CANADA

ELECTRICITY AND HEATING

Canada, the long road towards decarbonisation of the electricity mix

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Canada, the long road towards decarbonisation of the electricity mix

Canada needs to achieve total decarbonisation of its electricity production by 2050 if it is to achieve its climate commitments. Fossil fuel power stations emitted 79 megatonnes of CO_2eq (carbon dioxide equivalent) in 2015, which represents 10.9% of the 722 Mt of total GHG emissions in Canada[1]. Yet this country is the second producer of hydroelectricity in the world, after China and at the same level as Brazil. Canada's hydroelectric reservoirs can provide balancing services to enable wind and solar power to be better integrated into the electric power grid. Geothermal energy and biomass also offer significant potential for both electricity and heat production. The new renewable energies also facilitate the gradual decentralisation of Canadian electricity systems, offering new opportunities for both public and private businesses and for community initiatives.

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1 - Environnement et changements climatiques Canada (Environment and climate change in Canada), 2017

1 • THE GRADUAL DECARBONISATION OF THE ELECTRICITY MIX

Because of its geography and very severe climate, Canada is one of the countries with the highest energy consumption per person[2] on the planet. With 17 tCO_2/capita in 2017 (emissions due to energy), it is also one of the highest emitters per person, just below the United States and Australia and over twice the level of the EU (data from ENERDATA, 2018).

This sector is a leader in the decarbonisation efforts of the Canadian economy, in stark contrast to other sectors such as transport. After peaking between 2000 and 2002, CO_2 emissions due to public energy and heat production have shown a downward trend. **The decrease in electricity produced from coal and oil, along with the increase in hydroelectric and wind power, and to a lesser extent nuclear, explain the 31% decrease in emissions by the sector between 2007 and 2017 (Figure 1).** This movement has been strongly supported by Ontario, which completed the closure of its coal-fed power stations in 2014 (Division des inventaires et rapports sur les polluants du Canada [Division of inventories and reports on pollutants in Canada], 2018). The 2.6% increase in 2017 is accounted for by a steep increase in electricity consumption (7%)[3] and by the accompanying increase in average production (7%) of gas-fired power stations.

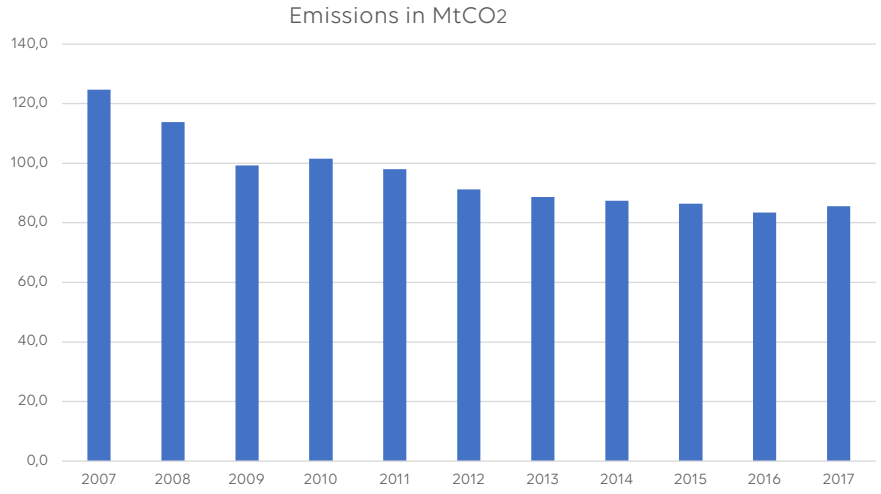

FIGURE 1. CO_2 EMISSIONS FROM THE PUBLIC PRODUCTION OF ELECTRICITY AND HEAT

Source : drawn up by the author using data from ENERDATA.

The declassification of old power stations and the addition of renewable capacity has taken the green energy share of electricity production in Canada from 63% in 2015 to 64.7% in 2017. Over the same period, the share of renewable energies other than hydroelectricity increased from 6.3% to 7.9%. This is explained by the surge in wind power from 26,060 GWh in 2015 to 35,995 GWh in 2017, and to a lesser extent by solar power which went from 2,900 GWh to 4,430 GWh. Electricity produced from coal has decreased (from 65,943 GWh to 63,706 GWh) whereas that produced from gas has increased (from 56,408 GWh to 62,763 GWh) and oil-based electricity has remained stable. **Hydroelectricity clearly remains the principal source with 349,664 GWh in 2015 and 37,164 GWh in 2017 whereas nuclear has shown a slight decrease from 101,423 GWh in 2015 to 99,343 GWh in 2017.**

2 - In 2017, energy consumption was 7.84 toe/capita and electricity consumption was 15.6 MWh/capita, among the highest levels in the world.
3 - The reasons for this rise are not yet fully established but are likely to be linked to the increased pace of economic growth, which reached 3% in 2017, as well as to climate change factors.

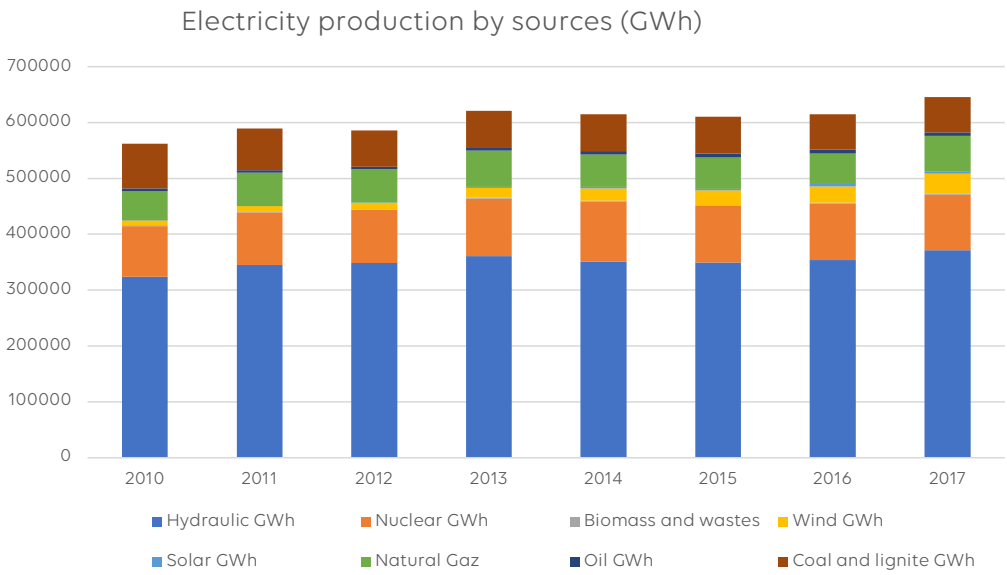

FIGURE 2. EVOLUTION OF THE CANADIAN ELECTRICITY MIX

Source : drawn up by the author using data from ENERDATA

This evolution in the energy mix allows us to position the carbon intensity of public energy production in Canada (CO_2 emissions per kWh produced) well below the world average (Figure 3). Radical decarbonisation suggests that a carbon intensity close to zero could rapidly be reached, at the same time as electricity use becomes widespread in other high carbon sectors such as transport.

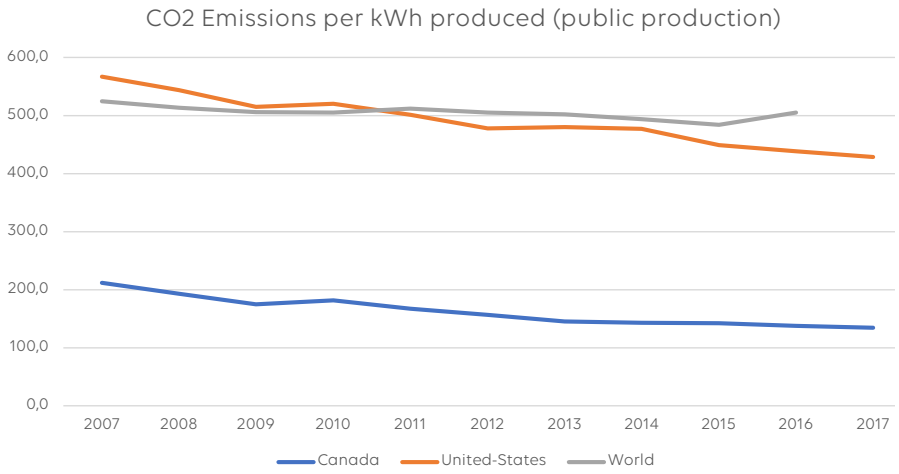

FIGURE 3. CARBON INTENSITY OF THE ELECTRICITY MIX

Source : drawn up by the author using data from ENERDATA

2 • FEDERAL POLICIES ARE QUITE AMBITIOUS YET NOT YET SUFFICIENT

According to the terms of the Paris Agreement, Canada has committed to reducing its GHG emissions to 30% below 2005 levels by 2030, a target equivalent to 523 $MtCO_2eq$ per year, that is, a decrease of 28% compared to 2015, when the total GHG emissions in Canada were 722 Mt CO_2eq.

In 2016, Canada published the 'Pan-Canadian Framework on Clean Growth and Climate Change' whose central element is **a plan to impose a compulsory tariff on carbon, requiring all provinces and territories in Canada to set up either a capping and emissions trading system or a price-based system, such as a tax on carbon.** Compliance with the pricing systems proposed by the provinces and territories to meet the federal standard will be evaluated, so that they come into force in 2019.

A federal ceiling price of 20 CAN/tCO_2$eq (15 US/tCO_2$eq) will also come into force on 1 January 2019 for provinces that have not yet proposed a system or a satisfactory minimum value. This benchmark price will progressively increase up to 50 CAN/tCO_2$eq by 2022 (Climate Action Tracker, 2018).

Carbon tax and 'carbon dividend'

The federal carbon tax has been a subject of heated debate in Canada[4] , especially because of the uncertainties surrounding its impact on the economy and household incomes. On the other hand, this law on the pricing of GHG emissions obliges the federal government to transfer all revenue generated by this pricing to the province or territory from which it originates, in the form of payments to provincial governments or rather, as suggested by the federal government, directly to private individuals and businesses. This approach, consisting of taxing carbon and then transferring the tax directly to households in the form of 'dividends' is called a 'fee and dividend' or 'carbon dividend' and has become popular in the United States with associations such as the Citizens Climate Lobby and the Climate Leadership Council. A recent study shows that households could receive more money on average than they had paid via the tax (Sawyer, 2018), a fact which was not enough to persuade all the Canadian provinces. Ontario and Saskatchewan were strongly opposed to the federal government initiative and instigated legal action to challenge the federal government's legal authority to impose such a tax. However, four provinces had already put in place a system for carbon pricing – British Colombia and Alberta (carbon taxes) and Quebec and Ontario (emissions trading system).

TEXT BOX 1

The Pan-Canadian Framework also proposes supplementary measures to further reduce emissions across the whole of the economy while accelerating the pace of innovation and job creation. The Low Carbon Economy Fund (LCEF) makes available 2 billion Canadian dollars (1.34 billion Euros) to support implementation of the Framework in the territories. 70% of this Fund will help provinces and territories to reach the objectives they set in the Framework, and 30% is to help stakeholders in Canadian society (provinces and territories, local authorities, governments and local community organisations, businesses and NGOs) to devise and implement innovative projects. In addition, in the autumn of 2017, Canada co-founded the Powering Past Coal Alliance to accelerate the elimination of electricity produced from coal. In February 2018, the Minister of the Environment and Climate Change announced modifications to the existing rules, aimed at ending electricity produced from coal by 2030, together with a revision of the standards for electricity produced from natural gas (Environnement et Changements climatiques [Environment and Climate change] Canada, 2018).

Despite all this, Canada's commitment to the Paris Agreement is considered "highly inadequate" by NGOs and academics. "*Commitments with this rating fall outside the fair share and are not at all consistent with holding warming to below 2°C let alone with the Paris Agreement's stronger 1.5°C. If all government targets were in this range, warming would reach between 3°C and 4°C*" (Climate Action Tracker, 2018). **There is also a fundamental tension between Canada's climate objectives and its place in the hydrocarbon market:** "Implicit in the national discourse about the intersection of our historically resource-based economy and the challenge of decarbonisation is the message that Canadians do not have to make choices: we can decarbonise domestically while still benefiting from the global market for conventional and non-conventional fossil fuels. Extensive citizen

4 - See for example the following report : www.cbc.ca/news/canada/carbon-tax-canadians-cost-prices-1.4753664

dialogues as part of the Generation Energy process[5] , however, challenge the logic and wisdom of this assumption" (Burch, 2018).

Carbon pricing and the development of wind power

Several studies show that the considerable technical and economic potential of wind power in Canada could enable electricity production to be radically decarbonised more rapidly and at a lower cost (Dolter & Rivers, 2018; GE, 2016). Canada has several regions where the annual average wind speed at an altitude of 50 metres reaches 7 m/sec or more, including the plains of southern Alberta and Saskatchewan, southern Ontario and northern Quebec. Hydroelectric reservoirs can provide balancing services to enable wind and potentially solar power to be better integrated into the electric power grid. This potential may be supported by carbon pricing, and the authors estimate that a carbon price of 50 $/tonne of CO_2eq (planned for 2022) could reduce GHG emissions in the electricity sector by 20 to 21% in comparison with 2005. Nevertheless, if Canada wishes to substantially decarbonise the electricity sector by 2030, the price of carbon will have to continue increasing beyond 2022..

The optimal composition of electricity production in Canada changes as the price of carbon increases. Investment in energy from wind power offers an inexpensive way to reduce emissions and becomes increasingly attractive as the price of carbon increases (Fig. 4). At 200 $/tonne of CO_2eq, wind power makes up almost 30% of the optimal production mix. In scenarios of 100% decarbonisation, wind power represents 35% of production when electricity trading between provinces is possible and 33% when it is not. These levels of penetration by wind power are comparable to the 35% of production judged technically achievable by the GE study (2016).

The study also highlights the relevance of increasing energy exchange between the Canadian provinces (from east to west) to facilitate balancing the electricity system when faced with the variability of wind power

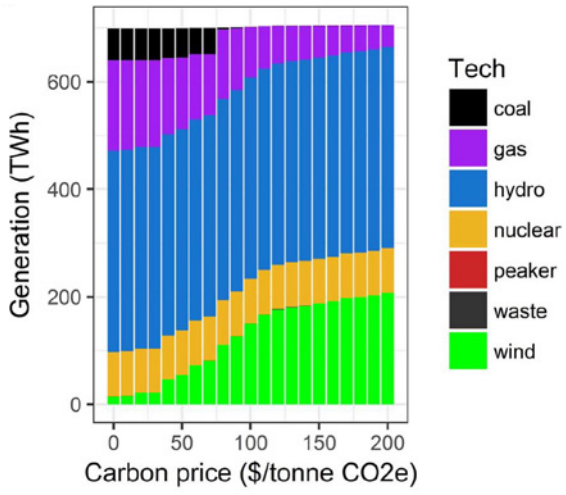

FIGURE 4. ANNUAL ELECTRICITY PRODUCTION IN CANADA IN THE CARBON PRICING SCENARIO

Source : Dolter et Rivers (2018)

TEXT BOX 2

3 • THE CENTRAL ROLE OF CANADIAN LOCAL AUTHORITIES

Hydroelectric power stations are a major source of energy for electricity production in Quebec, Newfoundland and Labrador, Manitoba and British Colombia. Provinces that depend on coal and natural gas include Saskatchewan, Nova Scotia, New Brunswick and Alberta. Geographically, each province where electricity is produced from fossil fuels is adjacent to a hydroelectric province. **Nevertheless, the existing transport structure only allows a limited number of east-west inter-province connections, which limits electricity trading between provinces and therefore the integration of renewable energy sources**. Figure 5 below shows the huge contrast in the energy mix of two adjacent provinces.

Canadian provinces have advanced skills in environmental matters and some have been very active in carbon pricing. British Colombia, Quebec, Ontario and Alberta introduced different

5 - Voir : www.nrcan.gc.ca

arrangements for carbon pricing. They also implemented various mechanisms to support the roll-out of clean energy for electricity production (see Text box 2)

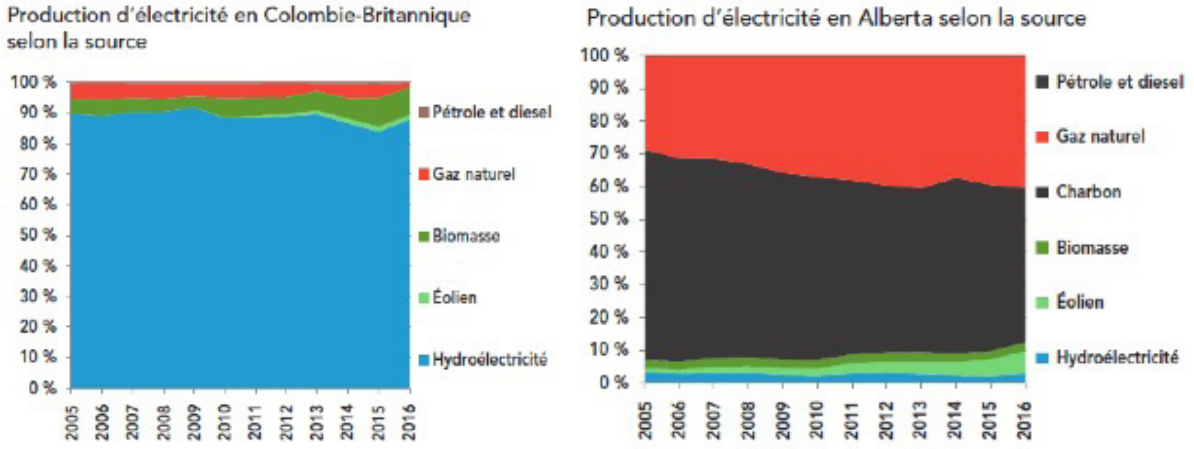

FIGURE 5. EVOLUTION OF THE ELECTRICITY MIX IN ALBERTA AND BRITISH COLOMBIA

Source : National Energy Board 2017

In addition, several Canadian cities such as Toronto, Vancouver, London, Edmonton and Windsor have set objectives and put in place actions for mitigation, in particular for the production of electricity (or electricity and heat) locally and from renewable energy sources.

The provinces in action

The 'First Annual Summary Report' of the 'Pan-Canadian Framework for Clean Growth and Climate Change' was published in December 2017. It highlights specific actions undertaken by the Canadian provinces during 2017.

• **Newfoundland and Labrador** continue working to complete the hydroelectric project at Muskrat Falls. When it is finished, 98% of the province's electricity will come from renewable sources. The surplus will be exported to Nova Scotia and elsewhere. The Holyrood Thermal Diesel Generating Station, which produces over a million tonnes of GHG emissions per year, will be declassified.

• **The North-West Territories** have installed 55 kilowatts of solar energy with an efficient variable-speed generator in the community of Aklavik, and are undertaking design works for large-scale wind turbines at Inuvik. They are also trialling the combined production of heat and electricity on a small scale from biomass at Fort Simpson to reduce diesel use in these far-flung indigenous communities which are off the grid.

• **Prince Edward Island** is one of the world leaders in the field of developing energy from wind power. Wind power energy meets twenty-four per cent of the energy requirements of Prince Edward Island and future expansion is planned by 2020 and 2030.

• **Alberta** has announced the Renewable Electricity Act and launched a renewable electricity programme aimed at creating a renewable energy production capacity of 5,000 megawatts by 2030. The province has also announced that 35 million dollars has been set aside for financing leadership initiatives in climate change, especially solar and renewable energy projects in the communities of the First Nations and the Métis Nation.

• **Quebec** has announced an action plan for its 2030 energy policy in which it commits to increasing its capacity for renewable energy production by 25%. This province also created Transition Energétique Québec (TEQ) (Quebec Energy Transition) to support, stimulate and promote energy transition, innovation and efficiency, and to finalise the implementation of all the programmes and measures necessary to reach its energy objectives.

Source : Pan-Canadian Framework for Clean Growth and Climate Change (2017).

TEXT BOX 3

In 2012, in partnership with Toronto Hydro, the capital city of Ontario launched the first phase of a programme that will enable buildings belonging to the city to be equipped with solar photovoltaic (PV) panels. The first phase of the feed-in tariffs was completed in June 2014 and the second phase in 2016, which led to the installation of 20 PV solar systems on the roofs of the city's buildings, with a total installed power of 2.5 MW. On an annual basis, phases 1 and 2 combined make it possible to reduce GHG emissions by approximately 147 tonnes and generate more than 3,300 megawatts (MWh) of electricity, which is equivalent to the energy consumption of around 280 households. In October 2016, Toronto began the third phase of the FIT programme, which will see the installation of over 40 PV solar systems for total installed power of 6.0 MW. These installations will produce approximately 7,800 MWh of electricity per year - the equivalent of the consumption of some 350 households - and will reduce GHG emissions by around 353 tonnes each year.

The city of Vancouver is internationally recognised as one of the most ecological cities on the planet. The capital of British Colombia has a long history of support for climate action, from the Clouds of Change reports in 1990 to the Community Action Plan for Climate Change in 2005 and the Greenest City 2020 Action Plan in 2011, and now the Renewable City Strategy and Plan. This plan, whose aim is to achieve a city with 100% of its energy supplied from renewable sources by 2050, targets buildings, transport and waste as well as cross-cutting opportunities, and also the reduction of energy consumption. The results of the plan's progress are published annually[6] . In addition, the city strongly opposed the expansion of the TransMountain oil pipeline between Edmonton and Burnaby, recently relaunched by the federal government. "*Vancouver's path to be the greenest city in the world started decades ago. Thanks to the passion of the people who choose to call Vancouver home, it will continue long after 2020*" (Greenest City 2020 Action Plan Part Two: 2015-2020).

Flexible nuclear reactors for New Brunswick - a sustainable choice?

The government of New Brunswick has signed an agreement with the American company Advanced Reactor Concepts which seeks to develop small flexible reactors in this province of eastern Canada. Thanks to the Point-Lepreau power station, nuclear power has played a significant role in the electricity production of New Brunswick since the 1980s. The provincial government strongly supports scientific research to develop small nuclear reactors which are seen by certain stakeholders as a decarbonisation solution but remain very much criticised by other stakeholders.

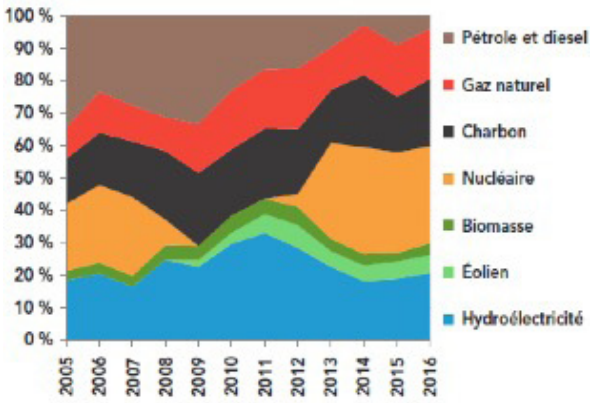

FIGURE 6. ELECTRICITY PRODUCTION IN NEW BRUNSWICK

Source: National Energy Board, 2017.

With a surface area of 72,908 km^2 and a population of 747,101 (2016), New Brunswick is one of the smallest provinces in Canada. In 2016, it produced its electricity from various sources and 29.9% of these were renewable. However, the continuing high percentage for coal (20.7%) largely explains the fact that the level of GHGs in electricity production, at 280 g of GHG per kWh, is double the Canadian average (National Energy Board, 2017).

Following the agreement with the provincial government, Advanced Reactor Concepts (ARC) announced an investment of 5 million dollars in R&D activities in New Brunswick and will open an office in Saint-Jean to develop reactors

6 - https ://vancouver.ca/files/cov/greenest-city-action-plan-implementation-update-2017-2018.pdf

with a capacity of 100 MW. This company is seeking to develop and market a sodium-cooled reactor of metal construction. It uses the technology of GE Hitachi Nuclear Energy. The company's reactor could be on the market from 2028. The provincial government will not invest finance in this specific project, but it recently announced financing of 10 million Canadian dollars for a nuclear research group formed by the New Brunswick Energy Solutions Corporation, a partner in the project[7] .

According to ARC, this new type of reactor has several advantages. One is that the modular components of the reactor may be transported as separate parts to an assembly site and rapidly brought into service. In addition, the reactor may be used for non-traditional purposes, such as in desalination plants for seawater and sites extracting shale gas. However, these new agreements in favour of nuclear have been the subject of fierce criticism from various NGOs and political groups, such as the Green Party of New Brunswick[8] . They stress the risk of accidents, the ever-present problem of radioactive waste, the non-renewable nature of these resources and the high cost.

TEXT BOX 4

4 • A HIGHLY CONCENTRATED INDUSTRY FACED WITH NEW INNOVATIVE BUSINESSES

The Canadian electricity sector is organised around provincial public companies. In fact, the provinces have constitutional jurisdiction over natural resources. The process to partially liberalise the markets in the 1990s modified certain industry parameters, for example the functional separation of electricity production, transport and distribution activities. Most provincial governments are still directly involved in the electricity market as managers of a more or less significant part of the electric power network.

A number of local authorities manage local distribution networks in their territory. Some municipally-owned companies, such as EPCOR in Edmonton, are major players in electricity production, under their corporate name or through their management of companies listed on the stock exchange.

Over recent years, the partial or total deregulation of wholesale electricity sales has created a number of independent producers, who build and manage electric power stations and sell their production over the long term - using contracts with a duration of up to 35 years - or on the electricity market, where such a market exists.

The principal companies in the sector are grouped together in the Canadian Electricity Association which has been in existence since 1891. This association publishes an annual report, Sustainable Electricity, which evaluates progress in the sector in matters of economic, social and environmental sustainability. Among the initiatives undertaken by businesses in the sector in 2016-2017, the following may be noted:

• **Capital Power is reducing coal consumption and CO_2 emissions thanks to renewable biomass.** The private company Capital Power is actively pursuing co-combustion of biomass (wood waste) with coal at its Genesee power station, located to the west of Edmonton. This is the first time a trial of this size has taken place in Canada, involving the co-combustion of woody biomass and coal in an electricity power station. Integrating biomass into the fuel mix at Genesee has the potential to reduce coal consumption to 30%.

7 - ICI.Radio-Canada.ca, 9/07/2018, Research into small nuclear reactors in New Brunswick.
8 - Acadienouvelle, 10/07/2017. Mini nuclear power stations: a 'mad adventure' to be avoided

• **Nova Scotia Power has focused on developing renewable energy over the last ten years.** Nova Scotia Power has tripled its production of renewable energy to 28% thanks to biomass and wind power, and has reduced its GHG emissions by over 30%. It is set to achieve a 58% reduction in emissions, compared to 2005 levels, by 2030, a performance that is almost twice the level of national objectives. A major reduction in GHG emissions is expected when Nova Scotia becomes linked by sea to the hydroelectric plant under construction at Muskrat Falls in Labrador.

• **Alectra and Enbala are working together on the management of smart electric mini-networks.** Alectra provides the advanced technology necessary to ensure the operational stability of electricity networks by managing the power of the energy distributed. Enbala's real-time energy balancing platform offers an extremely flexible approach to create energy resources that can be controlled and distributed via flexible loads, energy storage (including electric vehicles) and renewable energy sources. In 2013, Alectra set up a project for a pioneering micro-network in Vaughn, Ontario, to rise to the challenge of renewing the workforce on the large-scale electricity distribution networks and show that renewable energy can effectively meet the growing demand for electricity.

As far as the development of geothermics is concerned, Canada is lagging behind in respect of the enormous potential that exists for the production of heat and electricity, especially in the west of the country. Businesses in the sector and political representatives of the provinces of western Canada both[9] stress that the expertise and skills of the oil industry can be used to advance projects for geothermal power plants. Among the latest initiatives is that for a power plant near the town of Estevan headed by the company *DEEP Earth Energy Production* which had carried out several conclusive tests since 2014. It plans to sink the first wells from June 2018. In the area of Estevan, Saskatchewan has aquifers on which DEEP is conducting its geothermal operations. They contain a subterranean layer of brine - extremely salty water - preserved beneath permeable rock 3 kilometres from the surface. To release energy or geothermal heat from this, all that is required is to draw out this water at a high temperature (120 degrees Celsius), then pass it through a turbine which will extract the heat or energy. The cooled water is then reintroduced into the aquifer. It reheats rapidly on contact with the rock on its journey to the depths (*Source: DEEP Earth Energy Production*). The Saskatchewan State company *SaskPower* signed a contract in the spring of 2017 to purchase electricity from DEEP, which could produce 5 megawatts per power plant. One single power plant will be able to supply 5,000 homes with electricity. DEEP is planning to build more than ten of them.

5 • THE MEDIA, USERS AND THE SOCIAL DIMENSION OF THE TRANSITION: THE EXAMPLE OF SMART NETWORKS

The challenges of a transition towards an economy of low carbon emissions are largely social and political rather than technical (Burch, 2018). To achieve this, there is a need for deliberate policies at various levels on the one hand, and, on the other, proactive behaviour on the part of citizens. Other stakeholders such as the media or NGOs also play an important role as intermediaries as well as opinion formers on this subject. Smart grids have been known for several years and are a revealing example of the role of users and the media in the energy transition because they incorporate technologies that can directly affect our daily life.

In recent years, several research teams in Social Sciences have focused on analysing the rather problematic establishment of smart networks in Canada and the United States[10] . Smart networks are designed as a cutting-edge tool aimed at transforming the ways societies produce, distribute and consume electricity. A smart grid is a network that links producers and consumers to ensure a safe, sustainable and economically efficient electricity supply. It includes tangible and intangible information and communication technologies (ICT), such as smart meters, real-time information

9 - Voir : //ici.radio-canada.ca/nouvelle/1023713/geothermie-reconvertir-puits-petrole-orphelins-budget
10 - Consulter : (Peters et al. 2018 ; Mallett et al., 2018a ; Mallett et al., 2018b ; Jegen et Philion, 2018 ; Winfield et Weiler, 2018 ; Meadowcroft et al., 2018).

for consumers, dynamic pricing and the incorporation of electric vehicles into the networks. For their supporters, smart networks constitute a key element of the transition to sustainable energy, aimed at mitigating climate change, improving energy security and preventing surges in energy prices (Jegen and Philion, 2018).

The development of smart grids is relatively recent in Europe and North America. In Ontario, a strategy of rapid roll-out for smart meters was launched in 2004 and is still to this day considered the most advanced experiment in terms of the formulation and implementation of policies for smart networks in Canada (Winfield and Weiler, 2018). In this province, smart grids have been put on the policy agenda as an ambitious strategy to improve the network while mitigating climate change. In contrast, in the neighbouring province of Quebec, the roll-out of smart networks occurred later, lacked political relevance and was limited in its scope. The principal objectives linked to their introduction were the security of the supply and economic efficiency, with little stated ambition for a more fundamental change in the way the energy industry works.

In 2011, Hydro-Québec - a public monopoly - launched its programme to replace 3.75 million traditional meters with smart meters. Although the new infrastructure was designed to enable bi-directional communication, the meters are in fact used by Hydro-Québec to collect data on the use, voltage and quality of electricity, yet no hourly rate has been introduced and consumers cannot check and adapt their energy use in real time. Furthermore, the authors show that key players in the electricity sector of Quebec did not establish any link between a smart network and strategic challenges such as climate change and energy transition. Media analysis shows, however, that the media coverage on smart networks was generally negative and mainly focused on the potential detrimental impacts of smart meters.

The analyses by Mallett et al. (2018) start from the observation that different provinces in Canada continue to promote the integration and expansion of smart networks within their electricity systems, but roll-out rates vary despite them having similar policies and programmes. To try to understand the reasons for this discrepancy, they focus on the way smart grids are perceived by users and reflected in the written media. The authors emphasise the fact that the media coverage of smart networks began as generally positive but this was reversed some time later. In other words, and according to the theory of Gartner's 'hype cycle', there is first a bias in favour of innovation when support for new technology increases rapidly in a more abstract and general way, then decreases as users experience these new technologies in reality. The negative perceptions of these technologies were greater in British Colombia and Quebec, two provinces where users had more negative experiences with the way they were initially introduced to smart meters (often in a letter from their public service informing them that their analogue electricity meter would be subject to compulsory change). On the other hand, media coverage was more positive in Ontario, where the fact that there are more local electricity distribution companies helps put in place strategies that are better adapted to the characteristics of each territory.

Peters et al. (2018) finally highlight the fact that 'environmental scoping' was largely absent from the socio-political discourse (citizens, media and key participants) during the establishment of smart grids in British Colombia. A clearly communicated vision of the way smart networks can help mitigate climate change may increase acceptance and participation by citizens. To sum up, the results of these studies remind us that political decision makers must pay particular attention to the dynamics and characteristics of each territory in order to enhance the success of the policies and programmes involving new technologies.

CONCLUSION

The provinces of Canada have very strong prerogatives in terms of energy and the environment. Most of the provinces have therefore set objectives to reduce GHG emissions and have taken measures towards achieving them. All these actions are harmonised in a federal plan aimed at the total decarbonisation of the electricity sector in the decades to come. Municipal authorities are also active in the climate field, urged on by citizens who are increasingly concerned. Finally, new technologies associated with renewable energy facilitate the decentralisation of energy systems, which opens opportunities for new businesses in various areas such as geothermal and the smart management of networks.

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PRESS & COMMUNICATIONS :

• Bullfrog, entreprise canadienne vendant des produits d'énergie renouvelable, a été accréditée par CDP en 2017.

• Manitoba Hydro, exportateur d'hydro-énergie basé à Winnipeg, produit 97% de son électricité à partir de sources renouvelables. C'est un exemple d'initiative territoriale récurrent.

• Government of Canada, Government of Canada committed to modernizing heating and cooling plants in National Capital Region, pour un aperçu de la stratégie nationale en matière de chauffage/ refroidissement des villes.

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