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Let's get this transition moving

Paper prepared for the Big Ideas for Sustainable Prosperity Conference
Low carbon economy panel

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This discussion paper makes four basic points about movement towards a low carbon economy in Canada. First, it argues that it is useful to frame the issue in terms of a *transition* to a low carbon emission society. Second, it notes that in the Canadian context the development of *regional pathways* to a green and low carbon economy is crucial. Third, it argues that while 'industrial strategy' has fallen out of political favour, we will need something very like '*green development strategies*' if we are to maximize the opportunities presented by this transition. Finally, it observes that we should think about *low carbon politics* as well as low carbon economics.

1. Framing the argument in terms of transition

More serious engagement with the challenge of climate change can be encouraged in Canada by framing the discussion in terms of **societal transitions**.

The idea of 'transition' suggests movement over time from one set of circumstances to another. It has been used widely in the social sciences to discuss long term processes of societal transformation. We talk, for example, of the transition from hunter-gatherer societies to settled agricultural communities, or of democratic transitions away from authoritarian rule. And there is an established discussion of energy transitions: the shift from traditional reliance on biomass to modern fossil fuel-based economies, which witnessed first the ascendancy of coal, then of oil and now (increasingly) of natural gas.

In the context of movement towards a low carbon society, the sort of transitions which interest us most can be described as 'socio-technical transitions', involving major shifts in core systems of societal provisioning, spanning one or more generations. They involve deployment of new technologies but also the adoption of novel social practices, rules and governance mechanisms. Such transitions can be appreciated at different scales, relating to their spatial extension, but above all to the reach of the social and technological practices involved. Obvious examples of socio-technical transitions from the past relate to transport systems, such as the switch from canals to railroads for the inland movement of goods, or the change from horse and buggy to automobiles for personal mobility.

A classic case of socio-technical change is the transition from sail to steam for maritime transport which took place over more than a century, between 1780-1900. Interesting observations of this historical process include: the role of niches in fostering the development of emerging technologies (for example, military vessels, tugs, transatlantic steamers); the recourse to hybrids during the transition process (ships with both engines and sails); and the fact that the established technologies improved during

intense competition with emerging alternatives (the simplification of rigging and dramatic crew reductions of sailing ships).

Historical experience suggests that periods of relative socio-technological stability -- where innovation focuses primarily on incremental improvements to a dominant design -- predominate. Path dependence and social and technological lock-in make a switch to an alternative trajectory difficult. At the outset novel technologies typically appear inferior (more expensive and with functional disadvantages); it is not obvious existing arrangements should be displaced; and attempts often fail. Yet with time problems accumulate for the existing regime, more challenging innovations emerge in protected niches, and a shift in broader economic, social and political circumstances (the 'landscape'), can open the way for a more or less significant reconfiguration of existing arrangements.

Over the last few decades a substantial academic literature on transitions has emerged, providing insight into historic processes of socio-technical change and reflection on the extent to which it is possible to orient and accelerate such changes to address issues of sustainability. Of course, it is common to note that while historical transitions have been largely 'spontaneous' (unplanned, driven mainly by private actors, with implications often appreciated only after the fact), a timely transition to a low GHG emission energy system would require conscious intervention by public authorities (involving regulation, expenditure, negotiation of international agreements, and so on). Yet care must be taken not to overstate this contrast. 'Visions' play an important role in orienting all transitions; states have often assumed an active role in mobilizing resources (think of railroads or the internet), and in reorganizing legal rules to facilitate change (expropriating property, changing regulatory rules, adjusting intellectual property regimes, and so on). Moreover, transitions typically involve protracted battles as interests associated with established socio-technical configurations deploy all the tools at their disposal to preserve their position.

Consider the transition from horse drawn transport to automobiles. Between 1880 and 1920 there was a burst of experimentation to develop a modern passenger vehicle, involving competition among alternative chassis configurations and power-trains based on steam, electricity, ethanol, and even compressed air. Ultimately the design settled on a four-wheeled vehicle driven by an internal combustion engine running on gasoline. And this 'dominant design' has been stable for a century. Over time hundreds of thousands of engineers, and vast amounts of capital, have been mobilized to secure incremental improvements that have given us the automobile we know today. As the industry grew, auto producers and their allies in the petroleum sector used a range of political and economic tactics to disable competitors (streetcars, ethanol fuels), institute societal norms compatible with the new regime (the offence of J-walking), and secure investment of societal resources (building national highway networks). Today the auto sector is closely integrated with the oil and chemicals industry, the production of steel, glass, plastics, synthetic rubber, electronic control systems, and so on. It involves networks of dealers, repair shops, institutes for training and design, finance (for firms and consumers) and insurance, and complex governmental regulation. Moreover, it has co-evolved with the design of buildings and the organization of cities. Yet today this socio-technical system is beginning to show strain. A variety of landscape factors (including climate change, 'peak oil', energy security, urban air quality) have increased interest in alternatives, including electric cars, plug-in hybrids, fuel cells, natural gas and hydrogen and biofuels. New business models are appearing (direct sale, car sharing), and there are hints in a shift in the interest of the younger generation away from vehicle ownership. Pressure from industry outsiders (Tesla, China) are disrupting established routines and creating radical uncertainty for the future path.

Framing movement towards a low carbon economy in terms of a transition has a number of advantages. From the perspective of *public discussion* it emphasises the fundamental and long term nature of the challenge, while helping to define a context within which public and private actors can approach energy decision-making. 'Transition' conveys the idea of change stretched over time: not a one-shot effort or an overnight turn-around, but a process of cumulative change that will span several decades. Moreover, 'transition' imparts a clear sense of directionality: although the pace of change may vary, its orientation is clear.

Over the past few decades discussion of climate change and energy policy in Canada has tended to focus on short term incremental goals. Instead we need to articulate a clear vision of where we want to end up, and consider current actions in relation to the long term goal. The basic science is clear: in the long run climate change mitigation implies reducing global GHG emissions to a few percent of current emissions. Limiting climate risks this century entails GHG reductions over the next three or four decades of about 80% in rich countries such as Canada with the virtual elimination of emissions from energy production and consumption. And this implies (among other things) a radical transformation of the energy system to drive out emissions from electricity production, the built environment, and the transport sector.

To extent that it is possible to establish a widely shared consensus, a transition framing provides a common point of reference for societal debate. Of course, it does not preclude argument about the pace and orientation of this transition or about which technologies and social adaptations to privilege. In reality, of course, we are dealing not with one transition but with a number of partially overlapping transitions involving energy production and consumption in varied sectors (industry, electricity generation, transport, the built environment, and so on).

A transition framing enables a critique of rhetorical exploitation of the phrase -- 'fossil fuels will continue to dominate world energy supplies for many decades to come' -- whose repetition is often taken as the entry ticket to 'serious' discussions of energy policy. Well, yes, of course fossil fuels will be with us for some time to come, but the point is to set society on a trajectory where fossil fuel usage generated GHG emissions will end. The sooner we start shifting our energy system in that direction, the sooner we will get there. So that low-carbon ambition needs to be brought forward into current energy decision making. Or consider the recent discussion of a Canadian energy strategy. For a while the language emphasised 'sound environmental stewardship'. Great. But what does that mean given the reality of climate change? More recently there has been reference to a 'transition to a lower-carbon economy while meeting current and future energy needs'. Better. Yet this suggests that we can define those energy needs without considering the climate change impacts of our energy economy. Above all we do not just need a transition to a 'lower' carbon economy (we are headed there slowly anyway as the GHG intensity of GDP gradually improves) but a transition to low-carbon economy, which in Canada implies a virtually GHG emission free energy system.

A number of countries have already adopted elements of a transition approach: Sweden with its goal of eliminating fossil fuels for transport over several decades; Denmark with its aggressive targets for renewable energy in the electricity system and the goal for an all renewable electricity system; even the UK with its Low-carbon Transition Plan (2011-2020) and national carbon budgeting process (although the current government appears intent on watering it down). The transition idea is most explicitly embodied in the German *energiewende*, which is intended to achieve a phase out of nuclear power even as it achieves ambitious climate change targets.

From the perspective of *policy*, a transition framing makes explicit the long term goal of dramatically curtailing carbon emissions (and reaching a carbon neutral energy system), encourages the development of alternative visions of how that goal might be achieved and the identification of pathways towards those visions. It can help coordinate societal actors -- consumers and producers, firms and public institutions -- providing a common point of reference for investment decisions and energy choices. It links up to other strategic approaches such as national, regional, and enterprise carbon budgeting. And it provides a framework within which to approach the design of particular policy instrument such as carbon pricing.

A transition perspective can also provide guidance for approaches to driving technical and social innovation and identifying the functional requirements for successful systems of innovation (). It points to the importance of developing: collective visions and transition pathways to further social; protected niches where novel technologies and social practices can be tried out; and a wide portfolio of experiments to generate variety on which selection pressure can act to improve the most favorable approaches.

From the perspective of *research*: a transition approach helps focus the research agenda on identifying barriers and enabling conditions for the low carbon transition, including issues related to technology development, social acceptability, experimental strategies, and so on.

2. Think about regional as well as national pathways to a low carbon economy

Until comparatively recently Canadian discussion of climate change was largely focused at the national level. To some degree this was understandable: national governments undertake commitments under the UNFCCC, and the constitutionally defined authority of the federal government, with its significant powers of taxation and expenditure, make it a potentially powerful actor. Yet with the abdication of federal responsibility attention turned to provincial programs (such as the BC carbon tax, Alberta's Specified Gas Emitter Program, the Ontario coal phase out), and engagement with US state-led initiatives. Still, for the most part these have been seen as 'second best' options, as suboptimal and expensive ways to implement GHG control. Clearly there is substantial truth to this perspective: a Canada-wide climate strategy with a coherent set of policy instruments is likely to be more effective and more cost efficient.

Yet I want to argue that in the Canadian context exploring *regional transition pathways* is of critical importance. Moreover, the national approach should be designed to enable these regional efforts and to encourage their mutual coordination.

Let's face it: the country is big, diverse, and politically decentralised. Above all, there are critical differences in the *energy political economies* of the Canadian provinces. By 'energy political economy' I do not just mean the energy industries related to natural endowments found in each region, although differences here are already profound. I refer also to the larger patterns of economic and political development related to energy which have emerged over time. This includes: the structure of the provincial electricity sector (generation sources, ownership and regulatory system); energy-dependent industrial and economic activity, as well as the government strategies and programs related to this activity; the intertwining of economic and political interests that lend a distinctive colour to provincial politics; and the energy-related linkages in the construction of regional political identity.

Consider the contrast between Alberta and Quebec. On the one hand, we have a jurisdiction with massive oil and gas resources, an economic development trajectory tied to hydro carbon extraction, a powerful petroleum industry lobby, a coal-based and deregulated electricity system, state reliance on hydrocarbon rents to keep tax rates low, a history of tension with federal government over energy, and a political culture deeply marked by its energy frontier status. On the other hand, we have a region with abundant hydro resources; a state run electricity system established during the 'Quiet Revolution' that is a symbol of national pride; an economic strategy that has been focused on leveraging cheap hydro for industrial development (aluminum, aerospace, now solar) and supplementing provincial revenues through electricity exports to the US; and an identity that draws on a green image. Again very different stories could be told in British Columbia, Saskatchewan, Manitoba, and so on.

The fact is that Canada's energy political economy is to a large extent a series of regional political economies. The current configurations have deep historical roots and are closely entwined with the overall development trajectory of the province. And precisely because of this history, with its significant lock-in and path dependence, efforts to accelerate the transition to a low carbon economy need to start from a clear appreciation of these particularities.

Now I do not want to overstate the case. There are also many unifying factors across the country. Oil sells to an international market, gas to a continental market, and electricity is traded across jurisdictions. Major energy firms are active in multiple Canadian regions. The Canadian banks are big players in energy across the country, and major projects tap international financial markets. Firms in eastern Canada provide goods and services to the Western oil boom, while labour is pulled to where demand is highest. Federal jurisdiction extends over many energy-related issues, providing a unifying frame. And consumers from coast to coast fill up their cars at the gas pump and expect the electricity to be there when their turn on the switch. Moreover, with respect to the transition to a low carbon economy it can be argued that many of the core technologies required will involve transnational production chains, and that Canadian firms contributing to the green economy must be competitive in these international markets rather than in local/parochial spaces.

All this is true, and yet in the Canadian context the very different regional political economies of energy, and the potential for provincial administrations to enable (or frustrate) the low carbon transition cannot be ignored. Transition pathways must take account of the existing energy industries, economic structure and infrastructure, but also of the potential to exploit new low carbon resources (wind, tidal, geothermal, biomass, etc), to redeploy existing economic or technical prowess into low carbon economic opportunities, to favour technical pathways and social innovations that are appropriate in particular circumstances, and to mobilise political and cultural specificities. Alberta has wealth from hydrocarbon exploitation that might be set aside to diversify its economy towards low carbon options; existing technologies could be adapted to low carbon uses (for example, geothermal energy production). There may be possibilities to generate carbon neutral energy from the bitumen resource. Alternatively there are routes to step away from the bitumen trap. Whatever, the pathways that are explored here, they will be rather different from those in Quebec, which (for example) has ideas about using its hydro surplus (exports to the US have fallen) for the electrification of transport.

Anyway here is not the place to try to elaborate regional decarbonization pathways. Rather my point is to argue that this needs to be done. Defining regional low carbon pathways would include:

- developing a good understanding of the historical trajectory of the regional energy political economy, and how past choices may enable or constrain low carbon development pathways;

- analyzing key regional economic clusters and leading firms, and their potential contributions to decarbonization effort;
- identifying critical technologies (but also social practices) with a particular significance for decarbonization in the regional context, given the character of local resources and economic structure;
- defining transition visions that build on existing strengths and opportunities;
- exploiting regional and local governance institutions and potentials;
- mapping complementarities and collaborative initiatives with neighboring jurisdictions;
- constructing story lines that exploit local/regional symbols, and resonate with established social and political traditions .

Clearly these sorts of issues would constitute the basis for a substantial research agenda.

3. Green economic strategies

Over the past several decades the idea of 'industrial policy' has fallen out of favour in most developed countries. It is not a great exaggeration to say that the accepted wisdom has been that the core contribution governments can make to long term economic prosperity is to provide a stable macroeconomic environment that allows private sector actors to exploit business opportunities, develop markets and drive forward innovation. Emphasis has been on trade liberalization, ensuring flexible labor and capital markets, and establishing policy regimes that encourage entrepreneurial activity, with perhaps some attention to education and training. And yet, notwithstanding the official rhetoric, the substantial consensus, and the formal rejection of industrial policy, *in practice* all OECD governments maintain elaborate programs intended to protect or encourage certain industries, strengthen domestic firms, build exports, attract foreign investment while controlling foreign ownership in strategic sectors, and steer technological development in areas deemed to be in the national interest. A vast array of policy instruments -- including regulation, taxation, depreciation allowances, investment credits, low interest loans, subsidies, and even occasionally tariffs or local content requirements, are deployed to this end.

The idea behind traditional industrial policy was that national economic development was too important to be left entirely to the whims of the market, that government intervention was required to steer economic activity, and that protection was sometimes needed to shield domestic industries from the structural power of international competitors. In short, industrial policy was linked to the idea of national economic development and power. It was deployed first by states playing industrial catch up in Europe, acquired a further twist during post-World War II economic reconstruction, and was then taken up by developing countries to steer their industrial rise. In its 1970s guise in countries like the UK it was seen as way to break out of stagflation, and associated with support for key economic sectors, nationalization of failing industries and the support of national champions. The actual practice of such industrial policy has been the object of numerous critiques, but underlying most is the idea that state policies that aim to achieve the policy-makers' ideas of what economic development should look like (eg establishing or preserving this industry rather than that industry) ultimately depress overall output and squander existing comparative advantages.

'Green economic strategies' can be understood as government intervention (at various levels) to encourage a greening of economic activity to meet economic, social and environmental goals. They

share with traditional industrial strategy a belief that state action is required to reorient the 'natural' path of economic development. They differ in that their focus is primarily to ensure a 'green shift', building the foundations for economic prosperity in an environmentally constrained world. I refer here to 'economic' strategies (rather than 'industrial' strategies) to emphasise that this is not just about material goods production but about economic activity writ large. And it is cast as 'green', rather than 'low carbon', because the economic adjustments required for climate change mitigation can then be set in the context of a broader array of environment and resource issues, which will in any case become increasingly difficult to disentangle, as the impacts of climate change become more severe. These include conventional air quality, water and land use management, biodiversity, and so on. () And, of course, this resonates with recent work by UNEP on 'the green economy', and the World Bank and the OECD on 'green growth' ().

The core political justification for governments (at various levels) to pursue green economic strategies is that the existing economic, social and political circumstances are so skewed, that state action is required to break historically constituted patterns of activity (path dependence, lock in) and to allow a timely shift to an alternative development trajectory. Economists would put this in terms of externalities that relate not just to the social costs of carbon (and to other forms of environmental destruction) but to other issues such as under investment because of the difficulty for firms to recoup the full benefits of innovation. So while carbon pricing is essential, it is not adequate. After all, there are political reasons why the carbon price is unlikely to be set high enough to secure desirable change. And while policy frameworks that encourage innovation in general can be helpful, they can also generate innovation that is counter-productive from an environmental perspective.

Let me make clear that I am not advocating a return to old fashioned industrial policy that depends on tariff barriers to protect domestic industry from international pressures, or that funnels huge amounts of public money into designated national industrial champions. I do not think governments should compete with one another, offering public money to attract transnational firms to their district. Nor should the idea be to make green investments to secure specific job numbers in designated sectors. And yet there is a great deal that governments can do to encourage the emergence of green economy -- beyond a carbon tax and maintaining the general framework conditions for a healthy innovation-oriented economy.

One of the arguments involved with industrial strategies is that 'states are not good at picking winners' (technologies, but also companies and even sectors). Well, in the first place no one is particularly good. For every hundred bright ideas dreamed up by engineering professors, only a handful make it to the start-ups phase, and most of these fail. Moreover, private sector firm regularly go belly up or become vulnerable to take over by competitors because of bad technology bets. On the other hand, dominant firms can continue for decades making money with socially suboptimal technologies, because informational deficits, barriers to entry, un-priced environmental externalities, and so on prevent alternatives from getting established. And while firms that place losing bets eventually disappear, states hang around and can be reminded of their mistakes.

Green economic strategy does not necessarily mean picking specific technologies. In many contexts it is sufficient to define functional requirements, and leave it to competition among firms and technologies to see who can deliver the most attractive package (acceptable performance at reasonable cost). On the other hand, policies which simply encourage the uptake of the lowest cost (functionally adequate) technology may provide insufficient support for potentially higher performance technologies that are further from market (and which therefore require more targeted support). Moreover, it is important to

realize that in relation to many large scale energy technologies government cannot simply stand by and 'let the market decide'. The scale of social investment required, the potential social impacts, and the nature of the risks mean that developments will not proceed unless the public power decides whether it wishes to support a given trajectory. For example, there is no possibility that new nuclear installations will be built or CCS projects implemented unless the state accepts the ultimate risk. States are already involved up to the hilt in structuring energy markets, the question is how to tip the table so low carbon development policy is advanced.

The most helpful starting place is considering how to exploit existing resources, infrastructure, technological capacity and expertise in order to leverage into greener areas. In other words, how can existing comparative advantages be extended in new directions. And how can potential comparative advantages that might emerge in the context of world that presses more closely against environmental limits, be actualised. Canadian political economists spoke of exploiting resource linkages to break free from staple- (on this case also carbon-) traps (Innis abcd, Haley wxyz). Here one might consider sideways steps to use existing resources in more sustainable ways, green existing industries, and adapt technological strengths for new areas. And, there is also the theme of investing in natural capital that over time can enhance resource productivity while bringing environmental benefits.

The idea of green development strategies provides many promising avenues for research, particularly in learning what does and does work and how to avoid costly mistakes. There are a number of possible tracks including: investigating what other jurisdictions have done and are doing; closer examination of Canadian experiences both with traditional industrial policy (such as the oil sands development) and with the green economy (for example, Ontario's Green Energy and Economy Act).

4. Think about low carbon politics as well as economics.

Finally, I want to suggest that we need to spend more time thinking about low carbon politics. After all, the primary obstacles to moving towards a low carbon economy are not technological. They are not even economic, in the sense that such a movement would impose debilitating economic costs or threaten long term prosperity. Above all they are political: because policy action is required to tilt economic development away from its current GHG emitting fossil energy path. And, so far, powerful economic interests that benefit from current arrangements have been rather successful in hampering the emergence of a more determined political stance. Of course, developing such a stance in a country that earns so much of its way in the world through hydrocarbon exports was never going to be easy.

The truth is that at present we have lots of neat policy designs and instruments that could accelerate a transition to a GHG emission free energy system. But we do not yet have the political conditions for them to be put in to play. So here are a few suggestions that could be cited under the heading of thinking more politically.

- *building coalitions*: how can we establish political coalitions that are interested in driving forward the transition to a low carbon economy? In this context strengthening a green business sector is important not only economically but also politically: because such a sector will mobilize resources to push economic greening further. And we might ask: what can be learned from the experience of other countries?
- *governance institutions*: how can we set in place institutional mechanisms that can maintain momentum for a low carbon transition over the longer term (even when the attention of political

leaders and the public wander)? The UK system of long term carbon budgets, with its independent Climate Change Committee and system of parliamentary reporting, provides an example along these lines.

- *distributional burden sharing*: one of the successes of EU climate policy was to institute a burden sharing approach (with differentiated climate targets) that acknowledged the varying circumstances of member-states, allowing more enthusiastic states to push ahead while recognizing that others would eventually have to pull their weight. No comparative Canadian mechanism exists.
- *in politics and policy efficiency is not everything*: while lowest cost solutions are desirable, the messy character of political bargaining, and the layering of new policies on top of old, mean that it is very hard to find policy areas where design and implementation are ideal. The low carbon transition is unlikely to be any different. Ontario's coal phase out was achieved by political fiat, over and above the objections of industry insiders. Equivalent carbon reduction might have been achieved more cheaply by carbon pricing. But carbon pricing was not on the table. Sometimes a policy that strikes at a narrow target, is politically easier than one that more directly involves wider publics.
- *delegitimizing opponents is a critical transition maneuver*: transitions are not just about technologies, but about the definition of social norms, public preferences, habits and tastes. They involve cycles of hype and deliberate attempts to undermine the appeal of alternatives. Supporters of large scale fossil (or nuclear) generation contrast the 'reliability' of their facilities with the 'intermittency' of new renewables, while the supporters of wind and solar now complain about the 'inflexibility' of traditional plants. US campaigners have made the Alberta tar sands the poster child for irresponsible hydrocarbon development. Whether or not they succeed in blocking the XL pipeline they have raised their profile and increased the costs of doing business. In a similar sense it does not matter whether detail's of Neil Young's comments about the tar sands are entirely accurate. Twenty years of denial, obfuscation and resistance to climate policy led by producer organization like CAPP, and compliant governments, have earned their reward.
- *weakening the structural power of incumbents can open the door for change*. Incumbents enjoy economic and political ascendancy. Anything that weakens either strand can build momentum for change. For example, it is in transport where fossil fuels enjoy their greatest ascendancy. Rather than leaving this for last (because it is harder) immediate efforts to spur countervailing innovation can open up options. In the personal transport sector electric vehicles stand furthest from the established trajectory. Even the threat of significant electric vehicle (or plug-in hybrid) penetration in major markets would have a powerful impact on oil producers. If nothing else it would stimulate innovation in directions (like biofuels and hydrogen) where established firms have some hope of controlling long term supply. So investment in EV might make sense whether or not they ultimately emerge as the dominant personal low carbon transport solution. And weakening incumbents economically also weakens them politically.