

# Canada's Cleantech Investment Landscape:

Analysis of Public and Private Financing  
for Clean Technology Companies and the Advanced Bioeconomy

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**deepcentre**

Centre for Digital Entrepreneurship  
+ Economic Performance





## About the Report

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The DEEP Centre's report on Canada's Cleantech Investment Landscape provides an overview of the cleantech investment landscape in Canada and identifies needs and opportunities for public investment in the sector's venture capital and startup support infrastructure.

The report was commissioned by the Department of Natural Resources Canada (NRCAN). Specifically, NRCAN asked the DEEP Centre to:

- Provide an overview of recent investment trends in the Canadian cleantech sector, including data-driven insights into recent startup and investment activity.
- Interview ecosystem leaders (including executive with business accelerators, VCs, cleantech and bioeconomy companies and large industrial firms) to identify commercialization challenges and investment needs in the cleantech sector that can be addressed by public interventions.
- Provide the Government of Canada with recommendations for how to strengthen Canada's cleantech and bioeconomy sectors, with a focus on building a more robust venture capital and startup support infrastructure to nurture homegrown global champions.

This report summarizes the DEEP Centre's key findings from the research and provides recommendations for maximizing the global success of Canada's leading cleantech and bioeconomy companies.

The information, opinions and interpretations expressed in this report are those of the authors and do not necessarily reflect the official policy or position of the Government of Canada. The Government of Canada is not responsible for the accuracy, reliability, or currency of the information.

### About the DEEP Centre

#### Advice – Impact – Success

The Centre for Digital Entrepreneurship and Economic Performance (DEEP Centre) is a Canadian economic policy think- tank. Founded by Anthony Williams in 2012 as a non-partisan research firm, the DEEP Centre's work shapes how jurisdictions build fertile environments for launching, nurturing, and scaling companies that will thrive in an increasingly connected world. Its research and advisory services have helped policymakers around the world identify and implement powerful new policies, programs, and services to foster innovation, growth, and employment in their jurisdictions.



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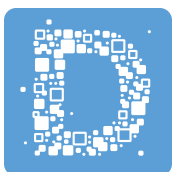
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## 1. Executive Summary

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There is widespread consensus that the development and global adoption of low-carbon technologies are essential to achieving needed reductions in GHG emissions to cap the rise in average temperatures at 1.5°C or less. This includes the adoption of proven technologies available today and new technologies not yet developed. Some of the changes include dramatic improvements in the energy efficiency of products, including the processes to make them; shifting to renewable and recyclable materials; increasing transportation efficiency and the adoption of electric vehicles; and running commercial buildings and corporate facilities using clean energy sources. According to the 2021 IPCC report, nothing short of a complete industrial transformation will avert an economic and environmental catastrophe.<sup>1</sup> Moreover, the bulk of this low-carbon re-industrialization must occur within the next two decades—much faster than previous industrial transformations such as the transition to steam power and electricity.

In this respect, investments in the commercialization and growth of cleantech solutions and companies in Canada are an urgent priority. Canada must significantly reduce its carbon footprint and seize this historic moment to become a leader in generating jobs and prosperity from the clean growth industries of the future. Nurturing a dynamic and globally competitive cleantech sector is a vital part of the path towards an economy powered by clean growth. Canada also needs a step-change in clean technology adoption to reinvigorate high-emitting industries around low-carbon solutions, including transportation, resource extraction, forestry, heavy industry, and construction.

With these challenges in mind, Natural Resources Canada commissioned the DEEP Centre to develop a report that provides a mixed quantitative and qualitative assessment of cleantech investment in Canada. In phase I of the project, we used quantitative methods to establish an overview of the population of cleantech companies in Canada and key investment trends in the sector. In phase II, we conducted thirty-six executive interviews with industry investors and other key stakeholders to identify opportunities and risks shaping investment decisions in the cleantech sector.

The DEEP Centre's investment analysis and executive consultation reveal mixed news regarding whether the current level of investment has put Canada on track to meet its emissions targets and build a robust cleantech sector. On the one hand, Canada has a diverse population of cleantech companies offering an array of innovative cleantech solutions to a broad cross-section of industries. Our data shows that 223 companies collectively raised \$1.4 billion in venture financing in the last five years. Signature deals include \$367m in total funding for Enerkem, a waste-to-biofuels company; \$172m for Toronto-based smart home device company, ecobee; \$90m for Carbon Engineering's direct air capture technologies; and \$77m for Minesense's suite of digital mining solutions.

However, a closer inspection of the investment data reveals an overwhelming concentration of investment dollars in software-based cleantech plays focused on industrial efficiency, energy analytics, building automation, and smart grids. Collectively,





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the top energy-related verticals in the DEEP Centre's analysis account for 73% of the \$1.4B in venture funding between 2016 and 2020. Investors consulted by the DEEP Centre acknowledge that a large proportion of VC deals over the past five years have focused on the so-called "low-hanging fruit" of clean technologies. However, most investors also concede that Canada and other countries will not meet their climate obligations pursuing software-based solutions alone. "Software-based efficiency plays can enable incremental improvements like a 5 to 10% efficiency gain," said one investor. "A lot of the environmental challenges require transformational hard tech that will significantly lower Canada's carbon footprint."

When asked about where they plan to focus their upcoming investments, investors pointed to areas such as hydrogen, carbon capture, energy storage, green chemistry, and the bioeconomy. However, the considerable barriers to expanding investment include the risk profile of hard tech companies, the lengthy timelines for commercialization, and the relatively small size of the cleantech funds in Canada, which constrains the ability to finance CAPEX-intensive companies. As one investor put it, "50 – 60% of the GHG reduction will come from low-hanging fruit. The next 40% will be very hard."

A further concern is the significant concentration of risk capital amongst a small number of companies. For example, the top 10 companies by total venture funding collectively raised over \$1B, or about 74% of all cleantech VC funding between 2016 and 2020. The following 27 companies shared \$336 million, while the bottom 50 raised just \$39 million. The presence of mega-deals demonstrates that some companies are receiving the large injections of capital required to become world-class competitors. However, the data and executive input also reveal that a significant proportion of early-stage cleantech companies are heavily reliant on public grant funding for survival. Of the 133 companies that secured public grants between 2016 and 2020, 65% (or 87 companies) have yet to raise a venture round.

The bioeconomy is a microcosm of the broader cleantech arena. With over \$500 million in private financing and nearly \$60 million in public grant funding, the bioeconomy is the 3rd ranked vertical behind renewable energy and waste management in total funding. However, just two large companies claimed an overwhelming 84% of the total investments in the bioeconomy sector. Interviews with bioproduct companies revealed that several companies secured financing from corporate strategic partners. At least one company is on the verge of closing a series-A round this year. Nevertheless, many innovative bioeconomy SMEs have struggled to secure adequate capital to commercialize innovative new biomaterials and energy sources successfully.

What can the Government of Canada do to help ensure more cleantech companies attract the financing required to reach scale? The DEEP Centre's recent research on Canada's cleantech sector suggests there is still some distance to go to make Canada a more hospitable market for cleantech solutions. As one executive explains:



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*“Cleantech companies are operating in industries that have existed for hundreds of years. There is very little ground that hasn’t been tread at some point. So the bar is very high for solutions that will work. It’s not like digital, where there are wide open green spaces, and you can raise money around an idea without demonstrating that it works. In heavy industrial areas, you have to demonstrate a mature process. We have strong cleantech alternatives in chemicals, fuels, and water, but you have to supplant the existing solutions that are proven and working at scale. The bar is incredibly high. There is no easy solution.”*

Such observations are not isolated. A variety of stakeholders consulted by the DEEP Centre recognize that Canadian companies still face deep-rooted challenges in the commercialization and scale-up of clean technology solutions. Challenges cited by interviewees include a risk-averse corporate culture and the need for more substantial infusions of public capital to de-risk, scale-up and deploy new technologies. Other issues include the fragmentation of support services and a lack of sophisticated management talent to take cleantech solutions to international markets.

Many of Canada’s highest emitters, on the other hand, operate in conservative, low-margin, commodity-based industries. Even in good economic times, such industries constitute challenging environments for making bold investments in the future. Indeed, there is broad support across the ecosystem for further investment in new tools and mechanisms to strengthen collaboration between cleantech solution providers and Canada’s industrial incumbents.

Canada will not solve its persistent difficulties in accessing patient capital, enlisting industrial partners for large-scale demonstration projects, or securing first sales overnight. Everyone agrees, however, that collective action by all interested stakeholders—including business accelerators, industry associations, investors, large companies, SMEs, and federal government departments—can accelerate progress in creating a more welcoming environment for cleantech investment and adoption. Synthesizing the insights from sector leaders yields a list of ten key domains where urgent action is warranted.





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1. **Strengthen the capacity to create investment-ready companies** with additional funding to enable specialized BAs to offer startup capital, run demonstration projects, and hire the talent to bring private-sector discipline to the process of building new ventures around breakthrough science and technology.
2. **Boost early-stage cleantech financing and angel investment** by incentivizing angel investors and creating new seed-stage funds to diversify the pool of early-stage cleantech investors in Canada.
3. **Close the late-stage funding gap** with a dedicated funding envelope to support the growth of cleantech venture capital funds in Canada with the capacity to participate in late-stage venture rounds.
4. **Facilitate connections between cleantech SMEs and corporates with a matchmaking service** that will publicize technology and decarbonization roadmaps, identify connection points, validate solutions, and broker partnerships.
5. **Increase support for large-scale demonstration projects** with public procurement, investments in testbed facilities, and matching funding to encourage large industrial companies to come to the table as early adoption partners.
6. **Leverage the federal government's convening power to build new consortia projects** that will share the costs & risks of cleantech adoption, strengthen clean growth value chains, and fast-track the decarbonization of traditional sectors.
7. **Ensure regulations, tax credits and funding programs are globally competitive** by working with ecosystem leaders to identify and remove barriers to commercialization and create an attractive environment for hosting ambitious cleantech deployments.
8. **Build a national cleantech data clearinghouse** to increase visibility into cleantech solutions, companies, and pilot/demonstration projects across Canada.
9. **Launch ambitious innovation challenges with private sector buy-in** to incentivize the development of new technologies at several points along the innovation spectrum, from stimulating applied R&D to securing first sales and bringing new technologies to market.
10. **Strengthen the Government of Canada's cleantech leadership** to ensure that key agencies have the competencies and sector insights to deliver value-added and effective solutions to their partners in the cleantech ecosystem.



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The Government of Canada has identified the acceleration of clean technology innovation as a strategic priority in meeting Canada's economic and environmental goals. While Canada is well-positioned to be a global leader in this area – especially given its strengths in early-stage research and development – there remain well-recognized challenges related to the commercialization and scale-up of Canadian clean technology companies. Commercialization and scale-up challenges articulated by key stakeholder groups and clean technology companies often relate to an inability to access the resources required to fuel growth, including patient capital, talent, facilities and introductions to potential partners and customers.

In response to many of these challenges, the Government of Canada allocated more than \$3 billion to support clean technology commercialization. Among other things, Budget 2017 included \$400 million to recapitalize Sustainable Development Technology Canada's SD Tech Fund, \$200 million to support the development of renewable power technologies, and \$100 million for smart grid projects. A further \$120 million is available to deploy infrastructure for electric vehicle charging and natural gas and hydrogen refuelling stations. In addition, a \$2 billion Low Carbon Economy Fund supports projects that reduce carbon pollution, and nearly \$1.4 billion in new financing is available for the Business Development Bank of Canada and Export Development Canada to help clean technology firms.<sup>2</sup> Subsequently, Stream 3 of the Venture Capital Catalyst Initiative (VCCI) supported three dedicated cleantech fund managers in 2019, which raised more than \$450 million.

Despite notable successes and high levels of investment, questions remain regarding the targeting and adequacy of risk capital resources available to clean technology companies in Canada. In 2018, Canada's Economic Strategy Table on Clean Technology cited low access to patient growth capital, scale-up investments, and grant funding suited to clean technology's unique risks and costs as one of the sector's primary impediments to growth.<sup>3</sup> In a 2020 consultation with cleantech entrepreneurs and investors, the DEEP Centre heard consistent feedback on the dearth of adequate capital at various stages of company maturity. At the earlier stages, Canadian cleantech entrepreneurs claimed that VCs are abandoning the seed stage and favouring less risky series A+ investments, making it harder for cleantech companies to secure private sector investments. At the later stages, entrepreneurs and investors cited the need for large-scale financing to accelerate the growth of scaling firms and stem the loss of potential multi-billion-dollar firms.

The Canadian Council of Forest Ministers' has raised similar concerns in specialized areas of clean technology such as the advanced forest bioeconomy,<sup>4</sup> and is working to implement initiatives in support of bioeconomy investments. The advanced forest bioeconomy has the potential to be central to investors growing focus on decarbonization due to its ability to provide low carbon and environmentally sustainable materials and



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energy. The advanced forest-based technologies have applications across the global economy, from the cosmetics industry to the automotive sector. Specific uses range from advanced materials, such as cellulosic nanocrystals and engineered timber products, to energy sources, such as sustainable biochar, to consumer goods, like compostable biobased packaging.

Despite their potential, these advanced forest-based clean technologies can face serious challenges attracting investment. These appear to be caused by the unique nature of biomass supply chains with which many investors are unfamiliar and by the nature of many biobased clean technologies themselves, including intermediate materials later assembled into downstream components and finished products.

With these challenges in mind, Natural Resources Canada commissioned the DEEP Centre to develop a report that provides a mixed quantitative and qualitative assessment of cleantech investment in Canada. In phase I of the project, we used quantitative methods to establish an overview of the population of cleantech companies in Canada and key investment trends in the sector. In phase II, we conducted thirty-six executive interviews with industry investors and other key stakeholders to identify opportunities and risks shaping investment decisions in the cleantech sector.

The report outlines our key findings from both phases of research. It concludes with recommendations for enhancing the growth and success of the advanced bioeconomy and the broader cleantech sector. Readers can find a complete description of the methodology for the project in Appendix I.

### Key Findings from the Investment Analysis

The data-driven analysis of cleantech investment highlights several essential insights about the distribution of public and private funding within the Canadian cleantech ecosystem. Here we briefly summarize the key takeaways.

**Canada has a diverse population of cleantech companies that have secured some form of public or private financing.** Since 2013, a total of 435 cleantech companies in Canada received public or private financing or were involved in a merger or acquisition. This population of cleantech companies is diverse, spanning 11 different sectors and 22 different industries. Prominent industry classifications for cleantech companies include waste management and water treatment services, electrical equipment suppliers, software and service companies, chemical manufacturers, and independent power producers.

**Total funding for cleantech companies reached \$4.1B between 2016 and 2020.** Of the 435 cleantech companies identified by the DEEP Centre, 223 had a funding event between 2016 and 2020. Collectively, these companies raised a total of \$4.1B over five years. Venture investments represent the most significant share of financing, with 152



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deals for 87 unique companies totalling \$1.4B. Debt and private equity (PE) financing represent nearly \$1.2B each despite just 43 transactions over five years. Public grants for cleantech companies totalled \$288 million over five years.

**In a ranking of venture capital funding by vertical, energy-related plays come out as clear winners, but not the traditional Canadian energy sector as we know it.** With \$393 million in total funding, bioenergy takes the top spot thanks to a series of large deals for Enerkem, a waste-to-biofuels company that secured \$367 million over four venture rounds between 2016 and 2020. Firms in the energy management & analytics vertical rank 2nd with \$231 million in venture funding, while renewable energy firms rank third with \$160 million in VC funding over five years. Finally, energy efficiency and energy storage firms rank 4th and 6th with \$141 million and \$110 million in total venture funding, respectively. Collectively, these top energy-related verticals account for 73% of the \$1.4B in venture funding between 2016 and 2020. Interestingly, only two of the 34 companies that secured deals in these verticals have anything to do with Canada's traditional energy sector, the oil and gas industry.

**Energy efficiency and energy analytics firms have consistently closed big venture deals, highlighting the strength of energy-related plays.** While total venture funding ebbs and flows, investors poured significant dollars into firms that build digital solutions for analyzing energy consumption and increasing the energy efficiency of industrial operation in each of the five years between 2016 and 2020. The investment focus on energy efficiency and energy management is not surprising given the findings from the DEEP Centre's research on clean technology adoption by large industrial firms in Canada. In a 2016 survey of 72 firms (the majority of which are engaged in manufacturing, power generation, mining and oil and gas extraction), we found that investments in energy efficiency were the most common, with 81% of companies surveyed reporting investments in this area.

**Public grants play an important role in addressing the early-stage funding gap for cleantech companies.** With 283 deals over five years, public grants were the most common investment type for cleantech companies in Canada. We found 133 unique companies that were successful in securing grant funding. Eighty-seven of these companies have yet to raise a venture round, suggesting that public funding is vital to their survival. In aggregate, there was \$134 million in grant funding for startups and scale-ups and \$153 million for established cleantech companies. With \$83 million in total grant funding, firms in the 'Renewable Energy' vertical received significantly more public funding than any other vertical. Large grants for General Fusion, Canadian Solar and Eavor make up 88% of Canada's public funding for renewable energy companies. The renewable energy funding is more than double the amount allocated to forest product and carbon capture firms, which take 2nd and 3rd place respectively in a vertical market ranking of public grant funding.



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**An analysis of funding by company growth stage reveals a striking disparity in funding between early-stage and established cleantech companies.** While the deal counts are similar (167 deals for cleantech startups versus 176 deals for established companies), established companies secured far more funding than startups. Venture and public grant funding for established companies topped \$1.3B versus the \$290 million for startups over the five years. In fact, the top 10 venture-backed companies secured nearly 74% of all cleantech venture funding between 2016 and 2020. The following 27 companies shared \$336 million, while the bottom 50 companies raised just \$39 million. Larger, more established businesses need more capital to grow, so a funding differential is not surprising. However, a gap of nearly \$1B in venture financing seems significant when there was only \$1.4 billion in venture financing overall between 2016 and 2020. The numbers lend credence to entrepreneurs' observations regarding an early-stage funding gap for cleantech companies in Canada.

**Bioeconomy firms raised a significant amount of the funding, but the investment dollars are unevenly distributed.** The bioeconomy classification is a multi-disciplinary field that captures a unique population of cleantech companies that seek to develop new products, processes, and energy sources from biological resources. Between 2016 and 2020, 28 bioeconomy firms secured over \$500 million in private financing and nearly \$60 million in public grant funding. \$415 million of the total funding went to bioenergy firms, while bioproduct companies secured \$145 million. However, the underlying transactions reveal that 84% of the total funding for bioeconomy firms went to just two large companies: Enerkem and Kruger. In addition, six bioproduct companies closed venture deals totalling just \$9 million in the 2016 – 2020 period, the largest of which was a \$5 million Series A round for Amber Molecular.

### Key Findings and Recommendations from the Executive Interviews

One of the overarching goals of the study was to solicit input and recommendations from key stakeholders on how to enhance the overall commercial success of the cleantech sector. Executives interviewed by the DEEP Centre offered their assessment of the current health of Canada's cleantech ecosystem, opportunities and challenges related to financing cleantech companies, and the unique challenges bioeconomy companies face in accessing investment capital. Many executives also took the opportunity to reflect on the role of government in fostering cleantech innovation and commercialization and the perceived need to modernize Canada's regulatory framework to accelerate adoption and fast-track new cleantech deployments.

On the overall health of the cleantech ecosystem, sector leaders see both a deep reservoir of high-value IP and a robust pipeline of Canadian cleantech companies. Challenges remain, however, in transitioning early-stage companies out of the pilot phase and into the growth and scale-up phase. Among other things, these challenges include difficulties securing early adoption partners in Canada, a lack of sufficient financing to demonstrate and deploy cleantech solutions at scale, and a dearth of experienced management talent to execute sophisticated go-to-market strategies.



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As global concerns about climate change intensify, the executive interviews reveal an imminent shift in the investment landscape as investors pivot from industrial efficiency to industrial transformation and decarbonization. Investors acknowledge that a large proportion of VC deals over the past five years have focused on the so-called “low-hanging fruit” of clean technologies, including software-based cleantech plays focused on energy efficiency, energy analytics, building automation and smart grids. However, most also concede that Canada and other countries will not meet their climate obligations pursuing software-based solutions alone. When asked about where they plan to focus their upcoming investments, investors pointed to areas such as hydrogen, carbon capture, energy storage, and the bioeconomy.

Investors warn that “hard tech” companies are challenging to finance. Most also agree that solutions are required to mobilize more investments in transformational technologies with the potential to lower Canada’s carbon footprint. Bioeconomy companies, for example, need significant infusions of capital to build new manufacturing facilities that can produce biofuels and biomaterials at scale. The high costs and long timelines to bring advanced biomaterials or fuel sources to market are significant deterrents to investment, especially when the demand for new materials is unproven. These challenges suggest the need to mobilize more patient sources of capital, including corporate strategic partners, foundations and venture funds willing to invest on a twelve-to-fifteen-year time horizon.

The desire to keep high-growth companies in Canadian hands presents another challenge flagged by sector leaders. Much like other parts of Canada’s high-tech economy, the bulk of the capital for late-stage cleantech deals comes from much larger venture and private equity funds in the US and Europe. While sector leaders welcome foreign investment dollars, they worry that the foreign dominance of late-stage venture capital in Canada will inhibit the ecosystem’s growth. The main concern is that Canada’s comparative dearth of late-stage capital relegates Canadian funds to the sidelines in the largest and most attractive deals and makes it harder to maintain Canadian ownership of homegrown companies. Sector leaders believe that scaling late-stage funds in Canada and increasing the proportion of Canadian ownership in growth-stage cleantech ventures would increase the probability of keeping our best companies in Canada.



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### Highlights from Sector Leaders on Canada's Bioeconomy and Cleantech Ecosystem

**"Cleantech companies are operating in industries that have existed for hundreds of years.** There is very little ground that hasn't been tread at some point. So the bar is very high for solutions that will work. It's not like digital, where there are wide open green spaces, and you can raise money around an idea without demonstrating that it works. In heavy industrial areas, you have to demonstrate a mature process. We have strong cleantech alternatives in chemicals, fuels, and water, but you must supplant the existing solutions that are proven and working at scale. The bar is incredibly high. There is no easy solution."

**"We can't solve the world's most fundamental problems with software alone.** Software-based efficiency plays can make incremental improvements like a 5 to 10% efficiency gain. A lot of the environmental challenges require transformational hard tech."

**"There is a big pipeline, but there are not enough great Canadian companies for us to invest in.** We declined 846 out of 850 of the companies we looked at last year. We need specialized accelerators with the resources and expertise to help create investment-ready companies. Right now, most of the accelerators are living on fumes. They need more funding; they are fighting for their lives."

**"We need larger, more experienced funds. Canadian companies typically have 50% less capital relative to their US peers.** The US cleantech funds have much deeper pockets. Without the capacity to participate in the big deals, it becomes impossible to maintain majority ownership in Canadian companies. If you want to maintain ownership, the VC funds must have the resources when the time is right. We need champions that stay in Canada. They are critical to building the ecosystem."





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***“Canadian technologies are among the best in the market.*** We are competitive scientifically. We have good capabilities that we can translate into international markets. But it’s a competitive market, and you must be on the ground to win deals. You also need proven solutions. The inability to point to domestic adoption partners can be a big obstacle to winning deals. For example, Indian companies will balk at the idea of investing \$500,000 - \$1 million in a pilot project when the technology is not yet proven.”

***“The regulatory environment is a big piece of it.*** If you want to drive adoption, you must force industry to reduce emissions. Unless there are long-term structural changes to their obligations, they will just nibble and play. The regulatory environment has to be both supportive of new technologies and ultimately drive incumbents to make significant changes in their operations. There are two kinds of regulatory concerns. First, you need a regulatory push to put cleantech on a level playing field with existing solutions, and then you need frameworks to fast-track new deployments.”

***“On the bioproduct side, we are seeking to move higher up the value chain.*** But volume is key for new products and materials. We need to be able to do stuff at scale for the economics to make sense, and unfortunately, a lot of the emerging bioproduct innovation has not been proven at scale. SDTC can help make the marriages with startups successful. We depend on the additional resources to help develop, validate and de-risk the technologies.”



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Building a cohort of global cleantech champions to anchor the ecosystem and initiate a virtuous circle of growth and reinvestment will take time. However, collective action by all interested stakeholders—including business accelerators, industry associations, investors, large companies, SMEs and federal government departments—can accelerate Canada’s transition to a low-carbon economy. Synthesizing the insights from sector leaders yields a list of ten key domains where policy action is warranted.

1. **Strengthen the capacity to create investment-ready companies** to ensure a robust pipeline of cleantech companies. Sector leaders recommend investing further in high-quality startup support services. Among other things, additional funding could allow BAIs to offer client companies startup capital, run demonstration projects, and hire the talent required to bring private sector expertise and discipline to the process of building new ventures around breakthrough science and technology. There were also appeals for improved benchmarking and for cleantech BAIs to share resources, coordinate activities and enable greater sub-sector specialization.
2. **Boost early-stage cleantech financing and angel investment** to support an expanding pipeline of startups. Several sector leaders recommend creating new seed-stage funds to diversify the pool of early-stage cleantech investors in Canada. Others are encouraging later-stage cleantech funds to invest earlier and direct more of their dollars to hard tech companies. In addition, there were calls to improve support for angel investment with a combination of tax incentives, deal syndication and investor education. Sector leaders would also like better visibility into angels and family offices willing to invest in cleantech ventures.
3. **Close the late-stage funding gap** to accelerate growth and stem the loss of potential multi-billion-dollar firms. Sector leaders appealed for a dedicated funding envelope to support later-stage venture and private equity capital funds in Canada that can invest alongside the larger US-based funds such as Blackrock and Breakthrough Energy Ventures. There were also calls for Canadian institutional and pension funds to co-invest in the more advanced Canadian companies, especially CAPEX-intensive companies that need large-scale project financing to deploy their solutions in Canada.
4. **Facilitate matchmaking between cleantech SMEs and corporates** by publicizing technology and decarbonization roadmaps, identifying connection points, validating solutions, and brokering partnerships. Several sector leaders suggested that Canada could deploy a direct-to-business financing mechanism to assist both the sellers and buyers of new technologies and solutions to overcome obstacles to commercialization and technology adoption. There were also calls for a matchmaking service to provide education, training, and support for structuring effective early adoption partnerships. A streamlined model of engagement, for example, could enable larger corporate entities to gain exposure to companies and investment opportunities across the country, rather than working bilaterally through individual BAIs. The government could organize and support such a service and deliver the programming through a national network of cleantech BAIs and VCs.



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5. **Increase support for large-scale demonstration projects** to create springboard opportunities for companies to raise capital and market their solutions domestically and internationally. Sector leaders recommend increasing matching funding for technology demonstration projects to encourage large industrial companies to come to the table as early adoption partners. In addition, there were calls to create shared testbed facilities in a few strategic areas to provide cleantech companies with the infrastructure and expertise to test, refine and verify the performance of new technologies. Sector leaders also recommend expanding public procurement of clean technologies, citing the extensive network of publicly-owned buildings, transportation fleets, ports and other infrastructure that will require retooling to meet greenhouse gas reduction goals.
6. **Build industry consortia to share the costs & risks of innovation** and accelerate the transition to clean growth by Canada's industrial sectors. Sector leaders see a role for the federal government to leverage its convening power to build new consortia projects that will fast-track the decarbonization of traditional sectors, integrate new technologies into industrial processes, and address long-standing productivity challenges. Executives are also calling for support for the creation of new value chains to bring advanced biomaterials and other cleantech solutions to market.
7. **Ensure that regulations, tax credits and funding programs are globally competitive** by working with ecosystem leaders to identify and remove barriers to adoption and commercialization and ensure that Canada maintains an attractive environment in which to host ambitious deployments of cleantech innovations. Sector leaders see a role for a national cleantech association to document industry innovation needs and gather input on how the government could modify policies, programs, and regulations to enhance the overall growth and success of the cleantech sector. Sector leaders specifically emphasized the need for an aggressive plan to deploy regulatory standards to accelerate adoption and pave the way for the deployment of low-carbon solutions and infrastructure. Sector leaders also called for more flexible or customizable solutions from government programs rather than one-size-fits-all solutions.
8. **Build a national cleantech data clearinghouse** to lower the search costs for VCs and corporates and increase visibility into cleantech solutions, companies, and pilot/demonstration projects across Canada. Specifically, sector leaders see value in a detailed database of cleantech companies that VCs and corporates could use to identify solutions and investment opportunities. Large corporates would also appreciate an up-to-date source of cleantech capabilities and foresee the potential to leverage a national platform to present problems and innovation needs and share insights from cleantech demonstration projects.



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9. **Launch ambitious innovation challenges with private buy-in** to incentivize the development of new technologies at several points along the innovation spectrum, from stimulating applied R&D to securing first sales and bringing new technologies to market. Sector leaders are calling for the Government of Canada to partner with large firms and industry associations to co-host challenges around a variety of high-priority technology needs in key sectors. In addition to a prize purse, stakeholders see the potential for corporate partners to agree to test, pilot and procure winning solutions that meet pre-defined criteria.
10. **Strengthen the Government of Canada's cleantech leadership** to ensure that key agencies have the competencies and sector insights to deliver value-added and effective solutions to their partners in the cleantech ecosystem. Most of the recommendations above highlight the need for a knowledgeable and competent "crack team" within the government with widely respected cleantech expertise and judgement. For example, deep sector expertise and credibility will be required to marshal and coordinate the activities of BAIs, convene new consortia projects, support the creation of demonstration projects and testbeds, launch national innovation challenges in partnership with industry, and fine-tune the delivery of bespoke solutions from government programs. To execute these functions effectively, the Government of Canada needs the right talent, including experienced individuals who speak the language of the private sector and have deep connectivity to key decision-makers in specific verticals and industry niches. Stakeholders suggested that cleantech policy and program delivery leaders can acquire these competencies through partnerships with sister agencies such as IRAP, BDC and EDC and with ecosystem participants, including BAIs and industry associations.

### Applying the Recommendations — Canada's Bioeconomy Sector as a Use Case

How could the proposals above be put into practice to help accelerate the growth and success of Canada's cleantech sector? Using the bioeconomy sector as an example, we can see how meaningful action on the priorities identified above would result in a more robust chain of support for cleantech ventures in Canada.

At the inception and startup phase, bioeconomy companies would benefit from specialized startup support services with a unique focus on helping entrepreneurs navigate the emerging bioindustrial landscape. However, as documented in this report, sector leaders argue that cleantech BAIs in Canada are generally under-resourced and understaffed to fulfill this mandate successfully. Indeed, most cleantech BAIs are run by generalists when companies need the nuanced advice and connectivity that only experts with deep, sector-specific knowledge can provide.



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A specialized bioeconomy accelerator, for example, could bring sector expertise and greater private-sector discipline to the process of building investment-ready companies. With adequate resources and the right approach, a world-class bioeconomy accelerator could shorten the timeline for getting new bio-based materials and energy sources to market. Doing so would also increase the probability that portfolio companies will secure the private sector financing required to reach scale.

Such an accelerator would need both the prestige and budget to recruit a roster of well-connected and highly experienced managers and advisers. It would need access to testbed infrastructure to enable companies to test and verify the performance of bio-based materials and processes. A panel of investors could help select and mentor the best candidates. A network of corporate partners could make their executives available to provide management expertise and industry know-how. When the time and strategic fit is right, corporate partners could also step forward to participate in large-scale demonstration projects.

Early-stage bioeconomy companies also need access to financing. While bioeconomy entrepreneurs routinely access non-dilutive funding from government agencies, this funding is rarely, if ever, adequate to cover the entire cost of bringing bio-based materials and fuels sources to market. Unfortunately, pre-revenue bioeconomy companies frequently report difficulties securing the private sector capital required to run large-scale pilots, build manufacturing facilities, and scale up operations to meet the demands of large commercial customers. Insufficient access to capital, in turn, undermines efforts to overcome these critical commercialization hurdles, placing pre-revenue bioeconomy companies in a catch-22.

Among the menu of recommendations presented above, several actions could help bioeconomy companies close the funding gap that has hampered their commercialization efforts. Consistent national tax incentives for angel investment, for example, could help bioeconomy companies attract untapped funding from wealthy individuals and family offices. Better capitalized cleantech venture funds in Canada, on the other hand, could afford to make deeper investments in capital-intensive ventures and accept the risks associated with commercializing novel materials and energy sources. Finally, a top-drawer matchmaking service could broker connections to domestic and international corporate investors with a strategic interest in diversifying into new markets through partnership with bioeconomy companies.

Regulatory modernization is another domain where government agencies can play a vital role in paving the way for a thriving bioeconomy sector. For example, bioeconomy companies often cite regulations targeting environmental contamination from petrochemical plastics as a significant factor underpinning the viability of fully compostable, non-toxic alternatives. However, as documented below, sector leaders also observe that Canada's patchwork of regulatory standards lags leading jurisdictions



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and often impedes cleantech adoption. A cross-jurisdictional team of knowledgeable sector experts could work with industry partners to identify regulatory barriers and fast-track the implementation of changes required to accelerate the deployment of greener, low-carbon solutions.

Finally, like most cleantech ventures in Canada, bioeconomy companies report that the domestic market provides inadequate opportunities for developers of innovative new technologies to test, refine, and scale their innovations. On the other hand, large industrial incumbents argue that demonstration projects are expensive and risky and are reticent to bear the costs of such projects alone. Larger corporates consulted by the DEEP Centre suggested that they would be less reluctant to partner with cleantech SMEs if mechanisms were available to share the costs of running demonstration projects.

Here again, there is a menu of options for governments to consider, including consortia projects, innovation challenges, and matching funding to help industry partners validate and de-risk new technologies. For example, the federal government could offer matching funding and leverage its convening power to support the creation of consortia focused on building the domestic value chains required to bring advanced biomaterials and biofuels to market. Like the Bio-Based Industries Consortium in Europe, such efforts could help companies demonstrate the viability of new technologies, develop the business models to bring complementary companies together into new value chains, and set up flagship production plants.

Alternatively, the Government of Canada could partner with large firms and industry associations in Canada to co-host challenges around a variety of high-priority technology needs in key sectors. For example, NRCAN could co-host an innovation challenge focused on bioenergy with Foresight Cleantech Accelerator, the Creative Destruction Lab - Rockies, and key players in the energy sector. In addition to a prize purse, corporate partners could agree to test, pilot, and procure winning solutions that met pre-defined criteria. Other prizes could include rewards such as executive mentoring, the opportunity to secure media exposure, and access to additional resources that are otherwise not available publicly.

Taken together, these and other recommendations provide a well-rounded set of supports for enhancing the success of Canada's bioeconomy sector. Although the focus here is on bioenergy and biomaterials, policymakers could apply the same actions to cleantech verticals such as renewable energy and sustainable mobility.



## 2. Introduction

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### Organization of the Report

The remainder of the report consists of three chapters.

- **Chapter 3** develops a taxonomy of cleantech companies and provides an overview of investment activity in the cleantech sector between 2016 and 2020. Among other things, we analyze total funding by investment types, verticals, regions and company growth stages.
- **Chapter 4** summarizes key findings from a series of 36 executive interviews, including an assessment of the current health of Canada's cleantech ecosystem, the intricacies of cleantech financing, and the unique challenges bioeconomy companies face in accessing investment capital.
- **Chapter 5** summarizes our conclusions and provides detailed recommendations to enhance the growth and success of the advanced bioeconomy and the broader cleantech sector.





### 3. Cleantech Investment Analysis

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For the cleantech investment analysis, we examine the publicly disclosed Canadian cleantech funding transactions completed between 2016 and 2020 using the official data records of the Canadian Venture Capital and Private Equity Association (CVCA). The initial sample included more than 700 public and private grants, venture investments, debt financings, private equity deals, and mergers and acquisitions.

Before proceeding with the analysis, the DEEP Centre verified the transaction records and removed transactions for US-based companies, yielding 526 transactions for Canadian cleantech companies. Where possible, we filled in missing fields and added the sector, industry, and cleantech vertical classifications to the transaction records.

In the following analysis, we use various techniques to analyze the cleantech funding transactions completed between 2016 and 2020. These include an analysis of total funding by investment type and year over the five years, total funding by industry and vertical, total funding by province and city, and funding by company growth stage. We also take a closer look at the two most important investment types for earlier-stage cleantech companies: public grants and venture capital investments.

#### The Population of Cleantech Companies Funded Between 2016 and 2020

As a starting point for our analysis of the investment landscape, the DEEP Centre built a database of all Canadian cleantech companies that have recorded a financing transaction between 2016 and 2020, with a total population of 223 companies. The DEEP Centre subsequently verified all company records, filled in missing fields, and added industry and vertical classifications to enrich the analysis potential.

We sourced the industry classifications from the MSCI Global Industry Classification Standard (GICS).<sup>5</sup> The investment industry, including the S&P Dow Jones Indices, uses the GICS to assign sector and industry classifications to companies that have issued equity securities.<sup>6</sup> In Table 1, we provide brief definitions for the sectors and industries represented in the population of 223 cleantech firms.



### 3. Cleantech Investment Analysis

Table 1: Sector and Industry Descriptions

Sectors & Industries	Description	Company Count
<b>Consumer Discretionary</b>	Companies producing discretionary consumer products and luxury goods that are not necessary for survival.	<b>6</b>
Automobiles & Components	Manufacturers of passenger automobiles and automobile parts and components.	4
Household Durables	Manufacturers of household appliances, home furnishings and consumer electronics.	2
<b>Consumer Staples</b>	Companies producing the necessities of life, including agricultural products and processed foods & beverages.	<b>5</b>
Agricultural Products	Producers of agricultural products, including crop growers and food processors.	5
<b>Energy</b>	Companies that discover, extract, refine and market oil, gas and other consumable fuels.	<b>19</b>
Energy Equipment & Services	Providers of supplies, equipment and services to oil and gas companies.	8
Oil, Gas & Consumable Fuels	Companies engaged in the refining and marketing of oil, gas and other consumable fuels.	11
<b>Industrials</b>	Companies engaged in transportation, commercial services and the manufacturing of capital goods.	<b>99</b>
Building Products	Manufacturers of building components and home improvement products and equipment.	2
Electrical Equipment	Producers of electrical components or equipment, including power-generating equipment.	28
Environmental & Facilities Services	Companies providing environmental services, including waste management and pollution control.	42
Machinery	Manufacturers of industrial machinery and components, including heavy trucks & farm machinery.	20
Professional Services	Companies providing business support services, including consulting and research services.	7

Table 1: Continued Next Page



### 3. Cleantech Investment Analysis

Table 1: Continued

<b>Information Technology</b>	Companies that develop or distribute technological items or services.	<b>47</b>
Semiconductors	Manufacturers of semiconductors, including the raw materials and equipment for the solar power industry	5
Software & Services	Companies producing software, applications and IT services for the business or consumer market.	31
Technology Hardware & Equipment	Manufacturers of communications equipment, technology hardware and electronic components.	11
<b>Materials</b>	Companies that provide the raw materials needed for other sectors to function.	<b>34</b>
Chemicals	Manufacturers of a diversified range of chemicals and chemical products.	22
Construction Materials	Manufacturers of construction materials, including aggregates, cement and bricks.	2
Containers & Packaging	Manufacturers of metal, glass, plastic, paper or cardboard containers and packaging.	4
Metals & Mining	Companies engaged in the diversified production or extraction of metals and minerals.	2
Paper & Forest Products	Manufacturers of timber, related wood products and paper products.	4
<b>Utilities</b>	Companies that generate and distribute electricity, water & gas to residential and commercial customers.	<b>13</b>
Independent Power Producers	Companies that engage in the generation and distribution of electricity.	13
<b>Grand Total</b>		<b>223</b>



### 3. Cleantech Investment Analysis

Table 2: Description of Cleantech Verticals

Cleantech Verticals	Description	Count
Agtech	Producers of technologies and solutions for improving yield, efficiency, and profitability in agriculture.	16
BioEnergy	Producers of liquid biofuels, energy from biomass and the equipment for converting biomass to energy or fuels.	11
BioProducts	Producers of products, materials and chemicals from renewable biological resources.	17
Carbon Capture	Producers of technologies and solutions to capture and store carbon dioxide.	3
Energy Efficiency	Producers of technologies and solutions to reduce the energy intensity of industrial processes.	18
Energy Management & Analytics	Producers of technologies and solutions to analyze and manage commercial and residential energy usage.	7
Energy Storage	Producers of solutions to capture and store energy for future use, including battery, flywheel and fuel cell manufacturers.	16
Environmental Consulting	Providers of consulting, advisory and technical services related to a broad range of environmental specialties.	6
Environmental Monitoring	Producers of technologies and solutions to monitor air, water and soil quality and other environmental indicators.	9
Environmental Remediation	Companies providing services and solutions to remove pollution or contaminants from environmental media such as soil, groundwater, sediment, or surface water.	6
Renewable Energy	Producers of energy from renewable sources, including companies supplying technologies & solutions for renewable energy producers.	34

Table 2: Continued Next Page



### 3. Cleantech Investment Analysis

Table 2: Continued

Smart Cities & Buildings	Producers of technologies and solutions to enable urban sustainability, including building automation solutions.	5
Smart Grids	Producers of technologies and solutions to make energy grids more intelligent, efficient and resilient.	5
Sustainable Mobility	Producers of technologies and solutions to enable low-carbon transport options for people and goods, including EVs, ride-sharing, traffic monitoring and mass-transit electrification.	8
Upcycling	Producers of technologies and solutions to transform non-organic byproducts and waste materials into new products or materials.	7
Waste Management & Recycling	Companies that collect, transport, recycle and dispose of waste, including producers of technologies for waste management.	34
Water & Wastewater Management	Companies that provide water management services, including producers of technologies and solutions for water treatment.	21
<b>Grand Total</b>		<b>223</b>

Another way to classify companies is to identify the specialized vertical market or niche they occupy. Verticals describe groups of companies that focus on a shared niche or a specialized market. Verticals are also helpful in describing companies that develop and market emerging technologies that do not necessarily align with traditional industry definitions. In the broader universe of emerging technologies, analysts typically include cleantech as one of many verticals alongside others like fintech, nanotech, edtech, e-commerce and 3D printing. However, for greater precision in our classifications, the DEEP Centre devised 17 specialized cleantech verticals, which enabled a more granular analysis of the population of cleantech companies and the allocation of investment dollars. We provide brief descriptions of each vertical in Table 2 (above).

#### Total Funding and Deal Count Analysis

To analyze total funding and deal counts, we looked at the aggregate deal counts and total funding amounts for the primary investment types over the five years between 2016 and 2020.



### 3. Cleantech Investment Analysis

#### Total funding by investment type and year

Canadian cleantech companies collectively raised a total of \$4.1B over five years. Venture investments represent the most significant share of financing at \$1.4B over five years. Debt and private equity (PE) financing represent nearly \$1.2B, respectively, despite the comparatively small deal count. Public grants for cleantech companies totalled \$288 million over five years.

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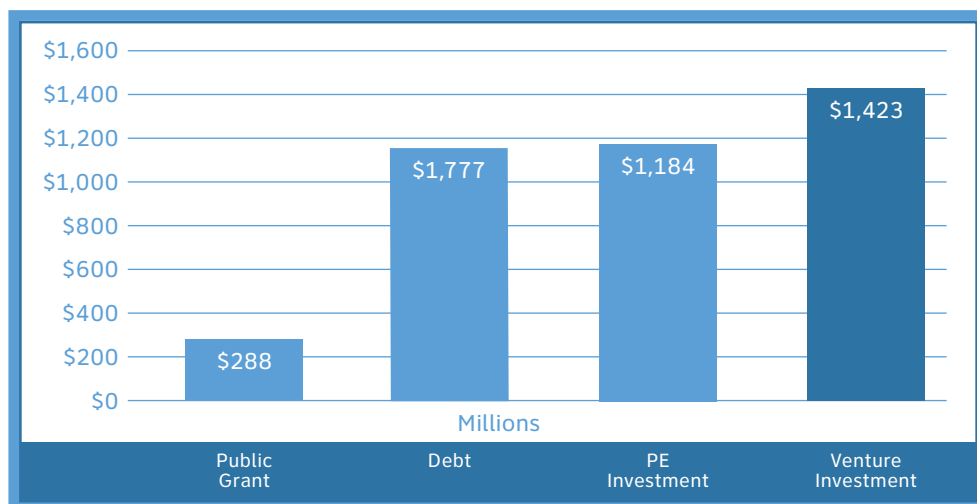
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Chart 1: Total Funding for Canadian Cleantech Companies, 2016 – 2020

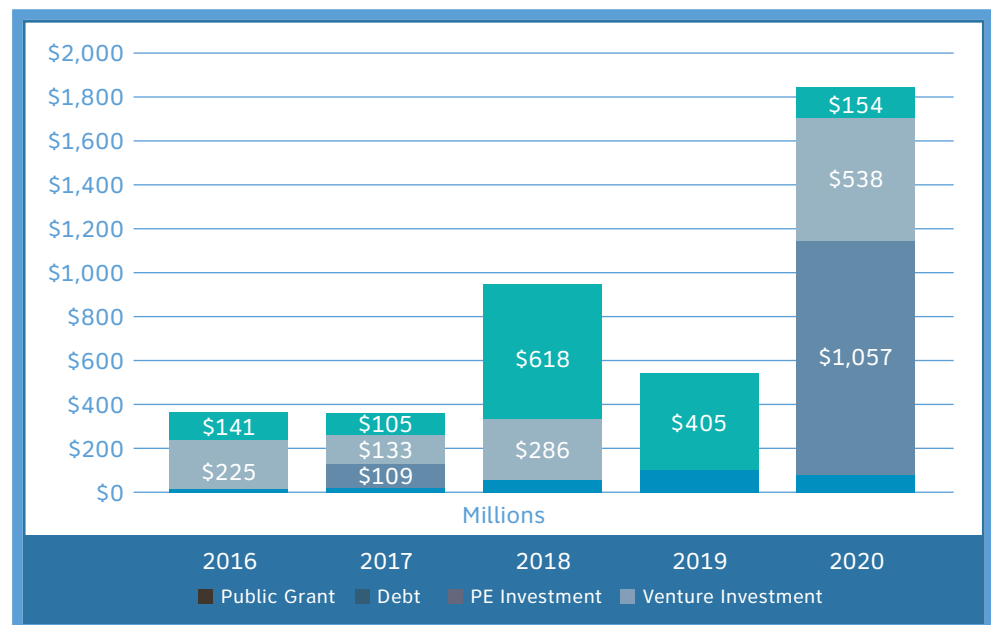




### 3. Cleantech Investment Analysis

In chart 2, we look at total funding across the four main investment types by year. Here we see that there were \$1.8B in cleantech deals in 2020, almost double the \$953 million raised in 2018. However, 88% of the 2020 total comes from a small number of substantial debt and PE deals. 2018 was the peak year for cleantech venture financing, with \$618 million in funding. This figure represents a six-fold increase from 2017. While venture funding declines in the subsequent years, the 2020 aggregate venture funding of \$154 million exceeds the 2016 and 2017 totals.

Chart 2: Total Cleantech Funding by Year, 2016 – 2020



#### Deal count by year and investment type

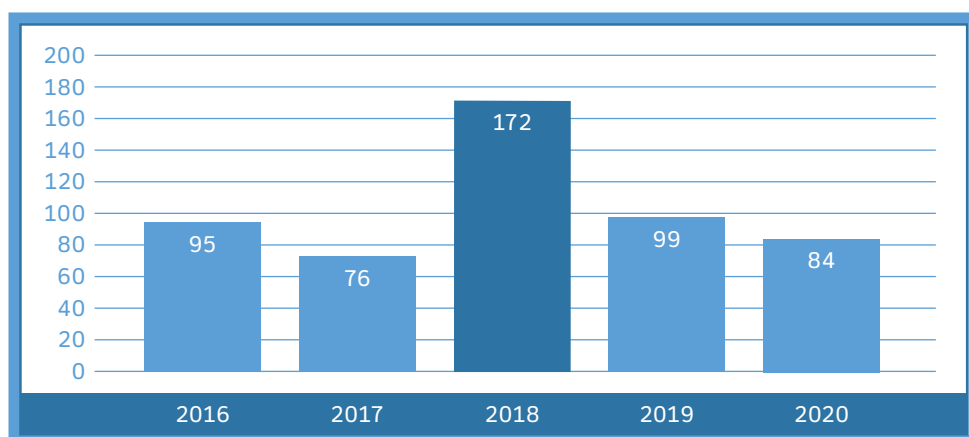
In the analysis of deal counts, we look at the total number of transactions completed for a given year, organized by particular investment types. Chart 3 shows that 2018 was the top year for cleantech deals, with 172 deals concluded. The deal count tapers off in 2019 and 2020.





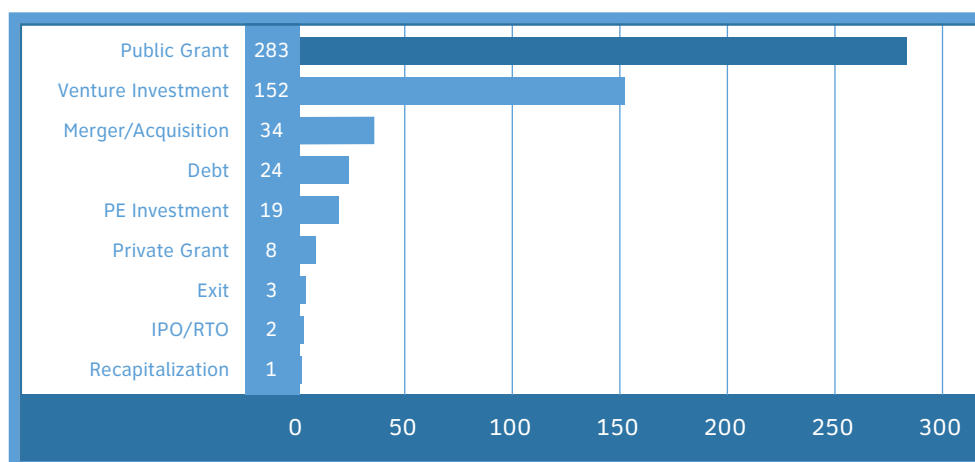
### 3. Cleantech Investment Analysis

Chart 3: Cleantech Deals by Year, 2016 – 2020



Shifting to deal counts by investment types (chart 4), we find that public grants represent the most common investment type for cleantech companies with 283 deals, followed by venture investments (152), debt (24) and PE (19).

Chart 4: Cleantech Transactions by Activity Type, 2016 – 2020



#### Private equity and debt deals

With a detailed venture deal analysis presented below, it is worth offering a few observations about the PE and debt deals for cleantech companies. First, PE and debt financing went to only 21 companies (see Table 3). Second, at a total of \$2.4B, the 43 PE and debt transactions constitute over half of all cleantech funding between 2016 and 2020. Third, half of the PE and debt total, in turn, went to GFL Environmental, a waste management firm that used the proceeds to roll up a series of smaller companies into a larger entity. Finally, renewable energy firms were the other significant recipients of PE and debt funding, with Amp Solar, Canadian Solar and Potentia Renewables striking \$100+ million deals.



### 3. Cleantech Investment Analysis

Table 3: Private Equity and Debt Deals for Cleantech Companies, 2016 – 2020

Cleantech Verticals & Companies	Debt	PE Investment	Grand Total
<b>Energy Management &amp; Analytics</b>	\$1,250,000		\$1,250,000
Parity	\$1,250,000		\$1,250,000
<b>Agtech</b>	\$1,500,000	\$10,000,000	\$11,500,000
EarthRenew Corporation		\$10,000,000	\$10,000,000
Enterra Feed Corporation	\$1,500,000		\$1,500,000
<b>Water &amp; Wastewater Management</b>	\$3,942,600	\$33,763,600	\$37,706,200
Aquam Corporation		\$33,763,600	\$33,763,600
Ostara Nutrient Recovery	\$3,942,600		\$3,942,600
<b>BioProducts</b>		\$99,600,000	\$99,600,000
Kruger Inc.		\$99,600,000	\$99,600,000
<b>Upcycling</b>		\$151,000,000	\$151,000,000
Alliance Magnesium		\$151,000,000	\$151,000,000
<b>Renewable Energy</b>	\$159,220,500	\$550,690,000	\$709,910,500
Amp Solar Group		\$200,000,000	\$200,000,000
Canadian Solar		\$348,790,000	\$348,790,000
Clear Blue Technologies	\$6,000,000		\$6,000,000
Clir Renewables		\$1,900,000	\$1,900,000
Polaris Infrastructure Inc.	\$36,220,500		\$36,220,500
Potentia Renewables Inc.	\$107,000,000		\$107,000,000
Xebec	\$10,000,000		\$10,000,000
<b>Waste Management &amp; Recycling</b>	\$1,008,625,000	\$339,065,000	\$1,347,690,000
Arrowhead Environmental Partners		\$13,415,000	\$13,415,000
Bouffard Sanitaire inc.	\$300,000	\$10,200,000	\$10,500,000
Conteneurs Verts Inc.	\$2,200,000		\$2,200,000
EBI Operations Inc		\$70,000,000	\$70,000,000
Environmental 360 Solutions Inc.		\$15,000,000	\$15,000,000
GFL Environmental	\$1,006,125,000	\$225,000,000	\$1,231,125,000
White Swan Environmental Ltd.		\$5,450,000	\$5,450,000
<b>Grand Total</b>	<b>\$1,174,538,100</b>	<b>\$1,184,118,600</b>	<b>\$2,358,656,700</b>



### 3. Cleantech Investment Analysis

#### Cleantech Venture Deal Analysis

For the cleantech venture deal analysis, we examine the subset of cleantech 152 venture deals concluded between 2016 and 2020 with 87 unique companies. Taking the large PE and debt deals out of the picture helps portray a more balanced representation of early-stage funding for cleantech companies. The PE deals are relatively few (just 19 out of 526 transactions), involve significant sums, and overwhelmingly direct financing to large established businesses rather than startups or scaleups.

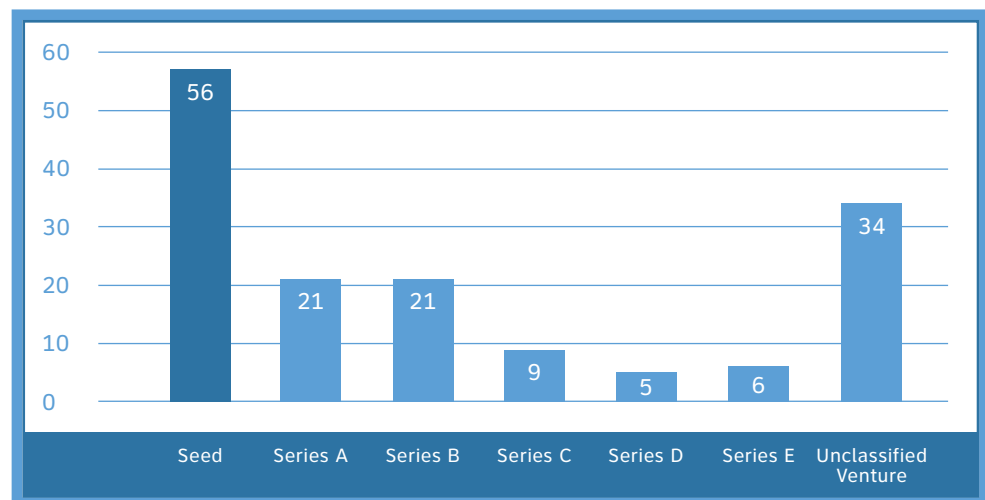
The venture deal analysis focuses on the aggregate deal count and funding amounts across the 2016 – 2020 period. We also disaggregate the venture deals by round to assess the amount of funding cleantech companies are raising at different stages of maturity. Finally, we examine the distribution of venture financing across industry and vertical classifications. We also look at shifting investor priorities over the 2016 – 2020 period with an analysis of the top five deals and verticals in each of the five years.

#### Venture deal count and funding by round

Chart 5 looks at the total number of venture deals by round concluded in the 2016 – 2020 period. As expected, most of the deals are at the seed stage (56 deals), followed by 21 Series A and 21 Series B deals and a smaller number of late-stage deals. 34 of the 152 venture deals were not classified by round. However, judging by the total amount of unclassified venture funding (chart 7) and the individual transactions in the database, we assume that about half of the 34 deals were series A+.

In chart 6, we examine the distribution of deals by round and by year. Here we see that the venture deal count resembles the total deal count across all investment types seen in chart 9. 2018 was the top year for cleantech venture deals with 41 deals concluded. However, the deal count tapers off in 2019 and 2020, with the 25 deals in 2020 representing the smallest number since 2016, which also saw 25 venture deals.

Chart 5: Cleantech Venture Round Counts, 2016 – 2020





### 3. Cleantech Investment Analysis

Chart 6: Cleantech Venture Round Counts by Year, 2016 – 2020

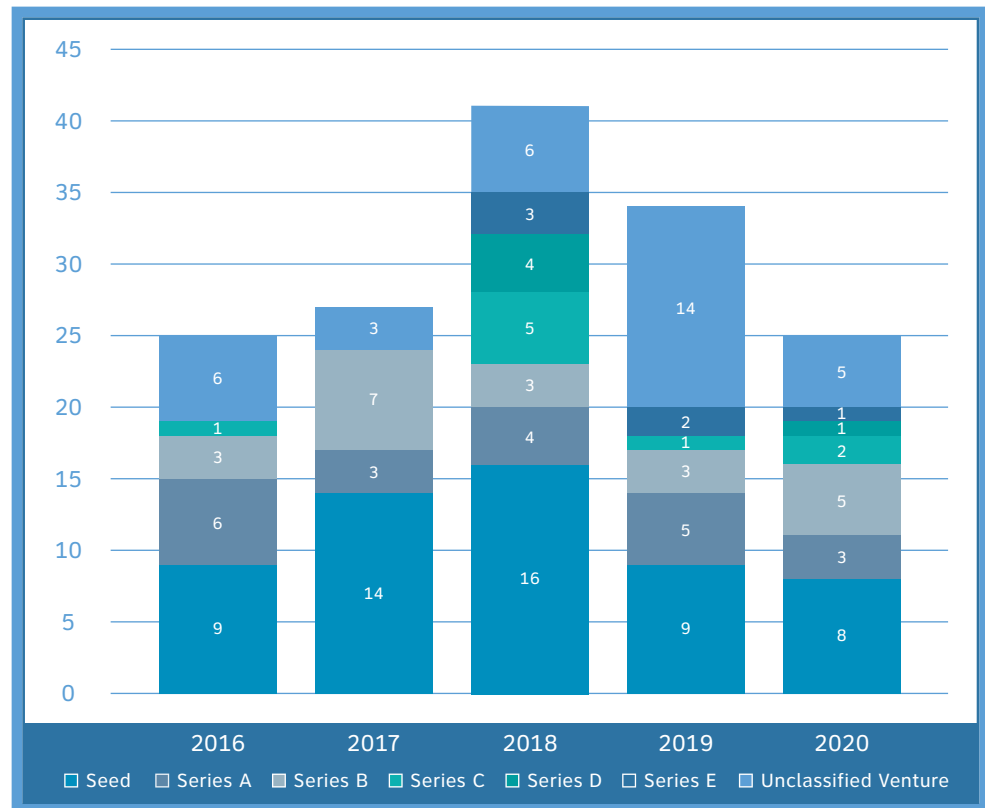
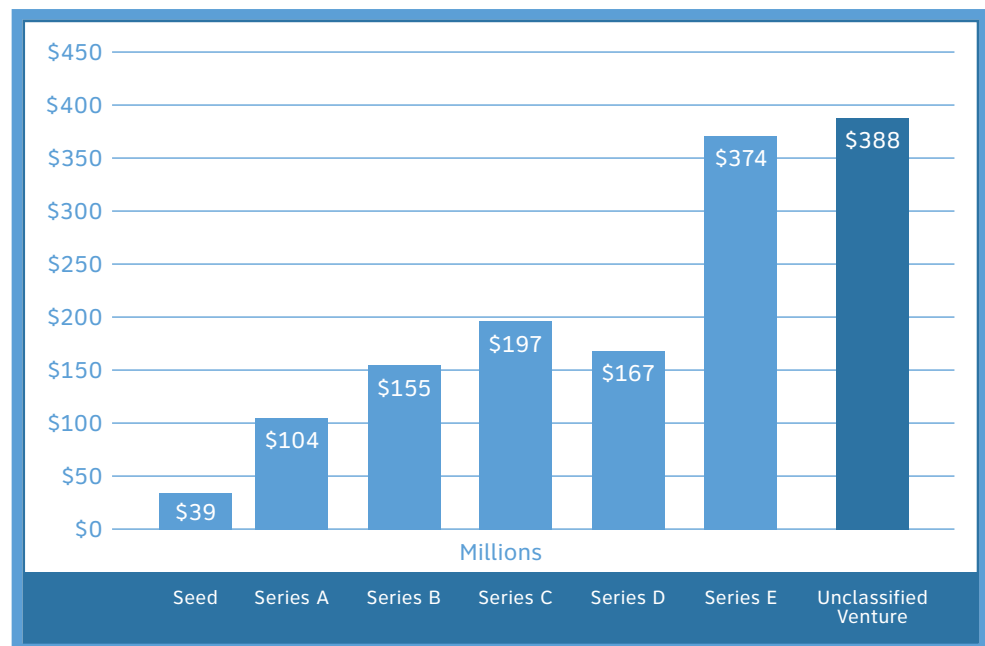


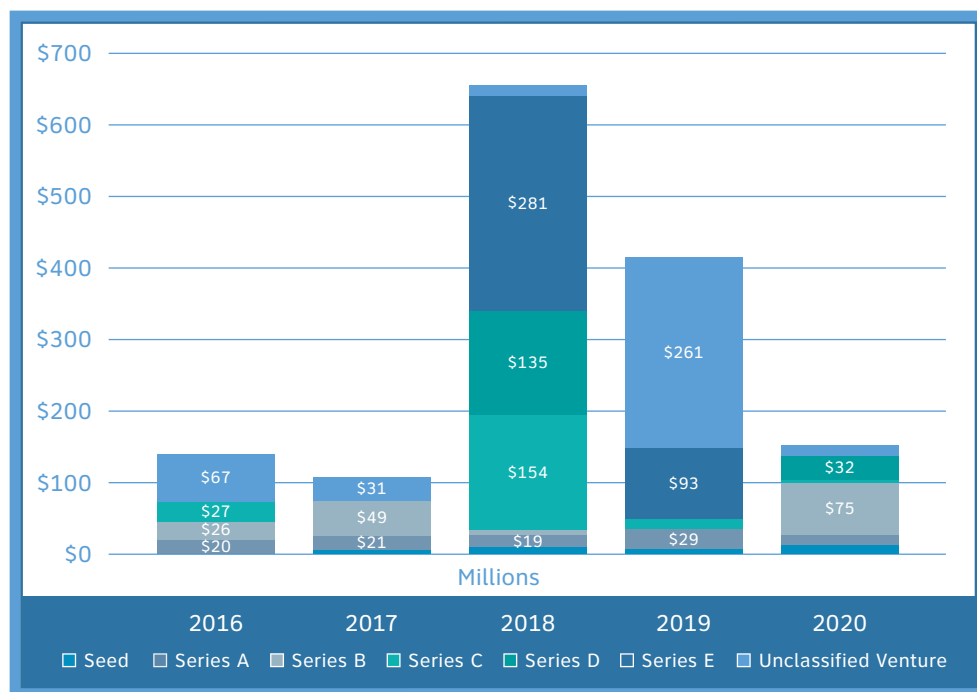
Chart 7: Cleantech Venture Funding by Round, 2016 – 2020





### 3. Cleantech Investment Analysis

Chart 8: Cleantech Venture Funding by Round and Year, 2016 – 2020



In charts 7 and 8 (above), we look at the total amount of venture funding by round and year. There are no surprises in the total venture funding by round, with the aggregate amount over five years generally increasing in the later stage deals. We can attribute the record total venture funding for 2018 to several large late-stage venture deals (specifically, late-stage deals for ecobee, Enerkem and Stem). In 2019, we saw a significant amount of ‘unclassified venture’ funding. Series A deals were consistent between 2016 and 2020, ranging between \$15 and \$30 million in total each year.

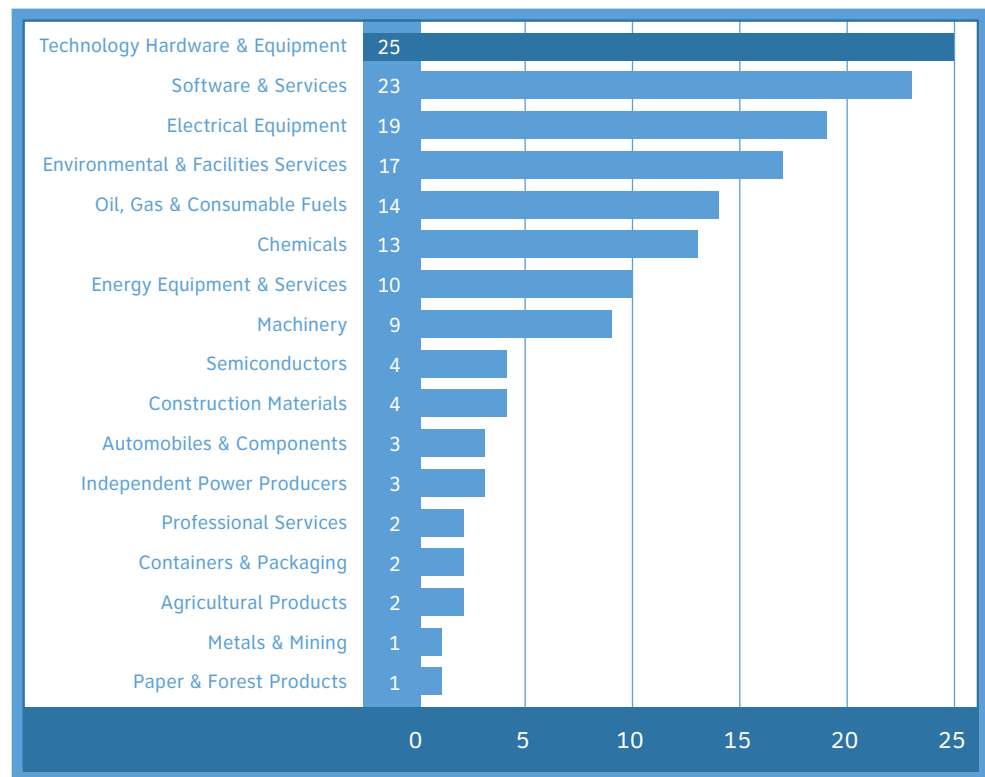
#### Venture funding by industry

Chart 9 displays the total deal count by industry over the five years. The industries with the highest deal counts include ‘Technology Hardware and Equipment’ (25 deals), ‘Software and Services’ (23 deals), and ‘Electrical Equipment’ (19 deals). Examining the individual transactions, we see venture deals for hardware companies that develop smart home devices, environmental sensors, and robotics. In the software industry classification, we see deals for companies that develop solutions for smart cities, smart grids, energy management and analytics, sustainable mobility, environmental monitoring, and agriculture.



### 3. Cleantech Investment Analysis

Chart 9: **Cleantech Venture Deal Count by Industry, 2016 – 2020**

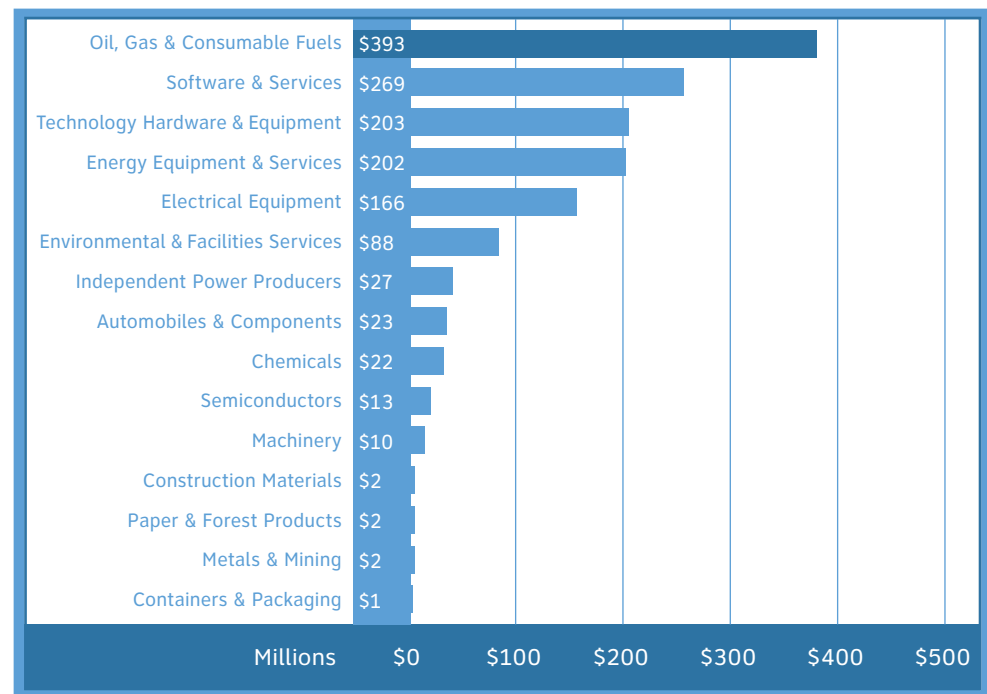


Shifting to total funding raised across industries (chart 10), we find that the ‘Oil, Gas and Consumable Fuels’ industry ranks 1st with just under \$400 million in venture funding thanks to several large venture deals for Enerkem, the Quebec-based refiner of bio-based fuels. Software deals rank 2nd, with large deals for Stem, an AI-enabled energy storage and energy management provider (\$104m), Minesense’s AI-enabled mining efficiency solutions (\$77m), and GHGSat, an emissions-tracking data platform (\$43m). Technology hardware comes in 3rd with the most notable transactions involving Toronto-based intelligent home device company, ecobee, which raised over \$172m in a series of deals.



### 3. Cleantech Investment Analysis

Chart 10: Cleantech Venture Funding by Industry, 2016 – 2020



#### Venture funding by vertical

Looking at the same set of venture funding deals by vertical (chart 11) highlights the prominence of energy-related plays. Here again, we see the series of significant financings for Enkern, which secured \$367 million over four venture rounds between 2016 and 2020. Firms in the energy management & analytics vertical rank 2nd with \$231 million in venture funding, while renewable energy firms rank third with \$160 million in VC funding over five years. Finally, energy efficiency and energy storage firms rank 4th and 6th with \$141 million and \$110 million in total venture funding, respectively. Collectively, these top energy-related verticals account for 73% of the \$1.4B in venture funding between 2016 and 2020. Interestingly, only two of the 34 companies that secured deals in these verticals have anything to do with Canada's traditional energy sector, the oil and gas industry.

Finally, we were interested in identifying any discernible shifts in investor priorities during the 2016 – 2020 period. In other words, did the allocation of venture funding among verticals remain consistent, or did verticals fall in and out of favour? To shed light on this question, chart 12 ranks the top five verticals by year. Table 4 below lists the top 5 venture deals each year and corresponds closely to the vertical rankings. Looking at the vertical rankings and big deals, we see an anomaly and some evidence of consistency in venture deal-making. The anomaly is the large Enkern deal in 2018 and the follow-on investment in 2019. Apart from Enkern and a smaller transaction for Airex Energy, the BioEnergy vertical has not attracted consistent funding from venture capital firms.





### 3. Cleantech Investment Analysis

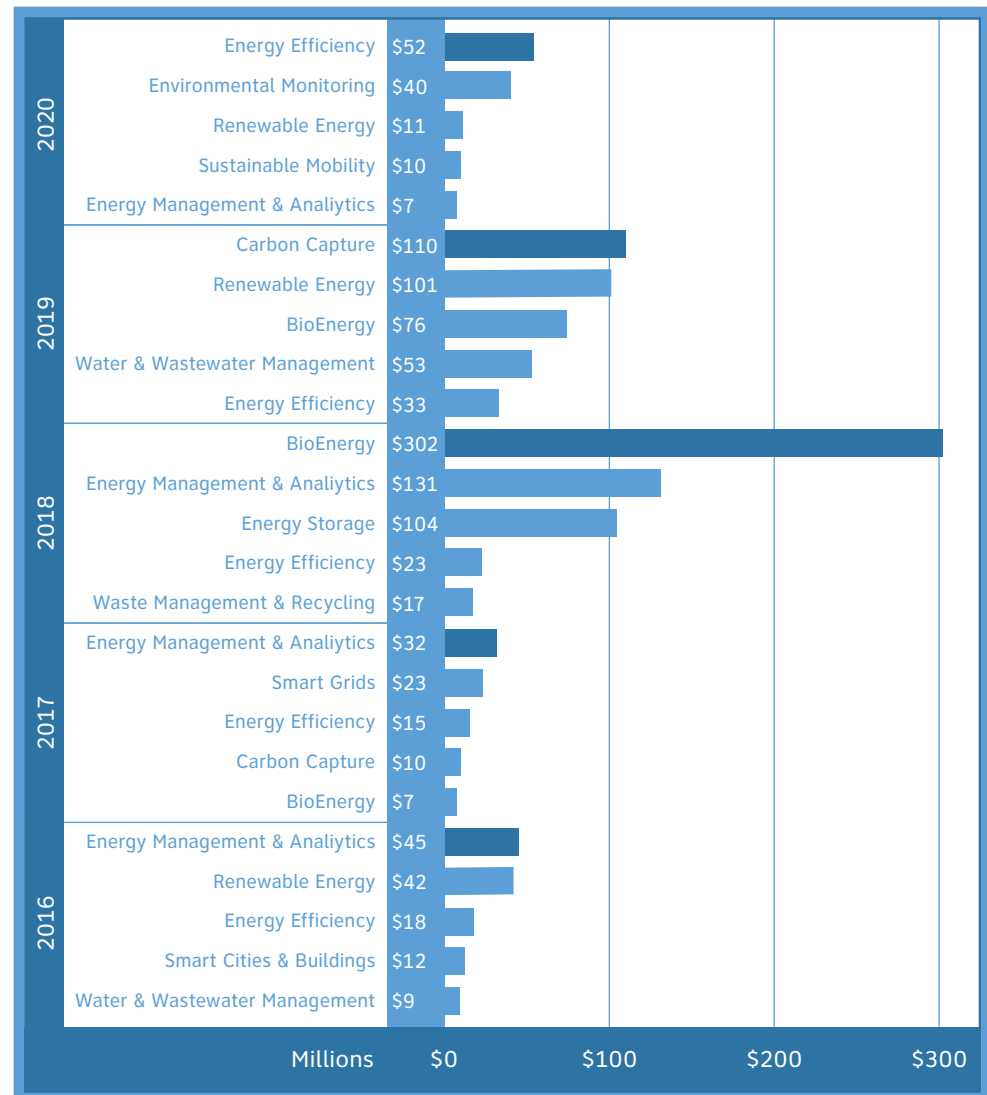
Chart 11: Clean tech Venture Funding by Vertical, 2016 – 2020





### 3. Cleantech Investment Analysis

Chart 12: Venture Funding for the Top 5 Cleantech Verticals by Year





### 3. Cleantech Investment Analysis

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In terms of consistency, significant investment dollars have been flowing into firms that build digital solutions for analyzing energy consumption and increasing the energy efficiency of industrial operations. Firms in the 'Energy Efficiency' vertical, for example, were consistently successful in raising VC dollars in each of the five years between 2016 and 2020. As shown in Table 4, the big deals include three large rounds for MineSense and two deals for Ambyint, a developer of digital solutions for optimizing oil production. There is also one large deal for Valent Low-Carbon, which provides technology solutions to reduce the energy intensity of fuel production. Firms in the 'Energy Management & Analytics' and 'Renewable Energy' verticals raised big rounds in three of the five years (notably ecobee, Stem and Power Survey in the former and Eavor, General Fusion, BBOX and Morgan Solar in the latter). Developers of Carbon Capture technologies (Carbon Engineering and Svante) were among the top five deals in three of the five years, but the broader vertical was only in the top 5 in 2017 and 2019.

As discussed further in the executive interview findings, VCs like energy efficiency and energy management plays because they are CAPEX-light and typically offer a more predictable path to short-term returns. In addition, the investment focus on energy efficiency and energy management also fits with the findings from the DEEP Centre's research on clean technology adoption by large industrial firms in Canada.<sup>7</sup> In a 2016 survey of 72 firms (the majority of which are engaged in manufacturing, power generation, mining and oil and gas extraction), we found that investments in energy efficiency were the most common, with 81% of companies surveyed reporting investments in this area. We also found that lowering operating costs was the principal motivation for most investments in clean technologies. At the same time, the most frequently cited environmental benefits of cleantech adoption were lower GHG emissions (83%) and increased energy efficiency (71%). Finally, firms identified higher than expected costs associated with cleantech solutions as the number one implementation challenge, with 74% of the sample indicated that the high costs of cleantech solutions are also the primary barrier to future investment.

In short, large industrial firms invest in energy efficiency solutions because efficiency measures can significantly reduce operating costs. Savvy entrepreneurs and investors honed in on the growing demand for energy efficiency solutions, along with the tools to measure and analyze energy consumption.



### 3. Cleantech Investment Analysis

Table 4: Top Five Venture Deals by Year

Top 5 Venture Deals by Year	Vertical	Sum of CAD Funding
<b>2020</b>		<b>\$113,275,000</b>
GHGSat	Environmental Monitoring	\$39,500,000
MineSense Technologies Ltd.	Energy Efficiency	\$32,475,000
Ambyint Inc.	Energy Efficiency	\$19,900,000
Eavor Technologies Inc	Renewable Energy	\$11,400,000
Effenco	Sustainable Mobility	\$10,000,000
<b>2019</b>		<b>\$319,267,450</b>
Carbon Engineering Ltd.	Carbon Capture	\$90,229,200
General Fusion Inc.	Renewable Energy	\$86,248,500
Enerkem	BioEnergy	\$76,300,000
Ostara Nutrient Recovery	Water Management	\$36,489,750
Valent Low-Carbon Technologies	Energy Efficiency	\$30,000,000
<b>2018</b>		<b>\$559,131,300</b>
Enerkem	BioEnergy	\$290,900,000
ecobee	Energy Management & Analytics	\$127,000,000
Stem	Energy Management & Analytics	\$103,656,000
MineSense Technologies Ltd.	Energy Efficiency	\$23,322,600
Svante Inc.	Carbon Capture	\$14,252,700
<b>2017</b>		<b>\$86,175,800</b>
Power Survey	Energy Management & Analytics	\$31,166,400
Enbala Power Networks	Smart Grids	\$22,725,500
Ambyint Inc.	Energy Efficiency	\$14,933,900
Svante Inc.	Carbon Capture	\$10,000,000
Airex Energy Inc.	BioEnergy	\$7,350,000

Table 4 Continued Next Page



### 3. Cleantech Investment Analysis

Table 4: Continued

2016		\$110,910,025
ecobee	Energy Management & Analytics	\$45,000,000
BBOXX	Renewable Energy	\$26,500,000
MineSense Technologies Ltd.	Energy Efficiency	\$17,910,025
Encycle	Smart Cities & Buildings	\$11,500,000
Morgan Solar Inc.	Renewable Energy	\$10,000,000
Grand Total		\$1,188,759,575

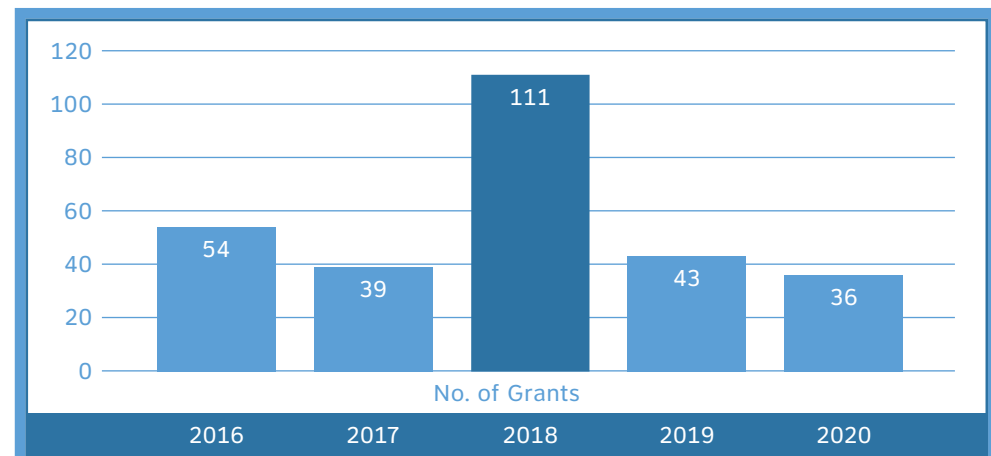
#### Public Grant Analysis

For the analysis of public grants, we examine the subset of 283 public grants issued between 2016 and 2020. Our research focuses on the deal count and amount of public funding by company growth stage between 2016 and 2020. We also examine the distribution of public funding across cleantech verticals. We should note that while the Hockeystick database captures many public grants, it is not clear whether its data is exhaustive of all public grants issued to cleantech companies in Canada.

#### Public grant count and funding by year

In our analysis of public grants, we found 133 unique companies that successfully secured grant funding. Eighty-seven of these companies have yet to raise a venture round, suggesting that public funding is vital to their survival. As with previous analyses, we see that 2018 was the top year for cleantech public grants, with 111 deals concluded. But, again, the deal count tapers off in 2019 and 2020, with the 36 deals in 2020 representing the smallest number over five years.

Chart 13: Public Grant Count for Cleantech Companies, 2016 – 2020





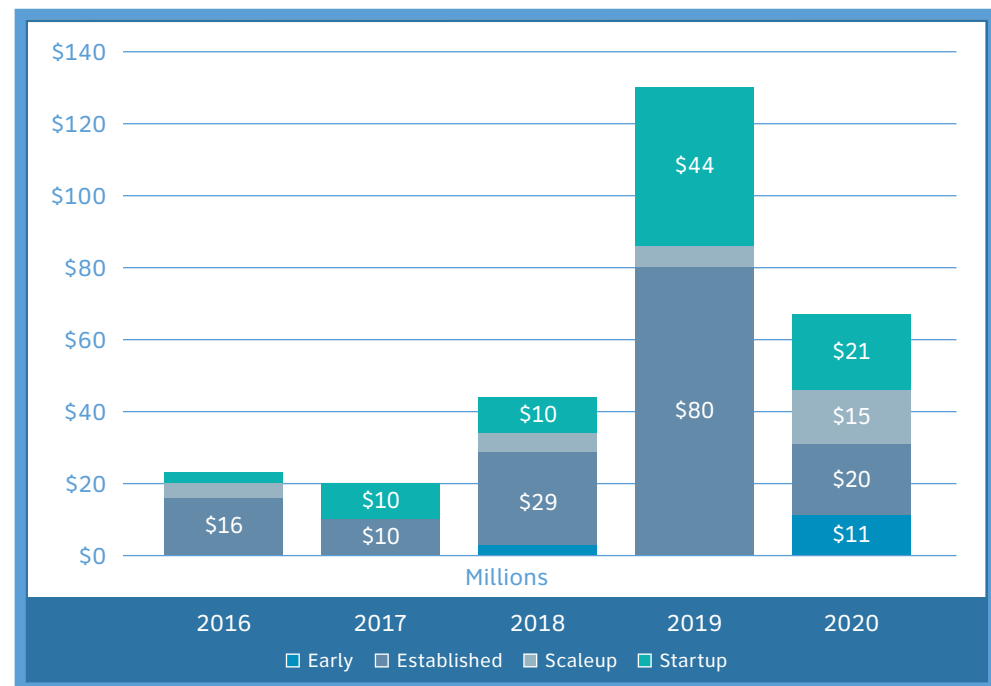
### 3. Cleantech Investment Analysis

Although the deal count was substantially higher in 2018, in chart 14, we see that 2019 was the peak year for grant funding by dollar amount with a total of \$130 million. This figure represents an almost three-fold increase over 2018 and is more than five times the amount issued in 2016 and 2017. Significant grants from the Strategic Innovation Fund (SIF) for General Fusion (\$50 million), Carbon Engineering (\$25 million) and Krueger (\$14 million) help explain the significant funding total for 2019. In aggregate, there was \$134 million in grant funding for early-stage companies, startups and scale-ups, and \$153 million for established cleantech companies.

#### Public grants by vertical

With \$83 million in total grant funding, firms in the 'Renewable Energy' vertical received significantly more public funding than any other vertical. Large grants for General Fusion, Canadian Solar and Eavor make up 88% of Canada's public funding for renewable energy companies. The renewable energy funding is more than double that allocated to bioproduct and carbon capture firms, which take 2nd and 3rd place, respectively.

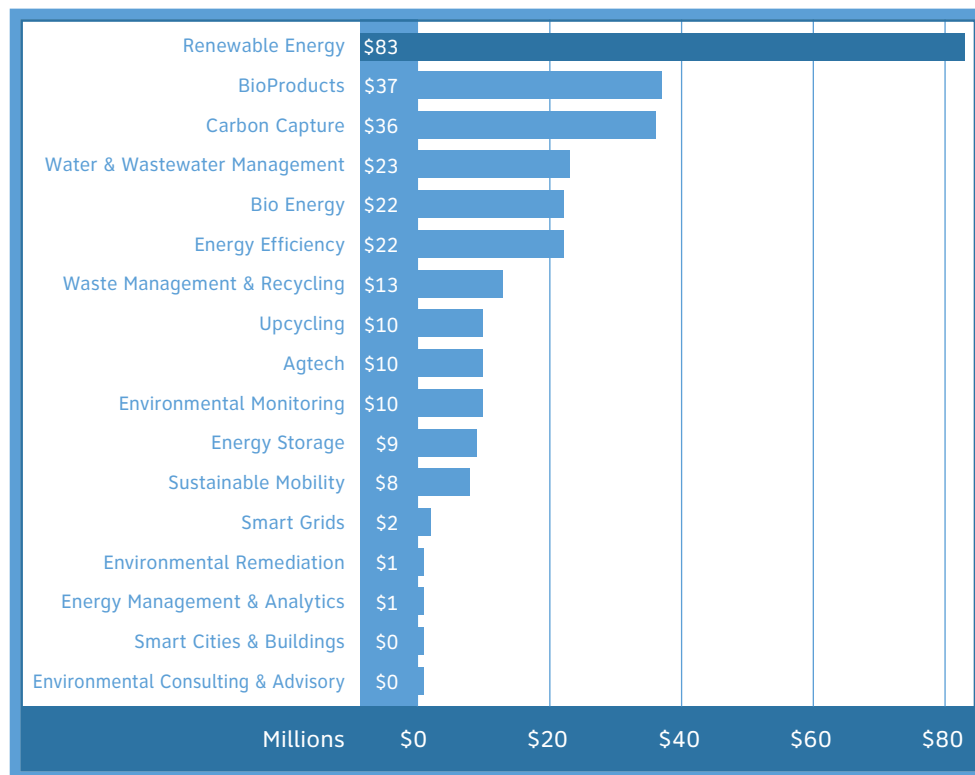
Chart 14: **Public Grant Funding for Cleantech Companies by Growth Stage, 2016 – 2020**





### 3. Cleantech Investment Analysis

Chart 15: Public Grant Funding for Cleantech Companies by Vertical, 2016 – 2020



#### Company Stage Analysis

For the company stage analysis, we examine a subset of 435 transactions, including 283 public grants and 152 venture deals between 2016 and 2020. We excluded the 19 PE deals knowing that most large PE deals are for established companies. The analysis focuses on the deal count and aggregate funding amounts by company stage for the entire 2016 – 2020 period. We also disaggregate the venture funding by round and company stage.

It is worth noting that investors record the 'company stage' field in the transaction records at the time of financing. Company stage classifications for deals concluded in 2016 could be out of date by 2021. Where possible, the DEEP Centre updated (or added) company stage entries for 223 companies in the database based on company birth years and a brief review of company websites.

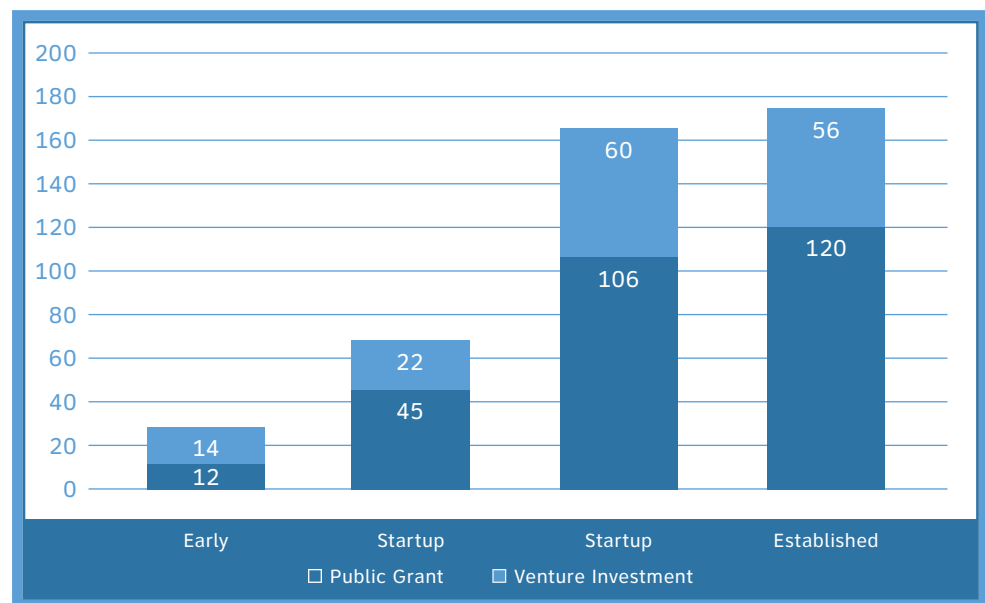
#### Deal counts and funding by company stage

In chart 16, we see a similar deal count for cleantech startups (167 deals) and established cleantech companies (176 deals), with slightly more venture deals for startups. Companies classified as 'early stage' and 'scaleups' are fewer in number and see fewer deals.



### 3. Cleantech Investment Analysis

Chart 16: Cleantech Deal Count by Company Stage, 2016 – 2020



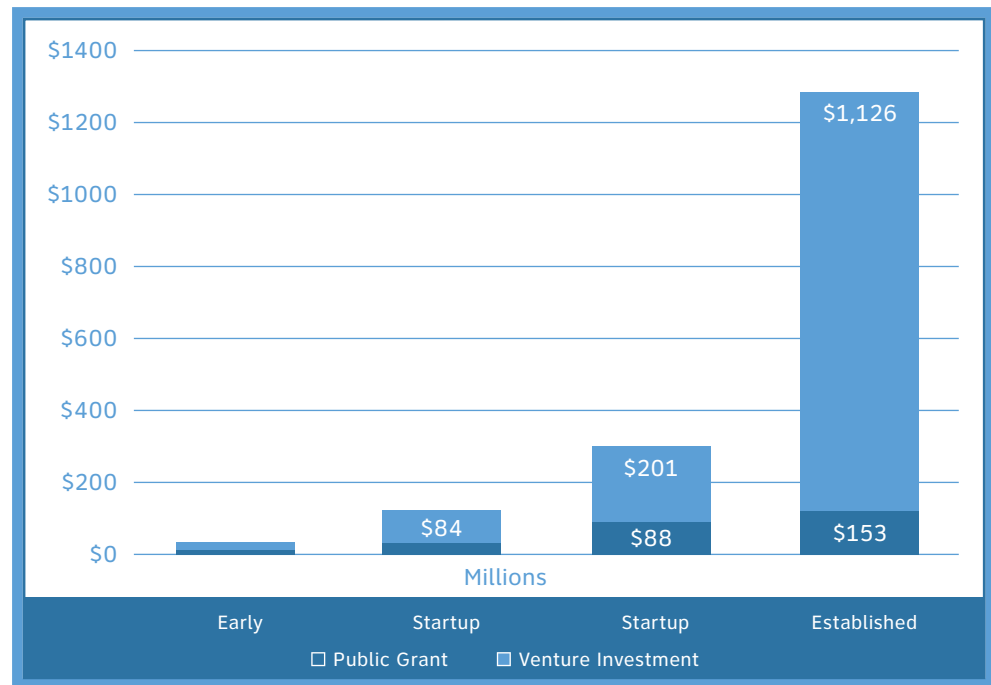
While the deal counts are similar, established companies secured far more funding than startups (see Chart 17). Venture and public grant funding for established companies topped \$1.3B versus the \$290 million for startups over the five years. Larger, more established businesses need more capital to grow, so a funding differential is not unexpected. However, a gap of nearly \$1B in venture financing seems significant when there was only \$1.4 billion in venture financing overall between 2016 and 2020. Moreover, just \$297 million in venture financing is thin for the 96 cleantech companies classified as early-stage startups and scaleups. The numbers lend credence to observations entrepreneurs have repeatedly conveyed to the DEEP Centre regarding an early-stage funding gap for cleantech companies in Canada.





### 3. Cleantech Investment Analysis

Chart 17: Cleantech Funding by Company Stage, 2016 – 2020



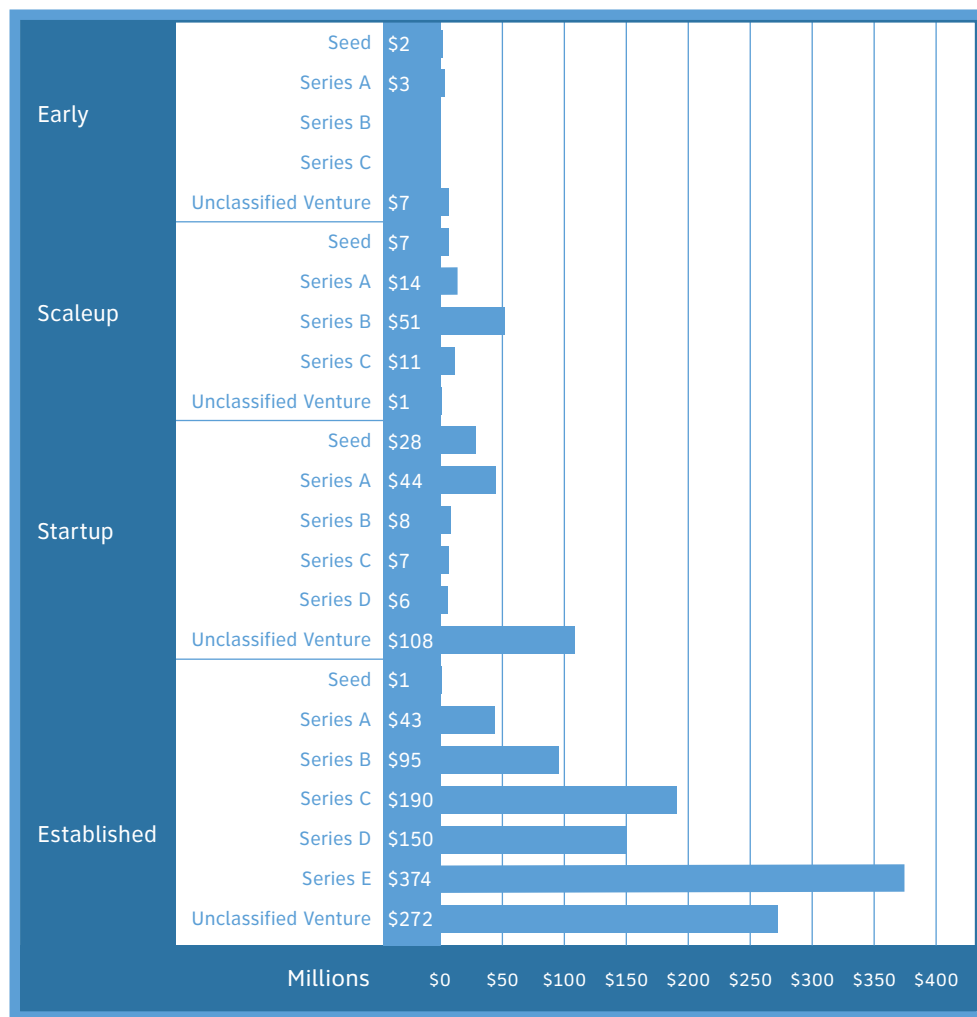
#### Funding by round and company stage

Disaggregating the venture financing by round further illustrates the funding gap for cleantech startups. Almost all late-stage funding rounds went to companies classified as established. Given the substantial costs often associated with cleantech product development, demonstration and manufacturing, the apparent dearth of earlier-stage venture funding points to a gap that requires further investigation.



### 3. Cleantech Investment Analysis

Chart 18: Cleantech Venture Funding by Round and Company Stage, 2016 – 2020



### Bioeconomy Analysis

The bioeconomy classification includes two vertical markets: bioenergy and bioproducts. Firms in the bioenergy vertical include producers of liquid biofuels, energy from biomass and the equipment for converting biomass to energy or fuels. Firms in the bioproducts vertical include producers of products, materials, and chemicals from renewable biological resources. Collectively, we find that 28 firms in these categories received funding between 2016 and 2020. Our investment analysis examines the distribution of financing across investment types, company stages, industry classifications, and other parameters.



### 3. Cleantech Investment Analysis

#### Total funding for bioeconomy firms

Between 2016 and 2020, bioeconomy firms secured over \$500 million in private financing and nearly \$60 million in public grant funding. In total, \$415 million went to bioenergy firms, while bioproduct companies secured \$145 million. Examining the type of funding received, we see that most of the private financing for bioenergy firms came from venture capital investments (\$393m). In comparison, most of the bioproduct funding was private equity (\$100m), with very little venture capital. Total public grants were \$37 million for bioproduct firms and \$22 million for bioenergy firms.

The underlying transactions reveal that nearly all venture capital financing for bioenergy firms went to Enerkem (Airex Energy also raised \$16 million over several rounds). All of the PE financing in the bioproduct vertical, on the other hand, went to Kruger, a large, diversified forest products company. In addition, six bioproduct companies closed venture deals totalling \$9 million in the 2016 – 2020 period, the largest of which was a \$5 million Series A round for Amber Molecular. Setting aside the large deals for Enerkem and Kruger, the transaction records reveal that bioeconomy firms have been more successful in attracting public grants (\$60 million) than venture financing (\$34.5 million) over the five years. However, as discussed further in the interview findings, bioeconomy firms report investments from corporate strategic partners that were not captured in the CVCA database.

Table 5: **Private Financing for Bioeconomy Companies, 2016 – 2020**

Bioeconomy Companies	Vertical	Sum of CAD Funding	No. of Deals
Enerkem	Bioenergy	\$367,316,000	4
Kruger Inc.	Bioproducts	\$99,600,000	1
Airex Energy Inc.	Bioenergy	\$16,550,000	7
Woodland Biofuels Inc.	Bioenergy	\$6,000,000	1
Amber Molecular	Bioproducts	\$5,000,000	1
Benefuel Inc.	Bioenergy	\$2,774,094	1
Anomera	Bioproducts	\$1,623,250	1
Renix Inc	Bioproducts	\$1,000,000	1
AecopaQ	Bioproducts	\$875,000	2
Terra Grain Fuels	Bioenergy	\$635,000	1
Just Bio Fiber	Bioproducts	\$85,000	2
<b>Grand Total</b>		<b>\$501,458,344</b>	<b>22</b>



### 3. Cleantech Investment Analysis

Table 6: Public Grants for Bioeconomy Companies, 2016 – 2020

Bioeconomy Companies	Sum of CAD Funding	No. of Grants
Kruger Inc.	\$13,761,000	1
Aspire Food Group	\$10,000,000	1
Woodland Biofuels Inc.	\$8,523,290	3
Enerkem	\$6,559,710	4
Anaergia	\$6,222,000	4
Anomera	\$5,195,100	3
CelluForce Inc.	\$3,953,000	3
Erthos	\$2,750,000	1
Greennano Technologies	\$1,200,000	1
Cellufuel	\$875,466	4
Biopolynet Inc.	\$301,471	4
Iogen Corporation	\$153,000	2
Phycus Biotechnologies	\$100,000	1
Impactful Health R&D	\$100,000	1
Mycodev Group Inc.	\$45,740	2
Terra Grain Fuels	\$40,000	1
Radiant Technologies Inc	\$30,000	1
Switch Materials Inc	\$23,039	2
Ensyn Corporation	\$3,360	1
<b>Grand Total</b>	<b>\$59,836,176</b>	<b>40</b>

#### Bioeconomy funding by year, industry, and stage

Looking at the distribution of financing by year in chart 19, we see that the vertical follows the pattern of venture financing in the broader population of cleantech companies in Canada, with 2018 representing a peak year and diminishing funding after that.



### 3. Cleantech Investment Analysis

Chart 20 looks at the distribution of total funding by industry, including public and private sources. Again, we see the concentration of financing in two industries, skewed by the deals for Enerkem and Kruger. For paper and forest product companies, the \$100 million PE deal for Kruger and \$1.5 million seed round for Anomera were the only reported private equity or VC investments in the industry. The balance of the \$24 million consists of public grants, and over half of the public grant money (\$13.7 million) also went to Kruger. Additionally, the funding for independent power producers and agricultural product companies came from public grants, as did nearly all funding for containers and packaging companies. Only bio-fuel companies sourced most of their investment dollars from the private sector, with \$393 million from VC investments.

Chart 19: **Total Funding for Bioeconomy Companies by Year & Funding Type, 2016 – 2020**

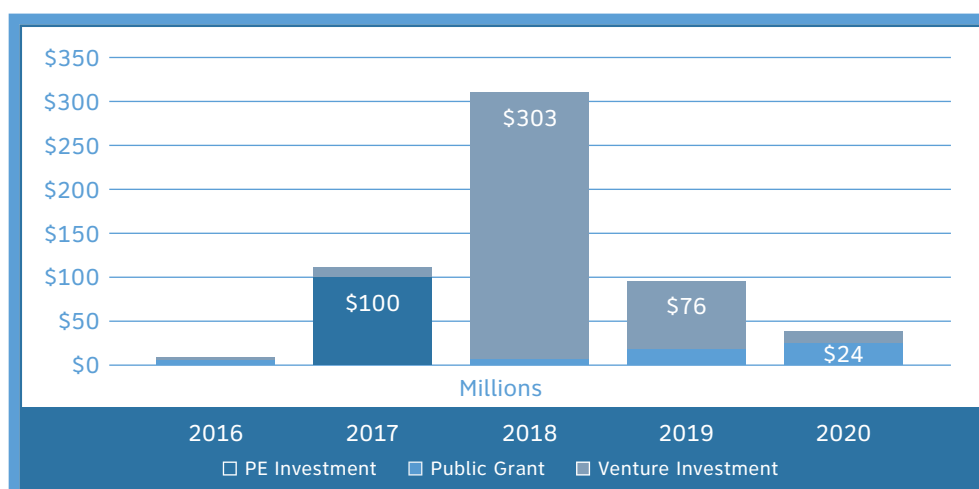
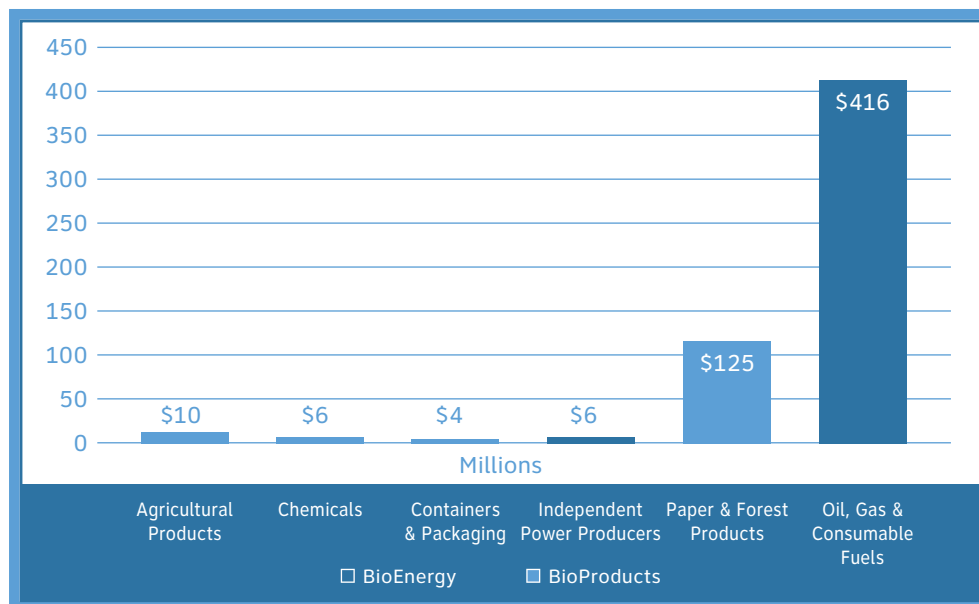


Chart 20: **Total Funding for Bioeconomy Companies by Industry, 2016 – 2020**

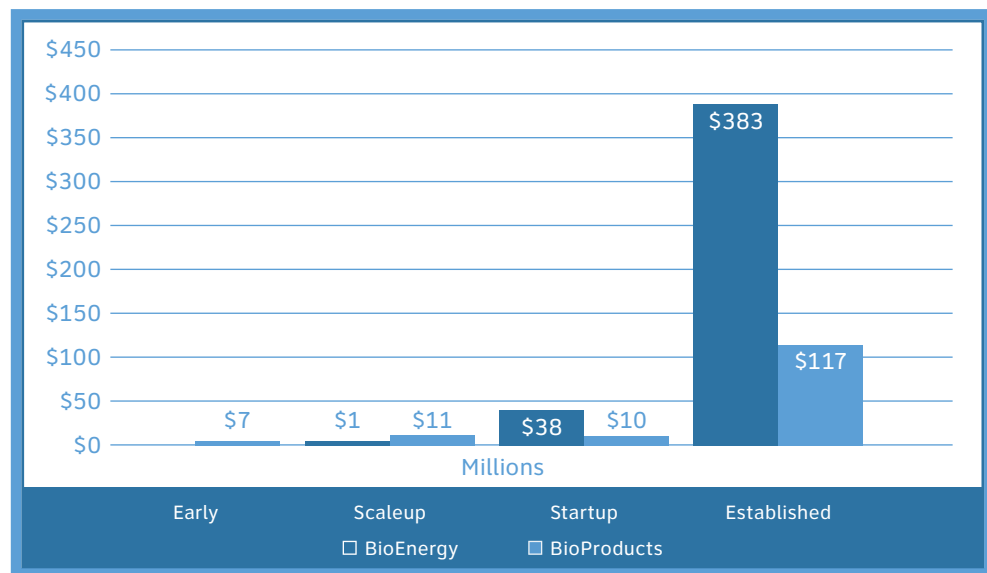




### 3. Cleantech Investment Analysis

Finally, in chart 21, we examine the distribution of financing by company stage. Here we see that 90% of the funding went to established companies, with 84% going specifically to Enerkem and Kruger. Twenty-six other companies divided the remaining 15% of the funding pie between 2016 and 2020. As with the broader sample, funding allocation suggests a dearth of private sector financing for bioeconomy firms and an acute shortage of earlier stage venture financing. We take a closer look at challenges bioeconomy firms are facing in obtaining venture financing in executive interview findings.

Chart 21: **Total Funding for Bioeconomy Companies by Stage, 2016 – 2020**





## 4. Key Findings from the Executive Interviews

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Between May 2021 and June 2021, the DEEP Centre conducted a series of one-to-one interviews with 25 executives in various public, private, and not-for-profit organizations working on clean technology innovation and commercialization. In addition, we interviewed 11 cleantech executives between January and February 2020 whose insights are pertinent to this study (see Appendix I for the combined list of interviewees). The organizations included business accelerators and incubators (BAIs), cleantech SMEs, large corporations, venture capital firms and cleantech associations and consortia projects.

Executives interviewed by the DEEP Centre offered their assessment of the current health of Canada's cleantech ecosystem, opportunities and challenges related to financing cleantech companies, and the unique challenges bioeconomy companies face in accessing investment capital. Several provided insights into other cleantech commercialization challenges, including the effectiveness of the startup support system, the slow pace of domestic adoption of cleantech, and the small pool of sophisticated and experienced management talent for cleantech ventures. Many executives also took the opportunity to reflect on the role of government in fostering cleantech innovation and commercialization and the perceived need to modernize Canada's regulatory framework to accelerate adoption and fast-track new cleantech deployments.

While there was broad consensus on some issues, there was also considerable divergence and disagreement on others. For example, almost every executive consulted by the DEEP Centre believes that urgent action is required to help Canadian cleantech and bioeconomy companies realize their potential on the world stage. There was broad agreement on some critical challenges, including the need to address gaps in access to financing, improve access to talent, and speed up adoption and new deployments by modernizing Canada's regulatory frameworks. On the other hand, there was less consensus on how to resolve challenges in cleantech financing and adoption. There were also diverging opinions on the best options for accelerating the commercialization of bio-based products and energy solutions.

To the extent possible, this diversity of viewpoints is well-represented in our findings. Although we included direct quotes to emphasize some of the points expressed, they have not been attributed to individuals to protect their confidentiality.

### The Pipeline of Investment Ready Cleantech Companies

Based on their current deal flow, investors see a deep reservoir of high-value IP and a healthy pipeline of Canadian cleantech companies. "We have opened up the pipeline collection," said one investor. "Stuff is flooding in. We have great innovation across the country. We see lots of potential."



## 4. Key Findings from the Executive Interviews

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Most VCs have their preferred channels for identifying promising companies, and Canadian investors feel confident that they see most, if not all, of the relevant deal flow in Canada. However, many investors noted a gap in the capacity to build investment-ready companies and cited a large proportion of early-stage cleantech firms that are yet to meet the threshold for private sector investment. As one investor explains, “We screened 850 companies in 2020, but we did not do many deals. We have allocations to invest in Canada, but our deal count has not been increasing. Relative to other countries, the proportion of Canadian investment is getting smaller.”

Although VCs often track the population of companies emerging from cleantech accelerators, there is a broad consensus that the companies graduating from cleantech BAIs are rarely investment-ready. Said one VC:

*“MaRS is there. Foresight is thinking progressively. But there is no coordination. There should be a national network of accelerators with specialization so that they can build unique competencies, real bench strength and meaningful connectivity to customers and capital. We need accelerators at the service of the investment community. They need to find the best companies and get them investment-ready. Techstars does that. CDL does that. In Canada, we have a lot of locally focused incubators and accelerators that serve the ecosystem and the companies, but they are not serving investors.”*

Corporates and VCs attribute the lack of capacity to foster investment-ready companies to a perceived lack of experienced entrepreneurial talent. Venture capital investors, for example, cite the lack of local bench strength as the reason they often overlook local BAIs as a viable source of support for companies that are approaching the scale-up phase. “Scaling companies need to research the distribution opportunities and test and iterate quickly around go-to-market in a variety of key markets,” said one investor. “We can’t do all of that work for them. We need to connect them with people who can. Most of the time that means connecting them with individuals in the United States.”

Another investor argued that BAI programming is ill-suited for growth-stage companies because BAIs lack in-house experts with deep experience in scaling companies. “The companies and entrepreneurs that need programs are typically the ones with problems. They are struggling, and the paradox is that once they are at that stage, they are in trouble. They are trying to extend their financial runway rather than scale-up.” “The good companies,” on the other hand, “are choosing not to engage in the locally available programs. The BAIs simply don’t have the bench strength of people that have done it.”





## 4. Key Findings from the Executive Interviews

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When VCs make time to look at the deal flow at BAIs, they tend to be very selective. “Y-Combinator works, and CDL works,” said one VC. “The competition is healthy, and we know as investors that we only see the best of the best. You have high-quality mentors around the table and high-quality companies. No one else in our team has conversations with BAIs anywhere, and that’s not just in Canada. That includes San Francisco, Houston, Boston, New York and other centers of innovation.”

### Sector Leaders on the Pipeline of Investment-Ready Companies

***“There is a big pipeline, but there are not enough great companies to invest in. We declined 846 out of 850 of the companies we looked at last year. We need specialized accelerators with the resources and expertise to help create investment-ready companies. Right now, most of the accelerators are living on fumes. They need more funding; they are fighting for their lives.”***

***“We know there is a strong and growing ecosystem in Canada. We are interested in better visibility. But there are so many incubators that it takes a while to figure out who is doing what and where the value is. There is a lot of value in filtering out the noise. We can’t have our hand in 30-40 BAIs. There would be a lot of value in the ability to aggregate across.”***

### Access to Capital for Cleantech Ventures

The state of financing for cleantech companies remains a subject of considerable debate. For example, there is a prevailing sense among investors and most BAI leaders that good companies with distinctive solutions and strong management teams have no trouble raising capital. “The good companies with good technology and good markets are getting funded,” said one investor. “The deals are usually oversubscribed. There is a strong appetite for Canadian companies.”

While cleantech SMEs routinely report challenges in raising private sector funding, it is not necessarily due to a shortage of capital. “If they are struggling to raise money,” said one BAI leader, “it’s because their tech is not that good, or they are not ready. But, overall, it feels like there is more capital available today than five years ago.”

Despite the increasing availability of capital, interviewees pointed to several gaps in cleantech financing. These gaps include private sector seed capital for pre-revenue companies, domestic sources of growth-stage capital, and funding for CAPEX-heavy hard tech companies. We examine each domain below.



## 4. Key Findings from the Executive Interviews

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### Early-stage financing

Interviewees offered opposing views on the state of early-stage financing in Canada. The spectrum of opinion ranges from those who insist that there is a wealth of early-stage capital (primarily from government agencies) to those who see pre-revenue, seed-stage financing as the most significant gap for cleantech SMEs. However, in sifting through these contrasting views, we can identify a couple of consensus points.

The first point of consensus is that the Government of Canada provides an abundance of non-dilutive funding for cleantech ventures. “The public funding at the seed stage in Canada is generous,” said one cleantech CEO, summing up a prevailing view from sector leaders. “35% of our funding is from the government, and the options are generally very good for early to mid-stage companies. When we talk to our peers in other countries, they always comment on how stark the difference is when it comes to non-dilutive capital in Canada versus the United States and other places.”

The second point of consensus is that there has not been a commensurate deployment of private sector capital to match the generous non-dilutive funding provided to early-stage cleantech companies. On the contrary, many sector leaders worry that VCs are abandoning the seed stage and favouring less risky series A+ investments, making it harder for cleantech companies to secure their first private sector investments. In their defence, VCs cite the risky and frequently unprofitable nature of early-stage investments in cleantech companies as a significant deterrent. As one VC explains:

*“We have been at this for 20 years. It does not pay to invest early. Companies take 10 -15 years to make it to market. Before investing, we require a commercial product. They don’t need to have a lot of revenue, but they need to be close. That is the sweet spot. It does leave a gap for the earlier stage. You can’t lose money investing at the seed stage where commercialization is still years away.”*

Cleantech SMEs consulted for the study note variable experiences in raising seed capital, but most claim seed-stage VC deals are tough to secure. “Finding private sector investment is tough,” said one CEO. “On the battery side, we have a long time to market. It takes ten years to go from the lab to the market. Investors don’t want an illiquid position for that long. Obsolescence could kick in and make your solutions obsolete by that time.”



## 4. Key Findings from the Executive Interviews

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Most interviewees expressed support for efforts to strengthen and diversify early-stage funding for cleantech ventures to support an expanding pipeline of startups. However, given the reticence to accept the risk and long runway to liquidity, sector leaders see a need to deploy a different structure of private sector financing than is typical of the VC sector, including fund managers who are willing to earn lower multiples and invest with a longer time horizon.

Finally, there were calls to channel more angel investment into the cleantech sector with a combination of tax incentives, deal syndication and investor education. As one association leader put it: “More and more VCs are coming back to cleantech. But we also need a strategy for angels, foundations and family offices that will invest at the seed stage. This is urgent. If we only focus on VCs, we will limit the pool of investment capital. VCs will say we evaluated 600 projects and we are working with six companies. What do you do with the 594 others?”

### Sector Leaders on the Early-Stage Cleantech Financing

*“Most companies graduating from cleantech accelerators are getting seed rounds or grant funding from SDTC, ERA, WD, Alberta Innovates and others. Most of the funding is designed to support technology-oriented deliverables on a project basis. Private-sector funding at the pre-revenue stage is scarce. Companies have had to limp through the COVID era. Those at the commercialization stage have had a hard time making sales. There is a gap around the seed stage and pre-series-A. We are handcuffing our ventures.”*

*“We have a lot of earlier stage companies that are right on the cusp of scaling. We have investors lining up. Many family offices and high net-worth individuals are investing in this space and will bring big cheques and expertise. We have a gap in the adoption of cleantech and the building of new projects in Canada. The gap is not necessarily at the early stage.”*

*“You need an investor that is willing to earn lower multiples. The ICE fund in BDC moved to software. BDC has other funds that could operate in this space. \$500,000 cheques with simple terms could work for earlier-stage companies. Needs to be coupled with outside money, maybe with angels, foundations and government grants.”*



## 4. Key Findings from the Executive Interviews

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### Growth-stage financing

By most measures, global venture investment in growth-stage cleantech companies is at all-time highs.

Crunchbase data, for example, shows a steady ramp-up in cleantech investments in the United States between 2012 and 2018 at an average of \$3 billion per year, leading up to a peak of \$4.9 billion in 2019.<sup>8</sup> Despite the COVID-19 pandemic, the uptick in cleantech and climate tech investments continued in 2020. According to Morningstar, global capital flows into clean energy-focused funds doubled in 2020 to US\$274 billion as investors seek to capitalize on the growing focus on decarbonizing the global economy.<sup>9</sup>

Although there is a lot of capital available for late-stage cleantech deals globally, the bulk of the money comes from the US and Europe. While Canadian funds top out at \$100 to \$200m, the larger US-based cleantech funds typically deploy billions in financing. Blackrock, for example, recently raised \$4.8 billion for a renewable energy fund, almost double its initial target of \$2.5 billion.<sup>10</sup> Bill Gates' Breakthrough Energy Ventures has raised two billion-dollar funds in less than five years.<sup>11</sup> Other cleantech specialists like G2 Venture Partners, Energy Impact Partners and True North Venture Partners have recently launched new funds in the \$500 million range and up. As one sector leader put it, "There is a lot of money floating around for the late-stage rounds, with a huge flood of capital going into funding the energy transition."

While sector leaders welcome the inflow of US investment dollars, they worry that the foreign dominance of late-stage venture capital in Canada will inhibit the ecosystem's growth. The main concern is that Canada's comparative dearth of late-stage capital relegates Canadian funds to the sidelines in the largest and most attractive deals and makes it harder to maintain Canadian ownership of homegrown companies. As one investor explains:

*"The heavier CAPEX deals are mostly done by foreign investors that can write bigger cheques. The problem is that the government provides these companies with generous funding, and then the majority ownership transfers to foreign hands. We should be more strategic about the late-stage deals. We shouldn't let foreign funds steal the best deals. We don't need to cut foreign funds out, but we should be at the table, especially when we are giving grant money at the beginning."*



## 4. Key Findings from the Executive Interviews

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Sector leaders appealed for a dedicated funding envelope to support the development of later-stage venture and private equity capital funds that focus on clean technologies. There were also calls for Canadian institutional and pension funds to invest as limited partners in later-stage venture capital and private equity funds.

Sector leaders believe that scaling late-stage funds in Canada would have several inter-related benefits. First, larger funds would have the depth of capital to write bigger cheques and support companies through multiple funding rounds while still diversify their risk. A typical fund will not put more than 10% of its capital at risk in a single company. That means a \$200 million fund can invest no more than \$20 million per company, limiting the size of their ownership stake and constraining their ability to participate in funding rounds following series A. That means that once companies get past the commercialization stage, they often get funded and acquired by more prominent players from the United States and elsewhere.

A larger pool of late-stage capital in Canada could have other benefits. For example, Canadian fund managers argue that increasing the proportion of Canadian ownership in late-stage cleantech ventures would increase the probability of keeping our best companies in Canada. The reasoning is that Canadian investors could retain more influence over company governance and may be more inclined than US investors to build capacity within Canada.

*“We need larger, more experienced funds,” said one VC leader. “Canadian companies typically have 50% less capital relative to their peers in the US. The US cleantech funds have much deeper pockets. Without the capacity to participate in the big deals, it becomes impossible to maintain majority ownership in Canadian companies. If you want to maintain ownership, VCs must have the resources when the time is right. We need champions that stay in Canada. They are critical to building the ecosystem.”*

Higher ownership stakes would also increase the capital recirculating in Canada when cleantech companies have a liquidity event. In other words, more of the profits from IPOs and acquisitions would flow back to Canadian funds, and Canadian investors could subsequently redeploy that capital in the next generation of cleantech ventures.

Finally, larger funds can also afford to invest in infrastructure and hire a larger bench of seasoned executives to support and advise the companies in their portfolios. A deep talent bench, in turn, would enable funds to invest more capital in early-stage companies that need funding and hands-on support to build demonstration facilities and manufacturing plants. Canadian funds could also better compete with US investors that offer cleantech ventures access to a deep pool of in-house resources and continuity of capital through to later funding rounds.



## 4. Key Findings from the Executive Interviews

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It is worth noting that not all interviewees agree that scaling the capacity of later-stage cleantech funds is the sector's most urgent priority. For example, a couple of interviewees indicated that promising Canadian cleantech companies have no problem tapping into the global supply of late-stage venture capital for cleantech innovation. Not only is the ability to raise money internationally a sign of strength, but there are also advantages in tapping the depth of experience and networks that international investors bring. Said one international investor:

*"The arguments about beefing up late-stage capital for Canadian funds is a little self-serving. The Canadian VCs tend to be risk-averse. They want stuff delivered to them on a silver platter. Their due diligence process is not as fast as it should be. They act like they are giving out government grants. And they don't have the resources or depth of talent of the US-based funds. The best entrepreneurs will go elsewhere for investment."*

That global cleantech investors such as Breakthrough Energy Ventures have tremendous experience and deeper pockets is beyond doubt. However, most Canadian fund managers argue that maintaining the status quo in late-stage venture financing would mean accepting the country's ongoing designation as a farm team for foreign investors and the associated problems in retaining valuable assets in Canada.

### Project financing

Project finance is the funding (financing) of large infrastructure and industrial projects where the debt and equity used to finance the project are paid back from the cash flow generated by the project. Such financing is critical for a wide range of complex and capital-intensive cleantech solutions—from constructing biofuel plants and renewable energy projects to wastewater treatment systems and energy storage solutions.

However, acquiring significant investments to build infrastructure or first-of-its-kind manufacturing facilities has been the Achilles heel of the cleantech sector. Banks and institutional investors have deemed such investments too risky, thus essentially depriving the sector of the debt financing it needs to overcome a crucial commercialization hurdle. Several interviewees argued that, in light of the need to move the needle on emission reductions, the government's most urgent investment priority should be helping mature cleantech companies to obtain the financing required to deploy their solutions at home.

Unfortunately, there is a consensus among the interview sample that cleantech companies seeking project financing have few options to turn in Canada. As one institutional investor acknowledges, "Are we going to provide project financing for unproven technologies? No. We finance proven technologies with proven agreements for adoption. The first-of-kind and second-of-kind deployments are too risky to finance."



## 4. Key Findings from the Executive Interviews

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Sector leaders argue that putting more weight behind a smaller number of proven solutions and companies would help ensure that large industrial partners take the cleantech sector seriously and open the door to getting more sustainable infrastructure built in Canada. As one VC put it:

*“The danger is that our industrial partners continue to think about cleantech as a population of little startups. If we want to engage the Suncors, Cenovus’s and the TD Banks, we should be presenting a dozen companies with the capacity to be unicorns. We have next-gen biofuel companies, we have solar companies capable of generating gigawatts-levels of energy, and we have energy storage companies bidding on multi-billion-dollar projects. We need to find partners for these companies and then help fund major deployments. We need to start showing some muscle to our industrial partners. If they are going to take us seriously, we have to get way beyond the demonstration mode to building large-scale deployments of clean technologies in Canada.”*

### Sector Leaders on the Late-Stage Deals and Project Financing

*“**The country is addicted to pilots and seed money.** We have companies that define success as raising some seed money and running a demonstration project. What we should be looking for now is scale, including large-scale concessional financing and corporate partners that are serious about reducing their emissions. Mature companies need structural support to deploy their solutions at scale. What we really need is a few billion dollars in concessional financing that is programmatically linked to \$5-10 billion in private capital.”*

*“**The conversation around cleantech has been the same for a long time.** It’s great that we have a support structure that is appropriate for early-stage companies. But it takes ten years to get these companies ready to go to market. We should be targeting growth-stage companies, and we should put our firepower there. It’s not a very Canadian thing to do. We tend to spread money far and wide. We have already done the early-stage priming of the pump. It’s time to change the structure of the support we are putting into play. We need to get behind the winners. It’s 2021 now, and scale surely has to be the focus.”*





## 4. Key Findings from the Executive Interviews

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### Investing in the Bioeconomy and Other Transformational Technologies

Investors acknowledge that a large proportion of VC deals over the past five years have focused on the so-called “low-hanging fruit” of clean technologies, including software-based cleantech plays focused on industrial efficiency, energy analytics, building automation and smart grids. Most also concede that Canada and other countries will not meet their climate obligations pursuing software-based solutions. “We believe that the world’s most fundamental problems can’t be solved by software alone,” said one investor. “Software-based efficiency plays can make incremental improvements like a 5 to 10% efficiency gain. Many environmental challenges require transformational hard tech.”

When asked about where they plan to focus their upcoming investments, investors pointed to areas such as hydrogen, carbon capture, energy storage, and, in some cases, green chemistry and the circular economy. “Our main focus is climate tech,” said one investor. “We are pulling out of the industrial efficiency space – that thesis has played itself out. So now we are looking at hydrogen and decarbonization. Agtech and water are the other pillars.”

Financing hard tech is challenging, and investors agree that solutions are required to mobilize more investments in transformational technologies that will lower Canada’s carbon footprint. The transformations include shifting to 100% renewable and recyclable materials while repurposing waste streams; increasing transportation efficiency and adopting zero-emission vehicles; and running commercial buildings and corporate facilities using clean energy sources. Other critical adaptations include making dramatic improvements in the conservation of water and other vital ecosystem services. “The marginal gains in efficiency are not going to get us to net zero,” said one sector leader. “Industrial efficiency is a super important piece, but it dominates the conversation.”

To prepare themselves to compete in a low-carbon economy, companies have to navigate profound disruptions and transformations in industries that have witnessed only slow incremental changes for decades, even centuries in some cases. Imagine, for example, a construction industry that produces net-zero energy buildings, a mining industry with zero waste, or an energy industry with zero emissions. These are the transformations that executives envision, but individual firms will not realize these ambitions pursuing solo innovation efforts.

The forest products industry is a case in point. With the pulp and paper business in a long-term secular decline, the forest product industry’s renewal efforts are focused on significantly increasing its growth and overall productivity by generating additional revenue streams from each log harvested. In many cases, this means diversifying product lines and developing specialty fibres, materials, and biofuels that the industry sees as its future. The transition is seeing companies strive to access leading-edge science and acquire the product development, sales and marketing talent required to tap into entirely new value chains.





## 4. Key Findings from the Executive Interviews

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Bioeconomy companies are attempting to seize the opportunity to become partners in the transition to a low-carbon future. But accessing the requisite private sector capital to develop and market new bio-based fuels and materials has proved challenging. Moreover, consultations with cleantech investors suggest that the economics of bioeconomy companies and other “hard tech” or high CapEx companies can make them a poor fit for traditional VC financing.

When screening for investment opportunities, VCs generally look for high-value and high-margin solutions that can generate a healthy 10x+ return in ten years or less. In most cases, bioeconomy companies fail to tick most of those boxes. Many bioeconomy companies produce low-margin biofuels or bio-based chemicals and materials that are the raw materials for higher-value products and services. The costs of bringing new fuels or materials to market are high, and the time to market is generally long. As one VC explains:

*“Bio-fuel companies and renewable chemicals companies are not very attractive investment targets. If we see a large amount of capital required to prove that the technology works, we tend not to look at those companies. They take a long time to develop, and they are burning millions per month. So it’s a difficult sell for investors. You can only attract financing if you can demonstrate that process at a smaller scale, produce something high-value and generate a decent margin.”*

Investors would like to see bioeconomy companies capture higher-value opportunities and own more of the end-customer relationship to increase their investment potential. When asked what bioeconomy companies could do to make themselves more attractive investment targets, investors pointed to the ability of disruptive food product companies to turn agricultural commodities into high-value meat substitutes as a potential model.

*“Beyond Meat and Impossible Foods are exciting models,” said one investor. “They both had IPOs and great outcomes for investors. Both companies established well-known consumer brands. The key ingredient is pea protein that comes from Canada. But the key is that you can’t just be an ingredient supplier – the pea protein is a low-margin commodity. You need the whole brand and consumer experience. Investors want to invest in companies that own the customer relationship. The brand and customer relationship increases the margins, and that drives the value for investors.”*

The bioeconomy companies that have successfully raised VC financing have robust customer pipelines and less capital-intensive manufacturing processes that can generate positive cashflows quickly. As one VC put it, “You can’t invest in the construction of a new processing plant without any certainty regarding how much future production



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capacity the market will absorb. We need to see a binding offtake agreement for a significant amount of production capacity before even considering an investment.”

Companies that have raised VC dollars have worked hard to generate customer buy-in and prove that they can cost-effectively manufacture enough output to meet demand. As one CEO explains:

*“We are in the process of securing a seed round. The investment will support our ability to build out our manufacturing process and ramp up production. The investor is willing to be patient, but they ultimately decided to invest because we have a full pipeline of customers. The fact that sales have already started means there is less risk for them. We also have a business model that will make our operations profitable within three years. We started with a smaller-scale facility in order to make a return on the investment, and we can do that with the current scale of about 1,000 tons per year. We ultimately want to get to 20,000 tons per year within five years to achieve our full valuation. To get to scale, we need a strategic partner that is willing to co-invest in a larger-scale production facility.”*

Although some bioeconomy companies have successfully raised money from VCs, stakeholders see investments from strategic corporate partners as the most natural source of financing. “We are a manufacturing company, and we need a lot of upfront capital,” said one CEO. “The timeline for returns is a lot longer than building an energy analytics app. Several Canadian investors were interested in our technology, but they would look at the financials and couldn’t do it. They wanted to be cash flow break-even in three years and wanted a put option to exit within seven years. The timeline to get the return was way too tight. We eventually found a corporate strategic investor in the US.”

Most VCs also believe that large resource-based companies seeking to diversify away from carbon-intensive business lines are a better fit for financing bioeconomy companies. As one investor explains:

*“There is a lot of important bio-industrial innovation – converting biomass residues into new products that will displace cement and petroleum, among other things. These companies struggle to access VC investments because they produce commodity products with an expensive product that is not yet competitive with petroleum that is still too cheap. Venture plays must have huge margins, and they need solutions for deep pain points that companies are willing to buy. We have seen some bio-synthetic plays that produce super inexpensive and highly valuable materials. They have high*



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*margins! Bio-industrial companies are more likely to be able to access investment from corporations that are seeking innovation opportunities that will help them diversify away from carbon-intensive business lines."*

While interviewees agree that corporate venture capital can often provide a better strategic fit for cleantech companies, they also acknowledge that there are very few corporate investors to turn to in Canada. "Unfortunately, most of the large companies in Canada do not invest in startups," said one VC. "We need a translator. The big corporates don't know how to work with startups." Facing few prospects at home, Canadian startups seek out investment and partnership opportunities with US multinationals. But here, they face considerable competition, as biofuels and advanced biomaterials are crowded domains with active bio-industrial clusters around the globe. As an executive with a global diversified chemical company explains:

*"We have scoped a whole bunch of companies in Canada, and we are actively looking. We have introduced several dozen startups to the corporate venture team, but we have not made cleantech startup investments yet. We always compare what we find in Canada with what we see globally. We only make investments in the very best companies. The general feeling is Canadian cleantech companies are not mature enough and scalable enough. The economics don't make sense. They need to understand what they are trying to replace. What process are they trying to disrupt? What are the economics? It's one thing to run it at lab scale; it's something completely different to prove that it's viable at an industrial scale. Incumbent solutions are tough to displace."*

### Sector Leaders on Investing in the Bioeconomy

***"We have enough funding to build a demonstration-scale plant, but we anticipate the need for a much larger raise to fund our expansion. We would rather our Series B round comes from Canadian investors, but funding for manufacturing companies is tough. Few players are interested in that space. Will likely need a strategic investor, not the ones that are looking for short-term return."***

***"The bioeconomy should be an area of strength given the abundant feedstock in Canada, but it's a capital-intensive play. For investors, it's a long hold, and you need to displace existing fuel sources that are abundant and inexpensive to produce by comparison. A lot of the companies that started with biofuels are migrating to higher-value chemicals."***



## 4. Key Findings from the Executive Interviews

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***“In software, you can get a 10x multiple in less than ten years. For bio-economy companies, we have a goal of a 2x average over ten years. No LP would invest in a fund that is offering 2x in ten years. We need sources of investment capital that are more patient. That’s the role that the government has to play.”***

***“We need to change how BDC and EDC invest in the cleantech sector. Right now, they are focusing on the incremental stuff and the low-hanging fruit. Their investment decisions don’t factor in what is strategic for Canada or what will move the needle on emissions reductions. We need to double down in the transformational technologies. Instead, BDC focuses on generating a return. When ROI is the primary driver of their investment decisions, they will not make the longer-term investments in the really transformative technologies.”***

***“Investors don’t want to lose time and money on CAPEX intensive deals. To keep LPs happy, you need a balance with lighter-CAPEX deals that can generate returns faster. We can’t do Enerkem-size deals all the time because you could only make two investments. While we agree that clean growth inevitably requires industrial transformation, most solutions have a software component these days.”***

### Early Adoption Partnerships and Domestic Demonstration Projects

Across most technology domains, observers consider Canada to be strong in the science and R&D aspects of the innovation cycle but weak when it comes to taking those ideas to market.<sup>12</sup> Observers attribute Canada’s weaknesses in commercialization in part to a domestic market that provides inadequate opportunities for developers of innovative new technologies to test, refine and scale up their innovations.<sup>13</sup> The internal market in Canada is not just small; it is also predominantly populated with late or reluctant adopters of new technologies. Among the cleantech SMEs consulted by the DEEP Centre, the lack of domestic adoption opportunities is a significant source of frustration.

*“Our experience has been that the academic and research infrastructure in Canada is at the top of our game. A resourceful entrepreneur can get access to great technology and IP, as well as the equipment to do breakthrough work. It is very easy to get on the phone with a professor and frame intriguing commercial goals. You can forge a good partnership.*



## 4. Key Findings from the Executive Interviews

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*One criticism that has hampered our growth is the industry's risk aversion when it comes to adopting near-ready technologies. The appetite in the construction and plastics is pretty low."*

Stakeholders agree that Canada's industrial firms could contribute significantly to helping cleantech startup companies raise capital and expand internationally by providing real-world environments for demonstrating new solutions. "Early adopter customers are critical in the whole process," said one investor. "They bring credibility. They help with financing and product development. They help on the management side too. These relationships accelerate the companies so much more quickly, even more quickly than a big check from an investor."

In practice, however, "significant disconnects" between small and large firms can hamper progress in forging early adoption partnerships between cleantech SMEs and industrial incumbents. For example, corporate executives frequently claim young startups often have an insufficient appreciation of the scale and complexity of the businesses to which they are marketing solutions. As one executive said about its dealings with clean technology suppliers, "We are very cognizant of the intricate challenges of running an industrial process. It's still difficult despite 100 years of experience. Many cleantech solutions simply haven't been calibrated to the needs of large industrial applications."

A second observation is that even when startup companies have a solution they can calibrate to the needs of a large multinational, they don't have the expertise or capacity to produce the solution at scale or on a timeline that makes sense for the potential customer. Reflecting on an experience working with an early-stage bioproduct company, one executive said the timeframe for co-developing the technology far exceeded their original expectations.

*"Marrying a startup with a large corporate takes real fortitude. I'm not sure that we will do it again. Or, if we do, we would need to do it very differently. We are looking for a higher TRL level going forward so that the process is less painful. It's been a 5-to-6-year road. Originally, we thought it would be 2 to 3 years max. Unfortunately, we underestimated how long it would take to develop the technology. They weren't there yet."*

These differences in scale and capacity can create risk and, by extension, reluctance on the part of large firms to engage with SMEs. As one executive noted, "while SMEs play a key role with innovation, their size, capacity and quality controls are sometimes of concern when developing partnerships." Similarly, another executive noted, "We certainly see a niche for small companies that provide a unique product, local content or greater flexibility, but the majority of our spend remains with large companies that can meet the capacity we are looking for."



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One executive noted that SMEs are particularly disadvantaged in areas where large firms “are looking for scale and coverage” either nationally or internationally. “If we invest significant capital into water recycling and bio-digestion facilities,” said the executive, “we need solutions that are scalable very quickly. We can’t mess around with small-scale pilots and demonstrations. We need something that can work on an industrial scale. It not only needs to be scalable but also repeatable. We have 30 plants across Canada that are operating 24/6.”

Another challenge concerns the inability of smaller companies to share the financial risk of demonstrating technologies with their larger partners. “They want a demonstration partner,” said one executive, “but the deals fall apart on financial terms because the risk of the investment all falls on the bigger partner.” When unproven technologies come with significant upfront capital costs, the larger partner bears a disproportionate risk if the technology doesn’t work.

Additionally, there are risks associated with technological and marketplace uncertainty. Large companies tend to be conservative when they have multi-billion-dollar projects in play. For large-scale industrial businesses, clean technologies must make a considerable difference at scale to make sense for investment purposes. The uncertainty of the technology and supplier landscape means that many companies tread carefully when partnering with SMEs. An executive at a large manufacturer put it this way:

*“The supply chain in renewables is a little bit like the wild west out there, especially with the ramp-up on carbon pricing. There is still very little certainty when it comes to technologies like battery storage and other renewable energy technologies. We can invest in a new solar array. But will the company be around to service the equipment if it fails or needs maintenance? It’s hard to have the confidence to know what technologies and suppliers will be around in five years. We are a risk-averse company and are treading very cautiously when it comes to investments when the technology and supplier landscape is constantly changing.”*

While it is easy to point the finger at immature startups, it is equally true that large companies are often ill-equipped to work with startups and can make difficult partners as a result. Executives interviewed by the DEEP Centre frequently talk about the importance of corporate culture and how it is vital to have the CEO’s direct support for investing in or partnering in startups. “Although the board and the executive are aggressive when it comes to innovation,” said one executive, “there is a challenge in the sense that innovation is not a department that solves all your problems. It requires a whole culture shift from the top down.”



## 4. Key Findings from the Executive Interviews

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“Every organization has a different culture and structure,” said another executive. “There is no cookie-cutter approach that will work for all companies in all situations. It depends on the CEO, the desire, the regulatory environment, among other things.” Even companies that have made investments in startups and experimented with innovation outposts still face significant challenges. As one executive explained, “Although we have tried to insulate the innovation team, they are still part of the same bureaucratic structure and subject to the same regulatory processes. The culture and speed of execution are very different for big companies, which has a huge impact on our ability to be entrepreneurial.”

“It can be tough to bring the players together in a way that makes sense for startups,” said another executive. “Big companies often operate on a much longer timeline. We will take three months to make a decision. Startups have to operate much more quickly.” Executives also noted that the goals of the startup should determine the scope and opportunities for engagement. “You need to understand the goals of the different players. Does the startup want to get acquired, to secure their first sale, to demonstrate its technology? Depending on the purpose and the timeline, a partnership with a large anchor customer may or may not be a good fit.”

### Sector Leaders on Early Adoption Partnerships

***“We needed to demonstrate our technology behind the fence line at a major oil and gas facility. It is very difficult to get behind the fence. It’s the biggest industry and the lowest risk tolerance the world has ever seen. I flew around the world to find places to validate the technology. We offered to give the solution for free if they were willing to pilot the technology. We couldn’t get something in the field in Canada, but we eventually succeeded in getting a pilot in Saudi Arabia. When we built one pilot, we hoped that others would come to the table. It turned out Canadian companies will only pay for technology once it has achieved scale.”***

***“The challenges are about educating the startup and corporate partner about how to work together. Key processes can make these relationships a non-starter, like the standard procurement processes that take six months or longer. Some startups can’t wait that long, or they can’t get insurance. Many companies are caught off guard by all the hoops they have to jump through. Anything we can do as ecosystem partners to help de-risk the investments for large corporates would make a difference. The risk is the major factor. Education, public procurement, matching grants or loans are all things we should be doing more of.”***





## 4. Key Findings from the Executive Interviews

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***“In a consortia project, small and large firms can provide complementary capabilities. SMEs are the engines of innovation, but they really need the demonstration projects and POCs to make it easier to get to the next stage of commercialization. On the other hand, we need large companies with the know-how for large-scale manufacturing and the resources to make significant investments in flagship projects. In some cases, we see the creation of new ventures. For example, large food companies are commercializing their waste streams to convert them to chemicals and other materials. However, they rarely want to commercialize these new products under their own brand names. Instead, they create joint ventures with smaller companies to bring them to market.”***

### The Cleantech Management Talent Pool in Canada

On the issue of accessing skilled talent, sector leaders see reasons for optimism and concern about the talent pool in Canada. On the one hand, none of the interviewees consulted by the DEEP Centre identified any immediate technical skill gaps in the cleantech sector. Indeed, most think Canada enjoys a significant competitive advantage in its talent pool, particularly in the education and training of highly skilled technical talent at Canada’s universities, colleges, and polytechnics.

On the other hand, sector leaders did express concern about the limited availability of repeat entrepreneurs and experienced executives who have seen companies scale, have done it internationally, and can join cleantech startups to share that experience and provide management depth. Even more than capital, sector leaders say this dearth of experienced management talent is the most significant challenge for Canadian cleantech ventures.

Support organizations and investors alike lament the relative dearth of go-to-market/sales/execution talent in the Canadian ecosystem, which, according to one investor, has resulted in startups with less mature go-to-market strategies than those seen in the United States. “Human capital is the biggest challenge for our Canadian ecosystem,” said one VC. “Even the fund management space has challenges. The expertise in creating scalable tech companies is not broadly available. There is no MBA for private sector investing at the seed and series-A level. Acquiring that knowledge is one of the biggest challenges.”





## 4. Key Findings from the Executive Interviews

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This recognition has sparked increased efforts to equip companies with the people, tools, and processes to support professional marketing and sales operations. “The quality of the management teams is lower in Canada,” said another VC. “The lack of serial entrepreneurs is a problem. You need big company experience as well so that you understand how these industries operate. The ecosystem is less dense in Canada, and the talent pool is limited.”

Particularly scarce skillsets include people with experience in sales, marketing, regulatory affairs, business development, product management, and specialized financial skills, including CFOs with experience raising capital and structuring business models that will win in international markets. One cleantech CEO explains, for example, that they have found lots of very talented PhD-level scientists and researchers but lack sophisticated business development people who can help translate their technology into the end-user industries. “They need a technical background, industry experience and a commercial mindset,” said the executive. “We have applications in packaging, concrete, oil and gas and other areas. We have had a hard time finding people who can build relationships and close deals in these industries.” With relatively few Canadian high-growth success stories in the cleantech sector, there is a paucity of homegrown executive leadership available to fill specialized roles like these.

A cleantech investor echoed these sentiments and noted that the specialized sales talent required for high-growth cleantech startups makes the talent search especially challenging.

*“The biggest problem is that we have a hard time setting our portfolio companies up with people with the right business and sales acumen. Most people are trained to be sales reps for large companies. We may find people with huge sales pedigree, but they don’t have the experience to sell into the early adopter market. It’s a tougher challenge for startups to find the right people. The people coming out of large companies are not a good fit.”*

While the Canadian talent pool is deeper than it used to be, several sector leaders noted that maturing cleantech companies frequently recruit experienced executives from the United States. However, cleantech companies often struggle to convince seasoned US-based executives to relocate to Canada for various reasons. Some of the challenges are related to compensation, taxation and the cost and hassle of family relocation. The lack of critical mass in the Canadian ecosystem is a factor as well. With the small number of proven cleantech companies in Canada, American executives may struggle to find alternative employment options in Canada if their current employer fails. “Having great technology here is a start,” said one VC. “We need to attract the talent. Getting executives to come here is tough. Housing prices are high. Resettling families is tough, and US-based executives have high salary demands. We have had lots of great people turn down offers. It’s a hard problem to solve.”



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In the short term, sector leaders see a continued need to source experienced talent from the US. However, over the longer term, sector leaders recommend placing a greater focus on developing the existing talent pool by backing first-time CEOs and training, coaching, and supporting competent local management teams that are firmly rooted in Canada.

### Improving Connectivity and Support for Internationalization

Amongst the biggest challenges facing Canadian SMEs is the ability to broaden their reach beyond Canada by building an international customer base. While internationalization is a necessary component of growth, Canadian SMEs often lack access to the global supply chains to unlock international growth opportunities. Said one BAI leader:

*"Countries across Southeast Asia are very aware of the environmental problems they are facing. They keep their doors open to companies that can provide solutions. Canadian technologies are some of the best in the market. We are competitive scientifically. We have good capabilities that we can translate into international markets. But it's a competitive market, and you have to be on the ground to win deals. You also need to have proven solutions. The inability to point to domestic adoption partners can be a big obstacle to winning deals. Indian companies will balk at the idea of investing \$500,000 - \$1 million in a pilot project when the technology is not yet proven."*

There is widespread agreement among those consulted for the study that the relatively small size of the Canadian market makes internationalization a critical success factor not only for firms but increasingly for the support organizations that work with them. A growing number of support organizations are building partnerships with leading international BAIs and establishing soft-landing programs that provide their clients with early exposure to global markets and thus hasten their ability to begin exporting their products and services. The need to get outside Canada isn't just about customers; instead, it's about validating the relative uniqueness and strength of a company's product or service compared to those offered by competitors around the globe.

*"Canadian firms often want to convince themselves that what they are doing is something that no one else is doing, which is rarely the case," said an executive at an investor-backed accelerator. "It is essential to understand the competitive landscape truly, not just in Canada, but around the world. If you don't see competition, you are not looking properly at the market, and you'll go to market with a misunderstanding of your relative competitive position."*



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Interviewees also called on large Canadian firms with deep international networks to play a more active role as “reference customers” and “market makers” by helping develop early traction for Canadian cleantech solutions in key export markets. And, despite existing supports, such as Global Affairs Canada’s Trade Commissioner Service, interviewees also called for a greater focus on helping Canadian startups and SMEs forge strong international ties. “There could be more support and better support for internationalization,” said one VC. “Startups and CEOs need to attend the big international cleantech events, including international tradeshow and investor events. In our experience, many founders don’t go to the events prepared. They haven’t booked meetings, and they don’t have a list of people they need to meet. It’s a real job to get them ready.”

### Modernizing Regulation to Accelerate Adoption and Remove Barriers to Commercialization

All stakeholders agree that Canada urgently needs to modernize its regulatory environment to ensure Canada remains an attractive and competitive environment to deploy new clean technologies. More specifically, there was widespread consensus across the interview sample that Canada’s achievements in clean growth and cleantech commercialization need to be driven, in part, by ratcheting up regulatory standards.

While carbon pricing plans are considered a market-friendly policy option, many executives called for a more activist approach from the Government of Canada, including an aggressive strategy to deploy regulatory standards that would raise the bar for entire industries. VCs consulted by the DEEP Centre were also unanimous in citing the need for regulatory action to accelerate domestic deployments. Said one VC:

*“The regulatory environment is a big piece of it. If you want to drive the adoption of cleantech, you must force industry to reduce emissions. Unless there are long-term structural changes to their obligations, they will just nibble and play. The regulatory environment has to support new technologies and ultimately drive incumbents to make significant changes in their operations. There are two kinds of regulatory concerns. First, you need a regulatory push to put cleantech on a level playing field with existing solutions, and then you need frameworks that fast-track new deployments.”*

Environmental regulations, including water quality/protection, soil quality, waste, and other airborne emissions standards, are set by federal, provincial, and territorial governments and can help drive the development and adoption of clean technologies. Cleantech SMEs would like to see bolder government incentives to drive behaviour changes in resources, agriculture, transportation, and other sectors. As one cleantech CEO argues:



## 4. Key Findings from the Executive Interviews

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*“We need to provide more motivation and a stronger business case for adoption. There are regulations and standards in place that can discourage companies from adopting new technologies. It takes an enormous amount of time for new tech to displace incumbent solutions and break into a market. The standards around the use of technology are so embedded. Many Canadian cleantech companies just decide to leave. I didn’t even bother with Canada. We are getting adopted in the US, Germany and others where they are willing to change the regulatory standards.”*

For bioproduct companies, regulations to reduce environmental contamination from petrochemical plastics have been a significant factor underpinning the viability of fully compostable, non-toxic alternatives. As one CEO explains,

*“Our prospective customers would not pay a penny more for a green alternative unless they had to. When there were no regulatory drivers, there was no incentive to change. It is very hard to displace what is already working. Price parity is not enough because there are high switching costs. Once the regulations came into place in Europe, they had to move quickly, and that changed the game for us. Now they have no choice but to pay more.”*

On the corporate side, companies characterized as market leaders in adopting clean technologies want interventions from governments that will “keep the rules of the game level for all players.” Said one corporate executive:

*“Our challenge with the cleantech sector is that there is no regulatory driver or specification scope to integrate clean technologies into the value chain. The provinces and municipalities set the regulations, so we have a patchwork with the inconsistent political will to address clean growth issues. Carbon pricing is the baseline. We also need a plan driven by regulatory standards, and we need to make the regulatory and fiscal framework advantageous for investments in clean technologies. Maybe we need to work sector-by-sector to establish minimum standards.”*

Finally, there is also broad concern that onerous regulatory hurdles make Canada less attractive for building new manufacturing sites and deploying new technologies. Company executives, BAIs leaders and VCs all agreed that Canada’s “zero-risk” approach to regulation is an economic killer when it comes to deploying new large-scale projects. As one VC explains:



## 4. Key Findings from the Executive Interviews

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*“The complexity of the regulatory process in Canada is a major inhibitor. Building a biofuel plant in Canada is tough compared to the US. You need environmental studies and Indigenous reviews, and there are multiple layers of approvals. It’s a heavy and expensive process, and it’s a big deterrent for companies that want to build here. Svante is going to build its first major carbon capture deployment in the US. Carbon Engineering is a global leader in carbon capture, and they probably will build and deploy in other jurisdictions. The IP and head office may remain in Canada, but the high-quality jobs and environmental benefits will go elsewhere.”*

Stakeholders broadly agree that any disincentives to deploy clean technology projects in Canada will harm our domestic sector and undermine our capacity to meet international climate obligations. As one BAI leader put it, “We need risk management and good science-based policy, but we really need to be faster than others. We talk about agile regulation, but in practice, we are too risk-averse. The US is killing us on this.”



## 5. Conclusions and Recommendations

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There is widespread consensus that the development and global adoption of low-carbon technologies are essential to achieving needed reductions in GHG emissions to cap the rise in average temperatures at 1.5°C or less.<sup>14</sup> These low-carbon solutions include proven technologies available today and new technologies not yet developed. Some of the changes include dramatic improvements in the energy efficiency of products, including the processes to make them; shifting to renewable and recyclable materials; increasing transportation efficiency and the adoption of electric vehicles; and running commercial buildings and corporate facilities using clean energy sources. According to the latest IPCC report, nothing short of a complete industrial transformation will avert an economic and environmental catastrophe. Moreover, the bulk of this low-carbon re-industrialization must occur within the next two decades—much faster than previous industrial transformations such as the transition to steam power and electricity.<sup>15</sup>

In this respect, investments in the commercialization and growth of cleantech solutions and companies in Canada are an urgent priority. As outlined below, Canada needs to strengthen its package of ecosystem supports to help promising cleantech companies climb on the ladder to high growth. We also need a step-change in clean technology adoption to reindustrialize high-emitting industries around low-carbon solutions, including transportation, resource extraction, forestry, heavy industry, and construction.

The investment analysis and executive consultation reveal mixed news regarding whether the current level of investment has put Canada on track to meet its emissions targets and build a robust cleantech sector. On the one hand, Canada has a diverse population of cleantech companies offering an array of innovative cleantech solutions to a broad cross-section of industries. Our data shows that 223 companies collectively raised \$1.4 billion in venture financing in the last five years. On the other hand, a closer inspection of the data highlights a couple of concerns.

First, VC funding for cleantech companies in Canada declined significantly from its peak in 2018 while total Canadian venture investment hit record highs. Interviewees suggest a variety of reasons for this dip. Some point to a lack of viable investment opportunities in Canada, with many early-stage companies but a dearth of VC-track growth companies. Several interviewees noted that Arc Tern and Cycle Capital (to name two) have been deploying more of their funds in the US. Others attribute the dip to turnover, with cleantech funds raising money in 2019 and 2020 for new funds to be deployed in 2021 and the years ahead. However, the trends are worth monitoring because diminishing investments in the domestic cleantech sector are not good news for Canada's ambition to build a prosperous low-carbon economy.



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A second concern is the overwhelming investment focus on software-based cleantech plays focused on industrial efficiency, energy analytics, building automation, and smart grids. Collectively, these top energy-related verticals account for 73% of the \$1.4B in venture funding between 2016 and 2020. As noted in the interview findings, investors acknowledge that a large proportion of VC deals over the past five years have focused on the so-called “low-hanging fruit” of clean technologies. Most also concede that Canada and other countries will not meet their climate obligations pursuing software-based solutions alone. While investors foresee increasing their investments in hydrogen, carbon capture, energy storage, and the bioeconomy, there are considerable barriers to overcome. The obstacles include the risk profile of hard tech companies, the lengthy timelines for commercialization, and the relatively small size of the cleantech funds in Canada, which constrains the ability to finance CAPEX-intensive companies that require large sums of capital.

A third concern is the significant concentration of risk capital amongst a small number of companies. For example, over half of the \$2.4B in private equity and debt funding between 2016 and 2020 went to GFL Environmental. This waste management firm used the proceeds to roll up a series of smaller companies into a larger entity. Another \$1B in PE and debt funding went to just seven companies. Venture funding is equally lopsided. The top 10 companies by total venture funding collectively raised over \$1B, or about 74% of all cleantech venture funding between 2016 and 2020. The following 27 companies shared \$336 million, while the bottom 50 companies raised just \$39 million.

An equitable distribution of venture financing across the population of cleantech companies is neither realistic nor desirable. On the contrary, the presence of mega-deals and late-stage venture financings generally shows that some companies are receiving the large injections of capital they need to become world-class competitors. However, the analysis does suggest that many innovative companies are not securing enough funding to reach scale. Indeed, it appears that a significant proportion of early-stage cleantech companies are heavily reliant on public grant funding for survival. For example, of the 133 companies that secured public grants between 2016 and 2020, 65% (or 87 companies) have yet to raise a venture round.

The bioeconomy is a microcosm of the broader cleantech arena. With over \$500 million in private financing and nearly \$60 million in public grant funding, the bioeconomy is the 3rd ranked vertical behind renewable energy and waste management in total funding. However, Enkern and Kruger claimed 84% of the total investment in the bioeconomy sector. Interviews with bioproduct companies revealed that several companies secured financing from corporate strategic partners. At least one company is on the verge of closing a series-A round this year. Nevertheless, the overall picture suggests that bioeconomy startups often struggle to secure adequate capital to commercialize innovative biomaterials and fuel sources.



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### Recommendations for Accelerating Growth and Innovation

What should the Government of Canada do to help ensure more cleantech companies in Canada attract the financing and other resources required to reach scale? Unfortunately, the DEEP Centre's recent research on Canada's cleantech sector suggests there is still some distance to go to make Canada a more hospitable market for cleantech solutions. As one executive explains:

*"Cleantech companies are operating in industries that have existed for hundreds of years. There is very little ground that hasn't been tread at some point. So the bar is very high for solutions that will work. It's not like digital, where there are wide open green spaces, and you can raise money around an idea without demonstrating that it works. In heavy industrial areas, you have to demonstrate a mature process. We have strong cleantech alternatives in chemicals, fuels, and water, but you have to supplant the existing solutions that are proven and are working at scale. The bar is incredibly high. There is no easy solution."*

Such observations are not isolated. Over the years, a wide variety of stakeholders consulted by the DEEP Centre have noted that Canadian companies are still facing deep-rooted challenges in the commercialization and scale-up of clean technology solutions. Challenges cited by interviewees include a risk-averse corporate culture and the need for more substantial infusions of public capital to de-risk, scale-up and deploy new technologies. Other issues include the fragmentation of support services and a dearth of sophisticated management talent to take cleantech solutions to international markets.

Many of Canada's highest emitters, on the other hand, operate in conservative, low-margin, commodity-based industries. Even in good economic times, such industries constitute challenging environments for making bold investments in the future. Indeed, there is broad support across the ecosystem for further investment in new tools and mechanisms to strengthen collaboration between cleantech solution providers and Canada's industrial incumbents.

The Government of Canada and its ecosystem partners will not find quick fixes to address the persistent difficulties cleantech companies experience in accessing patient capital, enlisting industrial partners for large-scale demonstration projects, and securing first sales in Canada. Everyone agrees, however, that collective action by all interested stakeholders—including business accelerators, industry associations, investors, large companies, SMEs, and federal government departments—can accelerate progress towards a more robust environment for cleantech investment and adoption. Synthesizing the insights from sector leaders yields a list of ten key domains where policy action is warranted.





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### Strengthen the capacity to create investment-ready companies

Canada has a large population of cleantech startups, but investors are concerned that too few companies are getting past the pilot phase and maturing into investment-ready growth companies. Sector leaders called for renewed efforts to enhance the capacity to create sustainable, investment-ready companies out of Canadian BAIs and universities to ensure a robust pipeline of cleantech startups. Specifically, interviewees see a need for more funding to equip startup support organizations with adequate resources and better coordination and rigorous benchmarking to ensure that BAIs deploy the resources for company creation, support, and scaling effectively.

**Invest in high-quality startup support services.** The propagation of cleantech support services means that governments spread the funding for program delivery far and wide. The dispersion of funding, in turn, is a consequence of Canada's geography, the multiplicity of funding sources, and the desire to foster regional cleantech clusters that cater to local dynamics. However, when questioned about the gaps in ecosystem performance, interviewees were often quick to point to inadequate funding for program delivery as a key reason they are not making faster progress in addressing some of the shortfalls in cleantech commercialization.

Given the perceived weaknesses in creating investment-ready companies, sector leaders recommend investing in high-quality startup support services that are sufficiently specialized to address the unique opportunities and challenges of different cleantech verticals. Additional funding would allow specialized BAIs to offer client companies startup capital, run demonstration projects, and provide connectivity to industry value chains. Most importantly, deeper resources would permit BAIs to hire the experienced management-level talent required to bring private sector expertise and discipline to the process of building new ventures around breakthrough science and technology. Said one VC:

*"We need more robust support for the cleantech accelerators in Canada. There are not many of them, and they don't get enough funding to run their programs properly. You need to hire the right people. They also need seed funds so that accelerators can help close the gap in early-stage funding. Then they need matching dollars so that they can use public money to leverage more private money in the demonstration phase. It is very tough to get pilots off the ground. In Canada, we do a lot of spray-and-pray. We provide small money, but not enough to do the job. Startups are shopping around for small investments. The system creates many grantpreneurs who struggle to get their technologies out of the pilot phase."*



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**Enhance support for talent development and export readiness.** In addition to supporting demonstration projects, well-resourced BAIs could address other concerns noted by sector leaders. For example, BAIs could place a greater focus on training, coaching, and supporting Canada's existing management talent pool to lessen dependence on recruiting senior executive talent from the US. BAIs could also work with EDC and Global Affairs Canada to better prepare cleantech companies to export their solutions abroad. For example, BAIs could provide guidance on international market research and the tax, HR and legal implications of operating abroad. They could ensure that Canadian entrepreneurs are highly strategic in selecting the specific markets, sub-sectors and opportunities that are most likely to advance their company's growth. With a sophisticated go-to-market plan in hand, BAIs could also help stream companies into soft-landing programs run by Global Affairs and others. As one interviewee put it: "Closing the gap in market insight would help ensure that companies are not blindly or reactively chasing international opportunities, but are doing so with very clear criteria."

**Improve coordination and specialization among support organizations.** While sector leaders favour making additional funding available to enhance the programming offered by BAIs, they were keen to advise funding agencies to focus on scale and resist the temptation to dilute the resources for startup support by distributing funding too broadly.

*"We have to look at the whole innovation ecosystem and resist the temptation to pour money into too many initiatives," said one sector leader. "Scale and critical mass are highly important. You need the funding to support the investments in people, expertise, infrastructure, and demonstration projects. They need to offer specialized services with deep expertise. A next step could be to create a seed and technology demonstration fund that support organizations could share."*

The emergence of an increasingly diverse network of cleantech-focused support services is raising concerns over duplication, a lack of coordination, and the efficient use of limited resources given the relatively small size of the cleantech sector in Canada. The proliferation of BAIs and government funding programs creates a multiplicity of decision-making authorities and a corresponding lack of cohesion, leadership, and vision to guide the ecosystem's development. As one BAI leader argued,

*"Everyone is fighting over turf and competing for the same pool of clients. We need better coordination across the country and less duplication. Entrepreneurs are getting confused. They are getting program fatigue. We are too small for everyone to do the same things in each region."*



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In light of these concerns, there were appeals for cleantech BAIs to share resources, coordinate activities and enable greater specialization. For example, a national network of cleantech BAIs could differentiate their services by crafting programming and support options for vertical clusters. Among others, cluster options could include the bioeconomy (bioenergy and bioproducts), climate tech (renewable energy, energy storage and carbon capture), and urban sustainability (smart cities, sustainable mobility).

Several sector leaders also proposed that a designated organization (perhaps the federal government or a national cleantech association) play a hands-on role in marshalling and better coordinating the support services offered by BAIs. Currently, the resources and mandates set by funding agencies determine the scope of support available from individual BAIs and may not be evident to the firms seeking support. A national cleantech association, for example, could work with its ecosystem partners to build a detailed inventory or road map of support organizations and service providers across the country. The roadmap could cover BAIs, industry associations, VCs and angel investors and provide details on:

- Current cleantech programming and services
- Areas of specialization/investment focus (by region, tech-focus, end-user markets, the growth stage of companies)
- Client intake (e.g., cohort-based vs. continuous intake and average number of clients served per annum)
- Types of funding offered (e.g., equity investments, grants, loans) and typical round sizes
- Current partnerships and analysis of their integration with the ecosystem (e.g. partnerships with VCs, corporates, universities and institutions)
- Lists of mentors, consultants, and executives-in-residence and their respective areas of expertise
- Detailed analysis of alumni performance

**Implement rigorous benchmarking.** Finally, sector leaders suggested that a road map for the ecosystem could be accompanied by rigorous benchmarking to help sector leaders direct their clients to the highest-impact support organizations. Said one cleantech association leader:

“The problem of diffuse small-scale mediocre efforts across the country is worth looking at. There would be some value in benchmarking and assessing how service providers perform relative to their peers. Who is having the biggest impact on moving companies along the commercialization pathway? Service providers may see themselves differently from how entrepreneurs see the service providers. Transparency and competition are



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good things that could enhance the quality of the support services that cleantech companies can access. Rigorous benchmarking for the cleantech sector would help sector leaders direct traffic to the highest-impact support organizations.”

Benchmarking, in turn, could help cleantech BAIs in Canada identify gaps in expertise or service delivery, build complementary programming that caters to specific niches and growth stages, and promote their programming to cleantech companies across the country. Over time, insights on the most effective forms of support for growth-oriented cleantech firms will also help BAIs refine their program offerings. Improved options for support, in turn, will ensure that cleantech firms get the targeted, high-quality services they need to build world-class ventures.

### **Boost early-stage capital and angel investment in cleantech venture**

Although cleantech is a challenging space for angels, sector leaders see wealthy individuals as a critical source of financing for early-stage companies. In a 2019 report, the National Angel Capital Organization (NACO) found that angels poured approximately \$35 million into cleantech companies in 2018, representing 25% of the total amount invested by organized angel groups in Canada.<sup>16</sup> Sector leaders identified three actions to promote angel engagement in the sector further.

- **Implement Canada-wide incentives.** First, sector leaders favour further initiatives by federal and provincial governments to lessen the perceived downside risk of providing seed capital to cleantech ventures. Several interviewees pointed to BC and Quebec as evidence that tax credits and matching funds have positively impacted angel participation in the sector. For example, Anges Québec Capital provides matching funds for qualified angel investments and has been an active investor in the province’s cleantech sector. Sector leaders would like to see such incentives rolled out across the country.
- **Syndicate deals and pool due diligence.** Angels generally lack the resources to perform due diligence on cleantech ventures. They may also lack the experience to provide mentoring, support, and guidance to the founding teams they elect to support. Where possible, family offices and angel groups should invest alongside established VCs in early funding rounds, which would allow angel investors to rely on due diligence performed by sector experts. However, the fact that angel investment often precedes VC investment suggests that there is also a role for organized angel groups to syndicate deals and pool efforts to perform due diligence on new cleantech ventures.
- **Improve investor education.** Third, sector leaders pointed to a general lack of knowledge about the returns and typical timeline to liquidity that early-stage investors can expect from cleantech ventures. Several interviewees encouraged organized angel groups to boost their efforts to educate angel investors about the cleantech sector in Canada.



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- **Increase visibility into angel financing options.** Finally, interviewees also suggested that cleantech companies could use assistance from startup support organizations in gaining better visibility into angels and family offices willing to make investments in cleantech ventures. “The investor pool that’s interested in cleantech is limited in Canada,” said one cleantech CEO. “Most of the funding for our company came from the US, with additional funding from Europe and Asia. We could use a better line of sight into Canadian sources of capital, including angels and family offices. If you want to remain a Canadian-controlled corporation, you need Canadian financing.”

In addition to angel funding, sector leaders point to the need to expand early-stage VC financing in Canada. VCs and other stakeholders argued that the timing is right to make more aggressive early-stage venture investments in technologies and companies move the needle on Canada’s transition to a low-carbon economy. “We could use more talent and more funds at the early stage, especially for hard tech and CAPEX-intensive companies,” said one VC. “Specialization is important. Climate tech is key. LPs have the appetite, but they have no idea what makes sense or where to invest. You need deep expertise. You have to connect the technology to the science and the user base. 50 – 60% of the GHG reduction will come from low-hanging fruit. The next 40% will be really hard. We need to be making the seed investments now.”

Interviewees suggested two strategies: introducing new seed funds to the ecosystem and encouraging later-stage cleantech funds to not only invest earlier but direct more funding to hard tech companies.

- **Create new seed funds.** Sector leaders called for creating a small number of new seed funds to attract new fund managers and diversify early-stage cleantech capital players in Canada. “Seed stage capital for cleantech companies is lacking,” said one VC. “Renewal in Vancouver says they are interested in late seed or early series A. MaRS IAF is the one fund that does seed rounds, but cleantech is not its primary focus. The Government of Canada could help stand up another seed fund.”
- **Encourage later-stage funds to invest earlier and with a focus on hard tech companies.** Several interviewees suggested that Canadian funds that primarily invest in Series A deals or later (e.g., Arc Tern, Chrysalis and Cycle Capital) could be encouraged to invest more of their funds at the seed stage. A dedicated envelope of VC funding could help existing cleantech funds such as Arc Tern, Chrysalis and Cycle Capital, for example, to deploy more seed-stage funding to hard tech companies, including firms working on capital-intensive solutions like advanced biomaterials, energy storage and carbon capture. Interviewees also suggested that any new funds should be set up with a mandate to invest with a longer time horizon and, in some cases, accept lower multiples. “How do you structure it in such a way that it overcomes the difficulties inherent in early-stage cleantech investing?” asked one sector leader. “Can you have a perpetual fund? Ten years is not enough for



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this sector. You need 12 to 15 years minimum. You also need a fund with the resources to participate in multiple rounds. When we look at companies, we want co-investors that will be there for the long haul. Once and done is not enough in this sector. We want investment partners that follow through and support the companies along the way.”

### **Close the late-stage funding gap in Canada**

As documented in the interview findings, the comparatively small size of Canadian cleantech funds has several detrimental impacts on the cleantech ecosystem’s economic performance. First, it limits the capacity to invest through to later funding rounds, resulting in earlier exits to foreign investors and ultimately fewer self-sustaining Canadian anchor companies. Second, it dilutes Canadian ownership stakes and means investors recycle less profit into the Canadian ecosystem. Third, it constrains their capacity to invest in demonstration projects and manufacturing facilities. Finally, it also limits the ability of fund managers to hire a larger bench of seasoned executives to support and advise the companies in their portfolios.

Sector leaders argue that boosting local sources of late-stage VC and private equity funding would accelerate the domestic ecosystem’s growth and stem the loss of potential multi-billion-dollar firms. Interviewees identified two important actions to help close the late-stage funding gap.

**Create a dedicated VC funding envelope for cleantech funds.** In addition to diversifying seed-stage funding, sector leaders recommend creating a dedicated envelope to increase the capacity of later-stage venture and private equity capital funds specializing in the cleantech sector. Sector leaders recognize that the Venture Capital Catalyst Initiative (VCCI) has already provided an important vehicle to secure VC funding for high-growth firms, including funds and companies in the cleantech sector. However, while the large share of VCAP and VCCI funding allocated to IT-related funds positioned OMERS, Georgian, iNovia and others to compete with US-based venture funds, the same is not true for cleantech funds. Sector leaders argue that a further infusion of public funding would help catalyze the additional private sector investment required to make Canadian venture funds significant players in late-stage venture capital and private equity funding for cleantech. As one interviewee put it: “The later stage capital is never enough in Canada, especially compared to the US. In the US, they are raising 100s of millions. Scaling technology requires a lot of money. We need much deeper investments if we are going to close the innovation gap and meet our climate obligations by 2030.

**Encourage Canadian institutional and pension funds to invest as limited partners in later-stage venture capital and project finance funds.** As noted in the interviewees’ commentary, the comparatively small size of the Canadian venture funds up to this point has presented an obstacle to LP engagement. Thus, in addition to public funding, sector executives called for federal leaders to cajole greater institutional participation in



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scaling the late-stage venture funds. Sector leaders would also like to see institutional investors co-invest in the more advanced Canadian companies, including companies like Carbon Engineering and Svante (to name just two) that need large-scale project financing to deploy their solutions in Canada.

*“Project financing is a big gap,” said one sector leader. “There are no players in Canada. Many deals need funds for big projects and infrastructure investments, but we don’t have the expertise to do those deals. Large project finance is complex, and you need to know how to structure big project deals. The government has a role to play there. We could be recycling some of the money from carbon credits to fund big projects that further reduce our carbon footprint. The institutional investors and pensions are not at the table either. They could do more, but they see it as outside the bounds of their usual risk profile.”*

### **Facilitate matchmaking between cleantech SMEs and corporates**

Cleantech companies and large industrial incumbents both recognize the potential to engage in mutually beneficial partnerships. Executives at large companies agree that cleantech companies can provide solutions that will equip our industrial sectors to fulfill Canada’s clean growth targets. On the other hand, Cleantech executives understand that large corporates can bring a much-needed infusion of capital, expertise, and channel/partnership opportunities to the domestic ecosystem. At the same time, sector leaders highlighted an acute need for policy interventions designed to create a business environment that is more conducive to generating early adoption and first sale opportunities. As one interviewee explains:

*“Canada has a large number of cleantech companies, but most are too small to offer full-scale solutions to large industrial partners. They can’t move beyond the research and pilot phase. They often have difficulty penetrating the large companies, either because they lack the financing or the knowledge or the connections. It is tough to identify the right people to contact in the first place. You could bring a solution to one executive, but they don’t have the right authority or the right mandate to enter into a partnership.”*





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From our consultations, the key challenges include:

- **A lack of transparency and connectivity for buyers and sellers.** Startups and SMEs have poor visibility into the operations of large firms in Canada and lack accessible entry points for marketing their solutions. Large corporate buyers also lack visibility into the landscape of potential solutions and companies that could address their innovation needs. When searching for innovative solutions, they confront a complex innovation landscape populated by a plethora of universities, colleges, incubators and accelerators—all of which host entrepreneurs who are developing new technologies and solutions that could reshape their industries. This lack of transparency and connectivity on both sides underlines the need for more effective matchmaking and visible entry points to bring small and large firms together in mutually beneficial relationships.
- **A shortage of know-how for forging effective partnerships.** Startups often fail to understand the intricacies of large-scale industrial processes and are ill-equipped to enter into serious business negotiations with a larger and more sophisticated partner. Likewise, large companies may lack basic innovation skills and competencies or not fully appreciate how to partner with startups without quashing the very qualities that make them agile and innovative. This shortage of know-how highlights the need for education, culture change and capacity building to support corporate innovation efforts and secure more first sale opportunities for startups.
- **A lack of capacity and a clear investment case to complete first sales.** Startups and SMEs seeking their first sale often lack the scale and ability to develop and implement solutions that will integrate seamlessly into national or international operations. Among large corporate buyers, there is a perception that new technologies developed by cleantech startups are risky and unproven. Furthermore, investments in clean technologies often come with significant implementation costs related to the need to reconfigure business processes and retrain employees. Such risks and costs make large companies reticent adopters of new technologies. This lack of capacity highlights the need for a direct financing mechanism to boost the capacity of startups and SMEs to produce viable, cost-effective and market-tested solutions. Such a financing mechanism could also address some of the common challenges large corporations face when integrating new technologies into their operations.

Despite these challenges, executives remain committed to working with Canada's cleantech ecosystem and offered several recommendations. The recommendations include co-financing to support first sales and a capacity building and matchmaking service to help small and large firms strike effective partnerships.





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**Offer co-financing for first sales.** First sales are notoriously tricky due to a series of challenges experienced on both the buy and sell-side of the equation. The government could deploy a direct-to-business financing mechanism to assist both the sellers and buyers of new technologies to overcome commercialization and technology adoption obstacles. Support for cleantech startups and SMEs, for example, could strengthen their value proposition to large adopters by addressing known barriers related to their lack of scale, capacity, and quality controls. Support for large corporate adopters, on the other hand, could address challenges related to the need to upgrade or reconfigure production processes and invest in the employee training and skills development required to integrate new technologies and solutions into their operations.

More specifically, a direct-to-business fund designed to support startups and SMEs in securing first sales could address needs such as:

- Strengthening a firm's capacity to manufacture, distribute or license their product or technology to corporate customers, including investments in manufacturing and distribution capabilities and appropriate quality controls.
- Acquiring technical and engineering expertise and capabilities to address product performance and reliability concerns in a large-scale industrial or commercial context.
- Building sales, marketing and customer support capabilities related to deploying a new technology or product to a corporate customer or broader sector, either by expanding sales and marketing capabilities at the management level or retaining the services of an experienced industry advisor or consultant.
- Offsetting the cost of manufacturing or distributing new products or solutions until the supplier reaps the efficiency benefits of producing and marketing the product/solution at scale.
- Establishing an intellectual property strategy, along with the costs of filing patents, trademarks, trade secrets, and copyrights to protect the technology's commercial value.
- Pursuing business development, including costs related to travel to develop new contacts or meet with prospective customers and professional fees associated with any outside expertise required to negotiate licensing fees or terms of sale.

This funding would be appropriate for startup companies that already have a market-ready product or, at the very least, a validated prototype that is ready for a large-scale pilot.



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Funding to encourage large companies to purchase technologies and solutions produced by Canadian startups could be deployed to:

- Upgrade or reconfigure internal business processes to integrate new technologies or solutions into their operation.
- Invest in skills development and employee training to support the deployment of new technologies or solutions.
- Build a compelling business case for technology adoption to help project proponents formulate a solid strategy to generate returns that meet internal rates of return (IRR) targets.

### **Create a capacity building and matchmaking service for early adoption partnerships.**

Sector leaders are calling for interventions to address the lack of connectivity between cleantech SMEs and corporates in Canada. Indeed, there is considerable support among those consulted for education, training, and support on structuring effective early adoption partnerships. Stakeholders also see value in a streamlined engagement model to enable larger corporate entities to gain exposure to companies and opportunities across the country, rather than working bilaterally through individual BAIs.

One option for consideration is a matchmaking service that would identify early adoption partnership opportunities and broker pilots and first sales. Such a matchmaking service could help ensure that small and large firms are equipped with the skills and knowledge to initiate, negotiate, and execute such partnerships successfully. Among other things, capacity-building services could help SMEs boost their institutional sales and marketing capabilities. On the corporate side, services could include performing a detailed needs analysis, verifying final product requirements, screening solution providers, and running a pilot in the customer's environment.

Ignite Sweden--a non-profit entity that runs a matchmaking program that connects startups with big companies--provides a helpful model for deploying such a service in Canada. The program offers large corporates the opportunity to have Ignite Sweden perform a detailed needs analysis, scout relevant SMEs and startups, facilitate matchmaking sessions, educate executives about how to work with startups, and host networking sessions with other large corporates facing similar challenges. Since Ignite Sweden's launch in 2017, 132 large companies and more than 400 startups have participated in over 2,400 matchmaking meetings. To date, 42% of the matches performed by Ignite Sweden have produced at least one follow-on meeting, while 112 startups have struck commercial deals with large corporates.



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In Canada, the National Research Council's Industrial Research Assistance Program (IRAP) provides advisory services to help Canadian SMEs connect to business and technology partners. NRCAN's IFIT program provides similar assistance in the context of the forest sector. However, no single program or agency is mandated to provide a full suite of matchmaking services equivalent to Ignite Sweden's. Some of the critical activities for a potential matchmaking service in Canada could include:

- **Developing and publicizing technology roadmaps to inform cleantech innovation activities.** Such roadmaps can convey industry needs and innovation priorities to entrepreneurs in incubators and accelerators across Canada. The roadmaps should identify specific problems that need solutions, describe the technologies already in use today, and specify the performance requirements to make a new solution viable at an industrial scale.
- **Curating cleantech solutions and companies.** Executives with large companies often confessed to being somewhat overwhelmed by the sheer number of solutions and the broad spectrum of maturity across the population of cleantech startups and SMEs in Canada. As a result, many see value in a curation and matchmaking function that could help them "cut through the noise" and identify high-value solutions from credible suppliers.
- **Offering product development support and mentorship** by connecting cleantech entrepreneurs to experienced business executives who can provide advice at key pivot points, shape product development and help mould vital management competencies. In some cases, product development support could include having entrepreneurs work directly with engineering and operations teams to optimize product performance and minimize costs during the product development phase.
- **Providing legal advice and a legal structure for engagement** to ensure that both startups and large corporations enter into mutually beneficial relationships and that each partner's interests are adequately protected. Corporate executives also expressed an interest in creating a safe space (i.e., non-disclosure environment) for exposing corporate innovation challenges or problems so that they aren't necessarily in the public domain.
- **Training startups on how to engage with large corporations.** For example, startups need to speak the same language as corporate executives. They need a compelling business case for investment. They also need to demonstrate that the solution they are offering can work at scale and meet the complex needs of a large international company.



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It is worth noting that there is a strong case for economic development agencies to pursue both direct to business plays and capacity-building plays simultaneously. Indeed, the strategies are mutually reinforcing. For example, in the absence of education, capacity-building and market-making, economic development agencies could find that direct-to-business plays achieve suboptimal outcomes. Likewise, capacity-building may lack sufficient traction without the direct financial support to address the challenges experienced by SMEs and large companies on the buy and sell side of the partnership and first sale equation.

### **Increase support for large-scale demonstration projects and testbed facilities**

Sector leaders argue that improving technology demonstration opportunities for cleantech companies would create springboard opportunities for companies to raise capital and market their solutions domestically and internationally. More specifically, interviewees point to three key reforms that could significantly improve technology demonstration opportunities for cleantech startups.

**Provide matching funding for demonstration projects.** Demonstration projects are expensive and risky, and there is a general reticence among Canada's large industrial companies to bear the costs of such projects alone. However, larger corporates consulted by the DEEP Centre suggested that they would be less reticent to partner with cleantech SMEs if matching funding were available to share the costs of running demonstration projects. As one executive explains:

*"On the bioproduct side, we will look for new opportunities to invest. We are seeking to move higher up the value chain. But volume is key for new products and materials. We need to be able to do stuff at scale for the economics to make sense, and unfortunately, a lot of the emerging bioproduct innovation has not been proven at scale. SDTC can help make marriages with startups successful. We depend on the additional resources to help develop, validate and de-risk the technologies."*

**Create shared testbed facilities.** The ability to test, refine and verify the performance of new technologies in testbed facilities would better position Canadian cleantech innovators to produce the best value-for-money technologies. Verified technologies would help eliminate technical risks and provide greater confidence to potential corporate adoption partners. Stakeholders are imploring federal institutions and programs to fund the creation of more shared testbed facilities for clean technologies. As one bioproduct company CEO explains:



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*"We need to scale our process and lack access to the facilities to demonstrate our technology. We have worked with the University of Alberta, where we have access to all kinds of equipment that we could not have otherwise afforded. But we need a full-scale demonstration facility, a bio-industrial complex that houses centrifuges, fermentation facilities and spray driers. In France, they have farmer's co-ops where they built a campus to support new companies with major agricultural processing facilities. It all links together into a supply chain where someone's agricultural waste becomes someone else's feedstock. We need these testbeds and integrated supply chain innovation consortia in Canada."*

**Expand public procurement of clean technologies.** Finally, other interviewees consulted for the study see public procurement as an underutilized vehicle for increasing technology demonstration opportunities. Several pointed out that Canada's federal, provincial, and territorial governments own and operate one of the nation's largest networks of buildings, transportation fleets, ports and other infrastructure that will require retooling to meet greenhouse gas reduction goals. Stakeholders argue that publicly procuring clean technologies would strengthen the business case for private sector adoption by demonstrating the potential of such technologies at scale.

*"Demonstration projects are the biggest obstacle," said one cleantech CEO. "Customers and investors always want technologies to be de-risked as possible. Having government partners arrange to deploy a new material would be a huge boost in the commercialization process. It alleviates a lot of the technical risks."*

### **Build industry consortia to share the costs and risks of cleantech innovation**

Canada has poured significant funding into consortiums organized around cutting-edge technologies like artificial intelligence, autonomous systems, the Internet of Things and regenerative medicine. While these are worthwhile and understandable targets for consortia projects, executives interviewed for this study were keen to point out untapped opportunities for clean growth innovation in more traditional sectors that remain essential sources of growth and employment in the Canadian economy.

Indeed, there was considerable support for the Government of Canada to play an ecosystem convening role and for this role to focus on mobilizing investment and addressing Canada's chronic cleantech adoption problem. Specifically, stakeholders think industry consortia could help organize new value chains around cleantech solutions and coordinate concrete investment projects to accelerate the transition to clean growth models by Canada's industrial sectors.



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**Convene consortia to accelerate cleantech adoption.** Executives consulted by the DEEP Centre believe that consortia projects could help traditional sectors integrate new technologies that will lead to new product development opportunities, lower their carbon footprints, and address long-standing productivity challenges. In addition, industry-wide collaborations create new markets and partnership opportunities for cleantech startups in sectors like agriculture, food processing, forestry, transportation, and energy.

“We see a big gap outside of the non-ICT and bio-medical sectors,” said one executive, pointing to domains like energy efficiency, agricultural innovation, food product innovation, and low-carbon transportation solutions. “We want to reuse and repurpose different materials and waste streams to develop biofuels and textiles. There are many opportunity spaces, but there is less government support,” said another executive. “We are trying hard to get better access to food innovation, and we have access to innovation around the world, but we would like to see more in our backyard.”

Entities such as Canada’s Oil Sands Innovation Alliance, the Carbon Impact Initiative, FP Innovations, the Canadian Mining Innovation Council and the Natural Gas Innovation Fund have all tried, in their own ways, to not only articulate and communicate industry innovation priorities but also broker connections between cleantech startups and their member companies. For example, the Net Zero Energy pilot projects led by the Carbon Impact Initiative bring engineering, infrastructure, and construction companies together with cleantech innovators to test and verify the performance of new technologies and materials that can improve the environmental performance of commercial buildings.

Such collaborative industry efforts are a step forward, but there is a recognition among executives that they could do much more. “Canadian companies see everyone as their competition, but they should rethink that,” said one executive. “A cohort of management could get further ahead through collaboration. They can make collective investments in technology but still compete on implementation, culture, and strategy. Collaboration benefits everyone by boosting the technological competence of the industry.”

Sector leaders argue that the government could significantly boost clean growth-focused consortia by helping to assemble private sector players and key federal entities (including NRCAN, Agriculture Canada, Environment Canada, and Infrastructure Canada) to work on concrete investment projects.



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*“Has anyone taken the leadership role on how we can accelerate adoption in the Canadian market? Our market is small worldwide. There is an argument to ignore Canada. But if we are going to grow the sector, finding domestic pilot sites is a precondition. Nobody has taken a leadership role. The government could bring NRCAN, Agriculture Canada, Environment Canada and Infrastructure Canada together on a mission to accelerate adoption. They provide a ton of capital startups; why not make adoption a priority? It’s a national problem. We need a strategic approach. We have ambitions to be a cleantech leader, yet we are crappy adopters in Canada. The government could bring the stakeholders together to help solve that problem.”*

Executives consulted by the DEEP Centre point to a handful of existing initiatives that could be replicated and scaled up in different sectors and regions of the country. One of the leading examples is the Canadian Urban Transit Research & Innovation Consortium (CUTRIC). This member-based innovation consortium partners stakeholders in industry, transit, and academia to develop the next generation of low-carbon, smart mobility technologies. CUTRIC’s work spans a wide range of emerging mobility technologies—from low-emissions propulsion technologies to intelligent infrastructure technologies for autonomous and connected vehicles—that promise to decrease fuel consumption, reduce congestion, increase road safety, and generally improve the quality of life for Canadians. It does this by supporting the commercialization of technologies required for a 21st-century low-carbon economy through industry-led collaborative research, development, demonstration, and integration (RDD&I) projects that bring innovative design to Canada’s low-carbon smart mobility ecosystem.

One of CUTRIC’s flagship projects is the Pan-Canadian Electric Bus Demonstration and Integration Trial. This \$40 million project brings competitive manufacturers together to build a high-powered, interoperable charging infrastructure for electric buses that will work across multiple municipalities, transit agencies and utilities. In addition to Canadian transit agencies, SMEs, and academics, the project proves that Canada can be a magnet for the innovation activities of some of the world’s most prominent and sophisticated technologies companies, including ABB and Siemens.

**Support the creation of new value chains around cleantech solutions.** There was an argument from some executives that companies developing less-polluting alternatives to traditional petroleum-based products and materials could use more assistance to organize new value chains with complementary capabilities to bring their solutions to market. For example, many bioproduct companies export their base materials to larger US and European companies. However, stakeholders see the potential to bring them together with companies in chemicals, agriculture, pulp and paper and automotive manufacturing to develop new bio-based materials and manufacturing processes here in Canada. As one BAI leader explains:



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*“Cleantech companies working in the biomaterials space need to think about the whole value chain, and not just the end customer or OEM. The big brand name companies, whether Ford, Danone, Nestle, Pepsi or Maple Leaf Food, all source their key components from tier-one suppliers, who source their inputs from companies further down the value chain. Cleantech companies have a hard time finding the right entry point into those value chains. In Canada, we do extraction and primary processing, and then we typically export the chemicals or materials to US-based companies that transform them into parts and systems. Once you get past the primary transformation stage, it is hard to find Canadian companies to take the chemicals through to the end customers. To get market traction, you sometimes need to disrupt those existing value chains.”*

As above, stakeholders see a role for the federal government in helping convene the relevant players and provide the matching funding required to de-risk new technologies. As an executive with an industry association explains:

*“We are focused on new processes, new products and new markets for the sector, especially new bioproducts. How do we turn forest fibres into plastics and composites? How can we grow the market for biodegradable materials? We are not doing a product push. We need a value chain approach that incorporates the chemical companies, the manufacturers, the equipment suppliers, and the end-users. What are the characteristics and the specs of the technology or materials that are required to be viable? How do we develop a new market? Scaling up some of the technologies is a priority. But it is costly. To do that, we need to de-risk the products and the market. It’s a \$25 – 45 million exercise minimum. We gather the players and the funders, and that can be cumbersome. You need to produce new products in sufficient quantities that the market can test them properly. Potential customers need to see that it can work at an industrial scale and that the economics make sense. Can it survive the valley of death? What are the specs? How will it work across the value chain? Helping to assemble value chains and de-risk new technologies is an area where the government can help.*





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As inspiration, bioeconomy leaders point to the Bio-Based Industries Consortium in Europe, which brings biotech companies together with companies in chemicals, agriculture, pulp and paper, and automotive to develop new bio-based materials and manufacturing processes. In a typical collaboration, an agriculture or pulp and paper company will supply the feedstock. Then, the biotech and chemical companies will convert the feedstock into new fuels and new materials. At the same time, the automotive companies adapt their engines and combustion systems to work with the new fuels. “The whole value chain can work together on proof of concept (POC) and a demonstration project to get access to further financing to launch a flagship production facility,” said the consortia leader. While large companies in resource-based industries tend to be very conservative, the consortia model provides a lower-risk environment for experimenting with new approaches to innovation. “They usually work in their silos, but they are breaking down barriers, and now they are working across sectors,” said one executive.

Beyond smart mobility and the bioeconomy, consortia projects across Canada could advance the development, commercialization, and adoption of new technologies in smart grids, energy storage, industrial efficiency, waste management, carbon capture, and other cleantech domains. Given their knowledge of and connectivity to the ecosystem, the NRCAN and ISED could play a valuable role in supporting this mandate. “With the right people, the government would have the chops provide a national voice and convening power for the industry,” said one VC. “The federal government has convening power, and if you use it right, you can get anyone you want in the room, including the big fortune 500 companies and the pension funds.”

The enthusiasm for government leadership notwithstanding, there is a prevailing sense of weariness among the interviewees consulted for the study. As one cleantech CEO put it, “There has been a lot of convening. We are a little worn out from all the convening. Nobody wants to sit around the table to talk.” At this juncture, any convening role led by the federal government must bring stakeholders together to advance focused innovation projects with tangible deliverables and genuine market opportunities. “You can’t do it for show and tell or song and dance,” said one executive. “You have to do it with a very concerted focus in mind. In other words, they had better bring money and apply it to concrete projects.”

### **Ensure that regulations, tax credits and funding programs are globally competitive**

While there is generous public funding for cleantech innovation in Canada, sector leaders characterized the regulatory environment for driving adoption and facilitating new deployments as less than satisfactory. Overall, there is a belief that the whole package of funding programs, tax credits and regulations must be competitive with other jurisdictions to ensure that Canada maintains an attractive environment in which to invest in new projects that will deploy cleantech solutions on a large scale. Unfortunately, numerous sector leaders claim other jurisdictions are moving faster than Canada to create regulatory environments that will attract significant investments in renewable energy, carbon capture, bioindustrial innovation, sustainable mobility and other cleantech domains.



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To accelerate Canada's progress, several stakeholders called for an 'intelligence gathering' function whereby a designated organization identifies barriers to adoption and commercialization and feeds information from the private sector into policy, program development and the modernization of regulatory frameworks. In other words, the designated organization would be acting as a sort of 'nervous system' for the cleantech community in Canada that senses and distributes vital information. For example, the ecosystem intelligence-gathering function could document industry innovation needs and gather input on how the government could modify policies and regulations to enhance the overall growth and success of the cleantech sector. Sector leaders suggested that a well-resourced industry association could fulfill this function on behalf of the cleantech sector.

For cleantech SMEs, the market intelligence function would be highly valuable, with several CEOs noting that gathering information about industry needs is time-consuming and expensive.

*"A national association could start to interview companies about the plans for adoption," said one cleantech CEO. "And they could help us better understand which markets present opportunities and what are the criteria for adoption. What barriers are they trying to break down? They could gather a lot of valuable information. The information gathering is expensive. Companies are constantly evolving. The tech landscape is constantly evolving."*

BAI leaders also need better market intelligence and called on the government or a national association to gather critical information about the challenges that cleantech SMEs are facing. Said one BAI leader:

*"We do workshops with corporate partners to understand what's preventing them from adopting technology. Beyond a demonstration project, things fall apart. We need to work together to make sure we move to the next level. The Hub could help us come up with the solutions. How do we establish a list of companies and corporates in Canada that would make an adoption pledge? How do we take it to the next level? The whole supply chain and ecosystem should be present in these processes. Having the federal government in the room is valuable. They can be present to identify resources and policy responses from the government that would make a difference, including regulatory drivers and cost-share programs. There could be incentives or other measures to enable the private sector or reduce the barriers to adoption."*



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An enhanced ecosystem presence, stakeholders argue, would lead to a more visceral understanding of what the ecosystem requires to be successful. As one BAI leader put it, “having the federal government integrated into specific networks would allow them to see and understand what’s going on.”

Finally, while stakeholders praised government support programs, many see room for improvement. Bioeconomy and forestry companies were particularly pleased with NRCAN’s IFIT program. However, on federal funding programs generally, there were repeated calls for more customized solutions. Numerous interviewees lamented the inability of federal programs to tailor the support they provide to the specific needs of SMEs. Echoing several of their peers, one entrepreneur cited instances where the rigidity and lack of flexibility of federal programs hampered their commercialization efforts.

*“The funding from the government has been awesome. 35% of our funding has been government leveraged. But the rigidity of the programs and offerings is a problem. The lack of flexibility can hamper the commercialization process. We would like to see better options for customization. The programs need flexible instruments. We also need better messaging from the agencies. They should make it clearer what the envelopes of funding are for so that we don’t waste time. It took a long time for us to understand what the expectations were.”*

Some suggested the government should roll up all cleantech relevant programming into one integrated entity with authority to be more responsive to ecosystem needs. As one cleantech CEO explains, “If they see a tech that they like, program officers ask how it can fit it into one of the programs. Instead, they should ask how they can make the programs fit the technology and business opportunities that exist.” As usual, there were also calls for less paperwork-intensive application processes, with large companies and several SMEs noting that the time intensity made them question the value of seeking government support.

### **Build a national cleantech data clearinghouse**

Interviewees voiced support for a national platform to provide visibility into cleantech solutions and companies across Canada. The idea is popular among VCs and corporates who think a database of cleantech capabilities and companies could lower their search costs. Said one VC:

*“Visibility wouldn’t hurt. Our industry is very disaggregated. The challenge is that everyone with a cleantech idea is suddenly a company. You tend to infantilize the industry by presenting 500 early-stage companies, and buried in there are twelve powerful commercial entities that get crowded out by 500 weak entities. How do you filter it? As long as you could filter*



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*it by company size and maturity. You need to be able to segregate out the more mature entities. Anything that centralizes and consolidates the industry is good because it is so disaggregated that the size and potential of our sector are not well understood."*

Stakeholders consulted by the DEEP Centre floated a variety of use cases for a cleantech data clearinghouse. An executive involved in trade promotion argues that a database of Canadian cleantech companies could enhance their capacity to promote the sector to VCs and corporate innovation scouts in international markets.

*"It's hard to plug into the business lines at 3M, Dow, GE and other big corporates. Corporates are very focused on narrow solutions to specific problems. So it becomes a bandwidth issue. Give me a tool to search and sort by size, capital raised, sector, and the TRL level. Then we could present more specific referrals to corporate innovation scouts. A database of cleantech capabilities and companies would be an enormous asset."*

An executive with a cleantech association foresees the potential to leverage a national database to monitor the evolution of the sector, better understand client needs and improve their ability to market the industry.

*"We need a central information clearinghouse and more networking opportunities to understand the real challenges in the market. Having BAIs across the country contribute to the clearinghouse could make a big difference. Without the data, it's hard to describe what's happening across our sector."*

An executive with a large Canadian utility sees a clear advantage in having access to an up-to-date source of cleantech capabilities. However, the executive pointed out that the database could be bi-directional. In addition to curating solutions, the platform could allow large companies to present problems and innovation needs. The executive also saw the potential to leverage the platform to accumulate and share best practices in cleantech adoption.

*"A clearinghouse would need to present more than a list of companies and technologies. We would also like to see a portfolio of existing industry pilots. We need to improve the sharing of best practices. It could be open source. We want to see what other utilities are doing and what they have learned from their experiments and pilots. Innovation accelerates when there is openness and sharing. It will provide more confidence in our ability to lead change."*



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While a cleantech data clearinghouse model has its champions, building and maintaining a high-quality data clearinghouse is resource-intensive. Just convincing ecosystem players (cleantech companies, BAIs, industry associations, and VCs) to share their data requires careful orchestration, leadership, and governance. Then there are technical challenges related to nomenclature, standardization, and data quality. Data curation is also an ever-present challenge because the landscape of business needs, solutions, startups, investors, and investment funds is continuously evolving.

As a result of these challenges, past efforts to build similar databases have quickly run out of steam. As one BAI leader recounts:

*"We put together a databank of companies in the bioeconomy space with some IRAP funding three years ago. However, without the resources to maintain it, the databank loses its value very quickly. Half of the companies in the database don't exist anymore. Trying to stay on top of the shifting landscape is very difficult. It is very resource-intensive. Without continuous funding, we can't maintain it."*

It is worth noting that Canada's Clean Growth Hub already leads a national Clean Technology Data Strategy, which collects and reports data on clean technology activities. This effort, which includes Statistics Canada and Natural Resources Canada, also produces statistics to track the economic performance of the sector and the impact of government support programs. While useful, this is quite different from a detailed database of cleantech companies that VCs and corporates could use to identify solutions and investment opportunities. Nevertheless, combining sector-level indicators and statistics with company-level information (including size, vertical focus, and capital-raised) could be especially powerful.

Additionally, several interviewees highlighted complementary database efforts that already exist or are in development. These include for-profit and not-for-profit initiatives led by MaRS Data Catalyst (a database of cleantech companies), Hockeystick (a database of Canadian startups and venture capital investment) and Intengine (an international database of environmentally responsible suppliers). Moreover, the Government of Canada could streamline the maintenance of a national clearinghouse if it tightly integrated the database with the reporting requirements of BAIs, government programs, VCs and other entities in the ecosystem.

### **Launch ambitious innovation challenges with private buy-in**

Several stakeholders advocated for the Government of Canada to organize cleantech innovation challenges. Incentive challenges are quite versatile in their structure. Governments can use them to stimulate a full range of innovation activities, from basic and applied R&D to demonstration projects and full product commercialization



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and first sales. Incentive challenges allow sponsors to establish a goal (i.e., defining the problem to be addressed) without prescribing a solution and only pay for the results. Doing so invites entrepreneurs to be creative in pursuing a course of action to achieve the desired result. Incentive challenges also tend to attract a more diverse group of innovators that may not otherwise participate in more traditional procurement processes,<sup>17</sup> allowing the sponsor to benefit from a larger pool of potential solutions that tap into a broader range of knowledge.

While the Government of Canada already posts challenges using the Innovative Solutions Canada platform, stakeholders suggested that innovation challenges would be more impactful if governments engaged the private sector. BAIs, industry associations, and SMEs argued, for example, that challenges that involved major industrial firms or industry associations would provide a more straightforward path to market. One cleantech CEO put forward the following argument:

*“My overall recommendation is that Canada should pursue an open innovation system with a strong mandate set by the federal government to create specific challenges. Tactically, a competition where multiple companies work with various startups to achieve certain strategic goals to gain a short-term competitive advantage would be a good mechanism to utilize competitive tension to make rapid progress. ARPA-E provides a good model for this. They make specific calls to action, with an accelerated timeline and a mentorship program that strongly pushes towards validating a product-market fit and a commercial rollout. These kinds of challenges would add significant value to the Canadian innovation ecosystem.”*

Often, the real value of incentive challenges goes beyond the investment made by the sponsor towards the dollar value of the prize and includes the impact they have in increasing the number of entrepreneurs and stakeholders engaged in the innovation ecosystem. In fact, prizes have proven to stimulate R&D investment 5 to 10 times larger than the cash reward itself.<sup>18</sup> Organizations like Canada’s Oil Sands Innovation Alliance, the Clean Resources Innovation Network, Ecotech Quebec, and Foresight Cleantech Accelerator have all run incentive challenges in the cleantech arena. COSIA’s XPRIZE challenge, for example, provides a high-profile vehicle and a solid financial incentive (\$20 million prize purse) for innovators to develop breakthrough technologies that convert CO<sub>2</sub> into usable energy products.



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In the context of supporting innovation and early adoption opportunities, the Government of Canada could partner with large firms and industry associations in Canada to co-host challenges around a variety of high-priority technology needs in key sectors. In addition to a prize purse, corporate partners could agree to test, pilot, and procure winning solutions that met pre-defined criteria. For example, the ISED and Transport Canada could co-host a challenge centred around smart mobility in conjunction with key players in the automotive sector. Or, NRCAN could co-host a competition focused on bioenergy with Foresight, the Creative Destruction Lab - Rockies, and key players in the energy sector, for example.

As one industry association leader explains:

*“The oil and gas sector has done a lot of work to crystallize their challenges and publicize their technology roadmaps. They hope that will catalyze investment and innovation. While there is value in articulating those challenges and making them accessible, they tend to lock in incremental approaches to innovation that prioritize the interests of incumbent players. It would be more motivating for entrepreneurs to look at the opportunities for climate abatement and put together really bold funding programs and normalize the culture of innovation so that we do more radical innovation within Canada.”*

*“The federal government could look at golden carrots with a willingness to pay for real breakthrough innovation using an innovation challenge model. Or they could help organize sectors into ‘buyers coalitions’ to coordinate the industry as a collective buyer. The Swedes have done this in their refrigeration challenge. We need to be more creative around the collective mobilization of buyers to advance innovation.”*

In summary, incentive challenges are a valuable tool for incentivizing the development and commercialization of new technologies at several different points along the innovation spectrum, from stimulating investments in basic and applied R&D to securing first sales and bringing new technologies to market. For many participants, the benefits of contributing to an incentive challenge go well beyond the cash prize. They include the opportunity to secure media exposure, gain recognition and credibility, accelerate their innovation efforts and establish themselves in the market. Some prizes also offer rewards such as mentoring or access to resources that are otherwise not available publicly. And the fact that numerous organizations offer platforms to run incentive challenges (at all stages of development and across all sectors) has reduced the complexity and administrative burdens associated with hosting a challenge.





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### Strengthen the Government of Canada's cleantech leadership

Most of the recommendations above highlight the need for a knowledgeable and capable “crack team” whose cleantech expertise and judgment are widely respected. For example, deep sector expertise and credibility will be required to marshal and coordinate the activities of BAIs, convene new consortia projects, support the creation of demonstration projects and testbeds, and launch national innovation challenges in partnership with industry.

To execute these functions effectively, the Government of Canada needs the right talent, including experienced individuals who speak the language of the private sector and have deep connectivity to key decision-makers in specific verticals and industry niches. As numerous interviewees noted, positioning the Government of Canada as an effective partner to industry will be challenging.

*“The most important thing is that you have to speak the language of business. You need to understand what a viable solution looks like to a corporate and what an investment-ready company looks like to a VC.”*

The breadth of cleantech domains compounds the challenge of acquiring deep expertise (e.g., everything from clean energy to wastewater treatment to AI-enabled industrial efficiency). So too does the sheer variety of sector applications (e.g., agriculture, construction, forestry, manufacturing, resource extraction and transportation).

*“You can’t be experts on everything. Cleantech is a broad category, and it’s hard to be credible to all of the various industry sectors. Doing so requires deep expertise in agriculture, construction, energy, and many other domains. It’s hard to offer value to people that are already experts in their fields.”*

Acquiring and maintaining the domain expertise to become a credible partner to industry across such a broad terrain represents a considerable endeavour. Stakeholders suggested, however, that cleantech policy and program delivery leaders could acquire these competencies through partnerships with sister agencies such as IRAP, BDC and EDC and with ecosystem participants, including BAIs and industry associations.





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### Concluding thoughts

A top-line conclusion from the evidence gathered for this study is that Canada will need dramatically improved coordination and collaboration to emerge as a 21st Century cleantech superpower. Sector leaders are rightly concerned about the lack of coordination between BAIs, VCs, regional cleantech associations and end-user industry bodies. Instead, these organizations should be working together to advance clean growth opportunities.

The government can provide leadership and resources to address Canada's cleantech commercialization and scale-up challenges, but government alone cannot remedy the ecosystem's limitations single-handedly. Other stakeholders, including industry, must come to the table to make Canada's transition to a clean growth economy successful. The bottom line is that well-structured collaborations that foster meaningful interactions between cleantech entrepreneurs, investors and large industrial partners will benefit all parties. A cleaner and more engaged corporate community in Canada can generate increased revenue for cleantech SMEs, create opportunities for SMEs to refine and scale their offerings, and provide better access to growth capital, channel relationships and global value chains. At the same time, these partnerships could infuse greater creativity and new momentum into the efforts of large firms to grapple with the economic and environmental challenges facing their industries. Such synergistic relationships will be vital to ensuring that Canada delivers on its promise to reduce its carbon footprint and seizes this historic moment to become a leader in generating jobs and prosperity from the clean growth industries of the future.



## Appendix I: Project Methodology and Approach

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The methodology for the report combines two distinct but complementary research methods: a quantitative analysis of investment data and a qualitative, interview-based assessment of the critical investment, commercialization, and growth challenges in the advanced bioeconomy and broader cleantech sector.

### Quantitative Methods

The goal of the DEEP Centre's data-driven analysis of cleantech investment activity was to obtain a granular understanding of the current size and scope of various investment types in Canada's clean technology sector. As cleantech companies and investors are diverse, we segment the analysis by participating asset classes (e.g., private equity, venture capital, and public grants) and highlight key regional, industry, and vertical trends.

In January 2021, the DEEP Centre gathered and analyzed five years of investment data (covering 2016 to 2020) on Canadian cleantech investments using Hockeystick's proprietary datasets.<sup>19</sup> The data for the analysis of investment activity includes investments from angels, VCs, private equity firms and government programs. The DEEP Centre performed a detailed data cleansing exercise to verify all records retrieved from Hockeystick. The data cleansing included removing erroneous entries (e.g., companies misclassified as cleantech), filling in missing fields, and adding industry and vertical classifications to enrich the analysis potential. The final dataset covers 223 unique cleantech companies and 526 transactions between 2016 and 2020.

In Chapter 2, we present seven different analyses of the data, including the following:

1. **Total funding and deal count analysis**, where we look at the aggregate deal counts and funding amounts for the primary investment types (i.e., PE, debt, venture and government grants) over the five years between 2016 and 2020.
2. **Industry and vertical analysis of total funding**, where we examine the aggregate deal count and total funding for each industry and vertical classification.
3. **Cleantech venture deal analysis**, where we focus exclusively on venture deal counts and funding by round and the distribution of venture financing across vertical classifications.
4. **Public grants analysis**, where we present the aggregate deal count and amount of public funding by company growth stage and the distribution of public funding across cleantech verticals.
5. **Regional analysis of cleantech funding**, where we analyze the aggregate funding in each Province and the top ten cities for cleantech venture funding.



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6. **Company stage analysis**, where we look at the deal counts and aggregate funding by company growth stage for the 2016 – 2020 period.
7. **Bio-economy investment analysis**, where we examine the transaction records for the 28 bioeconomy companies that had a funding event between 2016 and 2020 and provide an analysis of the distribution of funding across investment types, company stages, and industry classifications.

We deploy a slightly different approach for each analysis of cleantech companies and investments and reference a different subset of the company and investment records in our database. Rather than spell this out in detail here, we document the methodology and approach for each analysis in the body of the report.

### Qualitative Methods

Between May 2021 and June 2021, the DEEP Centre conducted a series of one-to-one interviews with 25 executives in various public, private, and not-for-profit organizations working on clean technology innovation and commercialization. In addition, we interviewed a further 11 cleantech executives between January and February 2020 whose insights are pertinent to this study (see Tables 1 and 2 for the combined list of interviewees). The organizations included business accelerators and incubators (BAIs), cleantech SMEs, large corporations, venture capital firms and cleantech associations and consortia projects.

The interview questions and format were structured to help:

- Better understand the current state of Canadian cleantech investment in different sub-sectors and the success rates in attracting investment for various forms of cleantech (e.g., products vs software).
- Identify the key sources of investment for the advanced bioeconomy (e.g., venture capitalists/angel investors, established forest companies, and the public sector).
- Document investors' perceptions of the risks and weaknesses associated with the advanced bioproducts and forest-based cleantech in Canada, as well as any advantages and future opportunities for growing the sector.
- Assess the extent to which existing entrepreneurial supports (e.g., business accelerators and incubators) are helping bioeconomy firms to become investment-ready.
- Identify practical interventions and recommendations for strengthening support infrastructure available to cleantech/bioproduct ventures in Canada.



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- Assess the extent to which new and existing investment strategies are likely to help facilitate the realization of Canada’s climate objectives and obligations, including the goal of net-zero emissions by 2050.
- Assess the extent to which the government and other stakeholders could leverage a regulatory “pull” to attract investment and accelerate the development of the bioeconomy.

Table 7: **Stakeholder Distribution of Interview Sample**

Stakeholder Type	Number of Proposed Interviews
Business accelerators, incubators, and innovation hubs	6
VC and institutional investors	9
Industry associations & consortia	5
Cleantech/bioprodut startups & companies	9
Large corporates	7
<b>TOTAL</b>	<b>36</b>

Table 8: **Interview Sample**

Category	Interviewee	Title	Organization
Association	Jason Switzer	Executive Director	ACTia
Association	Jonathon Rhone	Chief Executive Officer	BC Cleantech CEO Alliance
Association	Denis Leclerc	President and CEO	Ecotech Quebec
BAI	Burak Evren	Director, Cleantech Practice	Alacrity
BAI	Sandy Marshall	Executive Director	BioIndustrial Innovation Canada
BAI	Heather Marshall	Head, Partnerships & Engagement	Creative Destruction Lab
BAI	Olivier Gagnon-Gordillo	COO	Ecofuel
BAI	Jeanette Jackson	Managing Director	Foresight
BAI	Tyler Hamilton	Sr Manager, Partnerships	MaRS Cleantech

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Table 8: Continued

Consortia	Dirk Carrez	CEO	Bio-Based Industries Consortium
Consortia	Jean-Pierre Martel	VP, Strategic Partnerships	FP Innovations
Corporate	Joy Romero	VP Innovation	Canadian Natural Resources
Corporate	Irene Yang	Director, Business Development & Innovation	BASF Canada
Corporate	Sotirios Korogonas	GM, Biofuels Development	Canfor
Corporate	Carlo Dal Monte	VP, Energy & Strategic Development	Catalyst Paper
Corporate	Balaz Tolnai	VP, Research & Development	Kruger
Corporate	Tim Faveri	VP, Sustainability & Shared Value	Maple Leaf Foods
Corporate	Nestor Gomez	Entrepreneurship Program Lead	McCain Food
SME	Christina Gyenge	Founder & CEO	Agora Energy Technologies
SME	Nathan Hordy	VP Operations	Anomera
SME	Laurence Boudreault	CEO	Bosk Bioproducts
SME	Humera Malik	CEO & Founder	Canvass Analytics
SME	Apoorv Sinha	President	Carbon Upcycling Technologies
SME	Ajay Kochhar	President & CEO	Li-Cycle
SME	Gurminder Minhas	Managing Director	Performance Biofilaments Inc.
SME	Steve Slater	VP, Strategic Initiatives	Terramera
SME	William Bardosh	CEO	TerraVerdae BioWorks
VC	Tom Rand	Co-Founder & Managing Partner	ArcTern Ventures
VC	Susan Rohac	VP, Cleantech Practice	BDC
VC	Catherine Burebe	SVP	Cycle Capital Management

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Table 8: Continued

VC	Cassie Bowe	Vice President	Energy Impact Partners
VC	Marty Reed	Chief Executive Officer	Evok Innovations
VC	Michael Dennis	Investment Manager, Cleantech	Innovacorp
VC	Andrew Haughian	General Partner	Pangaea Ventures
VC	Peter McArthur	Senior Account Manager	RBC
VC	Aaron Chockla	Venture Capitalist	True North Venture Partners



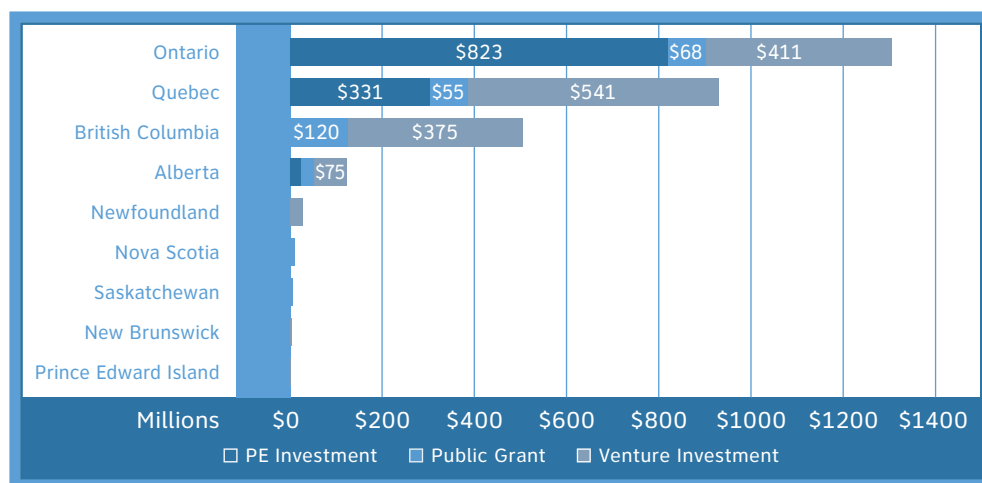
## End Notes

For the regional analysis, we examine a subset of 454 transactions, including 283 public grants, 152 venture deals and 19 PE deals between 2016 and 2020. The analysis focuses on the aggregate funding amounts for the entire 2016 – 2020 period for each province. We also provide a list of the top ten cities for total cleantech funding and venture funding.

### Total funding by province

Chart 16 shows the provincial distribution of funding across three investment types: public grants, PE investments and venture capital. Here we see that Ontario-based cleantech companies raised the largest amount of total cleantech funding at \$1.3B, thanks to nearly \$823 million in PE deals over the five years. While Quebec ranks 2nd with \$926 million, it comes out on top when taking just venture capital funding into account. Despite being home to the largest concentration of energy sector firms, Alberta lags far behind Ontario, Quebec, and BC, with only \$122.5 million in total funding over five years. That puts Alberta's total at less than 10% of the total raised by cleantech companies headquartered in Ontario.

Chart 22: Total Cleantech Funding by Province, 2016 – 2020



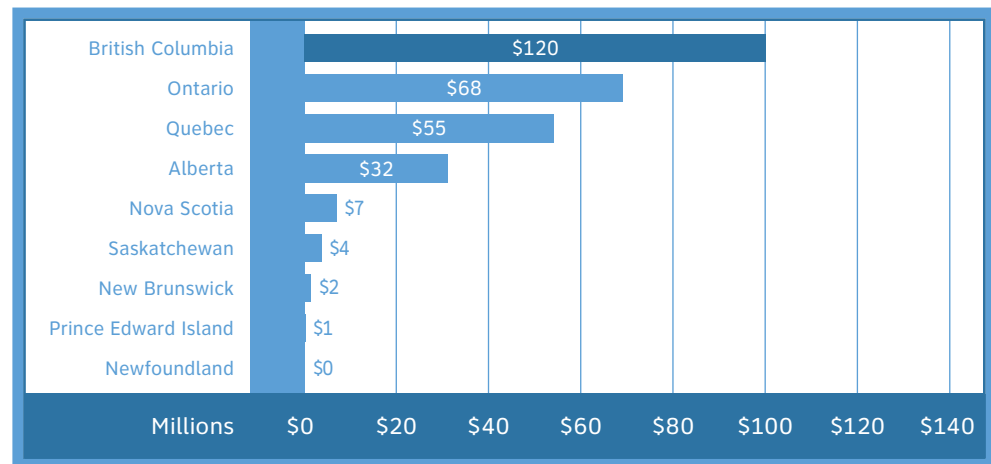
### Public grants by province

While lagging Ontario and Quebec in private financing, British Columbia-based firms are well ahead in attracting public grants. With nearly \$120 million in grant funding, BC-based firms received nearly double the amount received by firms in Ontario and more than double that of firms in Quebec. The \$50 million SIF grant to Burnaby-based General Fusion and a total of \$30 million in grants to Squamish-based Carbon Engineering help explain the discrepancy.



## End Notes

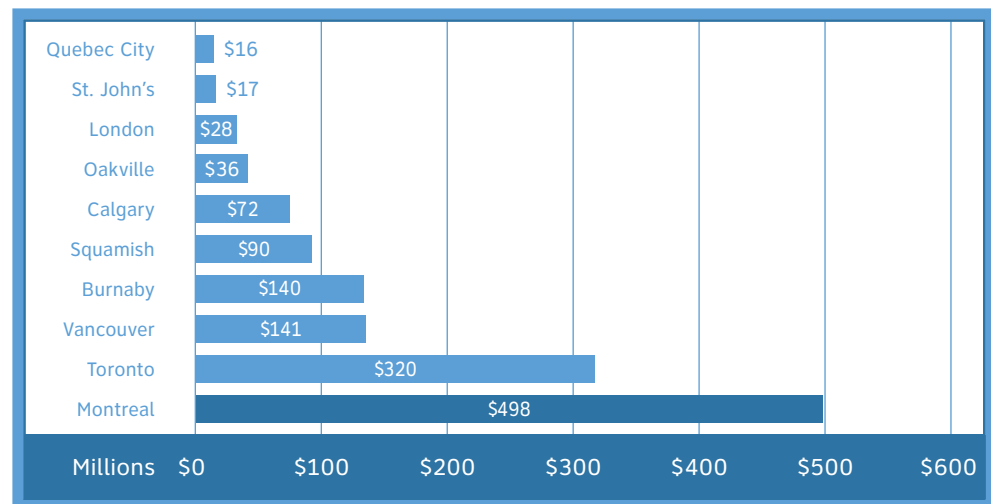
Chart 23: Public Grants to Cleantech Companies by Province, 2016 – 2020



### Top cities for cleantech funding

Montreal tops the list for total cleantech venture funding, beating other top cities like Toronto and Vancouver. Combining Vancouver, Burnaby, and Squamish into a “Greater Vancouver Area” would put the Vancouver area into 2nd place with \$371 million in total funding, ahead of the \$320 million raised by Toronto-based firms.

Chart 24: Top 10 Cities for Cleantech Venture Funding, 2016 – 2020







## End Notes

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<sup>1</sup> Climate Change 2021: The Physical Science Basis, (Geneva: IPCC, 2021).  
<https://www.ipcc.ch/assessment-report/ar6/>

<sup>2</sup> Canada's climate plan: <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan.html>

<sup>3</sup> Report from Canada's Economic Strategy Tables: Clean Technology <https://www.ic.gc.ca/eic/site/098.nsf/eng/00023.html>

<sup>4</sup> The advanced forest bioeconomy refers to a sub-set of the broader cleantech sector that uses forest-derived biomass to produce materials, chemicals, and energy. The advanced forest bioeconomy is also different from the traditional forest sector, which focuses on products such as lumber and paper. Given Canada's sustainable forest practices and forest biogenic carbon cycles, advanced forest-based technologies usually provide climate and environmental benefits.

<sup>5</sup> <https://www.msci.com/documents/1296102/11185224/GICS+Methodology+2020.pdf/9caadd09-790d-3d60-455b-2a1ed5d1e48c?t=1578405935658>

<sup>6</sup> The GICS classification standard has four levels of classifications that include 11 Sectors, 24 Industry Groups, 69 Industries, and 158 Sub-Industries. Our analysis of Canadian cleantech companies found firms in seven of the eleven sectors and 22 of the 69 industries included in the GICS.

<sup>7</sup> Anthony D. Williams, Accelerating Canada's Clean Growth Economy, Waterloo: DEEP Centre, 2016. <http://deepcentre.com/wordpress/wp-content/uploads/2019/10/DEEP-Centre-Accelerating-Canadas-Clean-Growth-Economy-September-2015.pdf>

<sup>8</sup> <https://news.crunchbase.com/news/what-a-biden-presidency-means-for-cleantech-energy-funding/>

<sup>9</sup> <https://www.theglobeandmail.com/business/article-as-clean-tech-funding-flows-in-canada-faces-a-familiar-problem>

<sup>10</sup> <https://ieefa.org/blackrock-raises-4-8-billion-for-new-renewable-energy-investment-fund/>

<sup>11</sup> <https://www.bloomberg.com/news/articles/2021-01-19/bill-gates-led-fund-raises-another-1-billion-to-invest-in-clean-tech>

<sup>12</sup> DEEP Centre, "Canada's Innovation Performance: A Scorecard," March 2015. <http://deepcentre.com/wordpress/wp-content/uploads/2015/03/DEEP-Centre-Canadas-Innovation-Performance-March-2015.pdf>



## End Notes

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<sup>13</sup> DEEP Centre “A Lynchpin in Canada’s Economic Future: Accelerating Growth and Innovation with a World-Class Business Acceleration Ecosystem,” October 2015.

<sup>14</sup> Climate Change 2021: The Physical Science Basis, (Geneva: IPPC, 2021). <https://www.ipcc.ch/assessment-report/ar6/>

<sup>15</sup> Climate Change 2021: The Physical Science Basis, (Geneva: IPPC, 2021). <https://www.ipcc.ch/assessment-report/ar6/>

<sup>16</sup> “2018 Report on Angel Investing in Canada,” National Angel Capital Organization, June 2019. <https://www.nacocanada.com/cpages/angel-activity-report>

<sup>17</sup> Thomas Kalil quoted in Mc Kinsey & Co. “And the winner is... <https://www.mckinsey.com/~media/mckinsey/industries/public%20and%20social%20sector/our%20insights/and%20the%20winner%20is%20philanthropists%20and%20governments%20make%20prizes%20count/and-the-winner-is-philanthropists-and-governments-make-prizes-count.pdf>

<sup>18</sup> Tom Kalil, “Power Tools for Progress,” June 2011. <https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/power-tools-for-progress-tk.pdf>

<sup>19</sup> In Canada, Hockeystick is the exclusive database used by the Canadian Venture Capital & Private Equity Association, the National Angel Capital Association and thousands of private firms and sources of capital.



## About the Author

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Anthony is the founder and president of the DEEP Centre and an internationally recognized authority on the digital revolution, innovation and creativity in business and society. He is co-author (with Don Tapscott) of the ground-breaking bestseller Wikinomics and its follow-up Macrowikinomics: New Solutions for a Connected Planet.

Anthony is a research director with the Blockchain Research Institute, an expert advisor to the Markle Foundation's Initiative for America's Economic Future, a senior fellow with the Lisbon Council in Brussels, and chief advisor to Brazil's Free Education Project, a national strategy to equip 2 million young Brazilians with the skills required for a 21st Century workforce.

