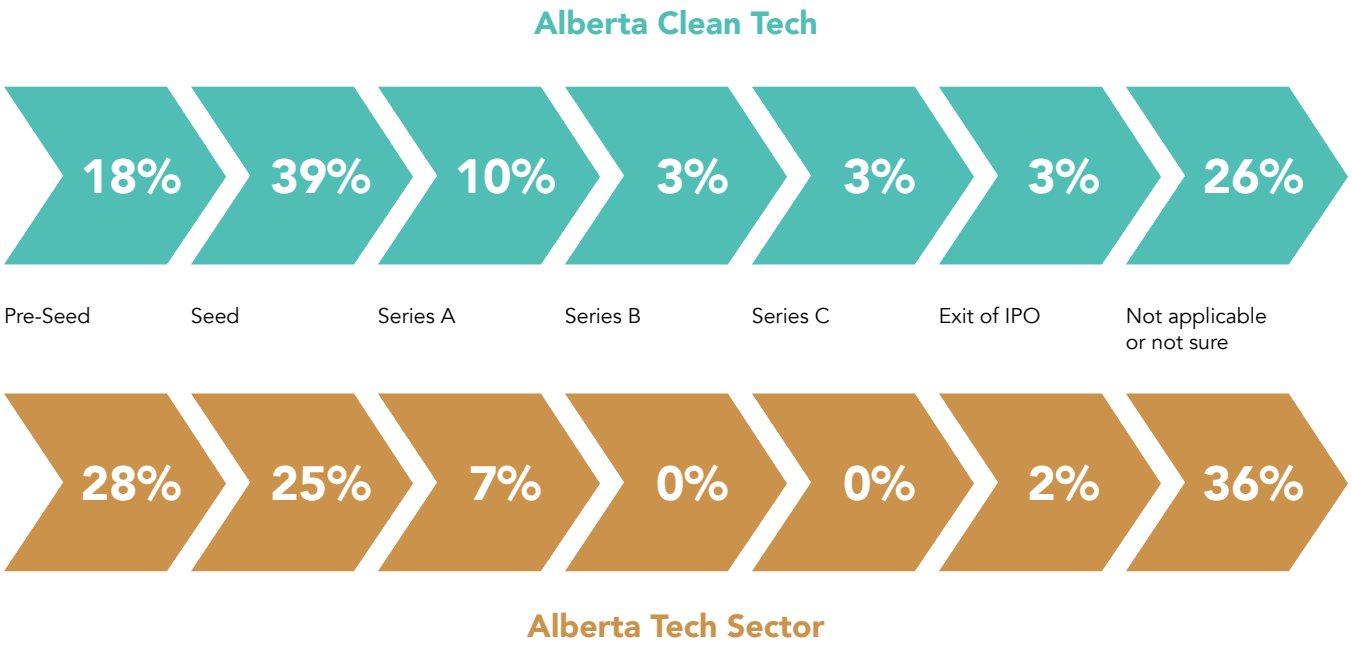
Funding

- Respondents raised over $51M in capital in 2017-18 (N=37), with $8M raised by ventures under 2 years old.
- Over three quarters of companies seeking funding in 2017-18 were able to secure it (N=73).
- Nine of 10 CT sector ventures will seek additional funding in 2019/20 (N=63)
- One in four of Alberta's clean tech companies reported advancing beyond seed funding.
- One in five ventures secured private capital within 5 years of founding.
- Only 3% (2 of 61) report an exit through IPO, private equity buyout, or acquisition. Those ventures reported being over 10 years old at the time of exit.
- Each dollar of public funding mobilized a reported $2.50 in private investment during this period. Public funding of $15,835,720 reported (n=15) mobilized a reported $39,670,030 in other funding (n=6).

In December 2017, Calgary-based water pipeline technology and inspection company **Pure Technologies** achieves the largest exit in Alberta Clean Tech history, selling for over $500 million to New York-based Xylem Inc.

Chart 7.1 Most-recent capital round completed by Alberta cleantech ventures compared to Alberta's wider technology sector

N = 69



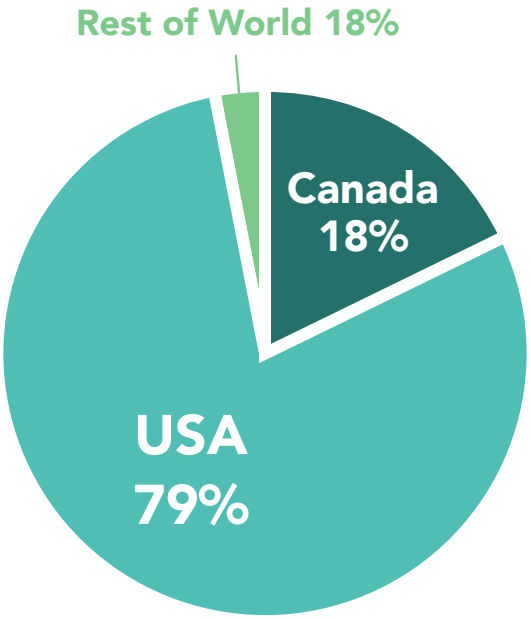
Revenue

- Alberta's clean technology sector generated over $385 million in revenues in 2017/2018,. (N= 37) Those ventures responding in both 2016 and 2018 saw average revenue growth of 37%.
- Over one third of companies reported revenue over $100,000 per annum, with 14% reporting more than $1M annually.
- Only one fifth of the sector's total revenue was generated in Canada, with almost all remaining revenue coming from the US. Other markets accounted for less than 3% of the sector's revenue. (N = 71), consistent with 2016.

In 2019, upstream methane solution provider **Questor Technology** places on The Globe and Mail's Canada's 500 Top Growing Companies, announces record quarterly revenue and profit, triples stock value in 3 years.

Geothermal technology developers **Eavor Technologies**, **Borealis Geopower**, **DEEP Corporation** and **Terrapin Geothermics** each achieved significant commercial milestones in 2018-2019 leveraging Alberta oil and gas know-how.

Chart 8.1 Breakdown of revenue by geographic market



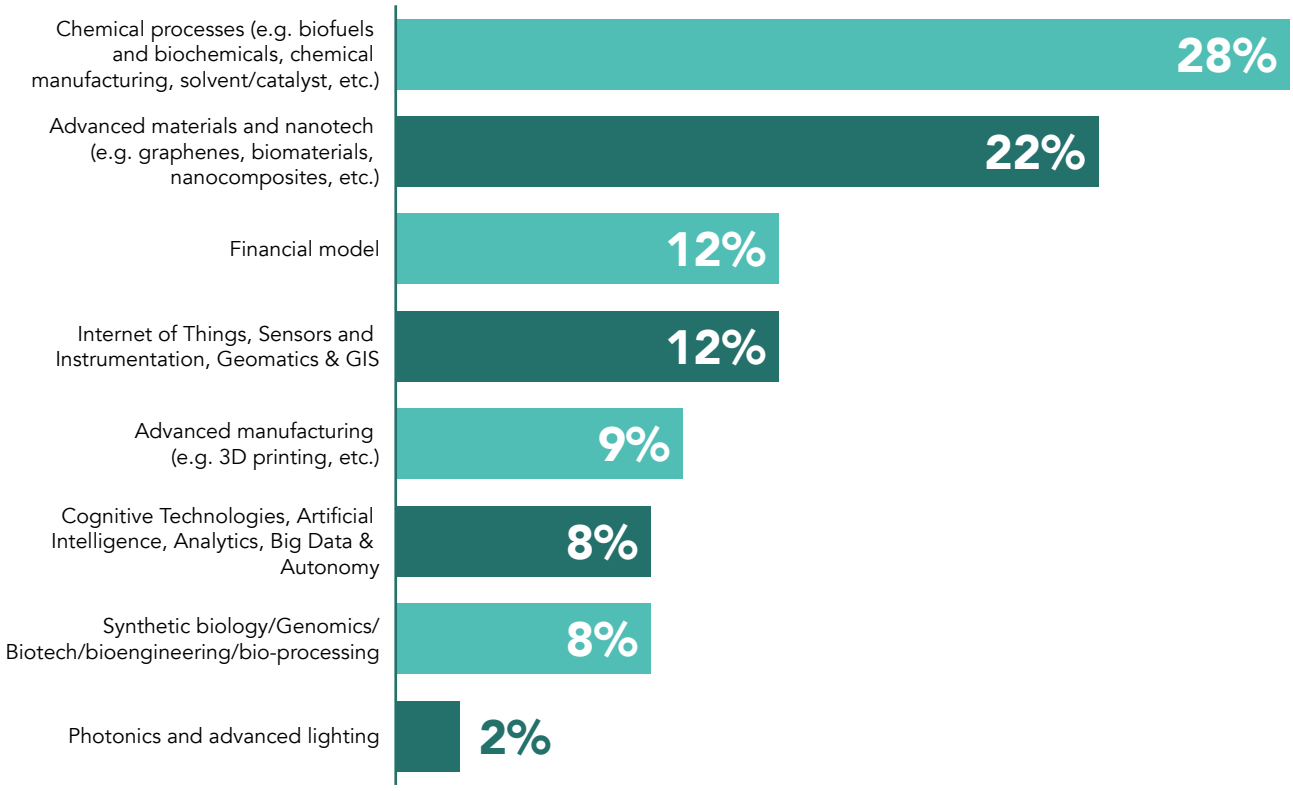
Total: $385,181,637

Innovation

- Half of Alberta's clean technology ventures are 'deep' innovation plays, developing hardware solutions based on novel chemical processes or advanced materials. While deep innovation ventures may have the potential for greater environmental and economic benefit, this comes with longer commercialization cycles and higher capital costs than software and IT-based startups that have been preferred by private investors (N = 65)[24].
- Alberta's clean tech ventures cumulatively secured 614 patents or other forms of IP protection as of 2016, and added 48 more in 2017-18 (N = 64)
- Nine in ten Albertan clean technology ventures report that protection or defence of IP is a moderate or significant concern. (N = 69)

Creative Destruction Lab-Rockies launches with great enthusiasm in 2017, helping Albertan clean technology ventures including IoT play **Ingu Solutions**, blockchain-enabled **ReWatt** and novel water treatment play **Swirltex** raise over $14 million in funding, and launching an Energy-specific cohort in 2018.

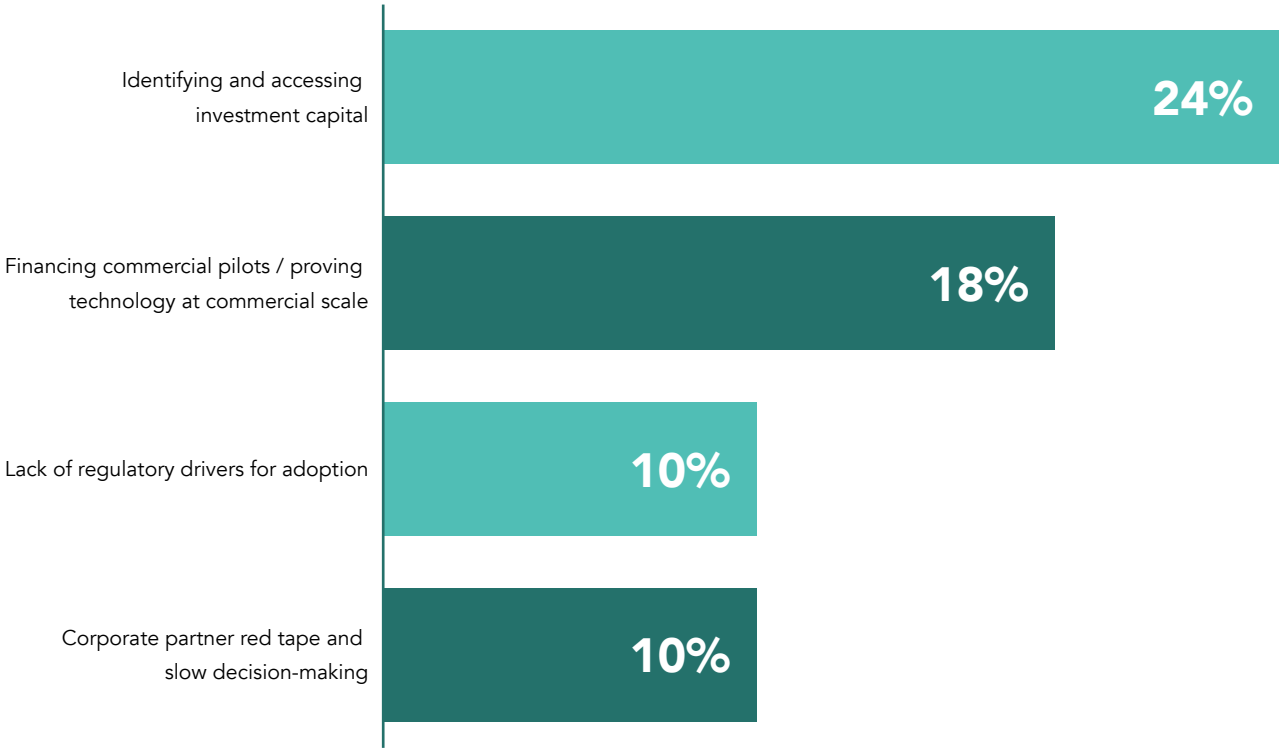
Chart 9.1 Sources of innovation (respondents could select up to 2) N = 65



Barriers, Strengths and Needs

- The most significant barriers to growth according to Alberta's clean technology entrepreneurs are accessing investment capital, financing pilot projects and finding domestic customers due to the lack of regulatory drivers for adoption.
- The organizations and programs they cited as most widely used and thus most helpful are the Federal Scientific Research and Experimental Development (SR&ED) and Industrial Research Assistance Program (IRAP), public project funders including Sustainable Development Technologies Canada (SDTC), Emissions Reduction Alberta (ERA) and Alberta Innovates (AI), and support from Universities, Colleges, and their associated commercialization offices.
- In response to the barriers, respondents called for additional grants, public loan guarantees and deeper SR&ED credits. To spur demand for Albertan clean technology, they called for expansion of public innovation procurement programs and for the formation and increased mobilization of end-user innovation collaborations like the Canadian Oilsands Innovation Alliance (COSIA) and Clean Resource Innovation Network (CRIN).

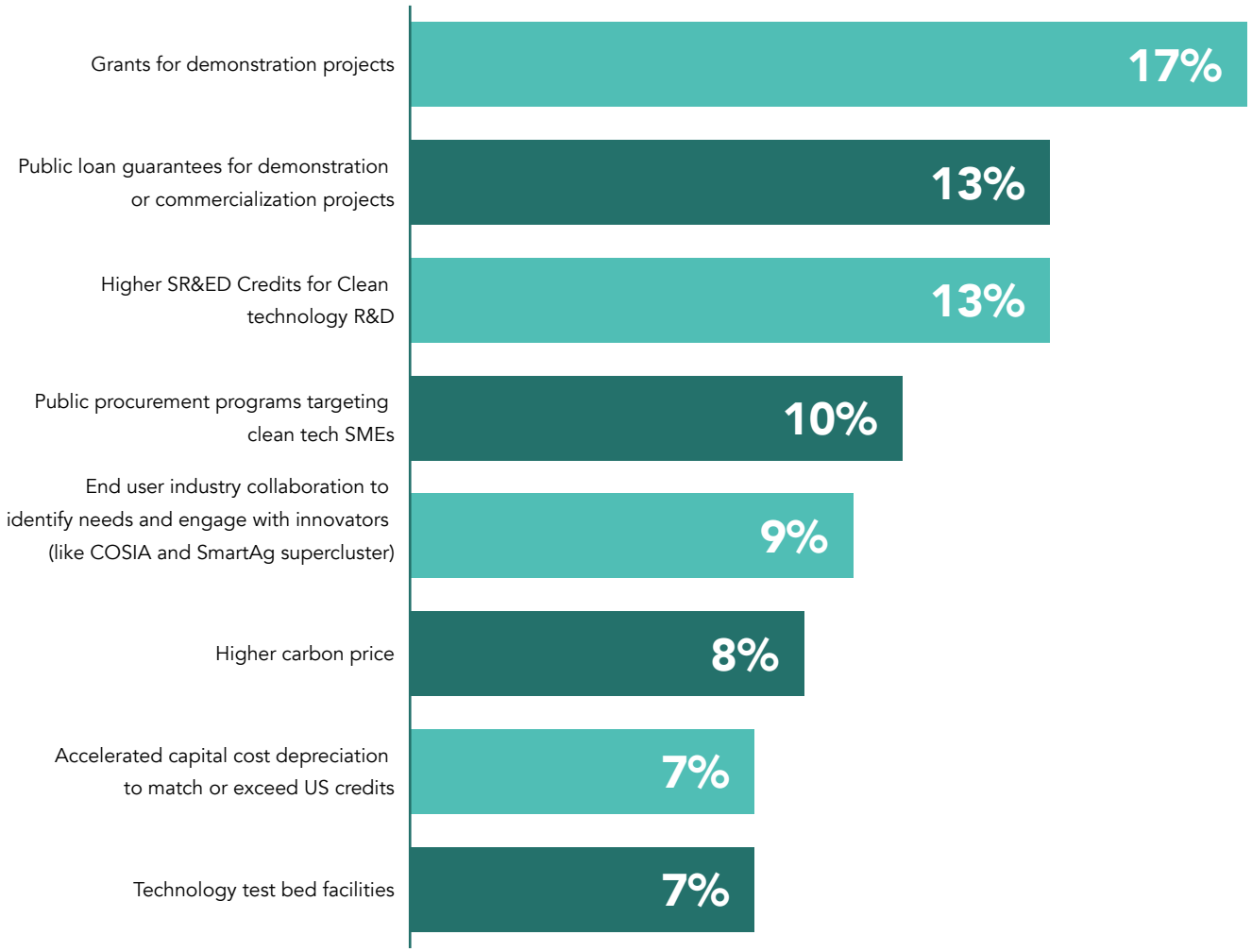
Chart 10.1 Top barriers to venture success (respondents could select up to 3) N = 67



Could Alberta lead development of the Trillion dollar global carbon capture, utilization and sequestration (CCUS) industry? Eight of Canada's 18 CCUS startups have roots in Alberta, including **Carbon Engineering**, **Quantiam Technologies**, **HTC Systems**, **CTCNT** and **Industrial Climate Solutions**.

Chart 10.2 Top 3 recommendations to improve the ecosystem (respondents could select up to 2)

N = 67



In 2019, Alberta-based innovation clusters the **Canadian Agri-Food Automation and Intelligence Network** (CAAIN) and the **Clean Resource Innovation Network** secure over $150M in private sector-matched Federal grant commitments to advance transformational technologies in agriculture and in oil and gas.

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.

MaRS Data Catalyst

MaRS Data Catalyst leverages rigorous research, analytics, and data-backed products to support venture success, inclusive innovation, and environmental sustainability. As part of MaRS Discovery District, North America's largest innovation hub, we work with major government and enterprise data holders to share data with the innovators who can use it best to turn smart ideas into reality. By tracking Canadian companies, investors, talent, and markets over time, sector, and location, we identify ways to strengthen the ecosystem and enable companies to scale.

JWN Energy

For over 80 years, JWN Energy Group has supported the energy industry, through our data and analysis products, and by delivering critical news each and every day. Used by members daily, JWN's suite of products and tools support decision-making, identify business opportunities, and allow members to be part of the ongoing energy conversation. JWN's advisory work positions our partners at the forefront of the clean technology movement. Supporting collaboration across Canada's energy industry, JWN engages associations, researchers, government and industry to come together, leading new industry standards and driving actionable solutions for change.

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