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International business thesis

Theoretical part

A comparative study of the energy transition and energy policies in the
European Union and Canada between 2003 & 2020

Practical part

Qualitative analysis of the development of the Electric Vehicle market in
Canada between 2011 & 2015

Supervisor - theoretical thesis

Professor Thierry Bréchet

International Business supervisor – Practical thesis

Professor Christophe Lejeune

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Presented by

Edward D. Still

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FORWARD

*This thesis marks the end of six years at University.
From Loughborough to Louvain-La-Neuve,
through Rotterdam and Montreal.*

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International business thesis

Theoretical part

**A comparative study of the energy transition and
energy policies in the European Union and Canada
between 2003 & 2020**

1 Introduction

1.1 Statement of the research problem

Through this theoretical thesis, a comparative analysis of the energy transition in Canada and the EU between 2003 and 2020 will be put forward. The general objective is to evaluate the state of the energy transition in the European Union and Canada, and to draw a comparison between the energy policies in both regions. This paper will focus on the transition of the composition of the energy mix in both the EU and Canada, from the dependency on fossil fuels to a greater consumption of renewable energy sources. In other words we will look at the transition from the supply of energy based on limited and finite resources that are ultimately unsustainable, to an energy supply based on unlimited resources of energy such as the power provided by the sun, by the wind, and by the sea for example.

The chosen time-lapse of the analysis is set between 2003 and 2020. This period marks the time between the last major oil crisis in 2003 to the next key year in terms of achievable energy objectives that is 2020. It also marks a sufficient time period to notice potential dynamics between public policies and energy transitions. This is an important factor to take into consideration given how energy transitions, as we will outline when looking into the concept more specifically, evolve over a relatively long period of time.

The paper is structured into four main parts; first we will look at the five main themes and issues that make up the context of the energy transition before moving on to the three main analytical parts of the paper which are the governance of energy, measuring the energy transition in the EU and Canada and an analysis of the main renewable energy promotion policies in both regions.

This will lead us to an overview of the state of the energy transition in the EU and Canada, before coming to a conclusion.

1.2 Interest of the research

Three general reasons justify the interest of the research and highlight its novelty in regards to existing literature and research. First of all the scale of the analysis is

different from traditional energy transition research that focuses on national or local trends rather than trans-national trends. Secondly the many political, energy and geographic similarities that exist between Canada and the EU and make a comparative study relative. And thirdly the contrasting positions of both regions in regards to energy issues despite the aforementioned similarities that make the research even more interesting.

Scale of the analysis

A key aspect of this comparative research is the scale of the analysis. A majority of research regarding energy and energy transitions focus on nation-states and micro-level technological niches within specific countries (van der Vleuten & Högselius, 2012). An important amount of research has been done for example about renewable energy in Denmark (Meibom et al, 2013; Hvelplund et al., 2011; Moreno, 2011) or the energy transition in Germany (Gawel, 2014; Patel, 2013; Jacobsen & Lauber, 2004). The fact of a majority of energy transitions research being done on a national scale is one that is confirmed by van der Vleuten and Högselius (2012) who argue that the analysis of nation-states is one that is “tacitly and uncritically reproduced (...) as its presupposed core category of analysis” (2012, p.78). The desire of looking at the European Union and comparing its energy transition to Canada’s is based on the willingness to go beyond the classic scale of analysis and look at the energy transition on a transnational scale, and thereby look into what Smith et. Al (2010) describe as the “geography of transitions” (2010, p.443). The aim is to understand transitions in terms of more general trends and of the interconnections of local, national and international dynamics (van der Vleuten & Högselius, 2012). Therefore the focus of this thesis will be of broader scale than typical transition analyses, and will take into account the entire dynamics of the existing energy systems and their structures rather than focusing on narrower perspectives.

Canada & the European Union

From the offset without looking into much detail, it is noticeable that Canada and the European Union have striking similarities that are important in order to highlight that both regions can be compared.

Firstly given the many similarities between Canada and the EU in terms of political factors. It can be argued that both have similar political structures, with a central government and ten provinces with significant autonomy in the case of Canada, and central governing institutions and autonomous member states in the case of the European Union. In this sense the systemic or macro level considered is the Canadian federal government on the one hand and the EU institutions on the other, while the sub-system or micro level of analysis is the ten Canadian provinces and the twenty-eight European Member States. It is important to note that this paper does not mean that we are reducing the European Union as being a Federal State. However the possibility of it being compared to a Federal State is possible given the fact that the EU has developed a single market, is governed by a set of common rules, has a 'legal personality' since the signing of the 2009 Lisbon Treaty, allows for free-movement of people across Member States and that a European identity exists (European Commission, 2012).

Furthermore another similarity between the EU and Canada is the diversity in resources that both regions have. In the European Union some countries such as Poland have abundant coal resources that explain their resistance to any new and more demanding energy policies set out by the EU, whereas other nations such as Norway or Germany for example have developed important renewable energy infrastructure meaning that they are far more ambitious regarding new European environmental policies. This resource diversity is similar to the situation in Canada where on the one hand Provinces such as Alberta have important sources of oil sands, and on the other hand Ontario and Quebec for example have little fossil resources but have therefore encouraged the exploitation of renewable energies to a far greater extent.

However on the other there are also a number of elements for which Canada and the EU are noticeable different and which make the comparative analysis of both of them that much more interesting. Canada is one of the largest energy producers and exporters as well as having the third largest renewable energy capacity in the world (IEA, 2009). It is also noticeable that total investment in renewable energy sources surpassed investment in traditional power sources for the first time in 2010 (Invest in

Canada, 2012). The country is faced with important sustainability challenges given how it is one of the highest per-capita emitters and that it has the highest energy intensity of any of the IEA countries (IEA, 2009).

One of the general challenges Canada is faced with is that of finding a balance between continuing to develop its huge unconventional oil resources, such as the important oil sands in Alberta, that are vital for the economy of the country and managing the broader environmental impacts and sustainability issues (IEA, 2009).

Europe's energy position is very different given how dependent it is on energy imports compared to Canada. Yet the EU appears to be more ambitious from the outside if we look at the energy targets that both regions have established. The EU's short, medium and long-term targets set for 2020, 2030 and 2050 are more thorough than the targets set out by Canada. However despite the EU being on track to meet its 20-20-20 objectives (EUFORES, 2014) that focus on sustainability, security of supply and competitiveness, it is arguable how efficient these targets really are in regards to the energy transition. There are other factors such as the different share of renewable energy sources in both regions' respective energy mixes, as well as their contrasting positions on the international energy scene, noticeably in regards to the Kyoto protocol, that make a comparative study of the energy transition in both regions very interesting, especially given that both the EU and Canada claim to be leaders of the transition in their own right (EU Commission, 2013; IEA, 2009).

2 The Energy Transition in context

There are five themes and issues that are the underlying basis for this paper, that provide the context for it and act as the binding tissue between the three main parts we look into. The first one is the view that energy is the lifeblood of our society. The second theme is that of renewable energy while the third is the idea of fossil fuels being unsustainable. Both of these themes lead us to the fourth one, which is the concept of energy transitions, and finally the challenges of governing an energy transition.

2.1 “Energy as the lifeblood of society”

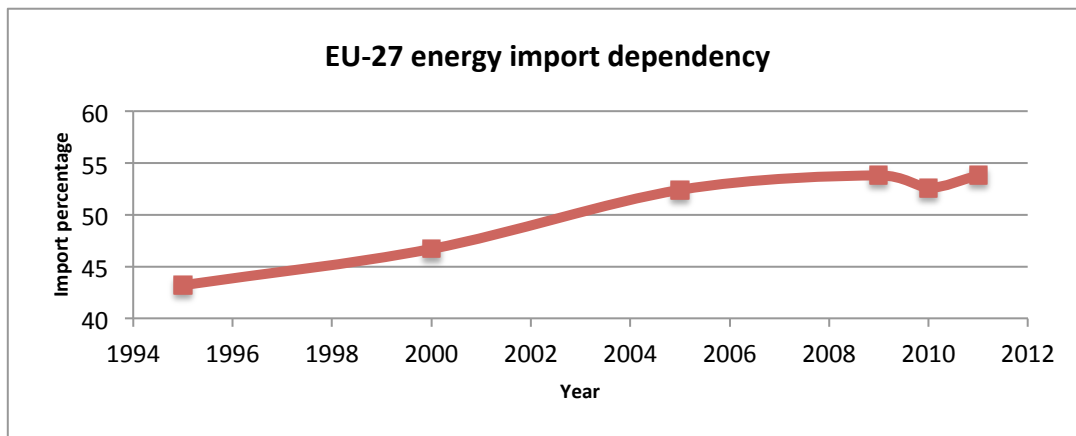
Today’s modern society is highly dependant on relatively cheap energy supplies (Verbong & Langendijk, 2012), to such an extent that we often only realise our dependency on having continuously available energy when a breakdown occurs, such as it happened in the Ukraine in June 2014 when Russia cut off its gas supply to the country following the crisis between both states. Such events are in turn likely to cause significant increases in fossil fuel prices, as has been the case in the past. Such events also illustrate the size of how big the stakes are regarding energy and the rising pressure that there is to continuously supply our ever-increasing consumption of energy (Verbong & Loorbach, 2012, p.2).

Currently most of the energy that we consume comes from fossil fuels. Take for example the EU and the overall consumption across its twenty-seven countries; in 2011 the energy mix was made up of 76% of fossil fuels (35% of petroleum and products, 24% of gas, and 17% of solid fuels), a figure only just down from the 81% in 1995 (EU Commission, 2013, p.20).

It is widely acknowledged, despite it still being disputed by some parties, that it is such an intensive use of fossil fuels that has caused a huge rise in CO₂ emissions thereby increasing the green house effect and causing the earth to reheat. Such man-made climate change has had drastic consequences on our environment and the earth’s natural processes (Verbong & Loorbach, 2012, p.2).

Oil reserves are constantly decreasing and the current rate of extraction will not be sustainable beyond the next fifty years, and inevitably a dead end will be reached. Moreover, other obvious risks are closely linked with high consumption of fossil fuels such as the increased risk of wars given the scarcity of resources and the ever-increasing dependency on imports. As figure 1 on the following page illustrates, the dependency of energy imports in Europe has increased by ten per cent since 1995 meaning that on average EU countries are importing more than half of their energy (EU Commission, 2013, p.22).

Figure 1 EU27 energy import dependency (source: Eurostat, 2014)



In its Energy Strategy, the European Commission insists on the fact that “Energy is the lifeblood of our society” (European Commission, 2010). This point is stressed further by Verbong & Loorbach (2012) who outline that all sectors of our society, from transport, to housing, to food production and healthcare for example, are fully dependant on reliable and affordable energy supply systems. Furthermore the European Commission underlined the crucial issue that energy represents by outlining that “The energy challenge is one of the greatest tests our society has to face. It will take decades to steer our energy systems onto a more secure and sustainable path” (European Commission, 2010).

All of the issues outlined above and the importance that energy has in our society are two of the fundamental dimensions that illustrate the complexity of the energy issue we are faced with. The issue is so complex that it is virtually immeasurable given the number of variables and problems involved. It also means that it there is not a single linear answer, that there is not one unique perspective that can address the whole issue, and that there isn’t one actor who will solve the issue (Verbong & Loorbach, 2012).

2.2 Renewable Energy

It is often argued today that renewable energy, while not being the answer to all the energy problems and issues, is a way of dealing with and managing the unsustainability of the current energy system. Bosman & Scholten (2013) argue for example that renewable energy has four major advantages over fossil fuels. Firstly

they are more easily accessible than fossil fuels as well as being readily available in every country and region. Secondly they are used mainly to generate electricity, which is easily transportable over big distances. Thirdly renewable energy is more efficiently harvested in certain regions meaning that some countries will be able to produce energy at a cheaper cost than other countries. And fourthly they argue that a “great part of renewable energy production is of an intermittent nature and electricity generation may be distributed in a large number of small units” (Bosman & Scholten, 2013).

It is commonly accepted that a renewable energy source is a source that is “continuously replaced at a rate that is at least equal to the rate at which it is consumed” (Bordier, 2008, p. 4). We will settle on this definition of renewable energy sources for this paper, as well as only considering renewable energy sources that originate from the sun, from water, from wind, from geothermal heat and from organic matter.

In Europe many countries such as Norway, Germany, Spain and Denmark are leading the way in increasing the share of renewable energy in their national energy mix (Raven, 2012). However to get to the level of renewable energy that we are at today in our energy mix has taken more than five decades. There are many reasons that explain why this emergence has taken such a long time, one of them being how deeply entrenched and locked-in the production and consumption of fossil fuels are in our infrastructure and throughout society as a whole (Raven, 2012).

The share of renewable energy in Canada’s energy mix is greater compared to Europe, reaching 18.3% of total energy in 2013, and certain Provinces such as Quebec for example produce over 95% of their electricity from renewable sources (Enerdata, 2014). In this sense regarding the exploitation of renewable energy sources, Canada is further advanced than Europe but it is faced with different environmental and sustainability challenges in terms of energy.

The question of what our energy mix will look like after 2030 is one that is difficult to answer, as illustrated by the European Commission’s prediction in the years that followed the Second World War that by 1990 nuclear energy would make up 70% of its energy mix (European Commission, 2010). They were wrong.

2.3 The unsustainability of fossil fuels

Smil (2010) outlines two specific reasons that explain why mankind should look to move away from the current high levels of fossil fuel consumption. First of all in regards to the concerns about long term effects of global climate change. It is widely accepted that, despite the complexity of climate change, fossil fuels and human emissions of fossil carbon are its biggest and most identifiable driver. In order to prevent excessive global warming and keep the global temperature to the acceptable level of 2c° above the preindustrial average temperature, reducing our reliance on fossil fuels and progressively shifting towards more renewable supplies appears to be the surest way to do so (2010). The second concern is regarding the rapid depletion of high quality, low-price fossil fuels. The peak level of global oil extraction is allegedly imminent, which will only logically be followed by a rapid decline in oil production (2010).

This argument is backed up by Klare (2008) who outlines that the huge economic growth and globalisation of the past half-century is based on the abundant supply of affordable energy and the continued increase of energy outputs, especially fossil fuels. According to figures of the Department of Energy (DOE, 2008) however, if the current trend continues then there will be a 50% increase in energy demand by 2030 compared to the levels of 2005. These numbers and predictions are backed up by BP's predictions (BP, 2013). Klare (2008) argues that it is highly unlikely that energy supply will be able to keep up and successfully cope with the extra demand despite new oil supplies being exploited in areas such as North America (2008).

Added to the issues of climate change and the rapid depletion of fossil fuel supplies are other crucial questions such as the economic impact of increasing prices and the political instability in key regions such as the Middle East, all of which highlight the need for the energy system to evolve and move towards a more sustainable structure (Kaltschmitt et al., 2007).

2.4 Energy transitions

As Smil outlines (2010), the concept of *energy transition* is usually used to describe “the change in the composition structure of primary energy supply” (Smil, 2010,

p.vii). The term *transition* by itself is readily understood as being the passage from one condition to another. Originally the term was used to describe the transformation of solid to liquid to gas, but since then has evolved to describe the evolution and change of a variety of systems and different states, or in Loorbach's exact words "a shift from one initial dynamic equilibrium to another new equilibrium" (2007). Crucially transitions involve an innovation in an important part of a societal subsystem and they are characterised by their unpredictable nature in terms of the speed and direction in which they evolve (Loorbach, 2007; Kemp & Rotmans, 2001). Regarding the evolution and different stages of a transition, Loorbach (2007) argues that there are long periods of relative stability and optimisation that are followed by relatively short periods of structural change. The existing structures thereby fade away or collapse leading to new structures emerging.

Loorbach and Rotmond established four specific phases that characterise a transition and its evolution in time (Loorbach & Rotmond, 2006, p.5):

1. *A pre-development phase*, significant experimentation on an individual level but little on a societal scale.
2. *A take-off phase*, during which reinforcing innovations cause the state of the system to shift.
3. *An acceleration phase*, when there is an accumulation of changes such as institutional, technological, social or economic for example, which create structural changes.
4. *A stabilization process*, during which a new dynamic equilibrium is met following a decrease in the speed of societal change

Finally Loorbach and Rotmans (2006) have put forward the idea of there being two specific types of transitions: on the one hand evolutionary transitions, in which no specific outcome is planned (Loorbach & Rotmans, 2006, p.4). An example of such a transition could be the transition from sailing ships to steam boats (Geels, 2002) (see Appendix 1 for a historical perspective of energy transitions). People didn't know when trying to develop new ships and ship engines what machine they were going to be able to develop, as no specific objective in terms of design or type was defined before hand. On the other hand, goal-oriented transitions are transitions that are driven by specific targets and guided by public actors. Such a goal-oriented transition

could be for example that of an energy transition where specific CO₂ reduction levels are set and are the objective towards which public policies and private actors will strive (see Appendix 1).

2.5 The challenges of governing an energy transition

The governance of energy is highly complex given how it involves so many different stakeholders at different levels and that the uncertainties caused are so fundamental and so deeply rooted in our structures and institutions yet given its complexity it is virtually impossible to envisage a central and global governance of the issue (Loorbach & Rotmans, 2006; Loorbach & Verbong, 2012, p.11). Klare (2008) describes this complexity of governance by describing the fact that the world of 2050 and the development of alternative energy sources is easily envisaged and will, according to him, unquestionably “alter our lives and those of our descendants” (2008, p.26). However “what is less clear is *how* we will get from here to there” (2008, p.26).

The idea of linking both concepts that of governance and of energy transitions, is fundamental in the analysis and comparison of policies that determine the structure of the energy supply. Before moving on to that specific analysis however it is important to understand and evaluate the challenges of governing an energy transition and the possible ways to do so. Florini & Dubasch (2011) argue the point that three main challenges can be outlined in terms of governing an energy transition:

1. The time-scale usually applicable in the policy domain, which is much shorter than that of an energy transition.
2. The fragmented governance that exists between the different actors involved, a challenge that is compounded by the size of scope of energy issues that cannot be solely managed by national governments.
3. The existence of multiple simultaneous targets that all overlap yet are all distinct from each other. Such targets are for example the reduction in CO₂ emissions, increased renewable energy targets, more sustainable and environmentally friendly energy supply, energy supply security, less import dependency, greater control of climate change and the reduction of oil prices.

These three challenges added to the complex nature of the energy system and the issues linked to it explain why the traditional policy-making pattern of making plans and strategies before implementing them in a straightforward and traditional manner needs to be replaced by policy-making that is based on a more holistic and integrated approach capable of taking the complexity of the issues at hand into account (Klare, 2008).

What is obvious though is that the energy mix beyond 2020 will be strongly influenced by decisions made today (World Economic Forum, 2013). To approach the energy issue from a transition approach is to recognise its complex nature and long-term period as transitions refer to “large-scale transformations within society or important subsystems during which the structure of the societal system fundamentally changes” (Verbong & Loorbach, 2012).

3 Energy governance in the EU and Canada

In the following part we will look into the energy governance in the EU and in Canada in order to understand the political processes that are needed to establish and implement policies. To do so we will look to outline the main responsibilities and the involvement of institutional actors in both countries, before highlighting the main objectives in terms of energy measures that both regions have currently set out, and finally looking into the respective international energy and environmental policy commitments of both regions.

3.1 Responsibilities and involvement of institutional actors

The energy agenda in Canada is split between the federal government and the provincial administrations (NEAWG, 2006) while in the European Union energy policies are set by the European Commission but also by national governments defending their individual interests (Christiansen, 2008). What this does is reduce the likelihood of having a uniform and universal policy agenda in either region, thereby increasing the chances of conflicting positions between the different actors and making the transition towards a sustainable energy supply less likely.

The Lisbon Treaty that came into effect in 2010 explicitly recognises the European Union's competence both in terms of energy issues and environmental issues yet policies regarding both of these issues remain EU non-exclusive competences.

A key element is the fact that under the ART 194 of the TFEU in the energy chapter rules, it is stated that the EU does not have the competence to adopt energy policy measures that would affect the right of Member States' to determine the conditions for exploiting its energy resources, to choose between different energy sources and in general to affect the general structure of a Member State's energy supply (ClientEarth, 2010).

In terms of the EU's involvement in energy policies, there is an argument that distinguishes three different types of EU involvement, depending on the specific policy that is in play, in shaping the Union's energy policies and defined targets (THINK, 2012).

The first type of EU involvement is that of "effort sharing" (THINK, 2012, p.30); the EU sets binding targets that Member States have to respect and abide to through their actions (THINK, 2012). The second type of EU involvement can be described as "harmonisation", which involves framing the choice of measures that Members States take. What this can do is to reduce policy fragmentation between Member States and thereby reduce incoherence within the EU (THINK, 2012). The third and final type of EU involvement is "level playing field". This involvement creates a EU-wide instrument and creates an added value for the Union and Member States through a single approach (THINK, 2012). An example of this type of involvement could be for example for the EU to establish an energy infrastructure investment cost recovery instrument, and the fact of an independent third party at the EU level managing such an instrument would go some way to solving the difficulty for stakeholders to find a consensus (THINK, 2012).

What of the level of involvement of the Canadian Federal Government in energy matters? The jurisdiction of energy in Canada is split into two main different parts between the federal and provincial governments. In terms of its federal regulation, there are three main agencies that shape national energy policies; the National Energy Board (NEB), Natural Resources Canada (NRCan) and Environment Canada

(IEA, 2009). The NEB is an independent federal regulatory agency created in 1959 that mainly has a regulatory role regarding inter-provincial and international energy issues. As for Natural Resources Canada, it is the lead governmental agency on energy policies and focuses on the development and use of Canada's natural resources and the competitiveness of the country's natural resources products (IEA, 2009). As well as NRCan, Environment Canada is another of the government's agencies, and is responsible for the regulations of green house gases and carbon emissions from industrial and transportation sources for example (IEA, 2009).

In regards to Canadian Provinces, they are the owners of their ground resources and in this sense they manage most of the country's resources as well as shaping the policies implemented in their jurisdictions (IEA, 2009). Moreover the Provinces have jurisdictional responsibilities for the exploration and management of non-renewable energy resources through Provincial Utility Boards (NEAWG, 2006). It is also the Provinces that oversee the cost of natural gas for consumers who purchase gas directly from the distribution companies. Finally, it is the Provinces that take the main initiatives in terms of retail and wholesale electricity competition.

It is widely acknowledged in Canada that the federal government has a limited role in terms of energy regulation and policies. Energy regulation is largely determined by the goals and policies set at the Provincial level, and as we will outline later, these targets and policies differ between the ten Provinces (Wagman, 2011). It is important to note though the focus put on coordinating federal, provincial and local regulations. Several councils have in this regard been set up, such as the Council of Energy Ministers for example, in order to provide a platform for discussion between the different governments about the challenges and the opportunities of the energy sector and about greater intergovernmental co-ordination (IEA, 2009). Moreover equivalency agreements can be established between governments as long as the standards of the provinces are at least as stringent as those set by the federal government. The aim thereby of the federal government is to avoid cases of duplicity.

So despite their being a similar fragmentation of energy policy actors and of the different levels of decision making in both the EU and Canada, there is a difference

between the governance in energy both regions. The EU has a more integrated approach given how the governance and regulation of energy and environmental issues are a shared competence between the EU and Member States. This is not the case however in Canada where competencies are explicitly split in the mean between the federal and the provincial governments.

3.2 Energy and climate targets

Both regions have short term goals set for 2020 that focus on their respective energy mixes, as well as energy efficiency, greenhouse gas emissions, and renewable energy. These short terms targets set by the EU and the Canadian federal government are there to shape Member State policies in the case of the EU, and Provincial policies in the case of Canada and thereby act as general guidelines for how they manage their energy and environmental policies.

It is noticeable however that the EU has been a lot more thorough by putting forward medium-term objectives for 2030 and long-term objectives for 2050 as well as its short-term objectives for 2020, with some of them being legally binding for its Member States (EU Commission, 2014). This is in stark contrast to the objectives that Canada has set out for itself, as the only target that has been formulated is the one agreed upon in the Copenhagen Accord to reduce emissions along with the USA by 17% compared to the levels of 2005 (NEB, 2013).

As outlined above, a key development in terms of energy policies and targets for the EU and its Member States was the Lisbon Treaty that became effective in 2009. The treaty outlined four general objectives that EU policies be would geared towards (ClientEarth, 2010):

1. To ensure the functioning of the energy market
2. To ensure security of energy supply in the Union
3. To promote energy efficiency and energy saving and the development of new renewable energy sources
4. To promote the interconnection of energy networks

Following on from the Lisbon Treaty, the EU Commission established the first main set of specific objectives to be reached in 2020. Entitled “a strategy for competitive, sustainable and secure energy”, it acts as a framework for European energy policy. A

key political step was made when these objectives were integrated in the Lisbon Treaty, thereby underlining the intent of the EU to fully commit to reaching them. More specifically, the 2020 framework outlines three detailed objectives (European Commission, 2011):

1. To reduce greenhouse gas emissions by at least 20%,
2. To increase the share of renewable energy to 20%,
3. To improve energy efficiency by 20%.

Canada has set itself two goals for 2020; first of all in 2008 the country pledged that by 2020, 90% of generated electricity would be produced by zero emitting sources (IEA, 2014) and secondly in 2009, Canada committed to reduce its greenhouse gas emissions by 2020 to 17% below its levels of 2005 by signing the Copenhagen Accord and thereby aligning itself with the targets of the United States. However this figure of 17% is subject to adjustment to remain consistent with the United States target (Environment Canada, 2013). In the longer term Canada has targeted to reduce its GHG emissions by about 60% to 70% by 2050 compared to levels of 2005 (IEA, 2009). This target for 2050 however has been set in an approximative manner without establishing a precise figure or strategy.

That is as far as national targets go however, and as the International Energy Agency highlights (IEA, 2014), the lack of binding targets set by the federal government is one of the main challenges that Provinces are faced with when setting their own energy and climate objectives (2014).

In terms of the EU's long-term strategy, named the 2050 Roadmap, it focuses on the objective of decarbonisation as well as on the security and the competitiveness of the energy supply (European Commission, 2012). More specifically, the Commission outlines that the EU should cut its emissions to 80% below 1990 levels through domestic reductions. In order to achieve this, the Roadmap details how the main sectors can make the transition towards this target while also outlining intermediate targets for 2030 and 2040 (European Commission, 2012). In October 2014, the European Council agreed on its 2030 energy policy framework that follows on from the 20-20-20 agreement outlined above, and provides an intermediate stage towards the 80% greenhouse gas emissions set for 2050. Noticeably the framework includes a

“flexibility clause” (Emmanouilidis, 2014) allowing Member States of the EU to review the 2030 targets after the UNFCCC of 2015 in Paris.

Therefore we can observe that the EU on the one hand has developed both a short and a long term vision while imposing legal obligations on Member States to achieve the targets that are laid out, whereas Canada has up until now only set itself a short-term non legally binding objective. In this sense Canada has left a lot more autonomy to its individual Provinces to determine their own targets and set the policies that are the most pertinent in regards to the resources and specific energy system characteristics of their Province.

3.3 International governance

The EU and Canada are both committed to the UNFCCC and the Copenhagen Accord. This means that both regions agree to strive towards the common goal of stabilising “greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (...) recognising (...) that the increase in global temperature should be below 2 degrees Celsius” (Copenhagen Accord, 2009, p.5). However it is key to stress that the Copenhagen Accord and the COP agreements that have followed are not legally binding, thereby meaning that countries have no legal obligation to fulfil the objectives that are set out (Regalj et al, 2010).

The largest international treaty regarding climate and energy issues is the Kyoto Protocol, which marks a significant difference between the EU and Canada in terms of international energy governance given that Canada withdrew from the protocol in 2011 while the EU remains in it and continues to strive to reach the objectives that the protocol sets out.

Canada’s withdrawal from the Kyoto Protocol was a bold step that they justified by outlining, “(...) the Kyoto Protocol has not served the international community well in meeting the real challenges of global climate change or effectively engaging all major economies” (Environment Canada, 2013). Undoubtedly this decision was heavily influenced by the fact that the USA is not covered by the Protocol (Environment Canada, 2013).

The Kyoto Protocol's compliance mechanism has seen Member States of the EU become jointly responsible for achieving to reduce their collective greenhouse gas emissions to 8% below the levels of 1990 between 2008 and 2012 (EEA, 2013). This was achieved as their reduced emissions to 15% under 1990 levels, and new targets have since been set along the same lines as the 2020 EU targets (EEA, 2013).

Canada and most EU Member States are also part of the International Energy Agency, an autonomous Intergovernmental Organisation that acts as a policy advisor to its Member States, which was established in 1974 following the oil crisis of 1973 with the initial goals of securing oil on "reasonable and equitable terms" (Florini & Dubasch, 2011). Today the focus of the agency has broadened to focus on energy security, economic development and environmental protection (Florini & Dubasch, 2011). The membership of both regions to the International Energy Agency for which there are strict membership requirements (IEA, 2014) does show that both remain committed to some extent to support a global action plan that requires all major emitters to take on real commitments and to maintain a long-term focus.

Canada and Member States of the EU are also active participants with other intergovernmental organisations' such as the International Renewable Energy Agency and the International Energy Forum for example who play an important role in terms of support for its members as well as developing international cooperation (Florini & Dubasch, 2011).

3.4 Overview of the governance of energy in the EU and Canada

Based on the observations that we have made regarding the governance of energy matters in Canada and the European Union, several key points can be highlighted.

First of all the fact that energy competences and responsibilities are fragmented in both regions, with neither presenting a totally unified and common in terms of the division of competences, established energy targets and their involvement in international governance. Whereas in the EU energy is a shared competence between European institutions and Members States since the Lisbon Treaty, in Canada it is a matter that is clearly divided between the Federal Government and the ten Provinces with far greater responsibilities lying in the hands of the Provinces.

In terms of energy and climate targets Europe is clearly far more ambitious and thorough in the targets it has set than Canada is. Europe uses its target as an important tool of governance, and has a precise short, medium and long term energy plan set out based on its energy targets. Canada however has only established a couple of vague short-term targets, neither of which are legally binding. It is left to the initiative of individual Provinces to set their own targets.

Finally in regards to the international governance of energy, again the EU plays a far greater role than Canada does. A fact reflected by the EU's continued adherence to the Kyoto protocol that Canada withdrew from in 2011. Both regions remain committed to the UNFCCC and subsequent accords that have come from it, while also being active members of different Intergovernmental organisations such as the International Energy Agency for example.

4 Measuring the energy transition in the EU and Canada

What stage has the transition towards a more sustainable and renewable energy reached both in the European Union and Canada? Has the transition effectively taken off yet, has it already stabilized, or is it still at a stage of pre-development (Loorbach & Rotmond, 2006)? This question is key before moving on and looking more specifically at the policies that have been implemented since 2003. To attempt to answer this question requires evaluating and measuring the transition. To do so we have chosen to focus on four specific areas:

1. Total primary energy consumption since 1990
2. Energy consumption by source since 1990
3. Electricity generation by source since 2003
4. Electricity & Heating Greenhouse Gas (GHG) emissions since 1990
5. Total Greenhouse Gas emissions since 1990

These five categories were chosen for several reasons to evaluate the energy transition in the EU and Canada. First of all for the fact that these five categories are at the heart of international, national and provincial energy and climate targets. The three European targets for 2020 around which their energy strategy is based revolve

around the share of renewable energy, energy efficiency and GHG emissions. Moreover the Kyoto protocol for example specifically targets reductions in GHG emissions.

Therefore the first category, total energy consumption, can be used to evaluate the evolution of energy efficiency while both the electricity generation and the electricity consumption by source will give a clear indication of the level of development of renewable energy sources. Finally the last two categories will give a straightforward understanding of the change in GHG emissions.

We should note that for energy consumption and greenhouse gas emissions we look back as far as 1990 given that international agreements in both these areas tend to take 1990 as base year.

4.1 Final energy consumption

The consumption of final energy is the energy that is supplied to the consumer for all energy uses such as heating, cooling or lighting (IEA, 2013).

The European Union's 2020 energy efficiency target of achieving 20% efficiency was translated and legally defined into final energy consumption being no more than 1078 Mtoe by 2020.

Figure 2 Evolution of the final energy consumption in the EU between 1990 and 2012

(source: US Energy Information Administration, 2015)

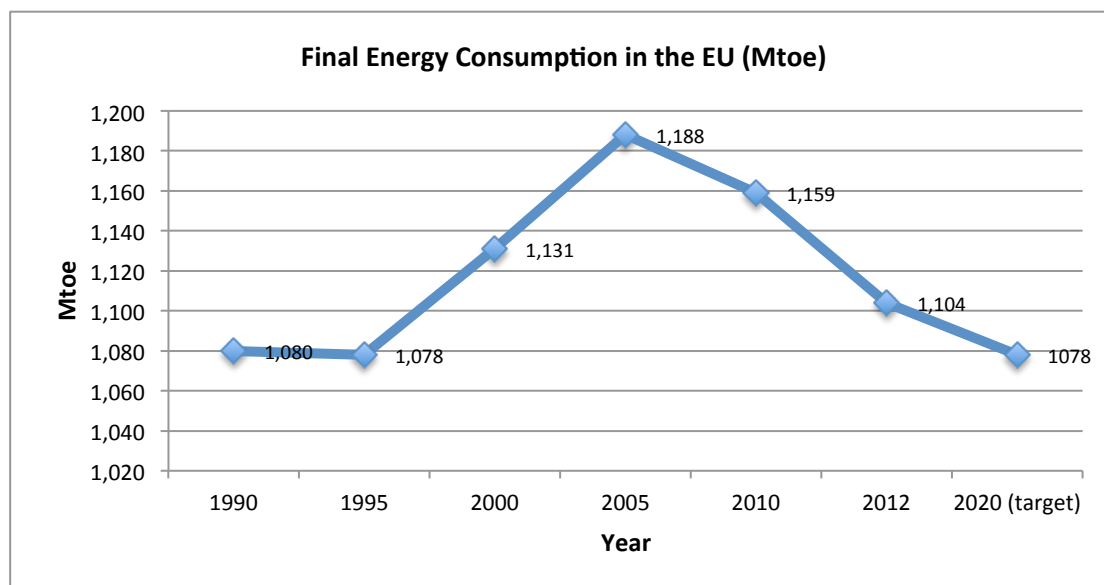
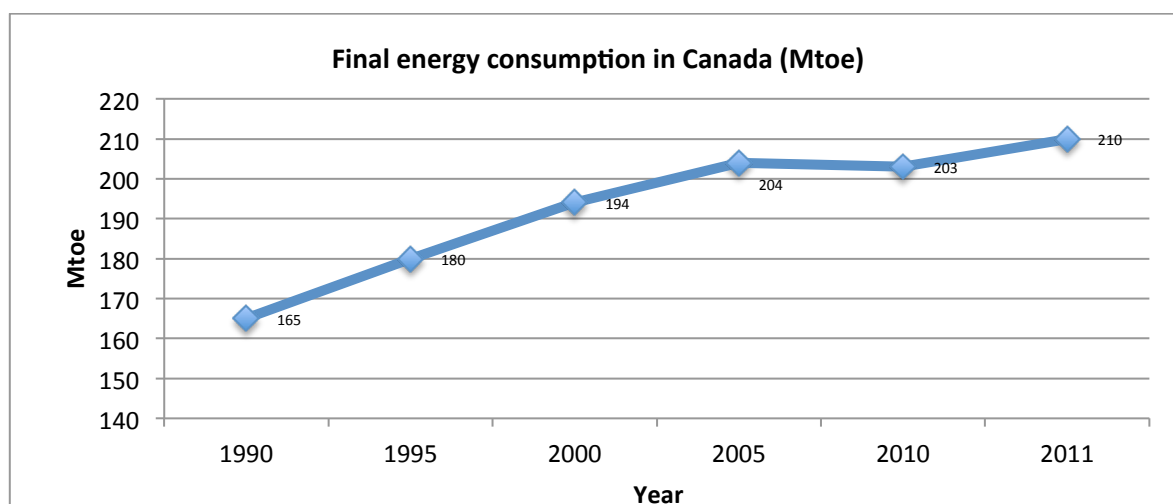


Figure 2 above shows that this would mean that the EU would reduce its final energy consumption back down to the levels of 1995. The figure also shows the huge increase that occurred between 1995 and 2005, when consumption hit 1188 Mtoe. The trend however between 2005 and 2012 is a positive one and shows that progress is being made in terms of final energy consumption and also therefore in terms of energy efficiency. Despite this progress and transition towards a more efficient state of energy consumption, the European Environment Agency in its 2013 report on the EU's progress towards its 2020 energy and climate targets stated that "further improvements are necessary" to make sure that the 2020 energy efficiency target is reached (EEA, 2013, p. 12)

The trend in terms of final energy consumption in Canada however is not a positive one based on the analysis of the numbers in the graph below. It shows how between 1990 and 2011, date of the last available numbers for Canada, final energy consumption has increased by more than 25% from 165 Mtoe in 1990 to 210 Mtoe in 2011 (National Energy Board, 2013).

Figure 3 Evolution of the final energy consumption in Canada between 1990 and 2011
(source: National Energy Board, 2013)



The increase in final energy consumption is reflected in the average annual increase across the different sectors. The biggest growth between 1990 and 2011 has been in the transportation and the commercial sector where average annual growth has been 1.8% and 1.7% respectively, while the increase in energy consumption in the

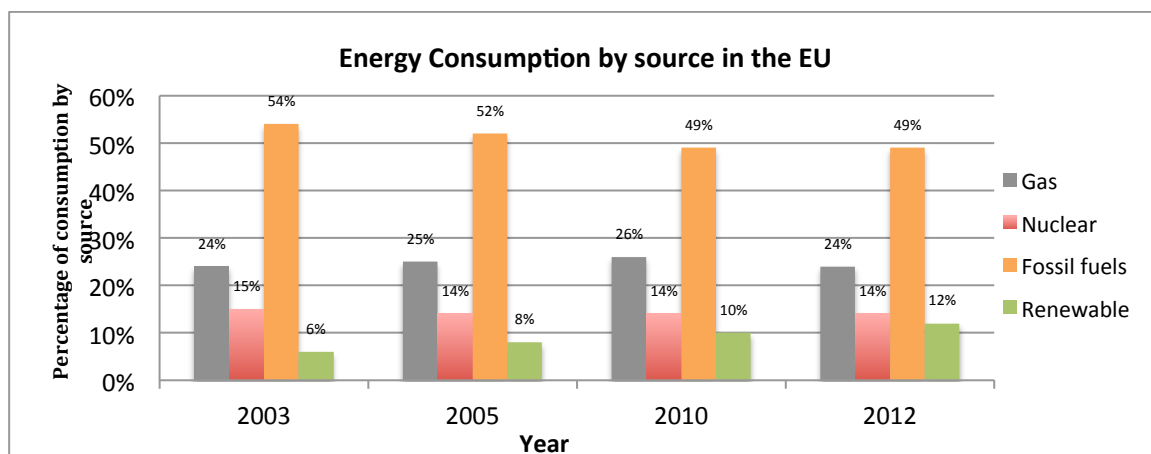
residential and industrial sector has been of 0.8% and 1.2% respectively (NEB, 2013).

4.2 Energy consumption by source

Energy consumption by type of source is the basis for the EU's renewable energy target, which in the short term is for renewables to make up 20% of the energy consumption. The graph below illustrates the progressive transition in terms of the energy consumption by type of energy source in Europe away from fossil fuels and towards a greater share of renewable energies. The consumption of fossil fuels between 2003 and 2012 dropped by 5% from 54% to 49% while the consumption of renewable energies doubled during that time from 6% in 2003 to 12% in 2012 (European Commission, 2014). Noticeably however the consumption of both nuclear power and natural gas have remained stable, with natural gas accounting for a quarter of energy consumption and nuclear power being stable at around 15% during between 2003 and 2012.

Figure 4 Evolution of EU energy consumption by source between 1990 and 2012

(source: European Commission, 2014)



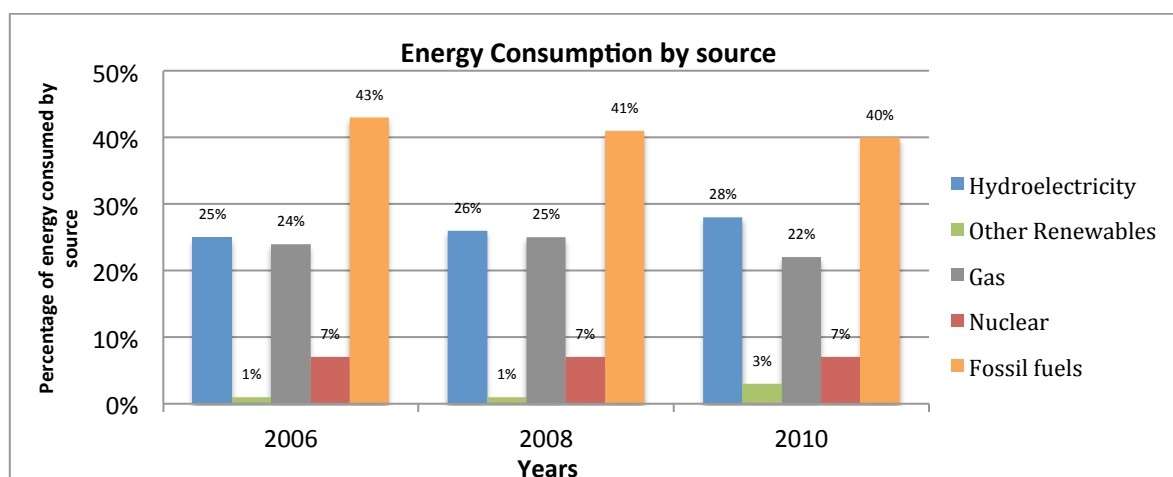
The share of renewable energy in overall energy consumption is therefore still someway off the EU target of 20% set for 2020, yet based on the indicative target for the period 2011-12 set at 10.8% the EU is on track to reach its 2020 objective. In regards to individual Member States, only six of them including France, the United Kingdom, the Netherlands and Belgium, were not on track to reach their 2020 renewable energy target based on the 2011-12 trajectory indicators (EEA, 2013).

In Canada the types of consumed energy are noticeably different. The main difference compared to Europe is the fact that renewable energies accounted for just over 30% of final energy consumption in 2010, with hydropower accounting for nearly 95% of consumed renewable energy. This fact is reflected in the steady rise of hydropower in terms of electricity generation, confirming the increased importance of hydro-sourced power, while the general consumption of other forms of renewable energy is also on the rise. In terms of oil consumption, it remained relatively stable between 2006 and 2010 making up 40% of the total energy consumed in 2010. This is largely explained by the country's huge oil resources, which rank third in the world (EIA, 2014). Yet while the consumption of oil has remained relatively stable over the past decade, between 2 and 2,5 million barrels per day (EIA, 2014), the level of production has increased dramatically from just over 3 million barrels per day in 2004 to nearly 4,5 million barrels in 2014. Given the relative stability of consumption, this has seen the level of exported oil increase hugely, with most of it being exported to the United States.

In regards to natural gas, Canada is also one of the largest producers in the world as it ranks fifth behind countries such as the USA, Russia, Iran and Qatar (EIA, 2014). However the opposite trend has occurred compared to oil production and consumption though as natural gas production has dropped quite significantly since 2003 given the accelerated depletion of reserves, and the level of consumption has also dropped slightly. This has lead to an important drop in the level of natural gas exports (EIA, 2014).

Figure 5 Evolution of energy consumption by source in Canada between 2006 and 2010

(source: EIA, 2014; US Energy Information Administration, 2014)

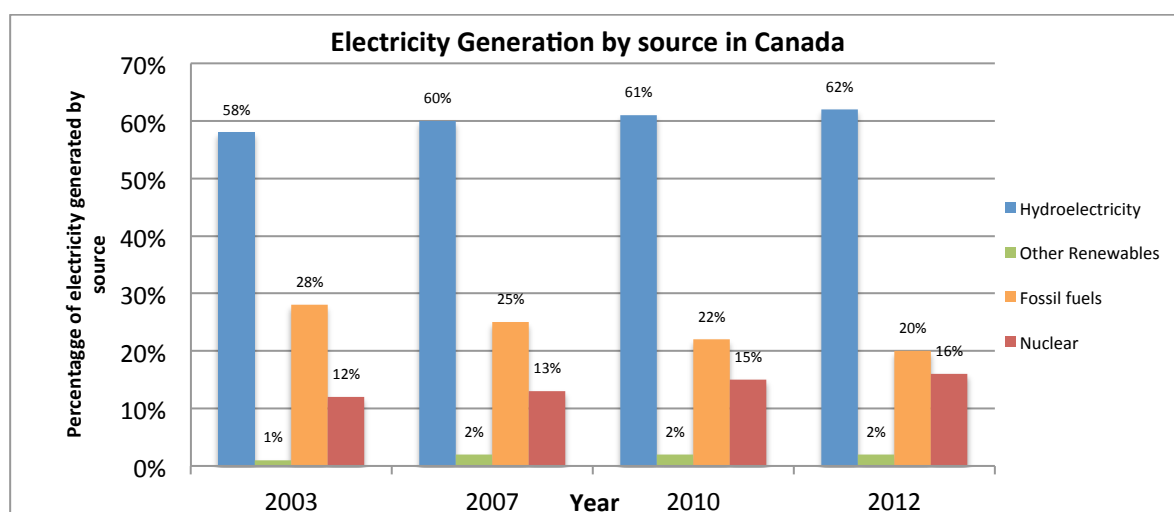


Coal is another form of fossil fuel to have seen its level of consumption drop off in the past decade, with a particular impact on the national average of Provinces such as Ontario where there has been a total phasing-out of coal burning (Clean Energy Canada, 2014). In terms of nuclear power, the level of national average of consumption has been relatively stable over the past decade (EIA, 2014).

4.3 Electricity generation by type

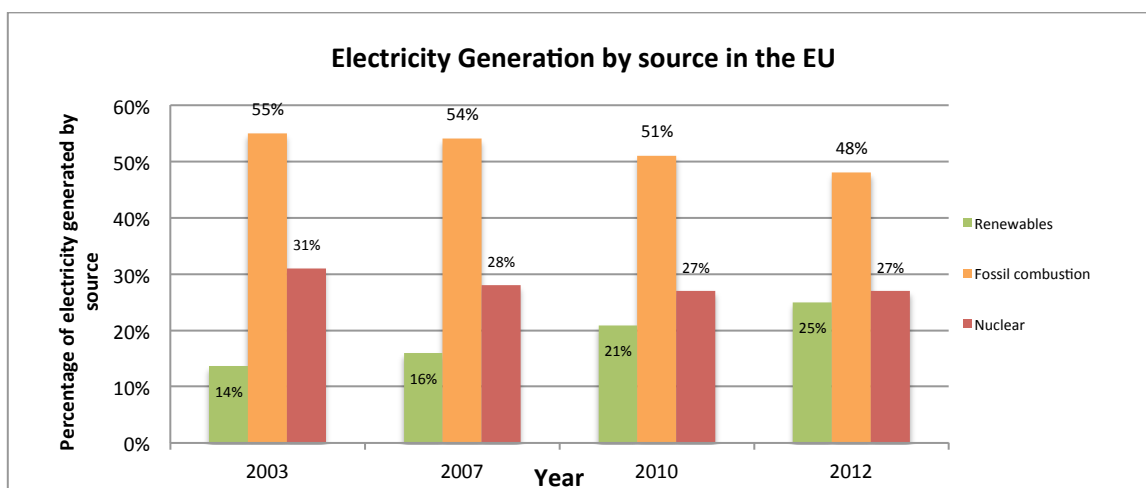
The table below (US Energy Information Administration, 2014) illustrates the fact that the generation of electricity from hydro sources and from other renewable sources such as wind and solar is on the rise in Canada, while the burning of fossil fuel to produce electricity has dropped by about 8% between 2003 and 2012. However this numbers are driven by a select few Provinces such as Quebec, Manitoba, Prince Edward Island and British Columbia for example who all have very clean and sustainable electricity generation plans in place, while other Province such as Alberta who are highly dependent on coal and oil only have 18% of electricity being produced from clean sources and other such as Ontario are highly dependent of nuclear produced electricity (Clean Energy Canada, 2014). Overall though the table does show that electricity generation is dominated by clean and renewable energy sources, and the overall trend in the past decade is moderately positive showing a shift away from fossil produced electricity.

Figure 6 Evolution of the generation of electricity by source in Canada between 2003 and 2012 (source: US Energy Information Administration, 2014)



In the EU while the share of renewables in electricity production is not as high as it is in Canada, reaching only 25% in 2012, their growth is also positive and in fact more important compared to Canada with a 10% growth between 2003 and 2012 (European Commission, 2014). That is a clear indication of the increasing sustainability of electricity generation and a sign of the growing importance of renewable energy sources in the EU. This increase in renewables is split between a 7% decrease in the use of fossil fuels and a 4% decrease in the use of nuclear power for the generation of electricity.

Figure 7 Evolution of the generation of electricity by source in the EU between 2003 and 2012 (source: European Commission, 2014)



Admittedly renewable sources still only make up a quarter of electricity generation, but the overall trend since 2003 is positive in terms of a transition towards a greener and more sustainable electricity base. Moreover the fact that there has been a 4% increase in the share of renewables between 2010 and 2012 is very encouraging given the economic context following the 2008 financial crisis.

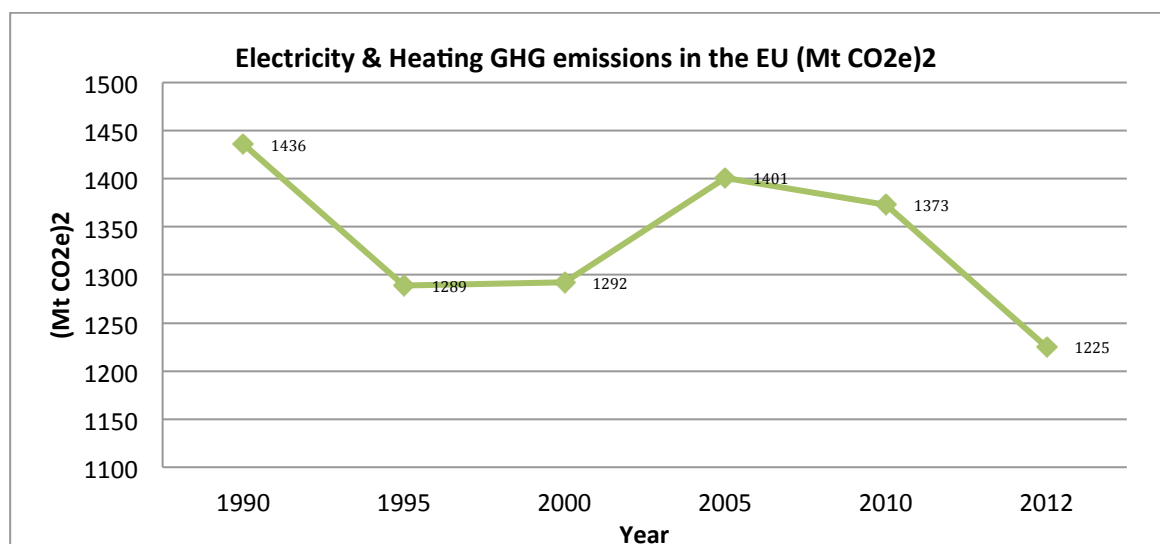
Noticeably just as there is in Canada between the different Provinces there is a large difference in the electricity production mix between different European Member States, with a few States such as Sweden (53.2% of RE in their electricity production), Norway (98%) and Portugal (62.5%) leading the way while States such as the Czech Republic (12.1%), Poland (12%) and Hungary (8%) bring up the rear (Enerdata, 2014).

4.4 GHG emissions

The last set of figures that we will look at is the evolution both regions' greenhouse gas (GHG) emissions, specifically from electricity and heating first of all before looking at total emissions. To do so we will look back as far 1990 given it is the year set by international GHG agreements such as the Kyoto Protocol.

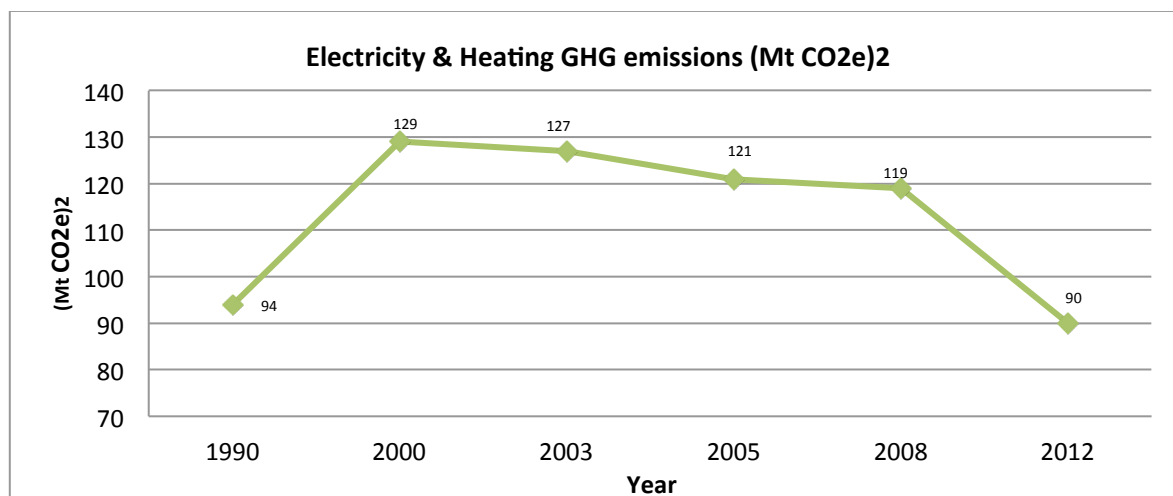
In the European Union the level of GHG emissions from electricity and heating dropped by nearly 15% between 1990 and 2012, a drop that is a reflection of the transition towards a cleaner generation of electricity and of the reduction in the amount of electricity, produced from fossil fuels and natural gas (EEA, 2014). Noticeably the decline in emissions wasn't a linear decline, as there was an important increase between 2000 and 2010.

Figure 8 Electricity & Heating GHG emissions in the EU between 1990 and 2012 (Mt CO₂eq) (source: European Environment Agency, 2014)



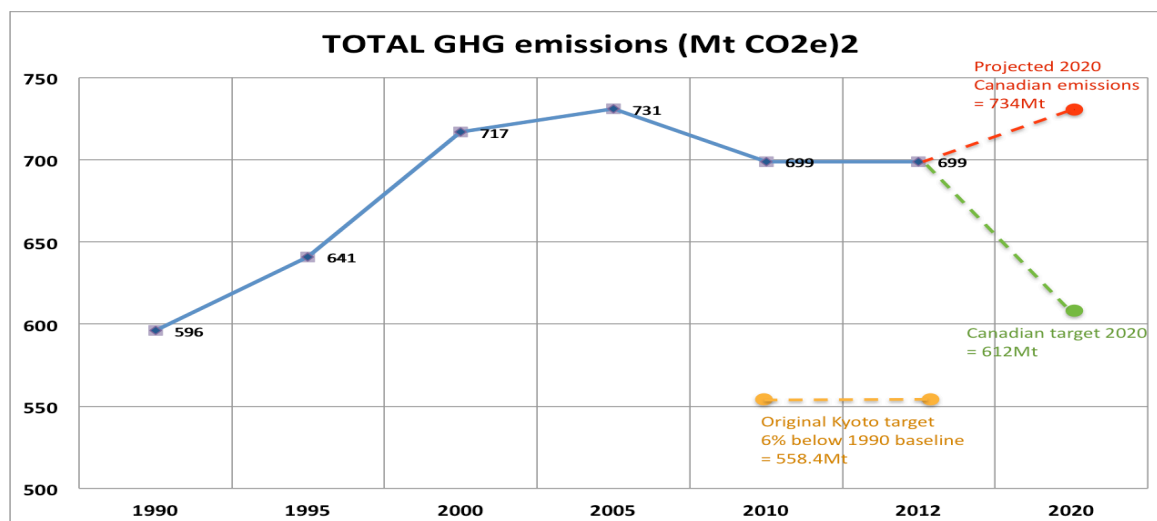
In Canada the level of GHG emissions from electricity and heating are relatively similar in 1990 and 2012, with only a slight drop from 94 to 90 Mt. Yet the trend in between time is quite remarkable as similar to the EU there was a huge peak of emissions from electricity between 2000 and 2008 before a drop in emissions between 2008 and 2012 (Environment Canada, 2013). This trend is proof that an energy transition towards a cleaner and more sustainable future is on going in Canada and that is has accelerated over the past few years.

Figure 9 Electricity & Heating GHG emissions in Canada between 1990 and 2012 (Mt CO₂e) (source: Environment Canada 2013)



All is not perfect however. The following graph shows the evolution of the total greenhouse gas emissions in Canada since 1990, rather than just those caused by the consumption of electricity. The trend in the case of total emissions is a lot more worrying (see Appendix 2).

Figure 10 Total GHG emissions in Canada between 1990 and 2012, and projected trend to 2020 (Mt CO₂ eq) (source: Environment Canada, 2013)

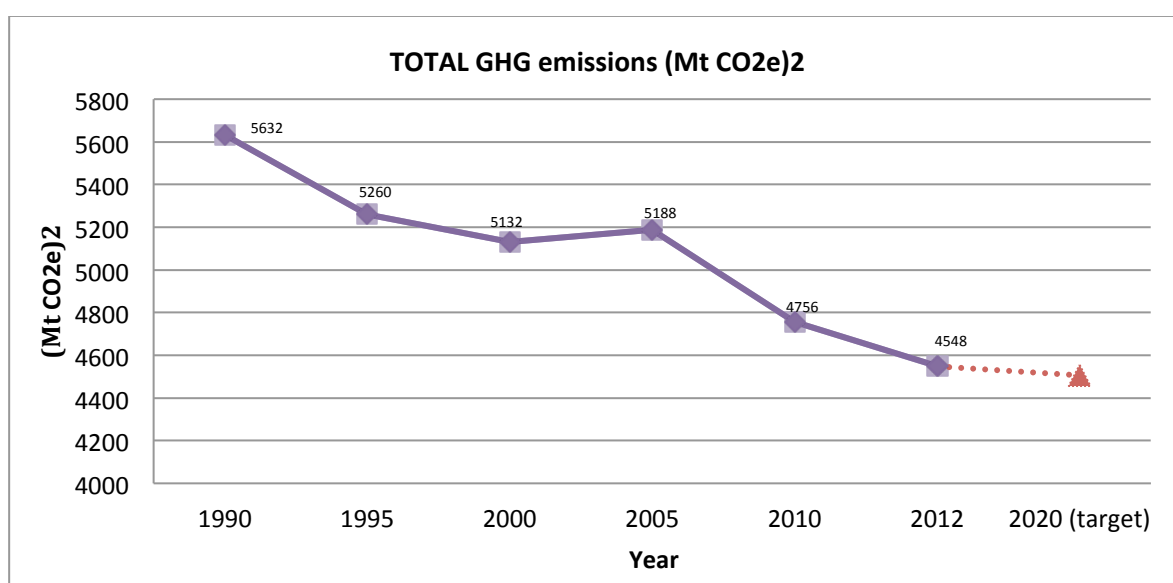


As the figure 10 on the previous page shows, between 1990 and 2000 emissions increased by nearly 20% to reach 700 Mt, while this figure is expected to rise again to reach up to 734 Mt by 2020, which is a considerable way off the target that the

Federal Government pledged to achieve by 2020 and even further away from the original Canadian Kyoto target (Environment Canada, 2013).

As for the European Union, it has followed a far more positive trend in terms of its total GHG emissions and it is in fact already very close to achieving its target of reducing total emissions by 20% compared to 1990 by 2020. The EU is expected to carry on this positive trend and is expected to have reduced emissions 24% by 2020 compared to 1990 (EEA, 2014).

Figure 11 Total GHG emissions in the EU between 1990 and 2012, and projected trend to 2020 (Mt CO₂eq) (source: European Environment Agency, 2014)



4.5 Overview of the energy transition in numbers

In this sense both regions appear to be at different stages of the energy transition. In Canada renewables play a far greater role in both the production of electricity and total energy consumption, yet the overall trend since 2003 in regards to GHG emissions, energy efficiency and final energy consumption is not one that represents a cleaner or more sustainable energy scenario. The EU presents a different state of affairs with renewables still being a relatively minor contributor to the generation of electricity and total energy consumption but the growth in the share of renewables is one that has been a lot greater since 2003, and such a positive trend is expected to keep on going beyond 2020. The energy potential of Canada is huge compared to the EU, and in this sense both regions are faced with different challenges. It is in the

interest of the EU to push its energy transition further given the amount of energy it has to import and given the issues of energy security and energy efficiency. This is not the case for Canada however as it is a net exporter of energy and has huge available oil resources meaning that energy security and efficiency are not as pressing issues for the country.

If we relate these trends and observations back to the four stages of a transition put forward by Loorbach and Rotmans (2006), what stage of the transition is the period between 2003 to 2020 in the EU and Canada? For the European Union the answer appears relatively clear-cut given the consistent trend that appears across at least four of the five categories we have analysed. Since 2005 there has been a break and a marked improved in terms of final energy consumption, greener and more sustainable electricity generation, reduced GHG emissions from electricity and heating as well as a drop in total GHG emissions. As mentioned what is noticeable is that there is a clear break and rupture between 2003 and 2005 that takes place. In this sense it can be argued that the EU this period between 2003 and 2005 is the “take off phase” that is described by Loorbach and Rotmans as being “the process of change that starts to build and the state of the system begins to shift” (2006, p. 4). Based on the numbers alone it is difficult to evaluate at this stage whether the take off phase goes beyond 2005 or if the acceleration phase is entered. The following part however that takes a closer look into the policies and institutional changes that have taken place in the past decade will enable us to do so.

As for Canada it appears a lot harder to judge the stage of the transition the country has reached given the differing and contrasting numbers across the five categories we have analysed above. The country has an important share of renewables in both its electricity generation and its energy consumption by type, and this share of renewable energy sources has kept on steadily increasing since 2003. However final energy consumption has also carried on increasing meaning that energy efficiency has not improved, and the situation in regards to greenhouse gas emissions appears relatively bleak. The numbers from these five categories alone in this sense do not provide a clear enough picture to be able to evaluate at this stage what phase of the transition Canada has been through since 2003.

5 Renewable Energy Promotion Policy overview in the EU and Canada

In the following part we will look at how the European Union and its Member States, and Canada and its Provinces have gone about promoting the development of renewable energy sources. To do so we will look at the strategies put in place and at the different specific support measures used before drawing a comparison between both regions (see Appendix 3 for an overview of the main types of renewable energy support measures). This will then enable us to move on to a general overview of the energy transition.

5.1 In the EU

To achieve its short, medium and long targets set out for 2020, 2030 and 2050 respectively; the European Union has highlighted five key policy areas (European Commission, 2015). The first of these five areas is a European Energy Security Strategy in order to guarantee a greater level of security of supply. Second is a more resilient and integrated Internal Energy Market; this European energy market is a EU-wide gas and electricity network based on common rules so as to increase supplier competition and promote greater choice for consumers. Third is a development of renewable energy sources in order to boost the production of European energy. Fourth is the greater promotion of energy efficiency, and finally the fifth policy focus is the greater focus on strict energy rules such as the disposal of nuclear waste or the operation of offshore oil and gas platforms (European Commission, 2015).

Noticeably the promotion and development of renewable energy sources is one of these five policy areas that the EU has targeted. It is on this area that we will specifically focus on in the following part, in order to draw a comparison and understand the main differences and commonalities between how the European Union and Canada promote renewable energy sources through their energy policies. Both regions claim to be striving towards a cleaner and more sustainable energy

future, and in the following part we will look at the policy tools they are using to do so.

European Measures,

The EU underlines three main factors that drive its need to develop the production of energy from renewable sources (European Commission, 2015). Firstly the European Union stresses the need to reduce its dependency on imported energy (Eurostat, 2014). Secondly it puts an important emphasis on the renewable energy industry being a driver of technological innovation and of employment throughout Europe (European Commission, 2015), while thirdly the EU argues that developing renewable energy further is also a key variable in aiming to combat global warming (2015). The main policy tool implemented by the European Union is the Directive 2009/28/EC on the promotion of renewable energies, which established that by 2020 there should be at least a 20% share of energy produced from renewable sources in that year and at least a 10% share of biofuels in transport petrol and diesel to be introduced in a cost-effective way (Official Journal of the European Union, 2009).

The Directive also established a binding national target for each Member State to achieve by 2020, which translates the European 20% renewable energy target. The national target was determined by taking into account the starting point of each Nation as well as its energy potential. Each Member State has then had to develop a National Renewable Energy Action Plan in order to set out the time frame and measures that they intend to put in place to reach their national target. As well as these targets, a number of interim targets are also defined in the Directive (Fouquet, 2013). It is important to highlight the fact that each national target set for 2020 is legally binding, while the intermediate targets are not binding. The reason that the Directive (2009) points out that the targets are mandatory is to provide certainty for investors and to encourage the development of technological innovation. It is also important to note that Member States can achieve their national renewable targets across all energy sectors, meaning that they can combine the use of renewable energy sources to produce electricity (RES-E), heat or cooling (RES-H), and transportation (RES-T) (Kitzing et al., 2012).

Part of the European Union's renewable energy policy is the Cooperation Mechanism established in the 2009 Directive that encourages cooperation between Member States to "increase economic efficiency of their RES target achievement, optimize TES resource utilisation and contribute to the internal energy market" (Ecofys, 2014, p.1). Four different forms of cooperation are in place, yet Sweden and Norway are currently the only two countries that have engaged in such a form of cooperation by developing a joint support scheme, meaning that they coordinate part of their RES support schemes as well as collectively defining how their renewable energy is allocated to their national target (Ecofys, 2014). The European Commission has published new guidance documents so as to provide further information regarding the potential benefits of such cooperation mechanisms in order to encourage Member States to increase levels of cooperation (2014).

Since the Directive of 2009, the European Commission has published several communications regarding the design of national support schemes for renewable energy (EEA, 2014). These updated guidelines have been implemented so as to support Member States in reaching their 2020 targets while also dealing with market distortions that have arisen from support granted to the development of renewable energy. In this sense an important shift is noticeable towards a market-based approach, with public support from 2016 only being allowed to be in the form of market-oriented mechanisms such as premiums for example. Moreover there will be a gradual introduction of competitive bidding for public support (EEA, 2014). In terms of more direct European energy investment grants, two programmes have been set up so as to help Member States increase the share of renewable sources in the energy mix. The main programme is ELENA, the European Local ENergy Assistance, which is a joint initiative from the European Investment Bank and the European Commission to help local and regional authorities develop renewable energy and energy efficiency projects. An estimated EUR 1.6bn have been invested between 2012 and 2015 (EIB, 2012). The other support programme was the European Energy Programme for Recovery, or EEPR, which was designed to help accelerate infrastructure and technology investments so as to improve the security of the energy supply of the Member States and to speed up the implementation of the 2020 energy targets (ManagEnergy, 2015).

Two other renewable support programmes that are in place are the FP7-energy programme and to a certain extent the SET Plan. The FP7-energy programme is a funding programme that encompasses renewable support initiatives such as the European Wind Initiative, the Solar Europe Initiative, the Bioenergy Europe Initiative and the European Electricity Grid Initiative (CORDIS, 2012). The objective of the programme is to aid the creation and establishment of the technologies necessary to adapt the current energy system into a more sustainable, competitive and secure one (CORDIS, 2012). In regards to the SET-Plan, the Strategic Energy Technology Plan, it plays a key role in the research and technological development of the different renewable energy sources (SETIS, 2015).

National Measures,

Denmark was the first country to introduce specific policy measures to support the development of renewable energy sources in 1979. Nearly a decade later in 1988 Portugal followed suit with their own policy measures, while Germany in 1989 and the United Kingdom in 1990 followed shortly afterwards by implementing their own national support measures (Energy Policy, 2012). Since then the energy policy landscape of Europe has changed dramatically. In 2001, only 19% of all energy support measures in Member States were specifically in place to support renewables (EEA, 2002). By 2012 this percentage had grown to 40,5% (EEA, 2013). The opposite trend is noticeable for support measures in place for fossil fuels and nuclear, as they made up 81% of policies in 2001 (EEA, 2002) but this number had dropped to just over 53% by 2012 (EEA, 2013). If we are to look at the general trend across Member States in regards to the types of policy support measures (see Appendix 3 for an overview of the main renewable energy support measures) that have been implemented in the European Union, four types of strategies are the most common (Energy Policy, 2012):

- *Feed-in-Tariffs* and Feed-in-Premiums
- *Quota Obligations*, also called Renewable Portfolio Standards with Renewable Energy Certificates
- *Investments Grants*
- *Fiscal Measures*

Feed-in-Tariffs are the most popular measure in regards to renewable electricity, while investment grants are the most common for renewable heat and cooling and quota obligations are the most frequently used measure for the use of renewable sources in transport (Energy Policy, 2012).

As we have outlined already, the energy scenario and context is very different across the twenty-eight member states. To highlight this fact and to highlight the different ways in which member states manage their energy, we have taken three countries; Denmark, Germany and Belgium, and looked into their energy policies and looked at how they are promoting renewable energy sources (see Appendix 4 & Appendix 6 for a more detailed look at each of these three countries). Both Denmark and Germany were chosen in order to illustrate the case of two countries playing a leading role in pushing the European energy transition forwards, while both have used differing policy measures to do so. Furthermore Denmark is also one of the more ambitious European countries in terms of renewable energy targets having set itself the goal of reaching 30% of renewables in final energy consumption by 2020 and aiming to be totally independent from fossil fuels by 2050. Germany's targets are just below the European ones, as it aims to produce 18% of its energy consumption from renewables by 2020 and 60% by 2050. On the other hand Belgium was chosen given that its 2020 renewable energy target of 13% in final energy consumption is considerably lower than the general European target of 20%.

A very noticeable aspect when looking into the energy programs targets set out by these three countries is the level of detail and strategic planning that both Denmark and Germany have put into theirs, while on the other hand Belgium's strategy is a lot less thorough. Belgium has established a strategy and a plan in the short term up to 2020 through its National Renewable Energy Action Plan yet it currently has no strategy established in the medium or long run, aside from its plans to phase out nuclear power by 2025. Germany and Denmark however both have clearly defined strategies both up to 2020 as well as up to 2050, with intermediated steps outlined for 2030 and 2040.

5.2 In Canada

Natural resources are of significant importance for the Canadian economy as they directly account for 20% of Canada's GDP and 50% of the country's exports (IEA, 2013). Given this, it is vital for the country and its government to strike a balance between exploiting their wealth of natural resources in a way that is environmentally responsible, generating economic growth and competitiveness, ensuring security of energy supply and guaranteeing the protection and development of infrastructure. Overall Canada is guided by the inherence of free-market principles as well as by the importance and regard for the jurisdictional authority of its provinces (IEA, 2013).

Federal Measures,

First of all as mentioned in the previous section, Canada only has two main Federal energy targets. One in regards to the production of electricity, with the country aiming to produce 90% of its electricity from zero emitting sources by 2020, and secondly in terms of GHG emissions with the country aiming to reduce emissions by 17% compared to the levels of 2005 (IEA, 2104). The country does not however have any imposed binding targets on any of its ten Provinces. Looking into the more specific renewable energy policies, the federal government has since 2009 replaced several of its energy policies installed in between 2000 and 2004 (IEA, 2013). These policies were shaped around the four following programmes (Environment Canada, 2013):

- WPPI - *Wind Power Production Incentive*, through which the federal government promoted the production of electricity from wind power by funding a significant part of the associated costs. The Incentive ended in 2007 with the change of government.
- REDI – *Renewable Energy Deployment Initiative*, which saw investment through marketing initiatives, infrastructure development and financial incentives promoted the use of renewable technologies in commercial and industrial organisations.
- MIP – *Market Incentive Program*, aimed at residential and small-business partners to encourage them to buy low-impact renewable energy.
- PERR – *Purchases of Energy from Renewable Resources*, a commitment from the federal government to purchase 20% of electricity from renewable

resources. Some provincial governments such as Alberta are already entirely powered by renewable resources.

These four federal policies shaped the renewable energy policy scene in Canada between the start of the new millennium and about 2007. It is noticeable that this shift away from these policies to a new set of energy policies occurred when the Conservative Party was elected, taking over from the Liberal Party who had been in power for over a decade (Parliament of Canada, 2012).

The ecoENERGY program, set out by Natural Resources Canada, shaped the new set of policies established in 2007 and marked the second generation of federal incentives for renewable energies (Brown, 2007). The program, still largely in place today, provides financial support and fiscal incentives to homeowners, small and medium sized businesses, and public institutions in order to encourage a more efficient use of energy, to boost renewable energy supplies and to help develop cleaner energy technologies (NRCan, 2014). The program is divided into nine specific dimensions, including energy efficiency, innovation and technology initiatives, renewables, bioenergy, electrification of transportation and unconventional oil and gas (Nelson, 2011). However it should be noted that the Home Retrofit Program, an important and popular part of the ecoENERGY program that granted Canadian homeowners rebates of up to \$5,000 for home energy improvements, was cancelled in 2012 despite its popularity and it only being renewed in 2011 (NRCan, 2014).

Besides from the ecoENERGY plan, the Federal government has implemented five other noticeable policies since 2007 that are either still currently live or will be in the coming months of 2015 (Clean Energy Canada, 2014):

- Greenhouse Gas Regulations on Coal Fired Electricity Generation – the policy will take place as from July 2015 and is expected to save 3MT of CO₂ by 2020, which is less than half the amount saved by the ecoEnergy program.
- Clean Energy Fund – which has supported carbon capture and storage, renewable energy, and R&D projects between 2009 and today.

- Sustainable Development Technology Canada – funding of Canadian clean energy technology development since 2012
- Renewable Fuel Development
- Pulp and Paper Green Transformation Program – which has provided efficiency and renewable energy investment in the forestry sector since 2012.

Yet currently only three Federal policies, the ecoENERGY efficiency program, the Sustainable Development Technology Canada and the Renewable Fuel Development, are still active today (Clean Energy Canada, 2014). The other policies have either already been fully committed or, in the case the coal regulations, are yet to come into force. Of all these policies though implemented in recent years, the ecoENERGY efficiency and renewable power program is the most significant one and the one to have had the biggest impact, through its financial incentives, on increasing the share of renewable energy in the country's energy mix as well as reducing estimated greenhouse gas emissions (Clean Energy Canada, 2014).

The matter of renewable energy is one that is specifically in the hands of the provinces though with little federal regulation, a fact that is illustrated by the diverse state of renewable energy across the ten Provinces.

Provincial Measures,

As we did for the European Union, we have looked more closely at three Canadian Provinces, Ontario, Quebec and Nova Scotia, that were each chosen for different reasons yet they all have the underlying commonality of striving towards a greener and more sustainable energy future (see Appendix 5 & Appendix 7 for a more detailed look at each of these three Provinces). Ontario first of all was chosen given the ambitious renewable policies that have been implemented through its Green Energy Act, which enacted a feed-in tariff modelled on the successful policy implemented by Germany (Clean Energy Canada, 2014). Between 2009 and 2013 there existed different levels of tariffs set for electricity fed into the grid from renewable sources, yet since June 2013 FIT's have been limited to small projects under 500kW. Moreover in addition to the FIT another key policy that has had a key role in the success of the Green Energy Act has been the streamlined approval, assistance and support processes put in place to help renewable energy projects

establish themselves, develop and connect to the electricity grid successfully (Runyon, 2009). Moreover the fact that the Province has totally phased out its coal burning makes it an even more interesting case, while it has promoted renewable energies through the implementation of feed in tariffs as its main policy tool. From a situation in 2005 when coal made up 25% of the Provinces electricity supply, Ontario totally banned and closed in 2014 all coal-fired power generation (Clean Energy Canada, 2014). This means that since then the electricity of Ontario, Canada's most populated Province, is officially coal free while 30% of its grid is renewable (Clean Energy Canada, 2014).

This phase out took place over thirteen years, between 2001, when the first legally binding regulation was issued requiring the phase out of coal burning in Mississauga at the Lakeview Generating Station, and 2014 by which time the four remaining coal-burning sites had been closed (Clean Air Alliance, 2011). It should be noted that this phase out is "the single biggest greenhouse gas reduction initiative in North America" (Clean Air Alliance, 2011).

Quebec is interesting given how it has managed to reach a point today where 99% of its electricity is clean making it one of the cleanest regions in terms of electricity in the world (Chassin, 2013), yet no energy policy appears to have had a significant impact on the Province achieving this. The huge share of renewable energy in Quebec's energy mix is largely down to the size of its main energy company Hydro-Quebec that has significant power being the largest electricity producer in Canada and the largest hydroelectricity company in the world. Noticeably Provincial support in Quebec is only available for large energy projects through its portfolio approach, thereby favouring such a big company as Hydro-Quebec, with relatively little support being available for small-scale renewable energy projects.

In this sense Quebec's energy scene appears to be less influenced by big and bold policies such as the FIT or the coal phase that have been in place in Ontario. The key determinant is the size and scope of Hydro-Quebec and how it has shaped the energy production, distribution and consumption in the Province through the important exploitation of the significant hydroelectric resources available.

As for Nova Scotia, it is trying to move away from being highly dependent on coal imports as it has been over the past few decades. The Province has been trying to implement sizeable policies to make the transition towards a cleaner and more sustainable energy mix, with support policies for renewables mainly being through feed in tariffs and net metering. However beyond the new policies that have been implemented it should be noted that the electricity marketplace has remained regulated rather than being opened up to competition given the limited connection of the provincial electricity grid to the North American grid.

Firstly Nova Scotia has backed large renewable electricity projects and has split them evenly between Nova Scotia Power, the main electricity producer in the Province, and independent power producers from whom Nova Scotia Power is then obliged to buy power from (Nova Scotia, 2010).

Secondly in terms of small community projects, a community-based feed-in tariff (COMFIT) was established so as to encourage these smaller projects, typically less than 2MW. The third policy measure to be implemented was Enhanced Net Metering to give individuals and small businesses the opportunity to put surplus power they generate into the grid in return of payment at retail price (2010). Fourthly the last important measure was the setting up of Nova Scotia Efficiency Corporation in 2010 that has helped the Province to become the most energy efficient in Canada.

6 Overview of the state of the energy transition in the EU and Canada

There are many similarities but also many differences between both regions' promotion policies of renewable energies. The main overriding difference is that in Europe the transition towards a more sustainable energy scenario is one that is very much goal oriented. The EU and its institutions have established a relatively detailed and thorough strategy, which outlines general targets for the EU to achieve as a whole in the short-term and long-term, while more specific objectives are set for each individual Member State to achieve. Crucially these targets are binding for Member States, thereby underlining the intent of the EU to push its energy transition forwards. However each Member State is free to establish how it reaches its own

individual targets meaning that each Member state can determine the strategy, policies and measures that are put in place to achieve its objectives. In this sense the energy transition in Europe is a reality as we saw through the figures in part 4 of this paper. It is driven through the EU institutions and the general legislative framework that they have established, and it is implemented and made effective through the policies put in place in the individual Member States. In Canada however the transition is very much driven by a select few provinces, with the Federal Government playing a far smaller role than the EU institutions play in Europe. There are only two Federal energy and climate targets, which are both non-binding for the Provinces. However the EU and Canada are similar in regards to the fact that just like each Member State is in Europe, the Canadian Provinces are free to determine their own energy strategies and policies

In terms of the of the policy support measures for the development of renewable energy sources, it is noticeable how the strategies and policy measures of a few European countries such as Denmark and Germany have inspired Canadian Provinces. Measures such as the Danish and German Feed In Tariffs have shown themselves to be especially effective and have lead to Provinces such as Ontario and Nova Scotia to follow suit. Overall Feed In Tariffs and fiscal measures have so far been the most successful and most widely used policy measures both in the EU and Canada. Using the concept of sustainable development of Loorbach and Rotmans (2006) and based on the figures of part 4 of this paper and the overview of the policies in part 5, both regions are at different stages of their energy transition for the period between 2003 and 2020 (see Appendix 8 for a comparative table of the elements of the energy transition in both regions).

The EU appears to be currently at the beginning of a phase of acceleration (Loorbach & Rotmans, 2006). As we highlighted when looking at the figures since 2003 regarding electricity production, final energy consumption, energy consumption by source and greenhouse gas emissions, Europe between 2003 and 2005 went through a take-off phase given how there was a dramatic and fast change towards a greater use of renewable energy sources and therefore a cleaner energy scenario. Through its legislative energy framework, as well as its clear strategy and objectives, the EU has

gone through structural change since 2005 with noticeable events such as the Lisbon Treaty marking the institutional change that characterises the acceleration phase, while the individual Member States implement the more specific renewable energy support measures that makes the transition a reality.

It is a lot harder to evaluate at what stage Canada is in its energy transition. On the one hand it could argue that it has already reached a phase of stabilisation given the relative stability in the consumption of energy by type and in the generation of electricity by source. Since the early 2000's there has also been a relative stability in terms of total greenhouse gas emissions. In this sense it can be argued that an equilibrium has been reached where fossil fuels still dominate the energy scene but where renewable energy sources, especially hydro energy, has a significant role to play. However this appears to be in contradiction with a governance and policy perspective from which it can be argued that Canada is still only somewhere in between the pre-development and the take-off phase given how there is little apparent change at the national level and that the transition is driven by a select few individual Provinces. As Loorbach and Rotmans explain (2006), the pre-development phase is one where there is very little visible change at the systems level but a great deal of experimentation at the individual level. Therefore if you take the Federal Government of Canada as the system level and its ten Provinces as the individual level, the fact that the Federal Government's energy strategy is relatively under-developed compared to Provinces such as Ontario, Quebec or Nova Scotia leads us to believe that Canada is still only at such a phase of pre-development.

There is not one single answer however that truly answers the question of evaluating what stage of the transition a region is at given how it is only relative to the scale of analysis, to the factors that are focused on and taken into account, and the time scale under consideration. Overall what this highlights is the complexity of the issue at hand given the multitude of actors, the multitude of interests, the long term aspect of transitions and the uncertainty as well as the huge number of variables that are in play such as technological innovation, economic stability and state of grid infrastructure to name just a few. In this sense predicting the future state of the energy transition and how it will evolve in years to come both, even in the short term

between now and 2020, is extremely difficult. As it has been the case over the past decade events such as the financial crisis, the Japanese nuclear disaster, the BP oil spill and the political instability of the middle east for example can change the energy scene in an instant and make any predictions regarding the future state of the transition worthless.

7 Conclusion

Through this theoretical thesis we have looked to evaluate the state of the energy transition in the European Union and Canada between 2003 and 2020 from the perspective of energy governance and energy policies, and attempted to draw a comparison between both regions. The energy transition in focus is the transition of the composition of the energy mix in both the EU and Canada from the dependency on fossil fuels to a greater consumption of renewable energy sources.

The paper has been structured into five parts. First of all we looked at putting the energy transition in context in order to understand why many see energy as being the lifeblood of society and the role that renewable energy sources could potentially play. Secondly we looked at energy governance in the EU and Canada by evaluating institutional governance in both regions, the level of involvement of institutional bodies in energy matters, the specific energy and climate targets that have been established and finally the international governance of energy. The third step of the paper was to look at the numbers of the energy transition in both regions by taking into account five specific areas; total primary energy consumption, energy consumption by source, electricity generation by source, GHG emissions in terms of electricity and heating and finally total GHG emissions. In the fourth chapter before we drew up the key policies and support measures promoting the development of renewable energy sources in both regions. The fifth and final part was to evaluate the stage of the transition in Canada and the EU based on the findings of the three previous chapters of the paper in order to be able to draw up the differences and similarities in both regions.

The **main findings** of this theoretical paper are the following:

- Both the European Union and Canada actively claim to be aiming to reach a sustainable energy scenario, where sustainability is defined as being a scenario of clean, secure and affordable energy.
- The energy transition, based on the criteria established in part 4 of this paper, is a reality in both the EU and Canada yet it is at a different stage in both regions. While in Canada renewable energy sources already play a far greater role both in final energy consumption and electricity production than it currently does in the EU, there has been a greater upward trend in Europe since 2003 as it moves towards greater energy sustainability and reduced greenhouse gas emissions. In Canada the state of energy has appeared to be a lot more stable over the past decade, while the state of GHG emissions has considerably worsened over the past decade. The EU appears to be in between a phase of take-off and acceleration in its energy transition, while Canada is torn between a phase of stabilization on a national level and a phase of pre-development and take-off in certain Provinces.
- The European Union and its institutions appear to be far more involved and take a more hands on approach in terms of the governance of energy compared to the Canadian Federal Government. The EU's general energy strategy and energy targets are far more thorough, detailed and ambitious than those of the Canadian Government making the energy transition in Europe a goal-oriented one.
- The energy transition in Canada is a reality but it is very much driven by a select few Provinces. In this sense the Canadian transition could be seen as a more bottom-up approach where Provinces and local communities are the leaders of the transition, compared to the more top-down approach in the EU given the level of involvement of its institutions.
- In both regions specific energy policies and support measures are left to the individual Member States in the case of the EU and individual Provinces in the case of Canada. Feed in Tariffs and fiscal measures have been the most successful and the most widely used renewable energy promotion measures across both regions. It is interesting to note that many of the energy policies implemented in different Canadian Provinces have been inspired by those developed in European countries such as Germany and Denmark.

- An energy transition is highly complex matter that evolves on many different scales over the long-term with a multitude of actors involved who all have many different and often diverging interests.

There are no linear one-dimensional answers to the issue of reaching a sustainable energy scenario given the complexity of any energy transition. What has been evident in putting together this theoretical paper is the size of the issue, the huge number of variables that are in play and the multitude of levels on which the energy transition is being played out on. This very characteristic of the field of energy transitions marks **the limitations** of this paper as it is very difficult to take all of the variables, all of the actors, and all of their interests into consideration. In our case given the limited resources available we have not been able to look more closely at all of the Canadian Provinces and into all of the European Member States to draw out a fully detailed comparison. It should also be noted how difficult it is to obtain the exact same data for both regions at similar points in time. Furthermore we have not taken into considerations key issues such as technological innovations, infrastructure issues, and the nature of energy markets to name just a few. The findings are therefore incomplete of course, but it leads us to the question of wondering whether or not a complete model of analysis is possible or not?

In regards to potential **further research** that would enhance this paper, there are two areas that would add significant weight to it and improve the basic findings that have been reached so far:

1. To what extent are general energy strategies and policies developed at the macro-level (e.g. at the European level or the Federal level in Canada for example) more effective than when they are developed at the micro-level (e.g. by Member States in the EU for example or Provinces in Canada) in helping to create a context favorable for energy transitions to emerge and be successful in achieving a sustainable energy scenario?
 2. In the area of renewable energy support measures what are the key success factors that determine the relative effectiveness and impact of policy measures such as Feed-In-Tariffs, Feed-In-Premiums and Quota Obligations for example?
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International business thesis

Practical part

**Qualitative analysis of the development of the
Electric Vehicle market in Canada between 2011 &
2015**

1. Introduction

This second part of the International Business is a practical part that consists of a systemic empirical qualitative work. The aim is to produce original results from a field in order to answer a specific research question. Based on the definition of the Oxford Dictionary (2015), an empirical analysis is an analysis that is built on and verifiable by experience and observation rather than theory or pure logic.

1.1. Statement of the Research Problem

The aim of my research is to look into the transportation transition in Canada, and more specifically the Electric Vehicle (EV) Market, in order to understand the reasons that explain why the Canadian EV market is considerably less developed than most European Countries. The EV market is considered by the European Union as a key solution to the challenge that is the transportation transition, and it has made significant strides forwards over the past five years. However as this research will show the EV market in Canada is lagging behind many European countries despite the country's huge renewable electricity potential.

The main research question that this empirical research is based on is the following:
“What are the barriers and factors that explain why the Canadian electric vehicle market has been slow to develop between 2011 and 2015 compared to the EV market of most European countries?”

1.2. Interest of the research

This research represents a significant business interest given the huge green electricity potential in Canada that could be exploited by a more extensive use of electric vehicles. There are also huge technological developments and opportunities in the field of electric vehicles and electricity storage that currently exist and will continue to grow in the coming years yet as it stands are not being exploited in Canada. Highlighting the barriers that are holding back significant EV market growth could contribute to the improvement of EV market share and help capitalise on technological developments.

Furthermore this research also represents an academic interest given that it follows on from my theoretical research as it looks more closely at the issue of the transportation transition, which is one of the key challenges of the energy transition. This is highlighted by the fact that in 2012, 93% of transportation came from petroleum (Davis et al., 2014), meaning that greenhouse gas transmissions from transportation make up 27% of total global GHG emissions (EPA, 2015). These figures illustrate why transportation is one of the key challenges of the current energy transition. In this sense and based on the findings of my theoretical thesis that highlight how a select few Canadian provinces appear to be actively pursuing a transition towards a cleaner and more sustainable energy scenario, it seems obvious that replacing the huge fleet of fuel powered vehicles by electric vehicles is a transformation that should be desired. Electric vehicles are a way of directly reducing the consumption of fossil fuels by replacing them with electricity produced from renewable energy sources (IEA, 2013). As Axsen et al. (2015) highlight in their report, GHG emissions in Canada could be cut by 80 to 98% in British Columbia, around 45% in Alberta and up to 70% in Ontario through the usage of PEVs. These figures of potential GHG reduction underline the environmental desirability of a transportation transition towards electric vehicles and away from fuel-powered vehicles.

Finally the fact that this research will be performed while living in Canada and working there in the electrical and energy sector provides me with a significant opportunity to be able to meet key actors of the electric vehicle industry and of the transportation sector.

1.3. Definitions

In this paper, the definition used for Electric Vehicles is the one defined by the International Energy Agency (2013);

- Electric Vehicles (EV) in this paper are defined as passenger car Plug-in Hybrid Electric Vehicles (PHEV), Battery Electric Vehicles (BEV) and Fuel-cell Electric Vehicles (FCEV) (IEA, 2013).

- Battery Electric Vehicle: An all-electric vehicles propelled by an electric motor powered by energy stored in an on-board battery (2013).
- Plug-In Hybrid Electric Vehicles: A hybrid electric vehicle with a rechargeable battery that uses electricity as its primary propulsion source, while the internal combustion engine assists in charging the battery or serves as a back up when the battery is depleted (2013). The difference with a more classic Hybrid Electric Vehicle (HEV) is that a PHEV can be plugged in in order to recharge the battery.

Interesting to note is the fact that electric road transport is not a complete innovation; electric mobility has been around for over a hundred years. It was only during the 1930's that petroleum-fuelled internal combustion engines displaced electric vehicles nearly entirely. EV's did appear on the market once again in the 1990's without huge success, while there has been a resurgence in the past decade given volatile oil prices, poor urban air quality and huge levels of emissions from transportation to name just a few key factors (2013). The IEA has described this resurgence of EVs, especially noticeable since 2010, as a "third age" of electric vehicles (2013).

2. Methodology

This practical thesis is mainly based on a qualitative research. The research performed is of an exploratory and descriptive nature of a specific field (Van Campenhoudt & Quivy, 2011) ; the electric vehicle market in Canada.

There are two dimensions to the research. First of all an analysis of the electric vehicle data for Canada and a select few European countries, and secondly, interviews with experts and key players of the Canadian electric vehicle industry.

2.1. Electric Vehicle Market Data

The objective of collecting EV market data and analysing it is to set the scene of the electric vehicle market in Canada and to highlight the development of the market since 2011 compared to European Member States so that we can establish that Canada's EV market is lagging behind.

I was surprised to find out during the research for my theoretical thesis that the growth of Canada's EV sales was far less important than many European States; how

could this be possible given the huge renewable potential across Canada, especially in Provinces such as Quebec, Ontario and Nova Scotia?

To be able to establish how developed the Canadian EV market was, two main categories of data were analysed:

1. The percentage of EV car sales in regards to all car sales by year since 2011.
2. The total number of EV car sales by year since 2011.

These three categories give the best indication of the growth and development of the EV market given the limited amount of figures available.

All of the data has been collected both from official government publications and from independent organisations. However it should be noted how difficult it has been to obtain complete and homogenous data both for Canada and its Provinces as well as for European countries. Despite the importance of the issue and the size of the stakes that are in play, no official central international organisation exists that collects electric mobility data, and very few countries therefore release their electric mobility data. There is however a European body responsible for electric mobility information in Europe, the European Electro mobility Observatory (EEO, 2015), yet even their data publications are incomplete if not inexistent for many states. There is no data available for several countries such as France for example, while the data for many other countries is out of date. Yet there are exceptions; leading countries in terms of electric mobility such as Norway and the Netherlands for example have published extensive figures of their electric mobility over the past few years. This lack of reliable and consistent data can also be put down to the fact that the so called “third age” of electric mobility (IEA, 2013) is a recent phenomenon noticeable only since 2010.

The selected base year of 2011 was set given that it was the first year for which electric vehicle data is widely published by different states and organisations. In terms of the few selected European countries, only four were selected given the limited resources available for my research. These four countries chosen to evaluate Canada’s electric vehicle market are Norway, the Netherlands, the United Kingdom and France. There are two main reasons that explain the choice of these four

countries, first of all given the leading role they are all playing in terms of electric mobility in Europe and secondly for the availability of electric vehicle data for each country.

In regards to Canadian EV data, Matthew Klippenstein for GreenCarRaports (Klippenstein, 2015) is the only source that tracks EV data on a consistent and reliable basis. He is widely recognised by experts in the Canadian EV industry as being the most reliable source for EV data. A small amount of data published by the Canadian Government was also used when available in order to cross check Klippenstein's data publications. In terms of the four European countries, data is retrieved from official government sources for each of the four member states considered and from European organisations such as the European Association for Battery, Hybrid & Fuel Cell Vehicles (AVERE, 2015) and the International Energy Agency (2013). As mentioned above, the objective of collecting electric vehicle data for Canada and a select few European Member States is to be able to establish what the general trend has been since 2011 in Canada and evaluate it compared to a select few European countries. Taken alone these figures are worth little; the importance of this research is the interpretation and evaluation of the data through the semi-structured interviews held with experts and key players of the electric mobility industry in Canada.

2.2. Semi-structured interviews

The second part and the key dimension in regards to the methodology of this practical thesis is the set of semi-structured interviews held with experts and leading players from the Canadian Electric Vehicle industry.

The seven following people were interviewed:

Nicolas Danis-Godard	Tesla Motors Montreal	<i>Owner advisor & Product specialist</i>
Robert Dupuy	AVEQ	<i>Spokesman</i>
Chantal Guimont	EMC	<i>President</i>
Francois Haguette	Rexel-Nedco Canada	<i>Director of Energy Solutions - Quebec</i>
Pierre Langlois	Self-employed	<i>Scientific Author</i>
Philippe Louisseize	EEKO	<i>President</i>
Hazel Rempel	Rexel-Nedco Canada	<i>Director of Energy Solutions – Western Canada</i>

All seven of these people play a key role in the industry yet have different perspectives given the varying interests they hold. The seven interviewees cover four main areas of the EV industry. Firstly, both the Association des Vehicules Electriques du Québec (AVEQ) and Electric Mobility Canada (EMC) are organisations that can be considered as part of civil society, whose main mission is to inform about and promote electric mobility. Beyond that the AVEQ's two main missions are to increase awareness regarding electric mobility and improve EV infrastructure in Quebec (AVEQ, 2015). As for EMC, a national membership-based not-for-profit organization, it has three main purposes: to communicate key issues and interests regarding electric mobility, to help accelerate the adoption of electric mobility and to act as a resource centre in terms of electric mobility information (EMC, 2015).

Secondly, Rexel is an international electrical distributor for whom EV infrastructure is an important part of their energy solutions product portfolio (Rexel, 2015). The interest of talking to two of their Canadian energy solutions directors was to understand the EV market from a business opportunity perspective in two Canadian Provinces. Thirdly I was able to interview Pierre Langlois, an independent author who has a particular interest in electric mobility, and fourthly I was also able to discuss the matter with two players in the automotive industry; with the president of EEKO, an electric vehicle rental company in Montreal, and with the owner advisor and product specialist for Tesla Motors in Quebec.

There are three specific objectives to the interviews; first of all to gain an insight into the Canadian electric vehicle market and to enable an interpretation and evaluation of the collected EV data. Secondly to establish a hypothesis of the key barriers that explain why the Canadian EV market has evolved in the way it has done since 2011. And thirdly to be able to envisage potential solutions or opportunities for change that would create a tipping point for the EV market to evolve towards a greater electrification of transportation.

All seven interviews were conducted in a semi-directive manner. There were four general themes that were the guide for the interviews (see Appendix for full interview guide):

1. Evaluation of the Canadian EV market
2. The barriers to expansion of the Canadian EV market
3. Government intervention in regards to Electric Mobility
4. Explaining the delay in growth of the Canadian EV market

The aim of performing semi-directed interviews was to create an exchange that was as rich as possible with the different interviewees. This meant asking only a limited number of questions, all of which were open questions that would give enough scope for the respondents to answer in the manner that they wished (Van Campenhoudt & Quivy, 2011). It must be noted that for some of the interviewees, as Van Campenhoudt and Quivy outline in their research (2011), their opinions and thoughts are expressed from their own perspective only, meaning that the lack of objectivity should never be overlooked. Finally another consideration to take into account during the interviews and when analysing them is that it is not a case of the interviewees putting forward a set of facts and truths; it is always necessary to look beyond the immediate meaning of their answers by trying to read between the lines (Van Campenhoudt & Quivy, 2011). One of the main challenges of performing these interviews was finding and getting hold of key players throughout Canada, and not just stay restricted to Quebec given that I lived in Montreal during the time of my research. This geographical challenge was especially tricky given the size of Canada and the time difference between its different provinces. However I was fortunate enough to interview people with interests and knowledge from different parts of the country such as the director of Rexel-Nedco energy solutions for British Columbia in Vancouver, or the President of Electric Mobility Canada who has knowledge of the regional differences and specificities throughout the country. The results from the semi-directed interviews are therefore relatively broad and cover the main regions of Canada.

In summary, this practical research is a combination of the analysis of EV data and interviews with key players and experts of the Canadian EV industry. This is done so as to combine the strengths of analysing data and the advantages of talking to experts and hearing what they have to say about the issue. Therefore several dimensions are

considered rather than being limited to a single message (Van Campenhoudt & Quivy, 2011).

3. Analysis & Results

2.1 Analysis of Electric Vehicle Market data

As outlined previously in the methodology, the objective of collecting EV market data and analysing it is to set the scene of the electric vehicle market in Canada and to highlight the development of the market since 2011 compared to a select few European countries so that we can establish what stage Canada's EV market has reached.

Electric Vehicle Sales in terms of Total Car Sales per year

The table below shows the percentage of electric vehicles sold out of the total number of vehicles sold per year between 2011 and 2015 in Canada, Norway, the Netherlands and the United Kingdom.

EV % of car sales	2011	2012	2013	2014
Canada	0,03%	0,12%	0,18%	0,25%
Norway	1,6%	3,1%	5,6%	12,5%
Netherlands	0,15%	0,57%	5,34%	3,87%
France	0,12%	0,29%	0,49%	0,57%
UK	0,01%	0,14%	0,25%	0,55%

Table 1 Percentage of EV sales in regards to total car sales

In regards to Canada first of all, the increase between 2011 and 2015 is a considerable one with the percentage of EVs sold rising from only 0,03% in 2011 to 0,25% in 2015 (Government of Canada, 2015). Noticeably there is a huge rise between 2011 and 2012, before a consistent increase of 0,06% of EV car sales per year between 2012 and 2014 (Klippenstein, 2015). If we now look at the three highlighted European countries, then it is clear that Norway is streets ahead of everyone else (ICCT, 2014). Interestingly the Netherlands saw a significant increase of EV sales between 2012 and 2013 of just under 5% (RVO, 2015), a figure only closely followed by Norway who saw an annual increase of 2,5% during the same

time (Gronnbil, 2015). Yet what is interesting to note is that Norway managed to sustain this increase into 2014 as well with another rise of 6,9% from 5,6% in 2013 up to 12,5% in 2014 (Gronnbil, 2015). This was not the case however in the Netherlands who saw a drop in its increase of EV sales with the total percentage of EV sales dropping to 3,87% in 2014 compared to its impressive 5,34% in 2013 (RVO, 2015). Complete figures for both these European countries for 2015 were not yet available at the time of writing.

The increase in total EV sales for the United Kingdom was also very positive between 2011 and 2012 with the percentage of EV sales going from 0,01% in 2011 (ICCT, 2014) to 0,55% in 2014 (SMMT, 2015). Furthermore this increase had carried on in the first half of 2015 with the percentage of EV sales reaching 0,94% of total car sales by July 2015 (SMMT, 2015). Noticeable the share of EV sales hit a similar level in France in 2014, with 0,56% of car sales being EV sales compared to 0,55% in the United Kingdom (Automobile Propre, 2015). However France saw a more progressive increase between 2011 and 2014 compared to the UK. To draw a comparative overview of this first table across all four countries, the biggest increase between 2011 and 2014 is that of Canada. Yet this isn't totally representative of the situation given that Canada started from virtually 0% in 2011. The biggest percentage of EV sales by 2014 is that of Norway who had reached 14,6% of EV sales in relation to total car sales, a huge share compared to any other country (Gronnbil, 2014). In regards to the UK its increase of EV sales is a healthy and consistent one while the increase of EV sales in the Netherlands suffered an important dip in 2014 compared to the two previous years.

If we briefly look beyond the four countries in the table above, there are other interesting cases in Europe such as Germany, several Scandinavian countries other than Norway, but also Belgium where the share of EV sales increased significantly between 2013 and 2014 from 0,17% to 0,44% (Axsen et al., 2015). In Germany for example the share of EV sales rose from 0,23% to 0,44% between 2013 and 2014. This highlights the fact that the increase of EV sales is relatively widespread across Europe, with Norway, the Netherlands and the UK being especially positive nations in terms of EV sales (2015).

We can therefore draw from Table 1 that the percentage of EV sales in Canada is relatively poor compared to Norway, the Netherlands and the UK. Its significant increase in percentage of EV sales is mainly down to the country's starting point in 2011.

Total number of Electric Vehicle sales per year

Table 2 below shows the number of EV sales per year between 2011 and July 2015 for Canada and for the four European countries in question. What these numbers show is the volume of sales for each country over this four and a half year period, but also the near total number of EVs on the road in each country given that very few EV sales occurred before 2011.

EV car sales	2011	2012	2013	2014	2015 (July)	Total
Canada	521	1,981	3,106	4,596	2,773	13,565
Norway	2,243	4,700	10,769	23,492	22,953	64,157
Netherlands	819	5,744	21,790	15,089	14,105	57,547
France	2,630	5,663	8,779	10,560	9,305	36,937
UK	243	2,240	3,459	12,881	15,733	34,556

Table 2 Number of Electric Vehicle sales per year

First in regards to the four European countries, both Norway and the Netherlands stand out with a far bigger volume of electric vehicles sales between 2011 and July 2015 confirming their position as global leaders in regards to electric vehicles (Gronnbil, 2015; RVO, 2015). Each of the four European countries made progress though in their sales volumes between 2011 and 2014 and they were all on track by July of 2015 to surpass and nearly double their sales volume of 2014 if the same trend continued during the second part of 2015. A noticeable element in the table above is the difference in growth between EV sales in France and Norway; both countries had a similar level of sales in 2011 yet Norway's sales exploded especially between 2013 and 2014 compared to a more gentle progression in France.

If we now compare Canada's EV sales in terms of volume to the four European countries, the numbers are dramatically different and highlight the issue at hand.

Canada's sales between 2011 and July 2015 only make up a total of 13,565 EVs (Klippenstein, 2015), which is only a fifth of the number of EVs sold in Norway and less than half compared to the number of EVs in the United Kingdom. More worrying still is the fact that sales during the first seven months of 2015 up to July only just make up half of the number of EVs sold in the whole of 2014. This illustrates that the increase in EV sales is slowing compared to the growth between 2011 and 2014 while being nowhere near the rate of sales in most European countries. Furthermore if we take into consideration that Canada had more EV sales in 2011 compared to the UK, 521 sales in Canada compared to 243 in the UK, yet the United Kingdom managed more sales in the first seven months of 2015 than Canada managed between 2011 and July 2015.

Summary of the Electric Vehicle market data

Having brought together the EV market data regarding the percentage of EV sales and the volume of EV sales since 2011 of Canada and of four European countries, several important points can be highlighted. First all the data highlights how Canada is trailing behind the four European states both in terms of percentage of EV sales and of the volume of EV sales. Secondly the numbers highlight Norway's position as the global leader of electric vehicles. Thirdly in terms of the Netherlands, the country has an important total volume of EV sales between 2011 and July 2015 that is close to the numbers for Norway. Yet if this total volume is compared to the percentage of EV sales then the Netherlands fare a lot less well than Norway with a percentage of EV sales of 3,87% in 2014 (RVO, 2015) compared to 12,5% in Norway. Fourthly in regards to France and the United Kingdom, both present similar scenarios in terms of EV sales percentage and volume of EV sales. The only major difference being the bigger growth between 2011 and 2014 in the United Kingdom compared to that of France. It is important to underline the fact the all four of these European countries illustrate the general electric vehicle trend in Europe over the past few years (Amsterdam Roundtable Foundation and McKinsey & Company, 2014).

In summary the main takeaway from this data collection and analysis is how far behind the Canadian EV is compared to the European market. The data highlights how big an opportunity Canada is missing out on especially considering the enormous affordable and clean electricity resources that Canada has available.

2.2 Analysis of the semi-structured interviews

As outlined in the methodology description, this next part of the paper is the analysis of seven semi-structured interviews with key players of the electric vehicle. The objective of performing these interviews was to understand the key barriers that explain the relatively slow development of the Canadian EV market since 2011 but also to understand and evaluate the opportunities and potential for change in the coming years that would potentially lead to a greater electrification of transportation in Canada.

Four main areas of the EV industry are covered through the interviews:

1. Civil society; members of EV associations working for the promotion and awareness of electric vehicles throughout Canada (Association des véhicules électriques du Québec, Electric Mobility Canada).
2. Complementary business opportunities created through the development of a bigger EV market, noticeably the development of EV charging infrastructure (Rexel-Nedco British Columbia, Rexel-Nedco Quebec).
3. Independent research regarding the development of the EV market in Canada (Philippe Langlois).
4. Players in the Canadian automotive industry (Tesla Motors, EEKO).

There were many similarities that came out of the interviews, several key points and barriers to EV market development that the different respondents outlined and delved into, highlighting their importance. However there were also elements that certain respondents highlighted as being of significant importance, yet others saw them as being insignificant or at least not of great matter. Overall there were fourteen distinct factors that were considered by the interviewees as being a factor having influenced the lack of EV market development since 2011 in Canada and that came out of the analysis grid (see appendix) (Quevy & Van Campenhoudt, 2011). To be as accurate as possible in this analysis, I will go through the results of the interviews factor by factor and highlight the reasons and explanations put forward by the interviewees. What this will enable is to make links and correlations between the results of the different interviews as clear as possible rather than going through each interview one by one in a purely descriptive manner. Furthermore by highlighting the key elements

put forward in each interview it will also help to classify the main issues at hand into several general categories (Quivy & Van Campenhoudt, 2011).

Method of analysis

The analysis I have performed is based on the three stages of qualitative analysis put forward by Miles and Huberman (1994). The first stage is “data reduction”, which refers to the process of reducing and organizing the data obtained through the semi-directed interviews (see appendix 17).

The second phase of analysis is that of “data display” (1994); this was done by putting the raw data obtained during the interviews into a set of raw data themes with each theme representing a specific explanatory factor. For purposes of understanding I then classified these factors into a table based on the number of experts who mentioned each category as being a factor having played a potential role in slowing the EV market down (see table 3 & table 4). It is very important to highlight the fact that the classification is based on the number of experts to have mentioned each factor and not whether a given expert believes the factors to be important or not. Therefore this does not mean that the factors at the top of the table have greater weight or importance, just that they have been mentioned by more experts than the other factors. This is done so as to avoid the issue highlighted by Krane et al. (1997) that “rare experiences are no less meaningful, useful or important than common ones. In some cases, the rare experience may be the most enlightening one” (1997, p.214). The classification of the fourteen factors can be seen in Table 3.

The third and final stage is to draw a conclusion based on the first two stages of analysis. This conclusion will also take into account the coding of the data into five conceptual categories (see table 5).

	FACTORS	MENTIONS
1	Information availability and reliability	6
2	Political Support	6
3	EV Infrastructure	6
4	Reduced offer of EVs in Canada	5
5	Zero Emission law	5
6	EV Marketing	4
7	EV Autonomy	4
8	Public Perception of EVs	3
9	Purchase Cost of EVs	2
10	National & Provincial Economies	2
11	EV Technology	2
12	Lack of climate fears	1
13	Weather impact on EV performance	1
14	Bonus/Malus Incentives	1

Table 3 Classification of main factors having affected the development of the Canadian EV market since 2011

In the following pages each of these factors will be looked into more closely to evaluate and understand the reasons for which the experts I interviewed considered them as being factors in the slow development of the Canadian EV market. To do so

Factor 14) Bonus-Malus incentives

Bonus-Malus political incentives were rarely brought up and discussed during the interviews with the priority of most experts being on other political tools such as a zero emission law for example. However Pierre Langlois (see appendix 14) was adamant that in his opinion the lack of any form of bonus-malus incentive for constructors is one of the key reasons that explains how far behind the Canadian EV market is compared to most European countries. He argued that for any substantial progress to be made an important bonus-malus had to be in place to encourage car constructors to develop their EV offer in Canada but also for penalties to be in place for those that didn't. Given that Langlois was the only one to bring up the incentive, it ranks relatively low in the overall factor classification.

Factor 13) Weather impact on EV performance

The negative impact that the weather, may it be the deathly cold in the winter or the high temperatures of the summer, can have on EVs and especially on their batteries is a factor that was brought up in three of the interviews. Francois Haguette, energy solutions director for Rexel-Nedco Quebec, argued that there was definitely a public idea that the cold in the winter had a serious impact on EV batteries causing the autonomy of the cars to be reduced between 20% and 50% (see appendix 13). Whether this drop in performance due to cold temperatures is a fact or a public misconception he was unsure of, but what he did firmly believe is that either way the idea was something that is still stopping people from purchasing an EV especially in Canada where temperatures can drop to -30°C in places like Montreal during the winter months.

Danis-Godard (appendix 10) of Tesla disagreed completely with the argument however; he did admit that EV battery was affected by the cold but that normal petrol and diesel cars were also affected by winter temperatures and that it could not in any case be considered a factor having slowed down the development of the Canadian EV market over the past few years. He backed this argument up by highlighting the fact that Norway is the global EV market leader despite having temperatures in the winter that drop to similar temperatures as Canada.

The third expert to have an opinion on the effect of the weather on EV performance was Robert Dupuy (appendix 11). He also admitted that extremely cold temperatures have a negative effect on the performance of EV autonomy but not enough to truly be a factor stopping people from buying EVs. He argued that performance was only affected to the extent of 20%, yet the drop in battery performance was compensated for by the reliability of being able to start the car in whatever temperature, which is not the case for a classic combustion engine. Overall the impact that the extreme Canadian temperatures have had on the slow development of the EV market is debatable and by no means a key factor over the past few years.

Factors 12) Climate fears

The effect that climate fears have had on the EV market was a factor brought up only once during the seven interviews. Only Hazel Rempel (see appendix 16), energy

solutions director for Rexel-Nedco Western Canada, argued that the fact that so many Canadians feel totally removed and unconcerned from climate fears and the impact that Canada is having on global warming could also be playing a role in the slow development of the EV market. Rempel argued that the average Canadian feels far removed from any such kind of climate change fears, and has rather been looking to countries such as China or the United States as being the main protagonists in the matter and therefore that Canada had by no means such a damaging impact on the environment. Whereas in many countries climate fears and the impact transportation is having on global warming has pushed people to look at new alternative modes of transportation rather than petrol or diesel cars, Canadians have felt less inclined to do so. Rempel argued that global warming and climate fears are not an important preoccupation for many Canadians, and therefore EVs are not considered as being something that is either necessary or important.

Factor 11) EV Technology:

Nicolas Danis-Godard, owner advisor and product advisor for Tesla Motor, was insistent on how quickly the technology of electric vehicles was evolving, especially at Tesla Motors (see appendix 10). There is no doubt that Tesla is at the very forefront of technological R&D in terms of EVs but also in terms of battery technology. The fact that the company invests no money into marketing but instead puts every penny it has into R&D is a sign that shows how important technological development is considered. In this regard both Danis-Godard and Robert Dupuy (see appendix 11), spokesman for the AVEQ, put forward the argument that EV technology is evolving rapidly. Every year the latest EV models have improved battery autonomy and increased power. It should be noted though how both Dupuy and Danis-Godard, but also Francois Haguette (see appendix 13), energy solutions director at Rexel-Nedco Quebec, insisted on the leading role Tesla is playing in terms of EV technology while the other EV manufacturers are not considered as advanced. In general therefore none of the experts I interviewed considered EV technology or potential lack of it as a barrier to the expansion of the Canadian EV market since 2011.

Factor 10) National and Provincial economies

Only two experts brought up the make up of the Canadian economy and of its local provincial economies. Robert Dupuy first of all mentioned the fact that provincial economies were a potential explanatory factor of the stage of development of the EV market. He took the example of Quebec where the EV market makes up 50% of the total Canadian EV market; he explained this by the fact that the economy of Quebec was largely based around the production of hydroelectricity and that that therefore this conditioned people to exploit the cheap electricity by purchasing more easily an EV. However Dupuy was relatively cautious in his argument, unsure whether the provincial and national economies had a really significant impact on the EV market or not (see appendix 11). Hazel Rempel took a more decisive position arguing that Canada's economy is one based largely on oil and gas meaning that the Federal Government or key Provinces such as Alberta had no reason to push for the expansion of the EV market given the large oil resources available. By developing and looking to push the expansion of the EV market they would be going against the very basis of their economy. Furthermore in Rempel's opinion, oil and gas companies in Canada are pushing strongly to support the automotive industry not to invest in the development of EVs in Canada (see appendix 16).

Factor 9) Purchase cost of EVs

Two of the experts interviewed mentioned the relatively high purchase cost of EVs as being a factor having slowed the development of the Canadian EV market. Interestingly both experts were the energy solutions directors of Rexel-Nedco, Hazel Rempel and Francois Haguette. Rempel (appendix 16) argued that only a small percentage of Canadian would spend 30 to 40.000\$ on a car and that the EVs available at that price don't really match the performance or comfort levels of petrol cars of an equivalent price. She argued that the relatively high purchase cost of EVs could potentially explain the slow market development in Canada but that it wasn't a real leading factor (see appendix 16). Haguette's opinion was more marked on the issue as he argued that any EV was 25 to 30% more expensive than the equivalent petrol car, meaning that to buy an EV you would either be compromising on the type of car or on the amount spent on a car (see appendix 13). Therefore in his opinion the relatively high purchase cost of EVs had been an obvious barrier to the slow market

development over the past few years while Rempel was slightly more measured in her argument. None of the other five experts however mentioned the purchase cost as being a barrier to market expansion thus far.

Factor 8) Public perception:

Three of the experts brought up the issue of public perception regarding EVs. Again both Haguette and Rempel of Rexel-Nedco Quebec and British Columbia respectively held strong positions in terms of the negative public perception that EVs suffer from in Canada. Haguette (appendix 13) put forward the example of his wife who he said would never consider purchasing an EV when the time came to purchase a new car as in her eyes EVs are “awkward, bulky and ugly!”. In his view the issue of negative public perception is closely linked to the lack of information and awareness of EVs yet has to be considered and tackled as an issue in itself. Rempel (appendix 16) argued a different dimension of the negative public perception, and rather than the aesthetics of EVs it is the perception that EVs are “something a bit weird and unnecessary”. Unnecessary given the abundance of cheap oil and gas in North America, unnecessary because petrol cars work pretty damn well, and unnecessary because changing habits to buy an EV instead of a petrol car is more of an annoyance than anything else. In this sense she argues that the public perception of EVs is at the heart of the issue; the average Canadian still sees the EV as something different, which isn’t a necessity. Danis-Godard’s (appendix 10) position on the effect of public perception on the EV market in Canada concurred with that of Haguette and Rempel. He also underlined how people’s perception of EVs is a very out-dated one but stops them from looking into EVs more closely and considering them as a viable and serious alternative to petrol and diesel cars.

Factor 7) Autonomy of Electric Vehicles:

The autonomy or range of EVs was a keenly debated topic during the interviews. Four of the experts took a clear position regarding the issue, with three arguing that the perceived lack of range had been a significant barrier to EV market expansion over the past few years while only one respondent argued against this idea. Robert Dupuy (appendix 11) argued strongly against the idea that a lack of battery autonomy had been stopping people from buying EVs instead of normal petrol cars.

In his view battery autonomy was constantly improving, with each new EV model boasting an improved range and it was instead a question of changing habits, with people needing to accept that instead of refuelling once or twice a week they would just need to plug their EVs in every night at home or everyday at the office for them to be fully charged when needed. He argued that the average Canadian didn't travel more than 150 to 200km in a day anyway and therefore for a large part of the population, especially in urban areas, EVs were the ideal mode of transport. Dupuy sees the lack of range only as a misguided public perception rather than a real factor that has stopped the development of the EV market in Canada.

However for Francois Haguette, Pierre Langlois and Nicolas Danis-Godard the battery autonomy of EVs is still a key factor that explains the slow market development in Canada given the large distances between cities. In Haguette's opinion (appendix 13) as long as EVs couldn't comfortably cover 250 to 300km without being recharged then the market wouldn't develop any further. He gave this distance as being the reference for people in Quebec as it is the distance between Montreal and Quebec City. He says that many commuters make the drive between both these cities several times a week, and therefore that an important percentage of the working population was going to keep on ignoring the possibility of buying an EV as long as the range wasn't greater and more reliable.

This argument was backed up by Langlois (appendix 14) who agreed that the "affordable" EVs on the market (i.e. those under 25.000\$) still don't have sufficient mileage on them and that the equivalent petrol cars are far better in terms of performance. As long as this lasted then in his opinion the market would carry on struggling, especially in Canada given the huge distances between cities. Finally Danis-Godard (appendix 10) spoke of "autonomy anxiety", a term describing the fact that people are worried about the short range on EVs, which summed up the previous arguments of Haguette and Langlois very effectively. People are not purchasing EVs as they perceive them as having insufficient autonomy, and they are afraid of not reaching their usual destinations without having to stop to recharge their vehicle.

Factor 6) EV marketing:

Again on this issue both Haguette and Langlois had similar positions, both firmly arguing that EV marketing, or lack of it, had been a key factor over the past few years causing the EV market to develop so quickly. Langlois (appendix 14) was adamant that it is the responsibility of car manufacturers given the power and scope such companies have in terms of marketing to increase awareness and make information regarding EVs more available to a wider public. Haguette took this point further by highlighting the current lack of any such EV marketing. Furthermore he not only argued that it was the responsibility of car manufacturers to increase awareness through positive marketing campaigns, but he is also a firm believer in shock advertising. He asks the question why do cigarette companies and road safety organisations use shock advertising yet no car manufacturers do so to highlight the damaging effect road transportation is having on global warming and the role it is playing in climate change? Haguette was very forceful in his position regarding EV marketing and the effect that shock advertising could potentially have; yet he was the only one to mention such a potential measure.

Hazel Rempel (appendix 16) of Rexel-Nedco British Columbia and Nicolas Danis-Godard of Tesla also both recognised the possible effect that increased EV marketing could have, especially through TV advertising, yet neither truly took a firm position on the subject. Rempel highlighted how car manufacturers had made a very poor job of marketing their EV models thus far. As for Danis-Godard (appendix 10), he openly recognised that TV marketing for electric vehicles would definitely increase awareness regarding EVs yet he didn't want to recognise that the lack of EV marketing over the past few years has had any kind of negative impact on the development of the market, a position which can largely be explained by the fact that Tesla assigns 0\$ to its marketing instead putting every penny it has available into R&D. In general EV marketing was discussed during four interviews, with two experts insisting on the lack of EV marketing as being an important reason for the slow development of the EV market in Canada thus far and two other experts agreeing that increased EV marketing from car manufacturers could help to increase awareness yet neither of them would go as far as to say that the lack of EV marketing had been a key explanatory factor in the slow development of the Canadian market.

Factor 5) Zero Emission law:

A zero emission law was one of the most contested and debated subjects during the seven interviews. A zero emission law is a law that forces automobile constructors to retail a minimum quota of zero emitting vehicles on a given market (AVEQ, 2015). Such a law is in place in California for example and is credited to have played a significant part in the huge development of the EV market in California over the past few years (Axsen et al., 2015). Four people had a strong position on the subject, while three of the experts interviewed preferred to not to discuss the matter either due to lack of knowledge regarding the issue or given its contentious nature. Of the four interviewees having expressed a clear position, only Pierre Langlois, award winning scientific author, was strongly in favour of such a law to be implemented in Canada. For Langlois (see appendix 14) the lack of any such law was the main reason for the slow development of the EV market since 2011 in Canada. In his opinion it also explained why the offer of EVs in Canada was smaller than in many European countries and in the United States. With no zero emission law in place and therefore the lack of any coercive EV measures, there has been little reason for automobile constructors to develop their offer of EVs in Canada.

In complete disagreement with Pierre Langlois was Francois Haguette, energy solutions director for Rexel-Nedco Quebec (appendix 13). Haguette argued the lack of sufficient evidence that any zero emission law had any consistent causal link on the EV market. He argued the case of Norway, global leader in terms of its EV market as highlighted in the data analysis part of this paper, where no zero emission law exists at all. Such a law may have worked in California but for Haguette it is not a factor that can explain the slow development of the Canadian EV market. Other areas are of far greater concern in his opinion.

Factor 4) Reduced offer of EVs:

The smaller number of available of EV models in Canada compared to the United States of America and many European countries is an issue high up in the list of factors put forward by five of the experts interviewed. Interestingly the two who didn't mention the reduced offer of EV models in Canada as a factor having slowed down market development is Nicolas Danis-Godard of Tesla Motors and Pierre

Langlois, award winning author and physicists. Each of the five other experts mentioned it, with two of those uncertain whether it was a cause or a consequence of the slow EV market development. These two experts were Chantal Guimont, president of Electric Mobility Canada, and Philippe Louisseize, President of EEKO car rentals. For Guimont (appendix 12), increasing the offer of EVs alone would not have had any kind of significant impact on the market. The President of Electric Mobility Canada insisted on how the situation was improving rather than laying the blame of the size of the Canadian EV market at the feet of car manufacturers and their limited EV offer in Canada. She understood their position that Canada is only a very small car market, equal to the size of California's market, and that the manufactures are therefore not interested in investing any more into the EV market. As for Philippe Louisseize (appendix 15) he also recognised the importance of increasing the EV offer available in Canada but that it wasn't an issue in itself and that if the offer was increased it had to be accompanied by other measures. He put the lack of EV offer in Canada solely down to the lack of a zero emission law in Canada, and therefore that car manufacturers had very little incentive to develop any further their offer of EVs.

The position of Francois Haguette, Hazel Rempel and Robert Dupuy was a lot stronger in the sense that all three firmly argued that the lack of EV models available in Canada compared to the USA and to Europe had been and still is an important barrier to the development of the Canadian EV market. Haguette (appendix 13) argued that one of the reasons he hadn't yet purchased an EV is that he is very loyal to car manufacturers he has brought from previously yet that none of them have any EV model available in Canada. Furthermore Hazel Rempel (appendix 16) put forward the argument that not only are there less EV models available in Canada than in other countries but also the fact that car manufacturers with EV models available don't make them available in all of their car dealerships. Therefore even if you aren't intent on buying an EV you still have to find which car dealerships actually retail them, which is a challenge in itself. Added to this the extra long delivery time needed to receive an EV once you have ordered it compared to an equivalent petrol car, a point also made by Robert Dupuy and Pierre Langlois. Dupuy (appendix 11) took this point further though; as spokesman for the AVEQ

and having recently purchased an EV he told me of his first hand experience of buying his electric NISSAN LEAF. Not only was there no EV advisor at the dealership he brought the car from, but the salesman who did advise him actually got his facts completely wrong and gave incorrect information regarding the LEAF he was selling. In Dupuy's opinion there are only three or four EV advisors apart from those at Tesla in the whole of Quebec. The relatively poor offer of EV models in Canada is therefore one of the key factors that came out of the interviews as having slowed the development of the EV market in Canada since 2011.

Factor 3) EV Infrastructure:

The amount and the type of EV infrastructure both public and private is considered by three of the experts interviewed as being one of the most important factors that explains the slow rate at which the Canadian EV market has evolved since 2011 while three other interviewed EV experts saw the question of infrastructure as being an important issue yet not making it one of the most important ones. Of course EV infrastructure and its availability is an issue closely linked to that of EV range. If we take Pierre Langlois' perspective (appendix 14) on the issue, he firmly believes that despite public infrastructure networks such as Electric Circuit in Quebec being installed over the past few years, there is still a severe lack of available EV charging infrastructure. People are held back from buying an EV due to the autonomy anxiety but also the anxiety of not finding a charging station in a convenient place that will be powerful enough to recharge their car quick enough. Philippe Lousseize (appendix 15) agreed with this point, stating that it is mainly fast charging stations that are needed and that the EV market has been so slow to develop given that people aren't prepared to wait for thirty or forty minutes for their EV to recharge when they are used to refilling their petrol cars in a fifth of that time.

Again Chantal Guimont (appendix 12) agreed with this point of view so far as to say that the development of EV charging infrastructure was one of the main objectives for Electric Mobility Canada over the next couple of years and she clearly saw the lack of charging infrastructure as a barrier to EV market expansion across Canada. Guimont highlighted how bad the situation was in Ontario especially, one of the leading Canadian Provinces for number of EVs on their roads yet had a significant lack of public charging infrastructure.

Francois Haguette, Robert Dupuy and Nicolas Danis-Godard are agreed to a certain extent that the issue of EV infrastructure was an important one, but not quite to the extent argued by Langlois, Louisseize and Guimont. Haguette's view (appendix 13) was that EV infrastructure was especially lacking in workplaces, and that in this sense it was the responsibility of employers to install charging stations so that employees would need not worry about their EV's autonomy to get to and from work. However he argued that infrastructure would only be developed and extend itself once the EV market grows rather than the opposite. In other words more infrastructure would be developed as a consequence of a bigger market, rather than the lack of sufficient EV charging infrastructure being the cause for the market's slow growth since 2011. Danis-Godard's position (appendix 10) was that it isn't the quantity of infrastructure that is a problem but that it is the type of charging infrastructure that is the real issue. The Tesla charging network is huge, and growing day by day. But one of the reasons he argues that Tesla has been so successful is the speed at which Teslas can be recharged at these stations, while other EVs can't be given their inferior charging capacity. He was positive about the situation, and similar to Robert Dupuy he argued that the charging infrastructure network is growing day by day, while charging stations effectively cover 90% of the North American population. Both Danis-Godard and Dupuy illustrated their point by giving the example of how it is possible to drive an EV from Montreal across the USA down to Florida without any autonomy fear.

Therefore in summary six of the experts I interviewed see the issue of EV charging infrastructure as an issue that needs to be addressed in the coming months and years, yet they didn't all agree on whether the state of charging infrastructure in Canada was more of a cause or a consequence of the poorly developed EV market.

Factor 2) EV political support

The political support towards the development of EVs is considered as being on an equal level of importance to the availability of information regarding them. However, whereas the experts all shared a relatively similar perspective in regards to information and its availability, their views regarding political support and how it should be assigned vary to different degrees.

First of all Robert Dupuy (appendix 11) who was maybe the most forceful in his position argued that transportation and the development electric mobility is purely down to political will, or lack of it. He gave two main examples, that of financial purchase incentives and subsidies for the development of infrastructure, which have been nowhere near sufficient up to now in the different provinces. He asked the question without willing to offer a clear answer as to whether financial or fiscal incentives are more effective, but whichever needed to be developed far more both on a provincial and a federal level. To a certain extent Dupuy said that he understood the lack of Federal measures given how big the economic stakes are but also given the growing role that oil is playing in the national economy; therefore federal interests lie elsewhere rather than in the electrification of the transport sector. However that is certainly not the case for Quebec and a select few other provinces and it therefore EV development being slow to develop on a national scale is "understandable" but certainly not on a provincial scale at least in those provinces with great clean energy resources.

Chantal Guimont (appendix 12) focused more on the federal position and highlighted the work that EMC is currently doing in writing up a new EV ROADMAP, the federal strategic plan to develop the EV market across Canada, which hasn't been updated or renewed since the original one was written in 2008. Furthermore her position is that it is financial purchase incentives that hold the key to developing the market in the coming years, and is an area that EMC is especially focused on.

Both Hazel Rempel (appendix 16) and Pierre Langlois (appendix 14) underlined how it is unacceptable that Canada has such a feeble stance in regards to electric mobility and the electrification of transportation. Both of them insisted on the fact that Canada is one of the worst if not the worst country in this regard compared to other G20 countries. Rempel also argued in favor of restrictive legislation and new automotive standards to be implemented on a federal level that would force manufacturers to improve their offer. Nicolas Danis-Godard (appendix 10) also agreed that the lack of political support on all levels up until now has been one of the biggest factors holding the EV market in Canada back.

In summary it is both the lack of easily available information regarding EVs and the poor level of political support towards the EV market that are the two key factors that explain the state of the EV market today. It is important however to note that in both cases nearly all of the interviewed experts agreed on these two general points, they all argued different points in regards to them. Furthermore all of these fourteen categories are just that, categories used for the purpose of understanding and simplification of a highly complex issue.

Factor 1) EV information:

Six of the interviewed experts hold a strong position in regards to the availability of EV information. This is the greatest priority for example of Electric Mobility Canada, to increase the availability of EV information and to be able to get across the message that EVs are a viable and interesting alternative compared to normal petrol cars. Chantal Guimont (appendix 12), president of EMC, explained that the unavailability of clear or consistent EV information has been one of the greatest barriers that has made the Canadian EV market so slow to develop and one that is largely down to the fact that apart from EMC no central body or organisation is responsible for gathering and promoting information regarding EVs. Instead information is fragmented between different sources on a national and provincial level. In Guimont's eyes this information barrier is one that is at the heart of the EV market development issue, with all other factors slowing the development of the market coming from this one central issue.

Robert Dupuy (appendix 11) holds a similar position to Guimont; he is adamant that the poor availability of clear information regarding EVs is fundamental to why the market is less developed than most European countries. Moreover for Dupuy it isn't just the availability of EV information that is lacking but also the fact that the information that is available is very often incorrect. As outlined earlier, there are only a handful of expert EV salesmen in Quebec for example and many car salesmen have little if no idea about the workings of an EV and its advantages over a petrol car. What makes it even more frustrating for Dupuy is how those who do take the step of looking into the interests of EVs are quickly convinced about their value over petrol cars. Philippe Louisseize (appendix 15) of EEKO rentals argued exactly this

same point, while also agreeing with Guimont's point that the lack of accessible and reliable information is the single biggest cause of the slow growth of the EV market.

As for Hazel Rempel, Francois Haguette and Nicolas Danis-Godard, they all gave further arguments to highlight the issue of information, its availability and its reliability. Haguette (appendix 13) highlighted that despite being energy solutions director of Rexel-Nedco Quebec and having good knowledge of the specificities of the EV market in Quebec given that Rexel retails EV charging infrastructure, yet even he has very little idea regarding the pros and cons of EVs and where to get reliable information from. He insisted on the various technical issues such as autonomy anxiety, battery performance over time and battery maintenance for example saying that he has already looked into these issues with the potential purchase of an EV in mind yet the lack of consistent or reliable information added to the other issues mentioned have stopped him from making a purchase so far. Hazel Rempel (appendix 16) insisted on the concept of total ownership cost, which is one of the main advantages of buying an EV over a petrol car, yet for which very little information is available. Lastly Nicolas Danis-Godard (appendix 10) also agreed on the different information issues put forward by the other experts, and he argued that all of these issues are at the heart of what Tesla Motors is doing. In other words one of Tesla's main aims is to educate people and raise awareness regarding the value of electric vehicles for individuals and society in general.

In summary, the experts all agreed that information is only available to those who are proactive in their interest of EVs and thereby the benefits of EVs have not been effectively communicated to the general public, which largely explains the slow development of the market in Canada since 2011.

4. Discussion

4.1 Discussion of the results

Through this qualitative research I have produced a set of results regarding the development of the Canadian electric vehicle market. First of all through the data analysis, which showed how Canada has struggled to keep up with the rate at which the EV markets in several European countries have grown over the past few years

since 2011. This is the case both in terms of market volume but also in terms of percentage of EVs out of all new car sales. The data showed that the European country leading the way of EV market development is Norway. Secondly through a set of seven semi-directed interviews with experts in the EV field across Canada, fourteen key factors were pinpointed as being the main barriers having slowed the development of the EV market. The table below is the one used during phase two of the analysis, “data display” (Miles & Huberman, 1994). What I have done is use a colour code so as to be able to get a clear picture and overview of the arguments of all of the experts. A green cell means that an expert sees a factor has having played a key role in slowing down the EV market in Canada. Orange means that an expert sees a factor as being an important one, while being undecided if it will have been a help or hindrance to the market up to now. Finally the red is for when an expert disagrees with a factor having played a role in stopping the market from developing. I believe the table helps to get a consistent idea about each factor, but also see patterns between the response of the different experts.

Interviewee	Company / Organisation	Reduced EV offer	Information	Political support	Purchase cost	Infrastructure	EV marketing	Lack of climate fears	Autonomy	EV Technology	Zero Emission	Push: Pull incentives (weather)	Impact on EV market on EV	Provincial & economic perception
DANIS-GODARD	Tesla													
DUPUY	AVEQ													
GUIMONT	EMC-MEC													
HAGUETTE	REXEL_QC													
LANGLOIS	Author													
LOUISSEIZE	EEKO													
REMPEL	REXEL_BC													
Impact on EV market development since 2011?														
YES		3	6	6	1	3	2	1	3		2	1	1	3
MAYBE		2			1	3	2				2		1	
NO		0						0	1	2	1		1	
TOTAL RESPONSES FROM EXPERTS		5	6	6	2	6	4	1	4	2	5	1	3	3

Table 4 Classification into general dimensions of the main factors having slowed the development of the Canadian EV market since 2011

Based on the qualitative analysis methodology of Miles and Huberman (1994) I proceeded to code this data that came out of the interviews into five conceptual categories that represent general dimensions. These general dimensions are highlighted below in Table 5:

<u>GENERAL DIMENSIONS</u>	<u>INDIVIDUAL FACTORS</u>
EV information & awareness	Availability of reliable EV information
	Public perception regarding the value of EVs
	EV marketing
Political Factors	Political support and strategic planning of EV market development
	Measures and standards of emissions for the transportation sector and automobile constructors
	Federal and Provincial economic features
	Federal and Provincial incentive plans
EV offer	Availability of a wide range of EV models
	Purchase cost of Evs
Technical development of EVs	EV infrastructure
	Autonomy anxiety
	Evolution of EV technology
Climate & weather considerations	Lack of fears regarding the impact of Canadians on global warming
	The impact of the weather and temperature of EV performance

Table 5 Classification into general dimensions of the main factors having slowed the development of the Canadian EV market since 2011

The five general categories that encompass all of the individual factors are the following:

1. EV information and awareness
2. Political factors
3. EV offer
4. Technical development of EVs
5. Lack of climate considerations

These five dimensions are the main result and finding of this practical research. They represent the five main areas that have affected the development of the Canadian EV market since 2013. If we go through these general categories one by one, all of them are referred to and already defined by the experts during the interviews. Robert Dupuy for example (appendix 11) during his interview kept on going back to his argument that the EV market and its development were down to political will and support above all else. An argument that was backed up, albeit slightly differently, by Pierre Langlois (appendix 14) and Hazel Rempel (appendix 16). As for the issue of EV information, Francois Haguette of Rexel was one of the experts to stress the importance of the issue (appendix 13) in terms of EV marketing, the availability of information and the public perception of EVs.

Hazel Rempel was one of the experts to link the limited availability of EV models in Canada compared to European countries and the high purchase costs of EVs (appendix 16) thereby enabling me to put both together and create the general dimension of “EV offer”. As for the technical developments of EVs it was most interesting listening to Nicolas Danis-Godard of Tesla Motors (appendix 10) who spoke of autonomy anxiety and the effect it has on putting potential purchasers of from buying an EV. He also gave a very useful insight into the development of EV infrastructure and where it is at today. Finally the dimension of climate and weather considerations was one thoroughly argued by both respondents from Rexel. They highlighted how some people still see the weather in Canada as having a negative impact on EV battery performance while also underlining how the average Canadian feels far removed from climate change and global warming considerations.

These five general dimensions are by no means perfectly defined; they are subject to interpretation and are only a subjective classification based on the outcome and the analysis of the semi-directed interviews. They are the five most important areas highlighted by the interviewees, and appear to be at the heart of the issue of EV sales in Canada over the past few years. It is crucial to highlight that none of the categories can be taken separately and seen by itself as a unique explanation or potential solution to the issue at hand, rather that all five categories and subsequent factors are

intimately linked and connected to one another. In this sense all of the factors and categories interact and work as a function of each other.

4.2 Research Interest and contribution

The main academic interest of this practical thesis is to have followed up on the theoretical part by providing results regarding the transportation transition, which is a crucial area of the energy transition. Noticeably the results produced in this practical part and those produced in the theoretical part regarding the evolution of the energy transition in Canada and Europe show striking similarities. The theoretical part and the overview of the literature that was performed highlighted that the energy transition in Canada towards a cleaner and more sustainable energy scenario since 2003 is a reality for a select few Canadian Provinces but that overall on a federal level Canada has not taken an active role in looking to transform its energy system. In other words it is a select few Canadian Provinces such as Quebec, Ontario and British Columbia for example that are driving the Canadian energy transition, with the federal state and the other Provinces such as Alberta are playing a far more passive role. What is very interesting to note is how this dynamic is nearly identical to the evolution of the EV market across Canada. As I have shown in this practical part Canada in general has seen a very slow growth of its EV market compared to most European nations and it is mainly two Provinces, Quebec and Ontario, that have driven the market. In this sense the EV market has evolved in a similar way to the general energy transition, as the transition of the transportation sector is being proactively led by a couple of Provinces, while the federal government and the other provincial governments watch on passively.

Furthermore what this analysis of the Canadian EV market has illustrated is that an important contradiction has developed between the clean energy potential available in Canada and the use made of this energy potential by the federal government. This contradiction was highlighted in the theoretical literature part of this thesis and the practical part has allowed me to illustrate it with the specific case of the transportation sector. There is abundant renewable electricity potential throughout Canada that is not being fully capitalised on and while the electrification of

transportation provides a unique opportunity to exploit it, both the federal government and the provincial governments have been slow up to this point in making full use of it.

This practical thesis, beyond providing an empirical analysis of a specific dimension of the energy transition, will have established a unique comparative analysis of the electrification of transportation between Canada and Europe. A majority of similar studies provide a national analysis, looking into the case of a specific country, or compare countries on the same continent or political union, such as comparing European countries among themselves for example (Amsterdam Roundtable Foundation, 2014). This research represents a significant business interest given the huge green electricity potential in Canada that could be exploited by a more extensive use of electric vehicles. There are also huge technological developments and opportunities in the field of electric vehicles and electricity storage that currently exist and will continue to grow in the coming years, that as it stands are not being exploited in Canada. Highlighting the barriers that are holding back significant EV market growth could contribute to the improvement of EV market share and help capitalise on technological developments.

A final point on which I would like to insist upon is how, having looked into the governance and policy measures of an energy transition in the theoretical part, the question of governance and political factors emerged as being one of the main barriers according to the experts I interviewed that has held back the growth of the EV market in Canada since 2011. This confirms that the question of political governance is closely linked to the energy transition and to the transition of the transportation sector towards a cleaner and more sustainable scenario (Verbong & Loorbach, 2012).

4.3 Research limitations

Three main limitations proved to be the main challenge during the analysis of this practical part. Firstly the geographic size of Canada made it very difficult to get in contact and meet experts from every Province. Being based in Montreal during a large part of the research meant that I was mainly able to meet people from the

Province of Quebec. I was however also able to meet experts from British Columbia (Hazel Rempel) and Ontario (Chantal Guimont), while the other experts all had knowledge or experience of the remaining Provinces.

A second important challenge was being able to meet experts from a sufficiently broad background representative of the strategies and beliefs of all the actors and stakeholders involved in the Canadian EV market. In the end I was able to meet two experts linked to car manufacturing (Tesla and EEKO rentals), an expert having worked with and for both the national and provincial governments (President of EMC), two people with expert knowledge of EV infrastructure and its development (Rexel Energy Solutions), an independent author with expert knowledge of EV technology (Pierre Langlois) and finally an expert with a civil society perspective (spokesman of the Association des véhicules électriques du Québec).

Ideally it would have been most interesting to be able to meet an expert or stakeholder from each area and from each of the ten Canadian Provinces. In other words, to meet at least five key actors and stakeholders from each Province. This however proved impossible given the time and resources available to me.

Finally a third key limitation proved to be the lack of reliable statistics. It proved very difficult to get hold of a consistent database of EV figures both for European countries and for Canada and its Provinces. This I believe is a reflection of the lack of development of the EV markets in both regions, and hopefully the availability of reliable information and data will improve in the coming months and years. The recent Paris declaration from the UN climate change conference (2015) on electromobility and climate change could play a key role in this sense.

Finally I believe it is important to highlight the fact that my academic and personal background will have played some kind of role in how the interviews were held, but also in the interpretation of the results. The fact that I studied Political Sciences during my bachelor degree and Management & Sustainable Management during my Masters degree will have biased to some extent the result of the research. I believe that, as Miles and Huberman highlight (1994), being aware of this during the research is important so as to always be wary of one's initial snap-judgement while also being important for the reader to be aware of.

4.4 Questions and potential further research

Performing this empirical research and qualitative analysis has brought up a number of questions but also a desire to see the research pushed further on several levels.

First of all the two areas of interest for potential future research are the following:

- As mentioned in the limitations to the research, it would be highly interesting I believe to be able to perform the interviews with five experts from each of the Canadian Provinces. This would make the results of the research that much more accurate and extensive. I believe that five is the minimum number of experts that need to be interviewed from each Province as that would represent the five key areas of the EV market (car manufacturers, government officials, EV drivers, civil society and EV infrastructure).
- Furthermore to then be able to take the research further it would be of great interest to perform these interviews with experts from the four European countries (Norway, France, the Netherlands and the United Kingdom) for which the EV statistics have been collected and analyzed in this practical thesis. This would enable a full comparative analysis between the development of the EV market in Canada and of the selected European countries.

Finally there are two main questions on which I would like to end this thesis:

- What are the key factors that determine the relative success of policy measures such as a zero emission law and fiscal or financial purchase incentives in the growth of the electric vehicle market of a country?
 - To what extent can the electrification of transportation play a leading role and provide a tipping point in the development of the energy transition in Canada and the European Union before 2030?
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Appendix

Appendix 1 – A historical perspective of energy transitions

If we go back to the Middle Ages (500 AD. to 1500) noticeable developments in how energy was produced occurred throughout Europe. Agriculture relied in the main on human and animal power while industry also relied on wind and water energy through means such as watermills and windmills (Langendijk & Verbon, 2012).

The first transition that is noticeable is the transition from wood to coal. This started in Britain between the seventeenth and nineteenth century and led to the first Industrial Revolution as industrial activities expanded given the important labour and costs savings that were made through the wide application of coal and steam power. The fact that coal was abundantly available in Britain made the transition easier, but it is important to stress that this transition took over two hundred years and was very much a gradual process (Langendijk & Verbon, 2012). Just before the start of WWI in 1913, 60% of commercial energy in the world was provided for by coal, which was an increase of 50%, from 1800 when only 10% of commercial energy was produced by coal (Podobnik, 2010).

During the nineteenth and twentieth century, the emergence of grid or network based energy supply systems was to have a huge impact on society. The first grid was the town gas system, which was followed at the turn of the twentieth century by the electricity grid. This emergence of electricity forced gas to refocus on new markets such as heating and cooking rather than lighting and within a few decades electricity had become the base of modern industry. Yet, as Langendijk & Verbon (2012) argue, this happened at the same time as industry's overall energy-intensiveness decreased but its electricity dependency increased. Electricity is a second form of energy though and the main source of electricity generation at the time of its emergence was coal.

The end of the Second World War and the period of reconstruction that followed saw the necessity of abundant and cheap energy to meet economic progress. In 1951 the European Coal and Steel Community (ECSC) was established, which later led to the European Economic Community in 1957 and eventually to the European Union in 1992 that we know today. The establishment of the ECSC was a sign of the importance of coal at the time, but it soon became clear that the output of coal would be insufficient to meet the ever-growing demand for energy (Langendijk & Verbon, 2012).

This saw the transition from a relative dependence on coal towards oil and natural gas. Oil was the source of 50% of the world's energy by 1970 whereas reliance on natural gas had increased from 6% in 1946 to 24% in the year 2000 (Podobnik, 2010). An interesting aspect of this modern energy transition is the speed at which it happened; a total shift from a reliance on coal to oil happened in less than sixty

years, between the start of WWI and the end of the 1960's. Moreover it is quite staggering to consider the fact that it occurred despite two world wars, a cold war, and a major financial depression. This goes to illustrate that major shifts in the energy supply can occur despite very challenging circumstances (Podobnik, 2010).

Three fundamental factors can be pinpointed as explanatory factors of the energy transition towards oil and gas (Podobnik, 2010):

1. Political and geopolitical factors. An initial shift was provoked in the build-up to WWI and the race to arms that happened between European nations especially. By the start of the war most leading nations were converting to the use of oil, which in turn encouraged private companies to invest in oil companies and infrastructure linked to the conversion of oil into useful energy.
2. The synergy between public and private investment grew further during both world wars and even more so after WWII as nations became more and more reliant on oil-powered machines. This synergy kept on growing stronger during the second part of the twentieth century and went hand in hand with the significant expansion of the global economy, in the sense that the dependence on oil was made possible by the new global economy and vice versa.
3. Social tensions and resistance to coal. By the end of the nineteenth century social tensions were arising in different regions of Europe and North America leading to the formation of trade unions that saw large strikes, as workers demanded improved working conditions. This was followed by a second wave of social resistance after WWII that saw a steady but continuous drop in the reliance on coal during the second part of the twentieth century.

Langendijk & Verbong (2012) outline two additional explanatory factors. First, as we have mentioned already, the fact that the output of coal would not have been able to keep up with the rapidly growing energy demand. Second, the discovery in the 1950's and 1960's of huge oil reserves in the Middle East. Noticeably in 1960 the Organization of Petroleum Exporting Countries (OPEC) was set up to coordinate oil policies and increase their political and economic power.

The end of the Second World War also marked what was supposed to be the beginning of the "Nuclear Age" following the atomic bombs on Japan in 1945. The European Commission even went as far as predicting that by 1990 nuclear energy would account for nearly 70% of its energy needs (Langendijk & Verbong, 2012). The EURATOM (European Atomic Energy Community), set up in 1957, provided a framework for its development while the oil crisis of 1973 provoked a significant increase in nuclear energy production as nuclear power plant installations grew.

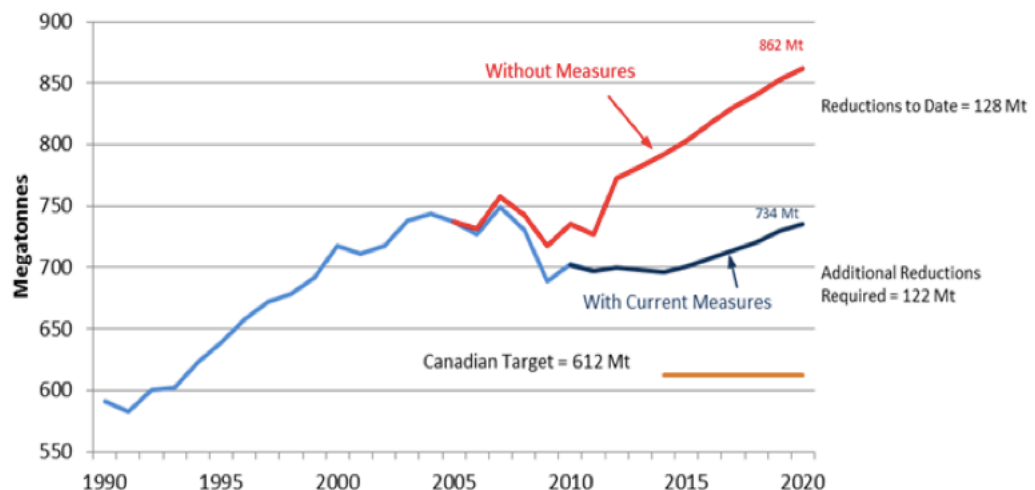
At the time the EU put forward three main arguments justifying the advantages of nuclear energy. It claimed that nuclear energy was more economical in terms of electricity generation, as well as being environmentally friendly and that it would improve security of supply (Langendijk & Verbong, 2012).

However the increasing costs of development and maintenance of nuclear power sites as well as the increasing number of safety questions following several nuclear accidents saw the share of nuclear energy in the overall energy mix stabilise and eventually decrease (Podobnik, 2010). Today nuclear energy represents just under 15% of the EU's energy mix (European Commission, 2013).

In regards to the energy transition from oil towards renewable sources, the first significant shift can be traced back to the 1970's and the nationalist movements in oil producing countries that saw the first oil crisis in 1973. The turmoil of the international oil system at the time was highlighted by the realisation that such an over-reliance on an energy source produced mainly by a set of small unstable nations, which had the effect of initiating the first wave of alternative energy systems based on renewable energy sources (Podobnik, 2010). Moreover other pressing issues have progressively emerged such as environmental issues and especially the issue of climate change, but also oil security issues, high prices, instable export countries and the increasing demand from newly industrialised countries such as China and India, thereby putting the dependency on oil supplies and fossil fuels in general under growing pressure (Langendijk & Verbong, 2012).

Appendix 2 - Scenarios of Canada's emissions to 2020

Scenarios of Canada's emissions to 2020 (Canada Environment, 2009, p.4)



Appendix 3 – Renewable energy promotion measures and policies

Below is a summary of the main renewable energy promotion measures that have been used since 2003 in the EU and Canada and that have shaped renewable energy policies in both regions.

FEED IN TARIFFS (FIT)

A FIT scheme is a financial incentive to feed electricity or heat produced from renewable sources into the grid or the thermal system. The price is usually either guaranteed for a specific period (a number of years, as in Germany), or for a pre-determined amount of production such as the first 10 TWh, as in Denmark for certain projects (Ecofys, 2014).

In most implementations of FIT called all-inclusive tariffs (especially earlier ones), the producers of renewable electricity are exempt from market participation, and receive the guaranteed price by delivering the power to an obliged off-taker. The main use of a FIT is to insure renewable energy investors against market insecurities (EEA, 2014) and in this sense one main advantage of the fixed feed-in system is the high effectiveness of policy support that has been achieved in the past. In some (more recent) applications, the price guarantee is granted in the form of a variable add-on to the market price. Here a specific target price is determined as the total tariff the producer of renewable electricity should receive. The FIT is paid out as the difference between the target price and the market price.

FEED IN PREMIUMS (FIP)

Feed-in premiums (FIP) are guaranteed premiums paid out as fixed add-on to the market price. Compared to FIT there is not always a purchase obligation and they are developed to create an incentive to feed electricity into the grid during peak demand (EEA, 2014).

Generally, a producer of renewable electricity receives a premium per unit (MWh) in addition to the proceeds of selling the power on the free market. As with FITs, the premiums are generally guaranteed for either a fixed period (as in Italy) or a pre-determined production (as in Denmark, for example for 12.000 full load hours).

TENDERS (TDN)

In a tender process, the responsible authority launches calls for tenders for specific projects with defined amounts of capacities. Potential investors then compete to win the opportunity to develop the project by giving their bid for the required support level and several other specifications (as e.g. specific timing of the project, grid positioning, and environmental impact) (Ecofys, 2014). The most attractive bid, determined by a low requested support level and favorable other specifications, wins the tender. In other words, a tendering scheme is a competitive mechanism for allocating financial support to RES projects based on the cost of the production of electricity. Noticeably it is usually used in combination with other support measures (Kitzing et al., 2012).

QUOTA OBLIGATIONS

Quota obligations with Tradable Green Certificates (TGC), also called Renewable Portfolio Standards (RPS) with Renewable Energy Certificates. In TGC schemes either producers or suppliers of energy are obliged to have a specific share of renewables in their portfolio (the quota obligation) (EEA, 2014). Thus, in contrast to FIT and FIP, where price levels are controlled by the policy-makers, TGC are

referred to as ‘quantity’-control instrument. Certificates that represent a certain production from renewables (e.g. 1 MWh of ‘green’ electricity equals 1 TGC) are used to demonstrate compliance with the quota obligation to the authorities. These certificates can be freely traded on the market and a market price materialises for the certificates in each compliance period.

INVESTMENT GRANTS

Investment Grants (INV) are financial supports granted by governmental institutions to investors in renewable energy projects in the form of non-reimbursable payments at the construction phase of a project (Ecofys, 2014). Most investment grants are paid out for the construction of a project, so the amount of RES-E being generated from the project is not directly targeted.

FISCAL MEASURES

Fiscal measures comprise mainly direct fiscal support such as energy tax exemptions, energy tax allowances or refund schemes. Indirect tax incentives, such as eco-taxes on fossil fuels or CO₂- taxes, are not specifically considered as support instrument in this analysis because it is assumed that they are implemented solely to internalise external cost (EEA, 2014).

FINANCIAL SUPPORT

These can be reimbursable equity investments or provisions of venture capital by governmental institutions, but also debt financing, e.g. in form of low-interest loans to renewable projects by a governmental financial institution (such as the KfW in Germany) (EIA, 2014).

NET METERING

An electricity policy for consumers who own small-scale renewable energy facilities and receive retail credit for at least a part of the electricity they produce (EEA, 2014). The most common small-scale renewable energy facility owned by consumers is solar panels.

PRIORITY GRID ACCESS

When a government or institution obliges grid operators to give priority access to renewable energy plants, and to connect and expand the grid when the connection of a plant requires such an expansion (EEA, 2014).

Appendix 4 – Renewable energy policies in three European Member States

○ DENMARK

Having been the first country to set out a renewable energy policy in 1979, Denmark has, in the wake of the European Directive of 2009, set itself very ambitious renewable energy targets, both in the short term and in the long term. The country has set itself the aim of reaching a 30% share of renewables in the national energy mix by 2020, with 51% of electricity being produced from renewable sources, and by 2050 Denmark aims to be totally independent from all fossil fuels (Jeppesen, 2014). Currently a majority of its renewable energy is produced from biomass and waste, while the country is a pioneer of wind energy in Europe with its wind farms providing over a quarter of the country's electricity demand. Moreover Denmark's wind industry is one of the country's most important exporting industries in regards to the national economy (IRENA-GWEC, 2012).

Denmark's energy policy since 2003 has been largely based around four main strategy statements, as well as being influenced by the 2009 European Directive. However it is also important to note the important development in 2002 that saw the liberalisation of the national electricity market (IRENA-GWEC, 2012). The first key policy agreement thereafter was the 2008 Energy Policy Agreement, valid until 2012, in which Denmark announced its short-term renewables target for 2011 as well as a short-term target to reduce energy consumption (2012).

In 2009 Denmark published its Promotion of Renewable Energy Act that put an important focus on the promotion of wind turbines, noticeably by providing compensation for individuals losing value on their property due to the installation of wind turbines in close proximity. Moreover local ownership of wind turbines was established so that the economic benefits made from them also directly benefit local communities. The Act also established new regulations and administrative measures to make the development of new renewable projects easier and faster. A last key point of the 2009 Act is the fact that companies would receive subsidies for the consumption of renewable energy and increased energy efficiency (IEA, 2012).

It was the 2050 Energy Strategy published in 2011 that has had the single biggest impact on the country's energy policy though, with significant emphasis being put on the importance of electricity in achieving the 2050 target of total independence from fossil fuels. Furthermore five more specific essential elements are highlighted that will have a direct impact on the successful achievement of this long-term target: offshore wind electricity generation, biomass, electric heat pumps, intelligent heat systems and the transport sector. These five elements are at the heart of Denmark's strategy for 2050 (The Danish Government, 2011).

In terms of the specific policy measures to have been implemented by Denmark, a general trend can be highlighted since the liberalisation of the electricity market in

2002 and the wave of new energy policies since then. This trend is based around market based support schemes such as Feed-in-Premiums and Tenders.

In this sense the two main support measures used by the Danish Government are tax reduction schemes and direct premium tariffs (RES-Legal Europe, 2012). Renewable electricity generation projects for example are supported by premium tariffs based on a bonus payment, which is paid on top of a fixed market rate. Tax reductions are also in place, as well as subsidies for small renewable electricity generation projects (2012). Renewable projects in the transport industry are also supported by tax reduction for companies producing or distributing fuels blended with biofuels, while companies importing or producing petrol, gas or diesel are obliged to ensure that biofuels make up a defined percentage of the company's total annual fuel sales (2012). Finally in terms of heating, there are tax exemptions in place for renewable source heating and a direct premium tariff is in place for the use of biogas for heating purposes (2012).

Standing as the main European country exporter of energy, Denmark's energy policy is noticeably ambitious and proactive and has led to renewable energy sources playing a significant role in the country's energy production, with biomass and wind playing a particularly crucial role. This is likely to carry on with the ambitious long-term targets in place, the important support schemes already in place, and the on-going support of the national Government.

○ *GERMANY*

Germany is at the heart of the energy transition in Europe given its political clout in the EU, its central geographical location, the size of its energy intensive economy, and more importantly, given "the scale of Germany's ambitions" (IEA, 2013) in regards to its energy policies. This is obvious in the "Energiekonzept", the document published in 2010 that outlines Germany's "Energiewende" or energy transition, which sets out the country's main goal: that "Germany should become one of the most energy efficient and environmentally friendly economies of the world". Furthermore the fact that Germany states in the document that "with the Energiekonzept the federal government describes the way into the renewable energy era" is a clear indication of the role that the country intends to play in the energy arena (Bosman, 2012).

The country's renewable energy strategy is based on its Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) that came into force in 2000 and has been amended four times since then, in 2004, 2009, 2011 and 2012.

In the short term, Germany aims to increase the share of renewable energies in total electricity consumption to at least 35% by 2020 while in the long term this target is 80% of total electricity consumption. Germany has also established a short and long-term target in terms of primary energy consumption as well as electricity consumption that would see 18% of primary energy consumption be supplied by

renewables by 2020 and 60% by 2050. In between these short and long term objectives, two intermediate goals for 2030 have been set, with 50% of electricity consumption and 30% of the final energy consumption to come to come from renewable sources (Bosman, 2012).

Crucially, since the 2012 amendment of the EEG, all of these goals are binding.

The purpose of the EEG is to promote the production of electricity from renewable energy sources. This general purpose as well as the specific targets set out both in the short-term for 2020 and the long-term for 2050 are translated into concrete support measures put in place by the German state, which are based on a principle of priority access for renewable energy to the power grid as well as a feed-in tariff scheme for a period of twenty years (IEA, 2013).

These feed-in tariffs are technology-specific, and while for most technologies they are set at a fixed price for every kilowatt hour produced, a reduction of the tariffs is in place that is based on technical and market developments. Moreover since 2012 an optional market premium has been in place, which opened the opportunity for those generating renewable energy to sell electricity directly into the market. If we take the example of a wind farm, it would mean that it could sell its produced output to a third party at the market price instead of selling it at the regulated feed-in-tariff to the grid operator (IEA, 2013). A management premium that is issued to cover the administrative costs of marketing their energy is also available to renewable energy generators.

By all accounts it is the success of its FIT support scheme that has pushed Germany forwards and drastically increased the share of renewable energy that makes up its electricity production, from just over 6% in 2000 to about 30% in 2014, while also having an important impact on job creation (IEA, 2014).

Its FIT scheme, first implemented in 1990, is highlighted as the single most important reason for the emergence of renewable energy in Germany and the country's energy transition but it is not the only reason (Lipp, 2007). Other key factors that have played a part are the complementary support measures that have been put in place such as increased R&D investment in renewable energies, low interest loan programmes, and increased tax rates on fossil fuels for example (Lipp, 2007), while the influential coalition of renewable energy supporters is another element to have played a very important role. This coalition, made up of renewable energy supporters, interest groups, multinational companies, universities and research institutes, has been a strong force behind bold political moves such as the 2011 decision to phase out nuclear power following the Fukushima nuclear disaster in Japan (Bosman, 2012).

Finally the fact that responsibility for renewable energy was transferred from the Ministry of Economics after 1998 to the Ministry of the Environment has provided a more effective institutional framework for the development of renewables in Germany (Lipp, 2007; Bosman, 2012).

○ *BELGIUM*

Energy in Belgium is mainly a regional matter, with renewable energies, the distribution and transmission of low-tension electricity, and energy efficiency being the responsibility of the three Regions. The federal state has the responsibility of high-tension electricity transmission, price regulation, offshore wind, hydro and nuclear energy (CONCERE-ENOVER, 2010). These competences and responsibilities were outlined in Belgium's National Renewable Energy Action Plan (NREAP) (CONCERE-ENOVER, 2010) that was drawn up in the wake of the European Directive of 2009.

The country's NREAP also established the energy targets for 2020, the main target being for renewable energy sources to make up 13% of the country's gross final consumption of energy by 2020. Furthermore this renewable energy target is specified for heating & cooling, electricity and transport with the percentage of renewable energy being 11,9%, 20,9% and 10,14% respectively for each sector (CONCERE-ENOVER, 2010).

If we look at the evolution of the share of renewable energy sources in the country's gross final consumption up to 2012, year of the latest available data, the signs are positive; in 2005 renewables made up only 2,3% of final energy consumption, and by 2012 this figure had reached 6,8% (renouvelle, 2014). Noticeably the biggest increase has come since 2008, since when the share of renewables has more than doubled. This growth has mainly been due to the huge increase in the production of electricity from renewable energy that has seen a 24% annual increase on average since 2005 to reach 10,4 TWh in 2012, while renewable heating and cooling has increased by an average of 6% a year since 2005 to reach a total of 14,3 TWh in 2005 (renouvelle, 2014).

In terms of electricity, such positive results between 2005 and 2012 were reached by a quota obligation on electricity suppliers established in 2002 to supply a growing share of their electricity from renewable sources. Each of the three Belgian regions implements the quota obligation system independently with different minimum prices (RE-shape, 2011). However in 2013 both Flanders and Wallonia drastically reduced their level of support by reducing the prices of green certificates, before ultimately cancelling the green certificate system for small renewable energy productions (renouvelle, 2014). This has had the effect of significantly slowing the growth of both the solar market and the wind market since 2013. In general the quota system in place in Belgium has been heavily criticised given the frequent changes in regulation and the impact it has had on the electricity bills of consumers (Nihart, 2013).

Besides from the quota system, Belgium's regions also have different small subsidy and fiscal measures in place to encourage the production of renewable energies and

investment into the development of renewables. All three regions also have a net-metering support scheme in place for small producers of green electricity (RES-Legal, 2012).

Despite the significant growth in the share of renewable energy in the final consumption of energy between 2005 and 2012 that has been driven by the important increase in the production of both wind and solar energy, Belgium has failed to capitalise on the positive momentum and push this growth further since 2012. Noticeably the support measures for renewable energies have varied in the three Regions thereby creating uncertainty, but more striking even is the fact that Belgium has no long-term energy strategy or targets in place beyond 2020. In 2003 the government did announce that it would be phasing out nuclear energy generation by 2025, yet the country is still heavily reliant on nuclear energy and fossil fuel in its energy consumption and there is no medium- or long-term plan in place that maps out the manner in which Belgium will achieve this ambitious target (renouvelle, 2012).

Appendix 5 – Renewable energy promotion policies in three Canadian Provinces

○ *ONTARIO*

In 2009 the Province of Ontario established the Green Energy and Green Economy Act (Legislative Assembly of Ontario, 2009) that focused on developing renewable energy sources to increase its share in the energy mix and creating improved measures in terms of energy efficiency in order to help conserve energy (Runyon, 2009). The overall aim of the Bill was to foster a new green economy through the creation of thousands of jobs and new renewable energy generation projects for organisations and local communities (Runyon, 2009). The plan has been largely successful since its implementation based on the evidence of the total phasing out of coal and the increase in the share of renewable energy sources in the Provinces energy mix to reach 30% (Clean Energy Canada, 2014). Today the Province's energy mix is dominated by nuclear energy (2014).

In order to achieve its first objective of increasing the share of renewable energy in the Province's energy mix, the Green Energy Act enacted a feed-in tariff modelled on the successful policy implemented by Germany (Clean Energy Canada, 2014). The aim of the FIT is to create investor confidence in the profitability of renewable energy projects so as to generate new and increased investment. Between 2009 and 2013 there existed different levels of tariffs set for electricity fed into the grid from renewable sources, yet since June 2013 FIT's have been limited to small projects under 500kW. Homeowners have also been encouraged to develop small-scale renewable projects through incentives such as low interest loans to help them finance solar panels for example (Runyon, 2009).

Moreover in addition to the FIT another key policy that has had a key role in the success of the Green Energy Act has been the streamlined approval, assistance and support processes put in place to help renewable energy projects establish themselves, develop and connect to the electricity grid successfully (Runyon, 2009).

As for the focus on energy efficiency and conservation, the Green Energy Act outlined that any given building would have to be reviewed every five years to identify areas of potential improvement in terms of its energy efficiency. Other specific measures were also established, such as household efficiency measures, conservation targets for local distribution companies, and the obligation for public sector organisations to set out energy conservation plans (Runyon, 2009). Along with these policies, an advisory council was set up so as to provide energy efficiency advice to the Government (Legislative Assembly of Ontario, 2009).

The Province's Long Term Energy Plan released in 2013 (Ontario, 2013) stressed the renewed emphasis on energy conservation and demand management, placing them at the heart of their long-term plan.

Added to its Green Energy Act of 2009 and its Long Term Energy Plan of 2013, a cornerstone of the Province's commitment to improving the sustainability of its energy supply has been the phasing out of coal from its energy mix. From a situation in 2005 when coal made up 25% of the Province's electricity supply, Ontario totally banned and closed in 2014 all coal-fired power generation (Clean Energy Canada, 2014). This means that since then the electricity of Ontario, Canada's most populated Province, is officially coal free while 30% of its grid is renewable (Clean Energy Canada, 2014). To put this in other terms, the move equates in GHG terms to taking seven million cars off the road (Leahy, 2014). This phase out took place over thirteen years, between 2001, when the first legally binding regulation was issued requiring the phase out of coal burning in Mississauga at the Lakeview Generating Station, and 2014 by which time the four remaining coal-burning sites had been closed (Clean Air Alliance, 2011). It should be noted that this phase out is "the single biggest greenhouse gas reduction initiative in North America" (Clean Air Alliance, 2011).

To sum up, Ontario has built its renewable energy policy around its Green Energy and Green Economy Act that puts forward the two priorities of increasing the share of renewable energy in the Province's energy mix and improving energy efficiency. The Long Term Energy Plan released in 2013 reiterates the latter by putting an even greater focus on the importance of energy conservation and efficiency.

The Province has set about achieving these priorities by establishing feed in tariffs for the generation of renewable power and frequent efficiency measures and reviews to improve energy conservation and efficiency. The total phase out of coal burning has gone hand in hand with these measures that have seen Ontario play a key role on the Canadian energy scene since the turn of the twenty-first century (Stokes, 2013).

○ *QUEBEC*

Quebec has also been playing a leading role on the renewable energy scene in recent years. In 2013 it retired its Nuclear power plant while all five of the top new clean energy projects in Canada during 2013 were developed in the Province (Clean Energy Canada, 2014). Moreover the fact that over 99% of its energy mix comes from clean and renewable resources, mostly hydroelectricity, means that it is one of the cleanest regions in terms of electricity in the world (Chassin, 2013). Energy plays a very important role in the economic landscape of Quebec in the sense that it is one of the Province's key comparative advantages for its industries. As the Government points out "energy development will help ensure the prosperity of Quebec and that of future generations" (2006, p.5) given the availability of energy in different forms and at very competitive rates

The main player on the energy scene in Quebec is Hydro-Quebec, a government-owned public utility company that is responsible for the majority of the production, transmission and distribution of electricity in the Province. The company also boasts the fact of being the biggest electricity producer in Canada and the largest hydroelectric company in the world (Hydro-Quebec, 2015).

Quebec's energy policy is established in its 2006 publication "Using Energy to build the Quebec of tomorrow" (Gouvernement du Quebec, 2006), which outlines its priorities in terms of energy issues and the means that will be put in place to achieve them. The Government of Quebec will release its next energy plan for 2015-2025 in the autumn of 2015.

The Province's energy strategy rests on six priorities and dimensions. The most important of these priorities, into which the Province has put the most focus during the past decade, is increasing energy security. They have set about achieving this by developing a "portfolio approach" (2006), which consists of launching the five-year phase of negotiations, studies and environmental assessments of several hydroelectric projects simultaneously instead of processing one project at a time. This has been done to accelerate the completion of major hydroelectric projects so that all necessary agreements and permits were in place by 2010, thereby meaning that the projects could be completed before 2015 (2006). Interestingly though and contrary to what Ontario has done through its feed in tariffs, the Government of Quebec has not promoted the development of small and privately owned projects given that they are not essential to the Province's energy security (2006).

Added to this portfolio approach has been the setting of very competitive electricity rates compared to other Canadian Provinces. The "heritage block" policy determines that 95% of electricity is to be priced at the fixed rate of 2.79 ¢/kWh (Sustainable Prosperity, 2010).

Added to its main energy priority that is energy security, the Government of Quebec also set the five following priorities:

- Energy as an economic lever; with investment focused on hydroelectricity, wind power and natural gas supplies.
- Increased energy efficiency.
- Energy field innovation.
- Increased involvement of local and Aboriginal communities, with small generating projects only being pursued by these communities without the direct support of the Government.
- The modernisation of legislative and regulatory framework.

Overall the main element that appears to have shaped the energy policy of Quebec is its focus on energy security and the promotion of big energy projects only through its portfolio approach. One of the main reasons that seemingly explains this approach is the size and presence of Hydro-Quebec that dictates energy matters in the Province given the economic weight of the company. It would seem in this sense that the Government of Quebec is more intent on supporting and promoting the projects of Hydro-Quebec rather than small local projects.

Another key factor that defines the energy policy of the Province of Quebec is the very cheap electricity rates that are in place and that are explained largely by the cheap production costs of hydroelectricity in the Province. A final important point to take into consideration is the high level of tax on petroleum that is in place, which is higher than in any other region in North America.

In this sense Quebec's energy scene appears to be less influenced by big and bold policies such as the FIT or the coal phase that have been in place in Ontario. The key determinant is the size and scope of Hydro-Quebec and how it has shaped the energy production, distribution and consumption in the Province through the important exploitation of the significant hydroelectric resources available.

○ *NOVA SCOTIA*

The Province of Nova Scotia published its energy plan in 2009. This plan elaborated on the four pillars of its energy policies, which were: energy conservation and efficiency, renewable electricity and a reduction of imported coal (Nova Scotia, 2009). Noticeably the main focus is on electricity given that it is fulfilling a growing portion of energy requirements for home heating and transportation

These pillars were further outlined in the Province's electricity plan published in 2010, which detailed Nova Scotia's energy targets for 2015 and 2020, as well as the means that it would put in place in order to achieve these targets. The plan is based on the general objective of making the transition towards a renewable electricity supply and moving away from the dependence on coal burning (Nova Scotia, 2010). When the Province published its plan in 2010, over 80% of its electricity supply was produced from imported coal with about 9% coming from more local natural gas supplies and, 11% of electricity coming from renewable sources (2010).

Nova Scotia formulated two specific targets in regards to the composition of their energy mix; by 2015 they intend for 25% of their electricity to come from renewable sources, with that figure rising to 40% by 2020, which would be above the current national percentage of 31% of renewables in the Canadian energy mix (EIA, 2012). If the Province were to reach this target of 40% by 2020 it would mean that its consumption of imported coal would have been halved by then. As things stand Nova Scotia is on track to meet both of these targets (Ruskin, 2014).

Four clear policies have been implemented that have seen Nova Scotia progressively make the energy transition away from fossil fuels towards a greater exploitation of renewable energies. However beyond the new policies that have been implemented it should be noted that the electricity marketplace has remained regulated rather than being opened up to competition given the limited connection of the provincial electricity grid to the North American grid.

Firstly Nova Scotia has backed large renewable electricity projects and has split them evenly between Nova Scotia Power, the main electricity producer in the Province, and independent power producers from whom Nova Scotia Power is then obliged to buy power from. Noticeably most commercial-scale wind turbines are owned by independent power producers (Nova Scotia Power, 2015). In this regard a new authority, the Renewable Electricity Administrator, was set up in 2010 to manage the bidding process between these independent producers and Nova Scotia Power (Nova Scotia, 2010).

Secondly in terms of small community projects, a community-based feed-in tariff (COMFIT) was established so as to encourage these smaller projects, typically less than 2MW. Access to this FIT is limited to community-based participants only so as to ensure that the projects are truly rooted into the communities, as well as creating greater public understanding and acceptance of renewable resources (Nova Scotia, 2010). The Province recognised in its energy plan (2010) that it drew inspiration from the FIT's implemented in Germany and Ontario.

The third policy measure to be implemented was Enhanced Net Metering to give individuals and small businesses the opportunity to put surplus power they generate into the grid in return of payment at retail price (2010). Fourthly the last important measure was the setting up of Nova Scotia Efficiency Corporation in 2010 that has helped the Province to become the most energy efficient in Canada. The corporation helped reduce the Province's annual electricity load by 5,5% in 2014 alone, and given the fact that it is funded by taxpayers, it makes it directly accountable to them thereby strengthening the link to local communities in Nova Scotia (Efficiency Nova Scotia, 2015). The setting up of such an Efficiency Utility is a measure recommended by the International Energy Agency (Ecology Action Centre 2013).

Appendix 6 – The standout features of the renewable energy policies of three EU Member States

DENMARK	GERMANY	BELGIUM
- Focus on transition to <i>renewable energy and independence from fossil fuels</i> - Total independence from fossil fuel by 2050 - <i>Feed In Premiums</i> as the main policy tool - Tax reductions in place for renewable energy projects - Energy mix dominated by oil	- Focus on <i>the energy transition</i> - Feed in tariffs as the main policy tool - priority access to the power grid given to renewable energy - very influential coalition of renewable energy supporters - Oil dominates the energy mix with nuclear power and natural gas	- Short term focus on <i>renewable electricity and a nuclear phase out</i> - Energy as a regional responsibility in the main - <i>Quota obligation</i> as the main policy tool - Small subsidies and fiscal measures are also in place - Nuclear power is the main source of energy

Appendix 7 – The standout features of the renewable energy policies of three Canadian Provinces

ONTARIO	QUEBEC	NOVA SCOTIA
- Focus on transition to <i>renewable energy</i> and <i>energy efficiency</i> - Total phase out of coal - <i>Feed In Tariffs</i> as the main policy tool - Streamlined energy administration - Energy mix dominated by nuclear energy	- Focus on <i>energy security</i> - Huge <i>hydro</i> resources - 99% of electricity is “clean” - Significant influence of Hydro-Quebec - Government support only for large energy projects, no support for smaller projects	- Focus on <i>renewable electricity</i> - Huge dependency on coal - Significant new renewable energy policies - <i>Feed in Tariffs, Net metering</i> and new regulation of large projects as the main policy tools - Creation of an efficiency utility

Appendix 8 – Summary of the state of the energy transition in the EU & Canada

EUROPEAN UNION	Successful transition in progress?	Observation
Final energy consumption	Yes	Currently on track to meet its 20% energy efficiency set for 2020, a positive trend of reduced final energy consumption is noticeable since 2005
Electricity generation by type	Yes	Renewables makes up 25% of generated electricity and despite fossil fuels still making up nearly 50%, that share is decreasing. The trend is positive for the share of renewables.
Energy consumption by type	Unclear	The consumption of fossil fuels has been relatively stable with only a 5% drop between 2003 and 2012. Fossil Fuels and natural gas make up 75% together of consumed energy.

		The share of renewables has doubled since 2003 but still only makes up 12%.
Electricity GHG	Yes	Despite a sharp increase between 2000 and 2005, there has been a significant drop in GHG from electricity since 1990.
Total GHG	Yes	The EU 2020 target of reaching a 20% drop by 2020 is nearly reached, and the positive trend of reducing GHG emissions is set to carry on.
CANADA	Successful transition in progress?	Observation
Final energy consumption	No	Energy efficiency has worsened given the 27% increase in final energy consumption between 1990 and 2011.
Electricity generation by type	Yes	Renewables make up nearly 65% of electricity production with a 5% increase since 1990 while the use of fossil fuels has dropped by 8% since then.
Energy consumption by type	Unclear	The consumption of oil is relatively stable at about 40% since 2003 yet there has been a marked increase in the production level of oil. The consumption of renewables has increased however making up for drop in the consumption of coal & gas, while that of nuclear has been relatively stable.
Electricity GHG	Yes	A very positive trend is noticeable since 2000 with GHG emissions dropping below levels of 1990 by 2012.
Total GHG	No	A consistent increase between 1990 and 2005 with a relative stability in GHG emissions since 2008. Levels are expected to increase further by 2020 and be way off target regarding the previous Kyoto objective.

Appendix 9.1 – Interview guide (French)

Nom			
Société/Organisation			
Fonction			
Region		Ville	

1. INFORMATION PERSONNELLE

- Parcours professionnel & Académique
- Explication de votre rôle actuel
- Intérêt pour VE purement professionnel ou personnel?
- Propriétaire d'un VE? Pour quelles raisons?

2. MARCHÉ DES VE au CANADA

- Selon chiffres de Juin 2015 : +/- 14.000 VE
- Prêt de la moitié au Québec
- Votre avis sur l'état du marché aujourd'hui au Canada?
- Vos attentes par rapport à l'évolution du marché dans les 3-5 ans à venir?
- Votre avis sur les modèles de VE disponibles au Canada? (Offre de VE)

3. LES BARRIÈRES à L'EXPANSION DU MARCHÉ

- Quelles sont les barrières qui ont freiné l'expansion du marché VE depuis 2010 au Canada?
 - Prix d'achat
 - Infrastructure
 - Climat
 - Évolution technologique
 - Durée de la vie de la batterie
 - Manque d'investissement marketing des manufacturiers
- Niveau de soutien direct fédéral & provincial

4. INTERVENTION DES GOUVERNEMENTS

- Votre avis sur le plan stratégique fédéral?
 - EV Roadmap Canada
- Votre avis sur le rôle joué par le gouvernement Provincial?
- Meilleur soutien provincial? (plus efficace selon vous)

5. EXPLICATION DU RETARD

- Énorme potentiel électrique = CONTRADICTION
- Quel est votre avis sur le fait que le Canada présente une situation contradictoire : d'un côté un potentiel d'électricité propre énorme et d'un autre côté un manque de volonté d'exploiter ce potentiel au maximum?
- Quelles explications aux barrières à l'expansion?
 - Volonté de mener le changement

Appendix 9.2 – Interview guide (English)

Name			
Company/Organisation			
Function			
Region		Ville	

1. PERSONAL INFORMATION

- Professional & academic experience
- Current function
- EV interest : personal or professional?
- Owner of an EV or not? For what reasons?

2. CANADIAN EV MARKET

- +- 14.00 EVs in Canada (June 2015)
 - 50% of Canadian market = Quebec
- Thoughts on the current state of the Canadian EV market
- Expectations for the development of the market in the next 3-5 years
- Thoughts on the EV offer in Canada

3. BARRIERS TO EV MARKET EXPANSION

- Which barriers have held back/slowed the expansion of the Canadian EV market?
- Potential barriers?
 - Purchase cost
 - Infrastructure
 - Climate
 - Technological evolutions
 - Battery lifespan
 - Marketing

4. GOVERNMENT INTERVENTION

- Thoughts on the national strategy from 2008?
 - EV Roadmap Canada
- Thoughts on the role played by Provincial governments?
 - Ex : 4-8.000\$ in Quebec
- Best cases of government intervention?

5. EXPLICATION DU RETARD

- CONTRADICTION → huge clean electricity potential / small EV market
- Thoughts on the contradiction between clean electricity resources and the development of the EV market
- Explanation of this contradiction
 - What could have/will make a difference to the development of the market

Appendix 10 - Interview with Nicolas Danys-Godard

TESLA MOTORS - Owner advisor & Product specialist

Bonjour. Je suis intéressé par la situation des véhicules électriques au Québec et au Canada en général, c'est pourquoi j'ai pensé à venir vous rencontrer ici.

Bonjour. Je suis donc employé chez Tesla et je suis là pour conseiller. Donc la situation actuelle au Québec : fin d'abord le Canada, c'est vague, la situation est pas pareille partout. On ne vend par exemple pas de voiture dans les provinces centrales, on n'est pas encore là parce que le marché... Ce qui se vend beaucoup, c'est sur le Québec et l'Ontario puis la Colombie Britannique. L'Alberta va rentrer sous peu dans nos marchés. Au Québec, c'est exponentiel : ça va de mieux-en-mieux. D'abord parce que notre ressource déjà, c'est l'électricité : les gens savent et connaissent donc un peu. Puis on paye chère aussi l'essence. Fait que ça part d'une ouverture d'esprit puis de ce qu'on a comme ressource chez nous. Fait que ces deux-là ensemble, ça marche pas mal... Dans les provinces centrales, bon on ne veut pas pointer du doigt mais c'est plutôt des pickups dans ce coin-là. C'est plutôt une « culture essence » on va dire.

Et les plus grosses barrières ici selon vous? Ce qui fait que tous les gens n'achètent pas ça ici? Parce que c'est ça que moi je ne comprends pas, vous avez une ressource infinie et...

Les plus grosses barrières je te dirais que c'est l'apprentissage. Ça fait 100 ans qu'on est habitué à faire la même chose, donc de mettre de l'essence dans sa voiture. A quelques occasions, c'est arrivé de faire à l'électricité, il y a 100 ans ça existait déjà les voitures électriques. Mais c'est une mentalité, c'est comme le faire à l'envers pour certaines personnes. Donc ça prend une ouverture puis c'est réapprendre, se demander à nouveau « bon c'est quoi un transport là ? » ?

Et chez qui est la responsabilité? Les gouvernements, vous les manufacturiers?

Ben nous c'est ce qu'on essaie de faire effectivement, c'est notre rôle ici. C'est plutôt d'éduquer que de vendre. C'est une approche qui est différente parce que ça change mais ça ne prend pas grand-chose hein. C'est juste qu'on veut faire comprendre comment ça se recharge, que quand on se lève le matin c'est plein, puis qu'on a de l'autonomie en mars. C'est ce qu'on appelle « l'anxiété d'autonomie », c'est un facteur principal des voitures électriques : le gens ont peur de ne pas se rendre. Donc chaque jour on en parle parce que dans notre cas à nous, et on ne peut pas dire pour tout le monde, mais on va dire qu'on peut faire minimum plus de 350 km par jour.

Et ça c'est réaliste?

C'est très réaliste. Et quand je dis 350 je suis gentil là.

L'hiver aussi?

L'hiver ça ressemble à ça aussi. C'est sûr qu'on a des différentes versions de batteries aussi, des plus petites et des grosses, les plus grosses c'est plus 400km. Mais d'office que le matin c'est plein. Maintenant si vous me dites que vous faites 500km par jour, là c'est non.

Mais pour aller à Québec par exemple ?

Oui là facilement ! Québec c'est 260km, donc vraiment facile.

L'hiver souvent les gens pensent qu'on perd 50% là mais ce n'est pas vrai. C'est un peu moins efficace c'est vrai, mais ce n'est pas au point qu'on ne se rend plus nulle part. Ça affectera plus une voiture qui a une autonomie réduite. Une voiture qui a 100 - 120 km d'autonomie l'été, dans les bonnes conditions, c'est sûr que l'hiver elle va en prendre un coup. Mais ce n'est pas juste ça, l'autonomie, c'est la technologie qu'on a derrière ça aussi, c'est la gestion des batteries. Puis nous on est très fort dans la gestion des batteries, elles sont moins affectées par les conditions. Donc le froid, le chaud, ça nous affecte c'est sûr mais moins parce qu'on a la technologie qui est là en arrière pour ça. La batterie va s'auto-réchauffer, elle va se refroidir, elle va se protéger des éléments. Alors dans une voiture moins chère ben... C'est sûr que tu ne peux pas mettre une batterie comme ça dans une voiture qui vaut 30.000 par exemple.

Mais en parlant de ça, mon patron il a une SMART puis il est full électrique à la maison aussi. Il habite à 15km d'ici donc, l'hiver ou l'été, ça ne change rien pour lui. Par contre, s'il veut aller plus loin, il prend dans nos Tesla. C'est une mentalité : fait qu'on l'apprend puis on voit que c'est très faisable.

Tu sais l'indice de satisfaction il parle de lui-même là. Tesla ne fait pas de marketing, on ne fait pas d'annonce. On a des ressources très limitées donc l'argent qu'on a, on le met en recherche et développement puis dans les voitures. Fait qu'on créé le meilleur produit qui existe et ce sont les clients qui le vendent à notre place. La satisfaction est tellement haute : on a eu 98% deux années en ligne, c'est la plus haute de toute l'industrie au complet. Le client ben... On n'a plus besoin de vendre la voiture, c'est la voiture qui se vend d'elle-même.

Et surtout dans le secteur automobile ou les budgets marketing et publicité sont tellement gigantesques.

Précisément. C'est impossible de rentrer dans le marché automobile. C'est un des marchés les plus durs. Faut penser au dernier joueur qui est rentré récemment, c'est Kia là peut-être au Québec et ça fait 15 ans, peut-être plus ! Mais c'était déjà établi partout ailleurs dans le monde. On ne peut pas lancer demain matin une compagnie de voitures puis s'attendre à avoir un succès instantané. A moins que ce soit des « super-car » à 2 millions qu'on en vend 10 peut-être. Pour nous qui sommes électriques en plus, donc qui nous battons contre des joueurs qui marchent à l'essence depuis 100 ans, la seule façon par laquelle on peut avoir le succès et la croissance qu'on a en ce moment, c'était de faire la meilleure voiture au monde. Elle ne pouvait pas être juste correcte, là on se serait planté dès le début. Donc Tesla, c'est un peu ça. On n'avait pas d'autres choix. Alors on a engagé plus d'ingénieurs et moins de cravate [rire]. Et c'est comme ça qu'on a notre produit.

Et le gouvernement fait assez ?

Ben là mon avis c'est qu'on est le seul pays du G8 qui ne reçoit rien du fédéral en terme d'allocations pour les voitures électriques. C'est provincial. Aux Etats-Unis ils ont parfois les deux : fédéral et les incitatifs. Ça dépend vraiment des Etats mais le

plus gros incitatif aux Etats-Unis c'est la Californie mais chaque état a des règles un peu différente.

[intervention d'un collègue peu audible]

En Ontario, c'est 8.500 pour une auto.

Peu importe la voiture ? Que ce soit une Tesla ou...

A condition que ce soit une électrique. Quelqu'un qui achète une Volt qui est vraiment pas chère, je pense que c'est 24.000, c'est quasiment le tiers en partant qu'il reçoit. Maintenant y a deux façons de penser : l'auto elle coûte plus chère donc on a ça en plus ou alors on a les moyens de s'acheter une voiture à 100.000 alors on a théoriquement les moyens de... Enfin c'est ça, c'est une voiture de luxe tout de même, on se comprend.

C'est ça. Et l'infrastructure publique est suffisante à vos yeux ?

Oui, vraiment. En fait en ce moment, nous on a un réseau de bornes très rapides qu'on appelle « les super chargeurs » qui couvre maintenant, et ça c'est en 3 ans d'installation enfin peut-être 2 an et demi, le réseau couvre 95% de la population nord-américaine excepté du Mexique, donc Canada et Etats-Unis. C'est énorme en 2,5 ans 3 ans d'installation. Puis ce n'est pas fini, on continue, on va aller chercher les 5 derniers pourcents. Puis ici disons entre Montréal et Québec...

Donc là je pourrais prendre ma Tesla puis m'en aller à Virginia Beach puis là me recharger...

Oui oui, facilement. Le seul point pour le moment qui est plus limite c'est dans l'ouest Canadien là, après Toronto. Là ça devient limite mais il n'y a plus rien par là. Donc on couvre la population. Aussi là au Québec, souvent les gens ils ne savent pas, mais si on couvre les axes Québec – Montréal, on aura couvert 90% de la population du Québec. On a des super chargeurs ici à Montréal. Y en a deux là. On va installer des super chargeurs dans la région de Québec. L'idée c'est de couvrir les longues distances donc pas besoin d'en avoir 26.000 partout, juste des bien placées.

C'est comme une station publique ?

Ben en fait ça ressemble à une station publique mais ce sont toutes des stations Tesla parce que, par rapport aux 700 publiques là, nos stations sont beaucoup plus rapides. Nous ça va jusqu'à du 500 ampères. Ça donne environ 500km/h de charge. En tous cas une borne publique va donner en moyenne 30-40, mais c'est fait pour des autonomies réduites.

Mais y a que des Tesla qui savent se brancher dessus alors ?

Oui. Ce n'est pas qu'on ne veut pas que les autres s'en servent, la mentalité de Tesla ce n'est pas... enfin nos brevets sont ouverts. Notre but c'est d'accélérer le transfert vers des véhicules soutenables. C'est ça la mission Tesla. Ce n'est pas qu'on ne veut pas que les autres s'en servent mais si vous branchez une autre voiture électrique comme une Volt ou une SMART, elle va exploser ! C'est beaucoup trop puissant ! On ne peut pas les laisser à tout le monde.

Merci !

Appendix 11 - Interview with Robert Dupuy

AVEQ - spokesman

Je suis de nationalité britannique mais j'ai vécu la plupart de ma vie en Belgique. Je termine ma maîtrise en gestion internationale, je suis là depuis 9 mois en stage dans l'entreprise française « Rexel » au sein de leur branche canadienne qui s'appelle « Nedco » dans leurs bureaux de la ville de St Laurent. J'ai effectué la première partie de mon mémoire sur la transition énergétique au Canada et je fais maintenant la deuxième partie sur le marché des véhicules électriques au Canada en tirant des comparaisons avec certains pays de l'Union Européenne.

Quels pays avez-vous choisis?

La Norvège, les Pays-Bas et pour le troisième, soit la Belgique soit la Grande Bretagne où il y a pas mal de bornes et de rabais gouvernementaux aussi mais qui ne se reflètent pas dans le nombre de VE sur les routes.

Oui la majorité est gratuite si je me souviens bien.

Ou alors un autre cas qui est intéressant c'est l'Islande vu la part de marché des VE assez intéressante sur les cinq dernières années et le fait que le climat est relativement similaire au climat du Canada. Parce que c'est vrai que un des arguments que beaucoup de gens m'ont dit c'est que « ah oui mais les VE ne fonctionnent pas quand il fait très chaud ou très froid ». Donc voilà pour moi.

Oui ce qui est bien c'est qu'en Islande il ne fait jamais très chaud même en plein été. Je n'ai pas encore été mais avec la Pologne c'est sur ma liste de pays à visiter. Je vais en Pologne au mois de Juin. Je pars en Europe pendant trois semaines mais je ne pourrai pas le faire en VE malheureusement.

Non je ne pense pas qu'il existe une entreprise de location de VE, en France en tous cas. J'en ai trouvée une ici à Montréal mais je n'en connais pas en France.

Oui y en a une très bonne ici : EEKO.

Oui j'espère rencontrer leur directeur bientôt.

Oh oui il est très bien et ce n'est pas très loin d'ici. Ce sont deux jeunes de la trentaine, très dynamiques. Ils ont commencé par acheter une Tesla qu'ils ont mis en location et là ils ont un parc assez intéressant, une ou deux leaf, une spark, et deux ou trois Tesla maintenant. Ils font la livraison des voitures, ils la livrent chez quelqu'un et dans le coffre avant ils ont un petit vélo électrique avec lequel ils repartent après la livraison.

Ha je me demandais justement comment ils faisaient pour organiser la livraison. J'imaginai qu'ils rentrent peut-être en taxi, ce qui serait contradictoire !

Non non, l'hiver ils font en transport en commun. Et ce sont tous des jeunes dynamiques qui sont bons. EEKO fait maintenant des ententes avec des compagnies

d'assurance parce que quelqu'un qui a un véhicule électrique ne veut pas se faire prêter une voiture à essence.

Et je vois que la mission de l'AVEQ se trouve sur votre carte de visite.

Oui notre mission risque de résumer pas mal des réponses que je vous donne. C'est important la mission, c'est ce qui guide nos interventions politiques. Parce que nous sommes un regroupement d'utilisateurs : nous ne sommes pas des experts de VE mais des experts en utilisation des VE. On les connaît bien, beaucoup mieux que les constructeurs ou que les concessionnaires et vendeurs en tous cas. Et quand je dis beaucoup mieux, c'est vraiment beaucoup. On a des gens extrêmement passionnés, j'ai d'ailleurs un copain, un belge en plus, qui a fait Montréal-Floride il y a un an en voiture électrique avec sa Leaf. Il en est revenu, et c'est 3.500km aller.

Tres interessant !

Sinon j'ai un fil conducteur qui n'est pas très rigide mais que l'on pourrait suivre pour cet entretien, il est basé sur cinq étapes principales : savoir qui vous êtes, avoir votre avis général sur le marché des VE au Canada, discuter des barrières qui ont freiné l'expansion du marché, discuter aussi des interventions du gouvernement fédéral mais aussi provincial et pour terminer avoir votre avis sur l'état du marché en 2018.

Vous m'avez bien fait rire avec le plan stratégique Fédéral, celui de 2009. Il n'y a pas eu de plus récent. Il y a beaucoup de discussions autour de cela actuellement, notamment avec Mobilité Electrique Canada qui est très actif là-dessus et s'est réuni cet été pour en rediscuter. Pour avoir fait ça dans une vie antérieure, des Roadmaps et des projections gouvernementales, c'est fascinant de voir comment ces trucs ne servent qu'à être amer ensuite parce qu'il ne se passe pas grand-chose.

Mais par où est-ce je commence ? Par qui je suis. Je suis un retraité heureux. Toute ma vie je me suis occupé d'applications technologiques dans la vie quotidienne, artistique, culturelle, etc. J'ai une formation en physique, informatique et mathématique et éducation des musiques. C'est grosso modo les domaines que j'ai étudié à l'université. J'étais au tout début de l'informatique, en 1960 environ. L'Université de Montréal qui était le premier centre de calcul informatique à Montréal a été fondé en 1958 avec les premières vraies machines dans les années '60. Moi ce qui m'intéressait c'était les applications non calculatrices comme en santé, en poésie, en musique. J'ai travaillé sur les correspondances dans les dons d'organes, et donc tout ça sont les domaines dans lesquels j'ai travaillé entre 1960 et '70.

C'est pertinent à notre rencontre simplement pour dire que j'ai toujours été fasciné par ce que la technologie peut modifier et quels impacts sociaux la technologie peut avoir. La technologie change les paradigmes. Prenons l'iPad par exemple qui a été fort critiqué lorsque c'est sorti. J'ai acheté le tout premier iPad à Montréal. Je l'ai eu et je me suis dit voilà qui va changer la façon dont on se sert de l'informatique. De la même façon j'ai acheté le premier Mac en 1984. Pour la petite histoire, j'étais prof à l'université à l'époque et un de mes étudiants me dit « ah mon frère va ouvrir un magasin d'ordinateurs ». Il avait déjà un magasin qui vendait des kits ou des parties

d'ordinateurs. J'avais eu une réflexion stupide dans le temps en me disant mais mon dieu qu'est-ce que l'on va faire avec deux magasins d'ordinateurs à Montréal !? Finalement ce gars-là qui était prof au Cegep a eu une clientèle via le Cegep et il a développé un magasin Mac vraiment très important. C'est lui qui m'avait dit viens ici tu vas voir quelque chose d'intéressant. Il m'a présenté le premier Mac, avant qu'il ne sorte donc, j'ai eu un des tous premiers modèles. J'ai toujours été comme ça, fasciné par des choses qui se modifiaient, parce que ça devenait de l'informatique pour les non informaticiens. Tu n'étais plus obligé de décortiquer des bites pour être capable de faire quelque chose.

Sinon par la suite j'ai travaillé dans la musique par ordinateur, dans le cinéma d'animation,... Donc je ne sais pas si c'est clair mais j'ai été excité par le fait que changer notre vision nous donne de « l'empowerement » qui nous permet d'aller plus loin et de modifier les choses.

C'est moins visible maintenant et on le voit plus en création musicale, mais pour la création littéraire l'ordinateur était une façon intéressante d'appliquer des filtres ou de travailler sur des traits stylistiques par exemple. La même chose en musique, l'idée c'est en quoi un musicien peut-il aller plus loin dans sa recherche et son expression musicale grâce à l'informatique. Je ne veux pas prendre le musicien et le rendre informaticien, je veux prendre les outils informatiques et les appliquer à la démarche musicale.

Tout ça pour dire que la voiture électrique m'intéresse parce que « it's a game changer » ! C'est quelque chose qui modifie la façon de voir les choses et qui, surtout au Québec, est quelque chose d'extrêmement pertinente. C'est fascinant de par sa beauté technologique aussi, une voiture électrique c'est quelque chose de bien pensée. Ça fait des choses que d'autres voitures ne font pas. Donc pour moi c'est le même émerveillement, et puis les voitures d'aujourd'hui sont des ordinateurs.

Voilà un peu d'où je viens et qui je suis.

Dans ce cadre-là j'ai été très longtemps dans le domaine universitaire en tant que professeur de communication, en création littéraire aussi. J'ai aussi fondé le groupe d'informatique musicale. Tout ça à différentes époques. J'ai aussi été celui qui a introduit l'informatique en musique à l'Université de Montréal dans les années '70. J'ai travaillé avec un musicien européen du nom de Yannis Xenakis qui est mort mais qui était ingénieur et grand compositeur. J'ai fait avec lui le premier spectacle contrôlé entièrement par ordinateur en 1970 dans des ruines romaines à Paris.

Cela s'est fait donc dans un contexte universitaire tout d'abord, ensuite dans le privé avec des gens très riches, moi pas, pour mettre sur pieds des réseaux de télécoms par satellites. J'ai été consultant aussi un peu partout dans le monde comme au Mali, au Burkina Faso, au Bénin, en Côte d'Ivoire sur des premières applications internet dans des cadres de missions pilotées par le gouvernement canadien mais réalisées par des entreprises d'ingénierie privées.

J'aimerais là faire une petite parenthèse et vous demander si je peux me permettre si vous avez pris plus de plaisir à travailler dans le privé ou dans l'académique ?

J'avais au niveau universitaire, d'une certaine façon, plus d'autonomie. Donc je pouvais déterminer mes champs d'intérêts mais aussi faire des ententes plus facilement au niveau international. Et cela permet aussi plus de temps pour réfléchir, pour participer à des conférences, pour travailler en commun avec des collègues et être dans des groupes de recherche.

J'ai beaucoup travaillé au sein d'organismes internationaux aussi et j'ai travaillé pendant quelques années pour l'institut national de recherche en informatique et en automatique (l'INRIA) qui était le grand développeur des premiers réseaux de communication de paquets. Grosso modo, l'internet d'aujourd'hui. Toute la conception théorique et technique s'est faite dans ces milieux-là qui étaient à l'interface entre les universitaires et les entreprises. Il y avait des grandes entreprises françaises telles que EDF, France Telecom, etc. Donc en tant qu'universitaire je pouvais un peu vagabonder et déterminer un peu ce que je voulais faire.

Dans le domaine privé, comme consultant, les impératifs sont au départ monétaire. Ensuite, il y a des éléments politiques parce qu'il faut se vendre et les décideurs sont des politiques. Quand on intervient dans un pays, surtout en Afrique, c'est au niveau des ministères donc il faut être capable de parler avec des gens de ce niveau-là, de vendre nos idées et répondre à leurs besoins qui ne sont pas toujours alignés avec nos objectifs. Donc c'est plus difficile d'être dans le domaine privé, mais en même temps ce sont des défis beaucoup plus grands avec des obligations de réponses.

Dans ce sens, est-ce que l'impact du privé est plus direct et plus vite ressenti au niveau du quotidien de la population ?

Je ne sais pas trop. Effectivement oui mais je te donne un exemple. Dans un pays africain, mais je ne veux pas généraliser, nous avons envoyé beaucoup d'équipements pour moderniser un ministère. Beaucoup. Une cinquantaine d'ordinateurs, etc. Tout cela pour se rendre compte six mois plus tard que quelqu'un les avait gardé et mis dans une salle où il ne les avait pas déballés parce qu'il ne voulait pas en perdre le contrôle, c'était son signe de richesse. Mais ce monsieur est resté assis sur son trésor et le matériel était perdu. Voilà quelque chose que l'on ne met pas dans un rapport officiel. A un moment dans un ministère, je travaillais avec des ministres et je leur expliquais les bienfaits d'internet et de la communication rapide. Cela avait des impacts majeurs sur la gestion du pays pour connaître le prix des denrées par exemple. Là on se fait dire « Ok le courrier électronique c'est bien beau mais est ce que l'on peut faire en sorte que les gens ne savent pas nous répondre, donc envoyer le courrier que dans un sens ? » Parce que c'est comme ça qu'ils voyaient la chose. Oui c'est naïf et caricatural mais voilà il faut être capable en étant consultant à l'étranger de faire plus que simplement tourner des boulons. Ce n'est pas simplement ça. Il faut savoir quelle couleur de boulon fait plaisir aux gens.

D'accord. Pour en revenir aux VE, est ce que vous êtes propriétaire ?

Oui ! Cela faisait quelques années que quelqu'un de ma famille avait une Leaf et je suivais la chose avec intérêt. Je suis sensibilisé déjà au niveau de la question sur le pétrole. Au Québec il y a une histoire d'amour/haine avec le pétrole. On a pensé exploiter des gisements qui sont certainement mirobolants mais c'est dans le golf du Saint-Laurent. Il y a des dangers de destruction d'un environnement majestueux donc c'est un contexte socio-politique et économique extrêmement délicat qui moi me touche beaucoup. D'autre part l'électricité au Québec est un atout. Un atout propre qui est pas cher, facilement disponible, et on en a même des surplus.

On vit dans une société qui dépend énormément du pétrole mais aussi des transports. Alors qu'est-ce qu'on fait ? On diminue le transport ? On diminue le pétrole ? On fait les deux ? Personnellement ce sont des choses qui me touchent beaucoup et il y a une compétence québécoise en termes d'hydro-électricité et d'électricité. On l'a démontré dans les moteurs, dans les batteries, dans la gestion des eaux et de la gestion de l'électricité. Et je le dis pour le Québec parce que ce n'est pas le cas pour le reste du Canada. Donc il y a une sensibilité sur ce point et c'est notamment pour ça que le concept de VE m'intéressait.

J'ai acheté mon premier VE au mois de Décembre 2014, ma première Leaf. On avait jusque-là des voitures assez confortables à la maison, des Audis, des Volvos, etc. J'adorais ma dernière Volvo mais depuis que j'ai acheté une Leaf je ne prenais plus plaisir à la conduire alors que la Leaf est une voiture amusante à conduire.

Pour ce qui est des voitures hybrides (VH) comme la Toyota Prius, c'est une technologie de transition. Mais les VE c'est un autre monde et une voiture vraiment performante. La petite Spark de Chevrolet par exemple, les pneus crient ! Ça part comme ça et le couple dans un moteur électrique il est maximum dès que l'on démarre. Ça bouge, ça tient bien la route donc c'est vraiment très agréable à conduire. On est dans un monde où nous sommes de plus en plus égoïste, notre monde est individualiste. Les valeurs collectives qui existaient ne sont plus d'actualités et les gens se demandent seulement « what is in it for me ? ». Moi je dis alors aux gens « conduisez une voiture électrique et vous allez vous faire du bien. Ensuite vous verrez c'est économique. » Ça me coûte beaucoup moins cher. Environ 20% moins cher. Ensuite, c'est moins égoïste mais ça nous touche aussi, c'est très bon pour l'environnement. Ici au Québec, pas nécessairement ailleurs mais en tous cas au Québec, l'argent pour l'énergie électrique que je mets dans ma voiture c'est de l'électricité québécoise et pas du pétrole Saoudien par exemple. En plus donc c'est propre. Pour la société aussi c'est donc intéressant parce que j'augmente notre PIB et je réduis le déficit commercial de la Province. Au Québec ce déficit est d'environ 25 milliards de dollars par année. Au niveau du transport et de l'énergie c'est de l'ordre de 15 à 18 milliards des 25 milliards du déficit total. Imaginons même 10% de ça, cela ferait 2 milliard de dollars qui rentrent dans le PIB. C'est drôlement important ! Et là on ne regarde que l'économie de pétrole. On n'a pas parlé du développement industriel et de tout ce qui peut suivre comme le

développement de compétences ou la création d'emplois.

Donc pourquoi moi j'ai une voiture électrique, parce que c'était ça la question au départ, ben les éléments étaient là et ça s'est fait sur un coût de tête. Je suis arrivée dans un magasin et là j'ai vécu ce que tout le monde qui veut acheter une voiture électrique au Québec vit : des grands yeux écarquillés du vendeur « Quoi ? Qui Quand ? Comment ? » Et moi j'étais là « Vous n'avez pas une voiture électrique d'occasion ? » « Bha non non... Ha si on en a une ». C'était une Leaf 12.000 km.

Je peux vous demander combien ?

26.000 ce qui était trop cher mais bon c'était le modèle haute gamme machin, j'aurais pu avoir moins cher ailleurs mais bon, ce n'était pas important. Et ensuite on a vécu avec ça et c'est devenu rapidement non pas la seconde voiture mais la voiture de prédilection et là j'ai eu le malheur de la faire conduire par ma femme qui est prof et qui va à Montréal tous les jours. Elle elle se promenait en Audi, elle aimait bien son Audi, 4 roues motrices, sécuritaire, etc. Et tout d'un coup « non moi c'est la Leaf ! » Mais c'est pas du tout un sacrifice ! Souvent les gens pensent qu'on est des gens très pieux... Des « Tree huggers » mais pas du tout ! C'est vraiment une question de plaisir, on s'amuse avec notre auto électrique. Et puis y a quelque chose que je n'ai encore jamais vu dans les recherches mais j'en ai fait l'expérience, t'es vraiment beaucoup plus zen et relax dans une voiture électrique que dans une normale là où t'es quasi à la crise de nerf ! Y a pas de vibration, pas de bruit, le pied gauche tranquille et le droit plus relax aussi parce que je mets même pas le frein là. Et je n'avais pas pensé à ça mais ma femme elle m'a dit que ça ça a une influence sur sa santé mentale.

Et le bien-être au quotidien...

Tout-à-fait. On redécouvre le plaisir d'écouter de la musique, etc. Bon c'est secondaire comme effet mais ça fait partie du tout aussi. Puis il s'est passé qu'on a regardé un documentaire qui s'appelle « Pump », à voir. Ça raconte l'évolution des moyens de transports et ça met en parallèle l'évolution électrique et l'évolution de notre consommation de pétrole. Il rappelle évidemment que les premières voitures étaient des voitures électriques, qu'au début du siècle on avait quelque chose comme 32% du marché américain qui était électrique, en 1910 ou 12, et qu'on a fait des voitures électriques jusque dans les années 40. Puis, tranquillement, il y a eu le pétrole qui est arrivé et là ils émettent une hypothèse que je ne sais pas si c'est vrai ou pas mais Ford avait dans la tête d'utiliser l'alcool comme combustible pour ses moteurs. Ils avaient tout en tête basé sur l'alcool. En parallèle, il y avait du pétrole un peu partout, on commençait à... Et hop ! Prohibition sur l'alcool ! Interdiction de consommer, de produire, de transporter de l'alcool. Est-ce que c'est une machination des pétrolières ? C'est ce que le documentaire laisse sous-entendre, c'est très marrant. Il raconte aussi que y avait tout un système de tramway électriques qui faisait de la côte Est à la côte Ouest et que ça, tous ces systèmes-là, ils ont été rachetés par des compagnies pétrolières. Et ça c'est vrai on l'a vécu nous-même à Montréal... Vous en Belgique vous avez encore des tramways je suppose ?

Oui, entre autres à Bruxelles.

Donc les compagnies pétrolières ont tout racheté des infrastructures électriques pour les brûler et remplacer ça par des bus. Anyway. En plein milieu du documentaire, ma femme dit « Non ça suffit, on va vendre la Audi et acheter une 2^{ème} voiture électrique ». C'est ce qu'on a fait.

Une Leaf ?

Non, une Volt.

Et la meilleure des deux ?

La Leaf est une meilleure voiture électrique mais entre guillemet parce qu'elle se recharge sur les bornes rapides à 400 volts, elle a une autonomie électrique plus grande que la Volt aussi. Donc pour faire Terrebonne Québec par exemple, je prends la Leaf sans hésiter parce que ça me demande 20 minutes de recharge sur le chemin, et 20 minutes c'est ce qu'on fait pour prendre un café et faire pipi, ce qu'on fait de toute façon ! Y a deux semaines on a été à l'île d'Orléans, c'est un coin complètement détaché d'une beauté bucolique et enchanteur, et sur l'île il y a 16 bornes de recharge. Pour une île qui fait je dirais presque 80 km de circonférence. Donc dans chaque village, à l'église, y a 2 bornes gratuites. Donc toi, l'électromobiliste tu te branches même si tu n'as pas vraiment besoin te recharger. Et qu'est-ce que tu fais, tu vas chez le chocolatier, le pâtissier, tu vas chez l'artisan, etc. Ils ont découvert eux le bénéfice du slow travel. Donc faire le voyage Montréal Québec île d'Orléans j'en ai eu pour 12\$ d'électricité. Dans ce sens-là la Leaf est supérieure à la Volt parce que la Volt elle aurait pu faire 75 km puis j'aurais dû mettre de l'essence parce qu'elle ne peut pas se recharger rapidement la Volt : elle est obligée de se recharger à 220 Volt et ça lui prend 4 heures. La Leaf, son autonomie c'est 160 km, la Volt c'est 70-80 km en été d'électricité mais ensuite y a une génératrice qui vient régénérer l'électricité qu'il y a dans ma batterie et qui me permet d'avoir une autonomie de 600 km si je veux parce que je mets 35 litre d'essence dans mon moteur qui est une génératrice dont la fonction est de fournir de l'électricité en gros. La fonction est donc de recharger la batterie et comme ça je peux faire 600 km à 120km/h si je veux. Je peux faire 12 ou 1500 km dans la journée, airco allumé sans aucun problème. Elle est très confortable. Donc laquelle je préfère, les deux ont des avantages différents.

Oui.

Alors ça explique où je suis. Puis moi j'ai une grande gueule et j'ai eu envie d'en parler. On a une télévision régionale et j'ai été invité à la télé pour un propos d'une trentaine de minutes sur les véhicules électriques. Alors dans ma région, on est quand même une bonne densité d'électro-mobilistes. Alors je ne sais pas pourquoi ce clip a eu un certain succès et s'est promené partout partout. J'ai rencontré les gens de l'AVEQ et ils m'ont demandé d'être leur porte-parole.

Et c'est comme ça que vous l'êtes depuis 6 mois ! Mais donc y a avant tout un intérêt personnel ?

Ben dans ces milieux-là, les gens sont des passionnés. Après y en a qui sont là par passion et ils ont aussi un intérêt professionnel comme technique par exemple. Moi, c'est en droite ligne avec toute mon expérience professionnelle.

Y a une logique.

Et pour moi ça a une valeur politique importante. Pour moi, l'électromobilité est essentielle pour le Québec, et je dis bien le Québec comme société.

J'ai envie de croire qu'elle est inévitable...

Je ne sais pas si elle est inévitable mais elle est drôlement rentable. C'est relativement simple à comprendre, on a de grands axes, 3 ou 4. A partir du moment où j'ai travaillé sur 2-3 grandes artères comme Montréal-Québec, Montréal-Sherbrooke, Montréal-Gatineau, j'aurai travaillé 90% de la population. Alors bien sûr au final j'en veux dans chaque village mais c'est beaucoup plus facile à travailler que si j'ai une population distribuée comme en France. Quand on a une grande densité de population comme en Europe c'est d'un côté plus simple parce que il y a toujours des points ou des villages où je peux trouver une prise électrique. Mais est-ce que je peux placer des bornes à recharge rapide un peu partout ? Non parce que je n'ai pas tellement de grands axes, même si y en a. Il me semble que c'est plus facile ici, ce n'est pas impossible.

Et par rapport au marché, si on regarde de manière rétrospective ce qui s'est passé entre 2010 et 2015, comment décririez-vous votre marché des VE ?

C'est un marché d'enthousiastes, de personnes qui en veulent. Mais ça c'est une petite portion de la population, on ne peut pas développer un marché sur des fanatiques. Donc je ne peux parler de ça sans évoquer l'importance des actions gouvernementales. Alors y a 3 ou 4 trucs et on va retrouver des trucs de l'AVEQ là-dedans. De façon claire, mais je les mets pas dans l'ordre, il y a la question des incitatifs fiscaux ou monétaires. Aux Etats-Unis ce sont des incitatifs fiscaux, ici ce sont de incitatifs monétaires : on donne 8.000\$ pour une voiture neuve à condition qu'elle soit électrique. Y a un chiffre magique comme 40 km d'autonomie là mais je suis pas sûr. Que ce soit une Tesla ou un Smart, vous avez 8.000\$. Ça c'est l'incitatif du gouvernement du Québec, et non pas d'Ottawa parce que là Ottawa, c'est zéro.

Je parle toujours de la question du marché mais je suis obligé de parler de l'environnement et politique et commercial. Je commence avec le politique parce que pour lancer les choses, si le gouvernement américain n'avait pas construit des autoroutes, le développement du marché automobiliste, en 1950 parce que c'est en 50 que ça a augmenté puisque tout est dans une boucle à ce moment, ce n'est pas le libre marché faut pas croire ça. Bref ceci étant dit, s'il n'y a pas quelqu'un pour démarrer le truc, on serait bien fou de s'acheter une voiture électrique si on ne peut rien faire avec. Au départ le gouvernement canadien avait, dans les années 2000, des incitatifs fiscaux pour les gens ou les entreprises qui achetaient des voitures avec réduction des émissions au sens large, on ne parlait pas des véhicules électriques exclusivement. Ça a disparu, ça a été aboli en 2009 en parallèle avec le roadmap.

Oui !

Le fameux roadmap qui prévoyait 500.000 voitures en 2018 là, c'est après-demain, on a 14.000 au Canada dont 7.200 au Québec. C'est intéressant ça 7.200 au Québec... C'est une réalité statistique là qu'on a la moitié des véhicules électriques

au Québec. Y a quelque chose d'un peu bizarre là. Evidemment c'est dû au fait qu'on a de l'électricité ici mais y en a à dans d'autres provinces aussi. En Ontario y en a mais elle est moins propre probablement...

Je crois que l'Ontario a au total 25 ou 30% des véhicules électriques ?

Probablement oui. Y a des chiffres importants qui sont sortis y a peut-être 3 semaines.

Oui j'utilise ce document-là moi !

Oui ben c'est ça, c'est assez similaire, c'est pas mal récent.

[Interruption de discussion]

Donc le marché... Parce qu'on peut parler longuement des incitatifs etc. Est-ce que ce sont eux qui permettent de débloquer le marché. C'est sûr que ça joue mais ce n'est pas suffisant parce que y a d'autres problèmes. C'est l'offre, il n'y a pas d'offre !

C'est un élément majeur du problème avec l'information du public, je suis toujours surpris de voir les préjugés et le manque d'information des gens concernant les températures de -35 par exemple.

Votre Leaf démarre ?

Bha oui. C'est un séchoir à cheveux ça, elle démarre toute seule.

Mais votre autonomie est affectée ?

Oui bien sûr, à 20% je dirais. Ça change ta façon de faire mais... Partons sur le démarrage. Moi comme Québécois ayant vécu des -30... « Est-ce que mon char va démarrer ? » ben oui, toujours. « Est-ce qu'elle se réchauffe rapidement ? » Oui. « Est-ce que je peux mettre la chaufferette ? » Oui. Alors ça coûte plus cher mais ça coûte plus cher en voiture à essence aussi. Alors là on arrive à la fameuse question de l'autonomie. Moi je m'amuse à dire que « l'autonomie est un problème sans borne ». C'est un problème si y a pas de borne mais si y a des bornes y a pas de problème ! Quand les gens me demandent comment je fais quand ma voiture s'arrête au milieu de l'autoroute, « ben elle s'arrête pas ma voiture, elle s'arrête toi ton char à gaz ? » *[rire]* Pourquoi les gens ont des préjugés comme ça ? C'est parce qu'ils ne sont pas informés. D'où la nécessité d'informer les gens que la voiture électrique est une solution.

Et alors là on arrive à une composante du marché, parce qu'on est toujours dans la question du marché, qui est celle de ceux qui doivent offrir : les vendeurs, les concessionnaires, les constructeurs automobiles. Et là il n'y a pas d'offre. Y en a un peu mais moins. Comme un copain dit faut toujours te méfier de celui qui répare les voitures. Si tu achètes une voiture à celui dont le métier est de réparer les voitures...

Il va peut-être te revoir assez vite...

Tandis que la voiture électrique, on sait comment ça marche pour le concessionnaires quand il vend une bagnole, il se fait peut-être 1.000\$. Faut distinguer les concessionnaires et les manufacturiers. Bon. Parlons des concessionnaires mais allons voir du côté des vendeurs : on compte sur les doigts de la main gauche, et j'exagère à peine, le nombre de vendeurs qui savent de quoi il s'agit. J'en ai fait l'expérience personnellement moi avec mes voitures, on en est vraiment là, très très

bas. Et combien de fois on n'a pas vu ça nous les gens de l'AVEQ. On fait de l'éducation, on dit venez conduire nos voitures et puis on encourage à acheter ça, pour voir ensuite les gens aller chez le vendeur et le vendeur qui dissuade en disant « non non non ne faites pas ça, vous allez avoir des problèmes ». Il déprécie son propre produit.

Ce qui est ridicule puisque les véhicules électriques sont plus chers, la marge qu'eux prennent dessus est plus grande aussi...

Ça je ne sais pas, peut-être bien que oui, peut-être bien que non, je ne sais pas.

Mais les gars n'ont pas de formation. Je connais un mécanicien personnellement qui est paniqué par les voitures électriques parce qu'ils n'ont pas reçu de formation ! Donc pas de formation, pas d'information, pas d'incitatif, ben il n'y a pas de marché parce qu'il n'y a pas d'offre. Si le gouvernement, et la moi personnellement je pense que le gouvernement du Québec fait fausse route à moins qu'ils nous annoncent quelque chose là dans 2 semaines parce que il y a une grande annonce qui s'en vient, on verra, on a demandé nous une loi zéro émission comme dans d'autres Etats. Alors on a reçu une réponse mi-figue mi-raisin de diverses ministres disant que « vous savez dans la vie on aime mieux être gentils que de frapper les gens ». Ils ne le feront jamais, ce sont des businessmen. S'il n'y a pas d'incitatif et une volonté ferme d'offrir un marché de voitures électriques au gens, les constructeurs ne viendront pas construire des trucs ici. Parce que ça a été le cas de la Prius quand ils l'ont construite, il la vendait je ne sais pas combien, peut-être 25.000\$ alors qu'elle leur coûtait 45.000\$. Et ça leur servait à eux de pub pour montrer comme quoi ils étaient en avance. Une compagnie comme Nissan a quand même eu des couilles si on veut, excusez-moi, d'oser se lancer dans ces trucs là avec beaucoup de vigueur. Et même chez Nissan il y a encore beaucoup de dépositaires qui ne sont pas accrédités, qui ne vendent pas de voitures électriques.

Donc ici tous les garages ne vendent pas... ?

Ha non, ce n'est pas partout, ha que non que non que non...

Ok j'avais supposé que comme chez nous...

Ha non, ce n'est pas le cas chez nous encore là. Donc le gouvernement actuel est beaucoup moins positif que le gouvernement antérieur qui lui avait dit qu'on allait faire l'implant de l'électrification. L'attitude actuelle, et je me rétracterai avec plaisir dans 2 semaine lorsque j'entendrai le nouveau plan, c'est dire « piano piano on va laisser faire les choses ». Au moins ils n'ont pas annulé ce que le gouvernement du parti québécois avait mis en place mais ils n'ont pas poursuivi non plus.

D'accord. Le problème d'offre est-il le problème initial ?

Ben où est-ce qu'on va quand on veut acheter une voiture ? On va au vendeur, on regarde dans les pubs. Voyons ce qu'il y a comme pub à la télé pour les autos électriques. Y en a eu un petit peu de Nissan et de Kia mais le reste c'est zéro.

Et l'offre vient donc bien avant la promotion ?

Ben oui on est d'accord. Et là où le bât blesse c'est que l'offre n'est pas là ou celle qui est là est mal conçue. Les gars du terrain, les vendeurs, n'ont pas les outils. Alors parfois on est chanceux et on a des vendeurs qui deviennent fanatiques alors on se les

arrache. Dans le domaine de la Volt on a 3 vendeurs de Chevrolet ici au Québec qui sont reconnus par la communauté comme étant des gens sérieux.

Qui eux font la différence comme ils le peuvent...

Voilà ! L'offre et le marché...

C'est très facile de voir pour nous qui faisons de la promotion, on fait essayer les voitures et, ce n'est pas scientifique ce que je dis là mais la majorité des gens disent « mon dieu si j'avais su... » Et je ne parle pas des Tesla où c'est l'extase.

Enfin. Et pourquoi ça s'est développé au Québec et pas ailleurs ? Et bien parce que nous on n'a pas une économie qui se repose sur le pétrole, on a une économie qui se repose sur l'hydroélectricité qui est gouvernementale et qui est un symbole d'indépendance et d'économie depuis longtemps pour le Québec. C'est un outil incroyable de développement local et international.

Et c'est ça qui est contradictoire pour moi, venant de l'extérieur. Quand je vois les ressources que vous avez et tout l'ancrage que cela a comme vous dites...

On est en droit de se demander ce qui fait que le gouvernement ne soit pas en train de tout mettre en place pour que ce soit développer. C'est fascinant. Y a une immense contradiction que je ne m'explique pas ; est-ce de l'ignorance ? Je ne le sais pas.

Que le gouvernement fédéral ne fasse rien, ça je comprends parce les copains sont ailleurs. Mais sinon c'est une question politique : est-ce qu'on veut que Montréal soit comme ça ou comme ça ? Promenons-nous dans Montréal, prenons l'air... C'est totalement insupportable.

Avez-vous entendu parler du projet de monorail entre Québec et Montréal ?

Ha non.

C'est un projet émis par le gouvernement Québécois, c'est un monorail, un train suspendu parce que le train c'est au sol, et au sol qu'est-ce qu'il y a ? De la neige et des routes. Donc on avait fait un prototype et tout ça, c'était tout-à-fait faisable : c'est rapide de 1 heure et sur un axe extrêmement utilisé, et en plus on s'en fout des températures et on est heureux parce que c'est tout électrique.

Et on en est où avec le projet ?

On a changé de gouvernement...

On pourrait penser faire la même chose avec NYC et là ce serait en 3 heures. Ça changerait la vie des gens ! Le gouvernement pour le moment n'a pas voulu mettre de côté les mesures qui étaient déjà prises mais on a qu'à espérer qu'ils vont oser aller de l'avant. Primo, en continuant les incitatifs. Secundo, en développant les infrastructures parce que s'il y a pas de bornes... Enfin ça va là ça avance, pas comme on voudrait mais ce n'est pas trop mal. On est sensé avoir 50 bornes rapides d'ici la fin de l'année, on en a déjà eu 4. Faut que la roue tourne et là pour le moment les gens laissent la roue tourner en libre sans la faire accélérer.

Le marché ne peut pas se développer sans le gouvernement. L'offre ne va pas se développer à moins que le gouvernement vienne dire aux constructeurs « Vous offrez des trucs, on vise x% de véhicules électrique d'ici 3 ans au Québec ». Si il y a cette volonté là, ça va se développer. Parce que les produits ils sont là, je peux aller

acheter une auto aux USA dans le Vermont par exemple, c'est plus proche que l'Ontario.

Et là ramener ici ?

Ben c'est vraiment compliqué... Enfin on peut toujours le faire mais c'est vraiment du chipot parce que y a pas les services et les incitatifs, etc.

Donc première étape, augmenter l'offre. Ensuite augmenter la formation et l'information puis les infrastructures. Enfin ça peut être en parallèle.

Juste pour revenir à l'offre, ce dont je suis vraiment étonné, c'est le fait que toutes vos habitations sont électrifiées alors que ce n'est pas le cas de vos voitures.

Oui c'est vrai.

Enfin désolé je vous ai coupé, vous parliez de l'infrastructure...

Oui. On est privilégié au Québec parce qu'on a un modèle différent et qu'on a cette grande compagnie d'électricité qui est très proche du gouvernement, qui a de grands moyens et qui a mis en place le réseau de circuit électrique au Québec qui marche merveilleusement bien.

Et les bornes sont des bornes qui sont fournies par qui ?

Oh différents fournisseurs. Je connais pas très bien mais il faut savoir que Hydro-Québec est le seul qui a le droit de vendre de l'électricité, personne d'autre ne peut le faire. Le circuit électrique d'Hydro-Québec opère la plupart des bornes rapides et plusieurs des bornes à niveau 2 qui sont facturées de 2,50\$ l'heure. Ce qui est un irritant, tu as besoin de 4 heures parfois ce que tu n'as pas toujours en déplacement. Bref. Et moi j'ai une bonne borne que j'ai achetée au Québec et qui est vraiment bien parce qu'il y a le service de proximité, je n'ai pas fait le choix d'aller aux USA ou en Chine pour ça.

Et l'installation a été facile ?

Ben vous savez comment ça marche, ça doit être fait par un électricien, le gouvernement paye la moitié, etc.

Et au niveau infrastructure publique, qu'en pensez-vous ?

C'est en développement je dirais, il y en a qui s'installent. Ça s'installe, ça marche, on espère. Mais l'infrastructure n'est pas encore suffisante. Toute la Gaspésie est en manque et là il y a des intérêts locaux. Y a un individu qui a mis 15.000 \$ pour inciter la municipalité à installer une borne. Mais ça ne peut pas marcher comme ça. Il y a aussi un mec dans le bas du fleuve qui a développé un parcmètre et tu peux te stationner là et te charger si tu veux. Comme ça il fait payer le stationnement et pas l'électricité.

Oui. Et j'ai été agréablement surpris de voir certaines entreprises comme Ikéa qui ont des bornes. Là on a même priorité sur les femmes enceintes !

Oui. Y a un cinéma à Laval, la borne électrique est devant la porte. Et hop. *[rire]* Mais les gens qui installent les bornes, ils ont compris que l'électro-automobiliste, il est relax et il va consommer sur place. Tous les parc-aquatiques, les lieux de culture et de sport, le magasin ils doivent y voir l'opportunité. Le retraité qui voyage et qui a le temps, il ne prend pas les autoroutes parce que c'est moche. Moi je préfère tomber

en extase devant un ruisseau des petites routes et je redécouvre ça au Québec. Là on a « Le tourisme électrique dans la belle province », je redeviens un touriste chez moi. Je ne vais pas aller à la chocolaterie parce que y a une borne mais parce que il y a une borne, j'irai à la chocolaterie.

On créé alors un cercle vertueux de consommation.

On peut être vertueux en parlant écologique avec les gaz à effet de serre etc. Et c'est vrai, ça marche. On peut y aller pour la santé et le zen. On peut y aller pour le fric.

Dernière question en vitesse. En 2018, le but était 500.000 véhicules électriques. Votre prévision ?

Là je ne sais pas bien ce qui se passe ailleurs mais Électromobilité Canada fait un gros travail. Les journaux en parlent. Le spectre de l'autonomie se réduit peu-à-peu et disparaît par l'information qu'on donne aux gens. Y a aussi la Tesla qui devient tout d'un coup la preuve qu'une voiture électrique peut être super performante. Ça a été annoncé hier que Montréal va avoir la formule E. La voiture électrique devient une réalité. 2016 nous montre déjà une augmentation de 20% d'autonomie, tout devient plus intéressant. On prévoit en 2017, les fameux 300 km. Là, si tu as les incitatifs, ça devient vraiment compétitif dans l'esprit des gens. Pour moi elle l'est déjà mais à 300 km y a plus de compromis à faire. De plus on peut prévoir qu'il y aura une augmentation au moins linéaire des implantations de bornes. Je crois qu'en 2017, il y aura un vraiment mieux avec les nouveaux modèles. L'augmentation technologique va être là et si par hasard la loi zéro émission passait, c'est possible qu'on se rende à 50.000, mais pas à 500.000. Et là après ça, ça va faire effet boule de neige.

Merci beaucoup, ce fut un plaisir.

Appendix 12 – Interview with Chantal Guimont

ELECTRIC MOBILITY CANADA (EMC) - President

Est-ce que ça vous va si j'enregistre notre entretien ?

Oui oui tout-à-fait, pour votre propre besoin c'est correct.

Bien merci. Et bien la première question que j'ai c'est de vous demander votre évaluation de la situation actuelle et de l'évolution depuis 2010 – 2011 concernant l'utilisation des véhicules électriques au Québec et au Canada en général.

Avez-vous vu les données disponibles sur notre site ?

Oui oui je les ai lues et analysées. Le fait que le Québec a 50% des 14.000 environ.

Voilà c'est ça. Alors c'est en progression. On voudrait bien sûr à MEC que ça aille plus vite que ça. C'est là-dessus qu'on travaille. On fixe encore un marché de niche puis on voudrait que ça devienne un marché encore plus accessible donc on travaille sur les conditions pour ça : c'est toujours la communication, les incitatifs financiers et le déploiement des infrastructures.

Ce sont d'abord des subventions provinciales que l'on retrouve actuellement dans 3 provinces et on travaille bien sûr pour qu'il y en ait partout : que les gouvernements provinciales et le gouvernement fédéral trouvent intéressant d'offrir des incitatifs financiers.

Ensuite, il y a bien évidemment le déploiement des infrastructures de recharge au travail, publiques de niveau 2 ou de recharge rapide qui se déploient à un bon rythme. Mais il y a encore... Ben par exemple en Ontario le nombre de bornes de recharge rapide n'est pas encore important et ça paraît au niveau des résultats parce qu'en termes de nombre de véhicules par habitant, c'est l'Ontario qui traîne de la patte.

Puis ça va passer entre autres par le développement de bornes de recharge encore plus importantes et plus rapides.

Mais notre cheval de bataille, c'est vraiment la communication et faire en sorte que plus de gens connaissent les véhicules électriques, qu'ils considèrent la chose des véhicules électriques et qu'ils aient l'occasion d'essayer les véhicules électriques. Alors si on veut, il faut une campagne de sensibilisation importante au niveau national. Ensuite, avoir un centre de référence national, un genre de site web où tout serait là. À l'heure actuelle, tout le monde a des initiatives mais il n'y a pas de regroupement, un endroit unique où on peut retrouver toute l'information quand on ne sait pas par où s'y prendre. Pour ensuite aller vers un programme permanent parce qu'aujourd'hui vous savez que c'est la semaine de la conduite électrique en Amérique du Nord, c'est pour ça que je suis fort occupée cette semaine, et on voudrait faire en sorte que toutes les initiatives, les bénévoles, les associations de conducteurs, les compagnies d'électricité qui font assez régulièrement des journées pour venir essayer des véhicules électriques, que ce soit plus permanent et connu à l'avance. Ça ne prend rien, c'est un endroit donné pour essayer et parler aux

différents conducteurs des différents modèles d'autos électriques. Pouvoir toucher le produit : ensuite l'essayer c'est l'adopter.

Tout-à-fait.

Donc ce serait structurer ça pour ensuite essayer que ça rejoigne le plus grand nombre de personnes parce que c'est aussi le point qui est plus faible. C'est notre point le plus faible dans toutes nos actions concertées, c'est vraiment la communication.

Donc vous diriez que c'est la barrière la plus importante actuellement ?

Et bien disons que c'est celle qui bloque le tout. Ensuite ce sont les incitatifs financiers : de les rendre plus accessibles à tous, au point de vue fédéral puis provincial dans les provinces où il n'y en a pas. Et puis ensuite les infrastructures bien sûr.

Il y a d'autres séries de mesures mais ce sont les trois plus importantes.

Et votre avis par rapport au fait que, de ce que j'ai pu remarquer en tous cas en faisant mes recherches, l'offre des véhicules électriques semble être beaucoup moins grande ici par rapport aux Etats-Unis ou dans des pays européens.

Oui.

Qu'est-ce que vous en pensez ? Y a-t-il une raison à cela ?

Et bien disons que ça progresse. Vous avez raison de dire qu'il y a des modèles qui ne sont pas encore disponibles. Vous savez que le Canada est un plus petit marché que celui des Etats-Unis. Le Canada complet c'est l'équivalent de la Californie. Donc on travaille avec des manufacturiers pour rendre le plus possible disponible mais y a des questions de ce côté-là qui seront abordées par les gouvernements dans les prochains mois, pour voir ce que les manufacturiers sont prêts à faire pour augmenter le nombre de véhicules qui seront disponibles et le nombre de modèles qui seront vendus.

Oui tout-à-fait. Vous dites que le marché canadien est relativement petit par rapport aux Etats-Unis en termes de nombre par exemple, mais le fait que le Canada dispose de tellement de ressources électriques... C'est là la contradiction que j'ai du mal à comprendre entre vos ressources et votre richesse et le fait que, jusque-là, vous n'avez pas encore réussi à l'exploiter totalement pour les VE.

Tout-à-fait. Et là il y a les économies importantes qui peuvent être faites entre l'électricité et l'essence parce que l'électricité est relativement peu chère dans certaines provinces. Mais vous avez raison du point de vue environnemental parce que plus de 65% de la production est renouvelable au Canada et plus de 90% au Québec. Ce sont des attributs importants. Mais du côté des fournisseurs de véhicules, c'est une question de marché, de volume, de critères qu'on veut modifier, faire évoluer, mais ce sont des considérations qui sont carrément de volume qui sont présentes. Dons voilà.

Et est-ce que vous avez un objectif chiffré pour les 3 à 5 années à venir ?

On va présenter dans le rapport de notre feuille de route d'ici la fin de l'année certains scénarios pour présenter des options aux différents gouvernements. Parce

que la boule de cristal qui fait qu'on dit que ce sera comme ça dans 5 ans, ce n'est pas évident ! Surtout que tout le monde a sa boule de cristal.

On a donc décidé de mettre l'emphasis sur les moyens à mettre en place puis dire que voici les scénarios où on pense qu'on peut aller chercher le plus de véhicules à moindre prix peut-être. Puis voici le scénario où on décide de dépenser plus mais d'avoir des résultats qui sont plus probants encore.

D'accord. Mais donc à ce jour il n'y a pas un objectif chiffré de la part du gouvernement fédéral ou provincial au Québec. Je n'ai pas trouvé d'objectif précis en tous cas.

Ben il y en avait dans un ancien plan. On attend un nouveau plan d'action du gouvernement du Québec qui est censé être présenté sous peu mais c'est beaucoup sous forme budgétaire hein. On a des incitatifs financiers pour autant de véhicules mais il n'y a pas d'objectifs précis qui ont été renouvelés.

Et votre avis sur le fait que, depuis 2008, c'est le dernier plan stratégique fédéral que j'ai pu trouver, il n'y en a pas eu un nouveau. Vous savez expliquer ça ? Ce manque d'initiative de la part du gouvernement fédéral.

Vous vous référez à quoi lorsque vous parlez d'un plan ?

Le roadmap publié par le gouvernement fédéral.

Oui tout-à-fait. C'est MEC qui est derrière ça non ?

Exacte.

Alors c'est nous qui avons proposé qu'il était temps de le rafraichir et c'est celui-là dont je vous parlais présentement.

Ha d'accord donc c'est celui-là qui sera mis à jour.

Exactement.

Ok. Et les quelques personnes avec qui j'ai eu l'occasion de discuter avant vous m'ont beaucoup parlé de la loi zéro émission. Quel est votre avis sur la chose ? Parce que je me trouve dans la contradiction du plus grand marché en Norvège où il n'y a pas cette loi et d'un autre côté ici les gens qui me la disent cruciale.

Vous avez raison de poser ces questions-là parce que ce n'est pas évident, comme vous venez de le mentionner. On sait que c'est un sujet qui revient constamment dans les discussions. C'est ce qu'on a toujours dit et d'ailleurs on vient de déposer au gouvernement de la Colombie Britannique notre discussion sur les mesures gagnantes. C'est sur notre site web mais seulement depuis hier, le premier document qui est là vous allez voir que c'est notre position sur le sujet. Puis vous allez voir notre position est très bien expliquée mais je vous la résume. On a toujours dit que la loi zéro émission n'était pas une solution stand alone, unique, mais c'est que c'est d'avoir l'ensemble des mesures qui vont supporter la demande. Puis on revient, vous allez voir, sur ce que j'ai dit - incitatifs, communication et infrastructure - que c'est absolument nécessaire avant de parler de quoique ce soit au niveau de l'augmentation de l'offre qui est l'objectif du MEC. Alors on dit que la loi ce n'est pas uniquement ça qui peut améliorer les résultats mais ça prend un prérequis pour améliorer la demande pour ensuite regarder d'autres options qui permettraient d'augmenter l'offre. Alors on est beaucoup plus nuancés parce qu'évidemment il y a

beaucoup d'exemple comme vous venez de le dire, des juridictions comme le Géorgie ou la Norvège qui n'ont pas de loi zéro émission mais qui ont des résultats tout-à-fait intéressants alors que pour d'autres pays ce n'est pas tout-à-fait le contraire mais pas loin.

Donc pour résumer vous êtes d'accord que ce serait une utilité mais que tout seul, cela ne fera pas la différence ?

Ben on n'est même pas allé jusqu'à dire que y a une utilité parce qu'on veut l'analyser plus en profondeur. On trouve qu'il n'y a pas assez d'analyse, c'est ce que notre document dit, on dit que c'est une solution parmi d'autres mais qu'il faut regarder l'ensemble des solutions puis vraiment faire un bilan et c'est ce qu'on va faire au cours des prochains mois.

C'est ça. Deux petites questions encore si je peux me permettre. Tout d'abord, et c'est plus personnel, est-ce que vous vous roulez en voiture électrique ?

Oui. Notre première voiture est électrique et bientôt il y en aura une deuxième.

Et quelle voiture est-ce ?

J'ai le privilège tout récemment d'avoir une Tesla.

Ha génial.

Mais j'aimerais mieux que vous n'en parliez pas car c'est personnel comme information. C'est juste pour votre information.

Evidemment, c'est juste que j'aime bien poser la question parce que beaucoup de personnes disent que oui ça fonctionne et que c'est fantastique...

Puis qui n'en conduisent pas !

Exactement.

Vous avez raison.

Et finalement, êtes-vous optimiste pour les années à venir concernant une éventuelle augmentation du nombre de véhicules électriques ?

Ben c'est certains que ça va se passer dans les 2 – 3 prochaines années comme vous dites. Je suis confiante qu'on va pouvoir influencer les politiques des gouvernements. Vous savez qu'à Paris, à la COP... Je me souviens plus du numéro...

COP21

COP21 c'est ça, il va y avoir on croit une emphase importante sur les véhicules électriques. Que tout le monde reconnait que c'est la solution rapide à implanter et déjà disponible qui peut faire la différence dans un grand secteur d'activité qui se transforme. Donc on espère attirer l'attention de tous les médias et les gouvernements pour faire en sorte qu'on prenne conscience qu'il y a des solutions déjà disponibles, qu'il faut les adopter tout de suite, qu'il faut bouger maintenant.

D'accord. Super. Merci ! Je vais vous laisser. Vous m'avez vraiment beaucoup aidé en répondant à toutes mes questions. Merci pour votre temps.

Avec plaisir.

Appendix 13 - Interview with François Haguette

REXEL NEDCO Quebec – Energy solutions director

Bonjour monsieur Haguette, merci pour votre temps. Alors nous avons 5 points importants que je souhaiterais aborder avec vous. Tout d’abord, faire le point sur le marché Canadien et Québécois : faire le tour et éventuellement les différences entre les deux. Puis discuter de la situation d’ici 3 ou 5 ans. Ensuite voir ce que toi tu penses être les barrières principales, tant pour les particuliers que pour les entreprises. Et puis voir par rapport aux gouvernements, provincial et fédéral, si selon toi c’est suffisant ou non. Et je ne sais pas si tu as déjà entendu parler de la loi zéro émission mais je voudrais qu’on en parle.

Mais la toute première question se porte sur toi et ce que tu fais ainsi que sur ce qui fait que tu as une connaissance particulière des véhicules électriques.

En tant que responsable du département éco-énergie pour Nedco au niveau provincial, membre de la famille Rexel qui a sa base à Paris, dans mon mandat je dois développer les marchés et produits d’économie d’énergie. Dans ces marchés, il y a évidemment les stations de recharge électrique. On en a vendu quelques dizaines dans les dernières années, c’est un chiffre qui est grandissant et au Québec spécifiquement et au Canada. Il y a une volonté internationale portée par Rudy Provost, notre CIO, qui a lui-même écrit en collaboration un livre qui s’appelle « Energie 3.0. ». Rexel cherche à devenir une source inhérente de solutions d’économie énergie mondiale. Donc au niveau local, j’ai cette responsabilité.

Quelle importance donc des véhicules électriques ? Est-ce que c’est un grand joueur pour vous ou est-ce quelque chose qui est sur le côté, pas une priorité ?

Présentement, au niveau de l’entreprise, ce n’est pas une priorité. Il n’y a pas un plan de match établi au niveau local, ni Canadien ni provincial. Et si on regarde la tarte des produits d’éco-énergie, les stations de recharge électrique sont une petite partie de l’économie. Si on regarde par rapport aux éclairages par exemple, y a beaucoup d’économies qui sont à faire avec ça. Tout ce qui est les changements de moteur, les contrôles des moteurs des industries aussi, il y a beaucoup d’économies à faire avec ça. Tout ce qui est au regard du chauffage aussi, que ce soit des systèmes qui fonctionnent à l’eau ou au mazout, ce sont toutes des citernes qui doivent être changées pour des systèmes d’économie d’énergie.

D’accord. Donc y a d’autres éléments qui sont plus importants aux yeux de l’entreprise ?

Plus gros marché en volume d’affaire que le marché des stations de recharge pour véhicules électriques, oui.

Donc on dit bien que le volume des véhicules électriques est... insignifiant ?

Présentement moins de 1% du chiffre d’affaire potentiel sur le marché. Par contre, c’est le marché qui aura le plus de développement sur 10 ans.

En termes de pourcentage de croissance annuelle alors ?

Exactement.

Donc ça s'est ton approche professionnelle de la chose mais y a-t-il un intérêt personnel pour les véhicules également ou pas ?

Ben il y a un intérêt professionnel que je voudrais d'abord encore pousser parce que moi je travaille donc pour le Québec et nous sommes des grands producteurs d'électricité : nous sommes autosuffisants avec même un surplus d'électricité. La majorité de nos maisons sont électrifiées : nos chauffages sont électrifiés, notre climatisation est électrifiée. Donc chez nous d'aller vers des autos électriques au niveau business au provincial, c'est là qu'on s'en va c'est sûr. Là déjà plus de 50% du marché canadien d'autos électriques est au Québec donc on est déjà bien en avance par rapport au Canada et probablement par rapport aux Etats-Unis. Ça va juste continuer à le faire.

Alors d'un point de vue personnel et bien je dois dire que c'est un concept selon lequel je pense que nous notre richesse provincial c'est clairement l'électricité. Plus on va en utiliser, plus c'est un avantage sur le plan économique pour chez nous parce que ça va coûter moins cher que le pétrole et plus on va en utiliser, plus on va avoir un savoir-faire relié à ça. On pourra exporter de l'électricité et un savoir-faire relié aux autos électriques, aux piles, aux stations de recharge, etc. Donc c'est une technologie que, au niveau provincial, on devrait prendre en main au Québec pour devenir un leader mondial à ce niveau-là.

Et toi tu n'es pas propriétaire d'un véhicule électrique ?

Non, je ne suis pas propriétaire d'une auto électrique pour l'instant.

Pourquoi ?

Présentement, moi je dirais que je fais 45 à 55.000 km par année et avec les distances qu'on peut faire sur une charge, ça limite présentement mes choix de véhicules. Je comprends que... Où faudrait que j'ai des stations de recharge rapide facilement accessibles dans mon territoire à moi parce que je fais facilement 200 km dans la même journée. Automatiquement, faut que je recharge et je ne reste pas systématiquement à la même place donc ce n'est pas dit que j'aurai le temps d'attendre les 6 heures que ça recharge. Le deuxième c'est le coût d'achat comme tel. Et j'ajoute que ma rémunération inclut un montant pour l'essence donc je ne sais pas comment ma société va transformer 965\$ d'essence mensuel en 50\$ d'électricité.

Ha oui, je n'avais pas pensé à ça, ça pourrait être transformé ! Attends mais donc ces 900\$ fois 10 ça fait 9000\$, donc tu as plus de 10.000\$ annuel. Tu pourrais rajouter ça à l'achat pour un véhicule électrique plus spacieux...

En fait si on regarde du point de vue de la société, à ce prix-là, elle devrait me fournir une voiture électrique gratuitement. Mais c'est un choix d'entreprise. Donc moi ce sont les 3 cas : autonomie, coût d'achat et ma prime d'essence parce que ça ne me coûte pas ça en essence non plus donc y a une partie qui devient du revenu.

D'accord. Et si on parle de la population québécoise générale. On prend un Québécois moyen.

Le Québécois moyen est pro électricité et pro vert.

Alors pourquoi cette contradiction entre le pro électricité, le pro vert et...

On voit que le Québécois moyen achète le plus d'autos que le reste du Canada, on voit que c'est ici qu'il y a le plus de bornes installées, qu'il y a le plus de modèles vendus...

Que les rabais sont les plus grands.

Tout-à-fait.

Mais donc certes il y a 50% qui est au Québec mais ça ne fait toujours qu'un demi pourcent de la flotte totale...

Mais au niveau des individus, au niveau des freins, le premier c'est l'autonomie. Les gens... La base c'est Montréal-Québec, 250 km. Si tu n'es pas certain de faire 250km, tu n'achètes pas une auto électrique. La deuxième c'est le prix d'achat qui est 25 à 35% plus cher qu'un modèle équivalent à essence. Le troisième c'est le fonctionnement en hiver parce qu'une mauvaise presse des compagnies d'auto électriques c'est que en hiver, des études ont montré que l'autonomie est en dessous de ce qui est annoncé. Y a même eu une poursuite qui a été gagnée, il y a de l'argent qui a été versé à des gens par Toyota Prius je crois. Donc l'hiver, les gens sont inquiets. L'auto électrique l'hiver ça ne fonctionne pas bien. Y a donc une inquiétude qui est fausse mais là.

Une inquiétude fausse ? Mais donc un manque d'information ?

Oui certainement un manque d'information.

L'autre point ce sont piles. Parce qu'il y a une question d'entretien. Combien ça va coûter lorsque tu vas changer les batteries du véhicule. Et si on pense à l'environnement, qu'est qui va être fait de ces piles et batteries.

Et là on parle de la technologie ou de l'information ?

Ben même moi, je vends des stations de véhicules électriques mais en ce qui concerne les piles et les batteries, je ne connais pas l'information. Mais... Comme ça moi ma perception c'est que ça va me coûter 10.000\$ un jour pour changer mes piles sur ma voiture électrique de 40.000. Quand ? Sous quel mode de paiement ? Va-t-il falloir changer l'auto ? Garder l'auto ? Valeur de prix de rachat ? Je n'en ai aucune idée. Enfin je ne suis pas un homme d'automobile. Mais donc le Québécois moyen, il a un problème là-dessus. Puis si on parle de recyclage de pile, c'est bien documenté que... Déjà les piles actuelles quand on doit les recycler... Fait que si on en met 5 fois plus dans une auto, je me demande ce que ça fait au bout de la ligne.

Mais de nouveau, y a un manque d'information parce si il y a une technologie qui fait qu'il ne faut pas changer les batteries au bout de 5 ans, faudrait le savoir.

Tout-à-fait. Fait que les 5 freins sont là pour le Québécois moyen.

Et qu'est-ce qui pourrait être fait au niveau du gouvernement provincial ? Faut-il agir sur les 5 freins ou y en a-t-il un qui pourrait faire effet boule de neige sur les autres ?

Et bien la publicité. Le meilleur exemple ce sont les cigarettes. Les bonnes nouvelles donnent moins de résultats que faire peur aux gens. L'augmentation du prix de l'essence. La pénalisation de ceux qui ont des automobiles à essence vont forcer les gens à acheter des véhicules électriques. Puis s'ils ne le font pas ça va être plus

d'argent pour le gouvernement donc des taxes indirectes donc c'est bénéfique pour tout le monde. Moi je pense que c'est la mesure numéro 1.

Hum... Tu es le premier à dire ça. Donc plus que de promouvoir...

Ben comme sur les paquets de cigarettes, tu mets les poumons des gens qui meurent et pas une petite phrase comme « Vous fumez moins vous êtes plus en santé » avec un petit gars qui court en rue là. Comme pour les accidents de la route, la société du Québec a longtemps fait une campagne avec le papa là puis il était écrit « Je t'aime, je t'attache ». Puis c'est prouvé scientifiquement que ce qui fonctionne c'est le papa qui va ramasser la petite fille coupée en 2 après l'accident d'auto. « Je t'aime, j'aurais dû t'attacher ». Ce qui marche c'est le drame.

Donc si on résume...

Il faut pénaliser le pétrole et faire une campagne de sensibilisation basée sur les effets négatifs du pétrole.

Ce que veut le gouvernement, c'est augmenter l'utilisation de l'électricité globale et réduire les pics. Donc avoir une consommation plus stable pour vendre ses surplus. Donc économiser de l'énergie, ce n'est pas ce que le gouvernement veut faire vraiment. Puis si je continue la logique, le gouvernement aimerait qu'on ait des autos électriques parce qu'on va consommer un peu plus d'électricité et qu'on va la consommer quand on n'est pas dans les pics. Ce n'est pas le matin quand on se lève pour aller travailler ou le soir quand on revient de travailler où c'est les pics de consommation d'électricité au Québec avec chauffage, laveuse, poêle, sècheuse. Fait que ce serait une consommation comme ils veulent.

Donc pénaliser le pétrole. Puis animer une compétition entre les différents manufacturiers parce qu'il va en y avoir de plus-en-plus. Il faudrait qu'il y ait une bataille pour les prix au niveau de la manufacture automobile. C'est la concurrence qui va faire baisser le prix, ce n'est pas le gouvernement.

Et si tu avais la possibilité de t'acheter un véhicule électrique, si on met toutes tes barrières de côté, est-ce que tu sais quelles démarches tu entreprendrais pour aller t'acheter un véhicule électrique ? Site internet ? Garage ?

Ben moi je ne suis pas un gars de char donc c'est compliqué. Puis je suis assez fidèle à mes marques là, j'en ai deux. Donc j'irais probablement magasiner chez deux ou trois concessionnaires où je trouve que le tout est joli. Parce que l'esthétique et le prix c'est ce qui compte pour moi, ce sont les qualités premières. Je ne recherche pas la vitesse ou la puissance. Donc j'irais chez Nissan ou Toyota, ce sont les deux premiers qui me viennent à l'idée.

Ok. Et les bornes...

Je sais où acheter une borne [rire] mais je sais aussi que ce n'est pas cher donc selon moi c'est négligeable dans l'achat d'une voiture électrique.

Parce qu'il y a pas mal de gens qui m'ont dit qu'il n'y a pas assez d'infrastructures.

Ben ces gens-là ils te parlent de leur lieu de travail, ça dépend de leur employeur. Le dirigeant... Enfin tant qu'il n'y a pas de demande d'un employé, d'un employé important je dirais, ou tant que y a pas une offre intéressante ou une exigence

corporative parce qu'ils veulent se montrer comme une compagnie verte, ce sont les 3 raisons pour qu'une compagnie achète une borne, ben il n'y aura pas de borne. Puis pourquoi installer une borne si tu n'as personne qui l'utilise, si tu n'as pas le souci de bien paraître point de vue de l'environnement, alors pourquoi avoir une borne ? Donc présentement, voilà. La clef numéro 1 ce sont les employés parce que vu que il y a une pénurie d'employés qualifiés, à un certain niveau les ouvriers magasinent les jobs. Fait qu'ils magasinent les locations de leurs employeurs, les salaires, les horaires, les vacances, y-a-t'il un gym ? Une prime ? Des facilités pour les familles ? Et les voitures électriques vont bientôt venir « Ben moi j'ai une voiture électrique » ou « Je veux une voiture électrique donc y a-t-il une borne ? ». Ça va venir dans les prérequis puis sinon je vais aller voir chez les autres. Puis comme c'est subventionné jusqu'à 5.000\$, c'est même plus une dépense là.

Mais l'infrastructure est-elle une priorité ou quelque chose qui arrive par après ?

Ce n'est pas ça qui va faire acheter plus d'autos ! C'est plus d'autos qui vont faire installer plus de bornes.

Ok bien.

Puis il y a les bornes publiques mais dans les faits, quand je fais le plein près de chez moi, je ne le fais plus au pétrolier près de chez moi mais je le fais à la maison. Après ça je m'en vais travailler et la majorité des gens ont un emploi, ils vont là, ils chargent là. Combien auront-ils besoin de se charger au restaurant ou au centre commercial ? Rarement voire jamais. C'est au boulot, à domicile et puis la charge rapide sur l'autoroute. Le resto sur une longue route, à l'hôtel mais ce sont des exceptions.

Ok merci. Et la loi zéro émission, tu en as entendu parler ?

Mmmm j'ai entendu parler de plusieurs versions de loi zéro émission. Que les entreprises doivent avoir zéro émission de carbone, fin de CO₂, et que je pense que le modèle le plus commun est le rachat de crédit de carbone à travers les industries soit générales ou l'industrie spécifique à laquelle ils sont. Où ils peuvent acheter des crédits de carbone à des entreprises qui ont des crédits à revendre. Donc finalement financer ton économie d'énergie par la diminution de carbone. La diminution tu peux la financer en revendant des crédits à d'autres entreprises ou en allant vers d'autres mesures environnementales comme par exemple semer des arbres. Tu peux t'acheter des crédits en t'achetant des arbres par exemple qui te permettent d'avoir une certaine émission de carbone. Mais ça ne s'applique pas au particulier de toute façon. Donc il n'y a aucun lien entre ça et les propriétaires de véhicules automobiles.

Intéressant. Parce qu'il y a plusieurs personnes qui m'ont dit que oui. J'en ai encore discuté l'autre jour avec quelqu'un qui disait que tant qu'il n'y avait pas de loi zéro émission, on pouvait oublier les chars électriques.

Mais qui payerait la loi zéro émission ? Ce serait le producteur d'automobile qui payerait parce que ce que son industrie produit n'est pas zéro émission tandis que l'entreprise elle ne paye pas pour ses produits mais pour sa production. Si ton usine est zéro émission, c'est parfait, même si elle produit des autos qui ne le sont pas.

Mais donc si une loi comme celle-là venait à sortir, tu ne te dirais pas « génial, les chars électriques vont aller mieux ! » ?

Je me dirais génial parce que l'environnement s'en portera mieux mais il n'y a pas de lien direct avec les autos électriques. Même à la limite, le pire... Enfin à la limite si on règle le reste, les autos ce n'est pas ça qui crée le plus de CO₂, c'est l'industrie. On a bien d'autres choses à régler avant les autos.

Oui ça je suis d'accord. C'est juste curieux parce que plusieurs personnes sont persuadées que ça va aider. Mais voilà, le meilleur exemple c'est la Norvège, plus grand marché des véhicules électriques, ils n'ont pas cette loi.

Il n'y a pas de loi de cause-à-effet.

Ou pas suffisamment prouvée en tous cas.

Mais ce que les gens ont besoin c'est plus chère l'essence comme ça le retour sur investissement des autos électriques va être plus intéressant. Ça pour moi c'est le plus important. Le deuxième c'est qu'il y ait plus de fabricants qui en fabriquent encore plus. Présentement, à cause des subventions, ils peuvent garder leurs prix mais à un moment donné, il va y avoir une compétitivité puis le prix des autos électriques va baisser. Il ne baissera pas sous le prix des autos normales mais ça va s'en approcher. C'est mon opinion.

Ça me fait penser, pourquoi est-ce que ta blonde elle n'achète pas un véhicule électrique ?

Première chose, pas assez joli. Deuxième chose, trop cher.

Tout simplement.

Et la vraie raison c'est qu'il n'y a pas l'information. Point de vue design, elle n'a vu que la Tesla mais là, il y a le prix. Pourquoi payer plus cher pour quelque chose de moins beau ?

Et penses-tu que l'information aurait plus d'impact si elle venait des manufacturiers ou du gouvernement ?

Manufacturiers. Pourquoi moi je payerais des taxes pour faire de la publicité pour ces autos de ces compagnies ? Moi je mettrais le pétrole et les compagnies : faut que tu vendes autant de modèles d'autos électriques et à essence. T'as 3 modèles électriques, t'as 3 modèle à essence. Pas plus. C'est des trucs comme ça que je vois.

Ok. Et tu es optimiste par rapport à la situation ?

Oui.

Crois-tu qu'il y aura une différence en 2018 ? Parce que le gouvernement fédéral en 2008 a publié un document officiel qui est leur stratégie nationale. Et en 2008, ils disaient que pour 2018 il allait y avoir un demi millions de véhicules électriques sur la route. Il y en a 14.000 là aujourd'hui donc en 2018 on n'aura pas un demi-million mais tu vois une amélioration ?

Y en aura 150.000.

Ha oui tu crois ?

2020 là y en aura 250.000 au moins. Ça va exploser. En plus le gouvernement actuel au Canada est un gouvernement pro-pétrole qui est non aligné sur l'environnement et

même Kyoto là à travers le monde ils sont non signataires. Donc nous, tant qu'on a ce gouvernement-là, il y aura aucune mesure fédérale pour stimuler. Rien.

Ok donc rien du tout.

Y a même pas mal de freins qu'on ne connaît pas. En fait y a de l'aide pour les compagnies pétrolières mais y a certainement pas d'aide pour les autos et les piles électriques.

Ou y a 9 fois plus de subvention...

Il va y avoir les élections fédérales donc dépendant du résultat ça pourrait aider mais... Pffff... Non c'est la concurrence puis le prix du pétrole. Chaque fois que le pétrole baisse, ça nuit aux autos électriques. A 1\$50 le litre, c'était bon. A 2\$ le litre c'est excellent.

Et là on est à combien ?

1 et 20. C'est moins bon. Et d'ailleurs c'est pas mal le dernier recours des sociétés et des compagnies qui produisent les autos à essence, le dernier recours ça va être la baisse du pétrole. Quand il y aura trop de véhicules électriques, ils vont baisser le prix du pétrole pour se sauver.

Mmmm.

Puis faut pas s'inquiéter pour eux parce que les plus grands actionnaires des compagnies de panneaux solaires, d'énergie éolienne, de piles, etc. ce sont les compagnies pétrolières qui préparent leur demain et contrôlent le développement d'une certaine manière. Ce qui fait que ça débloque un peu rapidement c'est Tesla qui est un pirate, c'est le Robin des bois qui lui n'est pas dans ce marché-là et pas dans celui-là non plus. Je ne dis pas qu'il n'y a aucun lien car il doit en avoir mais lui... A cause de lui, ça débloque ailleurs. Mais sinon tout le procédé de contrôle d'action de ces produits-là a été bien mis en place et puis bien organisés. Tu sais que même au Québec, Hydro-Québec avait une compagnie et un centre de recherche pour développer des roues électriques et des piles électriques mais ils ont vendus. Pourtant nous au Québec on a l'électricité la moins chère d'Amérique, puis on a de l'espace pour construire des centres de production, pour faire du stockage, on a des ports pour importer des piles par bateau, etc.

Et ton avis sur Tesla ? Pourquoi est-ce un pirate ? Du fait qu'ils ne sont pas détenus par les mêmes entreprises ?

Mais c'est pas pirate de mot que je cherche en fait. C'est... Bon. En fait si eux ça foire, c'est... Je ne vais pas dire que c'est mort mais ça stagnera vraiment. Si eux font faillite, d'après moi, il y a plus de chance qu'on se tourne vers l'auto à gaz que vers l'auto électrique.

Ok. Merci pour toutes ces informations. Autre chose à ajouter ?

Oui, c'est que j'ai la volonté d'aller vers une auto électrique donc lors de mon prochain achat je ferai une meilleure évaluation et il faudrait vraiment que mon évaluation soit négative pour que je n'en achète pas.

D'accord. Merci !

Appendix 14 - Interview with Pierre Langlois

Independent author

J'ai trouvé vos coordonnées sur le site de la MEC et je me suis permis de parcourir votre site internet. Vu votre expertise, je me suis dit que je devais absolument prendre contact avec vous donc merci pour votre temps et votre réponse positive, c'est vraiment très sympathique de votre part.

Ha mais allez-y, posez moi des questions !

J'ai des questions... Il y a 3 éléments généraux dont j'aimerais qu'on puisse parler juste après vous avoir posé quelques questions sur votre parcours personnel, juste pour pouvoir me situer. Les 3 éléments seraient d'abord avoir votre avis sur le marché des véhicules électriques au Québec et au Canada en général, avoir votre point de vue par rapport à ça, et puis voir ce que vous pensez être les plus grandes barrières au développement du marché électrique et essayer de voir un peu pourquoi le marché ici semble être en retard par rapport aux pays européens ou à certains pays européens du moins et puis terminer par discuter, si vous avez encore le temps, de votre avis sur l'intervention des gouvernements provinciaux mais aussi du gouvernement provincial pour voir ce que vous pensez de tout ça.

Ok...

Mais si je peux commencer par vous demander quelques mots sur votre parcours professionnel et savoir d'où vient votre intérêt pour les voitures électriques ce serait génial.

Bon ben essentiellement j'ai un doctorat en physique, j'ai été chercheur pendant 20 ans dans des instituts en recherche industrielle, au Canada et en France. Ma spécialité c'était les ondes électromagnétiques à hautes fréquences comme la lumière, les lasers, ces choses-là, faire des composants qui manipulent les faisceaux lasers pour être capable d'applications dans différents domaines comme la vision robotique ou comme présentement les applications automobiles ou encore dans le domaine de la communication. Bref. Ceci étant dit, tout au long de ma carrière, là j'ai 64 ans donc je dirais depuis l'âge de 26 – 27 ans, je donne des conférences à des jeunes de 5, 6, 7 ans jusqu'à 97 ans. J'ai toujours été impliqué dans les associations de vulgarisation scientifique auprès du public par intérêt personnel, parce que j'ai toujours aimé communiquer les beautés de la nature si on veut, la beauté de la science comme telle. Donc ces implications-là dans la vulgarisation m'ont amené à faire toutes sortes de choses notamment écrire des articles scientifiques chroniques d'une page là dans un journal qui s'appelle « Le Soleil de Québec » qui paraissait une fois semaine le samedi pour les jeunes, faire des activités pour les musées pour faire visiter des collections d'instruments scientifiques anciens dans le domaine de l'électricité auprès des élèves d'écoles primaires et secondaires. Donc... De fil en aiguille j'ai développé une nouvelle façon d'enseigner les sciences qui met à profit la création et l'émotion, créativité et émotion sont des choses qu'on néglige souvent dans l'enseignement traditionnel. Mais tous mes articles et toutes mes activités étaient

dans un journal qui n'était plus réellement disponible fin il n'y avait pas rien réellement mais... Puis y a quelqu'un qui m'a dit un jour « pourquoi t'écris pas des livres ? Ça n'a pas de bon sens, t'as ça puis y a rien qui reste » puis j'ai dit « ouais comment veux-tu que j'écrive un livre ! Je suis directeur de secteur, j'ai 2 personnes sous ma responsabilité, 3 ados et un jardin biologiques de 6000 pieds carrés fait que je n'ai pas... Fait que je n'ai pas une seconde à moi. Fais que la seule manière de le faire serait de gagner à la loterie » ; ce que j'ai fait 2 semaines après !

Oh mais non ça c'est incroyable !

C'est incroyable, c'est un conte de fée ! C'est ce qui m'a permis de sortir du système et puis de me mettre à écrire des livres. Tout d'abord les deux premiers livres qui s'appelaient « Sur la route de l'électricité » essentiellement qui mettaient... Enfin c'était une quarantaine d'épisodes par volume. J'ai fait les 2 premiers puis dans le dernier épisode... enfin je racontais comment s'est faite la découverte dans le domaine, dans la science de l'électricité depuis 2600 ans jusqu'à aujourd'hui avec de multiples illustrations 3D pour les expériences faites à la maisons et des illustrations venant de livres anciens, de livres de droit d'auteur pour raconter l'Histoire. Tout ça pour dire qu'après le deuxième volume de « Sur la route de l'électricité » qui était essentiellement pour des jeunes de 13 ans, c'était un peu le cours de physique que j'aurais aimé avoir moi, il n'y avait presque pas d'équations ou de mathématiques mais beaucoup de cheminements de la pensée, de concepts, etc. Donc le dernier épisode du 2^{ème} volume était une application du moteur électrique et, pour que ce soit glamour pour les jeunes, je me suis dit que bon les autos électriques c'était une bonne application. C'est là que j'ai commencé à fouiller le pétrole, le réchauffement climatique, le pic pétrolier qui potentiellement amène quelque chose de très grave pour la civilisation à partir du moment où le coût du pétrole se met à grimper en flèche, tout est basé sur le pétrole bon marché sur notre planète, autant le plastique que tout ce qu'on peut imaginer...

Oui.

Donc j'ai eu une conscientisation à ce moment-là et bon j'ai 3 enfants et je me suis dit ça n'a pas de bon sens. J'avais jamais pensé que c'est là, en fouillant en profondeur, que j'allais réaliser l'ampleur de la catastrophe qui s'en venait là devant nous autres à cause du pétrole comme je dis et puis tout le réchauffement climatique autant que l'aspect économique. C'est là que j'ai donc écrit « Rouler sans pétrole » qui est mon 3^{ème} livre. Faut dire que j'avais gagné un prix avec mes autres livres pour le meilleur ouvrage de communication scientifique en francophonie, à Paris. J'ai été là pour recevoir mon prix.

Excellent, félicitations.

Si tu veux je suis un vulgarisateur scientifique reconnu et j'ai bossé à date plus de 10.000 heures sur tous les dossiers de la mobilité durable pour les différentes filières et j'ai été le principal conseiller pour le gouvernement précédent, celui du parti québécois, en 2013, j'étais donc le principal conseiller pour la stratégie d'électrification des transports au Québec, pour le gouvernement.

Excellent, très intéressant comme parcours ! Et êtes-vous propriétaire aujourd'hui d'un véhicule électrique ?

Non [rire]. Pas assez riche pour ça [rire]. Non, en fait ce qui arrive c'est que j'ai dû changer de voiture en 2009 parce que l'autre avait 14 ans puis elle m'a laissé. En 2009, y avait rien sur le marché donc j'ai pris une Prius qui fait donc du 4,7 au 100.

Tout-à-fait.

Et moi j'habite la campagne donc pour aller à Québec ça me prend 35 km aller, 35 km retour donc 70 km. Les voitures électriques étaient limitées à 70 km dans nos pays en hiver, en février à -20 -25. Donc ça ne convenait pas pour moi là essentiellement. Ce qui aurait convenu c'est une hybride rechargeable, une voiture comme la Volt là. Mais bon ma voiture est payée et ma femme est morte entre temps d'un cancer y a 3 ans fait que je me retrouve avec toutes les charges à payer moi tout seul. Ce n'est pas très payant là ce que je fais là faut bien en être conscient, c'est presque du bénévolat.

D'accord... et votre point de vue alors sur la situation des véhicules électriques aujourd'hui, en 2015 ?

Ben je dirais quand même que, enfin juste pour... enfin moi le genre de profil que j'ai c'est que quand je donne une conférence là moi je roule 500 km dans la journée. 250 km aller à Montréal, 250 km retour. Une voiture électrique, ce n'est pas pensable dans des conditions comme ça. La voiture électrique sera pas la même dans quelques années. A part la Tesla qui est à part, les autres sont plus... les voitures toutes électriques se dédient plus à une seconde voiture là. Il faut une voiture qui soit capable de... On ne peut pas faire toutes les fonctions d'une voiture normale avec une voiture toute électrique, surtout en hiver au Québec. On a quand même des hivers très froids.

Oh oui ça j'ai pu en faire l'expérience !

[rire] Mais bon donc ça a un impact au niveau des choix de véhicules électriques qu'on doit faire. Et puis quand on voit les trajets de 500 km là quand je m'en vais donner les conférences, souvent je suis à 100 sur l'autoroute avec un 4.2 et même une hybride rechargeable c'est du 6,4 donc bon. Ça faisait beaucoup de dépenses alors que ma voiture est déjà payée et qu'en plus mes kilomètres sont limités maintenant que mon épouse est décédée parce qu'on se la partageait. Donc c'est ça.

Donc pour vous si on résume...

Si j'avais à en acheter une ce serait une Volt là, la nouvelle génération.

Et c'est quoi qui vous intéresse particulièrement dans celle-là par rapport aux autres ?

C'est parce que tu tombes jamais en panne, tu peux faire 500 km en une journée. Comme je te dis à part la Tesla où tu peux faire 500 km la journée quitte à te recharger un peu, les autres tu ne peux pas. Tu dois avoir tes zones d'arrêts puis tout dépend de où sont tes bornes de recharge. Tandis qu'avec la Volt, en tous cas celle qui sort cette année, quand tu as fait 85 km à l'électricité, 100 en été dans les bonnes conditions. Avant de prendre une goutte d'essence chaque jour... Enfin moi je sais que ce serait parfait pour moi parce que quand je vais en ville je fais toujours des 10

km puis quand je fais des grands voyages ben les premiers 85 km ils seraient à l'électricité. Donc je ferais 90% de mes km à l'électricité avec une Volt.

Oui

Et c'est peut-être pas parfait mais bon. Surtout que les 10% des km qui reste, ça consommera pas 10% de l'essence d'une voiture normale parce que les voitures comme la Volt 2^{ème} génération c'est 5,7 litres au 100 donc ce n'est pas les 8 litres au 100 comme les voitures moyennes ici, au Québec.

Oui tout-à-fait.

Donc c'est pour ça. La Volt elle te propose une infrastructure de recharge. Tu te charges à la maison ou au travail. Puis si tu pars en voyage tu vas dans les stations. D'autant que les infrastructures... Fin j'ai rien contre les voitures toute électrique mais le temps que les infrastructures se mettent en place, puis qu'elles soient suffisamment nombreuses, suffisamment rapides, ça peut prendre 10 / 15 ans là.

Oui, d'accord. Et donc en ce qui concerne la situation du marché des VE ici au Québec, quel est votre position ou votre avis par rapport à ça ?

Ben la première chose que je voudrais dire par rapport à la spécificité du Québec c'est qu'on a les 4 As dans notre jeu ici au Québec, ce qui est très rare sur la planète. Le 1^{er} As c'est qu'on a de l'électricité très abondante, on en a même en surplus présentement. Pour te donner une idée, les Québécois ont par habitant 3 fois plus d'électricité que les Français. Et 3 fois plus d'électricité que les Californiens aussi. Donc c'est beaucoup d'électricité ça. Deuxièmement notre électricité elle est renouvelable à 99%, c'est nous qui avons le taux d'énergie renouvelable le plus élevé pour les populations d'1 million et plus. Ya seulement l'Islande qui a un peu plus mais ils sont 200.000 habitants là. Donc c'est un intérêt pour les voitures électriques parce que si tu te recharges à des centrales au charbon là ce n'est pas génial. Donc deuxièmement, l'électricité propre.

Oui.

Puis troisièmement notre électricité c'est la moins cher en Amérique, même si y a des augmentations c'est quand même encore la moins chère en Amérique. Donc ça ne coute pas cher. Et quatrièmement, on a pas de pétrole au Québec donc on est obligé d'envoyer des milliards à l'étranger, en Arabie, un peu partout, en Afrique du Nord, enfin bon, Norvège, Mexique... Pour avoir des puits de pétrole. Donc ces milliards là ils ne font pas fructifier notre économie. Donc l'électrification des transports ça implique au Québec de garder notre argent ici et donc c'est un avantage économique pour toute la population. les 4 As dans notre jeu, c'est ça.

Et est-ce que... Enfin moi ce que je constate c'est que il y a une contradiction entre les 4 gros avantages que vous avancez là et...

E la volonté politique n'est-ce pas ? *[rire]*

Mais je ne sais pas, je ne sais pas si c'est la volonté politique... Si c'est les manufacturiers des véhicules électriques qui ne se sont pas rendus compte du potentiel démesuré qu'il y a ici.

Oui ben surtout que, enfin tu devrais être au courant de ça mais au Québec on représente 23% de la population canadienne et, de l'ordre que je pense, on achète la moitié des véhicules électriques du Canada.

Oui c'est ça.

Donc c'est quand même symptomatique. Maintenant les deux gros problèmes qui font que ça avance pas plus vite ici au Québec malgré tous ces avantages c'est que, premièrement, on n'a pas de loi zéro émission ici. Fait que la disponibilité des différents modèles n'est pas aussi grande qu'ailleurs comme en Californie, en Norvège ou d'autres places qui ont des lois zéro émission. Y a 11 Etats aux USA qui ont des lois comme ça qui forcent grosso modo les fabricants à fabriquer et vendre un certain pourcentage dans l'Etat sinon ils vont payer des amendes. Alors que nous on laisse faire à leur bon vouloir, fait que les voitures arrivent au compte goutte, faut attendre 3 mois tu vois que les concessionnaires... fin y en a même pas là pour que tu puisses essayer, etc. Donc ça prendrait une loi zéro émission pour que, comme dans les 11 Etats américains, ça force les manufacturiers.

Deuxièmement, ça prendrait un Bonus Malus comme en France ou en Norvège aussi c'est un peu ça là parce que si tu achètes une voiture qui consomme pas mal tu vas payer beaucoup là tu sais.

Hum Hum.

Parce que tes taxes sont fonction de la consommation du véhicule, des émissions de gaz à effet de serre, etc. Donc autant en Norvège qu'en France il y a un Bonus Malus qui fait en sorte que le public est incité à des véhicules à moindre consommation. On n'a pas ça non plus. Et encore là, on ne veut pas pénaliser et blablablas.

Ce sont les lobbyistes qui ont raison de nos gouvernements. Alors il manque de volonté politique parce que si on avait un Bonus Malus et une loi zéro émission, on deviendrait les premiers sur la planète avec les incitatifs qui vont de paire évidemment.

Et puis l'autre chose qui manque énormément pour que les véhicules soient plus disponibles c'est qu'il n'y a pas d'annonce télévisée sur les véhicules électriques, il n'y a pas de marketing, les gens ne sont pas informés. Quand je donne des conférences les gens réalisent seulement qu'ils peuvent économiser de l'argent en achetant des véhicules électriques. Evidemment, sur la vie d'un véhicule électrique, ça coûte plus cher à l'achat mais sur sa vie tu économises, même présentement. C'est ça qui manque, une campagne de publicité, d'informations télévisuelles dans tous les médias. Une bonne grosse campagne.

Oui ok. Donc ça dépend principalement pour vous de cette volonté politique ?

Ben oui parce que ces 3 éléments là, c'est de la volonté politique !

Ça prend une loi, ce n'est pas le citoyen qui peut... Donc la loi zéro émission, la loi Bonus Malus ça dépend du gouvernement. La campagne de publicité ça prend des fonds tu sais. Qui c'est qui va payer pour ça ? Au début, toutes les nouvelles technologies sont financées hein, on s'entend ! Par exemple les carburants fossiles sont financés à hauteur de 1,4 milliards de \$ par année. Ça veut dire que les Québécois qui représentent 23% de la population, on paye 325 millions par année

pour aider les pétrolières et gazières ! Alors quels sont le nombre de millions investis pour une politique d'électrification des transports ? Pas beaucoup.

Et vous êtes optimiste par rapport à la situation à court terme, disons pour les 3 années à venir, en 2018 ?

Ben le problème c'est qu'on est pris avec deux gouvernements conservateurs. Fin avec la politique précédente il y avait de prévu 517 millions de \$ sur 3 ans ce qui était déjà pas mal mieux que les 20 millions que le gouvernement avait amené avant par année. Donc le budget on ne sait pas, il vous l'annoncer là d'ici quelques jours. Puis quels vont être les incitatifs... Moi je suis pas mal prudent parce que le ministre des transports le dit lui-même, « oublier ça la loi zéro émission parce qu'on n'aime pas pénaliser ». Autrement dit on pénalise les acheteurs mais pas les fabricants.
[Rire]

Mais oui tout-à-fait !

Mais faut comprendre hein, faut lire entre les lignes !

C'est vrai. Et vous en avez touché un mot tantôt, sur le climat québécois, pensez-vous que ce soit un frein considérable ?

Pour les autos toutes électriques oui mais pas pour les hybrides rechargeables comme la Volt là, non. Et puis si on regarde Volkswagen ils annoncent une vingtaine de véhicules branchables dans la ligne Audi ou Volkswagen proprement dite. Il va y avoir dans les 2 prochaines années plusieurs véhicules hybrides rechargeables du style de la Volt là qui vont avoir au début 40 à 50 km d'autonomie. En principe, la Toyota rechargeable devrait aussi avoir 40 à 50 km d'autonomie sur la batterie. Bon ça commence à être intéressant surtout si tu peux te recharger au travail comme ça tu doubles ta capacité. Tu n'as pas besoin d'une borne de 200 volts, juste une de 120 volts est suffisante.

Oui c'est vrai. Et vous seriez d'accord de dire que par rapport aux ressources que vous avez ici disponibles au Québec, les ressources électriques et leur source, il y a une contradiction avec le nombre de personnes qui roulent véritablement en véhicules électriques ?

[Interruption : problème de communication]

Donc je me demandais si vous étiez d'accord de dire qu'il y a une contradiction entre les ressources disponibles et le nombre de personnes qui roulent en véhicules électriques ?

C'est normal que ça prenne du temps parce qu'on commence. Ecoutez au Québec ça a pris 10 ans pour qu'il existe 10 – 12.000 véhicules hybrides ordinaires. On est déjà rendus à 6000 et quelques véhicules électriques au Québec donc le taux de pénétration est quand même plus élevé que pour les véhicules hybrides ordinaires. Mais ce n'est pas encore suffisant, on pourrait doubler ça facilement si il y avait la loi de zéro émission, le Bonus Malus avec des incitatifs comme des stationnements, des voies réservées, etc.

D'accord. Et par rapport aux autres régions du Canada ?

Je n'ai pas trop fouillé ça donc je ne peux pas... Je sais que si on prend en compte l'énergie renouvelable du Canada c'est 60% mais ça prend le Québec alors que le reste du Canada s'est peut-être 40% d'énergie renouvelable, à part le Québec.

Oui d'après ce que j'ai lu c'est entre 35 et 40%. Et...

Le gouvernement fédéral, le gouvernement Harper, c'est le seul pays du G20 qui n'a pas de politique fédérale concernant l'électrification des transports.

Oui voilà c'était là où je voulais en venir. C'était ma prochaine question !

Y a l'AVEQ, l'association des véhicules électriques du Québec qui a envoyé un questionnaire aux partis politiques fédéraux pour demander leur avis sur différents points. Et le seul parti qui n'a pas répondu c'est le parti conservateur. Fait qu'on voit qu'eux c'est le pétrole et pas l'électrification. Fait qu'on doit jouer contre notre gouvernement fédéral.

Donc s'il y a un changement ou une évolution des chiffres concernant les véhicules électriques au Canada ça va vraiment dépendre...

De la province du Québec !

D'accord. C'est là que j'en arrive aussi au travers de mes recherches. Merci. Pour ma part je commence à avoir fait le tour des différents points que je souhaitais aborder avec vous. Donc un tout grand merci !

Appendix 15 - Interview with Philippe Louisseize

EEKO RENTALS - President

Unfortunately P.Louisseize was unavaible to meet face to face for an interview or do the interview over the phone. He did however agree to answer several key questions by email.

Bonjour Edward,

Premièrement, désolé pour cette réponse tardive. Nous sommes effectivement très occupés ces temps-ci.

Voici quelques réponses :

- Info personnelle :

Je suis titulaire d'un baccalauréat (équivalent bac +2) en Génie Mécanique de l'Université de Sherbrooke. J'ai toujours été passionné par les voitures, participant à la conception de 2 voitures pendant mes études (une formule SAE et un véhicule Supermileage).

J'ai toujours voulu être impliqué dans la transition écologique des voitures, car l'environnement me tient également très à coeur. J'ai donc un intérêt très personnel envers les VÉ, particulièrement depuis que la démonstration a été faite (en particulier par Tesla) que les VÉ sont plus agréables à conduire.

Je ne suis malheureusement pas propriétaire d'un VÉ moi-même, mais j'utilise nos voitures couramment. Cela ne saura tarder.

- Marché des VÉ au Canada :

Il y a moins de modèles offerts au Canada car nous n'avons pas de loi zéro émission, qui force les manufacturiers à fabriquer et réussir à vendre des voitures électriques. Beaucoup de manufacturiers ne sont tout simplement pas intéressés à vendre ces voitures et le font aux USA simplement parce qu'ils en ont l'obligation.

Le marché devrait grandir rapidement à partir du moment où des voitures à plus grande autonomie arriveront. J'entrevois une augmentation des ventes drastique, mais il faudra encore plus d'une décennie avant que les voitures électriques prennent le dessus.

- Barrières à l'expansion :

La seule vraie grande barrière est la perception des gens et le manque de connaissances. Ceux qui l'essaient et qui s'informent adéquatement deviennent rapidement convaincus, malheureusement ceci n'est pas le cas de la grande majorité.

- intervention des gouvernements :

À ma connaissance il n'y a aucune initiative de la part du gouvernement fédéral qui soit actif en ce moment.

Le rabais de 8000\$ du gouvernement aide, par contre il serait encore plus efficace d'investir massivement dans le déploiement rapide de bornes de recharge niveau 3. Ceci est en quelque sorte en cours avec "Le Circuit Électrique", mais ça pourrait être mieux.

- explication du retard :

Le Québec est en retard vis-à-vis de l'Europe, du Japon et de la Californie, mais au-delà il ne l'est pas tant que ça. Ceci s'explique, encore une fois, par le manque de connaissances du public et les fausses perceptions des VÉ qui sont véhiculées par les constructeurs eux-mêmes, les concessionnaires, etc.

Voilà, j'espère que ceci répondra à vos questions.

Cordialement,

Philippe Louisseize | Président

Location de Véhicules EEKO Logiques Inc

5815 Boulevard Métropolitain Est, Saint-Léonard, Québec, H1P 1X3, Canada

Appendix 16 - Interview with Hazel Rempel

REXEL NEDCO Western Canada – Energy Solutions director

I am performing a research in regards to the Canadian EV market and how it has developed since 2011. I am looking into the factors and conditions that have affected the development of the market. I am very pleased to be able to speak to you as so far I have only spoken to experts of the EV market in Quebec, and therefore to speak to you as you are from Vancouver in British Columbia.

To start of with what are you feelings and impressions regarding where the EV market is in Canada and BC ?

So I think what is really interesting is that provinces such as Ontario and Quebec which are a lot colder in the winter and where the EV adoption is decent and comparable to that of BC maybe even a little bit better. What is interesting is the gap with Alberta and Saskatchewan and Manitoba where they also have a cold climate yet the people don't have long commutes there. Maybe 45km a day. And the average EV would get them to work and back just fine. Especially if they plugged into a block at work. In BC we have the perfect climate for it as we have very moderate weather. In terms of it being really hot which is bad for battery life on cars we don't get that hot that often so we do in fact have a better climate than the USA which has a good adoption rate especially in California, Oregon and to a large part Washington. If my understanding is correct Washington has the same number of EVs as we have in the whole of Canada. One of the guys who is a member of the Vancouver EV Association as I am, Matthew Klippenstein, he is the guy who provides the statistics for the EV market for Canada. Although he doesn't yet have it broken down into the separate Provinces.

So in BC we are unique from Quebec and Ontario the two other big Canadian EV market as we have a more moderate climate. Vancouver is the most plugged in city so in terms of sustainability it's really pushed very big out here in BC. The Clean Energy Vehicle Program was launched in 2011 and I think there was 2.5\$ million available as an incentive to the point of sale and it was provided by the government and managed by the council. That money didn't go very fast initially and the program was in fact extended from one to two years in order to encourage people to buy the technology. We had a plug in BC program for business wanting to install commercial charging stations as we realised that without the charging infrastructure we wouldn't develop the market so there was a big push for that which ran for one year. And we did in fact get three of our branches done so that we have three Rexel branches here with charging stations here. In 2013 though there was still quite a lot of money left. Similar to when hybrid cars came out people were very suspicious with lots of reasons to not buy them. They just didn't trust the technology and didn't see it as a real alternative. It was only the really green companies that were installing the charging infrastructure. So that was the first round. Yet not as many charging stations were installed in the first round so then the Builders Owners Managers

Association, they did a second round for plug-in BC. So now we are up to about 350 stations. But BC is a massive province geographically. The biggest concentration is in the Vancouver lower mainland. Look at plugshare.com and you can see where all the stations are but it isn't updated live so there is always a delay between installation of a new station and it going on the site. Charpoint.com though puts new stations live on the map as soon as they are activated.

So the rest of the money got used up and our club did a lot of lobbying to the Provincial government for standards such as if you have an EV should we be able to drive in a special lane ? So a whole pile of lobbying went on and then we knew a new budget was being released early this year and sure enough they brought the clean energy vehicle rebate back and you can go to <https://www.cevforbc.ca/> that shows the rebates and incentive funds available. You can also go to <http://pluginbc.ca/> where you can look at a bunch of information there. See the clean energy vehicle rebates are back link. It shows you the money the government through out in the last round. So 7,5\$ million incentives for electric and fuel cell vehicles. 1,5\$ million for charging infrastructure and we know at the club that will mainly be levelled through BC chargers so people can travel round the Province a bit more. 1\$ million to adopting clean energy vehicles and 500.000\$ to research.

My understanding is that the 7,5\$ million is going to be gone before christmas. So they haven't even gone for $\frac{3}{4}$ I guess and it's a lot more money which has already virtually gone. Last time it was a couple of million I guess 2,3\$ million and it took them a long time to you know to be able to go through that funding and encourage people to buy the vehicles. So I think two things have happened :

1. There has been a lot of press and people have become more aware of the EVs and they are certainly ideal for city life
2. The cars are getting better, the range is improving slightly, and people have seen them around enough now so people think they are cool you know.

The other problem we have in the first round is that it's great to have all of these rebates but if none of the dealers are making money and bringing them money then how good is that ? So the first round there was a six to seven month wait to get say a NISSAN LEAF. The other thing which impacted in BC ; a lot of the auto manufacturers were getting huge incentives from the USA government for California, Washington states so they were sending most of their cars there as the government was spending most of their money on them so they were sending their cars where it was really being supported. Which makes sense from a business model perspective. We are today in BC where more mainstream people are seeing these cars as not the golf carts I thought they were. Tesla has done a lot for the image of electric vehicles and then BMW coming out with the i3 and it's kind of a cool car. The NISSAN LEAF and MITSUBISHI Mia, even though the NISSAN sells really well and it was the first EV to really hit the market you know they were expensive even with the rebates so the range is a factor and the price is a factor so if you're starting to get up into the 40.000\$ range you're not going to get, even in the mid to

high 30s you're not going to get many people spending that on a car so you get people who just get a Honda Civic which is 20\$ grand and is pretty good on gas right? So people would make those decisions. And the big educational thing at the club is we are trying to explain to people that you don't have all of these service costs, you don't have to worry about hoses and coolants and all these things you are talking for the most part at tyres. So people weren't looking at the total cost of ownership and I think in BC at least in the lower mainland the club has got that message out well. What we have done to promote vehicles in the lower mainland is there are a lot of meets. Where we invite all of the car dealers to bring down their EVs and then there is a line up for people to test-drive them. And so once people get in the cars and they feel all that talk and the really cool technology you get in an EV that you're not getting in something else you quite often find people get hooked then.

Yes very quickly...

And in all honesty I have just witnessed that with my husband. We have just bought a KIA Soul EV on Tuesday night.

Great congratulations!

Thank you I am pretty excited about it. So my husband drives a 5 Litter Mustang so he was like "I don't know honey" do these things ever really pay for themselves but after he went out in it and we saw how quickly it regenerates going down hills and in fact they told us that people who drive a sort of low key road trip they see up to 200km range themselves even though range is supposed to be 149km. So I think the next breakthrough will be when the batteries become even denser and lighter and when you get the range up to 300km I think that will open the floodgates. The people I work with, because I drive 80km to work each way when I go in and in takes me about 1h10 and I've got charging stations installed at work and we've got more added since the initial phase and literally it will cost me 1\$ to go 160km round trip compared to probably 8\$ to 10\$ in a hybrid car which goes down to total cost of ownership so you're paying more for the EV up front but I look at my Toyota hybrid service records and I'm probably spending 750\$ a year on service. You're getting the underseat air filters changed, your oil changed, and I guess I'll still be rotating my tyres but you know it all adds up. If you look at the average person, he is probably driving maybe (...) My last cars were 12,4L/100Km so it would have been 20\$ to drive to work and back. So there you go. And I have put on about 3500Km a month so it is going to be interesting to see and what we are doing is keeping the Prius as it's like new and under 100.000km and it will be for us the car for whoever is driving great distances out of range. We have both options whoever drives most in range on a day will drive the Soul and whoever drives out of the range will drive the Toyota but at least we have that option. Most of the people I know that have electric cars, unless they can afford a Tesla, will have something like a Prius or a highly efficient internal combustion vehicle and an EV so the EV becomes their city car. So that's my take on it. But it is going to get bigger. I remember when I would used to hang out with the guys at the club, even with the Nissan Leaf people would see it plugged in and they would come over and talk about it, they had never seen it. Apparently for

me when I get the Soul there are only four of the in BC so I am excepting the same thing.

Yes so you will be grabbing attention right! But I totally agree with all the pros and advantages of driving electric, and from how I see it we are at that transitional period right now where we aren't quite at that stage where it is accessible and useful to everybody because some people drive too big distances or because it's too expensive for people.

And if in the winter with the cold you will lose 20% or your range too.

Yes as well. But what I have also noticed is by going through EV sales numbers, despite there being significant growth in Canada and in certain Provinces that you have already mentioned. But the growth hasn't been as big as in some European countries such as in Norway. And Norway is the one I find really interesting because in Norway they have the same climate issues in terms of the cold as here. So are there one or two specific factors that jump out over the other barriers that you have mentioned already. You have mentioned the price and the range, are there other elements that jump out for you which over the past two or three years have been a significant barrier?

Well I am going to say with EV technology when you get over to Europe where you have dense populations if you look at other energy saving measures, if you look at solar generation and all that stuff then all that world is way ahead of North America. Way ahead. Because they have no choice. They have to conserve water and they have to conserve electricity. And I don't know what the utility rates are in Norway but I would just think from a general green technology perspective they would be more easily embraced in Europe and I also think in Europe there are cars with a significant range that are electric.

Yes well that is one of the things I am trying to understand is why in Canada the distances are greater yet the offer of EVs is smaller than in Europe. And even in California where I was looking that you can buy a Toyota Rav4 which is electric and has a significant range on it but that isn't available in Canada.

The only thing I can reasonably come up with is that in terms of Canada our economy goes so much around oil & gas, our energy markets. I firmly believe that is one of the reasons they have not been adopted in Alberta as much as they have in BC. I know it gets terribly cold in Edmonton and Calgary but it gets terribly cold in Quebec too! So I think or I wonder and I would be interested in any research, if somehow the oil and gas companies are somehow finding some way to support the automotive industry. I don't know. Sometimes it comes down to support with political parties, I don't know but perhaps that is a part of it which I a lot harder to uncover.

It is interesting you make the link there in between the oil & gas industry and politics. Of course both are linked as the oil & gas industry has such a huge impact on the Canadian economy and looking back over government documents the only strategy in terms of EVs they have published goes back to 2008 which is amazing when you think of the huge resources. And in 2009 they estimated

there would be 500 000 EVs on the road by 2018 but they are nowhere near that.

Yes there are some pretty aggressive numbers for sure. I do think a part of it is in North America in general compared to other parts of the world our politicians have not been as serious about GHG reductions. If you look at the OECD countries that are focused on climate change then Canada ranks terribly. It's an embarrassment and probably a reason why I won't vote for our current PM again but I just think that if our politicians are pushing it then how are people supposed to find out about it and make change? What I have seen from the lighting industry is that we are going to install an inefficient product that uses a lot of energy which then causes pollution then Natural Resources Canada steps in at some point to set a standard to say you know you can't do this any more.

Do you think that is necessary?

We totally know that in other types of energy efficient products, the only way to get people to truly adopt it is to legislate it and say you know what? You're not making the right decisions so this is now law. That is basically the way people only really make change. When I talk to people about their concern about the global climate change and GHG and all that, what people do is always try to relate it to themselves and they say one person can't make a difference and of course they are right. If it's the same cost and greener then maybe I will make that change if I don't look like a weirdo using that technology. If I'm now saving money then you know what nothing speaks to people like money. So if there are incentives and saving money then there will be a certain number of people who jump on it but you legislate it then people have no choice.

So maybe again not understanding that much about the automotive industry as you might, but if the Canadian government does like with lighting that when somebody installs a light bulb then the minimum light output needs to be this. I used to work for General Electric and Osram Sylvania, the lighting division of Siemens, so we had no choice as manufacturers we had two years to figure out how to sort out efficiency and our R&D were working their butts off to get there and to get there before the other guys did and have a more energy efficient solution than the other guys have. Because we knew when that date hits and we used to hate because that puts the pressure on. And two years can be a really tight time line. So you know I have often sat back and thought if the government said there will be no cars on the road that do not hit this EPA rating of X gallon per mile and you can convert that into electric range as well right, if they did that, consumers would have no choice and climate change would not go as bad as what it does.

But then there is the other thing and when I talk to people it doesn't matter what we do as there is China and China is polluting the world at such a rapid pace compared to our conservation measures are. I just think that is a lame excuse, China is getting better with a lot of solar. They are starting to look at their air quality and things like that. People think that if it is over there they don't have to think about it, it's for China to wear their little face masks right? It's funny when you talk to different

people, here is a classic example: Volkswagen. So you have heard all the news lately.

Yes I have followed it with great interest

Well I know a lot of people who drive Volkswagen Tdi's, I have been listening to talk-radios and driving round between customer appointments and the thing people care about the most is that their car has potentially lost fair bit of value. That is the biggest thing for them. And my brother drives a Tdi and I asked him whe he thinks about that and he said I don't really care about the green house gas issue and the emissions issue as someone like you he said but it makes me wonder what else under the hood is going on that I don't know about and that they lied about. So everyone's motivations are different. I think a lot of people like to think they are concerned about global warming but there is that percentage of people who think there is nothing you can do it's too late. Or it's happened before in the past and this is no different to what happened in the past.

But you are optimistic in regards to the EV market and here it will be in three years time for example?

Yes I am. Because I think and I have seen at the events we hold at the club, when you get people in to an EV it is a game changer. If you went out and drive a BMW i3, you need to go and sit one and take a test drive.

But that isn't politics though.

Yes it's down to the individual though who buys the car.

And down to the manufacturers also don't you think and them getting the information out there?

Yes but the manufacturers aren't doing a great job of it though, they have done a really poor job of makerting EVs and I can tell you why that is. Ok Tesla is in the news all the time, press conferences with Elon Musk all the time and press releases of the new releases all the time. You have to give them a lot of credit. But you tell me, have you seen any press with any other EV?

No not at all.

Me neither and there is a reason. You know I have had a lot of conversations as we do a lot of the EV charging installations for Nissan downtown Vancouver, but just at the dealership themselves not every dealer for one can sell an EV. SO if I'm a Nissan dealer, there might be fifteen Nissan dealers in Vancouver well there are probably two of them who can have the EV line up.

Ok so not every dealer can sell all of their cars?

Exactly so if I go into a Nissan dealer guess what they will do. They will try to talk me out of it so that is a game changer. The next part is compared to internal combustion engines, the EV an money can make on an EV if they can is maybe 500\$, that's it. So if I have other vehicles where I can make a thousand or two thousand then what will I focus on? So the big problem we have even with the EV market doing ok in Vancouver, the dealers kind of limit the offer because maybe they have to hit a certain number of sales per year to be able to offer them but I don't

think they will load the show room with them so they will go for higher margin vehicles.

The third piece of the puzzle is, and this is where we got more and more involved with car dealers. When somebody comes in to buy an EV. What is the biggest thing they are concerned about other than range?

Price?

Yes that is a big thing, but also where am I going to charge this thing? But where are most people doing their charging?

At home or at work.

Right; so if I live in a twenty-five story unit and I have a parking garage how is that going to work? So I'm going to talk to my property manager but a lot of buildings have a lot of complications. If you have a condo with an assigned stall, number ten for example by the elevator ok you might be a way off getting power from the electrical room. So now it could be 4.000\$ just to run the cable to my stall. Let's just say I've got money and I can do that. Next how do I stop the unit being vandalised? How do I stop everyone else using it and how does the building charge me for the energy consumption? It's on the main electrical service so some will ask to put a small energy meter on there just to see how many KW are being used to calm everyone down. In the city where the cars are ideal you have multiresidential so for me I started talking more to the condo association president we have been talking of ways to start working together because at the end of the days techie people will be moving into condos where they won't have to fight for these facilities. Even if you live the city close to downtown it's perfect to have an EV it would be perfect. But that isn't always the case. So there are issues charging at home in the city.

What happens is when someone goes into Nissan to get a Leaf but the dealer knows he will only make 500\$ from it so he will bombard the client with questions about charging for which he has no understanding at all. It is very complicated. I think it will come down to how we managed this, in terms of the industry in general. What Rexel has done here is set up an agreement with three highly trained contractors who understand the technology and know how to mitigate problems. So we have three guys we can send out and answer all those questions and get a quote. Sometimes dealers don't have a good program as people on the showroom floor don't have access to enough information. I think there is going to be an adoption but once we can get it outside the city core. So the 250 or 300km range with families who will save a lot as they are travelling further distances. When the range is there then it will take off.

So once the range is there, will the political support then get bigger? Rather than the other way round?

Well you would like to think that but if you are a politician and you see a bunch of money thrown at it without seeing progress you had hoped for. And another aspect that politics haven't dealt with yet is road tax. So every time I gas up at the pump I pay for road tax. How will that be dealt with for EVs? They use the same roads! The same infrastructure but they don't fill up at the pump. So if I take a thousand EVs

while taking a thousand petrol cars off the road that is a thousand cars not paying road tax which is about 500.000\$. So do the math. If we hit 40.000 EVs, do the math. In BC our utility is the Crown Corporation, they write checks to the governments so it's the government's control. I think Quebec and HydroQuebec is the same right? But Ontario is different I know. But I don't know if the utilities commission would create some kind of ruling of how the money would be collected. I know in the USA a fee is paid once a year which covers your road tax but nothing like that here and rumor has it that it will be calculated on the different loads which is why smart metres are installed permitting different levels of taxation.

Great well we have covered all of the bases I needed to cover so can I ask you to finish off regarding your profile so that I have all of my facts correct?

I am energy solutions manager for Nedco Western Canada so I have half of the country.

And do you occupy other functions aside from that?

Well I am the Vice-Chair for the BC Electrical Association. And the energy solutions role for Nedco incorporates anything that is energy for Nedco, so solar, EV charging, things like building energy monitoring systems and a whole plethora of different things as well as lighting.

And how big a share is EV charging out of that?

Well I have become well known for it. Sometimes when a new technology comes to the industry, electrical distributors tend to be an old business models where we have branches and wait for people to come in and buy cable and wire and sometimes we don't go out and aggressively pursue things so we got into these new technologies late, not only nedco but it's inherent in the industry. We sell the things we have done for over a hundred and five years so we tend to spend time focussing on our core business. With our energy solutions it is still a very small part of Nedco's business and when I started they said to me ok you're starting something new. I remember sitting down at my desk the first day, I had been given a computer, I read through everything about working for Nedco and I sat back ok so how do I tackle this?! It so happened there was a lot in the news about EVs and a couple of suppliers talked to me about it and supply equipment without any distributor dealing with it. So for the first couple of years it was 100% what I did. And I conquered that and since then I have delved into other areas. It is a steady income for us while other things have become bigger and more lucrative. It's not a high margin business selling EV charging stations just because the manufacturers have been going direct for so long and we didn't show them we were bringing them value.

Great well thank you ever so much for your contribution and your time.

With pleasure, good luck with the rest of your research! I look forward to reading it when it is finished. All the best.

Appendix 17 - Analysis grid of semi structured interviews

[illegible]

Interviewee	Company / Organisation	Function	Reduced EV offer	Information	Political support	Purchase cost	Infrastructure	EV marketing	Climate fears	Autonomy	EV Technology	Zero Emission	Public/ul incentives	EV climate impact on battery	National & Provincial economies	Provincial economies	
Charal Guénot	EMC-MEC	President	An increased EV offer from manufacturers is only worth if it is accompanied by the other 3 key points	Communication as priority for EMC	Political activities as a priority for EMC		Development of infrastructure as a priority for EMC										
			The Canadian automobile market is smaller than that of the USA for example (the Canadian market + the Californian market + the European market). It is a small market. The situation is improving	To increase EV awareness and show how it is a real alternative to petrol cars	Only 3 provinces with EV incentives in place	Ontario far behind Quebec despite the number of EVs on the road in Ontario											
			It is a small market. It will be looked into by governments in the coming months no doubt about it so to see what manufacturers can do to increase the number of EV models available	Lack of central body where all EV information is gathered. Information is communicated from different sources. Not all EV information is communicated from the same source. There are smaller more fragmented sources of information.	No new or updated EV Roadmap (i.e. strategic plan) since the federal one of 2008. EMC suggested to update it so a new updated EV Roadmap is currently being worked on and will be published early 2016.												
Philippe Lussier	EEO	President	See ZERO EMISSION LAW	Lack of awareness	ZERO EMISSION LAW		Infrastructure										
			The lack of EV offer is due to the lack of a zero emission law	The lack of awareness and understanding of EV and their advantages is the single biggest cause for the slow development of the EV market in Canada	Car manufacturers will only increase the offer of EV if they are forced to do so, as is the case in California for example. The current lack of a zero emission law means there is no reason for car manufacturers to increase the offer of EVs in Canada	Political investment should mainly go into developing infrastructure so that it can no longer be used as an easy excuse											
			Those who try out an EV are usually convinced very quickly and make the change to EVs	Federal support is ineffectual	Provincial support = 8,000\$ but is poorly targeted	It is especially fast charging stations that are needed											
Frédéric Nagrette	Roxel-Nedco	Eco-energy director Québec	Low level cars that brought previously, but no EVs from those manufacturers therefore an extra barrier to buy one	A lack of information regarding EVs and lack of public awareness regarding nearly all of the issues in question	Political support	About 25-30% more expensive than an equivalent petrol car	Infrastructure	Complex mix of EV advertising (in regard to petrol cars)									
			Not enough types of EV models available to satisfy all types of car users	Many people are not aware of the benefits of EVs. There is a lack of information regarding EVs and lack of public awareness regarding nearly all of the issues in question	As long as electric cars won't be able to go 300km at least without having to be recharged then the average Canadian or Quebecois won't purchase one	Why has Norway managed to develop its EV market to be world leader without a zero emission law?	EV batteries have had a very bad press over the past few years in regards to the cold temperatures. This is partly a misconception and an exaggeration of the truth but still, it has had an effect on the public impression of EVs.										
				Even him as eco-energy director for Roxel knows nothing about EVs and how rare information is and how difficult it is to get hold of pertinent information	Shock advertising nothing in place (e.g. advertising cigarettes or car accidents)	Not enough direct causal link between EVs and climate change and EV market	Other: need to be prioritized ahead of a zero emission law										