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Transition to the Low-Carbon Economy

EEM ISSUE BRIEF

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EXECUTIVE SUMMARY

While climate change may have been considered an external environmental issue up to now, the transition to the low-carbon economy has become a company-wide challenge, calling for strategy discussions, enterprise risk evaluations and action planning. If a company already uses sustainability thinking in its decision-making, the challenge won't be all new, but the urgency to take action is now heightened.

This brief explores the idea that the low-carbon economy is at our doorstep, finding evidence in the insurance industry, in the financial sector as well as government commitments and economic incentives. It looks at the energy implications associated with the low-carbon future to underscore the enormous challenge that a rapid transition poses and describes energy concepts that must be considered to ensure aspirations are based on viable choices.

Finally, the brief places the transition to the low-carbon economy into the context of sustainable development strategy and proposes the first steps that corporations must take to start the inevitable transition.

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IS THE LOW-CARBON ECONOMY REALLY AT OUR DOORSTEP?

The world is on a warming trend with the last ten years being the hottest since records began in 1880. The opening up of the arctic passage to commercial traffic [1] and the migration of the mountain pine beetle to the forests of BC are some obvious manifestations of our changing climate. Due to its northerly location, Canada is set to see twice the amount of warming as the global average, while the Arctic region will see three times the average[2]. Rainfall patterns in Quebec are already changing with more heavy rain in the spring and extended droughts in the summer.

The larvae of the mountain pine beetle now survive the milder winters in BC and have infected millions of pine trees, leading to a massive die-off. Infected trees are being harvested before they decay, changing the landscape dramatically and affecting mid-term timber supplies. In 2012, the latest computer modelling projections indicated that about 58 per cent of the pine volume in the province may be killed by 2021. See this government published animated graphic with observed data to 2014 and a projection to 2020.

The insurance industry has been at the forefront of understanding the physical risks related to climate change and developing new insurance policies to address and limit associated liability. Mark Carney is the former Governor of the Bank of Canada and the current Governor General of the Bank of England and Chairman of the G20's Financial Stability Board. As he explained in his September speech[3] to insurance companies at Lloyds of London, the risks are threefold:

Physical risks:	Floods/storms that damage property.
Liability risks:	Compensation sought by those who suffer loss from those they hold responsible. Could come in future decades but could hit carbon extractors and emitters.
Transition risks:	Adjustment to a low-carbon economy. Changes in policy, technology and physical risks that could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent.

Source: Financial Stability Board, 2015

Beyond insurance companies, investors are also concerned with all three of these risks. Most high profile are the university and church endowment funds such as the University of Toronto[4], that have chosen to divest of fossil fuel-intense assets. Even the institutional investors (pension funds, mutual funds, money managers, investment banks, etc.) are starting to see it as their fiduciary duty to assess risks related to climate change (and other environmental, social and governance factors) when reviewing their holdings. Investors of all stripes need to review the real risk that their assets may lose their value (e.g., infrastructure integrity affected by melting permafrost) or become "stranded" (e.g., coal that cannot be mined under potential bans or pricing mechanisms). Much movement is currently being seen under the responsible investing and low-carbon investing banners.

There are clear signs of a change in the political and economic spheres. The desire for a low-carbon economy is now clearly expressed by world leaders following the Paris summit on climate change in December 2015 (COP21). The agreement confirms the goal of limiting average temperature increases (see inset), committing signatories to national action and decarbonising the global economy. Different countries have, or will, set their own targets/actions to be ratcheted up over time. As set out in Article 4 of the COP21 Paris agreement, "… Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, […], and to undertake rapid reductions […] to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century."

THE PARIS AGREEMENT

Conference of the Parties 21st Session
Paris, 30 November to 11 December 2015

Article 2
This Agreement […], aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;
c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

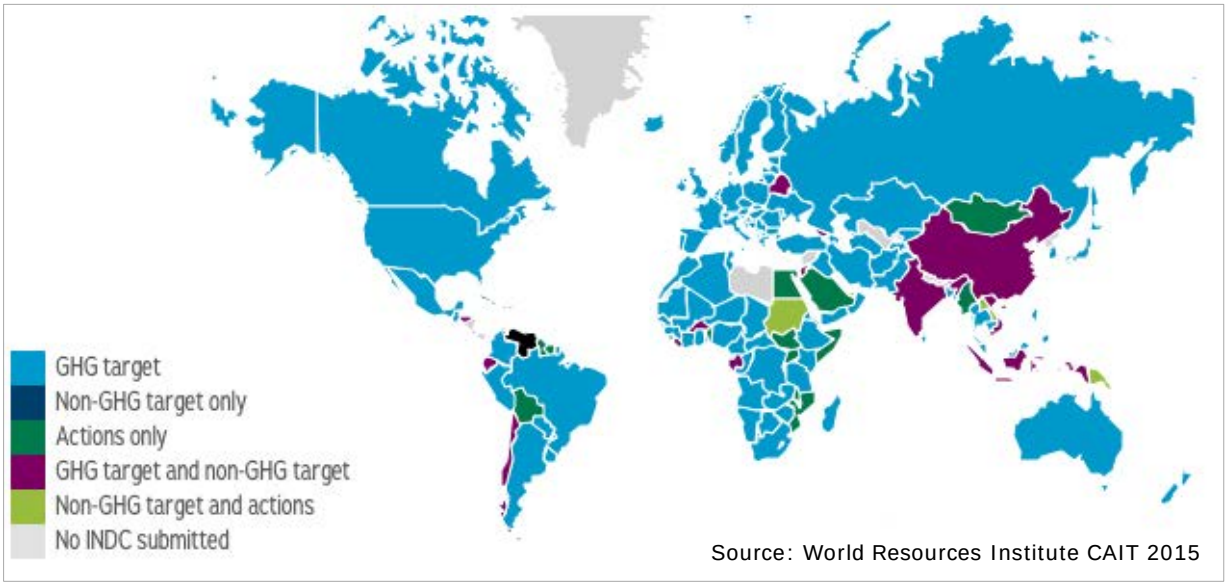
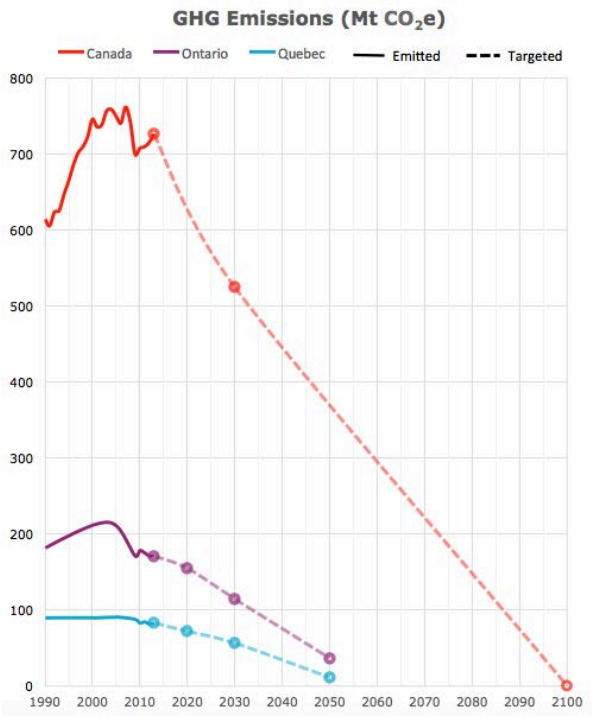


Figure 1 Intended Nationally Determined Contributions (INDCs) presented at COP21

Quebec and Ontario have not only committed to deep cuts in the carbon emissions of their economies, but they assert their ambition to be the seedbed of the low-carbon future – investing in leading edge technologies that will enable a global decarbonisation: the production of low emission cars to be sold throughout North America, modern public transportation solutions, a new generation of low emission aircraft, manufacturing excellence in renewable energy equipment, etc. - as well as embracing new, more efficient low-carbon business models (e.g., the circular economy, the sharing economy, etc.).



Data source: National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada (April 2015)

	Quebec	Ontario
	% below 1990	% below 1990
by 2020	20%	15%
by 2030	37.5%	37%
by 2050	80-95%	80%
Current position	8% (2012 data)	6% (2014 prelim. data)

Sources: MDDELCC[5] and MOECC[6]

In Canada now, 5 out of the 13 provinces and territories, representing nearly 90% of the economy[7] are now covered by, or have serious plans for, a carbon pricing mechanism, be it a carbon tax or a carbon emission cap and trade program. The former Harper government committed to both an emission reduction of 30% by 2030 (baseline 2005) and, at the G7 meeting last May, to full decarbonisation by the end of the century[8]. The new Trudeau government has yet to announce its specific policies, but from the discourse at COP21, we can only expect a commitment greater than the Harper government target, as well as better collaboration and presumably funding for policy support.

Carbon Pricing 101	
Carbon Taxes:	A tax is imposed on carbon emissions. Programmes differ on where the tax is applied (e.g., on upstream production or on purchases of fuel by consumers). Often, the funds collected are dedicated to emission reduction initiatives, including investment in public transportation, etc.
Cap and Trade:	After a monitoring period, emissions per site or industry group are capped, and facilities may not exceed that cap without financial penalty. The cap can be an absolute value (tonnes) or an intensity value (tonnes per unit of production). If a company produces less than the allowed emissions, it may trade the excess with others. The cap is reduced over time. The funds collected are often re-invested to reduce carbon emissions in another area of the economy.
Voluntary carbon credit purchases:	When commitments have been made to reduce emissions, but not achieved, remaining emissions can be offset by purchasing carbon credits from others who have reduced their emissions. Some consumers do this voluntarily too, for flights or to hold a “carbon neutral event”.
Who pays?	Ultimately, the consumer of the product pays, as the aim is to reduce consumption of carbon-based products through changing society’s behaviours. Relief for lower income citizens is often part of the government programs.
Price	Recent sales of carbon credits and current provincial carbon taxes put the price of a tonne of CO_2e between $10 and $30. If a barrel of oil is sold for $40, adding a carbon price of $20 per tonne at the production stage increases the cost of the barrel of oil to $48.60 (since, crudely calculated, combustion of a barrel of oil results in the release of 0.43 tonnes of CO_2[9]). When you fill up a 45 litre tank of gasoline for say, $50, you’ll produce roughly 0.1 tonnes of CO_2 (since combustion of a litre of gasoline results in 2289 grammes of CO_2[10]). Using a carbon price of $20 per tonne at the gas pump, the carbon cost will add $2 to the gas bill, making it $52 to fill the tank.

According to the CDP’s September 2015 report, *Putting a price on risk: Carbon pricing in the corporate world*[11], a growing number of reporting companies (all stock exchange-listed) are also applying carbon pricing internally to validate business decisions (435 companies in 2015, up from 150 in 2014).

With these signals from corporations, investors, insurance companies and government, we suggest that the low-carbon economy is fast approaching.

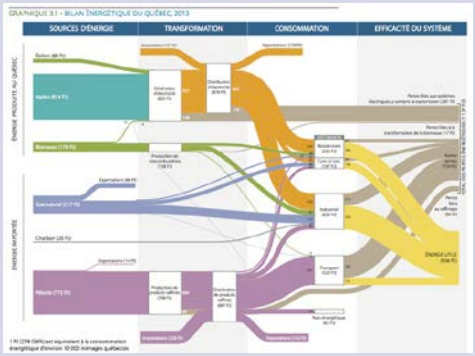
COULD THE LOW-CARBON ECONOMY BECOME A REALITY FOR CANADA?

So if the will is there, can we simply switch from using fossil fuels to using renewable energy instead, even if it is a little more expensive, and avoid the carbon levy?

Bridging the great divide between climate aspirations and energy reality!

Today, 65% of our electricity use in Canada comes from renewable energy, but this varies widely among provinces (e.g., 7.5% in Alberta, 99.5% in Quebec) [12]. Refined petroleum products were the main supply of energy consumed in Canada in 2013 at 38.8%, followed by natural gas at 32.6% and electricity at 20.9% from both renewable and nuclear sources [13]. In the big picture, renewables currently provide about 14% of Canada's energy use.

For an up-to-date synthesis of Quebec's energy situation and a valuable Sankey diagram that maps the energy flows, see this HEC report: State of Quebec Energy 2016.



Quebec is in an enviable position from its earlier investments in hydro-electricity, but precisely because Quebec's electricity is already no/low-carbon, there are no "easy" ways to decarbonize its economy, such as through thermal power plant conversions, as proposed in the US under Obama's Clean Power Plan or in Ontario with the shutting down of coal-fired power plants. All the effort in Quebec will be in the elimination of liquid fuels, which basically means, in transportation.

What is unquestionable is that, beyond electricity generation, all Canadians rely on fossil fuels for transport, for plastics and fertilizers, and much else. In addition, the embedded carbon in the products we use is substantial, especially where we buy our goods from manufacturing facilities across the world – and this is not included in national or regional figures.

Canada is also a net exporter of energy, currently dependent on income from those exports. Just satisfying our domestic needs would be a huge change to our economy from business as usual, and raises the question of how our current energy customers will satisfy their energy needs without Canada's carbon-based exports?

Today's transportation is predominantly dependent on liquid fossil fuels. Liquid fossil fuels are not easy to replace. They are energy-dense and readily transportable. Society, with its

private, semi-private and public corporations, has made huge infrastructure investments in fossil fuel exploration, extraction, refining, transportation and delivery. How do we transition these assets to the benefit of a low-carbon economy? Public transport, rail and marine transportation of goods, and electrification of certain individual vehicles will need to be favoured for investment at the cost of car-based commuting, suburban expansion and road transport of goods. How will Canada's resource based economy, so heavily dependent on road transportation, make the switch?

It is hard to imagine how we will replace the convenience of an energy-packed transportable fuel. While electric vehicle technologies are finally advancing in the passenger vehicle market, replacements for traditional liquid fuels for energy-intense transport such as heavy-duty trucks for mineral haulage are still in early stage field testing (liquefied natural gas LNG, for example). Even more of a challenge is air travel.

So while we are heading to a lower-carbon world, the feasibility of replacing all fossil fuel use in Canada is yet to be tested. Large scale carbon sequestration projects is the other option. While Canada has large carbon sinks in the form of its Boreal forest, can we augment land use for carbon sequestration on a scale adequate to compensate for chosen remaining on-going emissions?

TO BEGIN THE TRANSITION

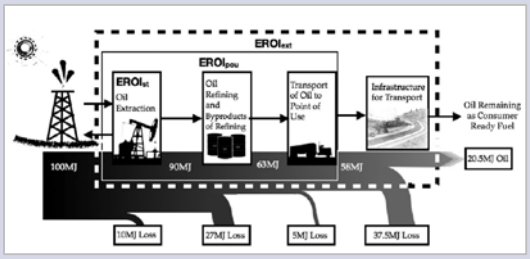
WHAT ENERGY CHOICES ARE MOST VIABLE?

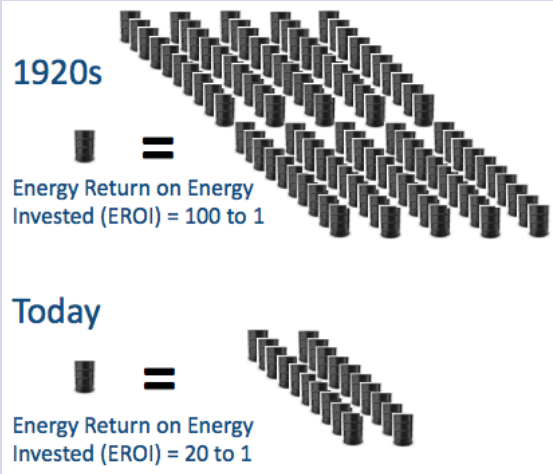
There are interesting metrics to guide decision-makers on the most viable choices. First, there are the fundamental thermodynamic properties of different sources of energy that need to be understood. Then there are secondary metrics such as, energy return on the energy invested (EROEI or more simply, EROI) or energy captured by a certain area of land. These may factor in different locations, needs for storage, points of use, cost scenarios, and of course, different carbon emission policies and pollution control technologies (including possible sequestration).

Note that the values of some of these metrics change over time with evolving technology, scalability and availability / scarcity. As an example, see the inset box for the evolving EROI of oil as we seek out harder to extract fossil fuels.

When selecting an alternative energy, it is essential to carefully consider these factors as they apply to a specific use.

For an up-to-date EROI of different fuels and the implications for society, see this report from researchers at State University of New York, 2013.





"Back in the 1920's, oil was paying off at 100-to-1. It took one barrel of oil to extract, process, refine, ship and deliver 100 barrels of oil. Now, conventional oil production worldwide pays off at about a 20-to-1 ratio. And in Canada, where the oil comes from tar sands, it's closer to 5-to-1."

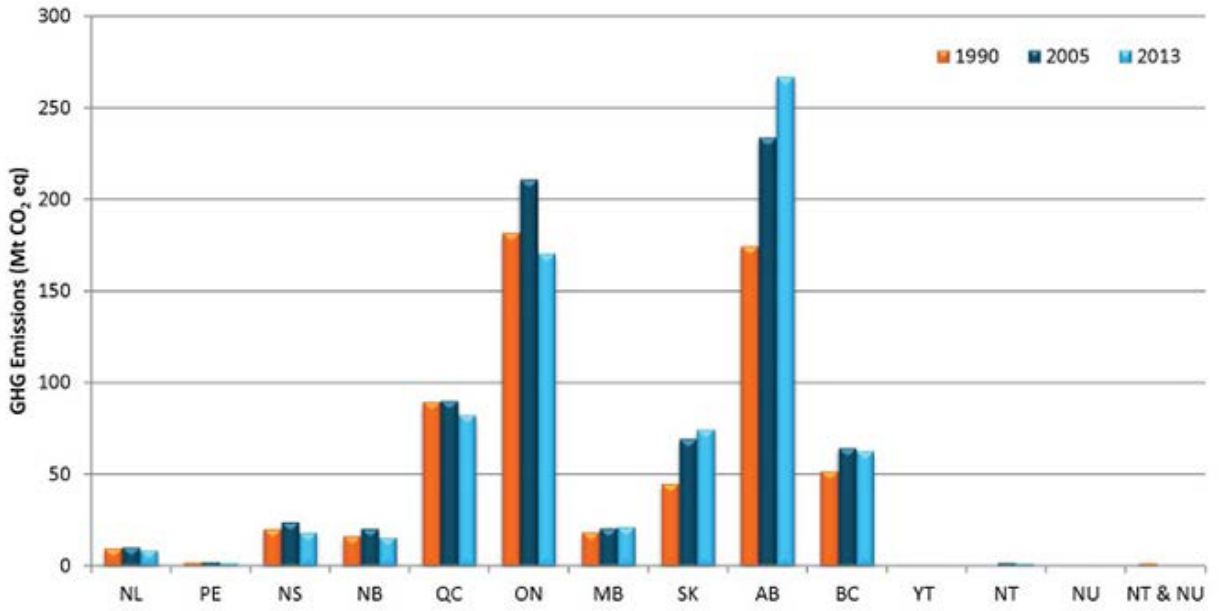
Eric Zencey, Fellow with the Gund Institute for Ecological Economics at the University of Vermont, 2012.

ELIMINATING ENERGY LOSSES

As noted in the State of Quebec's Energy 2016[14] report, for every unit of useful energy that we consume, there is a loss of 1.18 units. This correlates to system losses occurring in refining petroleum products (8%), buildings (11%), industrial processes (19%), electrical systems (25%) and transport (35%). Looking just at the loss in transport, 75% of the loss occurs at the user level, i.e. the inefficiency of the combustion engine when turning fuel energy into kilometres travelled. Clearly, there is much opportunity to reduce carbon emissions through addressing energy losses.

REGIONAL DIFFERENCES

While climate change will be felt around the globe, the carbon intensity of our economies varies widely. Modern lifestyles in Canada are far more carbon-intense than those in parts of South America for example, but more than that, across the country we have very different economies and energy mixes. The transition to a low-carbon economy will therefore look very different, depending on the region and the location of operations (urban, suburban, rural, etc.).



Source: National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada (April 2015)

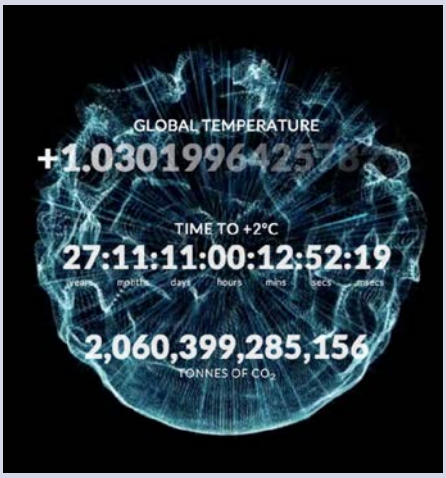
Figure 2: Emissions by province 1990, 2005 and 2013

The figure above presents the GHG emissions of each province, but the picture is incomplete when planning a transition to the low-carbon economy. Some additional considerations include:

- Emissions linked to the production of many goods used in a province are not included (e.g., food produced and transported from California, clothes made from US cotton in Bangladesh, electronics produced in China, etc.).
- Canada is a resource base for the global economy. Raw material extraction is carbon and energy intensive. What raw materials will be required for the low-carbon economy and can the associated extraction emissions be reduced?
- Much of Ontario and Quebec's emissions are linked to its manufacturing base, serving global markets.
- Alberta's emissions include production of oil from conventional sources and from the oil sands, but not the combustion of the oil produced, since much of the oil is exported from the province. The same is true for other energy exporting provinces.
- Quebec has no oil and gas production in the province, so it is dependent on imports including unconventional oil and natural gas from fracking operations.

LEVEL OF AMBITION

Many organisations are calling for countries, big cities and corporations to set "science-based targets". What that means is that targets should be worked out so that global action results in the scale of carbon emission reductions necessary to limit global temperature rise to less than 2 ºC. Without such mitigation, scientists warn of "severe, widespread and irreversible impacts" [15]. Many corporate reduction targets to date have been set based on past emissions and palatable investments in energy efficiency with relatively short pay back periods, typically, reductions of 5 to 10% over terms of 3 years or so. Often, these are then related back to production figures (weight of product, or sales revenues) allowing for absolute increases with sales growth.



David Usher's Countdown to 2 ºC clock, updated annually, based on the remaining global carbon budget.

However, what the "science-based targets" call for action is really about is that we need emission reductions of the order of 40% in the short-term (15 years) and 100% in the medium-term (50 years) to stay within the carbon budget consistent with 2 ºC of warming. Energy efficiency projects of 5% over 3 years are just not going to be sufficient to meet that goal.

While Ontario and Quebec governments have declared ambitious targets, and some corporations are taking the lead, we have not yet seen large-scale commitment from private enterprise nor real discussion of our energy challenge. Will the recent carbon

pricing schemes be sufficient motivation? Will the long awaited Quebec Energy Policy offer significant direction? What other regulatory pressures might be introduced?

As we saw in the discussion of regional differences, deciding where in the system to set boundaries for reduction targets becomes problematic when broken down for different areas of the country and for different industries. Evenly-applied targets for all sectors of industry don't make sense. Some industries have to do the heavy lifting for the rest of the manufacturing sector and the service economy. Even increasing carbon emissions in an area of the economy may be a good choice if it means displacing less productive carbon emissions elsewhere. This brings us to judge what is productive, a decision which may sometimes be based on values more than numbers. Using our remaining fossil fuels to create renewable energy infrastructure that can then be energy self-sustaining is certainly a responsible use of our remaining carbon budget when compared to a must-have fashion item that is discarded with the season.

HOW WILL COMPANIES TRANSITION?

First, let's be clear, some companies will not transition. A low-carbon future does not have a place for all the products that we use today. But many others will adapt and new enterprise will emerge. Companies will need to consider both what products/services they offer as well as how they are produced. They will need to:

- Decarbonise their offer to avoid new carbon cost, reduce exposure to fossil fuel price/supply fluctuation, remain competitive and maintain social acceptability;
- Adapt their offer to mitigate the physical impacts of climate change such as more extreme weather events, constrained or disrupted transportation, etc.;
- Ensure investments are not locking capital into products / services / facilities with higher long-term emissions;
- Increase the resilience of the organisation to external risks and ensure management systems are adapting to changes;
- Capitalise on opportunities by cultivating a culture of innovation and aligning efforts with strategic priorities; and
- Contribute to community/societal transition since a well-functioning society with a healthy workforce is a prerequisite to business success.

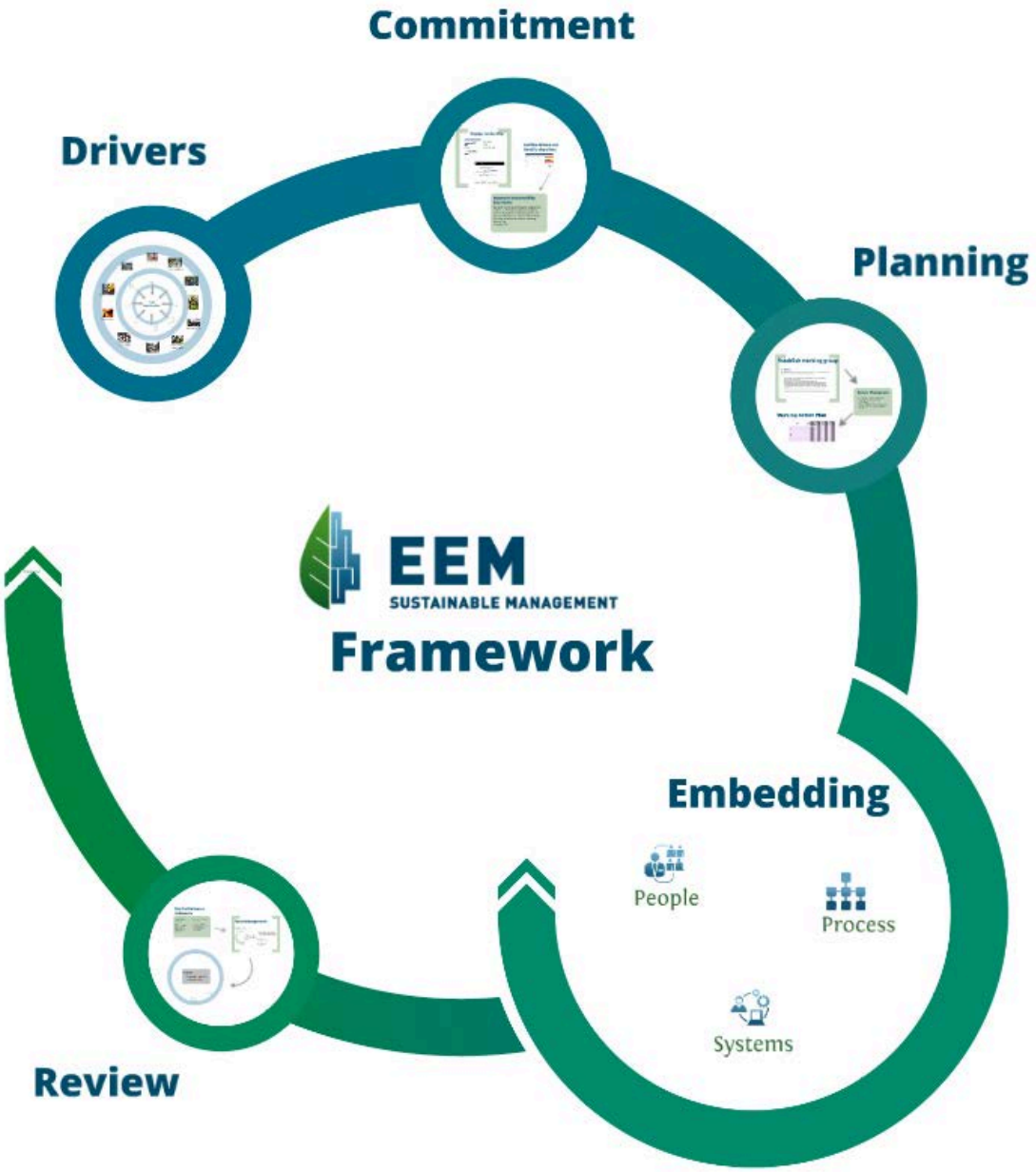
The transition to a low-carbon economy is a monumental challenge that will require deep commitment from all society influencers, including corporate leaders.

DEVELOPING A CORPORATE STRATEGY

While climate change may have been considered an external environmental issue up to now, the transition to the low-carbon economy has become a company-wide challenge, calling for strategy discussions, enterprise risk evaluations and action planning. If a company already uses sustainability thinking in its decision-making, the challenge won't be all new, but the urgency to take action is now heightened. If sustainable development considerations are not commonly discussed, it is important to do so now as carbon reduction plans or climate adaptation strategies need to take into account the full picture, so as to avoid unintended consequences, such as the hardships caused when farmland was repurposed for ethanol fuel production over food production[16].

We recommend a context review of the company's operations and facilitated workshops to increase the level of knowledge on climate and energy issues within the organisation, followed by workshops to explore different future scenarios and how the business will exist in the low-carbon future. Coming from this visioning exercise, EEM can help craft a strategy and develop implementation plans suited to the organisation's context, taking in account both the operational and cultural changes that will be required.

Context review and assessment of risks and opportunities related to environment are much better incorporated into the 2015 revision of ISO 14001. Read more in EEM's September 2015 White Paper.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Planning
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Framework
Embedding
People
Process
Systems
Review

ABOUT EEM

EEM inc. is a management consultancy offering leadership in sustainable business practices to a variety of industrial and institutional clients in Québec, across Canada and worldwide.

Building on more than 20 years of environment, health & safety, and community relations management work with industrial, public and First Nations clients from its Montreal offices, EEM offers a comprehensive suite of consulting services to assist its clients in developing sustainable business strategies and *operationalizing* sustainability.

EEM has three key service areas:

Strategy: Vision and objective setting, materiality assessment, sustainability embedding, performance measurement, and reporting.

Communities: Stakeholder engagement and communications, participatory planning, impact assessment, and socioeconomic assessment.

Environment: Environmental and health & safety management, regulations, impact assessments, biodiversity.

Stephanie Hamilton, ing., EP(Sustainability), Vice-President at EEM, heads up the Sustainable Development Strategy team. At EEM for over 20 years, Stephanie has seen a wide range of environmental challenges faced by companies. Today she is focused on accompanying our clients in their pursuit of sustainable development. Building on a career implementing environmental or integrated management systems, auditing and assisting clients with their environmental compliance obligations, Stephanie's efforts now centre on:

- the development and implementation of sustainability strategies;
- the definition and tracking of sustainability performance indicators;
- sustainability communications including corporate sustainability reports meeting international disclosure standards;
- facilitation of sustainable development committees or training events; and
- the communication of sustainable development issues with investors.

During a 10-year period, Stephanie guided the sustainability strategy of one of North America's largest printing and publishing firms with over 30 facilities. While working with senior executives as well as managers, she shaped the corporate sustainability strategy and set up a sustainability steering committee to oversee the strategy's evolution and its reporting to key stakeholder groups. For a period of 5 years, she was the driving force behind the company's sustainability report, taking it to a level B report in accordance with the Global Reporting Initiative's Sustainability Reporting Guidelines. She facilitated workshops with senior executives and provided training for company managers. She also played a leading role in the company's responsible paper procurement policy, which, over time, influenced supply chain sustainability. She worked on performance indicators, dashboards and reports for carbon disclosure among other sustainability topics.

Elsewhere, she developed an e-learning course on sustainability for a large engineering consulting firm. She facilitated scenario building and planning events with various stakeholder groups in the Montérégie of southern Quebec, as well as facilitated a participative planning workshop concerning a sustainability hub for McGill University. She co-developed the Green Plan for the Rogers Cup international tennis tournament and has prepared multiple company reports in accordance with the Global Reporting Initiative's Sustainability Reporting Guidelines.

Earlier in her career, Stephanie was central to the successful implementation and ISO 14001 certification of an environmental management system covering eight Canadian sites in the aerospace sector, with extensive time also spent at the Quebec facilities developing and training on operational control procedures and management system audits. Her extensive experience conducting and overseeing legislative compliance audits (she has participated in over 80 audits) is now being shared through NIMONIK, an environmental regulations database that guides subscribers through applicable environmental legal requirements. NIMONIK is a long-term partner of EEM.

Stephanie has a Bachelor's degree in Engineering with Business Management and is an accredited Environmental Professional with a specialization in Sustainability.

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