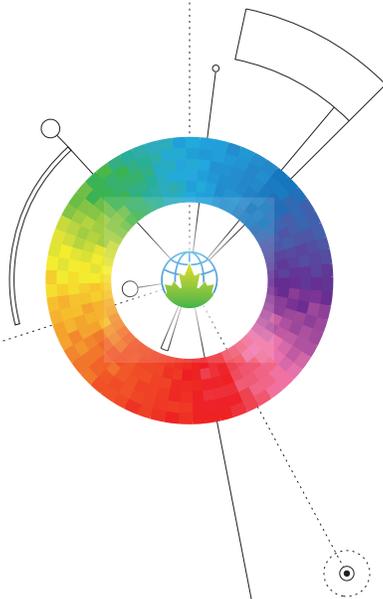


2017
CANADIAN
CLEAN TECHNOLOGY
INDUSTRY REPORT



GUEST EDITORIALS:
ACCELERATORS



Where Are We in the Clean Technology Investment Cycle?

Dr. Wal van Lierop

President and CEO, Chrysalix Venture Capital

Canadian cleantech companies are attracting global attention. Eleven Canadian companies were included in the 2017 Global Cleantech 100, a peer-reviewed list of private firms in clean technology and industrial innovation.

Many of these companies didn't start in cleantech—they had a strong business proposition, which then found a market in cleantech. The successes are those that provide a solution to a major industrial problem.

External factors are helping to drive these ventures. Last year's Paris Agreement, the Vancouver Declaration, and the Canadian government's climate strategy are all contributing to an intensified focus on environmental targets like cutting carbon emissions.

Sustainability is now a core value of industrial innovation. As we move towards a carbon-free economy, there is an urgent need to clean up industries that have long underpinned the Canadian economy. That means more efficient drilling, mining, and logging; mitigating environmental impacts; and totally rethinking some industrial processes.

A significant change has taken place in the cleantech investment cycle: We have moved from pushing technology to championing business opportunities. A company that enables mining operations to become more environmentally friendly is considered somewhat interesting, but when the solution includes the use of sensors and artificial intelligence to sort ore more efficiently and reduce waste rock movement, resulting in higher profits while also delivering environmental improvement—that's when investors and markets get excited.

Cleantech ventures must first deliver bottom line benefits rather than leading with sustainability and environmental benefits. Successful cleantech companies today are defining their value proposition in terms of productivity improvements.

Successful cleantech ventures focus on three elements:

- Addressing a significant need in the value chain of a large market. Key here is the targeting of major industries in transition.
- Doing everything that is commercially necessary for success. This includes moving quickly to market and ensuring the leadership team includes entrepreneurs that can drive commercial success, rather than focus solely on the technology.
- Providing a tangible solution that impacts the bottom line, instead of pushing the technology.

Canada is poised to build on our success in cleantech and become a global exporter of industrial technology. If we create the industries of the future, a world of opportunity awaits.

Shifting Our Innovation Mindset to Master the Green Revolution



Andrée-Lise Méthot

Founder and Managing Partner, Cycle Capital Management

Cycle Capital Management has invested \$100 million in the most disruptive cleantech startups in Canada and in the United States, leveraging more than \$1 billion into our portfolio companies, because we are confident that they will help us reach GHG reduction targets. As the leading Canadian cleantech fund, we are a privileged observer of the key challenges facing the industry.

In the past two years, Canadian industry has actively encouraged the development of clean technologies. There's a will to develop a carbon-free and more innovative economy. Yet one of the key requirements for this knowledge-based economy is the protection of the intellectual property associated with these innovations. A recent study produced jointly by Cycle Capital Management and Sustainable Development Technology Canada (SDTC), in collaboration with Écotech Québec, revealed that Canada's global competitiveness is threatened by the inadequate financing of cleantech innovations and a failure in commercializing research into market-ready technologies with appropriate intellectual property protection.

To reach the objectives set by the action plan for climate change and ensure the shift to a greener economy, we need to protect the ownership of these innovations. Canada's new mantra should be "publish, protect, or perish," to ensure the transition from innovation to market-ready solution is protected by sound patents.

The study also revealed that the Canadian cleantech sector needs more targeted investment in competitive cleantech companies. It revealed, moreover, that while our cleantech companies compete at the same level as their US rivals, they receive half the investment. Also, the low level of participation and involvement of corporate investors and pension funds in the financing chain is an issue. Their presence would help increase the size of financing rounds; partnering with a corporation is the real testing ground for cleantech companies. Governments must also act as model customers by buying these technologies.

Humankind faces a great challenge in global warming. The shift to a greener economy is therefore not only a desire, but a necessity. The cleantech sector will be a key driver of the fourth industrial revolution. To reach our goals and have an impact, industries, corporations, governments, and entrepreneurs need to work hand-in-hand to make clean technologies a top priority for all.



Accelerating Innovation in the Resource Sector

Neil Huff

Director, Foresight Cleantech Accelerator Centre

The global cleantech market is expected to reach \$3 trillion by 2020. Foresight Cleantech Accelerator Centre partners with entrepreneurs and industry leaders to foster innovation in the resource sector and to help Canada capture a share of this burgeoning market.

Foresight Cleantech Accelerator Centre: Supporting the next generation of Canadian success stories

Foresight is a not-for-profit company that helps cleantech startups develop and grow their ideas from concept to commercialization by providing education and mentoring to help them hone their product and value proposition, define their market, and secure growth financing; access to customer networks, lab and meeting space; and connections with investors, corporate partners, and potential customers.

Foresight's ARCTIC program: Partnering with industry and entrepreneurs to find solutions for resource-sector challenges

Foresight's ARCTIC program is a platform for bringing together key players in the industry and cleantech ecosystem. It provides a structured approach—the ARCTIC challenge process—for developing innovative ideas and environmental solutions, the ultimate goal of which is to commercialize innovative technologies in response to "real world" industry problems.

Each ARCTIC challenge follows the same three-phase process:

1. The Challenge Dialogue: A specific market challenge is identified, in consultation with industry.
2. The Challenge Sprint: A panel shortlists firms that will receive funding to develop prototypes over a six-month period.
3. The Field Trial: The industry sponsor selects one prototype to receive additional funding for field testing. Foresight then provides support to help the company move towards commercialization.



COSIA Waste-Heat Recovery Challenge: Innovation in practice

The Waste-Heat Recovery Challenge, sponsored by Canada's Oil Sands Innovation Alliance (COSIA), is one of four ARCTIC challenges currently underway. COSIA sought out innovators with ideas on how to a) capture low- and high-grade waste heat vented from oil sands in situ facilities, and b) transform it into a higher-value heat or electricity.

In our experience, the characteristics of a good technology adopter include:

- A willingness to identify a serious problem and provide commensurate funding.
- A willingness to create a challenge paper, participate in an SME selection process for the Sprint, and select a Sprint winner.
- Being open to providing the site and financial resources to facilitate a field trial.
- And being serious about commercializing a technology that shows promise in helping solve the identified problem.

By providing a platform for catalyzing innovation in the resource sector, Foresight's ARCTIC program is demonstrating that solutions to seemingly intractable environmental challenges can be found.

Accelerating Cleantech Start-up Success in Canada

Michael Dennis, Ph.D.

Investment Manager, Innovacorp

Under the Pan-Canadian Framework for Climate Change, the report of the Working Group on Clean Technology Innovation and Jobs (December 2016) recommended to “strengthen support for clean technology start-ups and entrepreneurs through incubators and accelerators.” A workshop held the same month in Calgary by Innovation Science and Economic Development (ISED) Canada brought together cleantech accelerators and incubators from across Canada and provided a rare opportunity to share information on models, learnings, successes, and failures. There was discussion and some excitement among participants for a national cleantech accelerator “platform” or network that would link and leverage resources and enable start-ups to access experts, facilities, partners, and networks that best fit their company’s specialization and stage, independent of where the start-up is located.

A recent commentary in a national newspaper argued that the growing number of IT accelerators competing for start-ups in Canada does not deliver the requisite value. In the case of cleantech, deep and specialized technologies, long development cycles, capital-intensive demonstrations, and complex supply chains put the sector much closer to medtech than to IT (although cleantech and medtech IT-innovations can be quicker to market). There is no oversupply of cleantech acceleration support in Canada; indeed, there is a strong case for federal and regional governments (and corporations) to support the emergence of a national platform that would provide cleantech start-ups with rapid and seamless access to acceleration resources and best practices.

Cross-collaboration between groups is happening to some extent. Innovacorp gives cleantech start-ups in Nova Scotia access to training and mentors provided by Ecofuel (New Brunswick is following suit) and to market intelligence services from MaRS (under a federal funding program to incubators and accelerators across Atlantic Canada). Innovacorp also works with Guelph-based BioEnterprise, a national AgTech accelerator with a unique model, to give AgTech start-ups access to a national advisor network. These examples are exceptions to the rule.

The time is therefore ripe for coordinated efforts and directed funding aimed at strengthening and linking regional accelerator nodes. This will ensure cleantech entrepreneurs get the best resources when needed. Building and tuning this national engine for cleantech start-ups and connecting it to the world offers the highest potential for creating technologies and companies that will change the world.

Spotlight on Innovate Calgary: Green Tech Mentors Global Accelerator Collaboration Turbo-Charging the Cleantech Sector in Alberta



Connie Raddatz

Program Manager, Green Tech Mentors, Innovate Calgary

The acceleration of clean technologies required to meet Canada's GHG-reduction goals is a long, arduous process. Cleantech start-ups often struggle to achieve the magical combination of a clever technology, a strong management team, willing customers, and a deployable product, all readily financed.

Alberta's innovation ecosystem leaders recognize that the value of global contributions such as human capital, investment, and market connections could fill certain gaps to fast-track start-ups and the cleantech sector. Innovate Calgary, supported by Alberta's Ministry of Economic Development and Trade developed Green Tech Mentors (GT Mentors), a program connecting Alberta-based start-ups to global talent, markets, and investment accessed through a global accelerator network.

GT Mentors leverages its global accelerator network to support Alberta-based start-ups in some of the following ways:

- **Leverage human capital and expertise.** GT Mentors sources and matches missing expertise (mentors, advisors, executives) for start-ups through its global accelerator network. One of our recent clients was connected with a potential advisor in the Pacific Northwest to further develop the client's strategic reach into the United States.
- **Access to new markets and broadening opportunities.** Early access to new markets can be difficult to achieve, yet critical to identifying the best market opportunity. GT Mentors connected two companies to customers, funding opportunities, and mentors in their path towards exports through leveraging our relationship with the Canadian Technology Accelerator programs in France and Denver.
- **The introduction of solutions into Alberta.** The technologies required to achieve Alberta's GHG-reduction targets may not be locally available. Through GT Mentors' global accelerator network, clean technologies are sourced for local funding calls to significantly increase the pool of high-quality solutions. The New Energy Nexus is an early facilitator of global collaboration amongst accelerators and Innovate Calgary is an early member.
- **Financing options.** Global accelerators could provide GT Mentors' start-up clients an access point for private capital through specialized high-net-worth/family offices, angel networks, and alternative cleantech funding mechanisms to support long development cycles.

While in its early days, GT Mentors and its international networks are part of a broadened trend toward collaboration to provide solutions, support the reduction of GHG's, and stimulate economic growth. Connecting cleantech start-ups to global market opportunities, human capital, and funding has only just begun.



Smart City: Ottawa's Cleantech Ecosystem

Jonathan Milne

Managing Director, Innovation, Invest Ottawa

When people think clean technology companies, their minds traditionally jump to images of solar panels, wind turbines, and hydro water dams. This has recently shifted to include electric cars, smart thermostats, and LED lights. As we look forward, the definition of a clean technology company will expand, as the possibilities for their impact are enormous. Increasing demands for energy, concerns about the environment, and the sustainable use of resources are the driving forces behind the rise of various clean technologies. Numerous economic development reports predict that by 2020 the cleantech sector will be the third largest industry globally, and Canada is poised to be a leader in the development and advancement of this high-potential economic sector.

Canada's capital is helping to grow this scene. In Ottawa, cleantech is represented by approximately 5,500 people and 200 companies, including top-ranked Fortune 500 companies such as Waste Management, Johnson Controls, Wesco, Honeywell, and Enbridge. The wealth of talent in the region has helped give rise to Ottawa's cleantech sector, whose breakout technologies are providing competitive and environmentally responsible solutions.

Ottawa also hosts a large concentration of clean energy and technology researchers in academia, federal labs, and private companies. This convergence of public, private, and academic expertise gives Ottawa a unique and competitive edge for those looking to further develop their technologies. As a result, many cleantech companies are drawn to this city because of its close proximity to these federal labs and researchers.

As we continue to build and foster the cleantech sector in Ottawa and, moreover, Canada, the push for incubators and accelerators is to help young companies find the early market adopters, likely within Smart Cities around the globe, that are ready to invest and take the leap forward. Smart Cities investing in these companies should also have a dramatic impact on society, albeit requiring new and significant investment cycles from government. The future in cleantech is in Smart Cities and the key areas will be smarter power, smarter infrastructure, smarter data, smarter broadband access, smarter . . . Yes we all need to get smarter!

Kinetica: De-risking and Accelerating the Commercialization of Innovation



Kevin Frankowski

Executive Director, Kinetica Ventures, Powered by Innovate Calgary

In today's marketplace, constraints are piled upon constraints: price pressures, market access, impending carbon constraints, etc. Stakes are high—financial, environmental and social and stakeholder aspects need to be addressed in a balanced, integrated way. The pace of change, its breadth, and the ability of more nimble, non-traditional players to create seismic shifts in your sector are all unprecedented.

There is a solution. The path to growth is through innovation.

Whether you are a new technology developer working from a spare room or a hundred-year-old super-major, there has never been a more urgent time than today for understanding how innovation works — and then doing it well.

Kinetica Ventures, powered by Innovate Calgary, is a commercialization accelerator that leverages proven best practices to make innovation more understandable and less risky. We work with energy technology developers and end users, both large and small, to help them understand the path to unlocking value and increased market share. Our experience shows that successful commercialization has some key enablers:

- **Value Proposition:** Before you can sell your great idea, you need to understand your customer's needs and business well enough to be able to frame your value in language and numbers that they see as compelling, rather than what you assume might be compelling. That typically means answering their key techno-economic question: can you prove this works and saves me money?
- **Commercial Focus:** As technical people, we often fall in love with the technology. However, successful commercialization requires a much stronger focus on commercial aspects, especially understanding customer needs earlier. In fact, advancing commercial readiness sooner will often result in faster, cheaper, and more successful outcomes than traditional "technology-first" approaches.
- **Use Best Practices:** There are proven best practices for de-risking innovation and accelerating commercialization, minimizing flailing and guesswork. Techniques such as Lean Startup, Business Model Canvas, and Design Thinking can overcome the Implementation Gap, and bring together operational and innovative approaches, unlocking significant value and growth.

Innovation should be used as a dynamic strategy, seeking and capitalizing on opportunities swiftly. Regardless of company size, maintaining this corporate fitness is essential today.



Innovation is Good, Adoption is Better

Jane Kearns
Senior Advisor, MaRS

Innovators look at the world and see how it can be made better. But sometimes, the world looks back and says it's just too difficult to change.

No matter how brilliant the idea or how clear its value proposition, it is tough to persuade purchasers to alter their buying behaviour, and even harder when markets are set up to favour the status quo.

Cleantech companies are particularly vulnerable to this kind of systemic inertia. Many of the markets they are trying to access—such as energy, wastewater treatment, and green buildings—are tightly regulated and dominated by a few incumbents who are highly risk averse and have little incentive to adopt new technologies.

This is where organizations like MaRS Discovery District come in. MaRS is well known as an innovation hub, but our advisors spend as much time talking to governments, regulators, utility companies and purchasing managers as they do helping startups develop their technologies and businesses.

The Advanced Energy Centre, a collaboration between MaRS, key corporate partners, and the Ontario Ministry of Energy, brings stakeholders together to identify factors preventing the adoption of innovative technologies, and then works to break them down. That's no easy task, as these barriers tend to include a complex variety of economic and human factors ranging from outdated regulations to lack of risk-taking in corporate cultures, or even just fear of the unknown.

While our primary focus is Canada, MaRS also takes this approach to the global stage. We have embarked on an ambitious effort to forge partnerships with key players in international markets to provide Canadian startups with connections and expert knowledge. We are also aiming to create a network of co-working spaces in major cities around the world for Canadian entrepreneurs to use when travelling overseas. For an export-focused sector like cleantech, these moves should pay significant dividends.

This work is the less glamorous side of innovation, but it is no less important. Any organization that is serious about supporting innovators should also be in the game of breaking down market barriers. With a sustained effort on this front, we can smooth the path for more Canadian clean technologies to enter markets and deliver their environmental and economic benefits.

Smart Public Procurement: A Multi-Billion-Dollar Opportunity to Boost the Low-Carbon Economy

ADVANCED ENERGY CENTRE
MaRS Cleantech | Ontario, Canada

Ron Dizy

Managing Director, Advanced Energy Centre, MaRS

\$150 Billion.

This is what federal-provincial/territorial governments spends on the procurement of goods and services each year. This tremendous purchasing power represents a huge opportunity to create the demand drivers necessary to seed market opportunities for clean technologies in Canada. Public procurement can have a foundational role in stimulating an innovative, low-carbon economy. Proving adoption in domestic markets is a boost for developing export opportunities.

But how can this be done in practice, while assuring value for taxpayer dollars?

Outcomes based procurement models are gaining traction on the international stage, with organizations such as the World Bank highlighting this as a key strategy to improve procurement efficiency. Under this model a customer contracts and pays for results delivered, rather than a defined activity, task, or asset—a move from focusing on the “how” of traditional procurement to the “what.”

Without prescriptive specifications, the innovation community is free to propose any solution that delivers the desired outcome. Sometimes that may be technology driven, but it might also be business-model driven. With payment based on the delivered outcomes, suppliers deliver innovation, efficiency, and value—accepting risk of delivery.

In 2010, the Norwegian Ministry of Transport used this method to procure the world’s first electric ferry. The tender did not specify a technology, only a clear objective (a 15–20 percent improvement in energy efficiency) and sustainability criteria. The success of this tender triggered others, helping create a market for low-carbon ferries.

But it can be difficult to define desired outcomes and develop the right performance indicators. A lack of relevant and enforceable metrics is often cited as the biggest challenge. The success of these procurements requires a cultural shift in organizational thinking, and relinquishment of a large degree of control on the part of the procuring organization. Achieving adoption of this new approach will require capacity-building initiatives for both procurers and supply chain players.

Despite these challenges, the potential benefits are significant. The Canadian government has committed to modern, clean, and scalable procurement that benefits Canadian businesses. Outcomes based procurement is a key part of the solution.



The Role of Cities as Innovation Platforms

Bryan Buggey

Director, Vancouver Economic Commission

Since 2010, the City of Vancouver has been executing its world-acclaimed Greenest City Action Plan (GCAP), which aims to reduce Vancouver's environmental impact by a wide range of measures and make it the "greenest city in the world" by 2020. The plan is a bold one and has called on the Vancouver Economic Commission (VEC) and the City to support and enable innovation and innovators in new ways. Today, Vancouver is more than halfway through the plan and has already produced some impressive results, including a 15 percent decline in greenhouse gas emissions; a 27 percent decrease in vehicle kilometres driven per person; and a 23 percent decrease in solid waste to the landfill, all since 2007.

Vancouver is moving to a low-carbon, knowledge-based economy that already counts over 20,000 "green jobs" representing over 5 percent of today's local workforce. Furthermore, local businesses from all industrial and commercial sectors are becoming more engaged in greening their local operations, despite the lack of any meaningful federal or provincial regulations. Today, Vancouver's economy is the most diversified in Canada and, at 4.1 percent, is enjoying one of the highest GDP growth rates in the G7. Clearly, going green has not constrained economic growth.

The GCAP has enabled the VEC to support a thriving green economy and cleantech cluster and help establish the city as a green-innovation platform. For example, the VEC's successful Green & Digital Demonstration Program helps local entrepreneurs accelerate the commercialization of their new cleantech, clean energy, and Smart City innovations by allowing free access to city-owned sites for pilot testing and showcasing. Another outcome of the GCAP is the work that the VEC is doing in partnership with City Planning to explore innovative land uses and zoning for inner-city industrial land, providing opportunities for future green enterprise zones and innovation districts.

Vancouver is set to become the greenest city in the world by 2020, but City Council has an even larger agenda. Last year, it passed a motion to become a 100 percent renewable-energy city by 2050, setting up Vancouver's innovators to create new solutions once again. The evidence is clear. Going green is good for business and the local economy and Vancouver is proving this every day. The innovation platform the city provides is central to our future and can be emulated in other cities around the world for the benefit of humanity and our planet.



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