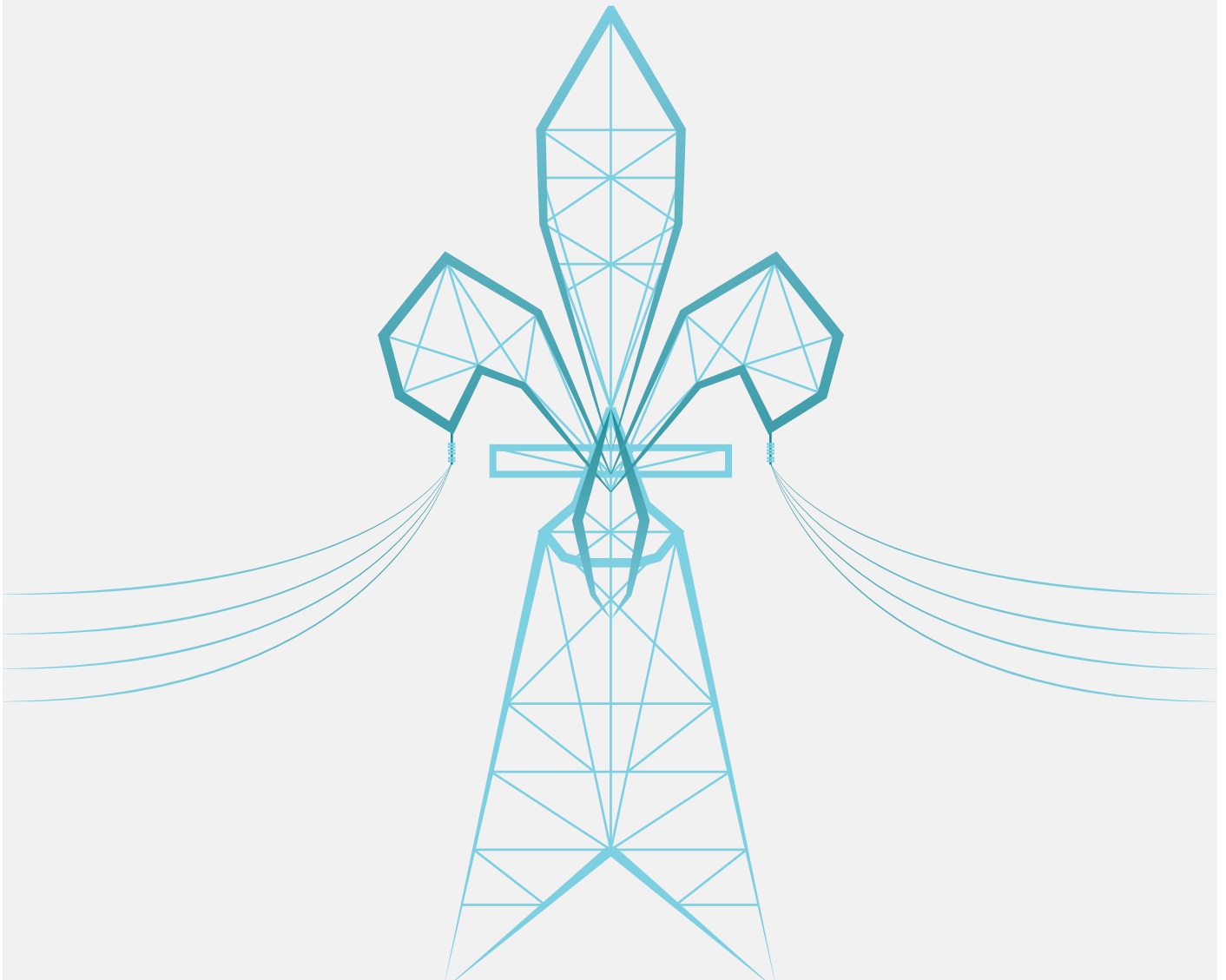


# GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



## QUÉBEC POWER 2014

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# Dear readers,

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The world is at a crossroads. Never before have decisions about energy been so instrumental in shaping the future. We have entered an era of bidirectional power grids, decentralised energy systems and highly evolved technology, all designed to improve the efficiency and reliability of services to the end user and to increase our resilience to extreme weather incidents. Expectations are high: economic growth must not suffer, energy needs must be met and the planet must continue to sustain life. Significant change is required if we are to meet the challenges before us.

By now, Québec has developed tens of thousands of megawatts of hydropower through its state-owned corporation, Hydro-Québec. This has given the entire population access to electricity, spawned a world-renowned industry and enticed heavy industry to settle in the province. Power production, transport and distribution were nationalised in the 40s and 60s, but the government nevertheless continued to support private production, recognizing that small-scale hydro and biomass cogeneration were run more efficiently by private industry. To mitigate hydrologic risk, the government then implemented a policy that called for the installation of 4000 MW of wind power. These megawatts, entrusted to private producers, resulted in the creation of a Québec wind power industry that now employs 5000 people.

At the time of writing, Québec is preparing to unveil a new energy strategy. Among the end goals sought are meeting ambitious GHG reduction targets, growing the economy and positioning the province as a leader in renewable energy. The recent launch of an 800 MW wind power initiative is a step in the right direction. Concrete recommendations have

yet to come out of the public consultations held throughout the Fall of 2013.

As the Association that brings together all the main players in renewable energy in Québec, we have noted several decisive actions the government can take at this critical juncture. Our suggested solutions include promoting alternative forms of clean energy; allowing flexible business models that empower regions to develop and benefit from the energy sources available in their area; continuing wind power development until existing wind farms are due to be refurbished; permitting new small hydro projects where communities can benefit; setting a new standard ensuring that a minimum content of biogas is injected in natural gas pipelines; progressively converting government transportation fleets to biofuel, biomethane, CNG or LNG; encouraging the deployment of biogas technology in waste and waste water treatment plants; and providing financial aid to agricultural businesses to help them convert their facilities to biogas.

We are not yet in a position to completely forego our reliance on fossil fuels, but by replacing oil with the energy produced through a 5% increase in the output of renewables, we can reduce our consumption by 3.3 Mtoe over the next decade. Québec has more than enough renewable sources to meet 21st century challenges. The AQPER is ready, willing and able to take an active part in bringing to fruition the transition to renewable energy. •

Jean-François Samray  
**CEO of the Québec Association for the  
Production of Renewable Energy (AQPER)**

## Hydropower

Québec can comfortably claim a spot among the world's hydropower leaders. Water generates the overwhelming majority of the province's energy, and Québécois expertise is renowned.



**14-27**

## Wind

Québec may be diversifying its energy supply, but its commitment to environmental sustainability remains strong. Wind power is the new growth sector in the province.



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## Unconventional Sources

Innovation is a strength of Québec, a province which boasts the highest R&D spending in Canada. Utilizing this, Québec has made strong inroads into the fields of solar, biogas and biofuel.



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## Transmission and Distribution

Transferring electricity around a province of 1.5 million km<sup>2</sup> is no easy feat. To do so presents numerous challenges, yet also creates opportunities for innovative solutions and services.



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## Data Centers

Québec holds certain unique advantages for the establishment of data centers: a cold climate and an abundance of cheap and green energy. The data center market has a strong future in the province.



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This research has been conducted by  
Gabrielle Morin, Razvan Isac and Sulaiman Hakemy  
Edited by Barnaby Fletcher  
Graphic Design by Leigh Johnson and Gonazalo Da Cunha  
A Global Business Reports Publication  
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# Politics and Power: An Introduction to Québec and its Energy Industry

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"When you look at the market, in Québec, or anywhere else, you start with the consumer perspective, which is focused on the lowest cost of energy. Vestas is competing in brutally efficient markets, from Brazil to West Texas and we understand that at the end of the day, the price will drive the strategic decisions of what should be implemented in the power sector. Obviously, there are alternate sources of energy for alternate times and while wind does not always blow, finding its role in an integrated system, whether it is in Québec, the US or Northern Europe, can be a great solution. You have to be sensitive to geography and to the cost-efficiency of production and if you are incentivizing all the time, you are not going to create a long-term sustainable solution."

- Chris Brown,  
PRESIDENT, VESTAS AMERICAS





# An Introduction to Québec

A brief overview of the province and economy

## Québec at a Glance

Source: Statistics Canada, Institut de la Statistique Québec, Chambre de Commerce de Montréal Métropolitain

**Population:** 8,155,334 (2013 estimate)

**Capital:** Québec City

**Head of Government:** Premier Pauline Marois (Parti Québécois)

**Currency:** Canadian Dollar (CAD)

**GDP:** \$357.859 billion (2012 estimate)

**Growth Rate:** 1.2% (2013 estimate)

**GDP per Capita:** \$35,111 (2012 estimate)

**Economic Sector Breakdown:** goods: 29%, services: 71% (2011 estimate)

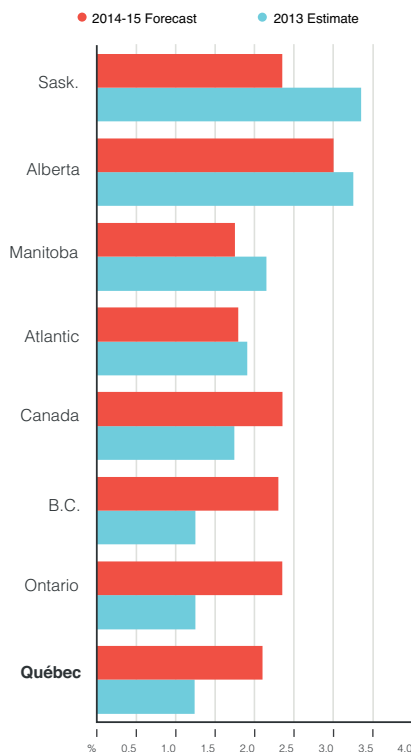
**Exports:** 63.53 billion (2012): aluminum, airplanes, paper, airplane parts, copper and alloys

**Imports:** \$85.61 billion (2012): petrol, automobiles, airplanes, trucks and frames

**Major Trade Partners:** USA, UK, Germany, France, China

## Forecast GDP Growth by Province

Source: Statistics Canada



Québec only province to claim French as its sole official language and its unique architecture and cuisine – alongside the natural beauty of its vast land area – supports a thriving tourism industry. Yet for the time being Canada’s second largest provincial population are less concerned with its magnificent scenery and rich culture than with political debates and economic woes.

If Québec is the heart of French Canada – which it undoubtedly is – it is, at the moment, beating rather weakly. Economic growth has fallen behind that of the rest of the country – 1.7% and 1% in 2011 and 2012 respectively compared to 2.5% and 1.7% for Canada as a whole – and with lower growth has come a lower GDP per capita, a lower rate of private investment, a lower rate of home ownership, and a greater public debt: all of which fall behind Canada’s three other provincial powerhouses of British Columbia, Alberta and Ontario. Indeed, these trends are not new, with Québec’s GDP growth averaging below Canada as a whole since the early 1980s.

There are, of course, multiple reasons why a province that holds such potential for a range of economic sectors has failed to fully exploit them. Unfortunately, political squabbles and the fight for independence are among them: whatever one’s thoughts on the validity of Québec’s sovereignty, the feeling that these issues are distracting attention from essential economic concerns that must be addressed is inescapable. This has become even more apparent in recent years: the minority mandate granted to Parti Québécois (PQ) in the 2012 provincial election has ensured that this sovereignty remains the focus of much public debate.

Other policies are adding to this distraction. The PQ’s “secular charter” – which bans conspicuous religious symbols such as headscarves yet makes allowances for

exclusively Roman Catholic “items of cultural heritage” – has sparked substantial controversy. Similarly, the so-called “language laws” have provoked commentators of the Montreal Gazette, the only English-language newspaper printed in Québec’s largest city, to wonder if debate over these issues are “stalling discussion on other topics”. As the provincial government debates whether a hijab is acceptable to be worn in public, the province’s manufacturing output continues to decline.

Québec is certainly not without huge potential. Six universities in Québec made it into the 2013 Academic Ranking of World Universities, more than most countries, and provide a highly skilled labor pool. The level of research and development in the province consistently surpasses its provincial peers. A mature financial sector is present to support large projects and it boasts a range of advanced industries: aerospace, information technology, biotechnology and health among them. Its mining industry, despite recent troubles, is among the developed and attractive in the world, both in terms of its geological potential and its regulatory framework.

Unnecessary debates about unnecessary issues will no doubt continue, and recent allegations of corruption involving the husband of Premier Pauline Marois and the Québec Federation of Labour will further distract from more pressing issues. The PQ’s economic policy at the end of last year, “Putting Jobs First”, was derided by many as “too little too late”, yet one may hope that with time slowly running out before federal elections at the end of 2015, the minds of politicians will start to focus. •



### Population and Workforce information

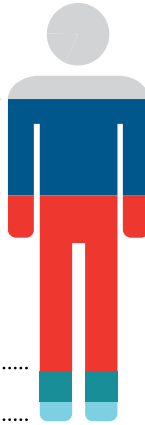
Source: Various

6,102,210 French as Mother Tongue

4,320,300 Labor Force

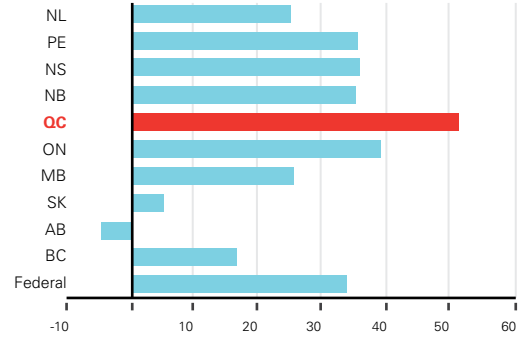
961,700 English as Mother Tongue

335,900 Unemployment Rate 2012



### Government Debt as a Share of GDP by Province (%)

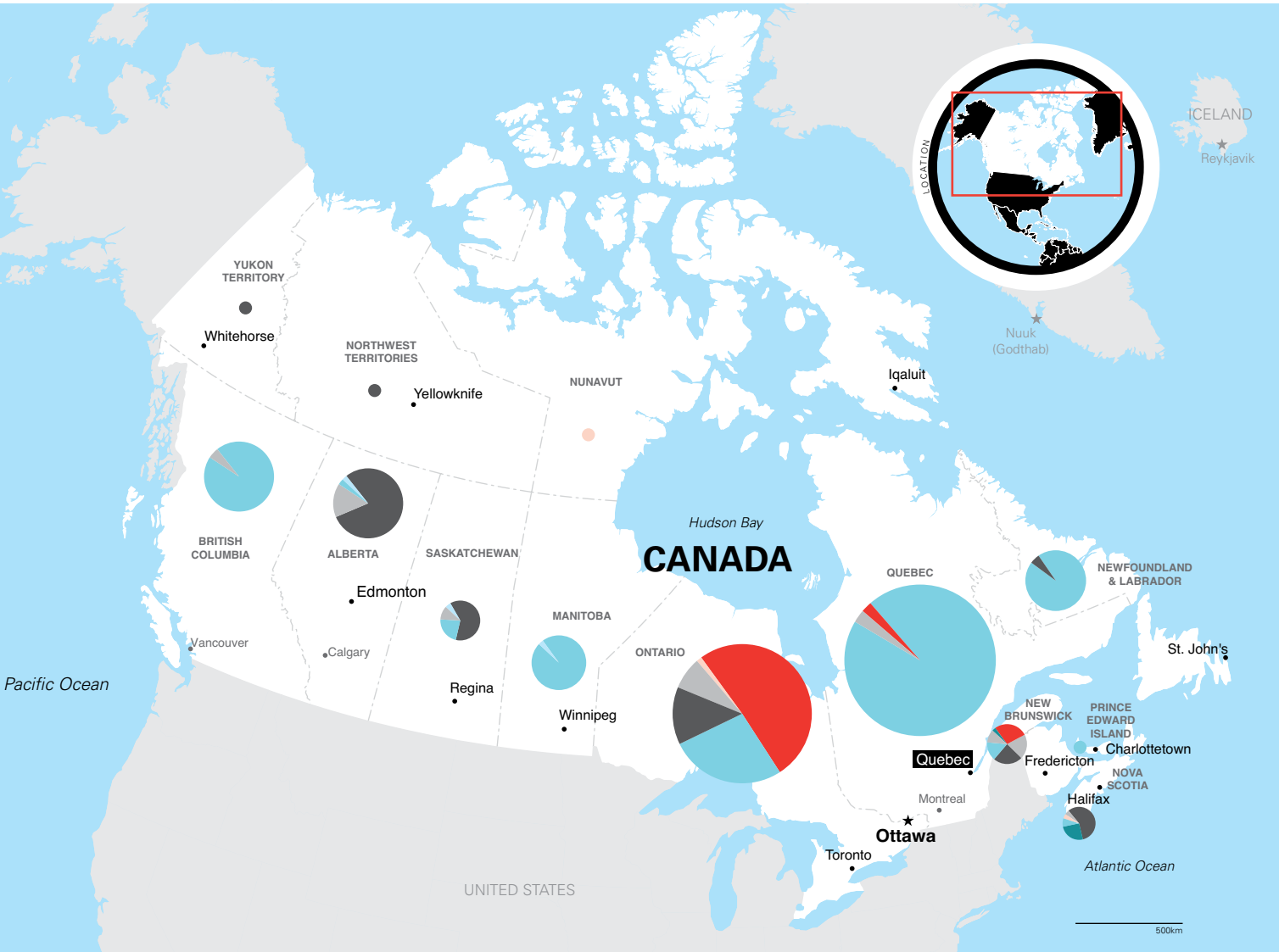
Source: Statistics Canada, Conference Board of Canada, provincial governments



### Energy Mix by Province

Source: International Energy Agency

● HYDRO ● COAL ● NUCLEAR ● NATURAL GAS ● PETROLEUM ● WIND AND TIDAL ● OTHER





## INTERVIEW WITH

# Daniel Laplante

PRESIDENT AND CEO  
L'ASSOCIATION DE L'INDUSTRIE ÉLECTRIQUE DU QUÉBEC (AIEQ)

Could you summarize some of the key moments in the evolution of Québec's energy industry for us? What sources of diversification have been developed in the province?

The creation of the Québec Hydro-Electric Commission (Hydro-Québec) in 1944 and the nationalization of electricity in the 1960s were key moments for the history of Québec's energy sector. With this nationalization came the grouping of producers, transporters and distributors, a move which had a huge effect on the development of a vast production base in northern Québec – the hydroelectric complex in James Bay being a good example of that. This has also allowed the province to establish a robust transportation network for itself, by using cutting edge technology and attracting multinationals such as ABB. Thereafter, new policies were introduced, allowing the establishment of private production between 1990 and 2000, including wind power. In terms of costs, it is very difficult to compete with hydroelectricity in Québec. Wind energy came online slowly, but surely, in the early 2000s – and that was an important source of diversification. Québec's power system can take about 10% of wind energy (4000 MW out of 40,000 MW total), and the province should be able to reach this ratio in a few years' time.

How do you see the moratorium on fracking affecting the competitiveness of Québec in terms of the rest of Canada or the United States, which saw a dramatic rise in their shale gas supplies?

The increase of shale gas in the United States has significantly reduced the price per kWh. Presently, the United States can produce electricity at very competitive

costs; however, we do not know how this industry will develop in ten or 15 years. Furthermore, we have not been able to measure its overall environmental impact – particularly regarding greenhouse gas (GHG) emissions. We must also consider that Americans use shale gas for their domestic market and if they decide to export their gas, their costs will automatically increase. A moratorium does not necessarily affect the electricity sector in Québec, because we do not essentially feel threatened by gas, as hydropower is still very competitive in comparison. The problem is that the low price of gas makes electricity exports less profitable than before. Despite this, in 2012, we still exported a high amount of electricity, roughly 35 TW.

Québec's power industry experienced a spike in exports to the United States in 2012. How do you assess the future role that the province can play for the northeast of the US?

Over the years, we have developed expertise in several areas that allow Québec to strengthen its role in the US market, particularly in balancing energy. There are currently many wind farms being built in the United States: 430 MW of wind power installed in Maine, 1,340 MW in Pennsylvania, 1,650 MW in New York, and 2,000 MW in Ontario, all of which represent potential markets. There is also a role for Québec in the field of global warming related technology, and the transport and distribution of power. Furthermore, the aging of the US' electrical infrastructure represents a good business opportunity for companies based in Québec.

What are some of the main factors that differentiate Québec from other

jurisdictions, such as the US, or Europe?

Québec has a strong commitment to environmental issues, particularly in regards to global warming. The target of reducing GHG emissions that Québec's government has set for 2020 is 25% below the levels of 1990, which is probably the highest of any North American target. The province is a great renewable energy producer, but there is an incredible paradox present here – although we have a clean energy surplus, we are also dealing with a trade deficit of over USD \$ 20 billion per year due to oil imports. Nonetheless, we believe there is a solution out there for this: 42% of GHG emissions in Canada come from ground transportation, and 72% of the imported oil is consumed by transportation. Therefore, the electrification of transportation can be an interesting solution for the province. Turning problems into opportunities can place us ahead as a North American leader in electric transportation.

What would be the role of Québec's government in the development of the electrified transportation sector?

We already have a strong model in Québec in terms of energy, but we can go much further in terms of innovation. The role of government would be to launch consultations related to industrial policy, energy policy, and documents on innovation and exports. Québec's economy should be based on its comparative advantages, particularly renewable energy, which would be balanced using wind power. In this way, an energy strategy may eventually become an industrial strategy. By effectively using our surplus and expertise, we can create a sustainable economic development. •

# Power in Québec

## A strategy to energize growth

Every year, government-owned utility company Hydro-Québec carries out a comparative analysis of electricity prices in various cities throughout North America. This study includes 22 cities: 12 across Canada, and 10 in the United States of America. In 2013, to little surprise and following a rather common trend, Montreal was found to be among the cheapest price per kilowatt hour (kWh) locations for both residential customers (at 6.87 ¢/kWh) and large-power (commercial, institutional and industrial) customers (at 4.88 ¢/kWh). Indeed, for customers with monthly consumption of around 1,000 kWh a month, it ranked first. For large-scale consumption of around 3,060,000 kWh a month, it ranked second.

To add to the financial advantages offered by Québec's electricity, there is an environmental benefit. An impressive 97% of Québec's energy comes from renewable sources, putting it among the top provinces for green energy generation: in reports such as Corporate Knight's Green Provincial Report Card it consistently ranks among the leaders for its environmental friendliness, with the lowest greenhouse gas emissions per capita in the country: contradicting the commonly assumed choice between financial cost and environmental impact.

Québec instead benefits from an overabundance of clean and green energy. A land of lakes and rivers, hydropower has long dominated production, supported by a staple of research centers such as l'Institut de recherche d'Hydro-Québec (IREQ), into which Hydro-Québec invests \$100 million each year. Increasingly, however, hydropower is being well complemented by the province's eastern wind energy farms: Québec claims to have the best wind power potential in North America. After a record eight wind farms – totaling 1,050 MW – were commissioned in

2013, another eight are promised for 2014. A range of smaller, yet no less important, energy-generation alternatives are also spring up: biomass and solar standing out.

In all of these generation subsectors, Québec has looked not just to install facilities and provide electricity, but create sustainable manufacturing activity and build expertise. The engineering capabilities and knowledge of its hydropower sector already hold a global reputation, but a strong emphasis on research

is enabling the province to make great strides in these new sectors of wind, solar, biomass and others.

Hydro-Québec rules over power generation, transmission and distribution in the province, and, over the years, the utility has decisively contributed to the establishment of a world-renowned cluster of hydro actors across the supply chain. The hydro industry's tradition contrasts with the wind sector's youthfulness, whose expansion was prompted by recent



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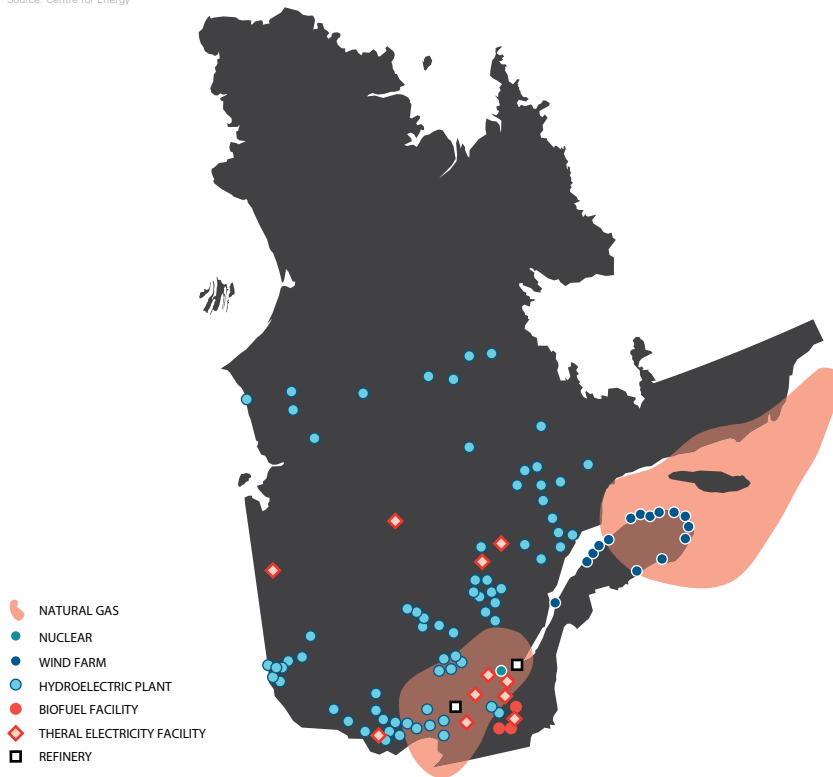
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WHEN YOU NEED TO BE SURE



## Québec's Energy

Source: Centre for Energy™



liberal governments and their 4,000 MW wind power RFPs. With its energy surplus estimated to last until 2027, Québec and its players are now looking inwards to optimize the province's aging hydropower infrastructure, while properly integrating and maximizing Gaspésie's wind sector contribution. More importantly, they are looking at foreign markets, where their expertise could shape many developing countries' energy infrastructures.

Nonetheless, for all the strengths of Québec's power industry – and there are many – there are challenges associated with catering to a province of over 1.5 million km<sup>2</sup> and a population of over 8 million. In January 2014 Hydro-Québec had to appeal to customers to reduce their energy consumption after cold weather (which reached as low as 26° C) led to record energy consumption. Encouraging energy efficiency when electricity prices are so cheap, however, is a difficult task: in this respect at least, Hydro-Québec can be considered a victim of its own success. •

## INTERVIEW WITH

# Jean-François Samray

PRESIDENT AND CEO, QUÉBEC ASSOCIATION FOR THE PRODUCTION OF RENEWABLE ENERGY (AQPER)

**What are the implications of Hydro-Québec's monopoly for diversification in the renewable energy sector?**

Québec is rich in water, wind and forests, so that the possibilities of development for renewable energy here are very promising. Hydro Québec supplies power largely through its huge hydropower plants. As we mentioned earlier, wind power is a perfectly complementary source of energy and there is hope that the government and Hydro-Québec will act to sustain the

industry that has taken root here. As regards biogas, biomass and solar, we keep an eye on regions like Scandinavia that have opened up the energy market to competition while maintaining a socialist model. We are going on fact-finding missions abroad to discover what motivates other countries to open their energy markets and what similarities their situations bear to that of Québec.

**Where are the most innovations and efficiencies in renewable energy in Québec**

**coming from?**

There is a lot of investment going into the biofuels sector from companies like Enerkem. Sherbrooke University is home to a lot of innovative research on ethanol. Hydrokinetic turbines are another exciting development coming out of the private sector. They can be placed in a free flow river in remote areas, such as mining sites, to provide electricity 24 hours/day.

Québec's reputation for innovation is enabling many of its companies to go global. Hydrep, for instance, manufactures break systems for all GE wind turbines; Delstar, a company based in Montreal, is doing all of the technical refurbishment for turbines for Alstom and Voith worldwide. We are not very far from integrating a full value chain in Québec from iron and copper ore mining all the way to renewable energy plant construction and production.

Québec has a bright future ahead in renewable energy. When the recession ends, and the province can no longer claim to be in a huge energy surplus, Québec's alternative renewable energy sector will be ready. •



## INTERVIEW WITH

# Frédéric Schenk

BUSINESS MANAGER, INDUSTRIAL SERVICES  
SGS CANADA

Québec is a mature hydro jurisdiction that has built a dense knowledge base over the years. How do you foresee the industry evolving in the future, based on its current competitive advantages?

Looking ahead, Québec's energetic success will depend on properly transitioning from the industry's build phase, which is coming to an end, to the maintenance and improvement stage of the cycle. The key challenge for Hydro-Québec will be to efficiently integrate new technologies and management techniques, so as to extract more value from its current assets. One side of the equation will consist of mechanical work and improving the physical parts of the system, such as turbines and other equipment. Another side will require building complex predictive models that will optimize the management of dams and basin flow rates. These hydrologic models will use stochastic processes (statistical inference) to predict how basins will respond to such factors as global warming and weather variability. Furthermore, green energy sources will also have to be properly managed and integrated within the system. Lastly, by incorporating a good market understanding within this complex picture, strong decision support systems can be created – these will allow for highly accurate recommendations to be offered to the decision makers in charge of managing the hydro-electricity assets, integrating sometimes conflicting goals such as maximizing income, flood protection and environmental protection. The physical, hard-asset knowledge is already very well established in Québec – the challenge will be to go beyond that and integrate all these knowledge based developments while considering profitability, but also human and societal factors.

Could you highlight the main services that SGS offers to its customers in Québec and the ways through which the company leverages its global reach to better advise its clientele?

SGS' role will be to continue to provide testing, inspection and verification services to Québec's hydroelectricity cluster. More than just inspections, SGS can help its clients to work on testing schedules and specific risk-based inspection systems that can predict the economic life of an asset. Asset management is a key area to take into consideration and as Québec's energy systems will become more and more complex with the integration of new technologies such as wind power, SGS will be there to add clarity to these structures. One of the key advantages for customers such as Hydro-Québec, BC Hydro and SaskPower in working with us is our global versatility: from China to Brazil, SGS has operations around the world, which give us the know-how to test and certify hydro or smart grid or wind power or battery components, irrespective of their country of origin. Innovation is not always a matter of technology: sometimes, it is as easy as making your client's processes more practical. SGS goes as far as testing products that are not even commercially available on the market yet, such as innovative battery and energy systems for cars. We effectively work with companies during their R&D process; we make sure that the product is economically feasible and performs well, while also testing its safety features, which will ultimately help legally homologate it.

**The wind power sector has rapidly developed in Québec over the past 10 years. With the advent of new smart grid and fuel cells technologies, what is the viability**

**of this type of green energy power in the province?**

It is difficult to predict what will happen to the wind energy sector once it will not be subsidized anymore. Looking ahead, the challenge will be to find efficient ways of transporting, transforming and injecting the power they produce into the grids. Ultimately, all developers want to see return on their investments and if the economic feasibility of wind power projects cannot be satisfactory, their popularity will decrease. Smart grid applicability largely depends on the nature of the market – the viability of such systems is different in densely populated areas than it is in more sparsely populated environments. Fuel cells will play an essential role in storing green energy and the technology itself has been proven to work. What is left to achieve now is to lower the costs of fuel cell production through economies of scale and thus increase their economic attractiveness. Already, China's attention shift to solar power has led to an industrialization of the process that has consequently decreased solar panel prices – the critical mass for fuel cell production will probably be led by the automotive industry.

**What are the perspectives for SGS in Québec and what is your final message?**

Given the shale gas boom in the US and considering Québec's potential energy surplus, the name of the game moving forward will be asset return maximization. SGS will continue to grow its expertise with the province's strong hydro cluster and we will leverage Québec's value and knowledge base for the benefit of our global organization. SGS has a long history here, and the reason we are still actively present is because we understand this province's value. •

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# A Land of Lakes and Rivers: The Role of Hydropower in Québec

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"Six years ago we started gradually developing a significant presence in Latin America. We are now closely eyeing a number of markets, including Turkey and the Balkans, which have mountain ranges suitable for hydropower generation and are well positioned between European and Asian markets.

Pakistan another focus market for us because of its proximity to India and China. Hydro-Quebec's prestigious reputation has really helped us in overseas markets, where Quebec has become associated with expertise in hydroelectricity projects."

- Sebastien Vittecoq,  
PRESIDENT, HYDROSYS CONSULTANTS





# Québec's Hydropower

The flow of electricity



Courtesy of Hydro Québec

Québec's choice for energy generation was always destined to be hydroelectricity. The province is home to more than one million lakes and 4,500 rivers, which represent over 40% of Canada's water resources. At the end of 2012, the province had an installed capacity of 35,829 MW but that figure should reach 40,000 MW by 2015, as outlined in the government's Energy Strategy. With 60 generating stations, 26 large reservoirs, 664 dams and 97 control structures, hydro power currently accounts for roughly 96% of Québec's power supply; moreover, it represents over 50% of Canada's total hydro energy.

All this impressive portfolio falls under the management of Hydro-Québec, the government owned utility, whose history dates back to 1944. After the development of the gargantuan 15,000 MW James Bay complex in the 1970s and 1980s, Hydro-Québec was not involved in any major projects for several years. However, that

changed over the last decade: between 2005 and 2013, Hydro-Québec commissioned a series of large hydro power generating units: Eastmain 1 (480 MW), Eastmain 1-A (768 MW), Sarcelle (150 MW), Toulmoustouc (526 MW), Peribonka (385 MW), and Chute-Allards and Rapides-des-Couers (138 MW). Furthermore, by 2020, Hydro's new chef-d'oeuvre, La Romaine (1,550 MW), comprising four units, will also come online: La Romaine 2 is scheduled for commissioning in 2014, while La Romaine 1 will follow suit in 2016.

The nature of hydropower also allowed for a healthy diversification of Québec's energy landscape over the last 10 years, with the government deciding to create a wind power sector in the province. "Québec is blessed with hydropower resources, but water is cyclical. We usually have regular precipitation cycles lasting approximately four years, but in the year 2000 there were back-to-back low periods with scarce

precipitation. The reason you combine wind with hydroelectric capacity is to mitigate the risk of droughts. The two resources complement each other," said Jean Francois Samray, president of AQPER, Québec's Renewable Energy Association. "Québec has the best energy mix people can hope for, with wind and hydro power. We can use wind power in winter, when the output is good and store precipitation in the dams and then, during summer, when wind is low, we can use that winter precipitation to smoothen output: it is the ideal scenario." added Daniel Laplante, president of AIEQ, Québec's Electric Industry Association.

Hydro-Québec's activity over the years has led to the formation of a tremendous hydro knowledge base in the province. Companies across the hydro supply chain have flourished in Québec and their expertise has become sought-after worldwide. EXP is a diversified engineering firm with presences across the US and Canada:

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## INTERVIEW WITH

# Thierry Vandal

PRESIDENT & CEO  
HYDRO-QUÉBEC

Can you give us an overview of Hydro-Québec's evolution within the province?

Hydro-Québec was founded in 1944. We gained scale in the 1960s with the acquisition of a number of local and regional power companies, and in the 1970s and 1980s we developed the 15,000-MW James Bay Hydroelectric Complex. This development really gave us a global standing in terms of generation and transmission. The 1990s saw little development taking place because of lower demand growth. Over the last five to 10 years, however, we have been able to launch a significant new phase of large hydro development, adding 4,000 MW to the system. Our most recent development is at Romaine, which is a \$6.5-billion project. We are currently investing \$1.8 billion into high voltage transmission to bring this resource to market.

One key aspect for Hydro-Québec is the quality of communication and relationships we have established with First Nations aboriginal groups throughout our operations. We involve them in our projects from the beginning. They have established businesses in procurement, air transportation, construction, and even catering. In the \$5-billion Eastmain Rupert project, we have awarded close to \$500 million in contracts to First Nations businesses. At the same time as we are developing these relationships, we are very proud of our environmental record and the way that we are able to install these major hydro developments so as to allow the ecosystems to remain vibrant and productive after the projects are completed.

In April 2013, the New York Public Service Commission approved a plan to build a 1,000 MW transmission line between Québec and New York City. What impact

will this project have on export potential for Hydro-Québec?

Currently, we have 6,000 MW of export capacity to move power to markets in New England, New York, Ontario and New Brunswick. Hydro-Québec's system of large-scale hydro reservoirs is the equivalent of a very large wholesale battery for the greater Northeast region. In addition to the renewable hydropower we produce, we store power that we have purchased off-peak with the intention of re-selling it on-peak when power demand is greatest. We can store more power in our reservoirs than a state like New York can consume in a full year. Now we are working on transmission projects to bring more of that power to our export markets. This new project will be a \$2 billion-plus, 1,000-MW mainly-underwater direct current line down the Hudson River through New York state into Queens, New York. Our US partner, TDI, with the backing of the Blackstone Group, has acquired the necessary permits from New York and we are expecting the Presidential permit later this year. We will also need a permit from the US Army Corps of Engineers because we will be laying wire.

Our other key transmission project will also be a high capacity direct current line starting from the Eastern Townships area of Québec, near Sherbrooke, and serving New Hampshire, Connecticut, and Massachusetts. The end point will be Franklin, New Hampshire. This 1,200-MW project is not as advanced as the New York project in terms of the actual permitting process, but it is a key focus for us, working with our US partner, Northeast Utilities.

What role is Hydro-Québec playing to help meet the government's goal of integrating

more wind energy into the province's power supply?

The integration of wind energy on our grid is really a function of how much policy support there is from the government. The Québec government has established wind power supply mandates, to the level of 4,000 MW overall. Hydro-Québec has run large RFPs to meet these mandates. We are purchasing the wind power on behalf of ratepayers in Québec, and we also handle the integration on the grid. To ensure that the wind power would not be a drag on the transmission grid, we pushed our equipment suppliers to put the best that they had into these generators in terms of technical aspects like low voltage ride through and the ability to supply reactive power. The grid is as robust today as it was before these wind farms were attached to the system.

Another innovative program Hydro-Québec has implemented in recent years is the Electric Circuit. Can you provide us with some further details on this initiative?

While natural gas will play a big role in long-haul heavy-duty transport in the years ahead, we think that electric transportation is the way of the future for both public and individual transit in the urban space. For that to become reality, you need connectivity, and this is where the Electric Circuit comes in. So far, we have worked with 33 commercial operators to create several hundred recharge points anywhere from fast food outlets to grocery stores. Under a common branding banner, we source the charge outlets and the commercial partners pay for the supply and installation and provide convenient parking spaces close at their store locations. For a low flat fee, drivers can park and recharge at these parking spaces. •

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in Québec, the company employs over 1,000 people. In recent years, EXP has been involved in the La Romaine, La Sarcelle, and the Chute Allard and Rapide-des-Coeurs projects, assuring mechanical and electric works for their auxiliary units. However, the benefits of working in Québec extend abroad. Jean Lavigne, EXP's vice-president for energy, explains: "In Québec, we have developed expertise in hydro-electricity alongside Hydro-Québec. We leverage and apply this to other markets as well, in places such as Western Canada, Africa and India. The experience we have gained working with Hydro-Québec has enabled us to export our expertise and develop a similar relationships with other clients as well."

Essential actors of the hydro cluster, turbine-manufacturing powerhouses such as Alstom Hydro, Andritz Hydro, and Voith Hydro also have strong presences in Québec. French giant Alstom has had a powerful impact on Canada's hydro market, as Pierre Gauthier, president of Alstom Canada, explains: "Alstom has serviced over half of the Canadian hydro power capacity through its manufacturing plant at Sorel-Tracy. Furthermore, we were recently awarded the La Romaine 2 and 3." Beyond new projects however, Alstom is targeting the rehabilitation market: since 2012, the town of Sorel-Tracy hosts Alstom's Global Center for Technology for innovation in hydro retrofiting. "We secured the rehabilitation contract for La Grande 2, Hydro-Québec's biggest power plant: through technology, we can provide dramatically increased efficiency. Alstom can increase power outputs by 30%, just by replacing the plant's equipment, which accounts for only 10% of the project's cost. Multiply this through the next 50 years and you see that the returns are impressive," added Gauthier. Alstom is not the only global turbine manufacturer to have one of its technology centers in Québec. In 2008, Austrian giant Andritz Hydro acquired several of GE Hydro's global assets, among which the American powerhouse's facilities in Canada and Québec, where the company was very well positioned in the market. Consequently, the global center of competence for Andritz Hydro's Francis turbines is now located in Québec. "GE Hydro's complementary technology and global footprint made the company very attractive for Andritz Hydro. We acquired low-head environment technology and at the same time, we were able to benefit from the core of engineering expertise that existed in Montreal: virtually everyone that worked for GE was transferred to Andritz following the acquisition. Finally, our global project reference base dramatically increased, as we accommodated all of GE's installed units in the Andritz family. This included the large installed base that GE Hydro had delivered in Québec, for Hydro-Québec," said Daniel Carrier, vice-president of operations at Andritz Hydro Canada. Five years after the GE acquisition, Andritz Hydro has consolidated its Canadian business with large projects in British Columbia (BC Hydro's Mica plant) and Labrador (Nalcor Energy's Muskrat Falls project). Looking forward, the company is targeting the rehabilitation market in Québec, as well as expanding into new product areas: "We still have a lot to offer to this province in terms of hydro power: our strong local presence and our long tradition in this particular environment recommend us for future projects. Looking ahead, Québec will turn more and more to the refurbishment of existing facilities and the fact that a large part of the existing base was installed by us means that we have the detailed knowledge needed to properly optimize it. We are also very interested in seeing the evolution of some of our newer product lines, such as our hydraulic gates," noted Keith Pomeroy, vice-president of sales and marketing at Andritz Hydro Canada. Indeed, with an aging hydro infrastructure, rehabilitation is high on Hydro-Québec's agenda, and the utility is currently undergoing works at nine of its large hydro structures, among which Beauharnois, La Tuque and Manic 1 and 2. Multinational turbine manufacturers in Québec also benefit from the support of local entities, such as Delstar Power, one of Groupe Delom's three companies. Delstar Power was founded in 2000 to serve the likes of Alstom and Voith rebuild or manufacture their turbines, by using a proprietary manufacturing process. Delstar leveraged the experience its sister company, Delom Services, already had in the maintenance and repair of small hydro equipment. Mario Montpetit, CEO of Groupe Delom, talks about Delstar's evolution: "Delstar now has a good presence all over North America, especially in the hydro sector, due to the fact that our global customers extended their collaboration with us beyond Canada. Looking forward, we are aiming at further developing our external markets."



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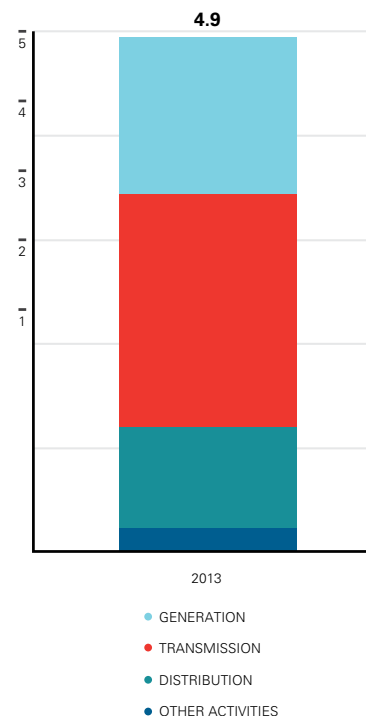
### Hydro-Québec at a Glance

Source: Hydro-Québec

- 61 generating facilities connected to the grid, including 59 hydroelectric generating stations	- 664 dams
- 35.7 GW in installed capacity	- 97 control structures
- 26 large reservoirs with a storage capacity of 175 TWh	- net electricity exports of \$1,233 million in 2012 for net reservoir drawdown of 30.1 TWh

### Hydro-Québec 2013 Investments

Source: Hydro-Québec



### World's Largest Hydroelectric Power Stations

Source: various

RANK	NAME	LOCATION	INSTALLED CAPACITY (MW)
1	Three Gorges	China	22,500
2	Itaipu	Brazil/Paraguay	14,000
3	Guru	Venezuela	8,850
4	Tucuruí	Brazil	8,370
5	Grand Coulee	USA	6,809
6	Longtan	China	6,426
7	Krasnoyarsk	Russia	6,000
8	<b>Robert-Bourassa</b>	<b>Canada (Québec)</b>	<b>5,616</b>
9	Churchill Falls	Canada (Newfoundland and Labrador)	5,428
10	Bratsk	Russia	4,500

## INTERVIEW WITH

# Marie-Hélène Briand

DIRECTOR, HYDRO  
HATCH

What are the particularities of Québec's hydropower market, given Hydro-Québec's dominant influence in the industry?

The two key elements to take into consideration when working with Hydro-Québec are the ability to offer competent and experienced services, and to be able to offer that in French: Hatch Water Power in Montreal can do both. Hydro-Québec, through its size and influence, can initiate technological revolutions by asking more of its collaborating

companies: due to the high standards they imposed, Québec has gained a lot of efficiency and the companies that complied with that are now more competitive on a global scale. As a result of Hydro-Québec's sustained work and high standards in innovation, the province has been able to develop tremendous expertise in hydropower over the last 40 years. Now, we have this fantastic opportunity to leverage this knowledge abroad and export it.

Could you tell us more about Hatch's contribution to the diversification of power supply options for the remote communities of Northern Canada?

Most of Canada's population lives close to the country's southern border and consequently, most of the big power projects are targeted towards this market; meanwhile, the remote communities that exist in the northern regions have to rely on expensive diesel generated power for their energy needs. Hatch is working on developing hybrid solutions for this issue – although we have not been able to completely replace diesel, we are advancing on replacing part of it with renewable sources of energy, such as wind power, cleaner thermal generation or hydrokinetic solutions for rivers or marine currents. Hydrokinetics is not yet considered a fully mature technology, but it is being developed at a fast rate, and we believe it has great potential for remote areas. Unfortunately, due to its long implementation time, hydropower does not always constitute the best option for remote communities or mining projects. •

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 Québec's value derives from the knowledge pool that was created here by Hydro-Québec, starting in the 1970s. This spirit of innovation needs to continue in order for us to be competitive abroad."

While the construction and rehabilitation of large hydro projects is on its way, Québec's small hydro sector has not been receiving much

attention in recent times. In February 2013, the government cancelled six such projects, citing economic reasons and the province's existing energy surplus as the main reasons for it doing so. "Smaller projects are frequently cancelled, which is a bad signal to send to communities and the industry. Municipalities that want to have their own projects often used to have

dams that were demolished in the 1970s just after the nationalization of the power sector. Now they want to regain the asset they lost. It is unfortunate that energy policies in Québec constantly change – that makes it very difficult to develop and mobilize a small hydro industry here. Meanwhile, we are wasting time and missing opportunities in other markets, where we might be afforded more opportunities," said Sebastien Vittecoq, president of Hydrosys, an engineering firm specialized in small and medium hydro developments.

Hydropower will undoubtedly remain the backbone of Québec's energy supply for decades to come. However, with the advent of wind energy and the probable halt of new construction projects after La Romaine, the next step will involve the optimization of this increasingly complex system. Frédéric Schenk, director of industrial services at Swiss certification and testing giant SGS, explains: "Given the shale gas boom in the US and considering Québec's already existing energy surplus, the name of the game moving forward will be asset return maximization. SGS has seen how Hydro-Québec developed a world-class hydroelectricity cluster in the province. The physical, hard-asset knowledge is already very well established in Québec – the challenge will be to go beyond that, to transition from the industry's build phase, which is coming to an end, to the maintenance and improvement stage of the cycle. This will require building complex predictive models that will optimize the management of dams and basin flow rates, based on such factors as global warming and weather variability. Furthermore, green energy sources will also have to be properly managed and integrated within the system. Lastly, by incorporating a good market understanding within this complex picture, an extremely comprehensive analysis tool will be created for the decision makers that will be responsible the system's optimization. SGS will continue to grow its expertise with the province's strong hydro cluster and we will leverage Québec's value and knowledge base for the benefit of our global organization. SGS has a long history here, and the reason we are still actively present is because we understand this province's value." •

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## INTERVIEW WITH

# Daniel Carrier & Keith Pomeroy

VICE-PRESIDENT OPERATIONS & VICE-PRESIDENT, MARKETING AND SALES  
ANDRITZ HYDRO CANADA

**What have been the main developments and achievements for your company in the Québécois market in the past three years?**

**KP:** The last three years have seen a tremendous consolidation of our company in Québec and our presence here has clearly surpassed the acquisition and integration phases that it went through several years ago. Andritz Hydro has had very good success across Canada during this timeframe, increasing its market share and gaining visibility through projects such as BC Hydro's Mica in British Columbia and Nalcor Energy's Muskrat Falls, in Labrador. For the Mica hydropower plant, BC Hydro requested us to install and commission two large Francis turbines, 520 MW each. Muskrat Falls entailed supplying four 209 MW Kaplan turbines and four synchronous generators to Nalcor Energy – we are proud to say that the equipment was chosen for both projects on a competitive basis, with proven performance in our hydraulic test lab.

**DC:** These sort of large projects are the key ones for a company such as ours, which has the full engineering, laboratory and project management setup. Another market-segment in which we are very well positioned is small hydro, which accounts for 25% of our revenues; the most interesting provinces for us in this sector are British Columbia and Ontario, where the IPPs are very active. Complementing these new projects, we have our service division, which has experienced constant growth over the last years. Meanwhile, our role as Andritz's global center of competence for Francis turbines has been consolidated through the continuous research and development that we have been doing in Québec. Lastly, we expanded our Canadian footprint in 2013 with a coil

shop in Peterborough, Ontario, which is strategically located next to our generator-engineering center; this new facility will serve the entire North American market.

**In 2008, Andritz Hydro famously acquired several GE Hydro assets and technologies.**

**How did that improve Andritz's business in Québec?**

**DC:** GE Hydro's complementary technology and global footprint made the company very attractive for Andritz Hydro, which subsequently gained strong positions in countries such as Brazil, Sweden and Finland. We acquired low-head environment technology and at the same time, we were able to benefit from the core of engineering expertise that existed in Montreal: virtually everyone that worked for GE was transferred to Andritz following the acquisition. Finally, our global project reference base dramatically increased, as we accommodated all of GE's installed units in the Andritz family. This included the large installed base that GE Hydro had delivered in Québec, for Hydro-Québec. We still have a lot to offer to this province in terms of hydropower: our strong local presence and our long tradition and expertise in this particular environment recommend us for future projects. Looking ahead, Québec will turn more and more to the refurbishment of existing facilities and the fact that 40% of the existing Hydro Québec units were installed by us means that we have the detailed knowledge needed to properly optimize it.

**What are your thoughts on the Québec government's proposed plan to implement an electric vehicle network?**

**DC:** Andritz Hydro Québec is tremendously important for our global business. Our

specific know-how here allows us to actively participate in projects across Canada and around the world, in places such as China and Laos. Participation in international projects is obvious given the prior experience of our Québec based staff in those regions in the GE days or because of financing considerations. In Alberta, we worked with TransAlta on a particular project that required the runner to operate at very low loads, an unusual requirement: we were able to adapt our development process to meet their needs and our R&D lab in Québec made that possible.

**What are your thoughts on the Québec government's proposed plan to implement an electric vehicle network in the province, which would leverage the existing energy surplus context?**

**KP:** Since the province has the renewable energy to support them, electric vehicles are a natural solution in Québec – however, this is rather a long-term project – in the meantime, Hydro-Québec will focus on modernizing its existing fleet of large-scale hydropower projects. While the US has benefited from very accessible gas prices over the last year as a result of shale gas exploitation, the market should be more cautious about its long-term viability. The 1970s saw a similar natural gas surplus context – however, those market circumstances did not last for long – companies that overinvested in gas-powered plants went bankrupt. The favorable developments surrounding shale gas exploitation still need to withstand the test of time. On the other hand, hydropower has centuries of proven reliability and furthermore, it is a completely green energy, which cannot be said about natural gas power sources. •



## INTERVIEW WITH

# Pierre Séguin

HEAD OF BUSINESS DEVELOPMENT -  
CANADA  
VOITH HYDRO

**What is the strategic importance of Canada and Québec for Voith Hydro, given the international footprint of the company?**

With Canada being one of the largest hydropower markets in the world, the Canadian market is of great importance for Voith Hydro. We are present in all the provinces and territories and we play an important role in the Canadian hydropower market. Headquartered in Brossard, Québec, Voith Hydro Canada is focusing on engineering, customer service, business development, project management and project administration for large hydro, small hydro, automation and the service business. Brossard houses a strong engineering team, capable to support projects from a planning phase through implementation to plant commissioning and aftermarket services.

**Québec has a well-established and mature hydropower market. How much untapped potential does it still have?**

Renewable energies are essential to Québec's economic growth and GHG emission reduction. Québec's neighbors recognize hydroelectricity as renewable and show interest in increasing hydroelectricity in their energy mix. Canada ranks among the top countries in terms of hydropower production and the potential is still enormous: Québec and Canada hydropower supply can technically be doubled. Also, performance, output and reliability of existing hydropower plants can be further increased. For example, Voith Hydro increased the efficiency of some existing power plants by more than three percent. In connection with output increase, the example would be La Tuque power plant where Voith Hydro increased the output of three units by more than 50%.

**What are the consequences of Hydro-Québec's dominant position in the market and how do those affect Voith Hydro?**

The high-standard requirements approach of Hydro-Québec is completely in line with the high-standard product philosophy of Voith Hydro. At the end of the day, high-standards linked to quality requirements translate in economies over the complete life cycle of the hydropower plant. The benefits are not only for Hydro-Québec but for all customers of Voith Hydro. We see two major consequences connected to the utility's dominant position in the sector: firstly, the high-standard requirements of Hydro-Québec lead to a market for high quality and highly reliable state of the art equipment. Secondly, the market is mainly consistent in terms of requirements given the limited number of hydroelectricity producers. We also find the same situation throughout Canada, in the regions where provincial utilities are dominant. This also characterizes the market as a market of very knowledgeable and experienced buyers. With its long-term experience and its broad experience in supplying hydropower plants, Voith Hydro sees itself capable and well prepared to meet the demands of experienced customers.

**Could you provide us with some insights into Voith Hydro's latest technological innovations and how those can add value to the industry?**

Innovation is a core value at Voith Hydro and with 11,000 active patents and around 400 new patents each year, we belong in the top 20 patent applicants in Germany. Crucial to the selection of compelling product ideas is the way customers see them. Despite its long history, hydropower is a modern, innovative industry. Today, hydropower is

more dynamic, flexible and diversified than ever before. The highly flexible pumped-storage technologies are just one example for this. We are continuously improving the overall efficiency of hydro stations. With modern plants, the efficiency rate can be 90% and above. We can reach this efficiency across a wide operating range — not only at full turbine load but also at lower outputs. This is an area where we have achieved remarkable progress in recent years, because we are now able to calculate turbine flows three-dimensionally.

As far as generators are concerned, we are close to the development of the 1,000 MVA class. This more or less constitutes the world's largest hydro generators soon to be installed in Chinese projects. Just recently, the most powerful turbine-generator ever built by Voith Hydro has entered service in the Chinese plant Xiluodu. At 784 MW, the output of this turbine-generator unit is higher than that of the world's largest hydro plants. This achievement is an important step toward the first 1 GW unit. The development and production of 25 kV generator stator bars is an important milestone in this context, which will bring us closer to these dimensions.

Voith Hydro has also been constantly working to minimize the impact of hydropower on the environment and offers especially environmentally-friendly products. Among others, these products developed by Voith Hydro include a Fish Friendly turbine, an Auto-venting turbine and oil-free turbines. In the automation area, digitalization has opened up numerous possibilities of controlling hydropower plants from remote, reaction times have improved drastically. Hence, power plant availability has increased remarkably and sustainably improved the economic output of hydropower plants.

**What is your outlook on Québec's renewable energy mix for the future?**

With its hydropower potential, and its capacity to integrate wind power, it seems to us that Québec renewable mix will remain within actual boundaries. Renewable energy provides almost all electricity in Québec and with the current electricity surplus the government is supporting the development of electric transportation for public and individual transit in the urban space. •

## INTERVIEW WITH

# Jean Lavigne & Hervé Rémy

VICE-PRESIDENT ENERGY (QUÉBEC) & ENERGY DIRECTOR  
PRODUCTION/POWER PLANTS  
**exp.**

Can you give a brief overview of Exp and its presence in Québec; and what were the experiences and key milestones of integrating Québec with operations in Ontario and United States?

**JL:** Exp is an engineering firm with many disciplines with a presence essentially in Canada and US. We have 1,000 employees each in Québec, Ontario/west provinces, and United States, and 300 employees in Canada's Atlantic Provinces. The formulation of exp is a merging of different companies across US and Canada. The rationale of any merger is to bring together expertise and facilitate the export of this expertise. In Québec, we have an expertise in hydro-electricity; before we merged with the company in Ontario and the west, it was difficult for us to penetrate this new market here and the US but now, by sharing expertise and client portfolios, we can achieve that much easier.

Can you outline your general energy-sector work in Québec and the balance of focus between hydrology, hydro-electricity, wind and other renewable energy sources?

**JL:** Essentially, our main energy market in Québec is hydro, followed by wind, which has seen good development over the past few years; apart from these two main ones, there are segments such as solar and biomass but the low electricity cost here have made these type of projects unfeasible. Despite the excess energy, the government has continued its support for the wind energy, mainly to conserve the local expertise that exists in the sector. For more than 35 years, exp Québec has been developing hydroelectricity, with Hydro-Québec playing a big role in that; nonetheless, in recent years, we have seen more private companies coming into play and we are collaborating with them, exporting the expertise to the US, thus being closer to our clients and facilitating the proper development of the projects.

Can you give some examples of key case-study projects where Exp has introduced its expertise into a project over the last two to three years?

**JL:** The La Romaine 2 and 3 projects were among the most important for exp in recent years. Additionally, when it comes to hydroelectric plants, we were involved in the Chute Allard and Rapide-des-Coeurs projects, as well as in the La Sarcelle one. These are all new plants that have been built in Québec in recent years and exp mainly took care of the mechanical and electric parts of the auxiliary systems of these facilities, working directly for the contractor of the projects; it was a different approach than the one

we usually employ, but the end results were very good. Exp also has a strong partnership with ABB, with which we were involved in such projects as the Outaouais Conversion Facility, which can transform alternative power into a continuous one and vice versa. This allows for the possibility to sell or buy energy, in Ontario or Québec, depending on the particular power need at any given point. Exp is proficient in this particular type of project and alongside our partner ABB, we have several new ones in the pipeline already.

Where do you see Exp in Québec in two to five years' time?

**JL:** Exp has the reputation to carry out projects to a high standard endorsed by client satisfaction. In two years' time, exp hopes it will have a wider range of projects and not a cyclical business dependent upon just one main client. Exp's strategy is to look long term and build solid client relationships. We have the expertise to be the best engineering firm in Québec for hydro-electricity production, distribution, and transportation, and can export this expertise across the world.

**HR:** Exp will focus not only on hydro-electricity but also to develop its involvement in wind farms and private power industry (PPI). We also want to find new ways to add more value to the projects of our clients with the current existing technology, i.e. capturing the energy loss from a waste water system and utilizing it to produce electricity. •



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## INTERVIEW WITH

# Pierre Gauthier

PRESIDENT & CEO  
ALSTOM POWER & TRANSPORT CANADA

## Can you give a brief overview of Alstom Canada in Québec, and some of its milestones over the last three years?

The company began its hydroelectric power manufacturing activities in 1968 with a technology transfer agreement between France and a shipyard in Québec called Marine Industries (MIL). In the 1980s and 1990s, the shipbuilding industry in Québec was in decline; it was decided to transfer MIL's focus to the boom for hydroelectric power, following the nationalization of all the power generation entities in Québec and the development of the James Bay complex. Alstom transferred its technology to enable MIL to build hydro turbines and generators. Alstom took a financial position in the MIL site of Sorel-Tracy in the 1990s. At the time that the site has been dedicated to the hydroelectric equipment design and manufacturing. For the past 45 years, we have designed and manufactured in hydraulic turbines and generators that have equipped over half of the Canadian hydropower capacity through our manufacturing plant in Sorel-Tracy. For the grid, Alstom introduced its transmission technology from France. Our big facility today is in La Prairie, Québec, which manufactures switchgear. We have a further facility in Saint-Jean-sur-Richelieu, Québec manufacturing up to mid-size power transformers. Alstom is also engaged in nuclear, solar, wind, and arguably has the largest portfolio of power generation technologies.

## Can you give details of your \$90 million contract for La Romaine, and how in this contract you applied your innovative cost-effective methods for equipment supply?

La Romaine is a new hydro complex, which has four dams; Alstom was awarded La

Romaine 2 and 3 (the contract values for the La Romaine 2 and 3 are approximately \$100 million and \$90 million, respectively). Alstom applies the latest technologies, and its customer, Hydro-Québec, has a very high-level of expectation for efficiency and power output; severe penalties are imposed if these are not met. Alstom goes through a detailed technical process before commercial aspects are undertaken. For rehabilitation mainly on existing plants, Alstom secured a contract for the biggest power plant for Hydro-Québec, La Grande-2 carrying out refurbishment of a number of units, providing through technology much higher efficiency; every drop of water is utilized to provide more electricity.

With our technology, we can increase an existing plant's power output by up to 30%. Financially, a dam is 90% of the cost, 10% is the cost of the equipment. Therefore, the increase in power output is achieved by only renewing the generating and transmission equipment: 10% of the original cost of the project; the 90% of the capital cost of the infrastructure is not affected. Multiply this through the next 50 years and you get serious money.

## How do you see wind energy progressing in Québec, and will Alstom have a role in this market?

Alstom was late to enter the wind market. Interest commenced through a company that Alstom acquired, Ecotècnia, a regional wind turbine manufacturer in Spain; its footprint was been widened by Alstom covering the whole of Europe, South America, and North America. Our plant in North America is in Amarillo, Texas, a perfect location to focus on our perceived growth market area of the US Midwest. Alstom has moved the technology from small wind

turbine units up to 2 MW to 3 MW units – the current preference of the wind market – and is the first to enter the offshore market with 6 MW units with contracts mostly in Europe. Alstom is confident this trend will progress to North America. Québec has 96% hydropower. Wind and hydro perfectly complement each other; hydro is a constant power, and wind is an interruptible power. With the current and future hydro capacity of Québec, arguably wind energy in Québec will have a limited role as a power generator compared to other areas in North America. Alstom Québec will have a role in this value chain and will always be looking to bid on wind projects from a turnkey project aspect.

## What are some of Alstom's goals for its footprint in the province over the next two to three years?

Some of our goals have already been achieved, i.e. power transformers now being manufactured at Saint-Jean-sur-Richelieu, where we acquired a small plant, which with investment has doubled in size and is supported by worldwide technology. In the grid sector, Alstom is seriously looking at high-voltage DC lines, an expanding market we have yet to enter in North America. For power generation, across Canada we are present in hydro, wind and thermal, but feel that thermal is a market with limited growth possibilities and requires further investment in technology. The availability of natural gas is postponing the advancement of carbon capture. Historically, Alstom had a manufacturing footprint in transportation; this was closed in 2003 due to the decline of the rail transportation market. However, we have recently inaugurated a bogie plant at Sorel-Tracy; it will serve to supply the Montreal subway plus other contracts in that market. •



# Québec's Power Sector

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## The spark of creativity

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On its surface, Québec's energy industry can seem one-dimensional. The province is a powerhouse of hydroelectricity led by a crown corporation, Hydro-Québec, with a staunch commitment to environmentalism. The relatively simple structure, however, leaves Québec's hydropower vulnerable to depressions in commodity prices from competing resources such as shale gas, which is an emerging force in Canadian energy. In the face of such a challenge, Québécois firms are securing a sustainable future through a variety of innovative strategies aimed at transforming the nature of the playing field at home. The integration of key technologies being developed in partnership with other industries has the potential to create new value chains to service a provincial energy market that seeks to grow by changing the way that consumers harness and use electricity.

As the local giant, Hydro-Québec sets the direction and tone of the Québécois power sector's evolution over time. The company has placed a considerable amount of faith in lithium battery technology as a point of innovation. Having acquired the intellectual property for a technology called lithium iron phosphate, first discovered at the University of Texas, Hydro-Québec is looking to use the material to revolutionize its power storage capabilities. Lithium iron phosphate has similar lightness and energy capacity to lithium ion, but the iron phosphate adds greater stability.

In a bid to increase the efficiency of the material's usage, Hydro-Québec has partnered with Grafoïd, a company aimed at cost-effective graphene production from graphite mined in northern Québec. Graphite, especially when transformed into graphene, is a highly effective thermal conductor that minimizes heat loss in energy storage. In spite of its reputation as a 'wonder material', graphene has thus far been unable to become a standard in the global

marketplace because of its notoriously high production costs. However, with the help of its partner firm Focus Graphite, Grafoïd is the only company in the world that has managed to produce the material in an affordable manner. Its location in Québec was serendipitous for Hydro-Québec, and set the stage for a joint venture that produced major breakthroughs in pairing graphene with lithium iron phosphate within the first six months of research. As both companies are waiting for appropriate patents to be filed before announcing results, the rest of Québec's energy sector is watching closely. Hydro-Québec's experience with Grafoïd may be a harbinger of many more backward linkages to come in Québec's lithium space. One of North America's first major lithium producers, Canada Lithium, began extraction at a site in La Corne, Québec this summer. Hydro-Québec's CEO, Thierry Vandal, is confident that the province can develop more production capacity for lithium over the next few years. To add a further link in the value chain, another firm, Nemaska Lithium, has set up a showcase processing plant in Salaberry-de-Valleyfield, near Montreal. The plant will seek to transform raw concentrate into lithium hydroxide and carbonate for specialty uses. If investors can be persuaded to give their blessing, Québec could see the development of a comprehensive, cross-industry production cycle that keeps lithium in the province from mine to plant and beyond.

Québec's strong tradition of environmentalism could be the key to ensuring that power capacity harnessed by new lithium battery technologies is put to good use. As the province moves toward less reliance on fossil fuels, increasing demands for urban mobility in Montreal and Québec city can be fed by electric transportation in the near future. To that end, Hydro-Québec and 33 commercial partners have recently installed

approximately 200 electric vehicle recharge points at various city retail shopping centers. Recharge points are connected to an electric circuit that Hydro-Québec's shareholders hope will eventually provide the backbone for urban transport. Hydro-Québec's plan has been to purchase these and future charge outlets, with commercial partners paying for installation and providing convenient parking spaces. If successful, the scheme can provide an important source of demand for additional electricity output capacity.

The rise of shale gas shows no sign of abating, and Québec will certainly face a low commodity price environment in the years ahead. The province will have to continue to seek new sources of demand for its hydropower. Upcoming expansion milestones, such as the completion of transmission lines linking Hydro-Québec to new customers in the northeastern United States, will achieve these ends, albeit at a significant short-term cost. The real keys to the province's success will be to continue its mission to create value through efficiency in its storage component, and to reinvigorate demand at home by redefining the terms of Québécois power consumption. Hydro-Québec's ambitions for innovation in lithium battery technology, as well as the backward and forward linkages that spring from them, constitute an important first step. •

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*This article originally appeared in the GBRoundup, Global Business Reports' weekly newsletter containing exclusive interviews and analysis from our on-the-ground teams. To subscribe to the GBRoundup or view past articles, please visit [gbroundup.com](http://gbroundup.com).*



## INTERVIEW WITH

# Michel Letellier

PRESIDENT AND CEO  
INNERGEX

Considering the monopolistic structure of the Québec market, as well as its low electricity costs, what gave Innergex the confidence to go forward with its work in the province?

The Québec market is different from other jurisdictions but it works well with the type of business strategy that Innergex has developed. Québec is not the place for a big IPP that wants to have direct access to customers because that does not exist here, since only Hydro-Québec and few municipalities here have the right to sell power directly to the customer. We are dependent on Hydro-Québec's RFPs and we like this business model; we concentrate on being the best in doing small and medium projects and we are cost effective and creative in respect to engineering, to the integration of the project with the community, and to environmental impact. As long as we have a solid relationship with one customer under a long-term PPA (Power Purchase Agreement) for renewable energy, we are content. Renewable energy is different from other types of energy in that the variable cost is very low; fixed costs for hydro account for 85% of the project so if you do not have an enduring contract, you are exposed to the spot market price of the commodity, which, in turn, makes it very difficult for you to invest long-term in the first place. Therefore, a stable, long-lasting contract with a big utility player is a good solution for us for renewable energy.

Could you give us some specific examples that speak to the effective cooperation between Innergex and Hydro-Québec?

The last three wind RFPs are a good example of the positive signals that we have

been getting from the government and Hydro-Québec, which have shown the willingness to buy this type of energy. Moreover, as a social license, they are also trying to develop business know-how and force IPPs to be creative and enhance their suppliers to invest in the manufacturing process of turbines here, in Québec. Through Cartier Wind Energy, Innergex initiated the first RFP with GE and that was really the start of the wind manufacturing industry in the Gaspésie; we are very proud of that, because we effectively set up Cartier successfully, we got very competitive prices from Hydro-Québec at 6.5 cents per kilowatt hour and we created jobs throughout the peninsula. The second RFP was done in the same style but it enticed 2,000 MW at a time when renewable energy around the world was at its growth peak; that meant the costs were not as competitive, as suppliers were busy all around the world. Now we are seeing municipalities getting more and more involved as partners in projects, which is a great solution in the long-run because it increases community acceptance of wind energy. Moreover, IPPs are starting to partner up with local communities across Québec, creating prosperity all around. The next step of the RFPs will be to eliminate the limit of 25 MW that the projects had, which put pressure on their economic viability. Innergex welcomes all these developments and we are making efforts to be part of them.

What are some of the measures that you would like to see implemented in Québec?

As a renewable energy player in Québec and Canada, we would like to see a standardization of regulations across the energetic markets when it comes to

environmental supervision. Renewable energy IPPs have many environmental criteria that they need to uphold and we are perfectly happy to do that but, in the same time, we are in direct competition with other energy sector players that are not subjected to the same rules. On wind projects, we have to advance money for the decommissioning of wind farms whereas other different energy players do not have to do that.

What are the plans for Innergex over the next three to five years?

In two years' time, Innergex hopes to complete its project with Mi'gmaoui Mawioni and hopefully, by then, we would also have some megawatts allocated out of the new RFP as well. Overall, we would like Québec to reconsider its position towards small hydro, which we believe is still very viable, and which could be done in environmentally responsible ways in partnership with First Nations and municipalities. Projects of 20 to 30 MW can be excellent tools, as they are absorbed incrementally a lot easier than big 1,000 MW plants; furthermore, they would create financial benefits across the province, sparking economic revivals in remote, depressed areas. Québec is blessed with an excellent power transmission network that allows for small hydro and wind to tap into it. The nationalization of Hydro-Québec in the late 60s as well as the commencement of large-scale hydro projects made Canada lose its know-how and edge in small hydro; however, that got revived with the 1991 RFPs. Now, this expertise that we have re-mastered is sought in places such as Ontario, British Columbia and the US and Innergex is getting ready to answer these calls. •



## INTERVIEW WITH

# Patrick Lemaire

PRESIDENT AND CEO  
BORALEX INC.

**How important is Québec for Boralex, given the company's international footprint, and how well do you collaborate with Hydro-Québec, given that they are also an energy-producing entity?**

We are a Québec-based organization so for us the province will always be strategically important - we certainly want to grow in our home base. However, we need the opportunities and the programs that can enable us to expand. We have 440 MW worth of projects currently in the process of commissioning in Québec by the end of 2015, so for the next three years, we will have a lot of business here. However, looking beyond that date, we do not see many opportunities arising. Boralex is among the few IPPs supplying power to Hydro-Québec in the province and overall, we have a good collaboration with them. Hydro-Québec is an electricity producer however and so, from their perspective, having other companies producing power in Québec is not necessarily a long-term vision. Nonetheless, we have a very respectful relationship with the utility and they are generally open to hearing our inputs and suggestions on how to improve things. Their quality requirements are quite high, but Boralex has always come with solutions to meet those standards.

**Could you bring us up to speed with your current wind power projects in Québec, and reasons for which you entered a partnership with Gaz Métro and Valener for the Seigneurie de Beaupré project?**

In 2005, when we started prospecting Québec's wind power map, we identified the Seigneurie de Beaupré area as being one with tremendous potential; and the fact that the land was private made the proposition even more attractive for us. At the time

however, Boralex had a total portfolio of only 300 MW and given the possibilities of expansion that Seigneurie de Beaupré offered, we felt that we needed a strong, reliable partner that could help us manage the size of these future projects. Gaz Métro was the ideal choice for us given the fact that we had already collaborated with them in the past, for some of our natural gas cogeneration plants; furthermore, Boralex and Gaz Métro complement each other very well. In terms of the timeline, we have just commissioned Phase 1 (272 MW) of the project in December 2013. By December of 2014 we will have commissioned Phase 2 (68 MW) as well and then, by the end of 2015, the 25 MW RCM partnership will also be in place.

**What are the perspectives for new hydro projects for Boralex, in Québec and in Canada, more generally speaking?**

Boralex is prepared to take on new hydro projects, but we need the opportunities to do so. The IPPs have been slowly pushed away by the regulations of this market, which currently emphasize First Nation and municipality participations. We need to have a high enough stake in these projects so as to make them economically viable for us - we need more than 50% and that is something we were not able to achieve during the last RFPs. Hydropower is an old technology which means that the most obvious and attractive projects across Canada have already been developed. Nonetheless, there is still enough potential left: what we really need is the political will.

**How do you see the future of Québec's wind power sector given the province's current energy surplus and what will be the role that Boralex will play in that context?**

Out of the last 800 MW wind RFP, 350 MW have already been allocated to two producers, which means that there are only 450 MW currently out there for the taking. That amount is very small, considering all the active players in the industry that are going to be competing for it and we predict that this will lead to very aggressive pricing. We are disappointed by the lack of sufficient attention given to the wind energy sector in the province: every dollar spent by Hydro-Québec on wind power generates three dollars back into Québec's economy: the industry's value is tremendous.

Moreover, we do not agree with the widely circulated rhetoric of wind power being too expensive. When you look at initiatives like La Romaine, you see that the cost per MW installed reaches \$7 million to \$8 million; a regular hydro-project's costs would amount to roughly \$4 million to \$5 million, while a wind energy project's expenses would be even less than that. Green energy is a social choice that comes with a certain cost and the only two viable options at the moment are wind and hydro. Wind is getting a bad reputation because there are simply not enough hydro projects out there to receive that sort of negative reception.

The current surplus we have in Québec was created by the losses in the manufacturing sectors; as recently as 2005, Hydro-Québec was running out of power. To not invest in creating new sources of energy equates to not believing in an economic recovery - we must look at matters in the long-term and constantly invest because building up capacity takes time. We are not necessarily advocating for 2,000 new MW per year but we do need around 300 MW to 400 MW annually to make sure that when the economy will bounce back, we will be prepared to serve it. •

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# **The Winds of Change: The Rise of Gaspé's Wind Sector**

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"Companies in Québec's wind sector cannot solely rely upon the local market for support; they will need to look at outside markets. It is important to own technologies, patents, and not just manufacture other companies' innovations.

Eocycle has its own patents bringing significant innovations. To achieve success, companies such as ours need to be supported by R&D tax credits, grants, and the local market; China, Germany, Denmark, and Spain has benefited from the support of their local markets. The province should have an energy policy that will utilize all its energy capacities."

- Richard Legault,  
CEO, ECOCYCLE TECHNOLOGIES





# Québec's Wind Power

Diversification and development of remote regions

The 2006-2015 Energy Strategy, unveiled by Québec's then Liberal Party Prime Minister Jean Charest in 2006, dramatically changed the province's energy landscape. Long reliant on hydropower, this strategy set ambitious targets for the development of wind power generation: 4,000 MW by 2015, or 10% of the total provincial energy supply. This was to be achieved through inviting Independent Power Producers (IPPs) to participate in the sector. While the diversification of Québec's power portfolio with another environmentally friendly alternative was the most tangible outcome of this strategy – an outcome that has been all but realized in the intervening years – this decision also had strong social and political considerations.

With a population of roughly 94,000, the Gaspésie-Îles-de-la-Madeleine is an administrative region located in Québec's extreme east: traditionally reliant on the industries such as fishing, pulp and paper, and mining, the region entered a state of economic depression in the early 2000s, when several key businesses shut down. Nonetheless, when everything was down, wind picked up. The government's call for wind power was destined to revive the Gaspésie, by exploiting its eolic potential. Seven years later, in September 2013, 1,866 MW of wind-power were already operational in the region, with another 1,596 MW under construction. "Québec now has 5,000 wind-industry related employees and nearly 1,200 of those work in wind-related manufacturing in the Gaspésie. There is a wealth of consulting expertise and there are also a number of research institutes, including the TechnoCentre Éolien, a unique organization specializing in northern wind conditions and icing," said Alex Couture, director of project development at EDF EN Canada, an EDF Energies Nouvelles subsidiary with a vast wind energy portfolio in Québec.

The first major development occurred in 2003,

when Hydro-Québec Distribution issued the first 1,000 MW RFP, which was shortly followed by a second 2,000 MW RFP in 2005. In 2009, a third, 500 MW RFP was put forth: 250 MW were destined for municipalities, while the other 250 MW were aimed at Aboriginal communities. By the late 2000s, the minimum 30% Gaspésie local content requirements had led to the establishment of a healthy supply chain in the peninsula, with companies such as Fabrication Delta (wind towers), Composites VCI (nacelles), Marmen (wind towers) and LM WindPower (wind blades) setting up dedicated shops across the region. Finally, in May 2013, Québec's current prime-minister, Pauline Marois, completed her predecessor's 4,000 MW promise and even went the extra mile with 100 MW by announcing a final 800 MW RFP, that would bring investments of \$2 billion. This latest batch would be assigned in four blocks: 150 MW for the Assembly of Mi'gmaq communities of Québec, 300 MW for competitive bidding in the Gaspésie, 150 MW for other parts of Québec and for the first time, 200 MW of projects to be developed by Hydro-Québec itself.

Founded in 1991 in Ontario, First Canadian Title (FCT), part of FAF International, provides title insurances and other real-estate related services to a wide market, and the company has taken advantage of the wind sector developments in Québec to extend its reach. "We can insure any type of real estate in the energy sector, including those of high value. We have recently been focusing on windmill farm projects; historically, we have insured hydroelectricity projects in the province. Contiguity of land is essential for an energy/power project; a leading facet we insure. Québec has an excellent land registry system with little risk and title insurance is affordable to the investors; nonetheless, title problems may still occur; insurance should be a fundamental part of a transaction," stated Laurent Nadeau, CEO for Québec at First Canadian Title.

Now, wind energy provides 1,200 jobs in the Gaspésie alone, and 5,000 overall, in Québec. Two years in a row, for the first time in a very long time, people immigrated into our region, instead of emigrating from it: and that is all thanks to wind power. The governmental RFPs greatly helped as well with their local content requirements: currently, 30% of any wind project's components have to be made in the Gaspésie, and 60% of the total cost of the project must derive from Québec: over time, this led to six plants being opened in the region, by local component manufacturers.

- Dave Lavoie,

Director, Créneau éolien ACCORD

## Québec's Wind Power IPPs and Their 300- Foot Machines

Cartier Wind Energy, a 2004-founded joint venture between TransCanada Pipeline and Innergex, is one of Gaspésie's major developers. Cartier won 600 MW during the first RFP and now operates five wind parks: Baie-des-Sables (109.5 MW), Anse-à-Valleau (100.5 MW), Carleton (109.5 MW), Gros-Morne (211.5 MW) and Montagne Sèche (58.5 MW). "Cartier was the first company to accelerate the wind sector value chain in Québec – we have been a pioneer in many ways, especially in management and social acceptability. The ministry has used our documentation and experience as a framework for wind energy for the next 2000 MW bids, making Cartier a model for other developers. Our focus will now be on the operational side of wind parks, coping with the extreme elements of the north like ice-rain, heavy snow, and low temperature. We have over 300 kilometers of road, 310 kilometers of power transmission lines, and five power substations within our wind parks to keep operational," explained Robert Guillemette, president of Cartier.

Northland Power, a Canadian IPP established in 1987, was the other big winner of the first RFP, with its Jardin D'Éole (127.5 MW) and Mont Louis (100.5 MW) wind projects, which were brought online in 2009 and 2011 respectively. "Québec, notably, was one of the door-openers for Northland Power's wind energy ventures, with the 54 MW Murdochville (Mount Miller) project, which was commissioned in 2004," mentioned Robert Demers, business development director for Québec at Northland. Now, the company, which has a portfolio of 1,300 MW of operational assets, is turning its attention to community and municipality projects. "Northland Power has forged

partnerships with municipalities because we believe that participation is an important part of social acceptance. Usually, the challenge is to achieve good financial performance given the smaller scope of these projects. For some municipalities, even assuring 30% of the equity of the project is a huge financial commitment and so we work to find them adequate financing at good rates. To solve this problem, in Québec we are working with a particular entity (Regie), which is an organization formed by multiple RCMs (Regional County Municipalities), in our case, five, coming together to develop a larger project."

Cartier and Northland's wind turbine collaborator was GE, which supplied all the turbines for the first 1,000 MW RFP. "Québec has been traditionally strong for GE. Our turbines are malleable to all sorts of climates and we benefit from adapted operational control systems, which allow our turbines to run differently in the harsh climate of Québec than they would in Brazil, for example – this comes from our global expertise. Now, we are developing technologies to make wind turbines behave more like conventional power sources. We are integrating energy storage, advanced controls and forecasting algorithms to manage the variability of wind resulting in a smooth power output, less power variability, and less backup power from the utility. This

technology will greatly help renewables' integration, seeing how variability is one of the major issues for utilities when considering wind power," revealed André Bourgault, sales manager, renewable energy, GE Power and Water. EDF EN Canada is one of the major second and third RFP winners: since 2009, the company managed to secure over 1,000 MW of wind power projects in Québec, which will all be completed by 2015. Massif du Sud (150 MW), Lac Alfred I (150 MW), Lac Alfred II (150 MW), and Saint-Robert-Bellarmin (80 MW) are EDF EN's main operating assets at the moment. "RFPs in Québec are far better structured and more straightforward than other provinces. However, it is important to understand the dominance of French in the Québec energy sector - every contract with Hydro Québec is in French," noted Couture. "The standards in Québec are very high. It is probably the toughest grid to connect to from a regulations standpoint, but it is worth it because it is a strong, reliable grid. In 2011, EDF EN Canada had nothing built in Québec. Two years later, we have a tremendous amount of knowledge on how to build wind farms in Québec and how to see things. One of the innovative strategies we employed was to erect turbines very early on: this showed great foresight, as it allowed getting the teething process out of the way early," added David Gallagher, program manager at EDF EN.

The exclusive turbine provider for EDF EN's Québec wind farms is Senvion Canada Inc., a subsidiary of the global German-based group; over the last years, the group Canadian's presence grew impressively, from three employees in 2010, to over 100 today. "Québec was our point of entry into the Canadian market; 2012 was a record year for us, in which we installed 200 machines, for a total of more than 400 MW. Senvion's Canadian subsidiary comprises 15% of Senvion's global turnover, a high figure considering that we have subsidiaries in ten countries. Since our Montreal office was essential in achieving this, it now manages all of Senvion's North American operations. Our approach has been to use even more local resources than were required. We utilize blades manufactured in Gaspé by LM Wind Power, which also happens to be our global supplier, and towers produced in Matane by Marmen. We already use Marmen for projects in the United States, which demonstrates that Québec's plan to create wind sector local champions is really working. Overall, between 46% and 49% of the value of Senvion's turbines is created in Québec," said Helmut Herold, president of Senvion Canada Inc.

One of Cartier's parent companies, Innergex Renewable Energies, is a Canadian IPP with a diversified renewables portfolio that contains hydro, wind and solar projects, for a

## INTERVIEW WITH

# André Bourgault

SALES MANAGER - CANADA,  
RENEWABLE ENERGY  
GE POWER AND WATER

GE won the first 1,000 MW wind power RFP in Québec. How did you manage the local content requirements?

Having good suppliers is essential so we had to be smart in the way we approached the local content issues for the first RFP. GE knew both Marmen and LM already, since

we were dealing with them on a global scale; it made sense to bring them in Québec as well. Furthermore, local players such as Composites VCI also added tremendous value and now we are bringing them with us around the world, in places such as the US and South America.

Are you looking at introducing multi-megawatt models in the future in Québec?

GE turbines are malleable to all sorts of climates and we benefit from adapted operational control systems, which allow our turbines to run differently in the harsh climate of Québec than they would in Brazil, for example. This comes from the global expertise GE acquired along its history and is one of the factors that give us the edge in meeting customer requirements. We have the capacity to implement single and multi MW machines in Québec but there are several constraints that we must

consider. While the new 800 MW RFP is a great initiative, there is still no long-term energy policy in the province. Add that to the excess electricity supply that we have, and it becomes clear that it is difficult to make big investments in the wind energy sector at the moment in Québec.

How do you see the future of Québec's energy mix evolving?

Québec's energetic future will be determined by the solutions chosen to offset the excess electricity that we have at the moment. Establishing the province as a center of excellence for data centers or building ties with NY and Boston are all viable alternatives which are being discussed at the provincial level and by Hydro-Québec. For us, the long-term idea is to make wind power sources behave more and more like conventional ones and thus help them integrate better into the grid. •

## INTERVIEW WITH

# Alex Couture & David Gallagher

DIRECTOR OF PROJECT DEVELOPMENT & PROGRAM MANAGER  
EDF EN CANADA



Please give us a brief introduction to EDF EN Canada's current activities in Québec's energy sector.

**AC:** EDF EN has two main offices in Canada, one in Toronto and one in Montreal. We have seven projects in Québec under PPA, with five projects awarded through a 2,000 MW RFP, of which we won 954 MW. Our two other projects are under a 2009 RFP from Hydro Québec Distribution and consist of two projects of 24.6 MW each. EDF EN Canada has other activities in solar power in Ontario, but our focus in Québec is mainly on wind. We also have another project under construction in Alberta.

One of our key success stories is the 2,000 MW RFP. For those projects, we partnered with REpower, a wind-turbine manufacturer. We use two types of machines that give us the flexibility to install in areas of varying wind capacity. One of the determining factors of the project was our ability to get REpower exclusively on board with us. Securing one manufacturer allowed us to get the best price possible for our machines, which can be 60% and 70% of the project cost.

What are some of the innovations EDF EN is working on in Québec to transform the sector?

**DG:** On the development side, our philosophy is to always learn from our last project. In 2011, EDF EN Canada had nothing built in Québec. Two years later, we have a tremendous amount of knowledge on how to build wind farms in Québec and how to see things. One of the innovative strategies we employed with our first project was to erect turbines very early on. We erected five REpower turbines, which were very different from the GE turbines common in the Québec's wind market. Although it was

expensive and they had to be heated in the winter because they were not connected yet, the decision showed great foresight. It allowed us to get the teething process out of the way early in the project.

What key strengths does EDF EN Canada use to bring projects to reality?

**DG:** Alex's team does an amazing job on social acceptability. EDF EN Canada is mostly welcomed with open arms by local communities. The community surrounding the first project that we did has helped us with permitting, site location, accommodation guidance, etc. People are often scared of having wind farms in their backyard for all manner of reasons, but when our most recent project was opened, the nearby residents were very happy because of the amount of money we invested in infrastructure and the upkeep of the area's national park. One very important point is that EDF EN Canada always keeps its promises to the community. At the beginning, it makes things harder, but it pays off at the end. In our projects, we usually work with one major contractor, but we ensure that the contracts stipulate to favour the employment of locals if they have the capacity and are competitive.

What are the biggest benefits and challenges of operating in Québec's renewable energy sector?

**AC:** RFPs in Québec are far better structured and more straightforward than other provinces. However, it is important to understand the dominance of French in the Québec for doing business. Québec's biggest advantage in wind energy is that we host the full value chain, which is unique. Québec has 5,000 employees directly related to the wind industry, and nearly 1,200 jobs in

wind-related manufacturing in the Gaspésie. There is a wealth of consulting expertise with companies like GL Garrad Hassan and Hatch. Montreal and Gaspésie are also home to a number of research institutes, including the TechnoCentre Eolien, a unique institute specializing in northern wind conditions and icing.

**DG:** The standards in Québec are very high. It is probably the toughest grid to connect to from a regulations standpoint Hydro Québec also has an excellent capacity to connect you. If they select you, they will be there on time to help you. Of course, the nature of the market restricts the ability to cater to demand independently, as all contracts must come from Hydro Québec.

What gives you confidence that wind energy will be able to remain competitive in the face of hydropower's dominance?

**DG:** Wind is often unfairly compared to hydro. Many hydro dams were built decades ago. The fairest way to compare costs would be to assess how expensive it would be to build a wind farm versus a hydro dam in 2013. In that sense, wind is a lot more competitive. Furthermore, the price for wind technology has been steadily decreasing. •



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total capacity of 617 MW. In May 2013, Innergex was awarded the 150 MW wind project for the Assembly of Mi'gmaq communities of Québec. "Innergex has been very proactive with respect to First Nation partnerships; we are very proud of this achievement and over the years, we have built a corporate culture of openness in understanding how First Nations operate in the market in Canada," said Michel Letellier, President and CEO of Innergex. "Nonetheless, we would like to see a standardization of regulations across the energetic markets when it comes to environmental supervision. Renewable energy IPPs have many environmental criteria that they need to uphold and we are perfectly happy to do that but, in the same time, we are in direct competition with other energy sector players that are not subjected to the same rules." Pauline Marois' new 800 MW RFP gave the sector some reasons to celebrate, albeit not enough for a market with so many active players, hungry for business. Vestas traditionally occupied the first position in global market shares for wind turbine manufacturers but recent years have seen it struggle to maintain that title, with GE and Sinovel challenging its authority. Present at the very beginning of Québec's wind energy development, the Danish company did not get involved in any of the first major RFPs. "In Canada, we are still the largest in terms of market share (around 35% of the total market), with an installed base of over 2,500 MW. For us, Québec is a primary market at the moment, especially given the current availability of local content solutions that did not exist before. We do not want to have a limited vision of what we can achieve only in Québec: we want to integrate Québec in the global market. Vestas is back in Québec and we are going to be competing hard; sales is like a contact sport and like in hockey, sometimes you get checked but then you need to get back up, to show people that you can take a hit and keep ticking. So look out for Vestas to reestablish its dominance in Canada," said Chris Brown, president of Vestas, US and Canada.

## Coping with Remote Location Challenges

Wind farms, due to their often-remote placement, have also triggered the development of complementary infrastructure across Québec's extreme east. Consequently, assuring proper logistical and power generation services in these regions during construction and operations

has been a key issue to tackle for developers. But where some sees challenges, others see opportunities.

SDV Canada, part of the Bolloré Group, is a Québécois logistics company whose history dates back to 1967 and which has seen its energy business become more important in recent years, notably through wind sector developments. Roger Gervais, president of SDV Canada, discussed the company's focus: "We have a specialty in power plant and windmill projects, but in the same time, one of our main and longstanding clients is Alstom Hydro. Although our interest in the wind sector is recent, we have already done three big projects. We delivered them successfully, and in this small industry clients talk amongst themselves. During 2013, SDV was already preparing for the work it was awarded for 2014, for the biggest wind farm in Canada, the Parc des Laurentides. We have to negotiate our route intentions with the MTQ, and then, because there are often unexpected obstacles, we frequently have to resubmit routings, which usually take a week or two to be approved. Foresight is especially

important in the wind sector, where we have to deliver one complete tower every day – if ever we fail, construction has to be postponed and there will be 400 inactive workers, at great expense."

Meanwhile, Atlas Copco, which celebrated 140 years of existence in 2013, has made a name for itself in Canada and the world through its comprehensive mining sector services. Now, a new division, dedicated to construction projects across the country, is trying to leverage the company's cross-sectorial ties to make an impact in Québec: "In Québec, we are targeting power projects, which, during the phase of their construction, will require portable energy sources – this is where we can shine with our pokers and diesel-fueled generator sets. The developments of the wind energy sector in Québec can act as an opportunity for Atlas Copco Construction Technique because of the often remote locations of wind farms; furthermore, these projects also lead to the construction of adjacent roads, a process which we can also support," noted Erik Thorsrud, president of Atlas Copco Construction in Canada. •

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## INTERVIEW WITH

# Roger Gervais & Patrick Lafrance

PRESIDENT & PROJECT DIRECTOR  
SDV CANADA



Could you provide an overview of SDV and its presence in Québec?

**RG:** SDV is part of the Bolloré Group. In Canada we have 250 people working across all aspects of logistics: transport, warehousing, and distribution. The company has been established in Québec since 1976; we are one of the very successful SDV entities around the world, and are very well seen within the group. The energy sector is becoming ever more important for SDV Canada. In the past decade or two we really focused on the mining industry, but that market has now subsided after its boom and we need diversity. We have a specialty in power plant and windmill projects, but also one of our main and longstanding clients is Alstom Hydro, and we have others involved in energy transport.

What are the unique characteristics when it comes to serving the Québec energy market?

**PL:** For project business in Québec, we are limited most of the time by the seasons. Most deliveries of heavy pieces have to be made after the spring thaw and before the snow. Everything is concentrated over three or four months, during which there are all sorts of different actors who need to be brought together. Last year was the biggest year in Québec's history for wind projects, and the MTQ were overwhelmed.

**RG:** In Québec it is always difficult to use road transport – first there is the spring thaw, and then in summer there is construction everywhere – so we will use whichever means are necessary. We always need to have contingency plans and keep on top of everything. Police escorts, which we require for all big pieces, are very complex to arrange here: we need to advise them 48 hours in advance, and they are not always available. Always be prepared in this market,

because things that could take a day can end up taking months.

How has SDV used its competitive advantages to work successfully with the sector?

**RG:** Although delivery may be just on time, we make plans a year in advance. For instance, SDV has for the last six months already been preparing for the work it has been awarded next year for the biggest wind farm in Canada, the Parc des Laurentides. We have to negotiate our route intentions with the MTQ, and then – because there are often unexpected obstacles – we frequently have to resubmit routings, which usually take a week or two to be approved. Foresight is especially important in the wind sector, where we have to deliver one complete tower every day – if ever we fail, construction has to be postponed and there will be 400 inactive workers, at great expense. There are cases when components are held hostage on the highway because suddenly the MTQ has decided to do emergency road constructions, or there are strikes, and then we have to produce the towers from a different location.

Environmental protection is a huge priority in the Québec energy sector, but a sticky issue for logistics providers. How do you ensure your operations are environmentally responsible?

**PL:** The environment is one of the main reasons for which we decided to concentrate on wind power as opposed to other sectors. **RG:** We prefer to use rail rather than road, although it still has to be economically viable. We also encourage buyers of windmills from overseas to ship the products to the closest port to their final destination. However, there is not much more we can do because electric trucks for our purposes do not exist. Unfortunately, the government

has stopped subsidizing measures to reduce greenhouse gas emissions.

What is your outlook for SDV's presence in the Québec energy sector over the next two to three years?

**RG:** The future looks good. Since our interest in the wind sector began recently, SDV has already done three big projects. We performed them very successfully, and in this small industry clients talk amongst themselves. This is perhaps how we have won the biggest contract in Canada. Hydro-Québec's RFP will last until 2015 for deliveries, and the government has just released another 800 MW to keep the sector alive until at least 2017. There are not too many logistics actors involved in it as most are actually from Ontario. We are working on a new slogan: 'never the same piece, always the same care'. •

## INTERVIEW WITH

# Robert Guillemette



PRESIDENT

**CARTIER WIND ENERGY INCORPORATED (CARTIER ÉNERGIE ÉOLIENNE)**

Could you give us a brief overview of Cartier Wind Energy and its recent key milestones?

Cartier Wind Energy was founded in 2004 as a joint-venture between TransCanada Pipeline and Innergex Renewable Energy Montreal to build wind energy in Québec. Initially, our focus was on Gaspésie Peninsula for its wind regime, where in 2006, our first wind farm, Baie-des-Sables, was erected. Our latest wind farm was completed in December 2012 at Gros-Morne-Sainte-Madeleine consisting of 211.5 megawatts. Cartier has now 5 wind parks (600 MW) under operation.

Cartier has been a pioneer in Québec in many ways, especially in management and social acceptability. The ministry has used our documentation and experience as a framework for wind energy for the next 2000 MW bids, making Cartier a model for other developers. Our focus will now be on the operational side of wind parks coping with the extreme elements of the north like ice-rain, heavy snow, and low temperature. We have over 300 kilometers of road, 310 kilometers of power transmission lines, 5 power substations, within our wind parks to keep operational even in the most extreme weather. Cartier has set up a special team and methodology for blade inspection; with 400 machines currently running, there are 1,200 blades to be inspected. Cartier has also developed specialized equipment to operate and to maintain wind parks during winter season.

In winter Québec experiences temperatures of -25° centigrade with heavy snow, and to the other extreme in summer of up to 34° centigrade. Cartier's goal will be to continue to develop materials and repair methods to overcome blade problems due to climatic diversity.

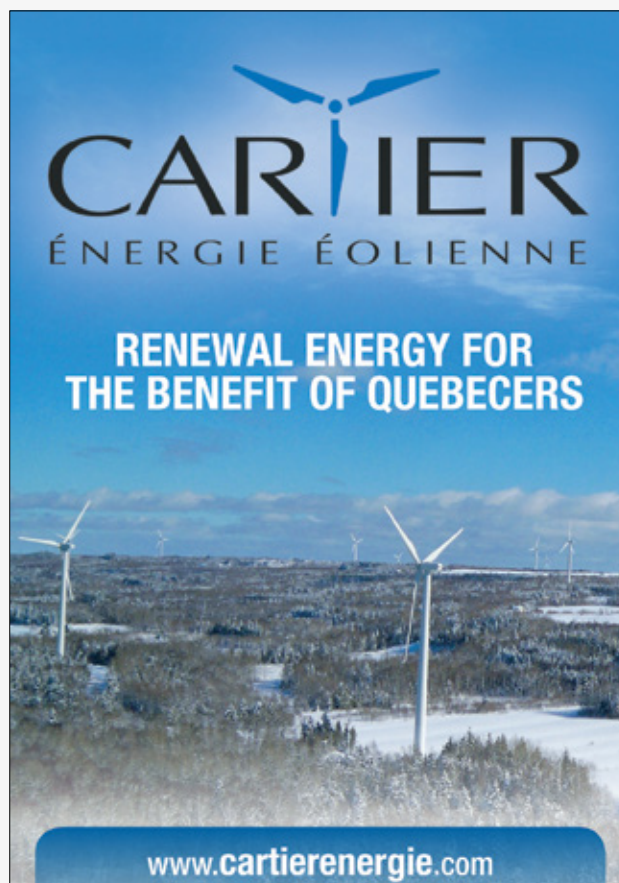
What R&D projects are you working on at the moment, particularly to tackle challenges specific to Québec?

Cartier is currently liaising with turbine manufacturers to tackle the climatic extremities of Québec; as yet, we have not developed specific technology to respond to the icy conditions, but have carried out market surveys on the subject of turbines and extreme cold conditions. A potential answer could be to add a semiconductor coating on the blades that will pre-heat during icy conditions to avoid ice build-up and sticking of the blade. On the operational side, we are working on blade inspection to speed-up the inspection procedure; we now have high-resolution, fully computerized camera technology to complete the scanning of the blades of a wind park in one month. It is enabling us to

build an engineering data-base detailing blade problems and method of solutions.

What is Québec's motivation to increase the role of wind in its energy mix?

Québec has the permits to have big dams to maintain a steady state-power. Wind energy fluctuates. It is not constant, but with the province's wind patterns it is possible to predict a steady power contribution from wind energy to supply Hydro-Québec. Therefore, wind and hydro can complement each other. It is important to have a good match of energy resources at Québec's disposal for full integration: hydro; wind; solar; and biogas. •



# Québec's Wind

A maturing sector risks outgrowing its market

For those in Québec's alternative energy sector, the relationship with Hydro-Québec—the monopolist national utility—has always been a complicated one. Biogas, wind, or solar companies with large-scale commercial ambitions face an uphill battle in the province where hydropower is king. Yet over the last few decades Québec has become home to a significant number of these firms, and they have no intention of leaving.

It is difficult to overestimate the influence of Hydro-Québec to Québécois society. When Québec's economy underwent a significant transformation to modernization in the 1960's, Hydro-Québec was one of a handful of crown corporations charged with incubating the technical skills required to lead a new generation of young French Canadian professionals to prosperity.

Today, Hydro-Québec employs over 21,000 people, the majority of them highly-trained engineers. Through the Hydro-Québec Research Institute (IREQ) and its R&D-driven subsidiary TM4 Electrodynamic Systems, Hydro-Québec has developed a number of groundbreaking technologies used in electrification around the world. The utility has also given birth to a number of partnerships and spinoff companies that have acted as vehicles for exporting Québec's electricity expertise abroad. The lithium ion battery technology that powers Paris's new electric car-sharing program, for example, was developed through such a partnership in a Hydro-Québec lab. Around the world, but especially in the emerging natural resource markets of Africa and Latin America, the reputation of Québec's engineers precedes them, and this is partly thanks to Hydro-Québec.

Of course, for any crown corporation power comes with responsibility. Hydro-Québec is responsible for utilizing its province's massive hydropower resources, which comprise over



Source: Flickr/Dennis G. Jarvis

96% of Québec's energy mix, profitably while providing market access to alternative energy sources where possible.

For Québec's young wind energy companies, the dominance of hydro can seem overwhelming. They have managed to develop a strong foothold in the Gaspésie peninsula in the last ten years, since the market was opened to them. However, they must balance their desire to utilize their expertise against a tightly regulated market for it. All new, commercial-grade wind projects in Québec can only be initiated after a successful bid to respond to a Request for Proposals (RFP) issued by Hydro-Québec. This way, Hydro-Québec acts as the gatekeeper to accessing consumer demand.

The system works well. Since 2003, approximately 3,500 MW of wind energy have been purchased by Hydro-Québec from the

private sector, including 3,000 MW of large-scale projects initiated through RFPs. Wind energy projects initially faced some opposition from local residents due to noise and the garish appearance of towers along the countryside. The people of Québec were also sceptical about the necessity of wind energy in a province home to half a million lakes and over 4,000 rivers that can produce hydropower indefinitely. According to Jean Francois Samray, president of the Québec Renewable Energy Association (AQPER), this is a narrow perspective. "Québec usually has regular precipitation cycles lasting approximately four years, but in the year 2000 there were back-to-back low periods in which precipitation was very scarce. The reason you combine wind with hydroelectric capacity is to mitigate the risk of droughts. The two resources complement each other."

In any case, such concerns have all but completely died down and today the Gaspésie thrives on wind. The wind sector has created 750 jobs in the peninsula, and nearly 5,000 in Québec as a whole, spread across 150 manufacturing and service companies.

Now a decade down the road, Québec's wind market is beginning to face the challenges of maturity. While the first round of projects from Hydro-Québec's wind tenders in 2003 were mostly awarded to Québec firm Cartier Energy, the second round is seeing a more diverse group enter the picture. French national utility EDF EN, American firm Invenergy, and Spain's Enerfin have all been approved by the government to be allocated a slice of the 1,000 MW available. EDF EN has entered into an exclusive partnership with German turbine maker REpower (now Senvion), which has made Montreal the headquarters of its North American operations and increased its staff presence in Québec from just three employees to over 100 since 2010.

In a bid to prevent the outsourcing of value chain activities overseas, the government has thus far bound foreign wind companies by a 'regional content' clause, requiring 30% of turbine costs to be derived from manufacturing done in the Gaspésie and its neighboring region, the Matane. This precaution has proven very effective, raising the global profile of local OEM sub-contracting manufacturers like Marmen. Nonetheless, for homegrown firms the level of competition has increased rapidly and new RFPs cannot come soon enough. To that end, 2013 brought welcome news.

The provincial government has announced an RFP for 800 MW of additional wind capacity to be purchased by Hydro-Québec from the private sector. The purchase will form part of a greater vision for Québec's energy strategy covering the period 2016-2025. However, until the strategy is fully outlined by the Ministry of Natural Resources, no one knows whether 800 MW will serve as the limit for new wind capacity and, if so, for how long. According to Mylany David, an expert in wind energy law at Dentons, many more RFPs- as many as possible- are needed in the near future to keep Québec's wind industry alive. With hydropower almost entirely consuming Québec's energy market, the biggest concern of wind companies is that the government will find little incentive to continue its support for them. "One of the key issues for AQPER", Samray says, "is maintaining government interest."

In Québec's energy sector, there is never a question of who is in charge. Any project of significance starts and ends with the signature of Hydro-Québec. But in the faraway corners of the Gaspésie peninsula, locals are seeing the gradual emergence of a wind sector value chain that may prove to become a real force of global industry expertise in

the decades to come. For the moment the industry is seeing success, but it is ultimately at the mercy of political will and the planning capacity of the hydropower giant. Under these circumstances and without more support, Québec's wind companies may find themselves with plenty of air but little room to breathe. •

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#### For more information contact:

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## INTERVIEW WITH

# Erik Thorsrud

GENERAL MANAGER

ATLAS COPCO CONSTRUCTION EQUIPMENT CANADA

Could you provide us with a presentation of the company's structure and tell us more about the Construction Technique division?

At a global level, Atlas Copco is celebrating its 140th year of history in 2013. In Canada, we have been present since 1949, and today, we are structured into four divisions: Compressor Technique, Industrial Technique, Mining and Rock Excavation Technique and Construction Technique. Out of these, the Construction Technique division is the newest one: our product offering in the field used to be part of our mining business, but since we were looking to further diversify our market reach and go more in-depth into the construction sector, we decided to establish a dedicated division for it. This change happened during 2012 at a global level and now, the Construction Technique business is one of the most important business areas in within Atlas Copco; AC Construction Technique portable energy products include portable compressors, pumps, mobile power generators and lighting towers for construction projects, needed on construction sites in remote areas where connection to the grid is not available.

What is the strategic importance that Québec has for Atlas Copco Construction Technique and what are the credentials that recommend you to the market?

Atlas Copco has had strong construction products for some time but in recent years, we further reinforced our portfolio in this domain through various acquisitions: in 2007, we assimilated Dynapac, and that helped us gain more presence in road construction equipment: incidentally, Québec has been a province where Dynapac products have been very successful. Canada, as a whole, has a more of potential for Atlas

Copco and Québec, alongside Alberta and Ontario, constitutes one of our key markets within the country. Canada's East Coast development will be driven by projects in which Québec will have a big role to play, such as the Energy East Pipeline. This potential prompts us to look at ways of expanding our footprint here, both organically and through M&As.

Over the past 10 years, Québec has significantly invested in its wind energy power sector. What potential does this hold for Atlas Copco Construction Technique and what other markets are you targeting?

In Québec, we are targeting power projects, which, during the phase of their construction, will require portable energy sources – this is where we can shine with pneumatic pokers, electric pokers, as well as with diesel-fueled generator sets. We do not work normally work with the utility companies directly, but rather with the engineering groups that supply the equipment to them. The developments of the wind energy sector in Québec can be an opportunity for Atlas Copco Construction Technique because of the often remote locations of wind farms; furthermore, these projects also lead to the construction of adjacent roads, a process which we can also support.

In order to have increased reliability, especially in remote areas, portable energy solutions need to be backed up by solid service structures. What are the measures in place at Atlas Copco Construction Technique to assure that?

Atlas Copco will never be the low-cost provider but the quality and reliability of our solutions ensures a great cost/benefit ratio over the years. Atlas Copco

has service departments dedicated to each of its business areas, the end purpose being that of increasing customer focus and satisfaction. Nowadays, we are going through a consolidation phase, assuring top quality support throughout our divisions: traditionally, the service groups were very strong for Industrial Technique, and now we want to bring Mining Technique and Construction Technique up to speed as well. The challenge within our department is related to software improvements and the standardization of computer programs across the global span of the company. However, we have already re-catalogued all our inventory and we set up a Canada support distribution center in Charlotte, North Carolina in the US. We want to assure product reliability and support because that will ultimately make Atlas Copco Construction Technique achieve its immediate goal, to build its brand image in front of Canada's key construction players.

Looking ahead, what are some of the newer products you are introducing to the market?

Atlas Copco always has new products in its pipeline and is ready to supply the most energy efficient, environmentally clean products available in the market today. New products, powered by help to diminish CO<sub>2</sub> emissions. We are compliant with all the sustainability related legislation in the US and Canada and we are ready with more ecofriendly engines. For our business area, we look to improve our market presence. We also look to leverage with our other business areas, such as Mining Technique. We want customers to see us as a trusted partner that can supply them the high-tech and efficient equipment that they need. •



INTERVIEW WITH

# Laurent Nadeau & Jean Claude Roy

CEO QUÉBEC & DIRECTOR  
FIRST CANADIAN TITLE

LN

**What is your perception of the evolution of 'not-in-my-backyard' syndrome for wind power in Québec?**

**LN:** It is not only wind projects that communities object to; there is a general 'not-in-my-backyard' mindset. The publicity that green energy is receiving will eventually persuade the public that it is a necessary phenomenon and acknowledge that clean energy comes at a price, i.e. the acceptance of a windmill farm location near communities. There is a lot of space in Québec for windmill farms; it is finding the right space. Community opposition does not impact on our product; we insure titles.

**JCR:** We are sent request for titles when the location of the windmill has been finally decided; we are not involved in the political aspect of the project. FCT offers no-fault type insurance. Once licenses and title have been agreed, we will play a role and defend a customer if the claims to title or the building of a windmill are contested, for example, by a sub-department of the Ministry of Natural Resources. FCT will rectify the title, ensure correct registration, and if a cost of doing so is incurred, FCT will pay.

**Do you see any regulatory barriers to the title insurance part of the business, or areas for improvement?**

**LN:** There are no legal problems; it is about securing a knowledge-base for our product and for the professionals involved in transactions to be more familiar with our product and trust in the job we do. The perception of some people is that we want to take their jobs; this is not the case. FCT's objective is to make the job easier and give the safety-net of insurance should an error be made during a transaction.

**JCR:** Due to the high value of investment in projects, there are instances when the insurance of the lawyer's law firm is insufficient to cover any potential loss; in FCT's case, technically there is no limit on the amount of insurance it is able to cover. We have, in the past, quoted cover of \$5 billion for an energy-related transaction with assets of \$5 billion.

**Do you have any strategies or programs to boost knowledge of the value of this part of the business?**

**LN:** We have a two-stage process. (1) We are currently educating the lawyer-community by visiting and telling them about our products and services and the benefits to them and their customers; the case-study we use is a \$3.5 million insurance claim which FCT paid out within 30 days. (2) We also educate some officials, for example, Autorité des Marchés Financiers (AMF), and The Law

Society, on our service offering. When lenders or project promoters are from outside of Québec, they already understand the value of our product, especially those from US. Although our land registry system in Québec is second-to-none, title problems may still occur; insurance should be a fundamental part of a transaction. Our premiums are set in accordance with the less-risk factor in Québec.

**JCR:** In Ontario, 95% of transactions are title insurance. Québec needs one major financial institution to require title insurance in all of its files for it to have a domino effect on the rest of the market. The Office of the Superintendent of Financial Institutions (OSFI) - the regulator for the banks of Canada, has instructed in its guidelines that banks should carry out all due diligence, or take a title insurance policy. •

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PH

## INTERVIEW WITH

# Peter Hansen & Robert Demers

WIND OPERATIONS GENERAL MANAGER & BUSINESS DEVELOPMENT DIRECTOR QUÉBEC  
NORTHLAND POWER

The Jardin D'Éole and Mont-Louis projects have been online for several years. What are the main challenges of operating and maintaining them in Québec and what new technologies are you using for wind-farm optimization?

**PH:** In operations, during the first couple of years, you are safe under the OEM's warranty but that said, you always want to maximize the efficiency and output of your turbines, whether we are talking about properly facing them to the wind or optimizing their blades. Northland Power has been working heavily with GE throughout the years to incorporate new techniques and technologies: now, there are new LiDAR systems that can forecast wind 300 meters in front of the turbines. Additionally, we are looking at installing collecting systems that can map all our turbines for simpler and better fine-tuning. Technology moves extremely fast with turbines, not unlike the technology of laptops: in 1995, the biggest turbines had a capacity of less than 1MW – today, not even 20 years after, we have examples of 7.5 MW machines. Québec has a harsh, cold climate from mid-November to mid-April and the snow and ice does affect production, especially if it accumulates on the blades. Thankfully, we have not been hit too hard by this so far. Our turbines have so far been performing well; it is true that the last two years have been low wind years but we are seeing signs of improvement already and are hopeful about the 2013-2014 winter season.

Could you tell us more about the partnerships that Northland has created across Québec in developing its projects?

**RD:** Northland Power has forged partnerships with municipalities because we believe that participation is an important part of social acceptance. Usually, the

challenge is to achieve good financial performance given the smaller scope of these projects. For some municipalities, even assuring 30% of the equity of the project is a huge financial commitment and so we work to find them adequate financing at good rates. To solve this problem, in Québec we are working with a particular entity (Regie), which is an organization formed by multiple RCMs (Regional County Municipalities), in our case, five, coming together to develop a larger project. The new rules for the new RFPs will potentially see 50% partnerships with communities (municipalities, RCM and other) so the pressure of financing will only increase – Northland Power is trying to be a good partner and is using its experience to try to find the best solutions for financing in these cases. As a company, we learn a lot during our community partnerships in Québec and we are now applying the lessons learnt there to our Ontario projects.

In Québec, we also have a development partnership with the Innu TakuaiKAN Uashat Mak Mani-Utenam (ITUM) First Nations to partner on the development, construction and operation of wind energy projects on the traditional territory of the Uashaunnuat people. The total estimated capacity of the projects is 170 MW to 200 MW, and would result in: a potential investment of more than \$500 million, up to 300 jobs during construction, and up to 30 permanent jobs.

The 24 MW Frampton project is a perfect example of the increasing trend of developer/municipality collaborations – could you tell us more about it?

**RD:** The 24 MW project at Frampton could end up assuring 40% of the municipality's annual budget so it is a key development for them. Northland Power tries to involve

everyone as much as possible, and we first look to source locally and then regionally for solutions. For examples, in the case of wood clearing, we initially assign that to the land owner to create more value; same goes out to transportation of materials and construction. It is an essential part of social acceptability and based on this good collaboration, we are already getting phone calls from other municipalities looking to do similar projects. Overall, Northland has great expertise in involving communities and communicating with them – we are there for the long run and our reputation is at stake.

How has Northland been impacted by the rapid development of Gaspésie's supply chain for the wind energy sector?

**PH:** The wind industry is a very good asset for the Gaspésie Peninsula especially because it came online during a time when the area was economically depressed, with forestry and fishing slowing down. The government's first RFP, through its high local content requirements, allowed for job creation and the development of regional manufacturing, service and transportation companies. Moreover, with new turbine projects coming in this fast, companies have to adapt, creating further value – the government also wants to develop local manufacturing of strategic components to develop the export potential so we expect more and more companies to be created in Gaspésie. Northland Power can only be happy about that because this local availability of quality services ultimately makes us more cost-efficient. In this business, it is essential to be able to get machines online as soon as possible when they break down and not having to call on specialists on the other side of the world advantages us. •





## INTERVIEW WITH

# Helmut Herold

CEO, NORTH AMERICA  
SENVION CANADA INC.

**We last met with Senvion Canada Inc. (at that time REpower Systems Inc.) in 2011. What are some of the key milestones the company has achieved in Québec since then?**

Senvion Canada was founded to supply turbines for the second tender for 2000 MW of wind energy projects issued by Hydro Québec in 2007. In 2009, we finalized a framework agreement with EDF EN Canada for 954 MW of contracts from that tender. With this, Québec was our point of entry into the Canadian market. It is really amazing to see how we have grown from three employees three years ago to over 100 today. 2012 was a record year for us, in which we installed more than 400 MW of turbines. This equates to more than 200 machines and in 2013 we have reached the 550 MW threshold. Senvion is very proud to be one of very few companies in the market able to get projects on the grid on time. We have seen delays of several months to a year with our competitors.

**How has Senvion incorporated local firms into its manufacturing value chain for North American projects?**

The nacelles of Senvion's machines are standardized and produced in Germany for all of Senvion's turbines, and all parts from our global supply chain are still sent to Germany and assembled there. However, as part of the Province of Québec's requirements, Senvion expected to produce a part of the value of its machines in local regions, particularly the Gaspésie (Gaspé, New Richmond and Matane).

Senvion's approach has been to use even more local resources than what was required. We use blades manufactured in Gaspé by LM Windpower, which also happens to be our global supplier, and towers produced in Matane by Marmen. We already use

Marmen for projects in the United States, which demonstrates that Québec's plan to create local champions in the wind sector is really working. A third company, Eaton-Woodward, assembles electrical converters for our turbines in New Richmond, Gaspésie. There are approximately 750 jobs created and maintained by the wind sector in Gaspésie, and two thirds of them are related to Senvion's work in particular.

**When we interviewed EDF EN Canada, they mentioned that one of the highlights of working with Senvion was the company's adaptation of its turbines to Québec's unique challenges. How has Senvion achieved this?**

There are several major challenges to be aware of when operating in Québec. The first is compliance with all of Hydro Québec's requirements, which are among the most stringent in the world. Québec's rules are very tough, but very innovative, and as a result we have features in our machines here that are not seen anywhere else in the world. One example is that Senvion's Canadian machines constantly react to frequency fluctuations in the grid and use the energy stored in the rotor to compensate.

The other challenge is Québec's climate, which experiences heavy icing right through the spring. Senvion has addressed this by developing cold climate turbines, the prototypes of which were first installed in China's Inner Mongolia region in 2007. Since the machines have been shown to run at a technical availability rate of over 99%, we have adapted them to our work in Québec.

**How do you address public perceptions of wind as an expensive energy source?**

Senvion is concerned to see that some misunderstandings are still communicated

to the population regarding the impact of wind on electricity prices. Wind is only 10% of Québec's overall capacity, so it cannot have a very great impact on pricing. The fact that a new wind power project has a higher cost of energy than a hydropower station built in the 1960s is clear. If you try building a hydropower station today, however, it is a different story and wind proves to be very competitive on an ROI basis. We would really like to see a fairer and more transparent discussion on this in the public space. Of course, Senvion is always looking into optimizing the cost base of its machines, but there is a limit to how much a company can pressure its sub-suppliers.

**Do you have a final message for our readers?**

Senvion is very happy to be part of the community in Québec. The long term stability and support of the province's leaders for the wind sector makes this an excellent jurisdiction for us. Notwithstanding that, we are excited to see other wind markets picking up. We are already part of the Ontario market, and are keen to have our first projects rolling out in British Columbia over the next 18 months. For Senvion, Québec provides an excellent starting point, but the end goal is to start developing in the rest of Canada, as well. •

# Mitigating the Risks & Simplifying the Complex in Clean Energy Developments

Paul Miron, LLB, Senior Title Counsel  
FIRST CANADIAN TITLE

At a glance, a field of wind turbines or a solar panel farm may look like a simple development involving real property and clean energy equipment. But on closer inspection, the variables involved in the acquisition, financing and closing these transactions is often multi-faceted and complex.

Projects can cover many different types of land interests: private, leasehold interests, native, municipal and crown lands. Not only are they located in rural areas but also increasingly on rooftops of many commercial buildings.

One growing method of dealing with these challenges is the burgeoning use of title insurance to streamline these transactions, reduce risk and provide the lender with security for financing. Separate policies are available for owners as well as lenders to protect their respective interests in a deal. The cost of a title insurance policy is based on the value of the property transaction: a one-time fee with no deductible and stays with the lender or owner for as long as they maintain an interest in the property.

A title insurer will often get calls just as a deal is about to close because an issue has arisen and the deal cannot close on time. The title insurer will work with counsel by taking on the risk in a transaction addressing issues such as zoning compliance, easements, off-title work orders, accuracy of site plans and land surveys, so a deal can proceed to closure. In order to address the unique features of these projects, a set of endorsements has been developed that deal specifically with energy projects and provide extra coverage for survey issues, amongst others.

Renewable energy farms often cover many jurisdictions, involving a variety of owners, tenants and lenders. Title insurance provides the

policyholder with continued secured interest over the development. This “contiguity” of secured title protects the policyholder from defects, charges, liens or encumbrances on the title, the title’s unmarketability and the lack of a right of access.

More and more companies and their legal counsel are turning to title insurance to structure their renewable energy developments. Increasingly title insurers have become involved in the early stages of a deal on solar and wind farms, pipe and transmission lines from the get-go because of the risk transfer the title insurance policies provide to parties.

One of the most attractive features of the title insurance policy is the ‘duty to defend.’ Duty to defend is an insurance term whereby the insurer must defend the insured’s interest if it is legally challenged. As such, a policyholder can rely on its title insurance company to take on the legal costs and challenge of defending its interest in court.

With so many interests involved in a complex renewable energy project, knowing that an experienced insurer will defend your interests greatly reduces the risks for financiers and owners: providing them with peace of mind for as long as they own the property. •

**About the Author:** Paul Miron, LLB, Senior Title Counsel, is responsible for the national underwriting of all FCT product lines, with an emphasis on the commercial segment. Since joining FCT in 2003, Paul’s unflappable, sunny personality and vast knowledge of the ever-changing legal landscape have earned him a number of increasingly senior roles which have directly contributed to FCT’s success. In addition to his current title as Senior Title Counsel, Paul is also Senior International Underwriter for First American Title Insurance Company (FATIC), FCT’s parent company. Paul earned a bachelor of arts from the University of Ottawa in 1982 and a degree in law from the University of Windsor in 1985. He was called to the Bar of Ontario in 1987. Paul is also an avid curler and reader.

**About FCT:** Founded in 1991, the FCT group of companies is based in Oakville, Ontario and has over 800 employees across the country. The group provides industry-leading title insurance, default solutions and other real-estate-related products and services to approximately 300 lenders, 24,000 legal professionals and 5,000 recovery professionals, as well as real estate agents, mortgage brokers and builders, nationwide. FCT has been recognized as one of the 50 most engaged workplaces in Canada in 2012 by Achievers. For more information on FCT, please visit the company website at [www.fct.ca](http://www.fct.ca).

The FCT group of companies includes FCT Insurance Company Ltd. which provides title insurance, with the exception of commercial policies, which are provided by the Canadian branch of First American Title Insurance Company. Services are provided by First Canadian Title Company Limited.

To find out more on how title insurance can mitigate the risks of your clean energy development and simplify your next commercial transaction in Canada please call FCT at 866.804.3112. Should your project be located in the province of Québec, it will be our pleasure to direct you to our commercial experts located in our Montreal office.

# Future Outlooks

## Different paths for different players

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 With a new Energy Strategy expected for 2014, optimists hope to see an increase of the 10% share wind energy has in the province's power mix. However, Québec's energy surplus and the US' shale gas frenzy do not prompt the need for more power generation. While salvation could come from increasing regional demand through initiatives such as electric vehicle implementation, these scenarios seem rather long-term. That is a luxury that Québec's wind industry cannot afford: the province's wind repowering cycle starts in 2024, but current works will keep players busy only until 2017. "According to one of our studies, Gaspésie's wind supply-chain players need a minimum market of 300 MW to 350 MW per year to survive; even so, they would be working only at a 40% capacity rate," said Frederic Cote, general manager of Tehnocentre Eolien, an organization that has played an important role in creating and developing Gaspésie's wind cluster.

In this context, the key to future success will take different forms for different types of players. Until 2024, new business for developers is exclusively dependent on new RFPs. On the other hand, maintenance and operations' service providers are finding plenty of work in Québec, as wind farms are coming out of warranties. "Generally speaking, operators benefit from a two year warranty from manufacturers. When this period ends, they have a renewal option but the majority of companies take the maintenance and operation of the farm on their own. For us, this moment is crucial because we can then step in and add our products to help operators," noted Roger St-Arneault, CEO of Maintenance Logic Systems, a firm that has developed wind-energy computerized maintenance management systems used by the likes of Cartier Wind Energy. "As a service company, we are well positioned for the long-term in a market that will increasingly need wind turbine maintenance in the future; we are covered for the next 10 years at least," added

Marc Poirier, business development director at Techéol, a local wind farm maintenance company that started its work in the sector with GE in 2007, having six technicians; now, it has 65. Other notable maintenance players in the market in a similar position to that of Techéol include East Coast Wind and Suspendem Rope Access, a company that specializes in rope access and suspended platform composite repairs.

Gaspésie's home-grown manufacturers, such as Composites VCI and Fabrication Delta, will survive by competing on the global markets. Composites VCI leveraged its composite experience in the transportation and energy markets to enter the wind sector during the first RFP alongside GE, fabricating over 1,200 nacelles at its dedicated Matane factory. However, as regional demand decreased, the company looked abroad: "Composites VCI's collaboration with GE meant that we could leverage the plant to export our products outside of Québec, in Ontario, for example. We gained valuable experience alongside major OEMs like GE in Québec, and we obtained all the necessary certifications and qualifications from their part – that is why we

are accompanying them in Brazil, a country with a strong wind energy market (1,000 MW of newly installed capacity per year). Our plant in Campinas is strategically located next to GE's assembly facility in the country and since they did not ask for exclusivity, we are free to collaborate with other industry players as well," explained Sylvain Charbonneau, executive vice-president of Composites VCI.

Fabrication Delta, a manufacturer of wind towers, is also looking to leverage its experience beyond Québec: "Québec alone will not absorb all our capacity and so the Maritime Provinces will keep being good markets for us in the years to come; we are also foreseeing good business in the NE of the USA for 2014. Our New Richmond plant gives us rail access and a wide radius of action. Furthermore, we are the only tower suppliers to have direct access to the Saint Lawrence River. These are big logistical advantages for tackling foreign markets," said Elie Arsenault, sales manager, Fabrication Delta. Having outgrown Québec, these companies will take the fight abroad, where survival of the fittest will determine success. •



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# **Innovative Québec: Alternative fuels for provincial growth**

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“Very few solar programs in the world have made economic sense thus far, but I would point out that every utility in the world exists because of government subsidies. The idea that solar technology is inherently incompatible with the grid is way off base. Today in 2013, you can put in a large grid-tie photovoltaic system for not much more than \$1.50/watt before installation and it will last more than 25 years. If our economy is growing at 3%, unless you have an energy efficiency program that will save 3% per year, you will need more power. Québec can flood more territory, use wind, or engage in fracking: all of these options have their issues. On the other hand, we have a reserve sitting there in the sky that in one hour produces the world’s energy needs for a year.”

- Brian Wilkinson,  
PRESIDENT, MATRIX ENERGY





# Québec's Solar Energy

In the shadow of hydro and wind

With an abundance of lakes and rivers and with political attention given to its wind energy sector, Québec has not left a lot of room to grow for its solar power segment. Even so, some support initiatives have surfaced in recent years: in March 2012, Québec's Ministry of Natural Resources announced the creation of PAIESO, a \$7 million fund aimed at supporting the installation of solar thermal and photovoltaic systems. Overall however, the implementation of large-scale solar projects is still far from becoming reality in the province, as Jean-Francois Samray, president of AQPER, explained: "It will be tough for solar to connect to the grid. The first reason is that solar can supply fairly cheap electricity. Québec is already active in the other renewable technologies. The second factor, demonstrated in a recently published paper by the Edison Research Centre, is that the more popular solar becomes, the more it will jeopardize the way that electricity is charged to the consumer. If there are more and more consumers producing their own electricity and just relying on the grid as a battery, they will consume less kWh on the grid, but grid maintenance costs will still be there; this, in turn, would lead to charging more per kWh. Subsequently, more and more people would move to solar – but everybody still needs the grid. On the other hand, Québec still has many remote areas where people need to look at solar technologies, so there will always be a market for it."

Currently, solar opportunities in Québec are with off-grid and mini-grid installations and consequently, with commercial, institutional, and municipal facilities. Founded in 2009, Rackam is a Québécois company that benefited from Québec's IRAP (Industrial Research Assistance Program) financial support during its incipient development phases: now, the company specializes in providing solar thermal power to industrial players. Having spent two years developing its concentrated solar power

technology and showcasing its potential, the company is now launching its two first large projects. However, looking beyond Québec, Rackam is targeting international expansion. Mathieu Chagnon, president of Rackam, discussed his company's future markets of interest: "We are a Québec-based company because a lot of good engineering is here, and there are good opportunities for research and to find investors. A large part of our supply chain is also Québécois, but our market is mostly international. We pursue two paths of research in partnership with the University of Sherbrooke and during our early research we were able to receive federal government subsidies. In two years, we will certainly have business activities in the US and Europe. Rackam is evaluating many foreign projects, and will continue to look at many more in the future."

Looking in the long-term, the key for scaling up solar power in Québec will be to attract political support, as Brian Wilkinson, president of Matrix Energy, a Québécois solar photovoltaic company with 28 years of experience in the field, concluded: "Very few solar programs in the world have made economic sense thus far, but I would point out that every utility in the world exists because of government subsidies. The idea that solar technology is inherently incompatible with the grid is way off-base. Today in 2013, you can put in a photovoltaic system for not much more than \$1.50/watt and it will last more than 25 years. If our economy is growing at 3%, unless you have an energy efficiency program that will save 3% per year, you will need more power. Québec can flood more territory, use wind, or engage in fracking. All of these options have their issues. On the other hand, we have a reserve sitting there in the sky that in one hour produces the world's energy needs for a year." •

## Solar Insolation in Canada

Source: Environment Canada

CITY	YEARLY PV POTENTIAL (kWh/kW)
Regina (Saskatchewan)	1361
Calgary (Alberta)	1292
Winnipeg (Manitoba)	1277
Edmonton (Alberta)	1245
Ottawa (Ontario)	1198
<b>Montreal (Québec)</b>	<b>1185</b>
Toronto (Ontario)	1161
Federiction (NB)	1145
<b>Québec (Québec)</b>	<b>1134</b>
Charlottetown (PEI)	1095
Yellowknife (NT)	1094
Victoria (British Columbia)	1091
Halifax (Nova Scotia)	1074
Iqaluit (Nunavut)	1059
Vancouver (British Columbia)	1009
Whitehorse (Yukon)	960
St. John's (Newfoundland/Labrador)	933

## Solar Insolation Worldwide

CITY	YEARLY PV POTENTIAL (kWh/kW)
Cairo, Egypt	1635
Capetown, South Africa	1538
New Delhi, India	1523
Los Angeles, USA	1485
Mexico City, Mexico	1425
<b>Regina (SK), Canada</b>	<b>1361</b>
Sidney, Australia	1343
Rome, Italy	1283
Rio de Janeiro, Brazil	1253
<b>Ottawa (ON), Canada</b>	<b>1198</b>
Beijing, China	1148
Washington, DC, USA	1133
Paris, France	938
<b>St. John's (NL), Canada</b>	<b>933</b>
Tokyo, Japan	885
Berlin, Germany	848
Moscow, Russia	803
London, England	728

INTERVIEW WITH

# Mathieu Chagnon

PRESIDENT  
RACKAM

.....  
**Could you introduce us briefly to your company and its recent milestones?**

Rackam specializes in providing thermal energy for industry. Our company's founding concept is using direct sunlight to provide heat at sufficient levels to feed into industrial processes with high quality energy. We took the idea of the big parabolic troughs that are used to generate electricity on very large ground installations, and scaled it down to make a product which can be easily deployed on the roof of a business, thereby recovering space which is usually left without any use. Our aim was a product that is very easy to install, and low in cost in order to compete with fossil fuels and diminish the consumption of natural gas. Rackam started four years ago; the first two were spent developing the product, the third installing two showcases - one in Québec and the other in Spain. We are now preparing the first large projects, one on an institutional building and another on a paper mill located in Québec. At the same time we have been working on finding ever more use for the heat we produce. We are looking at producing cooling solutions with the heat, using different types of chillers, and eventually providing co-generation of electricity and heat.

**What distinguishes your technology from other thermal solutions on the market in Québec?**

To our knowledge Rackam has the only technology in Québec to use direct sunlight. It is a mirror system, which works only under sunny conditions, so it has a very different profile for being integrated into a process. Secondly, it works at much higher temperatures - rather than providing preheating load, we can provide full heat load, generating saturated steam up to 200 degrees C. Our technology can cover most industrial processes. For example, in Spain we produce cooking oil at 240 degrees C. In comparison, vacuum tubes will go up to about 90 degrees C or a little higher, while flat panels reach around 60 degrees C. Another advantage is that, since this is concentrated power, it works well even in very cold conditions. Furthermore, the material cost of the trough is fairly well reduced by our concept - per square meter, it comes out much cheaper than the equivalent flat panel or vacuum tube installation.

**What R&D programs are you working on, or do you envisage conducting in the near future?**

Rackam is up-scaling its troughs for ground installation and to benefit from the economies of scale that would be associated

with this. We are also down-scaling them to fit commercial use in addition to industrial. The rest of our R&D is focused on cooling, co-generation and, to a small extent, heat storage. Most of the challenges we face with the up-scaling program are not technical, but rather financial. When a client buys a solar installation, he purchases 20 years of energy production all at once. Because maintenance costs are so low the energy is very cheap in the long term, but the standard financial appraisal of an industrial project relies to a great extent on very short-term considerations. As a start-up company, the financing issues we face are particularly critical.

**You have some financing coming from the government of Québec. How has the province been supporting you?**

In the early research stage, we were able to receive subsidies from the federal government's IRAP program. Subsequently Rackam was able to build showpieces using the help of the provincial MDEIE. We have also had some help from Développement Economique Canada for commercialization. Most of the rest of our backing has been private investment.

**What steps are you taking to make the manufacturing of your products more economical?**

Rackam has maximized the simplicity of its troughs, and the man-hours added to the products are a very small component of them. Most of the cost reductions we can expect are from scale economies on orders and improvements in the efficiency of the installation process; there are opportunities to lower the manufacturing costs, but they will be relatively small. •

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## INTERVIEW WITH

# Vincent Chornet & Marie-Hélène Labrie

PRESIDENT AND CEO & VICE PRESIDENT, GOVERNMENT AFFAIRS AND COMMUNICATIONS  
ENERKEM



**Given your end-product flexibility, what will be your market focus in the future?**

**MHL:** Enerkem was founded in Montreal in the year 2000, by Dr. Esteban Chornet, a professor of chemical engineering at the University of Sherbrooke and his son, Vincent Chornet, a young entrepreneur. Enerkem's business model relies on a breakthrough technology that replaces the use of petroleum in the production of fuels and chemicals by using municipal solid waste. Our vision is to transform both the waste management and the transportation fuel sector with this technology. We employed a very methodical approach to scaling up our technology over the years, and each time we made sure to have the proper validations and guarantees before going to the next level. In time, Enerkem grew from a small family business to a company that currently employs 160 staff and operates two facilities (pilot plant and demonstration plant) in the eastern townships of SE Québec. Moreover, we have three commercial scale facilities in our pipeline, and we are rapidly approaching the commissioning of our first one, in Edmonton, Alberta.

**Enerkem's partners include Natural Resources Québec and Sustainable Development Technology Canada. How did having proper governmental support help Enerkem's development throughout the years?**

**MHL:** Partnerships with government authorities are essential in developing these types of innovative technologies. Over the years, we benefited from the moral and financial support of both the Canadian and the Québécois government. At the federal level, Sustainable Technology Development Canada (STDC) plays an important role while

Québec's Department of Natural Resources is a key player in the biofuel sector. Beyond the financial aspect though, it is essential for the investment community to see that players in our field have the support of the authorities. The Renewable Fuel Mandate issued at a federal level in 2010 established a minimum 5% blend of renewable fuels into gasoline and 2% in diesel. Québec has taken a different approach and while it does not have a provincial mandate, it sets the 5% blend as an objective. The current blending technical limit in Canada is 10% but we are seeing a global trend of increasing that (Brazil has 20%, while the US just approved 15%). Furthermore, biofuel demand will only continue to increase in Canada, as emissions from car-fuels will count towards the GHG cap for refineries in Québec starting in 2015 and that British Columbia has established a Low Carbon Fuel Standard. This will prompt an increased usage of biofuels in the blends.

**In comparison with other types of fuels, what are the benefits that cellulosic ethanol can bring to the table for Canada, and Québec, more particularly?**

**MHL:** In Québec, 73% of oil consumption is accounted for by the transportation sector, which is also responsible for 42% of GHG emissions in the province. Moreover, oil imports amount to \$10 billion. Therefore, there is a consensus in the province to transform its transportation market by using electrical cars but also biofuels, which reduce oil dependence and create local jobs, while reducing emissions. Cellulosic ethanol adds further benefits due to its feedstock flexibility: first generation ethanol put pressure on sugar-rich crops such as corn and sugarcane. Cellulosic ethanol allows a much more regional, local economy model

to be implemented. We see our biofuel technology as a viable complement to the electricity generation sector in Québec.

**"Given your end-product flexibility, what will be your market focus in the future and what should we expect from Enerkem in the years to come?"**

**VC:** Our short-term focus will be on cellulosic ethanol due to better pricing. The market price for methanol is correlated to the price of natural gas, which is currently low. In the future however, we see our facilities as bio-refineries, having the flexibility of adjusting the nature of their output according to market trends. Meanwhile, using our existing platform, we continue to add innovative products to our portfolio, such as our drop-in-fuel. Enerkem's North American footprint will soon be launched and then we will pursue international expansion as well, where we intend to forge partnerships and adopt a technological licensing business model. Enerkem is dedicated to transform the waste and transportation fuel sector by providing a solution that will stimulate regional economies, reduce fossil fuel dependence, all while providing a sustainable solution. •

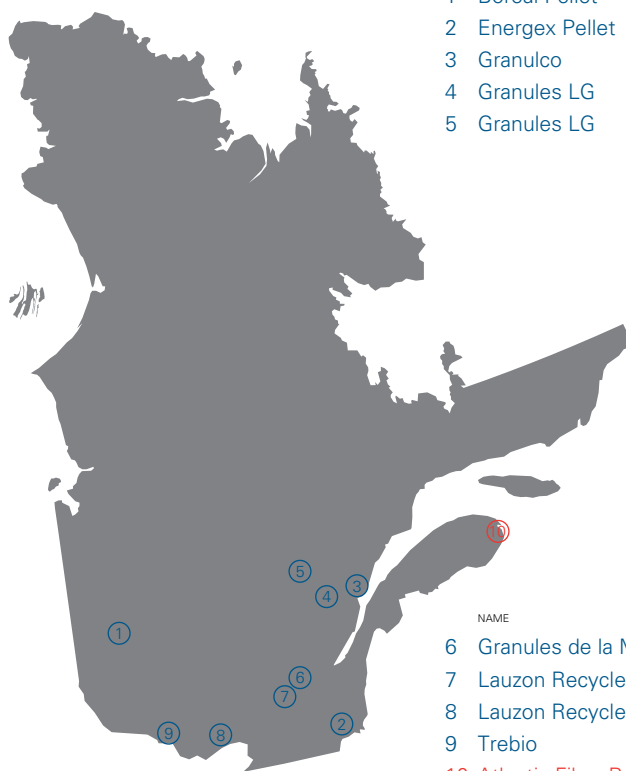


# Biogas and Biofuels

Making use of Québec's nature

## Biomass Pellet Production Facilities

Source: Canadian Biomass



NAME	CITY	CAPACITY TONNE/YEAR
1 Boreal Pellet	Amos	50,000
2 Energex Pellet	Lac-Mégantic	120,000
3 Granulco	Sacré-Coeur	40,000
4 Granules LG	Mashteuiatsh	80,000
5 Granules LG	St-Félicien	120,000

● CURRENT PRODUCERS  
● PROPOSED PLANTS

NAME	CITY	CAPACITY TONNE/YEAR
6 Granules de la Mauricie	Shawinigan-Sud	30,000
7 Lauzon Recycled Wood Energy	St-Paulin	30,000
8 Lauzon Recycled Wood Energy	Papineauville	40,000
9 Trebio	Portage-du-Fort	130,000
10 Atlantic Fiber Resources	Chandler	190,000

A smaller, but nonetheless very active, segment of Québec's energy portfolio is that of biogas and biofuels. The birth of this subsector was arguably sparked in 2005, when the Québec government passed regulation aimed at minimizing the impact of biogas from landfills, creating incentive to capture this potential source of energy. The government's Biogas Program was set up to provide financial support to projects that did just this, and further support has come from Gaz Métro – one of the largest natural gas distributors in Canada – who have shown willingness to purchase raw biogas from producers.

"In spite of Hydro-Québec's dominance, Québec is still a strong, open market," said Peter Morel, president of Pöyry Montreal, one of the two offices responsible for the northeastern North-American market for the Finnish multinational engineering company. Traditionally strong in Québec's forestry industry, Pöyry has recently shifted its attention to opportunities in bio-fuels and biomass. "While Québec is home to some interesting biomass-powered cogeneration projects, the low costs and high efficiency of hydroelectric power leave little room for diversification into large-scale biomass energy production," noted Morel. "We will however

stay focused in second generation biofuels like ethanol: there is good interest there, because it produces energy while reducing carbon footprints," added Zennie Lamarre, vice president of projects at Pöyry Montreal. Indeed, biofuel and biogas opportunities are out there for the taking in Québec. Traditionally proficient in organic waste dewatering and drying, Groupe Berlie-Falco has recently focused on also providing biogas energetic output to its municipal and industrial clients, through the process of anaerobic digestion. Having already obtained visibility in foreign markets such as the Middle East, Groupe Berlie-Falco is now

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## Biomass in Québec

Source: Centre for Energy

# 8

**Number of Biomass Plants**

# 223.9

MW

**Installed Biomass Capacity**

targeting its domestic market: “Canada offers good support for the industry, given the C\$650 million subsidy program for composting and biogas plants. Québec’s goal of eliminating organic waste going to landfills by 2020 is very ambitious and the fact that the province is part of the Western Climate Initiative are both signs of its commitment to reducing greenhouse gas emissions. However, the province needs to also provide the financial incentives necessary to attract the private sector on board – this would make business self-sustainable for the future. Nonetheless, we believe 2014 will be a very active year in our segment,” noted Bertrand Blanchette, co-president of Groupe Berlie-Falco. “The trend towards even more environmentally-friendly and innovative ways of producing power has brought with it a lot of debate on diversification into other energy sources in Québec. The government is certainly aware of these concerns, but it may be a while before we see significant shifts in the market structure,” concluded Morel.

In the meantime, the year 2014 will bring forth Québec’s new Energy Strategy: one of the most daring ideas on its agenda will be the implementation of electric transportation in Québec, an initiative which would decrease fossil fuel dependence, lower emissions,

and make good use of the province’s extra megawatts. Yet considering its innovation-prone biofuel/biogas players, such as Enerkem, Québec might want to reconsider its future energy mix plans. Enerkem, in partnership with GreenField Ethanol (the Canadian leader in alcohol production), were responsible for one of the largest developments in Québec’s biofuel scene, when they announced in 2012 that they were building the province’s first full-scale commercial cellulosic ethanol plant. The Québec government, through the Ministry of Natural Resources and Wildlife and Investissement Québec, committed \$27 million to the project. Near the end of 2013, it was confirmed that Sustainable Development Technology Canada (SDTC) will also be investing in the project.

What is clear is that Québec can now boast a host of innovative companies working in the biogas and biofuel sector, with an active trade body – Conseil québécois du biodiesel (Québec Council on Biodiesel) – that organizes conferences and promotes the use of biofuels. While these companies will undoubtedly struggle to carve out a commercially viable niche in an already crowded energy market, they are nonetheless an important and very welcome addition to the Québec’s renewable energy expertise. •



Courtesy of Biothermica



## INTERVIEW WITH

# Peter Morel & Zennie Lamarre

PRESIDENT & VICE PRESIDENT TO PROJECTS  
PÖYRY (MONTREAL) INC.

PM

## Could you provide an overview of Pöyry's presence in Québec?

**PM:** Pöyry is a Finnish multinational engineering company with expertise in projects involving a diverse range of energy resources. Our Montreal office, together with a sister office in Appleton, Wisconsin, is responsible for covering the northeastern North American market. Prior to its acquisition by Pöyry in 2002, the Montreal office was a private engineering firm focused on servicing the forestry industry. Forest Industry work continues to comprise 25-30% of our revenue, but as the industry struggled over time we moved more into biofuels and energy. Québec experience with biomass and how to convert it into energy really helped us to get our foot in the door in the power sector. Today Pulp and Paper, biofuels, and energy are still the three major areas of business for us throughout eastern Canada, including Québec.

Pöyry's biofuels-related work in Québec has thus far largely been centred on first-generation biofuels. More recently we have been starting to dabble in second-generation biofuels, but it just depends on which industry is going to get government funding and race ahead of the others. As an engineering firm, we are at the mercy of the government's ability to put seed money into the market and the ability of clients to do something with it.

## Do you believe that biomass firms can play a big role in Québec's energy sector?

**PM:** There is a lot of thought and restructuring going on right now in the biomass sector. Companies want to know whether they will receive a contract from Hydro-Québec and whether it will be long enough to ensure profitability if they

put down tens of millions of dollars for a biomass energy plant.

While the Québec market is still home to some interesting biomass-powered cogeneration projects, the low costs and high efficiency of hydroelectric power leave little room for diversification into large-scale biomass energy production. Nonetheless, Pöyry's Montreal office has always maintained involvement with biomass-to-energy projects because it is a technology familiar to us.

## What are your keys to success for implementing projects in a cost-efficient and timely manner?

**PM:** Communication is the biggest key to success. You have to talk to your client on a weekly basis, on the phone or in person.

**ZL:** The ability to balance quality and price when sourcing products is another significant factor, and having an established global network like Pöyry's really helps. When you are able to locate the best equipment at the optimal cost, the most important thing is ensuring timely delivery. Without that, delays and costs tend to add up very quickly.

## Do you have any examples of particularly creative energy projects in Québec in which Pöyry has played an important role?

**ZL:** Tembec is a good example of a Québec forest industry client converting waste material to power in order to be energy self-sufficient in one of its projects. The focus is different from other projects, and goes beyond simple waste disposal. The project has received funding from the government from the very beginning for the explicit purpose of producing energy. The project utilizes a 60MW turbine, which is one of the biggest used for this kind of waste

conversion project in all of North America. Pöyry's role has been to optimize this energy output in order to help the client get a better return on its investment.

## How do you see Pöyry's presence in Québec evolving over the next two years?

**PM:** Pöyry will mostly continue moving along the same track in Québec. We are going to stay with some of our forest industry clients because, although they are facing a tough market right now, they are not going away. They will reinvent themselves a bit and will need our help to do it. Energy will continue to be a main focus, though we will probably add other types of renewable energy projects to our portfolio because biomass activity in Québec will taper off. The overall picture of how much biomass is available for power generation in this province is still unclear.

**ZL:** We will stay focused in second-generation biofuels like ethanol. There is good interest there, both because it produces energy and because it reduces carbon footprints.

**PM:** Québec will still remain largely centred on hydroelectric power until there is a willingness to shoulder heavy infrastructure costs to mainstream new technologies.

## Do you have a final message for our readers?

**PM:** In spite of Hydro-Québec's dominance, Québec is still a strong, open market. But the growing trend towards even more environmentally friendly and innovative ways of producing power has brought with it a lot of debate on diversification into other energy sources in the province. The government is certainly aware of these concerns, but it may be a while before we see significant shifts in the market structure. •



## INTERVIEW WITH

# Guy Drouin

PRESIDENT  
BIOTHERMICA

**Biothermica is also involved in gathering financing for biogas projects. In the company's experience, what are the keys to success in this area?**

One of Biothermica's most important features is its full coverage of the value chain. We have departments for R&D, engineering, construction, business development and financing. The key to getting financing is to mitigate the greatest risks of the project. One aspect of this, and the first requirement of banks, is to have a good contract with the initial owner of the methane resource that includes strong guarantees against social and environmental liabilities. We won the bid for Gazmont, one of the first landfill gas power plants in Canada (and at 25MW, the second largest) because our project was well structured and low-risk.

**What are the difficulties in integrating the biogas sector into the rest of Québec's energy supply and how can those challenges be addressed?**

Biogas will never achieve the mainstream success of wind, for example, because it is not an infinite resource. How much biogas can be extracted is limited by the quantity and size of landfills. However, Hydro-Québec's RFPs are issued at good enough prices to make the sector profitable in Québec. Québec currently has an installed biogas project capacity of approximately 70 MW, of which Biothermica has 25 MW, and there is room for another 50 MW in the near future. To optimize the usage and efficiency of biogas plants, the new trend in the market is to use biogas in cogeneration instead of simple electricity production. In line with this, Biothermica is currently transforming its Gazmont power plant into a district heating plant.

**What can the Government of Québec do to better encourage biogas activity in the local market?**

At the moment there is a plan in Québec to put all of the organic content of waste streams through bio-digesters by 2020 in order to produce methane. The Ministry of Natural Resources has yet to clarify what will be done with the biogas coming out of that process. Gaz Metro recently tried to finance a project to clean the methane and use it as transportation fuel for trucks, but the Ministry did not allow it because such production-related activities are not in Gaz Metro's remit as a distribution company. These kinds of regulations need to be amended.

Secondly, the Ministry should ask Hydro-Québec's distribution arm to issue new RFPs to buy power coming from cogeneration plants utilizing biogas from small landfills or bio-digesters at a price that will incentivize more activity in the sector. It is strange that the government has allocated money to be put towards bio-digesters when the only way the gas output can currently be utilized is to flare it. That undermines the entire point of biogas as a source of clean energy. Ultimately, government programs have focused on financing infrastructure, but have not incentivized the market activities needed to make use of it.

**How have you exported the expertise you have built in Québec to overseas markets?**

One of the most interesting consequences of encouraging Independent Power Producers (IPPs) in Québec, despite the monopoly structure of the local market, has been the creation of an industry to export expertise abroad. In Biothermica's case, we have decided to participate by exporting our services or undertaking projects overseas

as an IPP. For example, in 1999, I began to develop such a project in El Salvador to take advantage of the benefits offered by the adoption of the Kyoto Protocol. We had the opportunity to undertake a project that brought two income streams: carbon credits and electricity production.

Using the experience we gained in financing projects in Montreal, Biothermica structured its El Salvador project in a very original way. We created a local subsidiary, BioEnergia, to be responsible for ownership and operation of the project. To insure against any political threats like indirect expropriation, we structured an insurance policy with the World Bank's Multilateral Investment Guarantee Agency (MIGA). This was the first time the World Bank had ever signed such an agreement with a company and project like ours. When the Conservative Party took power in Canada and decided to withdraw from the Kyoto Protocol, that was an unforeseen risk not covered by our insurance policy and we could no longer benefit from the sale of carbon credits as a Canadian company. We then made a deal with Luxembourg's Ministry of Finance to sell the carbon credits directly to them, considering Canada had not set up its national greenhouse gas registry. It was a very innovative, complex, and successful deal.

**What would be your final message?**

The development of sustainable projects in the fields of clean technology and renewable energy relies on strong and clear frameworks which provide certainty for innovation and investment. Cap and trade programs, renewable portfolio standards (RPS), feed-in-tariffs and tax incentives are among the measures that can stimulate such development. •

## INTERVIEW WITH

# Bertrand Blanchette

CO-PRESIDENT  
GROUPE BERLIE-FALCO

**Could you give us an overview of Berlie's business model?**

Berlie's business model is different from that of Falco's: although it invests in R&D aiming at adapting and improving its solutions according to its customers' requirements, Berlie is not a pure R&D company in the segment of valorization of organic waste into energy and other value added products. Instead of initiating its own technological innovation research program, Berlie is often looking out abroad for existing processes with proven effectiveness. When it comes to technological development in the energy sector, Europe is always five to 10 years ahead of the rest of the world: the EU's stringent environmental regulations and geophysical limitations make Europeans more innovation-oriented in this respect. We establish partnerships, we pursue technology transfer processes and ultimately, we get exclusive arrangements for some territories of the world for these solutions. For the last 15 to 20 years, Berlie has specialized in dewatering and drying technologies: we transform organic waste that is worthless, costly to dispose of and full of pathogens into energy and value-added products. Approximately 15 years ago, we began focusing on the treatment of sludge and, more recently, on the treatment of putrescible organic waste as well.

**The anaerobic digestion process is a relatively new field for Berlie. What prompted Berlie to shift its attention to this technology?**

Roughly two years ago, we realized that people also saw energetic value in bio-solids, which led to us the addition of anaerobic digestion technologies to our portfolio. The added value is that we can now offer both bio-solids and gaseous energy resources as a result of our sludge treatment. For the proprietary technology, we once again turned to Europe, where we partnered with Schwarting; currently, we hold an exclusive arrangement with them for the North-American market. In Québec, we are just starting on this front but the opportunity is here, given the C\$650 million subsidy program for composting and biogas plants. At the moment, Québec has only two projects in the realization phase, so there is plenty of room to grow. We believe 2014 will be a very active year for this segment, and we expect four or five major projects to take off during the year.

**How do you judge the level of governmental support that exists in Québec for organic waste treatment?**

Compared to other jurisdictions in North-America, Québec is doing very well in terms of governmental support: its goal of eliminating

organic waste going to landfills by 2020 is very ambitious and the fact that the province is part of the Western Climate Initiative are signs of its commitment to reducing greenhouse gas emissions. However, it is also necessary to provide the financial incentives to the private sector in order to get them on board with these initiatives. Québec does not yet have a feed-in-tariff or a mandatory minimum level of biogas in natural gas composition and these are measures that more mature jurisdictions, such as the ones in Europe, have implemented. The key is to find incentives that will be interesting for both the public and the private sector, and thus will make the business self-sustainable in the future. •

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## INTERVIEW WITH

# Richard Painchaud

PRESIDENT & CEO  
INNOVENTÉ

**What is Innoventé's main current focus and is standard biomass feedstock a feasible solution for your processes?**

Power production is our main focus. In Québec, the electricity-mix is relatively clean, but organic waste still has to be managed. With a power purchase agreement (PPA) in place, we can generate electricity and utilize the byproducts. There are two additional revenue streams on top of the sale of electricity: tipping fees from the organic waste that would normally be disposed of in landfills, plus value from the heat generated by the cogeneration plant. The electricity produced is fed into the grid. Going forward, this will be our "IPP model" for most projects in securing long-term contracts. When it is advantageous to do so, we can use standard biomass feedstock as part of the mix. For our first project at St. Patrice we will be using a 50/50 mix of bark and biocombustible from our biodrying process. The innovation of our biodrying technology separates us from other companies. The process patent for this technology was granted in Canada in 2011, in the USA in 2012; and there is currently a Patent Cooperation Treaty (PCT) application for the equipment. The power rating for our three plants will be: St. Patrice – 4.6 MW now operating at 12 cents/kilowatt hour, indexed annually; Trois-Rivières (commissioned for 2015) – 8.8 MW at 10.6 cents/kWh, indexed annually; and Matane (commissioned for 2015) – 7.2 MW at 10.6 cents/kWh, indexed annually; all contracts are for 25-year duration.

**Could you provide us with a more in-depth analysis of Innoventé's processes and operations by highlighting a particular case study?**

St. Patrice, which Innoventé owns entirely, is

now operational and it consists of a biodrying plant and a cogeneration plant we purchased second-hand from Newfoundland. Still under discussion with various partners is the greenhouse facility; we may build the greenhouse and another party operates it, or they build it and we sell the heat. The St. Patrice area has many farms and a surplus of manure that has detrimental effects on the environment. We will utilize excess manure from those farms, saving the farmers the cost of having to ship it to other regions. Also, we will receive at St. Patrice various other organic residues, produced within 50 km of the plant, including wastewater treatment sludge, food processing sludge and pulp and paper sludge. We will have five biodrying lines when construction is completed; the first line has been fully tested and commissioned. A typical biodrying line is 50 meters long, about three meters wide and four meters high; it has the capacity to dry 10,000 tonnes of wet organic waste annually, producing 6,000 tonnes of biocombustible. The mix of organic waste entering the biodrying process typically has 65% to 70% water-content, which is reduced over a seven-day cycle in the optimal conditions we create, as a result of the heat generated by microorganisms. A significant portion of the water from the drying process will be condensed in nitrogen-enriched water, which can be used as a fertilizer by farmers in the region. The provincial and federal governments (through Sustainable Development Technology Canada) have financially supported a \$7 million project for the successful development and full-scale demonstration of the biodrying process.

**Could you tell us more about Innoventé's strategic plan for scaling up its technology to other markets?**

Our plan is to realize our three existing projects first. Trois-Rivières is located in an area that has a long history with the pulp and paper industry, a byproduct of which is pulp and paper sludge. There are major stockpiles of this type of material in the area, an excellent feedstock for our biodrying facility. A single site has a stockpile of sufficient size to meet the needs of our plant for an estimated 10 years. Matane is a former cardboard mill: new biomass boilers had been fitted by the previous owners; our plan is to add a turbine and generator for producing electricity and use the byproduct heat in greenhouses. We have an objective of 15 plants by 2020 in our immediate markets in Québec, the Maritimes, Ontario and the Northeastern states of the USA. The US market in general has great potential, particularly with respect to the management of organic waste, albeit its shale gas has had an effect on electricity prices. For international markets, we consider partnering with local utilities or major equipment providers.

**What are Innoventé's hopes and expectations for the biomass and cogen sectors?**

We are hoping the provincial government will come forth with more feed-in-tariff programs focusing on all types of organic waste, an energy resource that is available and renewable. While there is always room for multiple approaches, Innoventé has a solution to organic waste that produces clean energy. The technology that Innoventé has developed enables a diversification in the usage of organic waste. Looking forward, there is no reason why there should not be a thousand of organic waste power plants globally, especially in emerging countries such as China, India and Brazil. •



## INTERVIEW WITH

# Philippe Gauthier

PRESIDENT & GENERAL MANAGER  
SHELL CANSOLV

The success of Shell Cansolv's business relies on its technology. Could you tell us more about your processes and about the advantages that derive from being based in Québec?

We have an excellent talent pool in Québec and the support for our research is outstanding here. We spend 15% of our yearly budget on R&D because if we stop innovating, we will fall behind. The technology is simple and effective: it involves a scrubbing process that selectively removes two components: CO<sub>2</sub> and SO<sub>2</sub>. The kit required for these operations is the same: the only difference between them is made by the solvent used in each case and we probably have the most efficient CO<sub>2</sub> solvent in the world. The big advantage that stems from our technology is that we can do this SO<sub>2</sub>/CO<sub>2</sub> capturing in a re-generable manner, with minimal use of water, fact which renders Shell Cansolv both effective and energy efficient, in comparison to other options on the market, such as throw-away technologies. Even though not all clients need it, we can capture up to 99.99% of all sulfur emissions – that makes us the leaders in ultra-high sulfur reduction. The main markets in which Shell Cansolv is active in are oil and gas, power, mining and smelting.

Given your global reach, what are the methods that Shell Cansolv adopts in order to protect its proprietary technology from being replicated elsewhere?

We have three layers of infringement protection across the world for our technology. The first is the legal, traditional one, which has relative effectiveness, depending on the market. The second layer stems from our experience and ability to deploy our technology in cost efficient and effective way, so it is more a matter of know-

how. Finally, the third factor has to do with the alliances we forge across the world: our strong local partners protect us very well in their markets.

Is there any further applicability to the captured CO<sub>2</sub> and SO<sub>2</sub>, which companies can then explore, and what is the role that Shell Cansolv plays in the implementation of the process itself?

The Cansolv technology works as a closed loop, where our solvents circulate through the equipment, selectively capturing SO<sub>2</sub>. Next, the solvent regenerates itself while releasing the SO<sub>2</sub> in its pure form. That creates a new revenue stream for companies, which can then deliver SO<sub>2</sub> byproduct to sulfuric acid plants. Shell Cansolv is a technology provider, so we do not build the physical plant for the client; we provide a blueprint of the process and then we assist the client and its execution team throughout its phases: design, build-up, start-up and operation.

What is the potential of the North American market for Shell Cansolv and what are the main projects that you are involved with in this part of the world?

The North-American market's potential is with the CO<sub>2</sub> market. In Canada, we are involved with SaskPower in building the world's largest CO<sub>2</sub> capture project for the power industry. Essentially, SaskPower had a coal-fired power plant, with two choices moving forward: the first was to retrofit it to operate on natural gas while the second was to make the existing one a clean coal plant by adding a capture unit to it. In 2011, SaskPower elected Cansolv to be its technology provider. It is a combined SO<sub>2</sub> and CO<sub>2</sub> plant, with a big focus on the CO<sub>2</sub> component, which will be recovered and

then sold to the oil and gas industry, thus generating an extra revenue stream.

Do you approach companies with a regulation-based value proposition or rather a commercial one, and what would you like to see improved in terms of support legislation for CO<sub>2</sub>/SO<sub>2</sub> capture?

In terms of regulation, what is lacking is a clear mechanism to reward entities that do CO<sub>2</sub> capture and the implementation of similar measures to those applied to renewables (subsidies, credits, etc.) would definitely help. Our goal however is to become a more mainstream player, to be recognized as a commercially viable technology provider. We do not want clients choosing us based on regulatory constraints, but rather based on economic considerations. We are already working on five projects that are commercially driven and a good example is the recently inaugurated CO<sub>2</sub> plant in South Africa that we have with Lanxess. Their chrome smelting facility was buying CO<sub>2</sub> from a third party, and so they were producing and buying CO<sub>2</sub> at the same time. After analyzing our technology, they decided to implement it in order to save money and become more efficient; we see great potential for this type of business in the future.

What are Shell Cansolv's goals moving forward?

We see ourselves confirming the leading position that we have in the power industry for CO<sub>2</sub> capture with the great projects we have today. Shell Cansolv commends the vision of open-minded entities such as SaskPower and we welcome any company that has the interest to look at our model to contact us, because we can make a difference for them. •

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# Vast Distances: Transmission, Distribution and Efficiency in Québec's Power Sector

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EHT worked with Hydro Québec to evaluate early versions of our products at their substation in Boucherville. After a year-long test period to determine our cabinet's durability against extreme weather conditions, Hydro Québec gave us very positive review. Several modifications later, we eventually ended up with a product that we could roll out onto the market worldwide... Of course there is a huge potential for EHT to service its home market with Hydro Québec being the primary customer in Québec. Other possible customers in Québec are industrial players like Rio Tinto Alcan, who have many substations for their facilities.

- Patrick Lalonge,  
PRESIDENT, EHT







# Transmission and Distribution

Operating an extensive network

Hydro-Québec's transmission and distribution arms, Hydro-Québec Transénergie and Hydro-Québec Distribution, operate the most extensive network in North America, covering 33,639 km of lines and 516 substations. To capitalize on the province's energy surplus, strong ties have been made with other Canadian provinces, as well as with the US: 17 interconnections exist between Québec and systems in Ontario, New Brunswick and the NE of the US, with a total export capacity of 7,994 MW. "Hydro-Québec's system of large-scale hydro reservoirs is the equivalent of a very large wholesale battery for the greater Northeast region. Now we are working on transmission projects to bring even more power to our export markets. One of these new projects will be a \$2 billion-plus, 1,000-MW mainly underwater direct current line down the Hudson River to Queens, NYC. Our other key initiative is a 1,200 MW high capacity

direct current line starting from the Eastern Townships area of Québec, and serving New Hampshire, Connecticut, and Massachusetts," said Thierry Vandal, CEO of Hydro-Québec.

The network's sheer size, alongside Québec's need to efficiently integrate its new wind energy supply, has brought smart grid technologies to the forefront of discussions in recent times. Hydro-Québec's IREQ research center is an organization renowned worldwide for its technological prowess. "We believe that the next five years will see tremendous developments in the electrical industry in Québec; Hydro-Québec has rooms full of PhDs, and a very strong engineering expertise that will play a big role in helping shape the future of the industry: self-healing systems will allow power to reroute and come back online automatically in case of an accident," said Angelo Gravina, vice president for Canada at S&C Electric, which acquired Omnion Power Engineering and Siemens' Power Quality division in the early 2000s.

"We made those investments thinking that one day, people were going to need solutions for renewable energy sources; now, we have our systems all over Canada and Québec, regulating wind farms voltages to smoothen out their output. Currently, we are already very advanced in smart grid and energy storage systems solutions," added Mike Studli, regional director at S&C Electric.

With over 35 years of experience in remote management and network automation, Vizimax is a Québécois company that resulted from the merger of SNEMO, an electrical product manufacturer and STR, a utilities engineering consulting firm. Jean-Guy Lacombe, CEO of Vizimax, discussed the company's collaboration with Hydro-Québec and the integration of renewables to the grid: "Our objective in the power industry is to move from master/slave architecture to client/server architecture where smart grid power will be distributed in the field. Smart Grid automation is a specialized market, there is no room for experimentation, and it requires specialized knowledge. When Hydro-Québec requires new technology or assistance in dealing with a problem, they look to Vizimax to work with their research center, IREQ, to find a solution. One of our recent projects helps five small wind parks to connect to the Hydro-Québec's grid without causing a noise disturbance, electricity tipping, and consequent power outages on the network. Québec will however see a lull in building new hydro generation projects. This is why Hydro-Québec is seeking to sell its expertise globally and secure new project streams for its engineers. Vizimax will follow that trend and look outward as well." •



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## Transmission System Overview

Source: Hydro-Québec

VOLTAGE	SUBSTATIONS (NUMBERS)	LINES (KM)
765 kV and 735 kV	38	11,422
±450 kV DC	2	1,218
315 kV	65	5,287
230 kV	53	3,188
161 kV	44	2,125
120 kV	218	6,926
> 69 kV or less	96	3,473
<b>Total</b>	<b>516</b>	<b>33,639</b>

## Québec's Transmission System

Source: Hydro-Québec







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## INTERVIEW WITH

# Jean-Guy Lacombe & Marc Lacroix

PRESIDENT AND CEO & VICE PRESIDENT OF BUSINESS DEVELOPMENT  
VIZIMAX



Can you give a brief overview of Vizimax and the services that the company has developed?

**JL:** Vizimax has been in business for 30 years, and is a fusion of two companies: electrical product manufacturer SNEMO and utilities engineering consulting firm STR. In 2008, we decided to address two markets: Smart Grid automation; and remote management. Our objective in the power industry is to move from master/slave architectures to client/server architectures where smart-grid-power will be distributed in the field. Historically, everything has been controlled from the central site, but this has become burdensome, so we want to carry out distribution automation and decentralized intelligence such as fault detection, isolation, and restoration (FDIR).

Thus far, Smart Grid automation is a specialized market actively dominated by five big companies: ABB Limited, Schneider Electric Corporation, Alstom, GE and Siemens. It is not a market for experimentation, and it requires specialized knowledge to deliver reliable and secure products.

What advantages does Vizimax have over the big five companies: ABB Limited, Schneider Electric Corporation, Alstom, GE and Siemens?

**JL:** Vizimax acquired SNEMO, a company that had a 30-year track record of successful work with Hydro-Québec. Now, every time Hydro-Québec requires new technology or assistance in dealing with a problem, they look to Vizimax to work with their research center, IREQ, to find a solution. Additionally, our affiliation with STR has given Vizimax access to the latest technology.

**ML:** Vizimax's advantage is that it can move from master/slave to the new client/server architecture whilst supporting the legacy

of standard design for electrical substation automation- a particular service offering that competitors currently lack.

What research and development projects is Vizimax working on at the moment?

**JL:** One of our recent projects helps five small wind parks to connect to the Hydro-Québec's grid without causing disturbances, electricity tipping, and consequent power outages on the network. We are working with Hydro-Québec in competition with two other vendors to achieve a solution, and Hydro-Québec will subsequently choose the best one. Vizimax is also involved in a further project in which Hydro-Québec has requested us and a competitor, Cooper Power Systems, to develop password/security solutions for grid protection.

What safeguards is Vizimax implementing to ensure that the grid can still function in case of issues with central connectivity?

**JL:** Vizimax has the technology to carry out local computing of grid intelligence distribution in case of internet failure. For example, in Brazil, Vizimax works on an installation of three GSM wireless modems, and three back-ups with different wireless providers. At 6 p.m. the chances of a call going through are 40% due to usage surges and network congestion. This reduces the ability of communicating with and operating the central site. Vizimax has the solution of a hybrid between the central site and the distributor; it can carry out the action, and then at 8 p.m. report to the central site to confirm its action.

What is the outlook, predictions, and targets for Vizimax in the energy sector in Québec and internationally over the next two to three years?

**JL:** Looking forward, it is likely that Vizimax's role in the power market will move from preventive maintenance to predictive maintenance. This is the reason why one of our product lines is focused on monitoring tools to enable our customers to ascertain the problem and its historic cause.

**ML:** We will want to pursue more substation automation, and to work with partners to offer a full-scale solution for utilities. Currently, 50% of our sales are outside Québec. Internationally, there are many opportunities for the company, and our product offering fits perfectly with their requirements. Vizimax will also investigate new international markets, particularly the BRIICS countries. With the evolution of the market, Vizimax continues to make sure its equipment is compliant to all market specifications.

**JL:** Regarding our home market, I predict that Québec will see a lull in building new hydro generation projects. This is why Hydro-Québec is seeking to re-establish Hydro-Québec International to sell its expertise globally and secure new project streams for its engineers. Vizimax will follow that trend and look outward as well. •

## INTERVIEW WITH

# Peter Brouwer

VICE PRESIDENT EASTERN CANADA  
AGGREKO



Aggreko is celebrating its 50th anniversary in 2013. Could you provide us with a brief history of your company's activity in Canada, and its most important milestones over the past few years?

Aggreko has been in North America since the 1980s, and in Canada, since the early 1990s. We have been pursuing the Québec market in various ways, either through agents or by going after customers directly. The past three to five years have seen Aggreko expanding significantly across Canada, with a particular focus on Western Canada, where we have become a market leader in providing temporary power and temperature control solutions. Now, we are shifting our attention to Eastern Canada, where we see tremendous potential for our solutions, given the utility projects and the natural resource investments presently going on.

What is the strategic importance that Québec has for Aggreko and which are the main market opportunities that you see for your business in the province?

Québec is tremendously important for Aggreko and proof of that is the recent service personnel mobilization that we have deployed in the province. We can assist the refining sector in Québec with our dedicated engineering department, called Aggreko Process Services, an engineering team within Aggreko that designs solutions to help improve operations and address environmental concerns of customers. We help refineries overcome fallbacks in their systems and reduce operating costs by leveraging our customized temporary power and cooling solutions. Another key market segment we assist is mining, as we have worldwide experience providing solutions in harsh weather conditions and

we are acutely aware of the need for fast and reliable utility for miners in remote locations. We have invested significantly in research and development for our power and temperature control solutions specifically engineered for miners. Mining is also contributing to the development of massive infrastructure work in northern Québec, where we can provide for the most basic of temporary utility needs. Additionally, the circuit of events in Québec provides exciting opportunities, such as the F1 Grand Prix in Montreal, with which we were involved in the past.

What are the preventive maintenance measures that Aggreko puts in place to assure the good performance of its generators?

Aggreko has field technicians located throughout Eastern Canada and we provide customers with the option of having Aggreko operate and maintain their generators and temporary power plants. Our preventative maintenance programs are very strong, and serve to enhance our already high, reliability rates. To further improve client support, we are using the Aggreko Remote Monitoring solutions to detect potential issues, such as low fuel or changing load requirements. Real-time monitoring by a dedicated technical team from our Remote Operations Center quickly troubleshoots issues to maximize uptime, a critical element for remote communities.

The past 10 years have seen the wind energy sector becoming an important element in Québec's energetic landscape. How has Aggreko acted to leverage this relatively new development?

Aggreko provides off-grid commissioning for IPPs that develop wind farms: in Québec we collaborated with Northland

Power on one such project. The execution occurred in the middle of winter so the inherent challenges with that were extreme weather conditions but again, going back to our global expertise, we were able to tackle them well. We managed to deliver the project on time and on budget, and most importantly, in a safe manner. We see good future potential for this part of our business in Québec, given the government's openness to renewable energy sources.

What does the midterm future look like for Aggreko in Québec?

We see the temporary power market growing across Eastern Canada and we are implementing the necessary measures to leverage this by deploying more local resources and thus improving our response times. Québec's grid is aging, especially in the urban areas, so there is a need for reliable emergency backup power, which can help reduce the blackout period for Hydro-Québec customers; Aggreko sees good potential in this market segment. We are expanding and opening service centers across Québec and we benefit from one of the newest fleets in the province. Moreover, in the case of emergencies, we can easily mobilize additional equipment that is already CSA-approved from the US. Although Aggreko is a global company, we want to be there for our customers, on the local level, and give them the support they need to power their projects. •



## INTERVIEW WITH

# Etienne Veilleux

FOUNDER, PRESIDENT & CEO  
DISTECH CONTROLS

Could you provide us with a brief introduction to Distech Controls and how the company emerged internationally from its home base here, in Québec?

Distech Controls was originally founded as a system integrator service business, but soon after, between 1997 and 2000, we felt there was an important market opportunity and started to develop our own technologies, based on feedback from clients and our experience installing the products available on the market. We started our international expansion in 2001 in the US, where we grew a loyal customer base by 2004. We then started getting involved in some overseas markets such as Asia (Singapore, Japan), the Middle East and Europe as well, being pulled there by some of our existent customers. Distech Controls acted opportunistically in those markets, taking advantage of the demand for new facility management solutions. It was a matter of recognizing the opportunities for our products and solutions worldwide, and having the courage to go there and putting the right people in place to promote our products. Nowadays, Distech Controls targets the full spectrum of commercial and institutional buildings: from small sized facilities to malls and from university campuses to high rises such as office towers.

Distech Controls prides itself with its spirit of innovation and unique products for energy management. Could you tell us more about how these values became essential to the company and about your current innovation focus?

Distech Controls is born from recognizing an opportunity in the market and delivering products that are different than what was then available. Distech Controls was

one of the first Canadian companies to embrace open systems and standards. This was a major development in 2001 and 2002, when most of the systems were proprietary. Distech Controls pushed the implementation of open standards further, by standardizing our technology solution on recognized open protocols not only for the products themselves, but also by embracing “open” business practices. As an example, we made our programming software freely available, to all end user clients. Combining open technologies with an open business model, clients could optimize and improve their processes, select best of breed products, only limited by their needs, and this changed the way business was done at the time.

Distech Controls has always integrated innovation in our product development, be it through leading hardware design, or developing tools and embedded features to reduce overall install costs. This innovation is what allows us to deliver great value to end users and continue to develop markets worldwide. Innovation is a constant process, supported every year with new product releases and this innovative spirit is something that we pride ourselves with as a differentiator from the other companies in the market. As an example, in 2008, we were the first in North America to introduce the wireless battery option for our devices.

A strong trend we are witnessing now is related to IP-based devices. There is a merging or heightened integration of all building technologies, providing increased convenience to users but also increased energy efficiency and cost savings. Distech Controls will be addressing this new trend, using our own approach of course!

From Distech Controls’ experience in working with clients, what are the key lessons to be learnt by the market when it comes to energy management and what are the aspects end-users pay most attention to?

Although Québec is known for its lower energy costs, this in no way impacts our business or our product development. Building owners worldwide want comfort, energy efficiency and to reduce the carbon footprint of their buildings – they seek out the best technologies that can help them achieve these goals: that is where Distech Controls comes into play. People seek freedom when it comes to technology and do not want to be tied in with one supplier or another. They need the proper information at the right time, from wherever they are located in the world. Open systems, web-based solutions offered by Distech Controls meet these requirements.

Our entire company is “global focused”, including our R&D and Product Development departments. In our Lyon office, France, we have a team of 55 employees, out of which 20% are directly involved in product development. This globalization of activities and thinking, means that we develop technologies taking into account the needs and requirements from around the world, so that we can offer an array of comprehensive solutions that are sought by building owners worldwide.

Distech Controls benefits from a global value-chain, with operation in Europe and sales office in Asia, Australia and the Middle East. In this context, what is the importance of Québec to your operations and what are the key differences between doing business here and in other international jurisdictions? The biggest value that Distech Controls sees

in Québec is the talented pool of engineers and developers here, which is nurtured by the array of highly ranked technical universities in Montreal. We can easily find talented expertise here and continue to foster innovation from our Québec office. All jurisdictions offer challenges for a global company. Our products and solutions must comply with local and regional regulations. One good example of that is France, where we have a physical presence: EU standards exist, but then there are also other national regulations that come into play as well. In terms of core technology, our products and solutions meet the needs of building owners' worldwide, however differences exist when it comes to the local certifications requested. We make sure to have those so that we increase the market's acceptance of our products.

**What are the key factors that will drive growth for building automation in the future and how is Distech Controls positioned to leverage that?**

The biggest factors of growth for the future of our segment are construction and government regulations. As more building occurs, the need for our solutions will obviously increase. Similarly, as government regulations for building efficiency become more stringent, Distech Controls will see more demand for highly efficient building automation and energy management solutions. With the emergence of mobile apps and with end-users gradually becoming more aware of energy saving methods, the future looks good for our line of business?

**Looking forward, what is the vision that you have for Distech Controls over the next few years and what is your final message to our readers?**

Our future is in building automation and energy management solutions and we plan on further improving the deployment of these systems in buildings. We want to introduce new technologies that will simplify the operation of existing systems. We have a strong network of roughly 400 partners that install and service our building automation and energy management solutions around the world and we want to further increase that in the future. Although Distech Controls is relatively new

in the industry, it can offer clients unique technologies and tools to cost effectively address their requirements for energy efficiency and comfort, delivering increased versatility. We want to continue our growth in the years to come and will continue to invest in innovation and development. •



□ □ □ **Your Energy Management Solution**  
to achieve over 30% energy and operational cost savings!

Let Distech Controls show you how our expertise, technology, and innovative solutions can make your buildings more comfortable, efficient, and sustainable.



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## INTERVIEW WITH

# Angelo Gravina & Mike Studli

VICE-PRESIDENT, CANADA BUSINESS UNIT & REGIONAL DIRECTOR  
S&C ELECTRIC CANADA

**What is the strategic importance of the Canadian and Québec market to S&C Electric?**

**AG:** In Canada, S&C Electric is celebrating its 60th anniversary in 2013, and Québec represents a big percentage of our Canadian business, it is very important. The backbone of that is represented by our strong relationship with Hydro-Québec - based on disclosure agreements, we even have them contribute with feedback in developing some of our own innovative products; they have rooms full of PhDs, who enjoy doing that. The renewable energy market developments, the smart grid solutions and the energy storage sector have been big breakthroughs in Canada over the last years. S&C Electric was visionary when it came to these aspects and in 1999 we acquired a company called Omnion Power Engineering, while in 2001 we purchased the Power Quality division from Siemens. We made these investments thinking that one day, people are going to need solutions for renewable energy sources; now, we have our systems all over Canada and Québec, regulating the voltage of wind farms to smoothen out their output. We were seven years ahead of the market; we are very proud of that.

**Which have been some of the major projects that S&C Electric has been involved with in Québec?**

**AG:** S&C Electric works with EDF on their wind farms in Québec, and our partnership extends to the Saint Robert Bellarmin, Massif du Sud and Lac Alfred projects. EDF contacted us directly to help them meet Hydro-Québec requirements. The same happened with Enercon, with whom we had been talking since 2004; at the time, it was all hypothetical scenarios but then

they actually came to Canada and we helped them fulfill local content requirements, and now we collaborate with them heavily throughout the country. Hydro-Québec has been our number one customer for years in Québec and we are very aware of their standards and regulations; we can help companies get adjusted to Québec's power climate by putting our contacts at their disposal.

**Could you tell us more about your collaboration with Hydro-Québec, the strictness of their requirements and the customization of products that you do for them?**

**MS:** Hydro-Québec's requirements are slightly more rigorous than in other places, but nothing out of the ordinary. Hydro-Québec has some of the best engineers out there and they know exactly what they want. There is a minimum three year process to put a new product into their system, and during that time, countless tests occur - S&C Electric likes that, because we are engineers as well, and we always want to improve our products; we love the challenge.

**AG:** Almost everything we do for Hydro-Québec is tailored. We first present them the product, and after detailed testing, during which several of its departments get involved, Hydro-Québec comes back to us with a list of elements that could be improved. The fact that we are an innovative, large-scale company, with our own production facilities enables us to meet these requirements and requests. For example, Hydro-Québec wanted us to come up with a remote solution for opening and closing our devices up on poles. We provided them with a functional product but then they started getting complaints from people in Montreal that the box was

too big; consequently, they assembled a team of university students to come up with ideas of what would make our product go unnoticed - the conclusion was to create a slim, round, version of the box that would be then painted the same color as the pole. Thus, the box would not be noticed anymore by the passing people. S&C Electric satisfied that request but that meant redesigning everything, and changing components. Now, we call that the Slimline M Series and we only sell it in Québec.

**What are some of S&C Electric's solutions to challenges such as diesel dependence for remote communities?**

**MS:** The power generation and transmission is very strong in Québec. The problems appear with the remote communities and mines in the north, which run off diesel generation. S&C Electric has a solution for that, a battery energy storage system, integrated with renewables and diesel power, which we are already implementing in British Columbia. Up until now however, we were not able to bring it to Québec, since the renewable companies did not have the technology to support our product. That changed when Enercon proved they had a good enough platform for it, when their turbines, helped by blade heating devices, survived a very cold winter up north.

**AG:** Remote communities want to build farms because diesel is expensive, but the problem is that wind does not blow all the time. The philosophy is to integrate storage with renewables so that late at night, the batteries can charge and then be used during the day to smoothen out the unstable wind output. The payback would be huge because it is a lot cheaper and it is also good for the environment because no one is burning diesel. •



# Energy Efficiency

## Fighting against low costs

Québec's abundant power generation has made the province a continental leader in low-cost electricity. Recent Hydro-Québec studies show that the average electricity prices in Montreal for residential customers were 6.76 c/kWh, compared to 22.57 c/kWh in NYC, or 13.89 c/kWh in Calgary. Furthermore, for large power customers, Montreal prices were at the 4.76 c/kWh mark, whereas NYC and Toronto's costs were more than double that figure, at 11.55 c/kWh and 10.60 c/kWh, respectively. Stimulating efficiencies in this context was always going to be an uphill battle for Québec's energy efficiency players, which did receive however a helping hand from their government.

"The 1990s was a tough period for the energy efficiency market as power was relatively cheap. However, in 2000, the price of gas escalated, creating a new market for energy efficiency amongst schools, businesses, hospitals. During this period, Québec's Liberal government introduced new legislation that institutions should reduce their energy consumption by 15% and attached to this legislation were grants and rebates," explained André Rochette, founder of Ecosystem, a company specialized in HVAC (heating, ventilation and air-conditioning/cooling) management. Since its creation in 1993, Ecosystem expanded its reach to cities such as Toronto and NYC, while securing local landmark projects, such as Montréal Biodôme's energy optimization.

The market versatility of energy efficiency companies has allowed them however to offset some of the challenges of operating in Québec. A good example is offered by Opnor, a company that shifted its focus from the recession-struck paper industry to mining, in recent years. "Opnor's business model is to work with large energy-users on site to oversee power generation on the process-side. In Québec, Opnor's clients are large industrial players, which are charged the L tariff rate by Hydro-Québec. Opnor ensures

its customers optimize their power contract by installing electrical capacity to gap the missing consumption not being used by the customer; an exciting proposition for the customer, as this can reduce energy costs by half: in the mining industry, energy costs can be up to 30% of a project's capital expenditure. We also offer the facility to stabilize energy consumption; a combination of process control and energy management software. Our in-house developed energy mapping software identifies the largest user of power and ensures its consumption is being optimized," said Daniel Maltais, president of Opnor.

Heat recovery systems are also Sofame Technologies' specialization. Set up in 1984, the company developed innovative proprietary technologies, such as Percotherm, which recovers boiler residual heat and transfers it to cold water streams. John Gocek, CEO of Sofame Technologies, discussed the market's receptiveness: "Québec is at the forefront of heating efficiency due to its climate, and is well aware of the cost of bringing energy or fuel to an operation. It is not difficult to explain to our customers the benefits of recovering waste heat. The big trend today is with district integrated cogeneration plants, emitting waste heat at various temperatures; Sofame recovers almost 100% of waste heat, regardless of scale. A high-profile project for Sofame that received an ASHRAE journal award was at the Montréal Airport, where we achieved 97% boiler-room efficiency – now, the airport is being heated by waste heat from the boilers."

Initially founded as a systems' integration firm, Distech Controls is a Québec-grown energy management company which saw its international business take off in the early 2000s in markets such as Asia and Europe. Having been one of the first Canadian companies to adopt open systems and standards for energy control technology, Distech is now targeting the

full spectrum of commercial and institutional buildings: "In the early 2000s, Distech Controls came up with open technology and with open protocols not only for the products themselves, but also for the software, which was made available to all end users. Clients could optimize their processes without the help of a technician and this changed the way business was done at the time. Building owners want comfort, energy efficiency and to make their buildings greener: they seek freedom when it comes to technology and do not want to be tied in with one supplier or another," said Etienne Veilleux, founder and CEO, Distech Controls.

Looking ahead, regulations imposed on the construction market will strongly influence the regional business of energy efficiency players; nonetheless, competing in Québec's tough low-cost environment has enabled these companies to have the edge abroad. "The Québec-gained expertise made it easier for Ecosystem to enter jurisdictions with higher electricity prices and our strongest growth potential at the moment is in New York and Toronto. Québec's current low prices of electricity and gas, as well as the government's lack of direction on energy policies, dilute the desire to activate energy-efficient projects. We are hoping that the expertise built in Québec in this field will not be lost due to a lack of vision," noted Rochette. "The biggest factors of growth for the future of our segment are construction and government regulations; the future looks good for our line of business," added Veilleux. •

“If energy efficiency is treated as a virtue, or a “nice to have”, then meeting targets will be of no consequence, and success may be sacrificed for other imperatives. Good policy ensures that, one way or another, those responsible for meeting the target with verified, evaluated savings have a stake in the outcome. When private utilities are responsible for delivering the savings, this may mean bonuses (or penalties) that significantly impact return on investment. Where not for profits are responsible, there are other levers, including reporting results very publicly, and/or linking continued responsibility in the future, to achievement of near-term goals.”

- Philippe Dunsky  
President, Dunsky Energy Consulting



## INTERVIEW WITH

# Jean-Luc Monfort

GENERAL MANAGER  
BLUE SOLUTIONS CANADA

Could you provide us with an overview of the main milestones that helped shape Blue Solutions to become what it is today?

In 2007, the Bolloré Group, which already had a subsidiary called BatScap that was dealing with lithium batteries, acquired AVESTOR and alongside it, more than 500 patents in the field. The new company, named BatHiium, was given a pure research and development role, and the former 250 AVESTOR employees were cut down to only 50. Furthermore, the organization's business focus was shifted from the telecommunication market to the automotive one. Since the automotive industry's battery cycling habit is much more demanding than that of telecommunications, we changed the battery's cathode material from vanadium oxide to carbonated lithium iron phosphate to give it endurance; the new batteries had a capacity of 30 kWh. In parallel, BatScap was developing the interface of the BlueCar, a car that would be able to run on these systems, in collaboration with the famous Italian designing house, Pininfarina. The year 2013 is a landmark year for us, because we officially went public with 10% of our company's shares – on the 30th of October, we launched our IPO, under our new name, Blue Solutions.

What are the main differences between telecommunication and automotive destined batteries?

Automotive applications are much more demanding than stationary ones, where issues such as vibrations and open air aggressions do not exist. Our batteries have the highest energy density available at the moment. Nowadays, we have more than 2,000 of our BlueCar EV (electric vehicles) running on this technology in

Paris, under the Autolib' initiative, which is a car sharing program. A user-advantage of the program is the availability of dedicated parking spaces for EVs in the center of Paris, where spots are very hard to find. Autolib's success prompted the opening of marketing offices in Lyon and Bordeaux as well, and we have just completed an agreement in Indianapolis, with good future potential in Asia as well. We are trying to offer a complete solution and to that end, we are also engaged in developing solar storage garages that accumulate energy during the day, which can then be unloaded into the BlueCar at night, thus assuring smooth and continuous functioning of the machine. The entire process is 100% carbon-free: the energy production is based on renewables and the car emissions are zero. Furthermore, at 30 kWh, our batteries give the cars an autonomy range of around to 250 km, one of the best on the market at the moment.

What are the challenges and the applicability potential of programs like Autolib' in North America?

Given the limited range of most EVs on the market today, having a comprehensive network of charging stations is essential. France has 6,000 such stations, out of which Bolloré owns 4,500 and they are compatible with all types of EVs, irrespective of the manufacturer. Before introducing BlueCars to the North American markets, we have to homologate them here by performing various safety tests and adding features such as airbags. The advantages we have come down to the versatility of the battery. First of all, we operate a battery that has its own internal stabilized temperature that does not get affected by cold or hot climates.

Safety is the other key point: our LMP batteries can withstand temperatures till 200° Celsius, whereas lithium-ion ones already burn at 65°. Our concept was to develop the car around the battery and not the other way around; that was essential. We were the first to put the batteries under the seats, where they would give good weight balance to the car and would be safe from frontal or back accident shocks.

What are some of the other market segments that could benefit from Blue Solutions' technologies?

Our BlueCar program reached the 5 million km mark, and with CO2 caps getting tighter for car makers worldwide, our technology becomes a good alternative for them to lower their emissions. Beyond that however, we hope to have demonstrated the potential our LMP batteries have for larger applications. In parallel, we started developing stationary applications for residential houses, and these 5 kWh modules can be used in the cases of emergency supply needs or leveraged to make profit for owners during peak consumption times. Additionally, we are working on solar energy storage units, which vary in capacity from 15 kWh to 1 MWh.

Blue Solutions is looking into introducing solar garages, BlueBuses and BlueTrams to serve public transportation needs as well: agreements were already reached in places such as Abidjan, the Ivory Coast, and other African countries, where Bolloré has a very strong presence. Our BlueHouses will also be installed in Africa and used as 100% energy autonomous clinics for the general population. All these developments lead back to Québec, to the expertise here, which allowed us to design the batteries that are at the heart of this technology. •



INTERVIEW WITH

# John Gocek

PRESIDENT AND CEO  
SOFAME TECHNOLOGIES INC.

**Can you explain your company-vision statement that you wish to be the supplier of choice to environmentally-friendly water heating and power generation projects?**

Since Sofame has been engineering energy efficiency for almost thirty years, we are lucky to have over 330 installed projects. Condensing water heaters reduce fuel costs, reduce CO<sub>2</sub> and NO<sub>x</sub> emissions, and also create water from methane combustion. It is an environmental home run! Sofame just returned from Finland where we were nominated for a clean-tech prize by Ecotech Québec, which is a member of the Global Cleantech Cluster Association. The kind of impact Sofame can make is being strongly encouraged by several organizations taking climate change seriously, such as the P80 Group Foundation, Club de Madrid (organization of former world leaders), African Development Bank, and the Clinton Climate Initiative. We target industrial large-scale water-heating for plants producing tens of thousands and even hundreds of thousands of gallons of hot water per day; applications in food-processing would be for process, wash-down and sanitation water for a slaughterhouse for example. The big trend today is district integrated cogeneration plants, emitting waste heat at varying temperatures from 1,200° fahrenheit down to 330° fahrenheit; Sofame's direct contact technology recovers almost 100% of waste heat, regardless of scale. With cogeneration, turbine efficiency rises from 40% to 70%, and can reach 100%.

**Can you give examples of case studies from the Québec market where you have been able to add special value?**

The second largest unit we recently shipped in Canada went to the McGill University Health Center's 3,800 boiler horse power central plant, a prestigious project for Sofame and arguably, the largest construction site currently in Canada; Sofame's unit will recover 20% of the center's fuel bill. This project is on-going. University of Toronto's central plant is home to the largest Sofame Percotherm® shipped in Canada. A longstanding proven project in Québec for Sofame is Sacred Heart Hospital where, in 1992, we installed a Percotherm® 1200 HP unit and a large Percomax® water heater; the return-on-investment (ROI) through saving by Sofame's heat-recovery system received a U.S. ASHRAE Prize.

**What kind of R&D innovative solutions is Sofame working on for the future?**

A new product we are developing is the Percofrac™, a custom-designed mobile water heater using propane that will fit into a

truck for the fracking industry; it is a 99% efficient water heater producing water at 120 degrees F to maximum 140 degrees F. It will compete with the current systems of frackers burning oil or using propane. Our custom-designed water heater will deliver cost savings and give flexibility; we have three models designed, with two in production, and the range includes 10 million BTU/h, 20 million BTU/h, and 30 million BTU/h units. In Alberta, we already have orders for eight systems, plus strong interest from the three main gas fields in the United States, from China, Great Britain, and other locations where fracking is or will be carried out. •



## Energy Efficiency: The World's Largest Untapped Reserve



Sofame engineers systems to recover waste energy from industrial boilers and cogen systems. Sofame's products also help customers to significantly reduce greenhouse gas emissions at their source.

The benefits of Sofame's technologies are potentially immense in proportion to the global market place. Sofame's products increase energy efficiency from 65 per cent seasonal average to 95-99 per cent. Sofame's customers see savings on construction, maintenance and insurance, reductions in greenhouse gas emissions, and users can gain credit towards LEED certification and qualify for carbon credits.

**Sofame Technologies Inc.**

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# Energy Performance Contracting: An untapped tool to unleash energy efficiency potential

Pierre Langlois, President,  
Econoler



Worldwide, energy efficiency (EE) is still not well understood and, as a result, it is probably the most underused approach to optimizing the energy sector and reducing greenhouse gas (GHG) emissions. In addition, EE can bring end-users other kinds of specific added value, including:

- Lower operation cost and high return on investment
- Optimized equipment operation
- Installation of new and modern equipment (increased value)
- Improved competitiveness
- Higher comfort level
- “Green” image

Despite these potential benefits, not as many EE projects are being implemented as they should be. Energy performance contracting (EPC), as practiced by energy service companies (ESCOs), has been around for about 30 years and is an approach that can help address the lack of EE project implementation.

EPC can be defined as “A contractual arrangement between a beneficiary and

a service provider for implementation of an EE project, where the investments in that project are paid for on the basis of a contractually agreed level of EE improvement”. While this concept has gained a certain level of credibility regarding its use thanks to successfully implemented EPC projects, doubt about its true value still remains, perhaps due to a lack of understanding how it works or bad experiences in using it. Overall, it is a concept not so well understood and certainly underused around the world.

The following common difficulties related to EPC can be encountered in most countries: 1) the absence of institutional support; 2) a lack of favorable legal frameworks; 3) a lack of knowledge about the concept; and 4) limited access to adapted financing. These still constitute major barriers to the application of the concept. Nonetheless, ESCOs have been trying to offer attractive, win-win proposals to energy end-users for eliminating many of the traditional barriers facing EE projects by employing specialized skills to help end-users reduce operating costs without using their own capital. Although EPC has not met with success everywhere, many countries have had their share of success stories in applying this approach.

Even though EPC seems to provide energy consumers with “the best of all worlds” (namely, a no-risk proposal with guaranteed savings), ESCOs still have difficulty developing their EPC business. The same barriers found in countries, such as the UK, Canada and the US in the early 1980’s, are now found in many different countries, where the EPC approach could bring a lot of advantages in their market. One of the most common barriers still being encountered is the wrong perception that

many have about EPC by identifying it only as a kind of financial mechanism. Indeed, in most countries where the concept is being tentatively introduced, the “shared savings” model, which involves an ESCO financing the whole project and getting paid a share of the savings, is the only EPC model so far understood. Although it seems attractive, its application meets many difficulties, which are probably tied to the lack of an adapted legal framework to address the particularities of the model, the lack of the right kind of financing to the ESCOs or the inability to offer the EPC approach to clients who are not qualified as “credit worthy” by ESCOs. The use of more innovative schemes may boost wider use of EPC. For example, by using the well-known “guaranteed savings” approach, the end-user secures the financing itself and obtains a technical guarantee by the ESCO as long as the savings to be generated by the project over a certain number of years, may lead to a better use of EPC.

Although EPC offered by ESCOs is still an underused approach around the world (even in the OECD countries), its use in some countries has definitely gained scale and momentum. Indeed, there is now quite an impressive market in many countries, as shown by the following figures:

- **USA:** USD 6-7 billion/year (mainly the public sector)
- **Canada:** USD 0.5 billion/year (mainly the public sector)
- **Germany:** USD 3.9 billion/year (all sectors)
- **China:** USD 4.25 billion/year (mainly the private sector)
- **South Korea:** USD 150 active ESCOs (mainly the industrial sector)

As a final note, it is important to mention that one of the key aspects of EPC is the obligation to demonstrate energy savings generation. Energy savings are essentially the absence of energy consumption that could have happened if no EE project had been implemented. Since it is impossible to directly measure such savings, it is essential to use an adapted approach to demonstrate such savings. For this purpose, most ESCOs in the world now use the International Performance Measurement and Verification Protocol (IPMVP) developed by the Efficiency Valuation Organisation (EVO), an international NGO that promotes the best practices in the measurement and verification (M&V) of savings achieved by EE projects. Greater efforts should be made to raise awareness about EPC among market forces and ensure a better understanding of its approach and value, as well as to demonstrate its flexibility and capacity in using EE as one of the key solutions to energy and environmental challenges of the future. •

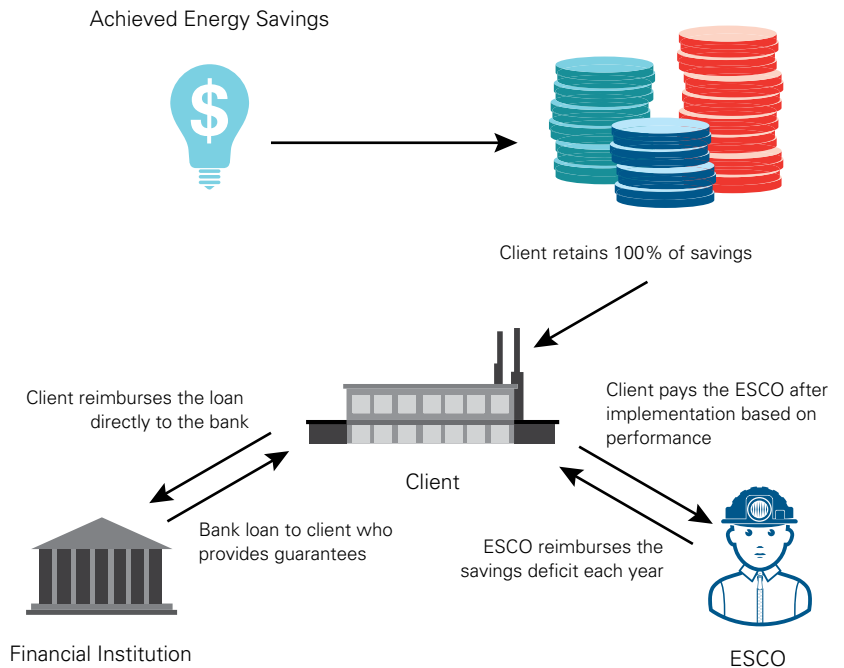
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**About the Author:** Pierre Langlois is one of the most recognized Canadian and international experts in the development and implementation of energy efficiency financial mechanisms, more specifically, in Energy Performance Contracting in industrialized and developing countries. He has also acquired solid experience in all sectors of energy policy development, demand-side management and project development for international financial institutions. Over his career, he has acted as member of the board of directors of several ESCOs worldwide and a different international organizations. He has worked in over 45 countries as part of mandates led or financed by major multilateral development, bilateral development organizations and several major electricity companies.

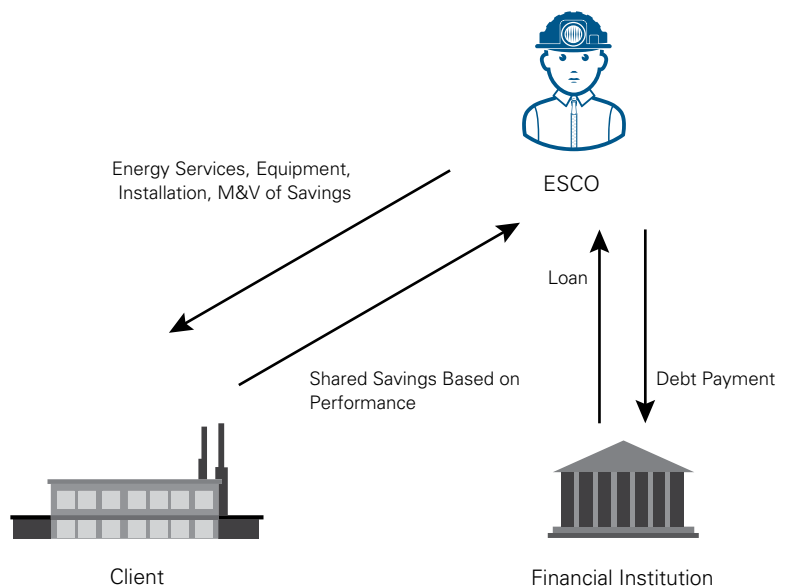
**About Econoler:** Econoler was established in 1981 by a subsidiary of Hydro-Québec (Nouveler) and ADS, a leading Canadian engineering firm at the time. It was the first energy services company (ESCO) in Canada and one of the first such enterprises in the world. Since then, Econoler's model has been to provide a broad range of comprehensive solutions to address the evolving barriers related to the EE market. Service offerings include the design, implementation, evaluation and financing of EE projects and programs in line with the national strategies or economic interests of its partners and clients. Its activities have included financing schemes, the use of EPC as an alternative approach to project implementation, energy savings measurement and verification (M&V), institutional program evaluation and many others. Econoler also develops and offers unique EE-related training services throughout Canada through its training arm, the Canadian Institute for Energy Training (CIET), which specializes in delivering world-class training and certification services in sustainable energy field.

### Guaranteed savings contract

Source: ECONOLER



### Shared-Savings Contract



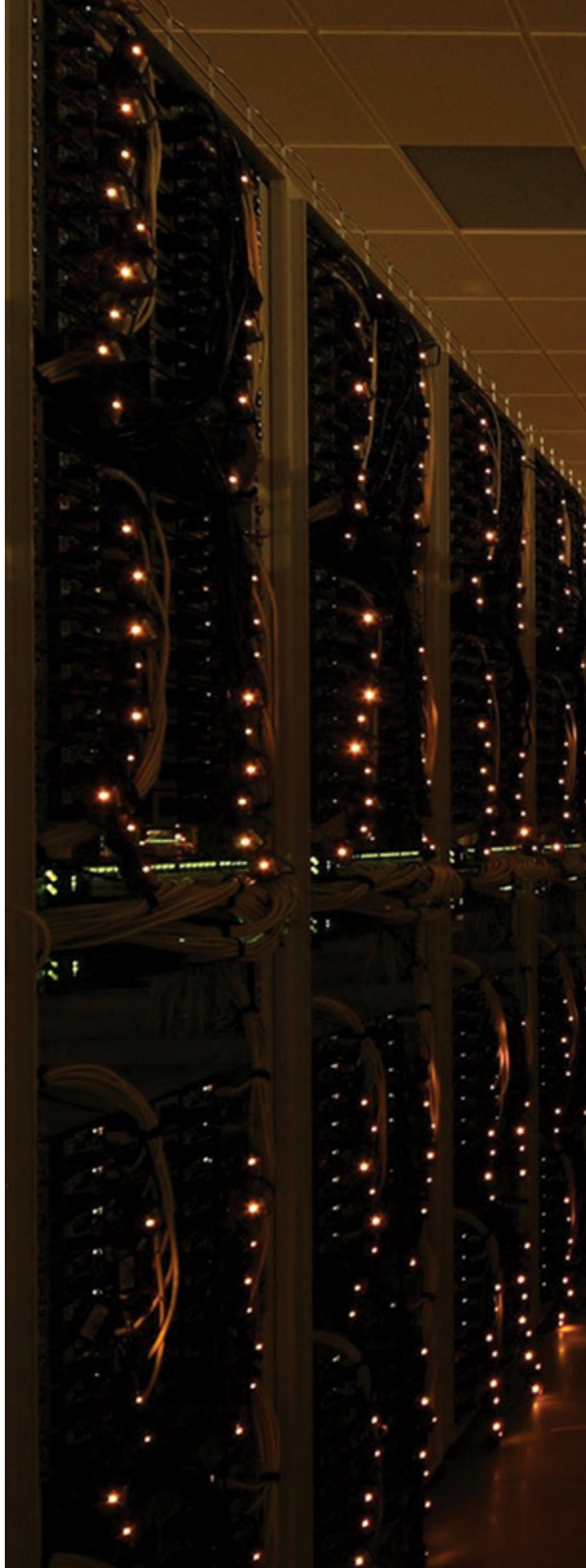
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# Data Centers: Making Use of Abundant Energy

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“Québec's energetic future will be determined by the solutions chosen to offset the excess electricity that we have at the moment. Establishing the province as a center of excellence for centers or building ties with NY and Boston are all viable alternatives, which are being discussed at the provincial level and by Hydro-Québec. For us, the long-term idea is to make wind power sources behave more and more like conventional ones and thus help them integrate better into the grid.”

- André Bourgault,  
SALES MANAGER - CANADA, RENEWABLE ENERGY,  
GE POWER AND WATER





# Data Hosting

A natural fitting environment

“We believe that a number of key factors combine to create very favourable conditions for Cummins Eastern Canada in this marketplace. As a member of the G8, Canada is a key supporter of free trade. Canada is firmly committed to security. And, Canada believes in and abides by the rule of law. Québec adds further incentives to data center owners/operators due to its relatively low electricity rates and a favourable (colder) climate. In the opinion of Cummins Eastern Canada, all of these attributes should motivate data center owners/operators to consider doing business in this part of the world”

- Benoit Parent,  
General Manager Power Generation Division, Cummins Eastern Canada

In June 2013, Swedish networking powerhouse Ericsson AB announced plans to build a new information technology center in Montreal, a project that will attract more than C\$1 billion in investments into Québec. Ericsson's data center is just one of the many facilities of its kind scheduled for commissioning in the province: with an excess of cheap, clean energy, Québec is quickly stepping up to become a jurisdiction of preference for this energy-intensive industry, which is projected to spend \$126 billion annually by 2015. Jeff Edward, vice president operation at Cogeco Data Services, explained the market's demand dynamics: “In this tough economic environment, companies started to analyze their overheads more closely and realized that the construction and maintenance of IT infrastructure is one of their major cost drivers; however, since this is only an auxiliary component of their activity, they are now increasingly outsourcing it to companies like ours so they can take a step back and focus on their core business.” Cogeco Data Services gained an important footprint in Québec through the acquisition of MTO Telecom in 2011 and now, the company is working on developing its new flagship project in Montreal.

“Québec is an ideal place for the placement of data centers. Firstly, cold climates offset the tremendous heating loads that the computers themselves have. Secondly, since data transfer is a key issue, Québec's excellent IT infrastructure places it ahead of other jurisdictions. Finally, since data centers deal with highly sensitive information, they must be located in geographically suitable environments, and Québec is just that,” said Benoit Parent, general manager for power generation, Cummins Eastern Canada. The company provides generator-sets for standby, prime power, and continuous applications, and has identified the data center business as being one of its prime targets in Québec. “Cummins Eastern Canada has been involved with data

center systems for some time and we benefit from having dedicated sales and service teams in Québec and an emergency rapid response team in Mississauga. We supply the generator sets, the switchgear and the various schemes that allow Tier III and Tier IV reliability standards for data centers. Since generators are often placed together in enclosed spaces, Cummins Eastern Canada offers fire proof modularization for its products. Consequently, we offset the risk of the entire system going offline due to an accident occurring with just one of the components,” described Parent.

Data centers are more energy-intensive today than ever and thus, power availability and costs are essential for their economic feasibility. “Data centers are notorious for consuming large amounts of energy so any low-cost environment automatically becomes very attractive for the industry. With its extremely competitive power prices and its energy surplus, Québec is the perfect market. We now see tremendous opportunities in this province, which is going to be our key target over the next years,” noted Vello Ehvert, president of Ehvert Mission Critical, a company that specializes in the engineering, procurement, construction, integration and support of data centers.

Meanwhile, Michel Chartier, president of Kelvin Emtech, a Québec home-grown company that operates in the same market segment as Ehvert Mission Critical, talked about the increasing technical requirements needed to run the facilities: “Data centers and telecommunications installations are using an increasing amount of power. A recent US report estimated that power usage by data centers and telecommunications account for 10% of the total global production of electricity. Ten years ago, we would have designed data centers with a total incoming capacity of 1 to 5 megawatts. We are now designing data centers with 25 kV of incoming medium voltage which is then distributed

between 5 MW and 15 MW of power required by potential data center customers; all of our clients require this capability. Furthermore, most customers will request an Uptime Institute Tier III topology.”

The sector has also benefited from a recent shift in the provincial government's policy towards it. As opposed to Scandinavian and US authorities, Québec's previous liberal government did not offer the tax breaks and the preferential electricity prices needed to attract the industry's heavyweights. The sector was deemed not sufficiently attractive from a job-creation perspective, a sensitive issue in Québec, which saw its employment rate grow only 0.8% in 2012. Now, Pauline Marois's administration has promised Hydro Québec's preferential L pricing rate for large power users and a 10 year corporate tax holiday for companies investing more than C\$300 million in data centers. Nonetheless, these measures were not the decisive factors for the private sector players' interest in Québec “The current incentive scheme's barrier-to-entry is too high, even for a project of our scale, of 100,000 square feet. However, there is a tremendous amount of IT infrastructure expertise in Québec, which also has a lot of pent-up demand for data center space: overall, we are very excited about this market's perspectives,” concluded Edward. •





## INTERVIEW WITH

# Michel Chartier

PRESIDENT  
KELVIN EMTECH

**What are the key aspects that you look for in terms of electricity and power components when auditing and assessing a site for a data center?**

One of the key aspects is power capacity. Ten years ago, we would have designed data centers with a total incoming capacity of 1 to 5 megawatts. We are now designing data centers with 25 kV of incoming medium voltage which is then distributed between 5 MW and 15 MW of power required by potential data center customers; all of our clients require this capability. Furthermore, apart from IBM's qualified internal requirements (usage of their own design criteria (?)), most customers will request an Uptime Institute Tier III topology. This option requires the usage of multiple concurrently maintainable generators as well as redundant cooling and uninterruptible power supplies (UPS).

**What are some of the important innovative methods you implement to optimize the power component?**

To optimize power efficiency we are moving towards medium voltage for both incoming and distribution power. We are frequently using medium voltage UPSs because of the amount of MW that can be carried (this can be as much as 5 MW to 6 MW at 415V). The medium voltage UPS also eliminates transformers. Our design strategy is aligned with European voltage designed at 240V/415V. In general, any server requires between 100V and 230V. By switching from data room voltage to medium voltage, means 5% less power required for a data center, lowering the PUE to 1.3 or 1.2.

**Can you give us some examples of case studies over the last two years where clients**

**have particularly benefited from Kelvin Emtech's expertise?**

A major project for the company was to design the first Tier III certified data center constructed in Buckingham, Québec; it was designed in a 2N system at 6.4 MW in a 2N configuration, using Piller's technology at medium voltage. However, changes have been made as we have had issues with ground fault directly on the powerline; we are now redesigning in order to directly isolate from the utility side. Using medium voltage and free cooling have given us a low PUE of 1.1 or 1.15. An advantage of using a medium voltage UPS is that it picks up the whole building, both electrically and mechanically; we worked closely on this project with Piller and with the electrical equipment providers. Another important project was in Montreal which involved using a crisscross design - three sets of systems, A, B and C. All servers today come with dual power supply, feeding one with A and B, one with B and C, one with C and A. The criss-cross configuration permits the same reliability of a 2N configuration with a 33% lower cost. As an example, for a 1 MW load, a 2N configuration will require the installation of two times a 1 MW system while the criss-cross will only require the installation of a 3500 kW system to reach the same result.

**What have been your biggest challenges when working with the utilities in Québec?**

There is a huge difference between working in Québec than in other Canadian provinces and the USA; Québec has a single power provider, albeit, by law we must be supplied the power we require. The average waiting time for a brand new connection for medium power voltage in Montreal can reach 183 days. The power provider

has a comprehensive knowledge and is competent; bureaucracy can sometimes interfere, and it is not always easy to secure additional power from Hydro-Québec. Québec follows the cities of Chicago and New York in terms of difficulty finding locations for building development for many Canadian and US companies.

**What recommendations would you put forward to make power optimization and efficiency better in the province?**

Power efficiency totally depends on the designer. Kelvin Emtech works hand in hand with Hydro-Québec in order to supply power to the client's site. Hydro produces a power surplus which could be used by data centers and with the Government they are both establishing strategies, to which we are taking part of, to attract major data center players. I believe 2014 will see a major growth in data center construction in Québec.

**Where do you see Kelvin Emtech in two years' time, and what is your outlook for the near term?**

Kelvin Emtech will still be building data centers, possibly some outside of Québec, but ideally would like to attract more business inside of Québec and Canada. The three huge data centers we are currently building will give us publicity and impact to promote Québec as a prime data center location. With a recent joint venture between COFELY Services and Kelvin Emtech and the creation of COFELY-KE, we now offer services to design, build, operate and maintain data centers. Our recent relationship with IBM also brought to the table many projects that we could not have turn in ourselves. We make a perfect team! •



## INTERVIEW WITH

# David Hotte

VICE-PRESIDENT, CONSULTING SERVICES, PUBLIC SECTOR UTILITY SOLUTIONS AND SERVICES  
CGI

**CGI is Canada's largest IT services company. Could you provide us with a brief overview of the company's history and its key achievements over the years?**

CGI is a Québec owned company, with more than 37 years' experience: during the last 30 years, CGI has been supporting Hydro-Québec with IT consulting services. In 2003, CGI acquired Cognicase Incorporated and its M3i system, which had Intellectual Properties (IPs) for outage management systems (OMS) and mobile workforces (MWFMS). CGI decided to build a group around the Utility IPs and align this with the IT consulting work it was carrying out with Gaz Métro and Hydro-Québec. CGI leveraged the IP expertise and subject-matter expert (SME) from the IPs to grow the business. From an initial number of 20 customers we now have more than 45 IP utility customers across North America using either the OMS or MWFMS solutions: our customer portfolio includes Exelon (electricity) and Oneok Incorporated (gas). Progressing through our acquisitions, CGI has developed an IP in the US called the Energy Efficiency solution, aligned to gather all programs and produce statistics on the performance of projects related to energy efficiencies objectives. This tool has led to six new customers in North America. CGI has also expanded its services to Canada's utilities, starting in Ontario, then progressing west and to the Atlantic Provinces. CGI's model is that of a service provider, but it does own many IPs, creating opportunities in different areas for projects in Canada, including: human resources, customer information systems (CIS) implementation with Oracle, and SAP implementation with enterprise resource planning (ERP) and supply chains. Coming back to Hydro-Québec, CGI also supports different sector

such as, energy trading in generation and grid load estimations for the transmission. Finally, for the corporate group, CGI carry out IT consulting services, such as SAP and also a successful major server consolidation project.

**As a Québec grown player, how important is the relationship with Hydro-Québec for CGI and what is the strategic relevance of utilities, generally speaking, for your business?**

The utilities are a key sector for CGI, accounting today with the Logica acquisition for approximately 8% of its business revenues. Within Québec, Hydro-Québec is a major player, albeit it is under pressure from the government for more returns and from a challenge market. The lower demands, due to the gas price, will probably affect its revenues. CGI has carried out many projects and especially on the Hydro-Québec Distribution Management System. A good example is the voltage control project development with IREQ, Hydro's Research Institute. No voltage control solution has reached the level of gain we have achieved with Hydro-Québec; 118 sub-stations have been automated with this voltage control system. We also have supported them with the implementation of 3,500 automated switches and reclosers; furthermore, we provided them with advance monitoring software and Outage Management, including Gateways with other systems (GIS, CIS, MDM, and SCADA). Utilities are looking to mirror Hydro-Québec's automated tools for permit deployment and switching plans. These types of tools have enabled Hydro-Québec to achieve a higher level of efficiency than most of its counterparts.

**What have been the main advantages associated with CGI being based in Québec, and have you been able to leverage the lessons learnt in the province abroad?**

With the IP coming from the Cognicase's M3i system and CGI's management frame work experience, we have been able to introduce two important IPs that are sold throughout North America (i.e. an outage management system and a mobile workforce dispatch covering waste water, electric, gas, cables and telecommunications). Our involvement and research work with Hydro-Québec can be applied to our IPs and delivers added value. CGI has received investment for its IPs from the province of Québec, adding functionalities to these and addressing market needs. To date, we have received encouraging feedbacks from the user-community; unlike 45 utilities in North America.

**Cyber security is one of the pressing matters on business' agendas nowadays. What are the related measures in place at CGI that deal with this issue?**

We have a group in Ottawa and one in the US (via the acquisition of Stanley Incorporated of Arlington, Virginia), that manage cyber security. With the addition of Logica, CGI is applying its Utility experience with cyber security to address the Utility security needs. CGI has carried out a risk analysis study supporting Hydro's corporate group. There are other important projects at Hydro-Québec coming from the North American Electric Reliability Corporation (NERC) audits where CGI can support from its Québec and Ottawa security expertise. Cyber security is an area we want to grow within the utilities, and we plan on achieving this through our global utility council. •



## INTERVIEW WITH

# Benoit Parent

GENERAL MANAGER, POWER GENERATION  
CUMMINS EASTERN CANADA

## Could you provide us with a brief introduction to Cummins Eastern Canada?

Cummins Eastern Canada is the exclusive distributor of Cummins and Cummins Power Generation products in the provinces of Ontario, Nova Scotia, New Brunswick, Newfoundland and Labrador, Québec and PEI (Prince Edward Island). Within the company, there are two divisions: one that supplies engines and one that deals with power generation. The power generation business offers generator sets for standby applications, prime power applications, continuous applications and data centers, but it also provides transfer switches, switchgear and complex monitoring systems. In Québec, the past few years have seen Cummins Eastern Canada get involved with some fairly large prime power projects in the mining industry, as well as with complex data center systems.

## What are some of the measures that Cummins Eastern Canada applies to ensure product reliability?

In Québec, we have service offices in Val-d'Or, Cadiac and Québec City, and these are further supported by our Mississauga, Ontario branch, which has both the personnel and the inventory capacity to give Québec operations a boost, in case of an emergency, if necessary. The CSA C282 standard prescribes generator performances regarding public lighting and, pursuant to this requirement, we perform very comprehensive tests for our products every six months. Furthermore, Cummins Power Generation offers remote monitoring feature, based on our Power Command Control™. This allows us to assess generator performances based on several key indicators, such as oil pressure and temperature; consequently, it permits

us to predict imminent failures, drastically improving our preventive maintenance capacity. None of this would be possible without our staff, however, which receives quality in-house training regularly.

## Québec is emerging as an increasingly viable destination for Data Center Systems. What are the main reasons behind this?

Cummins Eastern Canada has been involved with data center systems for some time and we benefit from having a sales and service team in Québec and an emergency rapid response team in Mississauga, both dedicated to this market segment. There are several reasons why Québec is an ideal place for the placement of data centers. Firstly, cold climates offset the very large heating loads that the computers themselves have. Secondly, since data transfer is a key issue, Québec's excellent IT infrastructure places it ahead of other jurisdictions. Finally, data centers, in that they deal with highly sensitive information must be located in geo-politically suitable environments, such as Québec. Cummins Eastern Canada supplies the generator sets, the switchgear and the various schemes that allow Tier III and Tier IV reliability standards for data centers. As listed by the data center industry's Uptime Institute, Tier III schemes have both redundant components ( $n + 1$ ) and multiple independent power and cooling distribution paths serving data processing equipment; however, only one path is active at a time. Tier IV schemes comprise multiple redundant components ( $2(n + 1)$ ) and multiple independent power and cooling distribution paths to all the supported data processing equipment. Additionally, since generators are often placed together in enclosed spaces, Cummins Eastern

Canada offers fire proof modularization for its products. Consequently, we offset the risk of the entire system going offline due to an accident occurring with just one of the components.

## New innovative technologies enable generator sets to now run on alternative fuel sources. What are the solutions that Cummins can provide in that respect?

Beyond our offering of natural gas engines, we also provide products that can run on landfill gas and digester gas. Essentially, we are taking gas from landfills, where it would simply be burnt, and using it in our products to make energy. Moreover, we further increase our resource efficiency by taking the residual heat coming out from the engine exhaust and using that to boil water or produce steam. Alternative gas engines are perfectly viable solutions, provided the gas is properly treated. Digester gas contains embedded siloxanes that can lead to a glassification of the pistons and ultimately to the malfunctioning of the engines. Cummins has been operating reliable digester gas engines in the UK for over eight years now. Proper gas treatment has been essential to this record.

## What is the importance that Québec holds for Cummins in the future?

Looking forward, Québec holds great potential for Cummins Eastern Canada, especially given the promising mining projects up north: these imply remote locations, with no power – that is where we can step in to offer prime power plants that can run for up to 20 years or limited prime power plants that sustain energy needs until the main electricity lines reach those locations. •

# Year of the Green Data Centers

Michel Chartier, President,  
Kelvin Emtech

Over the years, the power consumption of data centers have grown steadily to the point where now, a small data center consumes enough energy to power 50 homes during cold winter periods, close to 1,000 kW. A market survey we conducted indicates that this growth will generate the equivalent of six million square feet of facilities within the next three years in Canada alone! Considering a reasonable average of 100 W per square feet of power consumption for servers only, we get a total load of 600,000 kW. Adding the associated cooling requirements, this load surpasses 1,000,000 kW (or 1,000 MW). Considering that Quebec produces 40,000 MW of total power, in light of this predicted growth, it is natural to ask: Is it possible to save energy in a data center?

To effectively answer this question, we must first understand how this energy is distributed within a data center.

The energy consumption of data centers is divided into two broad categories: Servers and Cooling. In general, the energy required for servers represents two thirds of the overall power consumption, and the remaining one third is required for air conditioning.

## Energy-Saving Electricity

Except for the logical choice of purchasing servers certified by EnergyStar®, we have little control over what servers consume energy and their efficiency. However, some of the choices in electrical infrastructure equipment can improve the overall power consumption.

This is the case of the UPS (Uninterruptible Power Supply), which displays efficiency

between 94% and 97% with a load from 25% to 100% of the capacity of the device. Power devices in a computer room on a three-phase 240V/415V voltage as they do in Europe, without the internal transformer. A growing number of UPS system manufacturers are producing 240V/415V for the North American market. Servers are 10% more efficient at 240V than at 120V.

This alternative is particularly interesting when the input power of a data center is using medium voltage (13 to 25kV). It allows the designer to lower the voltage to any usable voltage. This eliminates a complete layer of transformers, lowering the over kWh of about 5%.

For existing facilities, a major source of electrical inefficiency is unquestionably the non-replacement and/or removal of old unused equipment, which are always connected! A good practice is to perform an annual inventory of equipment and to determine which can be switched off and removed from the room. An understandable energy saving strategy is to try not to consume energy when it is not required.

## Energy Savings in Mechanical Operations

Paradoxically, although mechanical operations consume only a third of the power required to operate a data center, this is where the largest energy savings can be found. In addition, certain measures can be applied to both existing and new computer rooms.

From this perspective, we consider the basic principles of CRAC or the concept of hot and cold aisles, keeping cold and hot air separated, sealing all openings in raised floor tiles (if there is a raised floor) to avoid any loss of cold air, installing “blank covers” where there are no servers, etc. These small improvements in a computer room can easily generate 1% to 2% of savings on air conditioning.

A higher stage to an existing room is cold (or hot) aisle containment to direct the cold and warm air to their respective destinations: the cold aisles for cold air to return back through cooling units through the hot aisles. This confinement methodology reduces power consumption for a fixed load and often allows for the addition of servers without the need to add a new cooling system.

When the room is brought up to the standards mentioned above, it is time to move to

the final stage, which is increasing the set point temperature in the cold-aisles. New trends and ASHRAE standards now mention operating temperatures in cold-aisles above 80°F. Naturally, this temperature change can only be done if the servers in place accept this temperature as the operational mode temperature.

In contrast, the largest savings can be found in the cooling method for data centers, commonly known as “free-cooling”. If we assume and accept an operating temperature of 80°F in cold-aisles, we could have free cooling for over 80% of the time in Montreal. Energy savings are significant, approximately 75% compared with the standard computer room design.

## A Few Words on PUE

Indeed, the PUE is the ratio of the total kWh over 12 months of the total Data Center on the IT loads kWh. In other words, if you spend 2,500,000 kWh annually for your entire data center load consuming 1,000,000 kWh, you have a PUE of 2.5.

The goal is to get the closest to a PUE of 1 possible. The average PUE for a Data Center on operation today is between 2 and 3. The best in class (Google, Yahoo or Facebook) have a PUE of 1.1. The best in class in the real world (Bell, CGI, IBM) have a PUE of 1.2 to 1.5. The PUE measurement is aimed to improve the efficiency of installations, and not the measure of energy efficiency.

To conclude, any energy begins with an analysis of not only your needs but also of your computer room and existing electro-mechanical installations in order to identify potential sources of savings. However, it is important that savings do not reduce the reliability and robustness of your facilities and your customer service. •

**About the Author:** Michel Chartier is Quebec's leading consultant for the design of Mission Critical Centers. He was the first Engineer in Quebec to receive Uptime's Institute accredited Tier Designer certification.



## INTERVIEW WITH

# Jeff Edward

VICE PRESIDENT OPERATIONS  
COGECO DATA SERVICES (CDS)

**What have been some of the recent market dynamics for the data center industry, both from an operational and supply/demand perspective?**

Many businesses are realizing that since IT management is only an auxiliary component of their activity, they can outsource this operational component to companies like Cogeco Data Services. We can take away their worries regarding telecommunications, power, heating, cooling and redundancy so that they can take a step back and focus on their core business, regardless of the industry they are active within. There is a much more mature and informed customer base out there today: clients know what they need and they are prepared to approach the market with a specific set of demands regarding reliability and redundancy. Given this fact, what we have seen is that some of the data center industry's smaller providers have not been able to keep up with these requirements. There have been several acquisitions in the market and we expect this trend to continue.

**What makes Québec an attractive jurisdiction for data center hosting and what are the market perspectives for Cogeco Data Services in the province?**

Data centers consume a tremendous amount of power and that becomes one of the largest operational expenses during the lifetime of a facility. There are various ways to mitigate this aspect: as a provider, we look to install the most energy-efficient, green technologies out there. However, the other factor, which is the price of power, we cannot control. That is why we are very excited to work in Québec, alongside Hydro-Québec, which supplies energy at some of the most competitive prices in the world. In addition, we have strong roots

in Québec through our parent company – Cogeco Cable. And we are very excited about entering the data center market in Québec - this is a natural step in our ongoing evolution. MTO Telecom gave us a local fiber footprint equally extensive, if not even more wide-spread, than the one we have in Toronto. There is a lot of pent-up demand for data center space in Québec: here, we are not talking only about lease space but also about reliable, redundant space, Tier III and Tier IV quality facilities. Cogeco Data Services is carrier neutral, and we do not tie in our telecom needs exclusively in our centers. This flexibility and the existing market demand give us confidence in our future in Québec.

**When completed, Cogeco Data Services' Kirkland data center will be the company's flagship facility. What is the current status of the project?**

We are currently in the middle of an RFP to award the design build for our future flagship facility, in Kirkland, Montreal. We have roughly 100,000 square feet of gross space available, which will however be reduced during the installation and construction process. The magnitude and complexity of this project has prompted us to be very careful and thorough about its implementation and choosing the right partners. We have been very impressed with both the number and the quality of local businesses that can aid us in completing this project – we have received a lot of interest from the supply-side of the market. It is important to note that Cogeco Data Services also wants to make sure that, once ready, this facility will hit the ground running so we are already looking at the market, trying to identify future clients.

**Could you highlight some of the innovative solutions that Cogeco Data Services implemented for its projects?**

We wanted to be as energy efficient as possible for our current flagship facility in Barrie so we partnered with Schneider Canada to gain access to their Eco-Breeze platform. The Eco-Breeze leverages the almost year-round free cooling that we get in Barrie. It also provides an evaporative cooling solution for days where free cooling is not available while keeping power usage at low levels: as a result, we utilize refrigeration-based systems only a few days a year. One of the most innovative measures implemented was to combine the Eco-Breeze platform with a hot air containment system - both these technologies were leading edge at the time and putting them together was a premiere. CDS wants to be leading edge, not bleeding edge; we are interested in new technologies, provided that have proven effectiveness.

**What kind of governmental support is there in place in Québec to incentivize investments in the industry?**

The current incentive scheme has a C\$300 million barrier-to-entry; even a project of our scale, of 100,000 square feet, will not reach that minimum threshold. As they stand now, these incentives do not work for us. However, there are indirect benefits of us working in Québec: there is a tremendous amount of regional expertise in IT infrastructure, and we can incorporate that into the offering we will present to our clients. •



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**Eastern  
Canada**

# The Future of Québec's Regulatory Environment



"A possible reform could be to allow exportation of electricity, but the public may not support that policy because it assumes the creation of projects to generate electricity produced for non-Québec consumption. The current prohibitions severely restrict the market as the only purchaser of electricity is Hydro-Québec. Investors may not have the same confidence in another purchaser of power because it lacks the financial strength, long history and stability of Hydro-Québec. The Québec government has an energy policy in place but it is lacking more defined, long-term energy policies to insure a regular release of specific megawatt amounts as well as a process for the renewal of existing Power Purchase Agreements. These policies would ensure continued development and job security within the sector. However, looking forward, Hydro-Québec's presence in the energy market is unavoidable."

- Sylvie Bouvette, Partner and Regional Manager – Energy Group, Borden Ladner Gervais (BLG)

"Generally speaking, liberalization of Québec's energy market is highly unlikely and undesirable. However it would be a good idea to a certain extent for specific markets. For example, one innovative reform could be to allow mining companies operating up north, relying on generators and gasoline, to have wind turbines supplying their energy needs without being connected to the distribution network. Some liberalization can also help native communities in isolated regions access renewable energy. Currently, however, the regulations do not allow for this. More extreme liberalization, for example allowing wind companies to generate power solely for export and accrue all of the profits, would be deemed socially unacceptable even if there are economic advantages. This is the balance that Québec constantly aims to strike between revenue and social acceptability."

- Mylany David, Partner, Dentons Canada

"There is always room for improvement of any process, albeit the tender processes in Québec have been well structured and administered endorsed by the volume of investment in the wind farm sector. The challenge will be to maintain this momentum and the jobs created in the Gaspé. I have no issues with past call for tenders for wind farms; the current calls for tender are open for criticism as they have been divided into smaller units. This makes it harder to achieve the particular social goals important to Quebec while encouraging private investment in the wind farm sector."

- Ilan Dunsky, Partner and National Co-chair of the Infrastructure and Public-private Partnerships Practice Group, Heenan Blaikie

"From a macro perspective, the biggest challenge ahead is represented by the greenhouse gas (GHG) emissions related to hydrocarbons, which we all depend on. Finding a way to change or modify our patterns of consumption of these hydrocarbons will be essential. In Québec, the majority of GHG emissions is produced by cars; that aside, the province's energy mix is very clean, as it is formed almost exclusively out of hydro and wind power plants, which emit virtually no GHG emissions during their life-cycle. Global warming should prompt us to continue developing these green sources of energy, not only to replace hydrocarbon-based plants in Canada, but also to supply the entire North-American market with clean power. However, the first step towards that is to quickly establish a clear energy efficiency policy, because all energy projects, irrespective of their type, have an impact on the environment and consequently, on societies and ecosystems."

- Vincent Clement, President, Biofilia



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**THANK YOU** .....

GBR would like to extend our thanks to the following organisations for the assistance provided during the research of this publication:

**L'Association de l'industrie électrique du Québec (AIEQ)**  
[aieq.net](http://aieq.net)

**The Québec Association for the Production of Renewable Energy (AQPER)**  
[aqper.com](http://aqper.com)

**Écotech Québec**  
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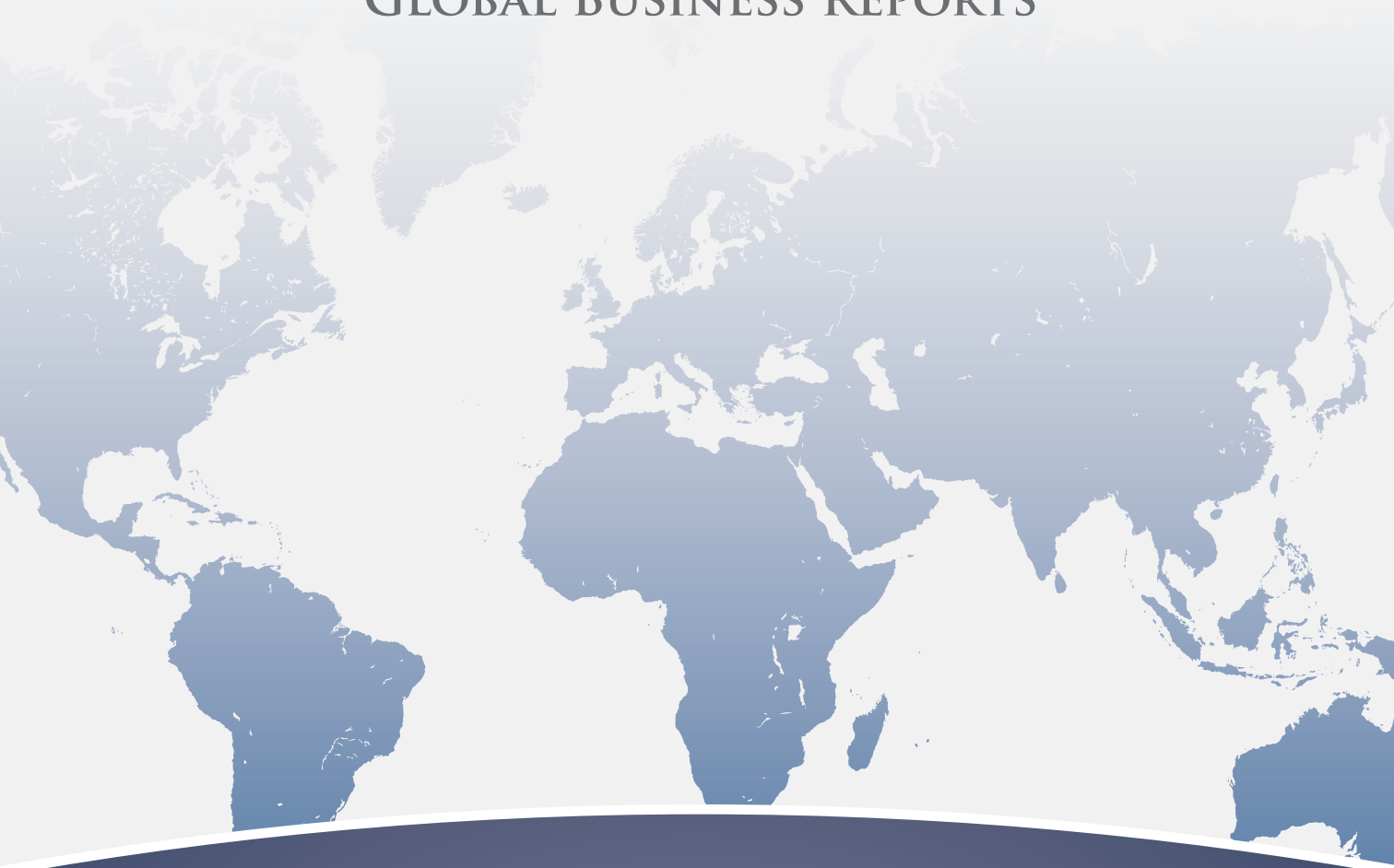
**Québec Wind Energy Cluster**  
[www.eolien.qc.ca](http://www.eolien.qc.ca)

**TechnoCentre éolien**  
[www.eolien.ca](http://www.eolien.ca)

We would also like to express our sincere gratitude to all the companies, associations and individuals who took the time to provide their insights into the market, with a particular mention to Paul Miron of First Canadian Title and Pierre Langlois of Econoler for their contributions of expert opinion articles to this publication.



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