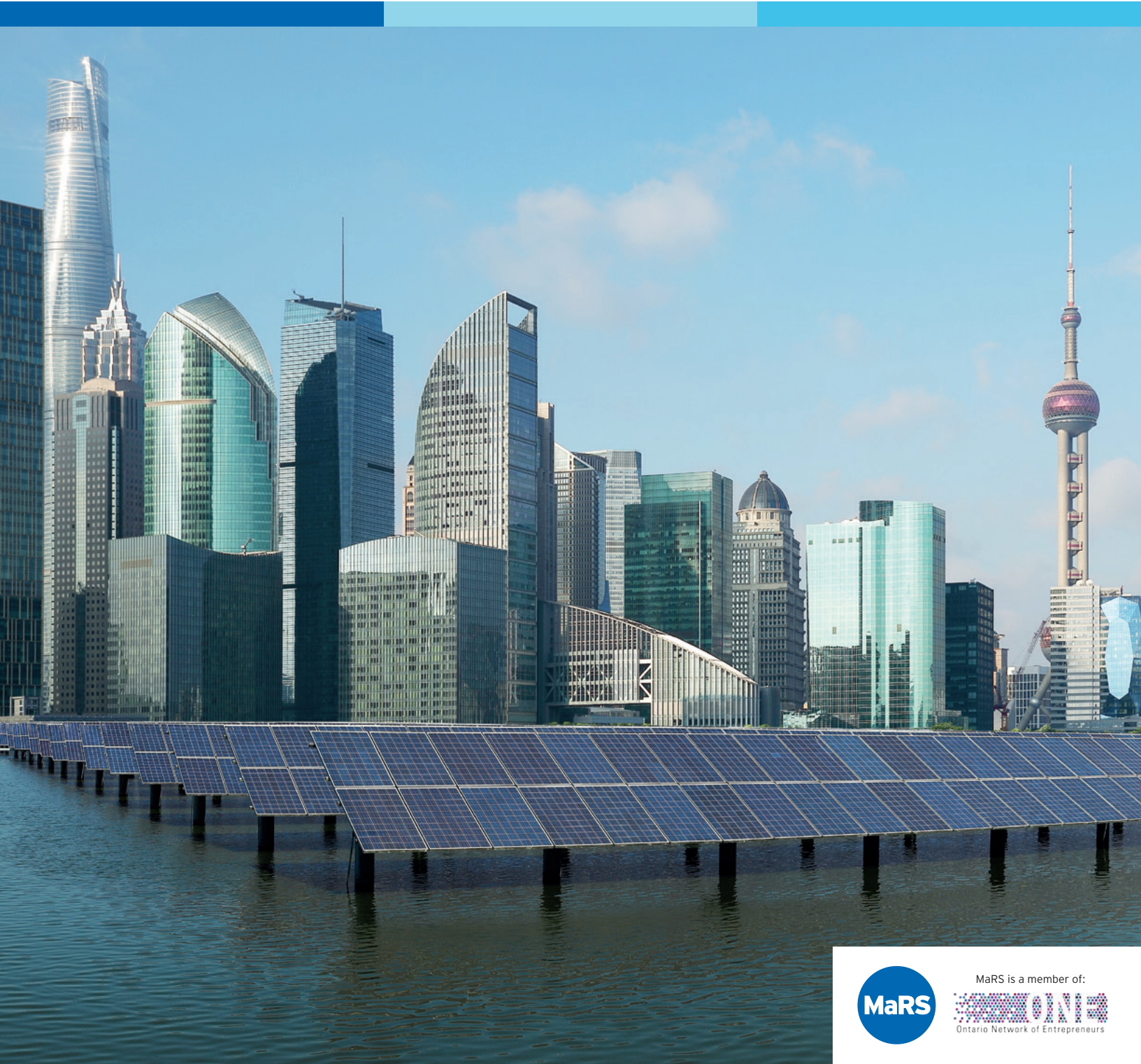


# Entering China's Emerging Cleantech Markets: An opportunity for Ontario startups



## About The Author

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*Special thanks to Cindy Dongxin Hu*

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MaRS Discovery District, ©June 2017

## About this report

This report is designed to reveal opportunities in China for the Ontario clean technology, or environmental technology, sector. Within this report, you will find an overview of elements that will influence those opportunities and issues around market access. Entering the Chinese market for cleantech startups can be challenging but the potential opportunities outweigh those challenges. This report will include an overview of recent changes in policy impacting the sector, key opportunities, the investment landscape, changes in China's innovation landscape, how to make first contact and evolutions in the IP landscape.

This publication is the third part of a series produced by MaRS called Going Global: China. Download the earlier reports, **Playing the Long Game: China's market opportunities for Ontario startups and Entering China's Emerging Life Sciences Markets: The opportunity for Ontario startups.**

**Note:** In this report, we use the term "cleantech" to refer to a range of products and services that are sometimes also known as "green technologies" or "environmental technologies." What they share in common is that they are versatile and adaptive and have the capacity to reduce the impact on the environment. This family of technologies can include renewable energy technology, energy efficiency, energy storage, transportation clean air technologies, recycling technologies, clean water technologies and clean agriculture technologies. All dollar figures are cited in Canadian dollars, unless otherwise noted.

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# Executive Summary

China has declared a dramatic shift away from its sole focus on economic growth, an approach that has created significant environmental challenges. In its place will be a trajectory toward sustainability—and a rapid one. Backed by a host of policies with tight deadlines and coupled with finance, this new era is ushering in the need for solutions. Over a period of four years, China will spend trillions of dollars to adapt its urban environments, ensuring cleaner water, air, food and energy supplies.

China presents Ontario cleantech startups with a vast array of challenges and opportunities. It can be a market to commercialize and scale up faster than in North America. It can also be an excellent environment to garner investment for promising technologies. Chinese companies are highly risk averse when selecting a brand or service. They are far less likely to opt for an unfamiliar company or technology. However, it might be easier to tap into the Chinese market by taking space in one of the country's accelerators to build coveted and necessary relationships. While intellectual property is still a concern in China, the landscape has changed dramatically and is changing quickly. Overall, this could be a golden era for Ontario cleantech companies to engage with China.



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# Introduction

China's rapid development has undeniably raised the quality of life for its population in a very short period of time while transforming the nation in ways and at a pace never before seen. Between 1980 and 2012, the United Nation's Human Development Index (which measures life expectancy, access to education and overall standard of living) for the nation increased by 72%.<sup>1</sup> The rapid development has produced unprecedented benefits for the population. During the first phase of this growth, not much attention was paid to sustainability and the environment. However, as the country continues to modernize, the need for environmental stability will be more tightly aligned with economic growth. This has given rise to a host of policies backed by finance to both innovate and implement cleantech solutions across a broad range of sectors.

## INTENSIFIED ENVIRONMENTAL POLICY REFORM DRIVING CLEANTECH ADOPTION

National policy frameworks play a crucial role in supporting the development and implementation of cleantech in China.<sup>2</sup> The national Five-Year Plan (FYP) sets the tone for subsequent policies to support investment and the implementation of technologies.<sup>3</sup> In the past two FYPs (11th and 12th), there have been notable increases in the levels of environmental targets addressing pollution, driving the need to adopt various clean technologies. In March 2016, China officially released its 13th FYP that will cover the years 2016–2020.

This version of the FYP appears to follow themes described in the previous plan, especially when pertaining to increased environmental stewardship and laying out environmental targets and timelines to achieve them. This plan will bring China closer to its emissions reduction commitments and ensure a more sustainable approach to its economic growth.

## HIGHLIGHTS OF CHINA'S 13TH FIVE-YEAR PLAN

- Ushers in a dramatic energy revolution that targets reducing consumption and/or demand, increasing efficiency, accelerating the departure from fossil fuels, promoting electricity market reform and reducing carbon intensity
- Bolsters the war on pollution with a focus on air, water and soil quality
- Fosters a circular economy with a focus upon resource reuse and recycling
- Encourages dramatic change to urbanization/ built environment with a focus upon land use and environmental quality
- Drives rural and agricultural development

## DRAMATIC SHIFT IN ENVIRONMENTAL REGULATION

Further evidence of China's commitment to altering its course on environmental matters is the ratification of the Paris Climate Agreement in September 2016 and sweeping changes to the Environmental Protection Law in 2015. In the Paris agreement, China has committed to peaking its CO<sub>2</sub> emissions by 2030 and might even reach that goal as early as 2025.<sup>4</sup> China has also resolved to maintain its commitment to the Paris agreement as the US backs away from its own. Will China become the global leader in tackling climate change?

Following eight years of running seven carbon trading pilots across the country, China is implementing a nationwide program in 2017.<sup>5</sup> It has also made sweeping changes to the national Environmental Protection Law for the first time since 1989. Updates to the law include creating financial mechanisms (punitive fines) to enforce compliance and broadening the scope for areas requiring environmental assessments. New measures to ensure environmental protection include harsher fines for offenders, obligatory reporting by companies creating environmental impacts and dismissing or demoting government officials for keeping environmental breaches from the public.<sup>6</sup>

# Ontario cleantech innovation

## ONTARIO: THE HOTBED OF CLEANTECH INNOVATION

According to Cornell University's report, INSEAD, and The World Intellectual Property Organization, Canada is the sixth most innovative country in the world.<sup>7</sup> A report by the Cleantech Group and the World Wildlife Fund ranked Canada in the top seven globally for innovation and commercialization in cleantech.<sup>8</sup> The 2017 federal budget, which makes innovation in Canadian cleantech a high priority, indicates that Canada might pull ahead in cleantech innovation. Within Canada, Ontario plays a significant role in Canada's vibrant cleantech startup community. However, startups in Ontario, like those in the rest of the nation, face the challenges of a relatively small market and limited access to funds for commercialization. China can offer Ontario cleantech entrepreneurs the opportunity to access capital, further develop technologies and reach a significantly larger market.

## A TIME OF OPPORTUNITY FOR ONTARIO CLEANTECH STARTUPS

Ontario is home to a robust environmental sector that covers a diverse range of technologies, including power generation, energy infrastructure and smart grid, biorefinery products, green building technologies, recycling, recovery and remediation, transportation, water and wastewater, among others. By 2022, the industry is estimated to generate approximately \$10 billion in revenues.<sup>9</sup>

China's 13th FYP and other recent policies outlined in this work demonstrate that China is implementing some of the most rigorous environmental remediation policies in its history. The evidence is clear that China is determined to rapidly clean up its environment. This determination creates unprecedented opportunities for cleantech in China. With Ontario's clear competencies in this area, this could make for a very interesting time for its cleantech sector if it is willing to take the plunge into this quickly emerging market. The section below discusses some of China's most interesting opportunities.

# An appraisal of environmental challenges and opportunities in China's cities

## THE URBAN BILLION AND THE BUILT ENVIRONMENT

It is projected that the equivalent of 10 times the Canadian population will relocate to China's cities over the next 10 years, all with transportation and consumption needs to be filled as standards of living rise.<sup>10</sup> According to China's 13th FYP, the urban population will reach 60% by 2020<sup>11</sup>, and by 2025 it will swell to approximately 65%, or more than 1 billion. Accommodating this volume of new residents will require a massive urban build-out.

As per the global engineering firm Arcadis' report *Global Built Asset Wealth* (2015), China's current built asset wealth stands at \$64 trillion. The same research predicts that this amount will double by 2025 to \$130 trillion.<sup>12</sup> The nation has built out approximately 65% of its basic infrastructure like

water, electricity, roads, telecom and Internet connectivity and supposes that nearly \$50 trillion will be invested in commercial and residential buildings.<sup>13</sup>

The McKinsey Global Institute released a study in 2009, which estimated that between 20,000 and 50,000 buildings with more than 30 stories will be constructed by 2025.<sup>14</sup> In the building sector, China's two most prominent building standards are China's Green Building Evaluation and Labeling (GBEL), otherwise known as China Three Star, and Leadership in Energy and Environmental Design (LEED).<sup>15</sup> These two systems are driving significant change in China's building industry and creating opportunities for innovative clean technologies in the sector.

## OPPORTUNITY ALERT

China's cities will need to be radically rethought to accommodate their new residents, while also maintaining urban sustainability and delivering a high quality of life. The management of traffic congestion, power supply, water, air quality, waste management and food security will all require innovative approaches. This will also include consideration of a building's entire lifecycle from minimizing the impact of construction, to operation to demolition. This leads to the need for sustainable buildings and building materials. As China develops more sustainable urban environments, here are some likely places for some of that \$50 trillion.

### BUILDING MATERIALS AND METHODS

China's urban build-out and approach to creating a circular economy will drive opportunities for technologies and products that employ circular building approaches, such as urban mining, waste to building materials and bio-materials. Services for existing buildings could include energy auditing, energy modelling and building retrofitting. Energy conservation technologies could include water heating, efficient lighting, appliances, efficient HVAC, smart home energy management technology and insulation.

There are **more than 100 cities** in China with budgets ranging from \$21–200 million for their **smart city programs**.

## SMART CITIES AND THE INTERNET OF THINGS

The expected dramatic growth of cities in China might bring a host of challenges, including traffic congestion and power supply, water, air quality and waste management. One solution that appears to be gaining traction in China is the significant ramping up of smart city technologies. In the context of sustainability, smart cities are defined as the

integration of the Internet of Things (IoT) into the urban landscape, with the overall intent of improving resource use.<sup>16</sup> A city of interconnected devices can ease the management of problems that might plague China's growing cities. The elegant beauty of the smart city in this context is that it employs IoT technologies to make better use of urban infrastructure, and influence resident decisions that will ultimately lead to more sustainable choices and/or better resource management.

## OPPORTUNITY ALERT

China is the leading country in the APAC region for smart city initiatives and shows the greatest prospects for growth. The Central Government has begun to orchestrate actionable smart city projects that include 200 cities that span a range of the three development tiers. The 13th FYP has also made the roll out of big data, the backbone of the smart city, part of the national strategy and a priority. The impact of this decision is likely to usher in a golden era for smart cities in China.

More developed "first tier cities" of the south and the coastal regions tend to be saturated markets in many respects. However, focus is shifting toward cities in western and northern China. In terms of opportunities, second and third tier cities have gradually become the gold mines of the smart city market.<sup>17</sup> There are more than 100 cities in China with budgets ranging from \$21–200 million for their smart city programs.<sup>18</sup> A secondary advantage of targeting second or third tier cities is greater ease of access to decision makers compared to their larger urban counterparts.

The value chain of smart cities includes hardware, cloud and networking solutions, cloud application developers, systems integrators and related areas of focus. The back end (electronics, asset management, cloud platform and application developers, and networking solutions) tends to be dominated by big players like General Electric, Toshiba, Phillips, Microsoft and Lucent. Opportunities for startups are more likely to be found in the front end in the transportation, smart building and utilities sectors. Opportunities for startups will include those that take advantage of the nation's robust information backbone and create innovative solutions for existing and coming urban challenges. The following innovative startups are making headway in the smart city sector.

## WATER POLLUTION

Policies, regulatory approaches and binding targets put into place in the 11th and 12th FYPs have significantly reduced water pollution across all water-related sectors. The most recent water strategy, The Water Plan, issued by the State Council in 2015, is essentially a complete reset of China's water use and treatment program. The Water Plan is the brainchild of 12 participating ministries and government departments. Also known as the Water Ten Plan, it identifies 10 general measures designed to have a rapid and sweeping impact on the quality of all sectors of the nation's water. There are 10 key measures subdivided into 38 sub-measures with clearly defined timelines and government departments responsible for each segment of the plan.<sup>19</sup> This is by far more ambitious than anything proposed in the previous two FYPs.

### OPPORTUNITY ALERT

**According to The Water Plan, approximately \$400 billion will go into enhanced monitoring of drinking water sources and the control of poisonous contaminants. Another \$900 billion is earmarked for municipal and industrial wastewater treatment between 2017–2020. This will drive the need for technologies like water quality monitoring and pollution rating systems, as well as technologies related to industrial and municipal wastewater treatment and reuse, such as grey water recycling and sludge treatment.**

Urban water supply and management are pressing concerns in China, and will continue to increase as the country's municipalities prepare to accommodate rapidly soaring population growth. Urban buildings in China consume significant quantities of water and generate large quantities of wastewater. Under the 13th FYP, by 2020, one aim is to reduce water consumption by 23% from levels observed in 2015. This reduction is despite the projected urban build-out.

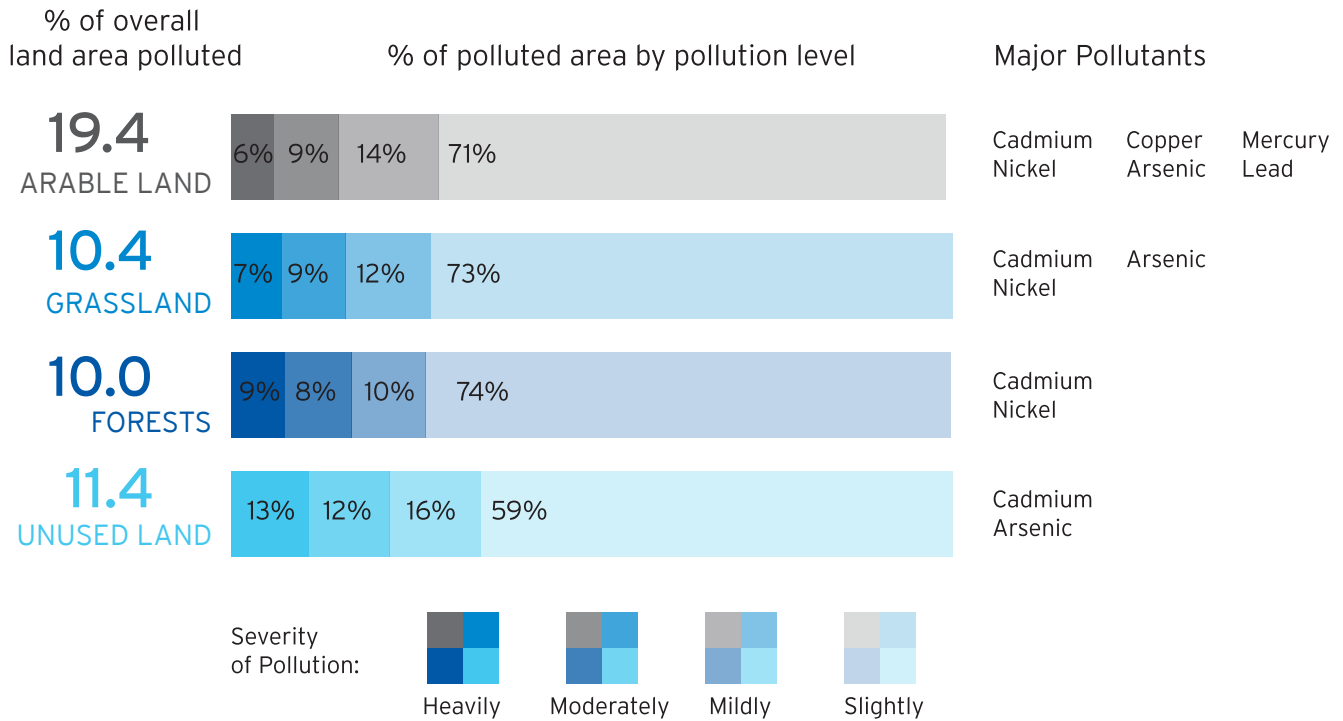
Urban water usage creates opportunities for a host of technologies related to the use, monitoring and efficiency of water use, as well as treatment and recycling. Opportunities likely to emerge from this include: point-of-use water filtration, smart water technologies, grey water technology, wastewater treatment, water recycling technologies, rainwater collection and monitoring technology, plumbing efficiency devices, run-off management, low energy municipal waste to energy, intelligent water meters and anaerobic digestion.

## SOIL CONTAMINATION

Soil contamination is a longstanding issue in China. However, only recently have soil remediation solutions become a priority. Until 2014, government studies on the state of the soil in China were not made public. In 2014, the Ministry of Environmental Protection (MEP) and Ministry of Land and Resources (MLR) released a report on pollution levels of varied types of land: arable land (19.5% contaminated), "unused" land (11.4%), grasslands (10.4%) and woodlands (10%). The report demonstrated varying levels of 13 kinds of inorganic contaminants across the areas surveyed, including arsenic, cadmium, cobalt, chromium, copper, fluorine, mercury, manganese, nickel, lead, selenium, vanadium and zinc.<sup>20</sup> Due to the extent of the contamination, soil cleanup is a priority in the new FYP; on May 31, 2016, the State Council released its Soil Pollution Prevention and Control Policy. The policy has two major deadlines: to stabilize contaminated industrial and farm lands by restoring 90% to safe use by 2020, and to ensure that all contaminated land is safe to use by 2030.<sup>21</sup>



Figure # 1: Land Pollution in China



Source: Ministry of Environmental Protection, 2014.

Opportunities in soil remediation are significant and, considering the area impacted, as well as the types and levels of contamination, are likely to be worth billions of dollars. However, one key challenge with soil remediation in China is determining who will pay for it. The Soil Pollution Prevention and Control Plan has not yet clearly defined a solution. It only states “the polluter pays”; tracking down the polluter and then extracting funds has proven to be challenging. Another key challenge is that the new plan lacks a budget.

Presently, local governments reluctantly bear the cost of remediation, unless the land is to be redeveloped for another use. In this case, the developer will pay. For those keen to engage in this sector, it will be key to keep an eye out for emerging policies and regulations that earmark capital toward remediation as funding will likely come from the government. Soil remediation is generally a costly endeavour, so under the circumstances, remediation technologies that reduce the cost of producing similar or better remediation outcomes are likely to garner traction.

**OPPORTUNITY ALERT**

Significant opportunities will emerge as funding is allocated for a range of services, techniques and equipment. This will include analysis, monitoring and remediation suited to China's vast territory, types of contamination, and an array of soil types and hydrological conditions. Significant urban expansion is already driving activity in brownfield remediation. Given the nation's land constraints and sizeable population to feed, agricultural land is most likely to be the first set as a priority for remediation. Keep an eye out for emerging policy in this segment.. Early estimates show that remediation in this sector is approximately \$1 trillion.<sup>28</sup> With a 2020 deadline to restore farmland to 90%, this will be the sector to watch closely for funding to emerge. As China expands efforts to clean up its soil, it will require a range of innovative biological, chemical and physical treatments.

## AIR POLLUTION

Air quality is facing a serious challenge nationwide. Air pollution comes from the electricity generation, industrial and transportation sectors. To reverse the tide on the nation's air quality problems, in 2013 the State Council (the nation's chief administrative authority) issued the Action Plan for Air Pollution (APAP). Part of this plan includes the regular monitoring and reporting of air quality standards in 338 cities, with clear targets to reduce the main contributors to air pollution. Pollutants monitored include particulate matter 2.5 and 10, sulfur dioxide, nitrogen dioxide, ozone and carbon monoxide. Particulate matter 2.5 is the largest problem in air quality nationwide, but ozone is also becoming a greater challenge. A more detailed description of these pollutants can be found here.

One of China's greatest environmental challenges has been its massive coal consumption to meet ever-increasing power needs. For nearly two generations, the trend to meet growing power demand involved the annual addition of 100 gigawatts of coal-fired power generation.<sup>29</sup> Presently, the nation consumes half of the world's coal, which accounts for 66% of the country's primary energy demand.<sup>30</sup> According to the International Energy Agency, electricity generation represents approximately 80% of China's GHG emissions, and half of those emissions come from coal-fired electricity generation.<sup>31</sup> Those same power plants also churn out massive amounts of particulate matter, making a significant contribution to often-dangerous levels of PM2.5, sulfur dioxide, nitrogen oxides and CO2. While reduction of coal use for electricity is a part of the country's mandate, coal-fired power will remain a part of the supply mix for many years to come.

### OPPORTUNITY ALERT

Since the APAP was implemented, it appears to have been impactful and the country has made progress in reducing concentrations of pollution in the environment. That said, only 20% of 338 cities monitored for air quality reached the national standard.<sup>32</sup> As China cleans up its air, the overall market size is estimated to be \$510 billion and technology types will include industrial air pollution, ambient air quality monitoring, indoor air quality and energy related air quality.<sup>33</sup>

## RENEWABLE RELATED TECHNOLOGIES

An increasingly successful shift away from coal use has begun. Emissions from energy in China dropped by 1.5% two years running as coal consumption

dropped.<sup>34</sup> In 2015, 63% of all new installed electricity production was non-fossil fuel.<sup>35</sup> Much of this power generation came from hydro and wind, 19% and 28%, respectively, as well as the vast majority of the world's solar heating and biogas installations. China is presently the world's largest solar market and intends to more than triple its capacity from 47 to 143 gigawatts by 2020.<sup>36</sup> As of 2015, it is the largest investor in renewable energy and has the single largest renewable energy capacity in the world.<sup>37</sup> Estimates indicate that another \$380 billion will be spent on renewables by 2020.<sup>38</sup>

China's power generation and distribution networks make up a wildly complex system. Equally complex are the policies and regulations that have rolled out to meet renewable/lower carbon energy objectives. An overview of those policies and regulations could easily be the subject of a voluminous study. What is perhaps most relevant is that the CCP Central Committee and State Council recently issued the "Guiding Opinions on Deepening Electricity System Reforms." This is the biggest reform in China's power in more than 10 years.

### OPPORTUNITY ALERT

It is expected that Chinese electricity markets will be more open to competition, which will usher in more capital and promote independent trading structures, demand response, ancillary services and distributed energy. Energy storage could garner a significant role within this change. As China continues to develop its renewable energy capacity it will spend an estimated \$380 billion. Key opportunities will include power grid technologies supporting grid integration, smart grid technologies, grid equipment, switch gear and transformers and grid scale energy storage.

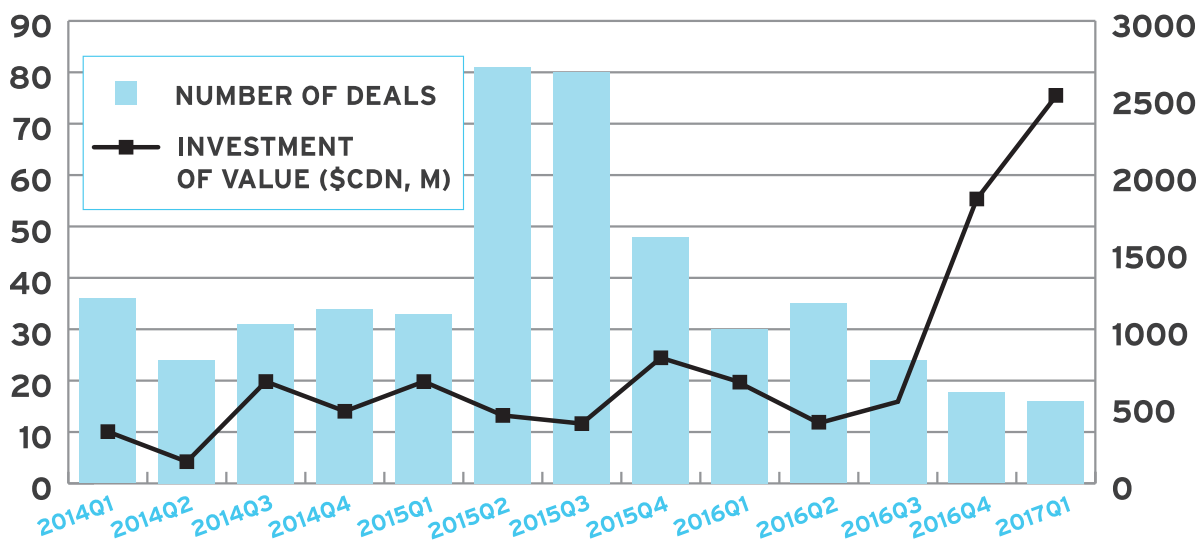
As of 2015, China is the largest investor in renewable energy and has **the single largest renewable energy capacity in the world.**<sup>37</sup> Estimates indicate that another **\$380 billion will be spent on renewables by 2020.**<sup>38</sup>

# China's investment landscape

## CHINA'S INVESTMENT IN CLEANTECH

The chart below represents some global Chinese investment in cleantech companies over a three-year period (Q1 2014–Q1 2017). During this period, the cleantech sector saw 453 deals by Chinese investors (see Figure #2). Levels of investment in each quarter varied drastically. Q3 of 2016 showed little activity, but this is largely due to limited availability of data for the period. Q1 of 2017 had investments totalling \$3.8 billion. This stems from significant investment in Tesla by Internet company Tencent. Q4 of 2016 and Q1 of 2017 show steep increases in investment into the cleantech sector. The large investment in Tesla aside, the investments in the two periods are a mix of largely foreign and domestic acquisitions and VC investment. The dramatic increases in dollar investment in cleantech are likely due to the broader understanding nationwide that cleantech will play a pivotal role in the country's future.

Figure # 2: China's investment in cleantech



Source: MaRS Market Intelligence, + Zero2IPO, 2017

## INVESTMENT ENVIRONMENT FOR STARTUPS: CORPORATE VENTURE CAPITALISTS ARE CHINA'S LEADING INVESTORS

Investment in startups from state-owned enterprises (SOEs), corporate mergers and acquisitions, venture capital (VC) and private equity (PE) firms is decidedly rare in China. The limited investment from these segments is largely due to the perceived risk at this phase of a technology's evolution or concern for the time and resources needed to develop new technologies to the level of market readiness. This circumstance is apparently driven by the perception that returns on investment in China are expected to be much shorter than in the West. In China, corporate VCs are likely to be the most interested in startups.<sup>39</sup>

Troy Ault, Cleantech Group's Director of Research, further refines this perspective by saying that "traditional" VC firms still view cleantech with skepticism. Instead, Ault says, cleantech investments are increasingly emanating from corporate VCs. "We've seen more activity than ever with corporate VCs in the sector." Listed below (see Figure #3) are China's most active VC funds are the top corporate investors in cleantech.<sup>40</sup> Presently, China's most active corporate VCs appear to be in the energy space, but this is likely to evolve as policies and finance to deploy cleantech are activated.



Tables 1, 2: China's Most Active VCs and Corporate investors in cleantech

Most active Chinese VCs in cleantech for 2016 (by number of deals)
1. <a href="#">Fortune Venture Capital</a>
2. <a href="#">China Eventbright Ltd.</a>
3. <a href="#">CCB International</a>
4. <a href="#">Jolmo Capital</a>
5. <a href="#">Suzhou International Development</a>
6. <a href="#">Shenzhen Co-win Venture Capital</a>
7. <a href="#">CCIC Jia Cheng</a>
8. <a href="#">China Innovative Capital</a>
9. <a href="#">CITIC Equity Funds</a>

China's cleantech top corporate investors in 2016
1. <a href="#">Guangxi Guiguan Electric Power Co.,Ltd.</a>
2. <a href="#">CGN Power Co., Ltd.</a>
3. <a href="#">Beijing Capital Group Co., Ltd.</a>
4. <a href="#">Tus-holdings Co., Ltd.</a>
5. <a href="#">Shunfeng Photovoltaic International Co., Ltd.</a>
6. <a href="#">Beijing Enterprises Holdings Limited</a>

Source: Zero2IPO, 2016

### WHERE TO MEET VCS IN CHINA

China is not only a potential market for cleantech, it is also a possible source of venture capital for Ontario cleantech companies. That said, where does one meet them? The ideal places to meet VCs in China are at events or technology-specific conferences (e.g., battery-, energy- or water-related). Harris Yang, of [Springpower International](#) in Mississauga, and Jacky Qiu, of [OTI Lumionics](#) in Toronto, both travel regularly to China, and have considerable perspective on building relationships with VCs in China. Both began building their understanding of VCs in China by joining provincial trade missions. They both also assert that provincial trade officials have been instrumental in identifying potential partners and facilitating introductions. The more professional conferences obviously attract bigger, more specialized VCs, angel investors and funds. Good VCs tend to be adept at quickly identifying interesting, high potential startups or IP.<sup>41</sup>

Venture capitalists also attend various metropolitan, regional, and national innovation and entrepreneurship contests. These, however, tend to be geared toward locals and are advertised locally. Rarely are foreigners found at these types of events as all advertising is done locally and in Chinese.<sup>42</sup> However, VCs also attend international events organized by the federal government. The exchanges often relate to specific technologies. The core challenges for a Canadian cleantech entrepreneur involve finding the time, support and resources to screen, develop, and negotiate reasonable relationships, deals and a clear roadmap forward, as well as to closely monitor and manage the relationship and progress throughout the agreement.<sup>43</sup>

# Profiling Ontario entrepreneurs' experiences in China

We spoke with three Ontario-based cleantech companies—one established company and two startups—that have valuable insights into establishing partnerships in China. These companies all have disruptive technologies, and have tenaciously built coveted relationships in China. We asked them to share some of their insights.



Cindy Donxin Hu

## AUG SIGNALS (WATER)

### Tell us about your company and technology.

AUG Signals was established in 1986 in Toronto and is now an industry leader in signal, image and data processing water monitoring technologies. AUG's expertise resides in multi-sensor fusion, detection, classification, recognition, data mining and indexing.

After an extensive period of in-house R&D, AUG successfully adapted its key technologies in the applications of environmental monitoring and quality control, introducing TRITON Intelligent Water Surveillance™. In 2008, AUG started deploying and testing TRITON, the innovative online water quality monitoring and early warning systems, through several pilot projects within Canada.

### What sparked your interest in China?

In parallel, AUG started exploring the environmental technology market in China, which has been growing rapidly due to the increasing concerns in quality of drinking water and environment pollutions in China. Since 2008, in preparation for the Chinese market, AUG has built strategic partnerships with several leading research institutes and water authorities across China.

### When and how did your business gain traction in China?

In 2012, AUG and a local Chinese company founded a joint venture company in Beijing during the fifth Canada-China Business Forum, witnessed by the Canadian Prime Minister at that time. In 2013, AUG received the approval of an Industrial Design

Innovation Patent from the State Intellectual Property Office (SIPO) of China. AUG's TRITON system also received the quality control certification issued by the Chinese National Institute of Metrology.

### What successes have you had in China?

As of 2016, TRITON has been successful in operating several locations in China, including:

- Veolia water plants in the City of Tianjin
- Tianjin Economic Development Area (TEDA) water plant
- APEC 2014 Meeting Centre/Beijing Health Inspection Center
- Central water treatment plant in the City of Lanzhou

After several rounds of third-party field tests in comparison with both lab test results and other online monitoring systems, TRITON clearly demonstrated its sensitivity, accuracy and low false alarm rates. In 2013, TRITON was featured in the Intelligent City guideline drafted by the water authorities in the City of Tianjin as a recommended solution for drinking water quality control practice. Currently, AUG and its partners in China are looking into expanding TRITON's operations by covering wastewater, source water and stormwater.

### KEY LEARNINGS

- Trade missions can provide opportunities for meeting local potential partners.
- Finding a reliable local partner is key to success.
- Joint ventures can provide access to growth markets.



Michael Wang

## SPRINGPOWER INTERNATIONAL (SPI) (BATTERY/STORAGE)

### Tell us about your company.

SPI is a battery designer/manufacturer based in Mississauga that uses its proprietary nanosilicon technology to produce nanosilicon anode materials, as well as building them into an advanced lithium ion battery that is capable of holding an extended charge. Initially, SPI produced batteries for the small-scale electronics sector. Furthermore, according to Dr. Harris Yang (President of SPI), SPI is confident about the scalability of the battery for an automotive application. Mr. Michael Wang, CEO of the company, says that in an automotive application, SPI's technology can extend automotive range from the present maximum of 480 kilometres to approximately 700 kilometres.

### With established connections in China, why did you join a trade mission?

SPI went to China on the Ontario Premier's Mission to China 2015 to look for potential investors and customers, but to primarily establish manufacturing partners. Due to their extensive experience in the battery industry, SPI already had a well-established list of contacts in China. With the aid of the Ontario Premier's Mission to China, SPI's technology and motivation drew attention from capital institutes and strategic partners, such as automotive manufacturers in Nanjing. SPI is currently following up with several potential partners gained from the exposure received by the trade mission.

### What did you gain from joining a trade mission?

As a result of the trade mission, SPI was able to participate in an "Innovation and Entrepreneurship Competition" in China, for which 30,000 companies registered. They ended up coming in fourth in the competition in "Energy Saving and Environment Protection Session." Consequently, SPI technology garnered a great deal of interest.

### How much interest in China is there in Canadian cleantech?

According to Mr. Wang, China is investing a lot of capital into Canadian-based cleantech operations, and are very interested in Canadian technology. According to Mr. Wang, there are few Chinese venture capitalists who want to actually manufacture products independently, given their lack of in-depth knowledge of the Canadian investment environment and market size. Some of China's investors believe that the best combination is to procure or jointly develop technology in Canada, but to manufacture in China.

### What are your thoughts on intellectual property in China?

Concerning intellectual property and working in the Chinese market, Wang's thoughts were: "If you have patents, people can sometimes find a way around it, especially for patents related to engineering and process. However, as long as you run fastest, no one can keep up with you." This means that, to stay relevant in this field, innovation must be a constant process.

### What is your advice for startups seeking opportunity in China?

His advice on seeking investors, especially for startup companies, is that in China they want to invest in technology that is closer to mature, that has a more immediate application and that can be made in China. This is the consequence of premature venture capital in China. For strategic investment, Chinese companies are likely to pursue a deal with a lower risk even at a higher cost given the fact that Chinese companies have less knowledge of overseas investment.

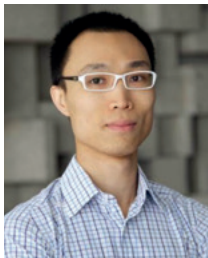
#### KEY LEARNINGS

**By joining a trade mission, one can meet key strategic partners for manufacturing and investment.**

**There is keen interest in China's VC circles in Canadian clean technologies.**

**China's key investors do not wish to develop or manufacture technology but wish to procure or jointly develop technology with Canadian innovators.**

**To protect IP, continue innovating.**



Zhibin Wang

## OTI Lumionics (LIGHTING)

### Tell us about your company.

OTI Lumionics was founded at the University of Toronto's Department of Materials Science and Engineering. OTI has developed organic light emitting diodes (OLEDs). They can convert electricity into light using less energy than traditional sources. They are constructed with environmentally friendly, carbon-based materials.

### How did your engagement with China start?

The founders of OTI began to gain expertise as a startup in China while on a provincial trade mission with the premier in 2014. This allowed them to generate leads and form/develop/forgo coveted contacts with government officials, potential manufacturers and potential investors. Currently, OTI is still in the process of shaping its position in China; however, their experience has provided them with valuable perspectives on identifying opportunities, locating potential partnerships and navigating China as a startup.

### Why should China be of interest to Ontario cleantech startups?

The innovators at OTI are clear in their belief that cleantech is of tremendous interest right now in China, and that Ontario comes from a position of strength in its ability to develop these technologies. They also believe that China complements Ontario's innovative prowess through the scale of its market, abundance of capital and capacity to mass produce. They caution, though, that China is not an easy market to crack and not all technologies will find traction in the Chinese market.

### How do you determine if your technology is going to be of interest in China?

ZhiBin Wang states that there is no simple means to determine if China's market is suitable for a given technology. Rather, he suggests that joining a trade mission is a highly effective way to maximize your exposure and quickly learn about the market with the guidance of experienced trade officials. If

a technology is identified as being something that will benefit the local market, it can gain significant support from a number of places (government, industry and financiers). Jackie Qiu is clear, though, that there is no magic formula to determine if your technology is going to gain traction in China. "You just need to go," says Jackie.

### After determining that there is interest in your technology, what are the next steps?

They stress that they have been introduced to many good contacts while on provincial trade missions. However, they note that this is only the beginning of the work, and actual work only begins when the right contacts are made. If your technology garners interest and you have identified key partners, you must put considerable effort into maintaining contact both remotely and through the exchange of visits. In the founder's opinions, if you have not already done so, this would be a good time to bring on team members with the right language, business and cultural skills to manage such crucial relationships.

It is necessary to understand local processes, or have someone who does, says Jackie Qiu. You have to push forward and ensure that you make your way up to the key decision maker. That might not be the person with whom you make first contact. The environment is very competitive with cleantech innovators from nations such as Germany and Israel vying for attention from the same decision makers you are contacting. Ensuring that you have the right person or the right team in place is key.

### Why is the role of government important in China?

An important point they raise, which cannot be emphasized enough, is the influence that government can have in the adoption of technology, compared to North America. If, for example, a local government identifies a technology as beneficial to their community and wants to promote it, they can actually create a market for the technology in question through legislation and commit government resources in the form of loans, land and subsidies. Regional governments will even compete with one another to convince the entrepreneur to set up shop in their region.

## KEY LEARNINGS

There is no formula to determine if your technology is “right” for China; the best approach is just to go.

Joining trade missions and making contacts is just the beginning for entrepreneurs in China. Relationships must be constantly maintained both remotely and in person.

The role of government is of much greater importance than in Canada and can have a crucial role in adoption of, or investment in, a given technology.

If you don't have them already, bring on team members with the right language, business and cultural skills to manage such crucial relationships.

Be prepared for a slow process, and also be tenacious if you want to work your way up to the right decision makers.

# Collaborating with China

Knowing which collaboration model to pursue for China is not readily apparent.<sup>44</sup> The best approach is to understand the options available and the pros and cons of each, and then decide accordingly. Each entrepreneur's circumstances and needs will depend upon the startup's technology, desired outcomes and expectations of the partnership. To help streamline the process, entrepreneurs should be well informed about the available options and be aware of desired outcomes.



Located in Beijing, Zhongguancun is China's oldest and largest science and technology park and innovation centre



# China Cleantech Quick Facts

Smart Cities and the Internet of Things  
100 cities with budgets ranging from \$21-200 MN

Water Quality monitoring and Pollution rating systems  
\$400BN by 2020

China's overall investment in cleantech risen  
Over 1600% since Q1, 2016.

Sustainable Built Environment  
Current built asset \$50TR

The Urban Water Cycle  
\$900BN by 2020

**TUSPARK**  
20 locations in China.  
Flagship location in  
Zhongguancun, Beijing.

**ZHONGGUANCUN SCIENCE & TECHNOLOGY ZONE (ZDG)**  
China's oldest and largest science and technology park and innovation centre. There are 1,733 cleantech companies registered in ZDG

**IP PROTECTION IS CHANGING RAPIDLY IN CHINA**  
However, having a robust IP strategy in place before going to China is a must.

**HONG KONG TECHNOLOGY AND SCIENCE PARK (HKSTP)**  
An ideal gateway to the Mainland for those who do not possess the Chinese cultural and linguistic skills

Soil Monitoring  
\$1TR

Renewable Energy  
\$360BN by 2020

Air quality  
\$510BN

Ways to enter China's market



Join tech incubator



Networking



Establish joint venture



# Innovation parks in China

Being part of an innovation park can offer considerable advantages and possible inroads into the Chinese market. Chinese markets are notoriously difficult to access for foreigners. This might, in part, be due to Chinese companies being highly risk averse when selecting a brand or service. They are far less likely to opt for a company or technology that they are unfamiliar with. Therefore, being aligned with a recognized and well-regarded science park/innovation centre could make all the difference in making a sale.

For example, companies in parks have greater opportunities to receive government funding, rental subsidies and access to officials with greater insights into favourable policies that might facilitate the adoption of a given technology. With more than 1,500 innovation parks, China's landscape appears large and complex, and could feel daunting to navigate. Most parks are located in more developed areas, closer to the bulk of environmental challenges. Emerging technology tends to come from the most developed areas. Below are three of China's best-known innovation parks.

...being aligned with a **recognized and well-regarded science park/innovation centre** could make all the difference in making a sale.

## TUSPARK

Established in 1994, TusPark is also one of the nation's first science parks. It was started by Tsinghua University and is now an independent entity. TusPark is considered one of the most successful university parks in China. It is presently represented in 20 locations throughout China, though the flagship location is Zhongguancun, in the northwestern part of Beijing. Cleantech is one of TusPark's key focal industries.

One of TusPark's key functions is to incubate startups. It does so by creating an environment for innovation, tech transfer and talent development. It offers mentorship, entrepreneur education and connection to a large alumni network. The organization also boasts deep industry connections to ensure that its companies' innovations have greater market opportunities. There are more than 190 major Chinese partner companies, including Shanghai Automotive and China Metallurgical Group Corporation.

Tenancy offers benefits for park member companies, including assistance with finding government incentives, tax breaks and grants. It can make third-party referrals for services like HR and accounting. Depending on the sector, TusPark can offer deeper insights into product market fit. It also operates a venture capital fund, known as TusPark Ventures. TusPark is open to foreign companies becoming tenants in their parks.

**TusPark**  
清华科技园

## ZHONGGUANCUN SCIENCE & TECHNOLOGY ZONE (ZDG)

ZDG is China's oldest and largest science and technology park and innovation centre.<sup>45</sup> It commenced activities in the 1980s by supporting the electronics industry in affiliation with the Chinese National Academy of Sciences and is considered one of the leading incubators in the country. Numerous notable Chinese companies have emerged from ZDG, including [Lenovo](#), The Stone Group (a well-known electronics manufacturer and distributor) and [The Founder Group](#). More recent additions include [Xiaomi](#) (smartphone manufacturer) and [Baidu](#) (one of China's largest Internet companies).

ZDG is currently home to 5,000 companies. It has an extensive reach, boasting connections to almost 40 colleges and universities, including two of China's most prestigious universities, Peking and Tsinghua Universities. It is also connected to more than 200 national (municipal) scientific institutions, such as the Chinese Academy of Social Sciences and the Chinese Academy of Engineering, 67 state-level laboratories, 27 national engineering research centres, 28 national engineering and technological research centres, and 24 university and science and technology parks.<sup>46</sup>

ZDG's cleantech cluster is the second largest industrial cluster in the park, just behind electronics, its flagship cluster. According to ZDG, the total number of cleantech corporations in the park reached 1,733 in 2014.<sup>47</sup> Sectoral expertise covers a broad range of clean technologies, including air quality, aquatic environment disposal, environmental monitoring, ecology, energy efficiency and conservation, resource conservation, recycling, renewable energy and waste management.



### ZDG International

ZDG also has a satellite incubation centre hosted by Invest Ottawa. Offered services include:

- Offers a free incubation space with administration support for up to three years.
- Opportunity for direct investment by the ZDG network in China and Silicon Valley.
- Expedited market access to China.
- Mentors and advisors to assist companies with developing their products.
- Facilitate introductions to legal and accounting services provider.

## HONG KONG TECHNOLOGY AND SCIENCE PARK (HKSTP)

For those keen on the Chinese market but who do not possess the cultural and linguistic skills needed for China, HKSTP could make for an ideal gateway to the Mainland. English is widely spoken in the former British colony and it has strong legal and financial systems. Hong Kong is considered one of Asia's great business hubs and has long been considered the gateway to China.

Hong Kong Technology and Science Park is situated in the special administrative region of Hong Kong. It is a not-for-profit, run by the Hong Kong government. The environment includes 220,000 square metres earmarked for high-technology enterprises and HKSTP describes itself as being "designed to accommodate companies of all sizes and stages of development and to promote interaction and innovation at both the local and global level." The organization claims to have affiliations with 18 government-run science parks throughout China.

The park offers office space and facilities at a subsidized rate, technical and management assistance, promotion and development assistance, business support, and a financial aid package. Monthly rents in the park are approximately \$4.25 per square foot. This is significantly lower than the average for a premium rental space in Hong Kong, which comes in at \$347 per month. [Follow this link for more detail on what the park offers incubatees.](#)

### Soft landing program

For those interested in getting a feel for whether HKSTP (or the region) might be a fit for them, entrepreneurs can apply to HKSTP's soft landing program. For those selected, the program includes assistance with travel arrangements, a round-trip economy class flight to Hong Kong, five nights' accommodation and local transportation. The trip also includes a day trip across the border to Shenzhen. This program is open to all technology transfer offices, incubation centres, universities, R&D institutes, science parks and their spinoff or startup technology companies. For more information on the program, see the link above.

For MaRS companies interested in the program, [contact us directly.](#)



# Ontario startups: How to make first contact with China

With no prior experience of operating in China, Ontario startups have a number of options to make their first contact with China. In the first part of this series, [Playing the Long Game: China's market opportunities for Ontario startups](#), some of the more practical means of taking the first steps to China are presented. Some of these options include trade shows, conferences and delegation visits. Joining one of these types of organized visits can assist with determining whether a technology will gain traction in the market. They can serve as a means to gain an overview of who the key players are both in innovation, financing and technology procurement. However, for these efforts to bear fruit, due diligence in partnership screening is an absolute must. Listed below are a number of organizations, beyond federal and provincial programs, that can assist with exploring China's market.

## [MaRS Discovery District](#)

MaRS Discovery District is the world's largest urban innovation hub and the largest innovation centre in Canada. MaRS is home to a [cleantech venture services](#) group, and draws together entrepreneurs, investors, policy makers, corporate partners and advisors to build globally competitive cleantech companies. It offers advisory services by experienced entrepreneurs who provide business advice, mentorship and market intelligence. MaRS plays an active role in building both local and global relationships for its entrepreneurs. The cleantech group travels regularly on trade missions.

## [Canada China Business Council](#)

The Canada China Business Council (CCBC)'s Business Incubation Platform offers a suite of services that meet many of the needs of Canadian SMEs entering China and those of Chinese investors entering Canada. Services include a business incubation centre in Shanghai. The centre provides SMEs with an affordable, low-risk way of building a presence in China. There is also virtual office space in Beijing and Shanghai. This service is on offer to SMEs that do not require a permanent presence in China and includes a mailing address, telephone answering service, WiFi, website translation (into Mandarin) and the occasional use of a conference room.

## [University of Western Ontario/WORLDiscoveries Asia](#)

WORLDiscoveries Asia is an initiative stemming from the University of Western Ontario. It initially focused on the life sciences industry and it seeks to promote international research collaboration and IP commer-

cialization in China and Asia. WORLDiscoveries develops and maintains close ties with many Chinese industry players, and currently works with MaRS' Advanced Energy Centre in China to establish relationships in the energy sector.

## **IMPORTANCE OF THE REGULATORY LANDSCAPE AND INTELLECTUAL PROPERTY PROTECTION**

While China might present significant market opportunities for cleantech companies, it is also important to consider and factor in some of the potential risks that one might encounter. Below are two key elements to factor into a China strategy.

### **Be aware of the regulatory market/protectionist policies**

For companies that are contemplating taking their technologies to China, it is important to attempt to understand the factors that might interfere with finding a place in the market. For example, there might be protectionist policies designed to favour a local technology—even if it is an inferior one. In 2015, the Chinese government announced that subsidies for electric buses would only be extended to buses using Li-ion batteries with lithium iron phosphate (LFP) cathodes. This type of battery chemistry dominates the battery manufacturing landscape in China. Nickel manganese cobalt (NMC) battery technology, which is believed to be a higher performing battery technology, is more commonly developed outside the country.<sup>48</sup>



## Intellectual property

The issue of intellectual property protection is often raised when companies contemplate bringing innovative technology to China. It should be noted that the intellectual property landscape in China is changing rapidly, as there is an increased demand for IP courts. To meet rising demand for IP courts, three specialized IP courts were established in Beijing, Guangzhou and Shanghai. It should also be noted that there are relatively few cases in higher technology sectors. Research has found that at least 80% of IP trials and lawsuits stem from the music, film and publishing industries.<sup>49</sup> However, fewer than 10% of cases are deemed to be in the life sciences sector; the situation in cleantech is similar.<sup>50</sup>

In the event of an infringement where there is litigation, the outcome of such a case in the Chinese court system might be more favourable than one might expect. Few studies have actually been conducted of outcomes of foreign firms and patent cases in China. However, a recent study showed that when foreign firms did take Chinese companies to court for IP infringements, they often tended to have more favourable outcomes than for local firms—with higher compensations awarded. The same study also showed that few cases involved recent patents. In most cases involving infringement, patents were more than 10 years old. It also showed that of cases being held in Chinese IP courts, only 10% were foreign companies and they won 70% of those cases. It further revealed a high rate of appeals across the board, indicating that the process is rapid and inexpensive enough to warrant appeals in the case of an unfavourable judgment.<sup>51</sup>

Regardless, before entering the Chinese market, a company should have an IP strategy in place.

- IP must be registered in China to be protected in China.
- Having a strong IP strategy is essential for your company to be in a strong position to protect IP.
- It is essential that your IP strategy be aligned with your financial situation and business plan in China.
- To prevent licensee companies or partners in China from copying technologies, ensure that your IP protection is robust.

## THE NEXT FIVE TO TEN YEARS: A WEALTH OF OPPORTUNITY FOR CLEANTECH ENTREPRENEURS

The cleantech industry in China is still uncharted and therefore there is a degree of uncertainty. However, changes in environmental policy give a strong indication that it is seeking to clean up its environment quickly, which is creating many opportunities for Ontario cleantech companies. Here are number of things to remember about China and cleantech. China is not just a potential market for cleantech but a place to seek venture capital. Joining trade missions and making contacts is just the beginning for entrepreneurs in China. Relationships must be constantly maintained both remotely and in person. When considering entering the Chinese market, be aware of the regulatory market/protectionist policies. While robust IP protection is still necessary, the IP landscape is changing quickly, and few recorded cases are cleantech related. Be prepared for a slow process, and also be tenacious if you want to work your way up to the right decision makers. Finally, considering China's environmental challenges, its need for environmental solutions, its robust policy environment and the unique environment that is emerging for entrepreneurs to connect, create and evolve, cleantech in China might make it the place to be for the next five to ten years.

# Appendix

Please find additional resources listed and described here.

## China's leading high-tech parks in advanced materials

High- tech park name	Province	Comments
Bao Ji High Tech	Shaanxi	Titanium, zirconium materials
Bao Tou Rare Earth High Tech	Inner Mongolia	Rare earth materials
Changzhou High Tech	Jiangsu	Energy materials, green building materials
Luoyang High Tech	Henan	Silicon/tungsten materials
Suzhou Industry Park	Jiangsu	Nanomaterials
Xiang Tan High Tech	Hunan	Manganese, nickel materials
Zhong Guan Cun High Tech	Beijing	Biomaterials, nanomaterials

Source: Lux Research, 2014

## China's leading high tech parks in LEDs, advanced electronics and electric vehicles

High tech park name	Province	Comments
Changchun High Tech	Jilin	LED, electric vehicles
Foshan High Tech	Guangdong	RFID
Jiangmeng High Tech	Guangdong	LED
Luoyang High Tech	Henan	Power storage (lithium batteries)
Nanchang High Tech	Jiangxi	LED
Suzhou Industry Park	Jiangsu	LED
Wuhan Dong Hu High Tech	Hubei	Optoelectronics
Wuxi High Tech Jiangsu	Jiangsu	RFID, sensors
Zhang Jiang High Tech	Shanghai	RFID, LED
Zhong Guan Cun High Tech	Beijing	LED

Source: Lux Research, 2014

## Chinese innovation networks of interest

### CHINA TECHNOLOGY INNOVATION STRATEGIC ALLIANCE FOR RESOURCES RECYCLING INDUSTRY

It is recommended as an outstanding innovation network with the capacity to assist with advanced research, project development, public funding and details about project developers.

The CIAR network reaches academic and commercial stakeholders in the recycling space. Its association members are industry leaders in resource recovery and material reuse with a particular focus on industrial waste treatment and utilization. It provides support in innovation and development among its 69 member organizations. Their network includes universities like Peking University and Nankai University (both



high-ranking 211 universities). Other members include science parks and high-tech zones like the Tianjin Ziya Circular Economy Area (a state level high-tech zone focused on building material recycling organizations). It also includes private companies like the Aluminum Corporation of China.

For its members, CIAR is notable for its openness to work with foreigners. It supports political and regulatory assistance, as well as applying for and using public research funding programs, such as China's well-known [863 program](#). It brings industries together in the form of academic seminars and technology workshops. It also creates opportunities for technology pilot testing through relationships with research institutes, incubators and corporate partners.<sup>52</sup>

### **ENERGY EFFICIENT WATER TREATMENT INDUSTRY INNOVATION ALLIANCE**

The Energy Efficient Water Treatment Industry Innovation Alliance (WEA) is administered by Jiangsu Institute of Environmental Industry (JIEI). It is the first

The WEA is an innovation alliance that focuses on the development of energy efficient water equipment. The alliance rallies more than 20 active member organizations. Its members include the Chinese Academy of Sciences, Tsinghua University (a 211 university), China Energy Conservation and Environmental Protection Group Asset Management (CECEP) and Research Centre for Eco-Environmental Science. WEA maintains a close partnership with Yixing Industrial Park, a not-for-profit that is considered the birthplace of China's environmental industry. Yixing is located in Jiangsu Province, approximately 200 kilometres from Shanghai. The park provides support for startups in research, commercialization, and business and project match-making. WEA is notable for partnering with foreign industry partners.<sup>53</sup>

#### **WEA focuses on a number of key areas:**

- Creating networking events for industry and academia
- Creating opportunities for technology collaboration and technology transfer, and facilitating partner match-making for project deployment
- Rallying political support for R&D, demonstration and pilot projects
- Providing guidance on investment and financial guidelines for entrepreneurs

## Unique programs

### **ONTARIO CENTRE OF EXCELLENCE THE CHINA ANGELS MENTORSHIP PROGRAM (CAMP)**

Ontario Centres of Excellence (OCE) is a non-profit organization that drives the commercialization of cutting-edge research across key market sectors to build the economy and secure Ontario's global competitiveness. OCE has partnered with the China Canada Angels Alliance (CCAA) to support Ontario startups seeking to enter the Chinese market.

The China Angels Mentorship Program (CAMP) is designed to help select companies shape their business model to fit the Chinese market, enter the marketplace and begin scaling their business. This is accomplished by providing mentorship, investment and direct business ties to the Chinese market. Initial seed investments are up to \$200,000 from CCAA investors, with possible co-investment by OCE through its Market Readiness Program, subject to program eligibility and criteria.

During the pilot phase of the initiative, OCE and CCAA selected 10 Ontario-based startup companies to participate. These entrepreneurs receive two years of mentoring while building relationships in both Ontario and China with prominent Chinese investors and learning to adapt their business plans toward successfully entering the Chinese market.

As part of this unique mentorship experience, the companies travel to China to work with their investors overseas, giving them the unparalleled opportunity to immerse themselves in the Chinese culture and market.

The CAMP program places strong emphasis on digital technology, including that related to cleantech.



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