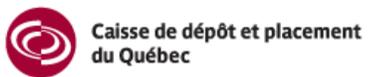




SUMMARY
The Quebec Cleantech Industry
Study and Benchmarking

March 2012

This study was made possible thanks to the participation of the Caisse de dépôt et placement du Québec.





The first organization of its kind in Canada, Écotech Québec brings together all of Québec's industry stakeholders from across the province, including innovative companies, R&D and technology transfer centres, major end-user companies, the financial community, education and training institutions, labour confederations and associations working in the clean technology sector. Écotech Québec supports the design, development, adoption, commercialization and export of Québec-based clean technology.

Écotech Québec works to position Québec as a centre of excellence for cleantech in North America. It is a major player in the development of this industry, which is recognized as an engine of wealth creation and prosperity. It helps make Québec more competitive, greener and healthier.

PREFACE

This document is a summary of *The Quebec Cleantech Industry: Study and Benchmarking*, a study carried out by Samson Bélaïr/Deloitte & Touche on behalf of Écotech Québec. Begun in 2011, this study aims to analyze international market trends and at the same time highlight Québec's assets in each clean technology category. It is not intended to be an exhaustive study nor does it claim to present the very latest data and statistics. Instead, it presents an overview of the sector and notes some examples of companies that illustrate Québec's potential. This study will eventually be updated to better reflect the changes in the Québec cleantech industry.

INTRODUCTION

The Quebec Cleantech Industry: Study and Benchmarking aims to highlight the strategic assets of Quebec's cleantech sector, thereby enabling Écotech Québec, and all stakeholders in the province's cleantech industry, to support the latter as they develop and commercialize their innovations.

In concrete terms, Écotech Québec has conducted a study of international market trends in the cleantech industry and combined this information with Québec's assets in this sector. The goal was to identify the categories (and subcategories) most likely to enhance the prosperity of Québec.

Écotech Québec's approach is inspired by the Canadian Olympic Committee's "Own the Podium" program, which encouraged our Olympic hopefuls to win medals. Écotech Québec aims to do the same with cleantech businesses so they can conquer the world with their innovations.

The Deloitte study shows that two categories (energy efficiency and waste management) and two subcategories (biomass and hydroelectricity) already enjoy a favourable position on the international market. The categories and subcategories of water, transportation, soil, green chemistry, wind energy and solar energy also feature significant assets in their respective niche markets.

Although the challenge facing the industry is ambitious, it is realistic. We must throw our efforts behind Québec's assets to further develop the province's cleantech industry, encourage Québec businesses to make use of it and work together to promote our expertise internationally.

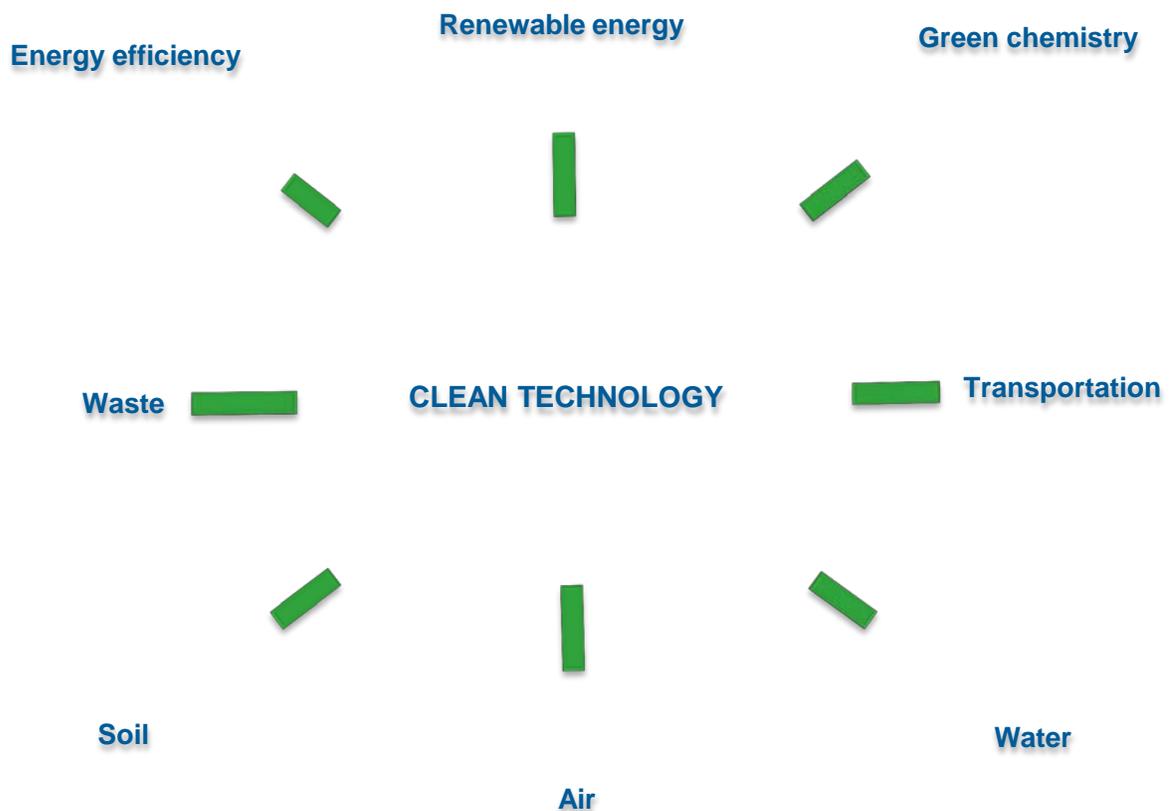
OVERVIEW OF CLEANTECH INDUSTRY

Climate change is a major global challenge that is forcing countries around the world to move towards a green economy. By fostering the growth of innovative solutions and re-assessing their competitive strengths, these economies will be able to take advantage of the opportunities offered by the cleantech sector and work towards economically sustainable prosperity.

Clean technology, also known as cleantech, green technologies, greentech, eco-innovations, ecotechnologies and ecotech, are part of a sustainable development outlook because they include new products, services, technologies and processes that:

- o significantly reduce negative impacts on the environment (environmentally effective)
- o offer users superior performance at a lower cost (economically superior)
- o help improve quality of life by optimizing resource use (socially responsible)

The Québec cleantech ecosystem is essentially composed of eight key categories of a green economy:



SUMMARY - QUÉBEC'S CLEANTECH MARKET POSITION VIS-À-VIS WORLD LEADERS

-  Overall position of Québec's industry vis-à-vis world leaders
-  Position of specific niches that are more advanced than the rest of Québec's industry

		Québec's cleantech market position vis-à-vis world leaders			
		Weak	Average	Strong	Remarks
Mature categories/subcategories	Air	Québec	Niches • Biogas purification • Carbon capture		<ul style="list-style-type: none"> Europe has stricter air quality regulations than Canada and Québec. Consequently, European companies are generally much more advanced.
	Soil	Québec	Niches • Bio-treatment of soil		<ul style="list-style-type: none"> The business environment is composed primarily of local SMEs. However, there are several major engineering consulting firms active internationally (service-oriented, involving a local presence). The level of innovation of these SMEs varies and the market lacks a distinctive critical mass. There is expertise, notably in the assessment and biological treatment of contaminated sites.
	Hydroelectricity			Québec	<ul style="list-style-type: none"> Hydro-Québec and its research institute (IREQ) are very strong in this segment. It provides the manufacturing sector with a competitive advantage. There is no real leader in equipment production. Numerous engineering consulting firms have developed unique expertise in the field, which they export to work on international projects.
	Water	Québec	Niches • Decentralized treatment systems		<ul style="list-style-type: none"> In Québec, companies working in this segment essentially supply local services. Although the market is fragmented, there are several large service companies working abroad. Some SMEs are also active in the international market.
	Energy efficiency	Québec	Niches Examples: • Industrial processes (advanced refrigeration/heat recovery) • Equipment for transportation applications		<ul style="list-style-type: none"> The low cost of electricity sharply limits local economic opportunities in this segment. Truck fleet operators are very interested in improving energy efficiency.
	Wind energy	Québec			<ul style="list-style-type: none"> Québec will rely less and less on foreign intellectual property (IP). Several companies will work on specific turbine components and will create IP to be sold abroad. The same will be true of electronic control interfaces.
	Waste	Québec	Niches Examples: • Vehicle equipment manufacturers • Sorting centre of the future and optical sorting • Recycling of plastic • Thermal plasma for waste destruction and energy recovery		<ul style="list-style-type: none"> Vehicle equipment manufacturers specialize in the collection, treatment, sorting and processing of recyclables. Some companies are North American leaders, notably in the brokerage and recycling of plastic and the production of plastic from recycled resin. The programs in Québec are considered very progressive (e.g., paint recycling) and the province will have expertise in managing the complete cycle of waste recovery/reuse.

		Québec's market position vis-à-vis world leaders in deantech			
		Weak	Average	Strong	Remarks
Developing categories/ subcategories	Geothermal energy	Québec			<ul style="list-style-type: none"> Apart from a few projects, the deep geothermal energy industry is underdeveloped in Québec, but near-surface geothermal energy is being developed.
	Biomass	Québec	Niches		<ul style="list-style-type: none"> Biomass as a generator of electricity is well developed in Québec (over 100 MW installed). Biofuels, biogas, forestry residues (biorefinery) and marine biotechnology are sub-segments in which Québec is active. <p>Examples:</p> <ul style="list-style-type: none"> 1st and 2nd generation biofuels Energy pellets
	Solar energy	Québec	Niches		<ul style="list-style-type: none"> Two major players in the solar thermal niche are in business in Québec. Apart from this niche, Québec has no presence in the photovoltaic market. <p>Example:</p> <ul style="list-style-type: none"> Thermal air heating
	Intelligent transportation	Québec			<ul style="list-style-type: none"> While a few small-scale smart grid projects have been launched locally in Québec municipalities, there are no large-scale regional projects.
	Electric vehicles	Québec			<ul style="list-style-type: none"> An electric bus project (\$60 million over 3 years) funded by the QRIS involves a number of different private partners, including Nova Bus (bus manufacturer). Public ground transit has traditionally been a strong sector in Québec.
	Power train component manufacturing and electrification	Québec	Niches		<ul style="list-style-type: none"> The Québec government's 2011-2020 Action Plan for Electric Vehicles will have a positive impact on the market. Major projects like the electric bus and ecological aircraft (funded by the QRIS), as well as Hydro-Québec projects associated with the development of a network of electric vehicle charging stations, will help Québec companies make progress in this segment. <p>Examples:</p> <ul style="list-style-type: none"> Batteries Charging stations Electric drive train systems Lightweight materials
Emerging categories/subcategories	Green chemistry	Québec			<ul style="list-style-type: none"> Although many players believe that this sector holds tremendous potential (e.g., industrial bioprocesses), there is very little special activity. The combination of biomass and numerous chemical product formulators could present an opportunity. However, plants to convert biomass into chemical molecules are required to link the two, and there are very few of them. Several local and international leaders work in the nanotechnologies and materials sector. Québec is home to the world's first nanocrystalline cellulose (NCC) demonstration plant.
	Hydrogen energy	Québec			<ul style="list-style-type: none"> Some Québec companies work in the hydrogen energy sector (niches: hydrogen/isolated regions, hydrogen energy generation and supply)

As part of this study, each cleantech category was analyzed according to the following criteria to determine the scope of international market trends.

Evaluation criteria		Description
Potential jobs created*		The job creation potential varies depending on whether the activity is in the secondary sector (manufacturing) or the tertiary (service).
Regulatory opportunity		The regulatory framework is one of the most influential factors on the cleantech market since the market does not naturally support demand without strict regulations. However, the regulatory opportunity alone does not constitute a success factor: a business must have a culture of innovation, a business model and knowledge of the market to be able to take advantage of the opportunity.
Economic barriers to entry**	Level of capital investment	The level of capital required for a new player to enter a market has an influence on its appeal. High barriers to entry act as a deterrent.
	Required skills in R&D	The level of skills in R&D required to enter a market can limit its appeal.
Level of international competition	Competitiveness costs (relocation)	A sector subject to fierce competition based on costs will be more likely to see activities relocated to countries with lower production costs. Therefore, there is limited potential to create jobs locally.
	World leaders abroad	The presence of world leaders increases the level of competition and limits the entry of new players.
Market size		Size of world market
Growth		Compound Annual Growth Rate (CAGR)
Strategic value***		Strategic opportunities and trends are used to assess the strategic value of the segment.

* Gross jobs created (not net).

**In the context of this study, a strong barrier to entry is considered disadvantageous. In fact, because the Québec cleantech sector only includes a small number of active players (and the long-term objective is to encourage new players), this criterion was viewed in terms of the ease of entry for new players.

*** The analysis of strategic value highlights the existence of niches. A niche is a very narrow market for a highly specialized product or service.

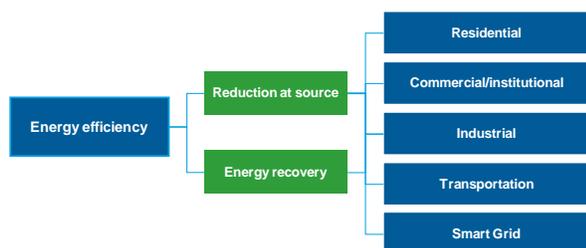
To evaluate the assets that characterize the Québec cleantech sector, each category was analyzed according to the criteria below.

Evaluation criteria	Description
Market position of players	The market position of players is a key factor in cluster vitality (players' degree of sophistication).
R&D / research centres / IP	Universities, technological transfer centres and all other organizations that support research and its dissemination to business.
Existence of comparative advantages	Advantages associated with a local resource: for example, the presence of natural resources, a favourable geographic position or even a particular climate that can facilitate the development of certain segments.
Regulatory environment	The health of the cleantech sector depends largely on the regulatory and fiscal framework as well as government orientations.
Business climate	The business climate is influenced notably by the access to corporate financing and R&D, the quality of government programs, the local administrative culture, etc.
Environment favourable to internationalization	Given the small size of the Québec market, internationalization is a key success factor in the field of clean technology. Cleantech companies usually manage to reach a critical mass by conquering foreign markets (born-global firms).
Commercialization capacity	Commercialization capacity is an influential factor in the cleantech sector because supply often outstrips effective demand.

Among the information sources consulted was a series of existing studies and analyses. In addition, five discussion groups, made up of Québec industry representatives, were organized for the various categories to help better define the level of expertise in Québec while at the same time confirming international market trends. Finally, validation sessions involving industry consultants from the Ministère du Développement économique, de l'Innovation, de l'Exportation (MDEIE), sector-based associations and organizations added to the section on Québec's assets.

The following pages present the various categories of clean technology found in Québec and how their international potential relates to Québec's particular assets.

ENERGY EFFICIENCY



Energy efficiency relies on managing (energy recovery) and reducing energy demand at the source. The market is extremely broad: it includes smart grid, transportation, industrial, commercial/institutional and residential uses. In addition, there are great disparities in terms of the maturity of these various market segments. It would appear that, in Québec, the commercial and institutional market has reached its peak. Furthermore, the low cost of electricity could limit the number of local opportunities.

Conversely, the industrial, transportation and residential markets do offer some development opportunities given the emergence of leaders, how the market is organized and the increased demand for eco-innovations in these segments. As for smart grid, this market is still in its infancy. According to data from 2010, the building trade accounted for nearly 60% of energy efficiency expenditures, followed by the industrial sector with 25% and transportation with 15%.

DO YOU KNOW...



CVT CORP manufactures and markets continuously variable transmissions (CVT). Variable speed generators can reduce fuel consumption by 25%, provide a return on investment in less than a year and reduce GHG emissions by approximately 100 metric tonnes per vehicle. CVT CORP is also active in the sector of agricultural and heavy machinery. At the present time, several major equipment manufacturers in this market are working with CVT CORP to integrate CVTs in their machines.
www.cvtcorp.com

At this time, when meaningful, sustainable energy savings must be accompanied by efficient energy management, countries like Japan, Denmark, Hong Kong, Ireland and Israel have successfully done just that and stand out from their competitors.

With a global market worth nearly \$300 billion (2010), the energy efficiency sector is becoming predominant on the institutional market. Although the trucking industry has already shown a keen interest in improving energy efficiency, many other market segments have yet to be explored. Both small and medium-size businesses and the residential market are very likely to be the scene of numerous technological initiatives. In fact, the residential energy efficiency market should increase from \$38.3 billion (2009) to \$50.2 billion in 2014. The

market for wood fibre based insulation (carbon-neutral), the management of integrating renewable energy sources and the growing influence of information and communication technologies in managing energy efficiency (smart grids) also present a number of opportunities.

With governments developing stricter energy efficiency standards, the field of energy audits¹ and energy efficiency training² will experience phenomenal growth. For their part, emerging economies, China in particular, will generate tremendous demand for technologies and services to improve industrial process energy efficiency. Québec has the enviable position of being able to count on

DO YOU KNOW...



CARNOT REFRIGERATION designs and produces top-end, custom-made energy efficient systems using environmentally friendly methods. It specializes in energy-recovery refrigeration systems for supermarkets, refrigerated warehouses and arenas.
www.carnotrefrigeration.com

several research chairs in energy efficiency (e.g., Chair in Industrial Energy Efficiency-Sherbrooke, Industrial Research Chair T3E-ÉTS), research centres in GHG reduction and energy consumption (e.g., CanmetENERGY-Varenes), renewable energy integration (e.g., NGTC-Boucherville) and industrial process optimization (e.g., INO, Optech).

Certain niche markets, like refrigeration industrial processes and equipment for transportation applications, will experience more noticeable growth in other global economies. The economic fabric of Québec, which is predominantly manufacturing, combined with the province's weather, gives it a comparative advantage on the international market when it comes to energy efficiency project development and testing and industrial process optimization.

DO YOU KNOW...



VERT.COM inc. is an innovative Canadian company founded in Québec, which specializes in the design and creation of energy efficient data centres housed in silos. Its foremost solutions are the Prefab Siloctet and the Rehab Siloctet, two cleantech innovations in the design of silo data centres.
www.vert.com

¹Growing from \$8.1 billion (2009) to \$23.4 billion in 2014.

²In Europe, approximately 1.1 million skilled workers are available, while it is estimated that 2.5 million will be needed by the year 2015.

DO YOU KNOW...

CAN2GO®

CAN2GO® solutions (SCL Elements) can help generate up to 40% in energy savings in commercial and institutional buildings. CAN2GO® building control and Web management interface products provide remote control, monitoring and management of HVAC (heating, ventilation, air conditioning), lighting and metering. These products combine wired technologies (BACnet, Modbus, CANbus), wireless (EnOcean, ZigBee) and web (IP/Ethernet).

www.can2go.com

DO YOU KNOW...

FRYGY CUBE INTERNATIONAL

Frygy Cube International is specialized in refrigeration systems used to transport merchandise. Frygy Cube has developed a new ecological and economic cold storage system used primarily to deliver fresh and frozen foods.

www.frygycube.com

DO YOU KNOW...

SOTECK

SOTECK's mission is to design and implement innovative, reliable and high-performing energy systems to redefine the energy efficiency of industries. The multidisciplinary SOTECK team features the combined expertise and knowhow of some forty professionals with a passion for developing turnkey projects that come with performance guarantees.

www.sotek.com

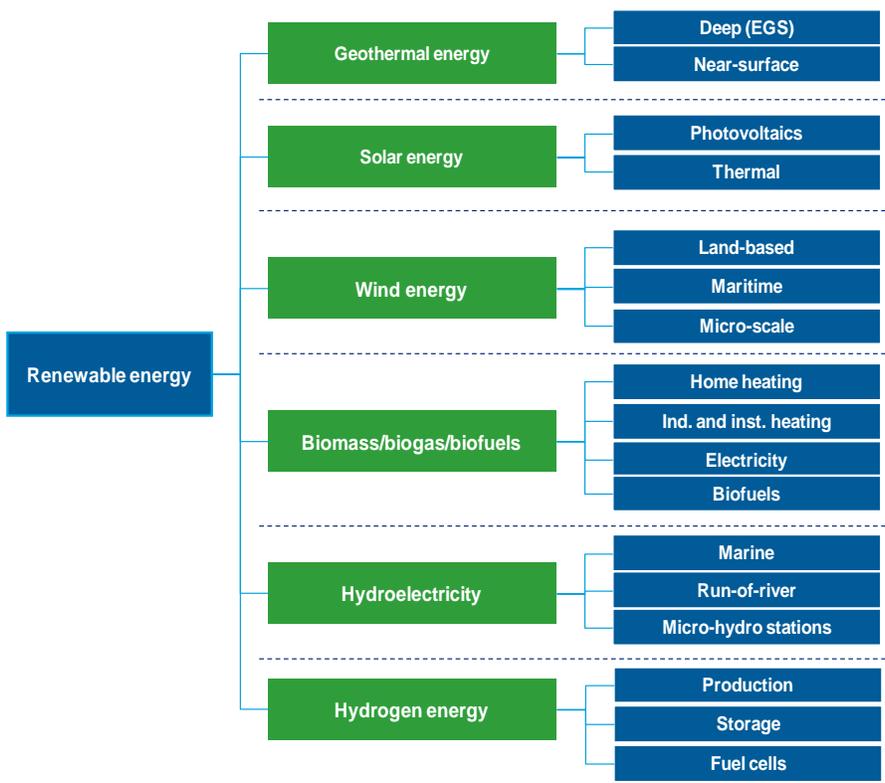
DO YOU KNOW...

INOVAE

INOVAE has created Smartmanager™ which helps provide building managers and experts with a complete and precise overview of their properties by gathering all the data available in a single, easy-to-use "scorecard." Current SmartApps™ can be used to monitor and manage energy and environmental performance in real-time, provide data for environmental certifications, adjust control systems, analyze all data and determine where to invest to obtain better performance.

www.inovae.com

RENEWABLE ENERGY



The primary forms of renewable energy, i.e. solar power, wind energy, energy from biomass / biogas / biofuels, geothermal energy, hydroelectricity and hydrogen energy, represent one of largest growing markets in the world. In addition to helping improve the sustainability of energy production, renewable energy offers environmental benefits.

Although Québec is privileged to be able to count on hydroelectricity, other forms of renewable energy like solar energy, wind energy, biomass and deep geo-thermal energy could be future sources.

Though the Secretary General of the World Energy Council has noted that "Québec is a leader among countries in terms of renewable energy," hydrogen energy, biofuels and 3rd generation solar power are alternative energies that remain challenging.

HYDROELECTRICITY

A highly promising market for Québec, hydroelectricity has earned recognition both here and abroad, thanks to Québec's unique expertise and engineering skills. Exporting their talents to international markets, Québec engineering consulting firms are creating and developing hydropower projects. Using the driving force of water to produce renewable energy, Québec has developed a solid reputation on the world stage. Research and development efforts in this field are concentrated primarily in Germany, France, the United Kingdom, the United States and Canada. In Québec, research centres like IREQ, LTE and GRANIT and industrial research chairs like the NSERC/Hydro-Québec TransÉnergie and NSERC/Hydro-Québec can be counted on to develop solutions in the fields associated with the transport of electrical energy and the management of water systems³ and to use government-sponsored measures to extend the scope of this sector.

At the present time, four leaders account for 50% of the market in electricity production: Canada, the United States, China and Brazil. The latter two are setting their sights on major sectors of the hydroelectricity industry. The production of the equipment⁴ needed to produce, transport and distribute electricity is a sector that could well be outsourced to other countries who are experiencing growth in hydroelectricity production.⁵ Even though the industry and its technologies are mature, hydroelectricity projects make a tremendous contribution to job creation because of their large scale. Bolstered by European directives on new renewable energies and various Canadian provincial government initiatives, it is estimated that the number of new jobs associated with hydroelectricity will reach 1.4 million by the year 2025.⁶ Some niche markets, like mini hydroelectric power stations, run-of-river micro-hydro stations, marine turbines (niches in which Québec could distinguish itself) and even hydroelectricity generated by tidal power could be market sectors to develop.

WIND ENERGY

With the best wind energy potential in North America, ahead of Ontario, the Maritimes and the United States, Québec can boast of having invented numerous electronic control interfaces in the field of wind energy. The global market for wind energy has reached nearly \$96 billion (2010) and this sector has experienced a surge in job creation since 2005 (the number has tripled to some 600,000 jobs). Wind energy is a must if China, Europe, the United States and Canada⁷ are going to reach their renewable energy production targets. Driven by leaders from Spain, Germany, China, the U.S. and even India, wind energy production should experience significant expansion. Although the technology for land-based turbines is relatively mature, certain niches (like offshore wind turbines, on-board wind turbines, autonomous wind turbines and micro-scale wind turbines) are poised to expand.

DO YOU KNOW...

INNERGEX

Énergie renouvelable.
Développement durable.

A leader in the Canadian renewable energy industry founded in 1990, Innergex develops, owns and operates run-of-river hydroelectric facilities, wind farms and a solar farm. Its mission is to increase its production of renewable energy by developing and operating high quality facilities while respecting the environment and serving the best interests of its host communities, partners and investors.
www.innergex.com

The United States and Europe will no doubt continue to play a major role, but Asia is making great strides, with China taking the lead. By strongly encouraging the domestic production of wind turbines and parts, in 2010 China⁸ became the largest market,⁹ displacing the position traditionally held by Europe.¹⁰ Emerging markets are increasing in importance (in terms of demand). By the year 2020, over 40% of the world's wind power capacity should come from Asia, Africa and the Middle East.

Stimulated by the global market, the Québec wind energy sector is flying high. With the greatest purchasing power in North America, Hydro-Québec has issued a request for proposals for large blocks of energy. With its ambitious wind objectives, the Québec Energy Strategy 2006-2015 aims to add 4,000 MW of wind energy to the grid by the year 2015.

³ Globally, very little R&D spending has been done in this sector in the past 10 years. Several technologies could benefit from advances in R&D to make them more economically attractive and suitable for use in a maximum number of regions.

⁴ Turbines, pumps, valves, conduits, insulators, converters, bus bars, meters.

⁵ Most of the growth in this sector will come from small-scale projects. Hydroelectricity production has grown the fastest in China, while many large construction projects are being planned in a number of African countries.

⁶ Hydroelectricity is produced in over 160 countries.

⁷ Europe has passed the EU directive to promote the development of renewable energy sources, which sets the target for member states to consume at least a 20% share of energy from renewable sources by 2020. In the United States, the American Recovery and Reinvestment Act adopted in 2009 aims to promote the development of the wind energy industry. In Canada, the federal ecoENERGY program promotes renewable energy.

⁸ In 2010, 3 of the world's top 10 manufacturers were Chinese.

⁹ In 2009-2010, the Chinese market grew 107.4%.

¹⁰ India and the United States are ranked second and third in terms of new facilities built in 2010.

Québec is home to several specialized centres like the TechnoCentre Éolien, which hosts the wind energy niche of excellence, as well as the Canada Research Chair on Nordic Environment Aerodynamics of Wind Turbines (ÉTS), the Anti-Icing Materials International Laboratory (UQAC) and the Wind Energy Research Laboratory (UQAR).

SOLAR ENERGY

While a promising market on the international stage,¹¹ solar energy in Québec is still not very developed and remains costly. The European Photovoltaic Industry Association (EPIA) estimates that solar energy could generate 1.62 million jobs by 2015 and some 4.64 million by 2030. Solar energy alone could create 35,000 jobs in Canada by the year 2015. Global R&D spending in the field remains significant and Québec could take advantage of research chairs in solar building (e.g., Concordia and Polytechnique) to acquire cutting-edge expertise. Given the global competition it faces from countries active in this sector, Québec does not enjoy a strong position because of weak development in solar manufacturing,¹² despite the fact that some Québec companies produce the polysilicon used in photovoltaic solar panels.

DO YOU KNOW...



Volts Energies is an innovative company that focusses on the design and manufacture of energy efficient systems. Specialized in the development of new hybrid energy systems, it combines solar photovoltaic, solar thermal, wind, generator, biomass, micro-hydro electricity and cogeneration.

www.volts.ca

That said, two of the leading global participants in the solar thermal niche are in business in Québec. Apart from this niche, Québec has no presence in the photovoltaic market. However, major geographic markets are opening to solar energy. It is estimated that, as of 2020, the predominance of developed regions (North America, Europe) should wane, leaving room for developing countries like China and India (2020), followed by Africa, the Middle East and South America (2030).

Niche markets like thin films, 3rd generation panels, hybrid modules, flexible/aesthetic panels for residential and commercial use, spray-on solar cell technology, air conditioning powered by solar energy and solar panels installed

on geostationary satellites should experience more limited development. Although the majority of countries have developed tax credit programs (covering installation) and set up some incentives to boost the solar energy share in their national energy portfolios, Québec will have to count on public funding if this renewable energy is to be sustainable in the province.

BIOMASS

While biomass remains the primary source of renewable energy in France, it is in Finland, Sweden, Denmark, Germany and Austria that heat and power produced by biomass is growing the fastest.¹³ Nonetheless, Eastern European countries and China should record the largest growth in the heat and electricity market.

As for new biomass conversion technologies like biocarbon or biofuels (2nd and 3rd generation made from microalgae or woody biomass), these could be used for things like buses and vehicle fleets (e.g., government, municipal). This market should expand significantly.

DO YOU KNOW...



Solart is a Québec company that installs custom-made solar panels in Ontario, Canada and around the world. The engineering team at Solart provides both residential and corporate clients with a 3D rendition of the solar installation and a financial analysis of their project. Solart's expertise focusses on solar project management, customer service, engineering and solar installation design.

www.solartgroup.com

DO YOU KNOW...



Innoventé is a renewable energy producer and the creator of an innovative concept that offers communities a green, sustainable solution to the treatment of organic waste. This concept, intelligent electricity, transforms organic waste into electricity, heat and fertilizers, while reducing GHG emissions. Innoventé is currently finishing construction of its first intelligent electricity plant, which will serve a population of 6,000 in Québec's Chaudière-Appalaches region.

www.innovente.ca

¹¹ The global market is estimated at US\$136 billion (2010). In an accelerated scenario, the global market is projected to grow 26% by the year 2020 (EPIA). It is estimated that the number of GW will grow 1500% in 10 years, from 23 GW in 2009 to 325 GW in 2020.

¹² China is the leading manufacturer.

¹³ This is known as combined heat and power (CHP).

DO YOU KNOW...



Biothermica is a company specialized in the development of patented technologies applied to the reduction of greenhouse gases and the production of renewable energy. The company also invests in infrastructure projects based on the technologies it has developed. Biothermica is the owner of Gazmont, a landfill gas power plant in Montreal (25 MW), and a coal mine methane abatement system in the state of Alabama (United States).
www.biothermica.com

Québec is holding its own vis-à-vis international competition in the field of biomass harvesting. In fact, biomass as a generator of electricity is well developed in Québec. Though biofuels, biogas, forestry residues and marine biotechnology are less prominent and still at the early stages, they are beginning to penetrate the market and Québec is well-positioned in them. These new forms of renewable energy are currently attracting new investment and several projects have been launched to explore the possibilities offered by these new energy sources.¹⁴ With the help of a large forest industry¹⁵ and low electricity costs, the biomass market in Québec is developing rapidly and catching up to international niche markets (1st and 2nd generation biofuels and energy pellets). Although the economic viability of this sector is precarious and relies largely on

R&D spending, biomass remains a promising market (e.g., CRIP-Biorefinery, CRIBIQ, FP Innovations, FORAC research consortium).

Sweden is currently a leading player in the biofuels market.¹⁶ While Québec has not set forth any legal obligations with regard to the use of the energy produced by converting biomass into biofuels,¹⁷ Europe, and Canada to a lesser extent, is creating a regulatory framework designed to foster the emergence of this sector. As for the use of biomass for combustion purposes, once again, Québec has

no legal obligations or targets in place. Québec's regulatory framework seems to offer more opportunities for the biogas market segment. With the new *Québec Residual Materials Management Policy* and its related programs and regulations, this sub-sector is likely to gain stature.

DO YOU KNOW...



Enerkem creates biofuels and chemical products from waste. Thanks to its proprietary thermochemical technology, Enerkem converts non recyclable waste into synthesis gas, and then into methanol, ethanol and other intermediate products that can be used to manufacture common consumer products. By using waste instead of fossil fuels, Enerkem is responding to the growing demand for renewable chemicals and energy sources while at the same time reducing landfill and GHG emissions.
www.enerkem.com

DO YOU KNOW...



Biofour Inc. designs, manufactures and sells boilers for biomass and waste heating that provide 10 to 300 BHP. Equipped with a second chamber for the post combustion of gases, the Biofour boiler can be used to convert a wide variety of biomass and waste into thermal energy. Its highly efficient combustion (+99%) makes it an excellent heating solution for institutions, churches, industries and farms.
www.biofour.com

GEOTHERMAL ENERGY

This source of renewable energy is found underground and, when extracted, can be used for heating or converted into electricity. With a market worth nearly \$2.94 billion (2010), this young sector offers a number of possibilities that could help boost its development, namely: the primary components that make up the geothermal system, the creation of geothermal plants by big companies and the services associated with operations, potential installation sites and project management. Although the largest growth will occur in the European and African markets, China, with its five-year energy plan, could increase the sector's influence.¹⁸ Despite the presence of leaders in field of electricity generated by geothermal energy from the United States, the Philippines and Indonesia, the deployment of this alternative energy remains precarious.¹⁹

¹⁴The Québec Research and Innovation Strategy (QRIS) supports a project to develop new products from forest biorefinery. There are also research and development projects in the field of algae and marine biotechnologies (used in biofuels and biomaterials).

¹⁵It provides residual ligneous biomass.

¹⁶The United States and Brazil are also major producers of biofuels (primarily from grain corn).

¹⁷Canada, with the exception of Québec and several Maritime provinces, requires 2% biofuel content in diesel fuel and heating oil.

¹⁸This market is expected to be worth \$10.6 billion.

¹⁹There are few large-scale projects in place around the world.

As for Québec's geothermal industry, apart from a few projects, the sector remains underdeveloped. In fact, deep geothermal energy is underdeveloped, but near-surface geothermal energy is being developed, primarily through the participation of the IREQ geothermal R&D program.

HYDROGEN ENERGY

Hydrogen as an energy carrier is a clean source of energy with great potential for Québec. Some Québec companies are making a name for themselves in this emerging sector and are investing in the search for clean energy solutions. The Québec government has recognized that "Hydrogen has to be part of the solution. It is an emerging energy carrier that will help us reduce GHG emissions and continue to help Québec wage a strong fight against climate change." While Japan, the United States and Germany are becoming active in this energy carrier and there is much work to be done to make this technology marketable,²⁰ Québec, despite several demonstration projects²¹ and the presence of research organizations in the field (e.g., NSERC Industrial Research Chair in Hydrogen Purification, Transport and Storage, Hydrogen Research Institute-UQTR), seems to have made limited progress compared to other global players.

Although experts agree that hydrogen will not play a major role in the field of renewable energy before 2020, some segments like hydrogen production, fuel cells, material handling vehicles,²² light utility vehicles²³ and uninterruptible power supplies (UPS)²⁴ are expanding markets that should, by the year 2020, account for one-third of the international market, respectively.

GREEN CHEMISTRY

A new branch of chemistry, green chemistry, is provoking a lot of interest in Québec. It refers to biocomposites, bioplastics and ecomaterials as well as bioproducts and bioprocesses. Renewable resources like cellulose, lignin and

fatty acids are transformed into ecomaterials that can be integrated into biocomposites.

It is estimated that this so-called emerging field was worth some \$2.8 billion in 2010. Globally, this sector offers strategic opportunities for the development of more environmentally friendly technologies and alternative solutions that encourage the design of less toxic chemical products. Green chemistry offers new processes that enable renewable raw materials to be used in the production of chemical products and materials as well as adapted production techniques that minimize waste with traditional processes.

DO YOU KNOW...



Using a collaborative innovation model, Magnus, a privately-owned Québec company, primarily develops mechanical and chemical solutions for water treatment and metalworking. It is recognized as a leader in the field of green chemistry. Anticipating new environmental trends and requirements, Magnus has made eco-design part of its product development process while increasing the focus on its customers' water and carbon footprint.

www.magnus.ca

Emerging countries like China and India are already active in this sector. In China alone, 14 green chemistry centres of excellence were created in just three years.

As many countries embrace green growth, green chemistry is becoming a necessity. Having becoming a priority for the chemical industry, green chemistry is a promising market for Québec. According to the Centre québécois de valorisation des biotechnologies (CQVB), Québec will be, per capita, the "Canadian leader in green chemistry." With the help of a few leaders in the field of nanotechnologies and materials, the sector is beginning to take shape. Stimulated by innovation, it is working to meet global challenges by increasing the design, manufacture and use of cleaner chemical processes and products.

DO YOU KNOW...



Bio-Lub Canada Inc. specializes in ecological, biodegradable, bio-sourced products made of renewable materials. From lubricants to hydraulic oils and multi-purpose cleaners, the products produced by Bio-Lub Canada are both safe and effective. Starting with the principle that one litre of oil can pollute 1 million litres of water, the company is working to save the planet.

www.bio-lubcanada.com

²⁰Several pilot projects have been launched, with the majority involving public transit buses in Europe, the United States and, to a lesser extent, Canada.

²¹Québec has got the ball rolling with a demonstration project deploying hydrogen transportation technologies in shuttle buses, as well as passenger and utility vehicles.

²²Handling vehicles will be a growing niche and should represent 36% of the market by 2020.

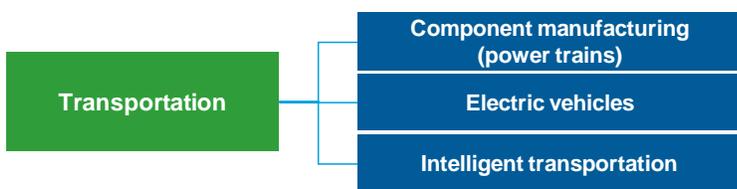
²³Light utility vehicles could account for 33% of the market by 2020.

²⁴These systems should represent 27% of the market in 2020.

Although industrial bioprocesses and biomaterials seem to offer great potential, biomass is another path towards sustainability. However, it must be said that there is very little special activity in this field in Québec. The province does, however, have significant assets at its disposal when it comes to expertise, which could help it make its mark. With the help of highly specialized workers currently active in declining sectors, this expertise could easily be transferred to the green chemistry sector. In addition, Québec is known for its large number of chemical product formulators and R&D organizations (e.g., CQVB, CRIBIQ, Centre in Green Chemistry and Catalysis, Centre québécois sur les matériaux fonctionnels and IMI).

As it works to increase the province's capacity for developing world-class technologies, the Québec government has committed to supporting specific projects related to green chemistry. Nonetheless, despite the government's willingness to stimulate this industry, Québec's regulatory framework appears deficient. In fact, there are no strategies or policies in place to encourage the emergence of green chemistry and some environmental processes could discourage the chemical industry from setting up shop in Québec.

TRANSPORTATION



Québec is home to no less than 30 university research centres and college technology transfer centres in various fields related to road transport. Although the sector of electric vehicles, including intelligent transportation systems and component manufacturing, is indeed expanding, electric mobility is slow to gain a foothold in Québec,

despite the province's comparative advantages such as electric vehicle purchase incentives and pilot projects. China, Europe, the United States and Japan are among the world leaders in this field. When it comes to batteries, electric motors and electronic components, Japan and Korea appear to hold the lion's share of intellectual property.

INTELLIGENT TRANSPORTATION

With a North American market worth some \$52 billion in 2010 and employing nearly 200,000 workers, intelligent transportation systems (ITS) use electronics, communications and information processing technology to improve all aspects of transport, including public transit. With the help of new technologies, ITS can improve the management and operations of road, rail, air and marine transportation networks, as well as service to users. With 40% of the market, the United States is a leader in intelligent transportation. Although several large companies, including IBM, are invested in the market, the majority of those active in the sector are small and medium-sized businesses.

At the moment, the traffic issues afflicting Québec and the presence of maritime routes represent an opportunity for project development in the field of intelligent transportation. Québec can rely on its strengths in mathematical modelling and operational research applicable to flow management software (ex. ITAQ, CIRRELT).

While several small local smart grid projects have been tried out in some Québec municipalities, the cities of Kyoto, Stockholm and Singapore have been the scene of ambitious ITS projects. In the long run, cities will be major drivers for the deployment of these new technologies. It is highly likely that applications for reducing congestion, cutting GHG and increasing road safety will be in the forefront. Traffic management, automated payment, public transit management and commercial fleet systems along with real-time user information systems could be promising niche markets for Québec if it applies its expertise, particularly in information technologies.

DO YOU KNOW...

Effenco is leading the way towards improved energy efficiency in the field of transportation. The HEAD hydraulic hybrid system helps refuse trucks reduce fuel consumption by 15-25%. Fleet operators can also diminish their greenhouse gas emissions by 19 to 28 tonnes per year for each hybrid truck.

www.effenco.com

ELECTRIC VEHICLES

Electric vehicles are gaining ground in Québec's transportation sector, notably in public transit. Québec enjoys numerous advantages that could drive its expansion into the electric vehicle market (e.g., IREQ, ITAQ, Industrial Research Chair in Energy Storage and Conversion). Backed by Québec's prime asset, hydroelectricity, the provincial government got things started in April 2011 by launching its *2011-2020 Action Plan for Electric Vehicles*; under this initiative, in the next few years, the "government will invest \$250 million in the deployment and use of electric vehicles and the development of an industrial sector."²⁵

Globally, it is estimated that the electric car market will grow 18 to 20% between 2009 and 2012, electric buses will experience growth of 19.8% between 2010 and 2016, while electric trains should grow annually by 1 to 1.4%. According to the Electrification Coalition (a group of industry leaders), 1.9 million new jobs could be created in the United States by the year 2030. Some segments like electric cars for institutional fleets and electric/hybrid heavy trucks and buses are poised to grow. Though dependent on the price of oil, the cost of batteries and government incentives, Québec is in a position to host some major developmental projects.²⁶ Such projects will promote the consistent development of this transportation subcategory and provide Québec companies with a way to stand out in larger markets.

DO YOU KNOW...



Made in Québec, GRIDbot's EV Smart Charging network is the solution to all your electric vehicle charging infrastructure needs. GRIDbot is the leader in municipal and multifamily electric vehicle infrastructure in North America. Its residential and commercial charging stations are designed today for the vehicles of tomorrow.
www.gridbot.net

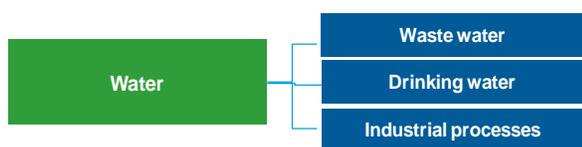
POWER TRAINS

China and India are well-positioned to produce electronic components for electric vehicles.²⁷ Québec's position on the global stage could also be enhanced by the strength of its research and development in the field of component manufacturing, particularly in the niche markets of batteries and charging stations.²⁸

It is currently estimated that this developing market could help create some 420,000 new jobs by the year 2030. It is important to note that the global market for lithium-ion batteries was \$11 billion in 2010. In Québec, IREQ (Hydro-Québec's research institute) holds several patents on battery materials.

Facing strict emission reduction targets (notably in Europe, Asia and the United States), traditional automakers must review their product and technology portfolio and include new components, thereby offering exposure to certain niche markets like charging stations, hybrid power trains and electric power trains.

WATER



The water sector, along with its water treatment sub-sector, is one of the largest in Québec. At the present time, the global market is dominated largely by ABB, Veolia, GE and Siemens; these

leaders have, in the past few years, focussed on acquiring high tech start-up companies to stimulate the emergence of this sector.

The renewed interest in this sector is also due to growing demand from emerging countries like China, India and Brazil for water treatment facilities and services. Japan and the United States, with markets of \$2.22 billion and \$1.85 billion, respectively, head the list, followed by China with \$1.13 billion, Korea with \$716 million, and India with \$588 million. It is estimated that China and India are likely to grow by over 10% yearly until 2015.

DO YOU KNOW...



Since 1981, AQUATECH has provided municipalities and industries with specialized services in the management, operation and maintenance of water treatment facilities, including drinking water treatment and distribution systems and waste water collection systems. AQUATECH was the first private company in Canada to offer services certified ISO 9002:1994 and ISO 9001:2000.
www.aquatech-inc.com

²⁵ Please see "Québec - Running on Green Power," April 7, 2011.

²⁶ Notably the electric bus and ecological aircraft projects supported by the QRIS.

²⁷ The Chinese and Indian markets will grow three times faster than the traditional markets (Europe, the United States, Japan) by the year 2030.

²⁸ This market should be worth some \$8.1 billion in 2014.

DO YOU KNOW...



E2Metrix specializes in the design, development, manufacture and marketing of innovative, patented waste water treatment equipment (electrocoagulation reactor) to meet the needs of various markets. This equipment is designed to meet the client's profitability targets while satisfying their environmental obligations. Water treatment is facilitated and the sludge produced is rendered reusable.

www.e2metrix.com

"Freshwater covers 10% of the territory of Québec. With 4,500 rivers and half a million lakes, Québec holds 3% of Earth's renewable freshwater reserves, and 40% of all this water is concentrated in the St. Lawrence River watershed!"²⁹ Unfortunately, the abundance of this resource has not guaranteed that it is closely managed by public authorities. For the past several years, however, the government of Québec has been making an effort to provide a regulatory framework. In fact, the province now has the *Regulation respecting the quality of drinking water*, the *Regulation respecting the charges payable for the use of water*, the *Regulation respecting the declaration of water withdrawals* and the *Regulation respecting waste water disposal systems for isolated dwellings*, as well as the *Québec Water Policy* and

the *Québec Strategy for Drinking Water Conservation*, all steps the government has taken to resolve water quality issues. A beneficiary of more than 20% of the province's R&D funding, Québec's water treatment sector would appear to enjoy a special position (e.g., CREDEAU, ERDAT, Centre des technologies de l'eau). Although this eco-industry appears somewhat fragmented with its

companies working primarily in local markets, some Québec SMEs are active in foreign markets. It is believed that it will be necessary, on a global scale, to invest in upgrading networks³⁰ and modernizing ageing European and North American water treatment infrastructure. Québec appears well-positioned in this sector, compared to international competitors, particularly in the segment of decentralized treatment systems.³¹ In this mature market, the innovations being explored primarily target water treatment processes like filtration membranes, ultraviolet rays, ozone disinfection and other new disinfection systems. Improved water use efficiency is also a market with future potential in terms of technological development.

DO YOU KNOW...



SONITEC-VORTISAND offers unique technology for the treatment of industrial process water, waste water and drinking water. Vortisand™ superfine filtration systems (0.45 microns) operate with a microsand filter and centrifugal force. These filters, sold around the world for over 20 years, can help companies obtain LEED certification and are GreenSpec approved.

www.sonitec.com

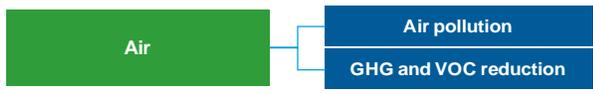
DO YOU KNOW...



Ovivo is a world leader in water treatment, deploying its products and services across 5 continents. Bringing together over 200 years of water expertise, the company generates annual sales of over \$450 million in a range of markets: municipal, industrial, wastewater, drinking water and ultrapure water. Ovivo is the water group of GLV Inc., a Québec multinational headquartered in Montreal.

www.ovivowater.com

AIR



Québec has a highly specialized air treatment industry. Made

up essentially of mature companies, this Québec sector could experience expanded business opportunities (principally in the subcategories of GHG and VOC reduction and the field of pollution) with the launch of the regulated carbon market scheduled for 2013 and Québec's target of reducing GHG by 20% compared to 1990 emission levels. With the market characterized by major players, small specialized companies have chosen to enter the market via niche segments.

Competition remains stiff with the United States, Japan, Germany and China all vying for the global market. At the moment, Asia, and more specifically China, is leading in this sector because Chinese production costs are 15 to 20% lower than other global equipment suppliers. The situation has led some companies to relocate to China.

DO YOU KNOW...



Gedden is recognized globally for its innovative, flexible and efficient solutions to stimulate greenhouse gas (GHG) emissions reduction. Gedden's solutions provide a variety of businesses with sustainable management alternatives focussed on re-using waste, optimizing transportation and increasing energy efficiency. By measuring and quantifying GHG reduction efforts, these efforts can be converted into carbon credits exchangeable on national and international markets.

www.gedden.com

²⁹ Please see http://www.mddep.gouv.qc.ca/eau/inter_en.htm
³⁰ In 2010, 12% of venture capital was invested in this niche.
³¹ Decentralized treatment is becoming more common as it helps reduce infrastructure costs and provide service to small communities.

In this era when climate change is making it necessary to find solutions to environmental degradation, several countries are passing laws and regulations with thresholds for toxic emissions into the atmosphere. Although Québec adopted the *Clean Air Regulation*, it would appear that Europe has stricter air quality regulations than Québec and Canada. As a result, European companies are more advanced in this sector, particularly in niches like carbon capture and biogas purification.

DO YOU KNOW...



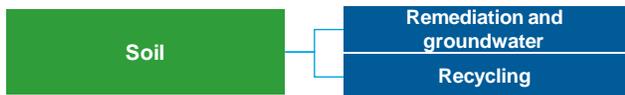
Odotech offers a full range of odour management services and technologies. It has developed and marketed OdoWatch® automated systems for the monitoring and management of site odours using electronic nose networks. Thanks to OdoWatch®, industries and municipalities can now proactively manage site operations, thus reducing odour complaints from neighbouring communities and saving on odour treatment costs.

www.odotech.com

While the traditional markets (North America and Europe) are saturated or even decreasing,³² emerging markets like China and India³³ offer excellent opportunities for air treatment technologies. Asia alone has driven most of the growth in this sector. The top purchaser of pollution control equipment, it is also a leader in the use of odour control technologies.

Despite the creation of a cap-and-trade system for GHG allowances, only 8% of total research spending has been devoted to the air sector; UQAM, McGill, Université Laval, Université Sherbrooke and the INRS Carbon Capture and Storage (CSS) Research Chair are all active participants.

SOIL



The treatment, remediation and recycling of soil and groundwater represent a mature market, technologically speaking. According to the Federation of Canadian Municipalities, "As much as 25 per cent of the Canadian

urban landscape is contaminated by previous industrial activities." However, the United States and Europe are markets with tremendous potential. Austria, Germany, Belgium, the United States and Sweden are leaders in the field of brownfield site remediation.

Unlike the field of air treatment, the category of soil remediation accounts for 14% of R&D spending, with a global market of nearly \$30 billion in 2002. The École Polytechnique, INRS, Concordia and the ÉTS with its Canada Research Chair in Characterization of Contaminated Sites are particularly active in the field. A number of SMEs have also developed expertise in the assessment and biological treatment of contaminated sites. Some are also active in R&D. However, this niche seems more developed in Europe where space constraints have encouraged the emergence, and indeed the development, of the decontamination industry, thereby positioning Europe among the top markets [Europe (27%), United States (39%) and Japan (14%)]. Although excavation remains the most commonly used technique, representing a market share of 78% in 2010, new techniques like bio-decontamination are starting to appear (5%).³⁴

DO YOU KNOW...



The Northex Environnement treatment plant can restore 200,000 tonnes of soil annually, contaminated with organic or mixed constituents. The company has adapted its expertise to treat contaminated properties in-situ, without excavation. Holder of innovative technology for remediating inorganic soil, it has applied for a certificate of authorization to treat soils contaminated primarily by metals.

www.northex-env.com

Other techniques like solidification and chemical and thermal treatments are making small inroads. While radioactive sites and military facilities will offer major business opportunities, the biggest driver for the development of this sector in Québec will be the mining industry soil that needs to be decontaminated. What with Québec regulations and the Federal Contaminated Sites Action Plan, in the past few years the various levels of government seem to be more aware of the importance of remediating contaminated sites. Therefore, it is highly likely that this sector could grow due to Québec's local assets (e.g., mineral resources).

³² However, stricter pollution thresholds or the addition of new types of prohibited pollutants could lead to an upturn in growth.

³³ The air pollution control market in India is valued at \$0.4 billion and growing at 15% annually.

³⁴ It is estimated that it will grow by over 10% by 2015.

Waste management is one of Québec's largest and most promising sectors. In fact, Québec can call on leaders in waste-to-energy technologies (biomethanation and biofuels), recycling and waste collection (sorting and disposal).

While the development of this industry relies on the local market and therefore carries little risk of relocation, some countries like Germany, Sweden and France do have a technological edge in waste management.

In the field of waste, Québec companies specialized in the brokerage and recycling of plastic and the production of plastic from recycled resin are among the most innovative. Québec possesses expertise in managing the complete cycle of waste recovery/reuse, collection, treatment, sorting and processing. Thermal plasma for waste destruction and energy recovery and optical sorting are some examples of promising niches. Moreover, it is worth noting that some Québec truck manufacturers and vehicle equipment manufacturers for sorting centres are particularly active in R&D and known internationally.

It is currently estimated that approximately 15% of university research funding is allocated to waste. The keen interest in this type of research could intensify in Québec with the anticipated increase in the amount of waste being generated in Asia and Africa. In fact, Québec university research chairs (e.g., INRS, Polytechnique, UQAT, McGill) could take advantage of their considerable assets to help developing countries optimize landfill management (techniques to minimize the environmental impact) of waste and sorting. The strategic possibilities of these new techniques will be especially strong if they are adapted to the realities of emerging countries. The management and recovery of organic waste will therefore represent a major opportunity. Other niches like thermal treatment, the recycling of hazardous products and the industrial reuse of secondary materials are also shaping up to be expanding technology market segments.

DO YOU KNOW...



Airex Energy designs, manufactures and markets technologies that can reduce the consumption of fossil fuels. The company's CarbonFX torrefaction technology can transform any type of biomass into a clean, renewable, carbon-neutral biofuel. Soon, biocoal will replace bituminous coal and oil in industrial applications involving combustion, filtration and pyrometallurgy.
www.airex-energy.com

With stricter government requirements concerning subsurface containment, the implementation of the Québec Residual Materials Management Policy, the emergence of a range of government programs designed to support technological waste reclamation initiatives and the new legislative framework with regard to reducing greenhouse gas emissions, it is highly likely that Québec could maintain its strengths in certain niches and improve its R&D performance.

DO YOU KNOW...



Specialized in turnkey projects, Berlie Technologies design, manufacture and install various processes and equipment used to treat municipal and industrial organic matter: biomethanation, biogas use, dehydration and drying. Its technology can reduce processing times to approximately 7 days, compared to the 20 days required with conventional biomethanation processes.
www.berliefalco.com

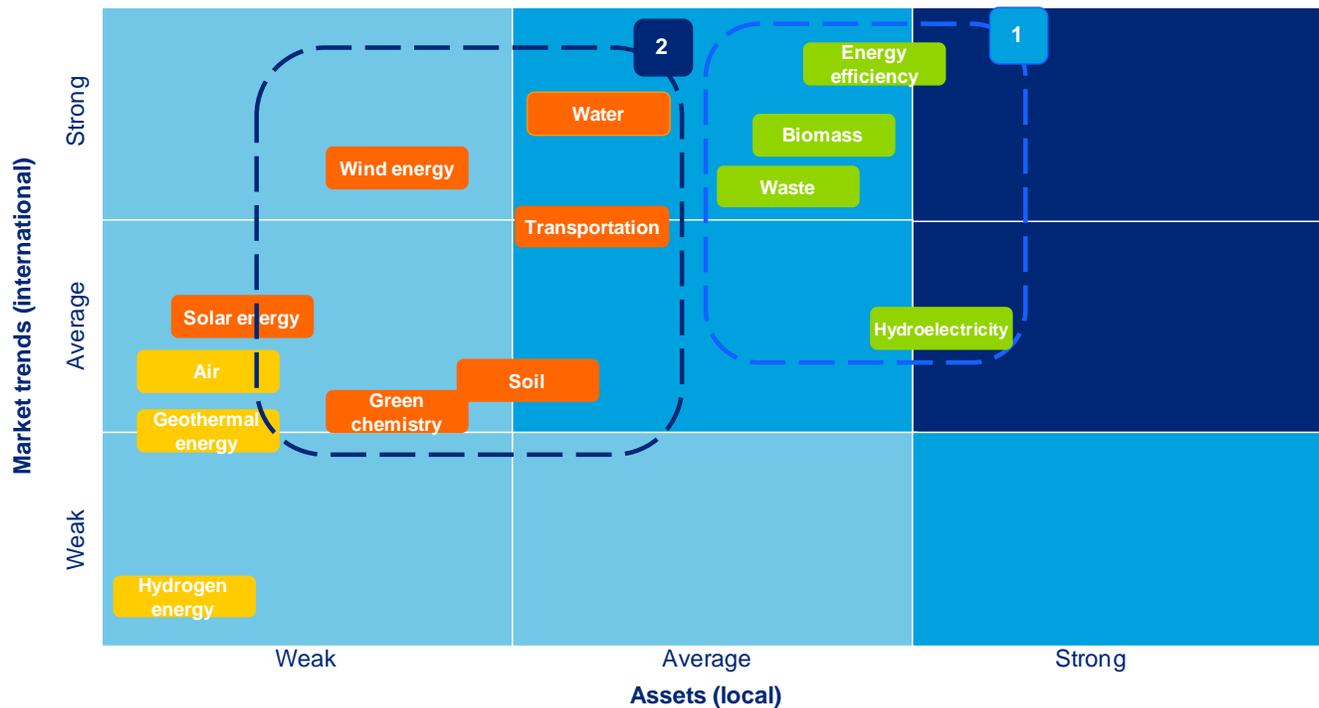
DO YOU KNOW...



Mechtronix Environment Inc. (MEI) has developed and markets Valoris™, the clean solution for the treatment of sludge and digestate. Valoris™ offers municipalities and industries a safe and environmentally-friendly sludge management system. Energy efficiency, safety and the production of valuable by-products like fertilizer, green energy and clean water are the primary competitive advantages of Valoris™.
www.mechtron.cpanel.modulis.ca

CORRELATION BETWEEN BUSINESS OPPORTUNITIES AND QUÉBEC'S ASSETS

The eight categories in the technology sector were analyzed in accordance with the analysis criteria set forth earlier with regard to international market trends and Québec's assets. Each criterion was weighted, thereby providing the positioning of two groups strategic for Québec. The Deloitte study shows that two categories (energy efficiency and waste) and two subcategories (biomass and hydroelectricity) already enjoy a favourable position on the international market. Other categories and subcategories also feature significant assets within their respective market niches, that is, water, transportation, soil, green chemistry, wind energy and solar energy.



Biomass: A promising option for Québec, which possesses significant forest resources

Thanks to its significant forest resources, Québec can hope to take advantage of this opportunity and profit from the markets offered by the biomass sector. The use of biomass for energy production is very widespread in Europe. In Québec, the government (which would like to reposition the forest industry) is encouraging initiatives to replace fossil fuels, like oil, with biomass, which is considered a renewable energy. The province should be able to compete in the biomass segment since Québec players have made advances in the field of 1st and 2nd generation biofuels and reclamation and there are research projects to optimize transformation processes for things like algae.

Energy efficiency, one of the challenges facing the industrial sector

Global energy consumption should increase 39% by the year 2030, led by emerging economies, and at that time, fossil fuels (oil, natural gas, coal) will still be covering more than 80% of the planet's needs.³⁵ To counter the growth in greenhouse gas emissions, countries, including emerging ones that are the primary drivers of the increased global demand for energy, must embrace energy efficiency. This should create strong growth in the demand for technologies to optimize industrial processes. Québec is well-positioned to assist these economies as they work to optimize their industrial processes.

³⁵Please see Les Affaires "Vers un bond de la consommation mondiale d'énergie," January 18, 2012.

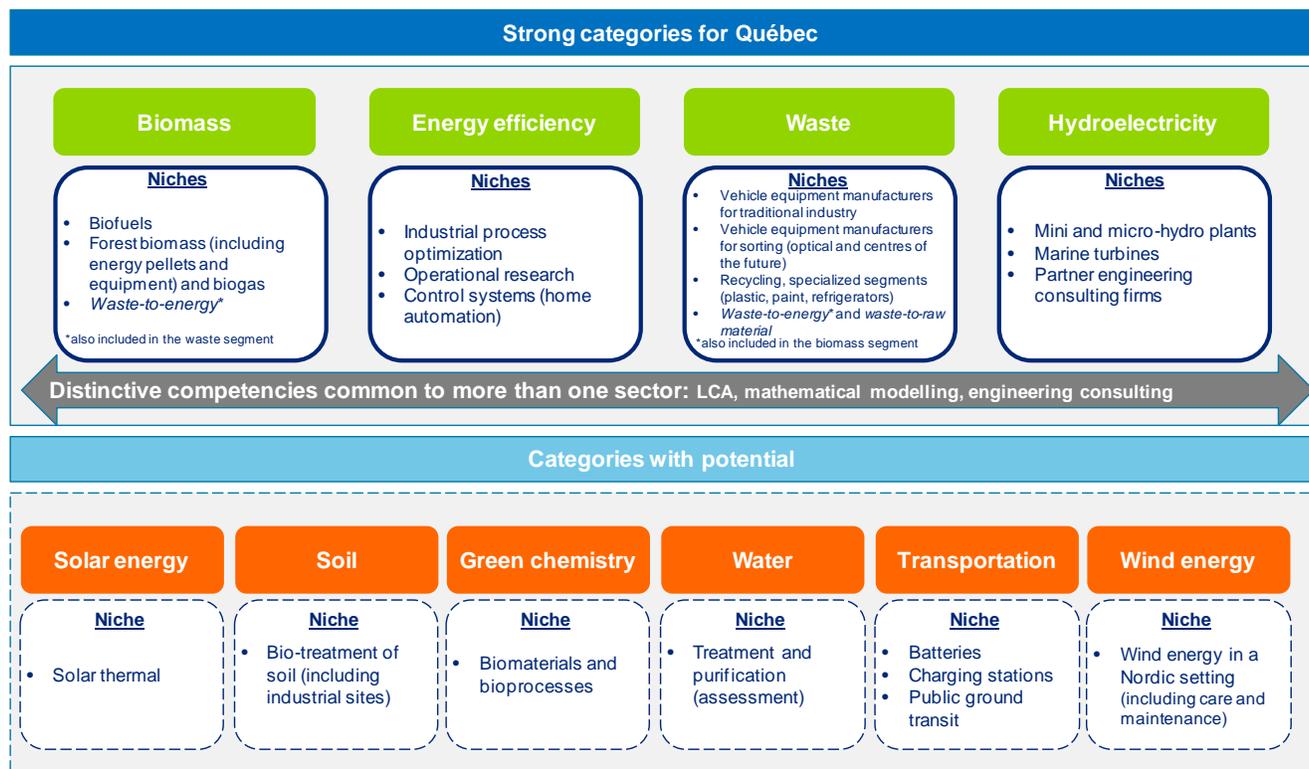
Waste management is effectively deployed in Québec

"The 13 million-odd tons of residual materials produced in Québec annually hold undeniable potential to be used both in manufacturing goods and energy production."³⁶ A very promising segment, the North American waste management market was worth some US\$70 billion in 2010 alone. With an enviable position in the global market niches of waste-to-energy, the recycling of specific products, the sorting centre of the future, and the management, collection and reuse of organic materials, Québec possesses a wide range of expertise.

Hydroelectricity gives Québec a competitive advantage

Hydroelectricity, the clean, renewable energy, gives Québec a favourable position on the global market. Québec is one of the globe's richest regions, when it comes to water resources. With its large-scale projects and the potential of the Plan Nord, it can pride itself on being a leader in hydropower production. With the emergence of numerous research and development projects examining electricity production systems, the deployment of technologies for small hydroelectricity plants (mini and micro power stations) and even tidal turbines, Québec is in a position to make dramatic breakthroughs in hydroelectricity technologies.

The table below presents the categories in which Québec distinguishes itself when international market trends are correlated with its assets, as well as those that offer significant opportunities for growth and niches with potential.



³⁶Please see http://www.mddep.gouv.qc.ca/matieres/inter_en.htm

CONCLUSION AND NEXT STEPS

The study conducted by Deloitte offers an analysis of the strengths, weaknesses, threats and opportunities for the eight main categories of the clean technology sector. On one hand, it helps identify international market trends while taking into account elements such as job creation potential, business opportunities, the level of competition, the size of the market in question and its growth. At the same time, the study aims to position Québec's expertise by examining the status of Québec players, the capacity for innovation, comparative advantages, and the regulatory environment affecting these categories.

Écotech Québec now intends to develop an action plan and tools to consolidate what has been learned about the categories and subcategories in which Québec excels, that is, energy efficiency, waste management, biomass and hydroelectricity, to enable these sectors to further develop here and abroad. These tools should also support the categories of water, soil, transportation, green chemistry and the subcategories of wind energy and solar energy.

Furthermore, it is important to note several elements that came out of the consultation process that merit mention because of their impact on market access and the growth of Québec's cleantech industry. These elements are: commercialization capacity, the role of public procurement and access to funding.

Commercialization capacity can be key to the sector because supply often outstrips demand. Therefore, major contractors could play a more strategic role by being more supportive of Québec companies. Furthermore, compared to Europe and Asia, fewer contracts are initiated by the government. In concrete terms, public procurement (federal departments, municipalities, etc.) can play a role in the development, demonstration and acquisition of clean technology, with the use of various tools like preferential pricing, purchase quotas, first purchaser, etc. Cleantech users and developers should be encouraged to work together, and the role of public procurement should be increased. Écotech Québec will take action to propose new approaches to respond to these concerns.

Access to financing also has an influence on the commercialization capacity of companies. The financing chain aims to provide companies with access to funding throughout their development, from basic research to product commercialization to selling shares on a stock market. For this to happen, Écotech Québec is working to finalize an evaluation of this chain that will be used to assess the current situation while aiming to support companies in their efforts to reach their sales and profitability targets.

Although the challenge facing the industry is ambitious, it is realistic. We must throw our efforts behind Québec's assets to further develop the province's cleantech industry, encourage Québec businesses to make use of it and work together to promote our expertise internationally. In this way, the cleantech industry will become even more strategic to the green economy, further advancing the prosperity of Québec.

LIST OF ACRONYMS

BHP	Boiler horsepower
CAGR	Compound Annual Growth Rate
CANMET	Canadian Centre for Mineral and Energy Technology
CIRRELT	Centre interuniversitaire de recherche sur les réseaux d'entreprises, la logistique et le transport (Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation)
CQVB	Centre québécois de valorisation des biotechnologies (Québec centre for creating added value in bio-industries)
CREDEAU	Centre de recherche, développement et validation des technologies et procédés de traitement des eaux (Research, development and validation centre for water treatment technologies and processes)
CRIBIQ	Consortium de recherche et innovations de procédés industriels au Québec (Quebec industrial bioprocess research consortium)
EPIA	European Photovoltaic Industry Association
ERDAT	Équipe de recherche sur le développement des technologies avancées de traitement des eaux usées (Research team on the development of high tech wastewater treatments)
ÉTS	École de technologie supérieure
GHG	Greenhouse gas
GRANIT	Groupe de recherche sur les applications numériques en ingénierie et en technologie (Digital applications in engineering and technology research group)
IMI	Industrial Materials Institute
INO	National Optics Institute
INRS	Institut national de la recherche scientifique (National Institute for Scientific Research)
IP	Intellectual Property
IREQ	Institut de recherche d'Hydro-Québec (Hydro-Québec's research institute)
ITAQ	Institut de transport avancé du Québec (Québec Advanced Transportation Institute)
LTE	Laboratoire des technologies de l'énergie (Energy technology laboratory)
NGTC	Natural Gas Technologies Centre
NSERC	Natural Sciences and Engineering Research Council of Canada
R&D	Research and development
UQAC	Université du Québec à Chicoutimi
UQAM	Université du Québec à Montréal
UQAR	Université du Québec à Rimouski
UQAT	Université du Québec à Abitibi-Témiscamingue
VOC	Volatile organic compounds

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