

INNOVATION
POLICY LAB

munk school
OF GLOBAL AFFAIRS & PUBLIC POLICY



UNIVERSITY OF
TORONTO

THE POLITICAL ECONOMY OF ENERGY TRANSITIONS IN CANADA: IMPLICATIONS FOR THE AUTO INDUSTRY

David A. Wolfe and Nathan Lemphers

INNOVATION POLICY LAB WORKING PAPER SERIES 2023-02

This chapter¹ explores the broader implications of the current energy transition from a carbon-based energy paradigm to one based on decarbonized energy sources for the automotive and broader transportation sector. This transition carries grave implications for two of Canada’s leading economic sectors — automotive and oil and gas — two of the sectors that will be most directly affected by the prospective transition. The chapter focuses on the two provinces most directly affected by this transition — Ontario and Alberta — but also explores the implications for Québec. Ontario’s automotive sector is on the cusp of a major restructuring that will determine whether it continues to enjoy the status of a semi-peripheral automotive region it has held since the mid-1960s under the Auto Pact and the successor North American trade agreements, or whether it follows the steady path of decline that it has experienced since the early 2000s (Mordue and Sweeney 2020; 2017; Anastakis 2013). While this restructuring most directly implicates Ontario’s manufacturing sector, the energy shift creates broader implications for the political economy of the Canadian federation through its impact on the provincial economies of Alberta and Québec, given that energy products and motor vehicles combined accounted for 37 per cent of Canada’s total exports in 2020. The Ontario and Alberta economies, based as they are on manufacturing and resources, have long been viewed as representing antithetical interests, particularly since the OPEC price revolution of the 1970s (Simeon and Robinson 1990, 236–249). In contrast, we argue that, since the late 1940s, the two provinces have been equally locked into the “carbon trap” in terms of the mutual dependence of their primary economic sectors on the production and consumption of carbon-based energy (Haley 2011). Consequently, they face similar challenges in restructuring their economic base in the coming transition to decarbonized energy sources and electrified transportation.

¹ Forthcoming in *The North American Auto Industry Since NAFTA*, edited by Dimitry Anastakis and Greig Mordue, University of Toronto Press, Toronto, 2024.

The future of the global automotive industry itself is being reconfigured by the shift in the socio-technical regime from the carbon-based technology of internal combustion engine vehicles (ICEVs) to the emerging battery electric vehicle (BEV) paradigm (Dijk 2016). Socio-technical transformations, in turn, are driven by the complex interaction of institutions, networks and firms that comprise the prevailing paradigm (Weber and Rohracher 2012; Markard, Raven, and Truffer 2012). As Matthews has observed, carbon lock-in comprised a dominant feature of the fourth techno-economic paradigm that emerged in the 1940s. “The breaking of carbon lock-in via creative destruction [is] the key challenge for the emergence of a new era based on renewable energies” (2013, 11; Freeman and Louçã 2001). While the pace of this transition remains open, the latest data indicate that BEVs are progressing from a small niche in the automotive market to an ever-larger share of automotive sales. Global electric vehicle sales accelerated in 2020, despite the pandemic, rising by more than 41 per cent to 3 million cars, representing 4.6 per cent of all vehicle sales. In the first quarter of 2021 they rose by 140 per cent compared to the same period in 2020 driven largely by sales in Europe and China (International Energy Agency 2021, 5). This shift towards electromobility forms one part of a larger disruption in the automotive sector that includes the introduction of connected and autonomous vehicles (C/AVs), and new forms of shared mobility (Covarrubias V 2018; Council of Canadian Academies 2021). The pressure on traditional automotive regions and conventional automotive producers is intensified by the challenge from new technology competitors from outside the traditional industry (Proff 2020, 341), and the growing presence of Chinese producers backed by strong state support (Jetin 2020). Governments in the U.S. and Europe have also dramatically expanded their support for the shift to BEVs (Goracinova, Galvin and Wolfe 2022).

The complex mix of technology systems that comprise automobiles today compounds the challenge of restructuring. Current technologies include new applications based on sophisticated embedded electronics that provide new functionality for automobiles. Key among these changes is the move toward electric mobility; the extent of the disruption given evidence in the integration of electric components, advanced materials, and battery packs and associated battery materials. These challenges are explored by Kazzaz et al. in Chapter 8.

As the transition to electrification unfolds, manufacturers will confront a range of challenges including the introduction of new producers from a cross-section of industries into the automotive sector's value chain. Meanwhile, intensified competition for a dwindling supply of natural resources will accelerate the pressure for product and manufacturing energy and resource efficiency. That process will highlight issues surrounding the organization of regional supply chains. At the core of these developments rests the difficulty of separating R&D/design and manufacturing processes because of complementary relationships between product and process innovation (Breznitz and Cowhey 2011; Pisano and Shih 2009; 2012). This issue goes to the heart of Ontario's challenge in managing the transition to BEV production based on different components and manufacturing processes than the ones in which it has traditionally excelled. Likewise, the accelerating shift to decarbonized energy sources for power generation and transportation underlines the vulnerability of Alberta's economy, as witnessed during the COVID-19 pandemic. As this chapter demonstrates, lessons can be learned from Alberta's previous efforts at economic diversification and emerging initiatives to improve the province's competitiveness in a rapidly decarbonizing global economy. The big winner in this transition may prove to be Québec, whose hydroelectric based energy source, cross-sectoral innovation policy and well-established development coalitions afford it an early head start in the emerging socio-technical energy system.

Theoretical Perspectives

The chapter draws upon two distinct bodies of literature to analyze the implications of the current energy transition for Canada's broader political economy and the future role of the automotive sector within it. First is the work in economic geography on new path creation and asset modification in terms of how the emergence of new technologies and new industries affects the trajectory of development in regional economies. Neither socio-technical systems nor institutional settings exist in abstract space, but rather in real geographic places that constitute their respective national and regional innovation systems, with distinct power relations, governance arrangements and firm and network dynamics. Economic geographers have long observed that complex systems of technology, production processes, industrial organization, and their supporting infrastructures of social and political institutions, exhibit distinctive spatial characteristics. Periods of transition from one set of technologies, and its associated production paradigm, to another, tend to coincide with a reorganization of the spatial distribution of production. The term "territorialization" describes the range of economic activity that depends on resources which are territorially specific. The types of resources involved can include assets that reside only in a certain place, or more critically, assets whose real value emerges from geographically proximate inter-organizational or firm-market relations. The more rooted the economic activities of a region are in the assets of that region, the more fully territorialized are those activities (Storper 1997).

The way the pattern of production is reorganized within a given region in the context of a major paradigm shift alters its developmental path. The concept of new path development is used to analyze the ways in which existing sectors change or new ones emerge in a regional economy (Hassink, Isaksen, and Trippel 2019). Trippel et al. advance a typology of four path development processes relevant to a green economy: path renewal, diversification, importation, and creation.

Path renewal refers to intra-path changes within established sectors. These changes could include new technologies, organizational innovations or business models that improve environmental performance. Path diversification describes the “process through which knowledge and other assets from existing green industries or brown sectors are transferred to emerging green industries that might be either related or unrelated to the established economic structures” (2020, 3). This intentional transfer manifests as the branching of firms, spin-offs, and the mobility of entrepreneurs and qualified labour. Path importation connotes the establishment of new green regional industries through the inflows and anchoring of non-local assets, which could include firms, talent, or knowledge. Path creation represents the rise of new green industries and often emerges from academic spin-offs and the development of new green firms.

Frameworks for analyzing new path development identify several key elements that constitute a comprehensive basis for analysis (Hassink, Isaksen, and Trippel 2019; Mackinnon et al. 2019). They suggest the need for a multi-actor perspective that accords attention to the role played by different economic and institutional agents. Ideational factors, such as actor expectations about future technology trends and opportunities, also play an important role in shaping the current strategies toward the realization of future opportunities (Grillitsch and Sotarauta 2020). However, a set of interrelated factors operating across multiple geographic scales also shape the process of new path development. Multinational enterprises (MNEs) pursue actor-level strategies in their global operations that may intersect with those adopted by agents at the regional level and impact regional path development through the process of strategic coupling (Mackinnon, D. 2012; Cantwell 2017; Yeung 2020). This underlines the need to recognize the linkages between local innovation-related assets (technological capabilities, firms, and institutional supports) and the interests, needs and strategies of translocal actors, particularly MNEs (Coenen, Benneworth, and

Truffer 2012). The challenge is to reconcile the explanatory factors that influence the evolution of existing industrial structures and institutional capabilities of a region with the disruptive changes occurring in technology systems and global innovation networks at broader geographic scales (Mackinnon et al. 2019; Binz and Truffer 2017).

The second body of work this chapter draws upon from political science and political economy concerns how underlying changes in the economic structure of regions and nations affect the alignment of social and political forces in support of alternative directions of economic development to form new development blocs/development coalitions. For political scientists, dynamics among established institutions embed and coalesce the existing power relations among groups in society. Institutional change reflects deeper realignment of societal power relations. The application of path dependence to institutional trajectories is echoed in the work of John Zysman who argues that distinctive institutional structures across nations are the product of historically conditioned political and industrial development, which define the choices available to firms or actors as they respond to new economic or technological trends. For Zysman, historically conditioned and nationally specific institutional structures create distinctive patterns of constraints and incentives that frame the choices of individuals and structure the terms on which agency problems are confronted. Contemporary political economies operate within an institutional framework that originated in the political process of state building, which accompanied and facilitated the emergence of modern industrial economies. The critical factor in determining national and regional institutional trajectories was how political coalitions formed around choices framed in response to the crises associated with the emergence and development of industrial economies (Zysman 1996; 1994; Gourevitch 1986). The key question for this chapter is how regional economies directly tied to the carbon economy will respond to economic crises

transmitted by exogenous economic and technological changes and how domestic coalitions will align to allocate the distributive implications of the transition.

We link this analysis to the recent work by Bernstein and Hoffmann (2018) who attempt to explain the politics behind experimental initiatives and how these interventions can catalyze broader decarbonization. Through normalization, capacity building, and coalition building, they argue, discrete governance interventions can propagate wider system effects of scaling and entrenchment, potentially leading to a trajectory of transformative emission reductions. This approach stresses the similarity of climate governance experiments by tracking three political causal mechanisms within mutually reinforcing subsystems across multiple scales. Incumbent economic actors and institutions largely shape the degree of contestation and cooperation exhibited in policy experiments focused on decarbonization. The transformative mechanism of capacity building works through changing the material, institutional and cognitive capacities of actors (Bernstein and Cashore 2012). Norm change alters expected appropriate behaviour. Mediated by local politics and institutions, norms represent a key driver of public policy change and actor interests (Finnemore and Sikkink 1998). Coalition building identifies and links winners and can neutralize losers. It works through empowering certain actors, building constituencies, and using market forces.

The key issue to be explored is how the potential distributive consequences of the technology transition from carbon-based energy and automotive systems to decarbonized ones – creating winners and losers throughout — will affect the political and policy responses in the regions affected. How are the processes of new path development playing out in the regions highly dependent on traditional carbon-based energy systems, such as Ontario and Alberta? As Zysman argues, this will depend on trajectories of policy development and the role played by coalitions of

regional interests in allocating the gains and losses arising from the transition to the new paradigm. The fundamental question is how coalitions are forged in the respective regions and whether coalitions are used to build the winning conditions for the emerging paradigm? Bernstein and Hoffmann (2018) build on Zysman's insights on coalition building to consider the role of norms and capacity building. How do regional actors come together in coalitions, reallocate resources, to normalize and realize a post-carbon energy system? Coalitions without capacity or even well-resourced coalitions shouting from the margins of society are not necessarily powerful. But if you pull them all together that can help shift a region's trajectory.

The Energy Transition in the Political Economy of the Canadian Federation

Canadian federalism complicates the transition to a more sustainable energy paradigm. This shift will play out in a constantly evolving national political economy with changing interprovincial relations. Two outstanding features of Canadian political economy have fundamentally structured regional development: a highly decentralized federal system of government and an equally regionalized economy. Indeed, the country's immense physical geography concentrates diverse resources in specific regions, each with distinct economic structures, industrial cultures, and policy challenges (OECD 2002). Far from static, the political economy of the Canadian federation has evolved over the past century and a half. The complex interaction between the underlying organization of the economy across its diverse regions and the coalitions of social actors rooted in the productive sectors of those regions — mediated by ethnic and regional identities — have driven this evolution. According to Simeon and Robinson, understanding the dynamics of the federal system in Canada requires a blend of a society-centred and state-centred perspective (1990, 9–16). To this we would add that the dissolution and reconstitution of coalitions of economic and social

actors in response to the socio-technical transitions discussed above exerts a strong influence on the framing of societal interests.

The structural break between the dominant, carbon-based Fordist paradigm of the postwar period and the emerging paradigm of the post-carbon economy has direct bearing on how these social, political, and economic relations will be reconstituted. Typically, the interests of Central Canada — Ontario and Québec — are pitted against Alberta and Saskatchewan as manufacturing regions versus resource and energy-producing regions. This facile categorization overlooks subtle differences and similarities that carry significant implications as the country undergoes the transition from a carbon-based to a decarbonized energy paradigm. Throughout the postwar period, both the Alberta and Ontario economies were inextricably tied to the carbon energy paradigm. One region emerged as the key producer of carbon-based energy and the other became home to automotive manufacturing sector — a key consumer of carbon-based energy through the dominant design of the internal combustion engine (ICE).

In the late 1940s, several factors crystallized to form the basis for a new accumulation model that underlay the long wave of postwar economic expansion. The core technologies of low-cost oil, petrochemicals, and synthetic materials sustained this accumulation model. Together with consumer durables and motor vehicles, these materials powered a carbon-based, energy intensive, mass production paradigm of economic growth. Petroleum was embedded at the heart of this paradigm. The widespread adoption of new refining techniques in the 1940s, dramatically transformed oil production and, along with advances in electricity generation, helped to lower its relative cost curve (Freeman and Louça 2001, 271–282; Perez 1983). The carrier branches of the new technological style consisted of the automotive and petrochemical industries, whose products created intensive demand for the resource. The collaborative R&D effort by most of the leading

oil companies between 1938 and 1942 was especially consequential. It led to the development of the fluid catalytic cracking process that ensured a steady supply of fuel to meet both civilian and military demand. By the end of the war, the interrelated technologies were positioned to power the dynamism of the new growth model into the postwar era. Not surprisingly, the technologically intensive industries associated with the new style, including crude and refined oil, natural gas, motor vehicles, chemical products, electrical equipment, rubber, and plastics, were among the fastest-growing sectors in the postwar period across the leading industrial economies (Freeman and Louçã 2001, 284–85).

The discovery of oil at Leduc in 1947 quickly transformed Canada from an energy importing economy into an energy producing and exporting economy. But it also dramatically transformed the balance of power within the federal system between the federal government and the provinces, as the beneficial impact of the petroleum-based economy was not restricted to Western Canada. Rather, its economic benefits extended into the central Canadian heartland, as Ontario benefited from the dramatic expansion of the Sarnia petrochemical complex developed during World War II, the continuing expansion of its automotive sector, and the widespread use of coal and later natural gas to expand the province's electricity generating capacity. Petroleum's growing importance transformed the balance of power between levels of government within the federation and among different regions.

As Garth Stevenson has noted, the rise of new regional centres of power in the Canadian federation during the postwar period, particularly Toronto, Vancouver, and Calgary, was closely tied to the shift in the locus of economic activity to new resource-based economic activities, largely under provincial jurisdiction and closely tied to the strong inflows of foreign direct investment from the US (1977, 78). The economic prosperity of both Ontario and Alberta was tied to the

dramatic expansion of the carbon-based energy system. In turn, that system was linked to new petroleum refining techniques and the diffusion of standardized techniques of mass production that originated in the automotive assembly sector of the economy. Beginning in the 1960s and 1970s, several observers commented on the emerging regional dynamics at the provincial level, most clearly reflected in the “prairie capitalism” of the western provinces (Richards and Pratt 1979). Despite the growing tension between energy consumers in the manufacturing heartland and energy producers in the resource-based hinterland from the 1970s, we suggest that the postwar rise of these regional centres shares more in common than they differ regarding their mutual dependence on the production and consumption of carbon-based forms of energy.

The Evolution of Ontario’s Auto Sector

Ontario rode the long wave of postwar economic expansion in both the manufacturing and resources sectors to replace Québec as the economic heartland of the economy as Canada’s trading patterns shifted from an east—west to a north—south basis and the inward flow of U.S. branch plants to the southern Ontario economy. Historically, much of Ontario’s resource economy supplied the US need for industrial materials, particularly minerals and pulp and paper. Today, the province retains its dominant export orientation. In the earliest phases of industrialization, British firms comprised the principal sources of investment capital in Central Canada, though American interests usurped their dominant position by late in the nineteenth century and the trend has continued to the present. Most of Ontario’s manufacturing industry grew up behind the sheltering walls of the protective tariff. As the industrial heartland of the national economy, Ontario benefited disproportionately from federal tariffs and other policies that promoted import substitution industrialization. The result was a truncated manufacturing sector, relying excessively on the

presence of foreign branch plants, with production geared to supplying the domestic economy. This trend was reinforced by the signing of the Canada—U.S. Auto Pact in 1965 (Anastakis 2005; Wolfe 1978).

Ontario, as the industrial heartland of the national economy, experienced many of the same trends that affected the country. In the expansionary atmosphere of the “golden age” after World War II, provincial governments in Ontario relied upon federal management of the economy and Canada’s improved trade relations to create the appropriate context for provincial economic development. Throughout the period of its economic ascendancy, Ontario’s economic and political elites were largely the same as national elites and viewed their interests as strongly aligned, “... until the early 1970s Ontario basked in the economic and political glow of its position within the federation” (Courchene and Telmer 1998, 15). To the extent they pursued a consistent set of economic development policies, provincial governments focused on the provision of infrastructure investment in highways, electric power generating capacity, support for municipalities in building water and sewage systems, and, in the decade of the 1960s, a dramatic expansion of the post-secondary educational system. The Automotive Products Agreement negotiated by the Canadian federal government with the US in 1965 represented the most significant piece of industrial policy for the province in this period (Rea 1985; Anastakis 2005).

The long period of growth and prosperity began to fade in the 1970s as the pressure of trade liberalization produced by the successive rounds of GATT negotiations exposed the structure of the domestic economy to more intensive international competition. This occurred in tandem with slowing economic growth, declining productivity levels and rising unemployment resulting from the exhaustion of the growth potential in the postwar paradigm of standardized mass production (Glyn, et al. 1990, 72–98). The dual energy crises in 1973-74 and 1979-80 hit Ontario

hard but the province was spared the worst effects of the energy price shocks by the federal government's two-price energy policy — especially in comparison to the US where the manufacturing sector immediately absorbed the full impact of the price hikes. For the most part, Ontario was spared the major job losses, downsizing, and restructuring that occurred in the US Midwest during the recession of the early 1980s (Anastakis 2013; Courchene and Telmer 1998).

The province's economic outlook changed dramatically in 1990. Although Ontario became gradually more integrated into the North American economy over the postwar period, the introduction of the Free Trade Agreement with the US in 1989 accelerated the restructuring of the manufacturing sector. While the notion of province-building in Ontario as the industrial heartland did not originate in the 1980s and 1990s (Nelles 1974), Ontario's determination to focus on the development of its regional system of innovation represented a dramatic break with the role it has played in the federation since 1945. The Liberal government in power from 1985 to 1990 voiced significant opposition to the federal government's negotiation of the Free Trade Agreement with the US, which it feared would undermine the protected position of its manufacturing sector. The more activist role adopted by the province was symptomatic of the growing divergence between Ontario's perception of its need for a regionally based development strategy and the federal government's reliance on a trade-led adjustment strategy (Cameron 1994, 114–17).

Within Ontario's manufacturing sector, the automotive industry holds a dominant place as the site of a significant proportion of North America's auto assembly by the US OEMs and, since the 1980s, by Japanese OEMs. This was reflected in the oft-repeated phrase that “one in six” jobs in the province were linked to auto assembly (Anastakis 2013, 335-37). During this period of rapid expansion in auto production, close alignment arose between the federal and provincial governments, provincial economic elites, and the union representing autoworkers, now Unifor, in

securing production at existing and new automotive assembly plants. Beginning with three major investments by Japanese transplants in the 1980s — Honda, Toyota, and GM-Suzuki — virtually every new investment by an OEM was subsidized by one or both governments, including the bailout of GM and FCA after the 2008-09 financial crisis (Anastakis 2013; Mordue 2020; Gertler and Wolfe 2004). Besides the five OEMs currently assembling vehicles in the province, the region is also home to over 700 parts producers in the supply chain plus 500 tool, die and mould makers, with 85 per cent of the product exported (Government of Ontario 2019). Ontario also boasts several domestic Tier 1 suppliers who have expanded under the continental trade and production agreements to become large global industrial entities, including Magna International, ranked 6th in the world, Linamar, Multimatic, Wescast, Woodbridge Foam, AGS Automotive, and Martinrea (Sweeney 2020; Council of Canadian Academies 2021, 39). However, a series of disruptions in the North American automotive industry since the early 2000s, including changes in consumer demand for the product mix allocated to Ontario plants and the impact of the 2008/09 financial crisis, has resulted in a shift of production to the American south and Mexico, leading to the increasing commoditization of the automotive sector (Klier and Rubenstein 2013; Mordue and Sweeney 2017; Yates and Holmes 2019). As a result, the value of automotive production has fallen from a peak of \$18.9 billion in 2005 to \$15.4 billion in 2019 and employment in assembly and parts manufacturing declined from its peak of 175,000 in the late 1990s to 133,000 in 2019 (Sweeney 2020; Clean Energy Canada 2020).

Ontario's position as a semi-peripheral automotive region is captured by Mordue and Sweeney in Chapter 1 of this collection. Key attributes of such locations include growing global competition arising from a steady and growing process of commoditization of automobile production as well as a relative lack of R&D. Canada's automotive industry ranks among its least

R&D-intensive industries, with the level of investment at about 12 per cent of the OECD average. The reliance on foreign technology in the largest manufacturing sector has been identified as a key factor explaining the Canada's weak innovation performance, consistent with its status as a semi-peripheral automotive region (Council of Canadian Academies 2009; 2018). Landmark agreements such as the Canada-US Auto Pact and NAFTA, which prioritized production over innovation-related activities, reinforced this reliance (Anastakis 2005; 2013). Recent studies maintain that manufacturing R&D in the automotive sector continues to gravitate towards those jurisdictions in which MNEs headquarters are based, suggesting a relatively bleak future for the region (Mordue and Sweeney 2020). However, automotive R&D spending increased from \$213 million in 2014 to \$329 million in 2019, reflecting the recent expansion of software R&D facilities by GM and Ford, among others (Sweeney 2020, 12).

The enduring semi-peripheral status of the Ontario automotive sector and the relative lack of automotive R&D jeopardize its future as the foreign OEMs have accelerated their transition to BEVs and plug-in hybrid electric vehicles (PHEVs) over the past half decade. While Ontario is home to the assembly of two conventional hybrid models by Toyota and one PHEV model by Stellantis, without substantially larger EV production mandates it risks being left behind as both American and Japanese assemblers shift their production to non-ICE technologies. The closure of GM's last assembly plant in Oshawa in December 2019 sounded a premonitory warning for the sector and entering the round of collective bargaining in the fall of 2020, seasoned observers believed that the future of other assembly plants could be at risk as well.

The Oil and Gas Era in Alberta

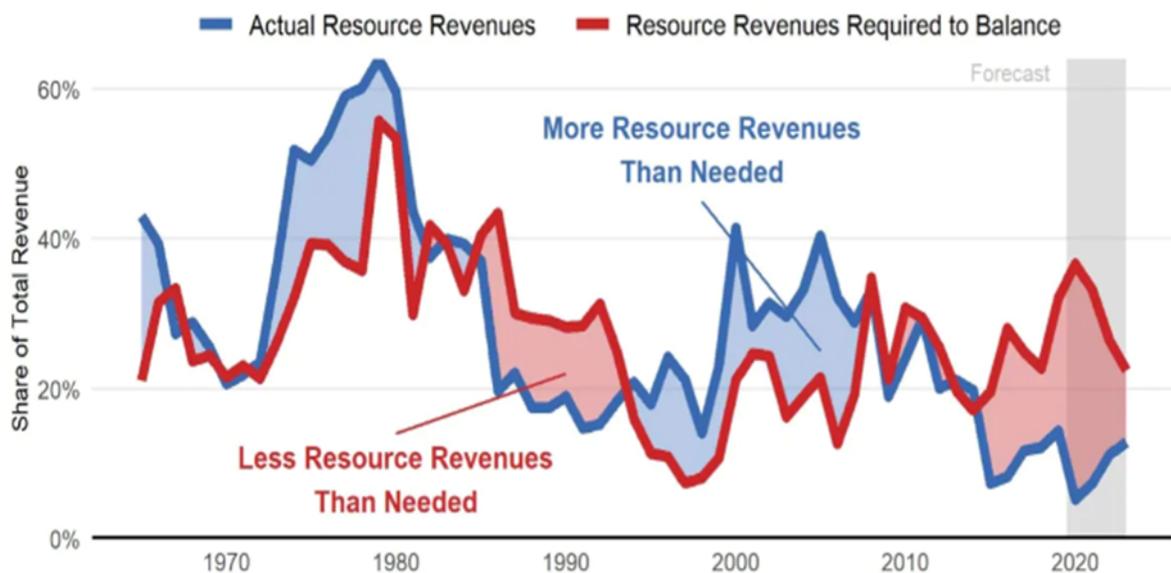
Like Ontario, we view Alberta as a region state: an area with shared economic interests, of sufficient size to maintain the digital and physical infrastructure and supporting professional services required to support a regional concentration of firms that can compete in the global economy (Ohmae 1995). Many scholars have pointed out the inherent tension between greater globalization and the increasing importance of regionally concentrated firms and industries. In the current era, the twin crises of the COVID-19 pandemic and the climate emergency underscore the need for increased resilience in global supply chains and regional economies. Materially, this can mean both regionalizing supply chains to protect against distant disruptions or diversifying the regional supply base. Past economic and political crises faced by Alberta and the ongoing challenge of diversifying its economy offer some insights into how Alberta can navigate its future in a post-carbon world.

While Ontario has long enjoyed its position at the centre of political and economic power in Canada, since its creation in 1905 Alberta has sought to wrest economic control from central Canada (Janigan 2012), more specifically from federal legislators in Ottawa and industrialists and financiers in Toronto. Unlike British Columbia, which secured control over natural resources when it joined confederation in 1871, it took until 1930 for Alberta to gain jurisdiction over the development of its vast natural resources. Despite this clarified division of powers — enshrined in the 1982 Constitution Act — and the diversification of capital sources for Alberta away from central Canada, interprovincial political animosities have remained. This conflict was epitomized in the struggle over oil prices in the late 1970s between Alberta Premier Peter Lougheed and Prime Minister Pierre Trudeau and the ill-fated the National Energy Program of the early 1980s. In the early 2010s, this regional friction resurfaced as Alberta’s booming oil exports to the United States

drove the value of the Canadian dollar higher, eroding a key competitive advantage for Ontario's export-oriented auto manufacturing sector.

Notwithstanding these sometimes fractious political and economic dynamics, Alberta and Ontario remained firmly entangled in carbon-based industrial development. In Alberta, oil and gas extraction became a major industry following the 1947 discovery of oil in Leduc, just south of Edmonton. As family farms disappeared with the increasing productivity of agriculture, many rural communities depopulated and faced economic hardship. In this context, the ascendent oil and gas industry assumed even greater importance for Alberta's prosperity and provided an economic lifeline for those communities. The Alberta Treasury and the balance sheets of municipalities and households grew more dependent on oil and gas production as a font of prosperity. This reliance on significant oil and gas-related revenue allowed the province to keep taxes much lower than other Canadian provinces; however, it also bound the province's fiscal fortune to the fluctuations of a highly volatile commodity (Figure 1).

Figure 1
Government of Alberta Resource Revenues as a Percentage of Total Government Revenue



Source: Kneebone and Wilkins (2016) and Alberta Budget 2021.
 Note: All values presented on a "Fiscal Plan" basis. Graph by @trevortombe

Source:

Tombe (2021).

Like Ontario, Alberta's economic development relied on foreign direct investment to fund its economic growth through the post-war period. The rapid influx of foreign oil companies in the 1950s and 1960s brought many political, economic, and social changes to the province. During the 1950s and 1960s, local capitalists were unable to compete with large, integrated U.S. oil majors, and, with a few exceptions, played a marginal role in the development of the industry and often relegated to ownership of oilfield services companies. During this period, concerns were expressed about the rising influence of foreign, particularly American, firms in Canada, a concern that extended both to Alberta's oil and gas industry and Ontario's auto sector (Government of Canada 1972). Amidst calls for more assertive federal government to Canadianize industries, provinces like Alberta also wrestled for control. At that time, American oil firms held 70 per cent of mineral leases and 80 per cent of proven oil reserves and most major oil pipelines and refineries (Richards and Pratt 1979). Richards and Pratt (1979) argued that local elites did not play a "comprador" function — selling out natural resources to foreign capital — rather that role was played by central Canadian finance capital and their local branches.

Efforts by Alberta-based elites to assert more control over the industry succeeded and by the early 1970s Canadian ownership eclipsed that of non-residents. Attracted by oil and the jobs it created, Alberta's population doubled between 1946 and 1976 (Stevenson 2009). By the 1970s, a regional economic elite emerged in Alberta. Richards and Pratt (1979) defined this incipient regional elite as including the owners and managers of Alberta-based companies, urban upper-income white-collar professionals who seek regional economic growth, senior provincial Conservative politicians, and government bureaucrats. This nascent class, buoyed by their growing wealth, harnessed the provincial state to capture additional resource rents, create and deepen

industrial linkages, and compete with foreign companies to execute large private industrial projects. Alongside Albertan efforts to assert more control over this highly profitable industry, the federal government also sought to Canadianize the oil industry, through the creation of Petro-Canada in 1975 and the National Energy Program in the 1980s (Doern and Toner 1985).

Once established, this regional elite sought to grow their wealth through additional oil and gas production and related diversification. The massive bituminous oil sands were developed. The Alberta Research Council created steam-assisted gravity drainage (SAGD) technology to access deep and abundant bitumen deposits without the need for a costly open-pit mine. Industry and political leaders pushed for domestic upgrading and refining and helped establish a provincial petrochemicals industry. Peter Lougheed was the most prolific province-building premier. During the 1970s and early 1980s, the Lougheed government transformed a quasi-state energy company, the Alberta Energy Company, mandating them with commercializing SAGD technology, and created a joint venture, Syncrude, to develop the oil sands. Using a host of financial and tax incentives, the government attracted international chemical companies like Dow and Celanese, who used local oil and gas as feedstocks for their products. These actions enabled Alberta to compete against the Ontario refining and petrochemical complex in Sarnia — which first began refining oil in 1862 and expanded rapidly during the Second World War to become the centre of Canada's petrochemical industry (Egan 2015).

Layered upon these tensions, the global oil crises of the 1970s and the heavy-handed response by the federal government to Canadianize the industry enabled Alberta to adopt a stronger entrepreneurial approach to economic development and bolster its capacity as a regional state. Subsequent Alberta governments re-enacted this script, which, along with low corporate taxes and royalties, was used to entice foreign investment in the oil sands. Furthermore, these conditions

convinced Royal Dutch Shell and Exxon-controlled Imperial Oil to relocate their Canadian head offices from Toronto to Calgary in 1984 and 2004, respectively. These moves, in part, signalled the arrival of Calgary as a globally important city for the fossil fuel industry.

With the rapid adoption of a neoliberal policy framework in the 1990s, Alberta sold off many of its provincial assets in the energy industry, halted its attempts to diversify the provincial economy, and proceeded with a single-minded fixation to rapidly expand oil sands production. It was not until 2010, after the Great Financial Crisis, that the Stelmach government (2006-2011) secured investment in another upgrader — a facility that enables bitumen to be converted into a higher value synthetic crude oil — in the province through a public private partnership and subsidized the first carbon capture and storage (CCS) project in Alberta. The Notley government (2015-2019) subsequently provided \$3.6 billion in subsidies for additional partial upgrading, petrochemical plants, and natural gas infrastructure (Varcoe 2019). While these investments created jobs, enabled Alberta to grow regional demand for fossil fuels, and captured more value from raw natural resources, they were not of the scale or direction needed for Alberta to weather the impending economic dislocation created by the decline in demand from oil and gas sparked by the pandemic and the growing global trends towards electrifying transportation.

Implications of the Current Transition for Ontario and Alberta

As the preceding section makes clear, Ontario and Alberta were equally unprepared for the gradual decline in demand for the carbon-based energy and ICEVs produced by the leading sectors of their respective provincial economies. Alberta strove to expand production of relatively heavy and sour oilsands crude, which is relatively more expensive to extract and refine than light, sweet crude produced found throughout the United States. Meanwhile, hydraulic fracturing and horizontal

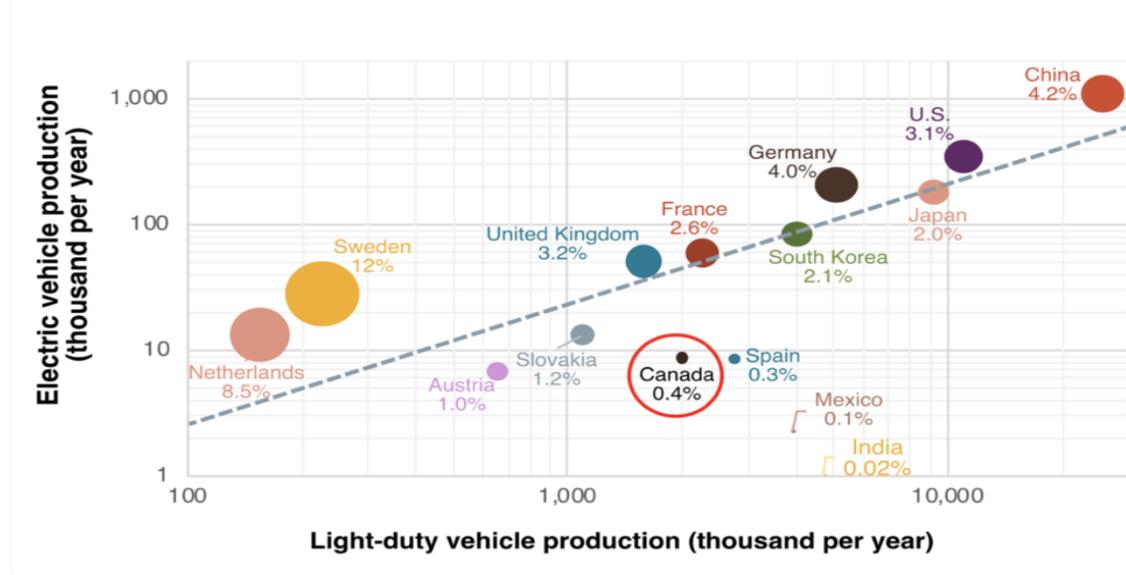
drilling technologies made it possible to dramatically increase US light oil production in the 2010s, which eroded the demand for Alberta bitumen (Yergin 2020). In Ontario's case, changes in consumer demand for the product mix allocated to Ontario plants and the growing commoditization of the industry placed growing pressure on the long-term viability of the province's auto sector (Mordue and Sweeney 2017). Although the recent developments documented below provide some positive signs for both regions, it is also clear that the legacies of their past development paths are positioning their respective economies in a different place for the transition to a post-carbon energy regime.

The Electric Revolution Comes to Ontario

While the long slow decline over the past two decades rang a warning bell for the long-term future of Ontario's auto sector (Yates and Holmes 2019), General Motors' unprecedented announcement of the closing of the last of its Oshawa assembly plants in December 2019 drove home the precarity of the entire sector. While some analysts saw potential resilience in the growing investment by auto makers in advanced R&D sectors (Tripl, et al. 2021), others remain more sceptical of the industry's ability to overcome the legacy of its semi-peripheral status (Mordue and Karmally 2020; Mordue and Sweeney 2020). RBC Economics estimates that *without* a pivot to battery cell and power electronics production and other EV-specific parts, Ontario's auto part sector could lose up to 4,000 jobs (RBC Economics 2021). Unifor, the union representing autoworkers, was aware of the fragility of the sector and the uncertain future for its members. In an editorial published in the summer, the union president pointed to the global competition for investment in BEVs that was ramping up and argued that without a national strategy and active government involvement, the prospects for the Canadian industry looked dim (Woynillowicz 2020).

In the fall of 2020, as the three US-based OEMs entered negotiations with the auto workers' union, Unifor, external observers warned that the outcome of the negotiations could precipitate the closure of another major assembly plant, which had not yet been assigned a new product mandate (confidential interview). Overall, Ontario appeared weakly positioned for the transition to the manufacture and assembly of BEV light trucks and passenger vehicles given the very limited presence of battery manufacturers in the province and the lack of product mandates for BEVs from the OEMs. While Canada ranked 12th globally in vehicle production, a report in April 2020 noted that Canada accounted for just 0.4 per cent of global electric vehicle production (Sharpe, et al. 2020, 5). By the time negotiations began, only Toyota, which assembled two conventional hybrid models in Cambridge, and FCA (now Stellantis), which assembled the Chrysler Pacifica PHEV in Windsor, were shifting from their reliance on ICEVs (Austen 2021).

Figure 2
Proliferation of Electric Vehicles in Major Market



Source:
 Sharpe et al. 2020

Thus, the outcome of the fall 2020 round of collective bargaining between the OEMs and Unifor was critical for the future of the auto sector in Ontario. The results came as a major surprise to many observers with the announcement of major new BEV mandates assigned to the Ford assembly plant in Oakville and the FCA (Stellantis) assembly plant in Windsor, as well as the conversion of a GM plant in Ingersoll to the production of the new BrightDrop EV delivery van. Out of the first round of its negotiations with Ford, Unifor emerged with a commitment by the company to invest \$2 billion. Most of that spending was slated for Ford's assembly plant in Oakville Ontario in support of plans to launch five new BEV models between 2025 and 2028. However, upgrades were also planned for two engine assembly plants in Windsor, Ontario. Ford's commitment was underpinned with commitments of \$295 million each from the federal government and Ontario to subsidize the total cost of converting the plant to assemble BEVs. The successful conclusion of labour negotiations was followed up within a week by Stellantis' announcement that it would invest \$1.5 billion to retool its Windsor plant to assemble both a PHEV and BEV by 2023 with an additional model added by 2025. The retooling will give the plant two platforms — one for the Pacifica and Voyager minivans and the second for the new PHEV or BEV model. While there was no concurrent announcement of government subsidies, the union said Stellantis was in talks with both levels of government for financial support (Jarratt 2020; Woynillowicz 2020; Austen 2021). However, there is little disagreement that the conclusion of the 2020 round of union negotiations has given Ontario's auto sector a new lease on life and underlined the accelerating transition from ICEVs to BEVs (Anastakis 2021; Clean Energy Canada 2020).

The final piece of relatively good news from the fall negotiations was the conclusion of a deal between General Motors and Unifor that the company would invest a total of \$1.2 billion to reopen the Oshawa assembly plant to produce GMC trucks that were in high demand and convert

its plant in Ingersoll to produce a new EV. In early 2021 the company announced that the retooling was proceeding ahead of schedule and the plant would recommence production before the end of the year. While GM made no commitment as to how long it would maintain truck production in Oshawa, the reopening was widely viewed as another bright sign for the future of the industry in Ontario. However, the most significant development came in early January 2021 with the successful conclusion of a deal between GM and Unifor that would transform the CAMI plant in Ingersoll (site of the original GM-Suzuki joint venture) into a centre to produce GM's new line commercial electric vehicles, dubbed the BrightDrop Zevo 600s, with an estimated range of 250 miles, that had just been announced at the virtual Consumer Electronics Show the same week. The plant opened ahead of schedule in December 2022 as the first BrightDrop vehicles rolled off the assembly line (Office of the Premier 2022). The new line of commercial electric vehicles also incorporates a suite of software tools that GM has developed to provide an EV ecosystem for its commercial customers, commencing with an initial deal with FedEx. The cloud-based software platform, accessible via the web or a mobile app, provides users with information that can be used to optimize delivery routes and other aspects of fleet management. According to Scott Bell, President of GM Canada, "GM Canada engineers were instrumental in the early stages of ideation and testing of this solution for the delivery industry" (Legatos 2021). The indication of a clear link between the expanded GM R&D operations by GM at its Oshawa and Markham Technical Centres afforded the first indication that the fruits of the enhanced R&D efforts being undertaken by the OEMs in Ontario would create regional linkages to enhanced auto assembly in the province (Balakrishnan 2022).

The Ontario government has been quick to claim credit for the turn to electric vehicles in the province and the dramatic revival of the auto sector's prospects. Economic Development

Minister, Victor Fedeli, claimed that a host of measures adopted by the province, besides the direct subsidy to Ford, and possibly Stellantis, had laid the basis for the new automotive investments. The Minister touted the province's reduction in Workplace Safety and Insurance Board premiums, the introduction of acceleration capital cost depreciation measures to provide additional tax benefits for new investments, lower electricity rates in the province, and reduced business education taxes as having lowered business costs by \$7 billion a year in the province since 2018. He also pointed to efforts by Hydro One and Ontario Power Generation, the two arms of the provincial electrical utility, to add 160 fast-charging stations to the 1500 already in the province as an additional inducement for EV production and adoption (Thompson 2021). In the provincial budget for 2021, the province targeted additional spending at enhancing its support for the manufacture of BEVs. It committed \$56.4 million to transform the existing Automated Vehicle Innovation Network (AVIN) into the Ontario Vehicle Innovation Network (OVIN) with a mandate to facilitate partnerships between universities, startups, the auto industry, and the battery sector to build on existing capabilities. This measure was in addition to the existing Automotive Modernization Program (O-AMP) introduced in 2019 to assist auto parts manufacturers in making the investments needed to stay globally competitive. Ontario's support for the transition to EV's was provided as Phase 2 of its automotive strategy, *Driving Prosperity* (Government of Ontario 2019), announced in the Fall 2021.

The momentum gained with the new product mandates for the US-based OEMs accelerated through 2022-2023 with the further announcement of investments in major new battery plants in Windsor, Oakville, Ingersoll, and St. Thomas by four of the largest global OEMs. The first announcement out of the gate was a \$5.1 billion investment by NextStar Energy, a joint venture of Stellantis and L.G. Energy Solutions, to construct a 4.5 million sq. ft. facility in Windsor (Jarratt

2021). The plant will employ up to 2,500 workers and produce sufficient batteries to power 400,000 vehicles, commencing in 2025. In addition, Stellantis is investing \$200 million to expand and modernize its Automotive Research and Development Centre in Windsor to support the company's electrification targets. In April 2023, Ford announced that it would add a new 407,000 sq. ft. battery assembly plant adjacent to its new EV assembly line in Oakville. Shortly after, GM announced that it would also build a battery pack assembly plant adjacent to its BrightDrop factory in Ingersoll (Bank 2023). But the blockbuster development came a few weeks later, with the announcement that Volkswagen would invest \$7 billion to construct its first overseas battery manufacturing plant in St. Thomas, representing the largest electric vehicle investment in Canadian history. Both the federal and provincial governments have provided Volkswagen with production support to match that available under the Inflation Reduction Act in the U.S., estimated to be worth between \$8 and \$13 billion. However, the governments maintained that the full cost of the subsidy would be recovered within the first five years of the plant's life (Office of the Premier 2023).

Thus, over the past three years, the bleak future of the province's auto sector has changed substantially. However, the one murky spot in the automotive innovation system remains the parts sector of the industry. Magna, the largest domestically controlled automotive parts company, and 6th largest in the world, has increasingly been locating key parts of its R&D activities outside Ontario, in Michigan and Austria to a great extent (Trippel, et al. 2021; Mordue and Karmally 2020). It has announced several strategic alliances with auto manufacturers to produce electric vehicles in China and in Europe. In October 2020 it announced an agreement with Fisker Automotive to build the Fisker Ocean SUV, which will use a modified version of a Magna-developed EV platform to power Fisker's FM29 platform. The Ocean SUV will be built

exclusively by Magna in Europe. In January 2021, the two companies announced a new collaboration to develop an Advanced Driver Assistance System (ADAS) for the Ocean SUV that draws on Magna's unique capabilities in automated driving systems (Clean Energy Canada 2020, 10). However, in a move to join the EV bandwagon, Magna announced a \$471 million investment in the EV supply chain in February 2023, including a new battery enclosure plant in Brampton to support Ford's F-150 Lightning program (Jarratt 2023). Linamar, the second-largest Ontario-based auto parts manufacturer announced that its first-quarter sales results for 2021, which were up 15 per cent versus 2020, with more than one third of new business wins in the quarter accounted for by electrified vehicles (Linamar, 2021). Thus, while some domestic parts manufacturers in Ontario on the scale of Magna and Linamar are expanding their production capabilities in both BEVs and CA/Vs, the extent to which this will extend to the rest of the parts sector remains unclear.

Another initiative that warrants attention is Project Arrow launched by the Automotive Parts Manufacturers' Association (APMA) at the 2020 Consumer Electronics Show. The APMA conceived the Arrow project as an all-Canadian effort to design and build a world class vehicle incorporating the best Canadian technology in the realm of electric, C/AV and lightweight materials. The design phase of the competition was won by a team from Carleton University's School of Design and the Vehicle Build team is led by Ontario Technical University in Oshawa working with the Virtual Build team in the Windsor Essex Economic Development Commission's virtual reality CAVE. Project Arrow was completed on time and assembled a prototype vehicle integrating the capabilities of fifty-eight Canadian industry partners. The first preview of the vehicle occurred at the APMA's seventieth annual meeting in Windsor in October 2022, and the global reveal took place at the CES trade show in Las Vegas in early 2023 (see APMA, 2022).

The other segment of the transportation equipment industry that has not traditionally been considered with the conventional automotive sector is the bus industry. In contrast to the light-duty vehicle section of the industry, which is mostly located in Ontario, the heavy-duty vehicle (HDV) section — which includes school buses, urban transit, and intercity buses — is concentrated primarily in Manitoba and Québec. According to Clean Energy Canada, currently six electric bus manufacturers operate in Canada, New Flyer Industries, Nova Bus, the Lion Electric Company, the GreenPower Motor Company, Grande West and BYD — five of which are domestically owned. Although starting from a relatively low base, there has been significant growth in the sale of electric HDVs in Canada over the past three years, largely the result of increased procurement of electric buses by municipal transit agencies, with support from the federal \$180 billion Investing in Canada Plan. CN is also participating in a pilot project using eight Class 8 electric trucks built by Lion Electric to be deployed in Vancouver, Toronto, and Montreal. Canada is currently one of a relatively small number of countries with multiple OEMs making electric heavy-duty vehicles. It appears likely that with the coming shift to connected, automated and shared electric (CASE) vehicles, the public transit sector will constitute a key driver for sales of this segment of the industry (Clean Energy Canada 2020; Sharpe, et al. 2020, 15–17; Council of Canadian Academies 2021).

A critical question for the Ontario industry in the coming shift to BEV is the extent to which the newly announced battery plants will supply the needs for domestic production or whether foreign battery manufacturers will remain critical to the supply chain. Battery costs currently comprise more than 40 per cent of electric vehicle production costs but are projected to fall to between 26 and 31 per cent by 2025, with the electric drive train components constituting another 13 per cent of the cost (Sharpe et al. 2020). At present, the major suppliers of batteries for

passenger EV produced in North America are all Asian companies — Panasonic, AESC, BYD, and LG Chem. Where Ontario does enjoy some notable strengths are in battery research — with Tesla’s battery R&D lab in Waterloo and McMaster’s Automotive Resource Centre (MARC), that conducts research in transportation electrification and smart mobility solutions using advanced electric motors, power electronics, energy management systems, and controls to electrified powertrains, electric vehicles, and autonomous systems. Given the significant portion of BEV production accounted for by the batteries and related electronic components, there appears to be some prospect of battery manufacturing ramping up in Ontario (Sharpe, et al. 2020, 9–11; Clean Energy Canada 2020, 10). Some small Canadian-owned battery manufacturers exist in Ontario, such as Electrovaya, which produces batteries for buses and commercial vehicles and Lion Electric has recently announced it will produce batteries in Québec (see Lion Electric, 2021). Another leading parts supplier, Martinrea, has recently formed a joint venture with Montreal graphene producer NanoXplore to launch a demonstration facility in a Montreal suburb, with plans for a 10GWh battery cell plant potentially employing 2,000 people, to follow (Buchanan 2021).

The terms of the new Canada-US-Mexico Agreement (CUSMA) on trade may also have a significant bearing on the location of battery recycling activities. Under the renegotiated terms of the agreement, vehicle manufacturers will have to certify that 75 per cent of their components are produced in North America by 2023, as well as paying 40 per cent of the labour force a wage of \$16/hour. Recent reports suggest that the dominant Asian battery producers may have difficulties meeting the North American sourcing requirements for batteries leading to a growing demand for recycled materials for the dominant form of lithium-ion batteries. Making greater use of recycled battery material would assist the battery manufacturers in meeting the CUSMA requirements and represent a cost-effective way of producing batteries in the regional setting. Recycling batteries

also offer an alternative to mining the critical minerals, which are expected to be in short supply as BEV production ramps up. One Toronto company that appears well positioned to meet this demand for recycled material, Li-Cycle Corporation has demonstrated its ability to recover 95 per cent of the material in lithium-ion batteries (Johnston 2021). The potential for this market opportunity was confirmed by the announcement in May 2021 of an agreement between Li-Cycle to recycle up to 100 per cent of the raw materials recovered from battery cells manufactured in the Ultium Cells manufacturing plant (Automotive News, 2021).

This news leads to the final area where Ontario is viewed as enjoying a competitive advantage to produce BEVs — as a source of the critical minerals needed for battery manufacturing. Canada, and Ontario, contain significant reserves of many of the critical minerals essential for battery production, particularly cobalt, nickel, copper, graphite and most recently lithium. Canada also boasts a relatively abundant source of low-carbon, low-cost electricity, which is viewed as a key asset for securing its place in the battery supply chain (Clean Energy Canada 2020, 10; Sharpe, et al. 2020, 11). These facts have been noted by the federal and provincial governments. The Government of Ontario announced a \$5 million investment in First Cobalt’s smelter in December 2020 and Minister Fedeli has underlined the strategic importance for the province of graphite mining in Hearst and lithium mining near Red Lake. For his part, former federal Innovation Minister, Navdeep Bains was an early promoter of this perspective, coining the phrase “mines to mobility” to signify that Canada’s comparative advantage in the race to electrification involved more than just the building of cars and trucks, but also included its strategic positioning to develop the next generation of battery supply chains needed to be a leader in all forms of electric mobility (Bains 2020).

The prospects for the future of Ontario’s automotive sector, and indeed the entire electrified battery supply chain, certainly look more promising than they did in mid-2020. While the critical implications of recent negotiated settlements around BEV mandates, the sourcing of battery production, and how much Ontario and Canada’s critical mineral resources are integrated into BEVs domestically remain to be seen, the prospects for the future of the semi-peripheral auto industry look brighter than they did. These recent developments also reveal that Ontario may succeed in avoiding the worst distributional consequences arising from the decarbonization of its auto sector through the shift to BEV assembly, although there will certainly be job losses entailed in the process. What is also clear is that the past trajectories of industrial development in the province, combined with the presence of strong system-wide assets, will continue to provide the region with the basis for diversifying into the emerging field of EV assembly and production (Gertler and Wolfe 2004; Hassink, Isaksen, and Trippel 2019). Both the speed and effectiveness of the transition reflect the fact that the traditional development coalition that has underpinned the success of the provincial automotive sector since the combined threat posed by Japanese transplants and the deindustrialization of the US Midwest in the 1980s (Anastakis 2013) — including the leading multinational OEMs, domestic auto suppliers, their respective industry associations, the sector union and the federal and provincial governments — all mobilized to support the automotive sector as it begins to transition to the new energy paradigm. Undoubtedly many challenges remain, and new distributional issues will emerge. The ability of the development coalition to hold will be a critical factor in determining how those challenges are met.

Implications of the Current Transition for Alberta

As the world rapidly decarbonizes, it remains uncertain if Alberta can smoothly transition. The fiscal reliance on expanding fossil fuel production and the wealth this industry has brought to the province makes a move from hydrocarbons extremely fraught. By design, past efforts to diversify Alberta's economy (e.g., petrochemicals, plastics, refining and upgrading) deepened linkages with fossil fuels and stimulated *additional* demand for oil and gas production — rather than develop new industries or strengthen existing industries not directly linked to fossil fuels. A powerful regional development coalition of political and economic elites emerged that ensured dependence on this resource increased and endured changes in government.

For the past two decades, efforts have been made to reduce the carbon intensity of the sector by pursuing more efficient extraction processes. For instance, most oil sands mines no longer burn petroleum coke — which has a higher carbon content than coal — to produce electricity and heat. Instead, these facilities now use natural gas cogeneration units. However important, when measured against the need to reduce total emissions, increased extraction rates erased any incremental intensity improvements. These rising total emissions — which increasingly concern investors, the federal government, and the Canadian public — further entangle fossil fuels into the fate of the province. What was once an asset has become a liability.

Moreover, the province's oil and gas industry is acutely vulnerable because of its monopsonic relationship with the US — its only export market. Even if Alberta or Canada were to stimulate more domestic demand, this would have little impact compared to shifts in demand and supply of fossil fuels from the United States. In 2019, 88 per cent of Alberta's oil production was exported to the United States (Canada Energy Regulator 2020). Alberta has no ability to shift American consumer demands, and little if any capacity to influence ambitious private and public

sector offerings (e.g., electric vehicles and high-speed intercity rail) and net-zero aligned policies (e.g., renewable fuel and electricity standards) implemented south of the border. In many respects, Alberta remains a price and policy taker. The International Energy Agency's Sustainable Development Scenario, which would only reach net zero by 2070, sees North American demand for oil and natural gas liquids fall by 51 per cent between 2019 and 2040 and demand for natural gas fall by 43 per cent (International Energy Agency 2020). If Canada and the United States were to achieve a net-zero goal by 2050 — the current emission reduction target of both countries — the continental decline in demand for fossil fuels would be even more precipitous. Selling additional petroleum to Asian or European markets enables some hedging of risk, but these regions are also pursuing ambitious decarbonization programs. Alberta cannot escape its geography or its location in the global economy. For resource extraction, the petroleum-laden province remains at the end of the supply chain, distant from major markets. Importantly, this remoteness matters less for digital innovation and export-oriented services.

Considering the dependence of Alberta on the oil and gas industry, a global shift of this magnitude would carry severe economic and social hardship, if policymakers remain unprepared. TD Bank estimates that 50 to 75 per cent or 312,000 to 450,000 workers directly or indirectly employed in the oil and gas sector could be displaced in a clean energy transition (Caranci and Fong 2021). Proportionally, the lion's share of these workers would be in Alberta. Of course, Ontario will still feel an impact from job losses at Ontario-based refineries and refuelling stations. As discussed above, Ontario's auto sector will also be affected by the transition.

To minimize this economic and social suffering in Alberta, insights can be drawn from Tripp et al. (2020) scholarship on green industrial path development and from Bernstein and Hoffmann's (2018) political analysis of policy pathways to decarbonization. Alberta is not a *tabula rasa*.

Existing political, economic, and geographic conditions enable and constrain future development. Its existing industrial structure is strongly oriented towards supporting the oil and gas industry. Hundreds of billions of dollars of physical assets linked to fossil fuel extraction, processing and transportation exist in the province. While Alberta's economy is far less diversified than Ontario's, other industries do exist such as agriculture and tourism. Alberta also has a rapidly growing technology sector, which has increased 233 per cent since 2012 (Alberta Enterprise 2021). Of the over 3000 companies in this sector, only 15 per cent serve the oil and gas industry. However, these industries do not generate the same historic revenues as the fossil fuel industry. A complex organizational support structure has evolved to support the oil and gas industry (finance, universities, provincial and federal innovation agencies, and non-profit or private sector led consortia). In a world where the transportation sector rapidly decarbonizes, these organizations would need to retool and change their missions to support Alberta-based businesses in other sectors. Many existing provincial and relevant federal laws and regulations in Alberta facilitate increased fossil fuel extraction. These institutions will need to shift to promote more efficient extraction within existing projects while stimulating economic diversification, particularly in regions acutely dependent on the oil and gas industry. Political and economic actors in Alberta can build upon the province's abundant natural assets beyond its hydrocarbon endowment: forestry, agriculture, wilderness areas, and, in the northern half of the province, water. Recalibrating these extant industrial structures, organizational supports, institutions, and natural assets will not replace the economic wealth generated by business-as-usual oil and gas development. Rather, they hold the potential to grow green industrial development in Alberta and manage the decline of the province's oil and gas sector.

For Alberta to thrive in a world with a decarbonized transportation system, new coalitions need

to be built and strengthened and powerful existing coalitions reoriented or neutralized. To accomplish this, reformers can use the fear of sanction — a key precondition for experimental governance (Sabel and Victor 2015) — towards productive ends. Besides the risk of reduced demand for oil, the dismal prospect of Ottawa raising more tax revenue from the province — as upheld in the Supreme Court of Canada (2021) reference case on the constitutionality of carbon pricing — offers the stick to bring Alberta-based stakeholders to the table and collaborate on provincial measures to reduce greenhouse gas emissions and keep the tax revenue in the province.

This regional coalition could include many members of the business elite that developed in the 1970s as Alberta sought to gain control over its oil and gas industry from American companies and guard against encroachment by the federal government. This province-building elite, as Richards and Pratt (1979) call them, can be used to strengthen the regional state as global energy markets decarbonize. Indeed, some institutions active during the Lougheed government, such as Alberta Innovates (formerly the Alberta Research Council) are partnering with oil sands companies and petroleum engineering firms to investigate non-combustive end uses of bitumen (e.g., asphalt, carbon fibre, carbon nanotubes), which could offset the potential decline in transportation fuel demand and accommodate continued oil sands expansion (Alberta Innovates 2021). While these end uses do not address significant extraction-related greenhouse gas emissions — approximately 20 per cent of lifecycle emissions — nor do they address the other environmental impacts of oil sands extraction (e.g., seepage from toxic tailings ponds, other airborne pollutants, water extraction from the Athabasca River), the province and industry have long hoped that widespread application of CCS technology could enable net-zero greenhouse gas emissions from extraction.

Crisis also creates new opportunities and new influential actors. Moments of international

economic shocks open “systems of relationships, making politics and policy more fluid” (Gourevitch 1986: 22). The Energy Futures Lab, an initiative which began in 2013 by the environmental organization the Natural Step Canada, has emerged a key convener to advance what they call “future-fit hydrocarbons.” This program includes a partnership with Alberta Innovates and oil companies and explores the potential of aviation biofuels, hydrogen use for transportation and industry, carbon capture utilization and storage in Alberta. Other programs from the Energy Futures Lab investigate how to leverage existing skills from the oil and gas industry to extract lithium, generate geothermal power, or find new uses for inactive wells. More recently, The Transition Accelerator, another non-governmental organization, has brought together a range of public and private sector stakeholders to pilot hydrogen fuel cell technology in a fleet of Alberta-based transport trucks.

Electrifying transportation holds the potential to strengthen coalitions beyond Alberta and deepen economic links across the Canadian federation. Alberta could become a supplier of materials (e.g., lithium, carbon fibre) or fuels (e.g., hydrogen, renewable gas) for zero-emission vehicles made in Ontario or Québec. In turn, British Columbia could supply Alberta with low-carbon hydroelectric power. As Garth Stevenson has noted, NAFTA caused a decline in Ontario’s traditional interdependence with the rest of Canada and resulted in more “self-centred” relations with other provinces (2009: xii). The CUSMA, with its heightened North American sourcing requirement for auto parts, may create opportunities for deepened interprovincial trade in Canada centred on the decarbonizing transportation, in addition to protecting existing North-South trade.

Coalition building is closely tied to capacity building. Indeed, initiatives like the Energy Futures Lab and The Transition Accelerator accomplish both. The Government of Alberta can also initiate further province-led diversification. In the second half of the 20th century, the Alberta

Energy Company and the Alberta Gas Trunk Line were implicitly used to train managers and capitalists who could then “provincialize” Alberta’s economy after the international oil companies have left (Richards and Pratt 1979). Richards and Pratt (1979) noted the parallel with the role of another provincial state enterprise, Hydro-Québec, in advancing regional economic development and the interests of Québec’s francophone middle class. Perhaps now is the time for an Alberta Energy Company 2.0? This new entity could, at a scale befitting the challenge, support technological innovation and economic development in rural regions acutely dependent on oil and gas production.

Compared to Alberta’s leaders from the 1970s, 21st-century province builders can leverage the material, institutional, and cognitive capacity accumulated from decades of significant oil and gas revenues: strong research universities, high-quality health care system, new infrastructure, and a young and educated workforce. Drawing on these varied capacities will also attract new, influential coalition members that can also support economic diversification.

Alongside coalition and capacity building is the ideational work of norms. Reformers can harness pre-existing norms of entrepreneurialism, independence, and resilience to convince Albertans that change is underway, and opportunities exist for them in a decarbonized world. Unlike the long-standing norm of grievance that many Alberta Premiers have invoked to advance Alberta’s interests and stoke animosity with the federal government, Ontario, or the environmental community, these other norms need not alienate important strategic partners. In turn, new interventions can spawn additional norms that help make a decarbonized transportation system seem common sense.

What modest initiatives that do exist in Alberta to help the province cope with a global decline in transportation fuel demand and position itself to compete in a decarbonized economy have yet

to scale or entrench themselves in any meaningful way. Thus far, the provincial government and the private sector have not expanded any of these economic diversification or decarbonization projects to the scale as seen during the concerted push to rapidly expand oil sands production in the mid-1990s (cf., Alberta Chamber of Resources 1995).

Bernstein and Hoffmann (2018) remind us of the importance of understanding governance experiments in light of expected reductions of greenhouse gas emissions. Not all “green” industrial pathways will lead to transformative decarbonization. It remains to be seen if the CCS and hydrogen technologies being advanced in Alberta will further entrench fossil fuel extraction. In Alberta, hydrogen is produced using natural gas via steam methane reforming, as opposed to electrolysis using clean electricity. Natural gas-sourced hydrogen would still produce significant emissions even if CCS were employed due to unmitigated production and transportation-related emissions. Moreover, in certain industrial applications carbon capture and storage can still result in additional emissions. For instance, enhanced oil recovery reinjects carbon dioxide to repressurize depleted reservoirs to extract residual oil, further increasing emissions and extending regional reliance on fossil fuel extraction.

With the end goal of net-zero emissions in mind, several insights from Trippel et al. (2020) are germane to this analysis. 1) Many pathways exist to green industrial development. Beyond renewal of existing industries — as with CCS for the oil and gas industry — reformers can pursue simultaneous pathways. Policymakers can help orient Alberta’s economy to compete in a world with electrified transportation by diversifying oil and gas industry into hydrogen production for long-distance trucking, importing renewable energy technologies (e.g., wind, solar, geothermal) for regional deployment, or creating a new industry to recover valuable metals and minerals from oil and gas industry waste streams for use in EV batteries. 2) Transition policies can leverage

existing local assets. Rather than creating a new industry unlinked from existing assets, policymakers can build on existing institutions, organizations, industrial structures, and natural assets to reduce the transition risks faced by incumbent economic actors and local communities.

3) Strategic asset destruction may be necessary for green path development. To introduce new technologies or stimulate new green industries, Alberta's existing institutional structure which facilitates expansion of the oil and gas industry may need to be modified. By intentionally destabilizing business as usual while providing necessary social and economic guardrails, policymakers can exercise system-level agency and guide the regional economy towards a more competitive position in a net-zero economy.

Regardless of what is or is not happening in Alberta, the rest of Canada will suffer if Alberta suffers. As the global transformation of the auto sector advances and historic projections of ever-increasing growth in fossil fuel demand seem increasingly outdated, Alberta could be increasingly marginalized — economically and politically — in the Canadian federation. In those places with a dim future, Rodríguez-Pose (2018: 189) warns of a populist driven, “revenge of the places that don't matter.” A populist turn in Alberta is already underway. The rightward shift in conservative politics and renewed calls for succession speaks to the mounting discontent (Mintz, Morton, and Flanagan 2020). Even if separation from Canada remains remote, the invocation of this “nuclear option” by Albertans suggests a perceived lack of paths forward.

In this context, place-sensitive development policies are necessary (Rodríguez-Pose 2018) — policies that make use of local assets. However, as Alberta's economy becomes increasingly stressed, a stronger federal presence in Alberta is likely required. This was seen during the COVID-19 pandemic, when federal support in the form of wage subsidies, loans, bailouts, and reclamation funding were directed to the province's struggling oil and gas sector. To help Alberta manage the

transition to a net-zero emission economy, a place-sensitive federal government will need to “take provinces and province-building seriously” (Richards and Pratt 1979: 7).

Conclusion

The substantive question for this chapter remains: how will the existing governing blocs and development coalitions, which have guided the trajectory of development in the two regions and been its major beneficiaries, respond to the challenge posed by the transition to a post-carbon era? As the preceding analysis suggests, both regional economies have been more closely tied to the carbon-intensive techno-economic paradigm than popular narratives suggest. Thus, while they face similar challenges in transitioning off their carbon dependence, their underlying systems of technology, existing production processes, industrial organization, and supporting infrastructures of social and political institutions afford them different regional assets. Alberta-based policy entrepreneurs have initiated important experiments to generate economic development outside the oil and gas industry and to reduce the greenhouse gas emission intensity from oil and gas production. However, the developmental pathway to successful asset modification remains long and challenging. Ontario, in contrast, has demonstrated a capacity to adapt its existing asset base to a new BEV production paradigm more quickly than was expected. Major challenges remain for Ontario’s innovation system to ensure that a) all product mandates announced are launched into development and production, b) the complex auto supply chain transitions to EV production without major dislocation and c) battery production (involving more than just the supply of critical materials) continues to expand in the province.

At this point, the critical difference between the two regions appears to be the facility with which regional economic and political elites have shifted to support a post-carbon path trajectory. In Alberta, large portions of the oil and gas sector remain wedded to the current production

paradigm, albeit with the hope that new techniques can incrementally reduce the carbon footprint of their production and make better use of CCS technology. The relatively small-scale experiments underway need considerably more support to expand to the point where they can have a broader economic or environmental impact. What is striking in Ontario, however, is the speed with which the provincial government has moved off its anti-EV stance to not only support the shift to electromobility, but even take credit for it. Equally notable is the degree of consensus between OEMs, the parts association, and the union on the need for a shift to the new paradigm. While cracks will undoubtedly appear in the current coalition, there seems to be strong agreement that pulling together is essential for securing the future of the provincial auto sector.

If the two regions continue to develop along divergent pathways, it risks creating uneven distributional consequences for parts of the federation that will pose greater threats to its governance. While the prospect of moving to a post-carbon energy paradigm holds some initial promise that Ontario and Alberta's interests may become more aligned, the uneven pace of the developmental trajectories suggests that the country may be in danger of revisiting the energy wars of the 1980s. The federal government's position remains more tenuous. It has pursued an ambivalent strategy with respect to reducing oil and gas supply in Western Canada, both purchasing pipelines and introducing carbon taxes, that has left its overall strategy confusing. Regarding Ontario's automotive sector, it has been supportive of the recent developments, but is clearly playing catch up to the initiatives of the domestic subsidiaries, the union, the APMA and an emerging sector of renewable energy providers. Absent at this point is a clear national strategy that maps a trajectory for shifting the developmental pathways of both the energy producing and energy consuming sectors of the national economy. Failure to provide one could result in increased regional tensions, and a populist response from those regions of the country that appear to suffer

the greatest economic dislocation – with the potential for a “revenge of the places that don’t matter” that has been identified as a clear source of populist reaction both in Europe and the US (Rodríguez-Pose 2018).

The internal contradictions between Central and Western Canada may be exacerbated to a greater degree by the unique position occupied by Québec in the coming energy transition. While realization of the radical transformation underway in global auto manufacturing has been slow in Ontario and especially Alberta, decades ago, prescient policymakers and private sector leaders in Québec foresaw the economic opportunities associated with electrifying transportation (Haley 2015). Since then, a broad and effective coalition of existing actors has formed across the electromobility supply chain, from mining companies, electric utilities, to manufacturers of recreational vehicles and medium and heavy-duty vehicles (Lemphers et al. 2021). Historically, Québec has been an EV policy setter in Canada; although many of these policies were pioneered in other jurisdictions, notably California. Beyond participating in the same cap and trade market for GHG emissions as California, Québec mimicked California’s ZEV mandate and GHG emission standard, and adopted the same date for the banishment of new passenger ICEV sales. Further, Québec-based companies with EV-related business lines also sell their products and services to a rapidly growing EV market in California. Unlike Alberta and Ontario, cross-party consensus has long existed on the economic opportunities associated with transportation electrification. This agreement produced a more stable and predictable public policy environment for the private sector. Beyond these existing players, many new companies are emerging in Québec that assemble and recycle EV batteries and install and manage charging network infrastructure as well as a growing ecosystem of policies to make EV ownership easier. All told, this broad, diverse, and expanding coalition advances a more compelling vision of the future of transportation than has existed in

Ontario and certainly Alberta. Failure by the federal government to formulate a national strategy that builds upon existing regional assets and supports the integrated transition to a post-carbon economy across the country risks exacerbating the underlying regional tensions to the detriment of future national prosperity.

References

- Alberta Chamber of Resources. 1995. "The Oil Sands: A New Energy Vision for Canada." In. Edmonton: Alberta Chamber of Resources.
- Alberta Enterprise. 2021. "2021 Alberta Technology Deal Flow Study." In, edited by Alberta Enterprise. Edmonton: Government of Alberta.
- Alberta Innovates. 2021. 'Advanced Hydrocarbons - Bitumen Beyond Combustion', Government of Alberta, Accessed 15 March. <https://albertainnovates.ca/focus-areas/clean-resources/bitumen-beyond-combustion-bbc/>.
- Anastakis, Dimitry. 2005. *Auto Pact: Creating a Borderless North American Auto Industry, 1960–1971*. Toronto; Buffalo: University of Toronto Press, Xiv, 285 p.
- Anastakis, Dimitry. 2013. *Autonomous State: The Struggle for a Canadian Car Industry from OPEC to Free Trade*. Toronto: University of Toronto Press, Xvi, 549 p.
- Anastakis, Dimitry. 2021. "Reinvestment in Automotive Sector Will Change Ontario's Future." *Toronto Star*, 3 January.
- APMA. 2022. "Project Arrow in Depth." <https://projectarrow.ca/arrow/>
- Austen, Ian. 2021. "Canada Catches Up in the Race to Produce Zero-Emission Vehicles." *The New York Times*, 26 February.
- Automotive News. 2021. "GM's Ultium Cells partners with Li-Cycle for battery recycling." 11 May 2021. <https://www.autonews.com/manufacturing/gms-ultium-cells-partners-li-cycle-battery-recycling>
- Bains, Navdeep. 2020. "Mining Gives Canada a Competitive Advantage in Electric Vehicle Market." *Policy Options*, 17 September.

- Balakrishnan, Anita. 2022. "General Motors once sold more than half the cars in the U.S." *The Logic*. 20 October.
- Banks, Brian. 2022. "GM building battery pack assembly unit at Ontario BrightDrop plant." *Electric Autonomy*. 20 April. <https://electricautonomy.ca/2023/04/20/gm-battery-pack-assembly-brightdrop/>
- Bernstein, Steven, and Benjamin Cashore. 2012. "Complex Global Governance and Domestic Policies: Four Pathways of Influence." *International Affairs* 88(3, May): 585–604.
- Bernstein, Steven, and Matthew Hoffmann. 2018. "The Political of Decarbonization and the Catalytic Impact of Subnational Climate Experiments." *Policy Sciences* 51(2, June): 189–211.
- Binz, Christian, and Bernhard Truffer. 2017. "Global Innovation Systems—A Conceptual Framework for Innovation Dynamics in Transnational Contexts." *Research Policy* 46(7, September): 1284–89.
- Breznitz, Dan, and Peter Cowhey. 2011. *America's Two Systems of Innovation: Recommendations for Policy Changes to Support Innovation, Production and Job Creation*. San Diego: Connect Innovation Institute, University of California San Diego.
- Buchanan, Emma. 2021. "Auto parts maker Martinrea spearheading new EV battery-making venture near Montreal," *Electric Autonomy*. 12 May.
- Cameron, David R. 1994. "Post-Modern Ontario and the Laurentian Thesis," Douglas M. Brown and Janet Hiebert. In *Canada: The State of the Federation 1994*. Kingston: Institute of Intergovernmental Relations, Queen's University, 109–32.

- Canada Energy Regulator. 2020. 'Crude Oil Annual Export Summary - 2019', Canada Energy Regulator, Accessed 24 September. <https://www.cer-rec.gc.ca/nrg/sttstc/crdlndptrlmpdct/stt/crdlsmmr/crdlsmmr-eng.html>.
- Caranci, Beata, and Francis Fong. 2021. "Don't Let History Repeat: Canada's Energy Sector Transition and the Potential Impact on Workers." In. Toronto: TD Bank.
- Cantwell, John. 2017. "Innovation and International Business." *Industry and Innovation* 24(1): 41–60.
- Clean Energy Canada. 2020. *Taking the Wheel: How Canada Can Cut Carbon Pollution and Revitalize Its Auto Sector*. Tracking the Energy Transition 2020. Vancouver BC: Clean Energy Canada.
- Coenen, Lars, Paul Benneworth, and Bernhard Truffer. 2012. "Toward a Spatial Perspective on Sustainability Transitions." *Research Policy* 41(6, July): 968–79.
- Council of Canadian Academies. 2009. *Innovation and Business Strategy: Why Canada Falls Short*. Report of the Expert Panel on Business Innovation in Canada. Ottawa: Council of Canadian Academies, [www.scienceadvice.ca/documents/\(2009-06-11\) Innovation Report.pdf](http://www.scienceadvice.ca/documents/(2009-06-11) Innovation Report.pdf).
- Council of Canadian Academies. 2018. *Competing in the Global Innovation Economy: The Current State of R&D in Canada*. Report of the Expert Panel on the State of Science and Technology and Industrial Research and Development in Canada. Ottawa: Council of Canadian Academies.
- Council of Canadian Academies. 2021. *Choosing Canada's Automotive Future*. The Expert Panel on Connected and Autonomous Vehicles and Shared Mobility. Ottawa: Council of Canadian Academies.

- Courchene, Thomas J., and with Colin J. Telmer. 1998. *From Heartland to North American Region State: The Social, Fiscal and Federal Evolution of Ontario*. Monograph Series on Public Policy, Centre for Public Management. Toronto: Faculty of Management, University of Toronto.
- Covarrubias V, Alex. 2018. "When Disruptors Converge: The Last Automobile Revolution." *International Journal of Automotive Technology and Management* 18(2): 81–104.
- Dijk, Marc. 2016. "Electric Revenge After 100 Years? Comparing Car Market Patterns Around 1900 and 2000." *International Journal of Automotive Technology and Management* 16(2): 147–67.
- Doern, G. Bruce, and Glen B. Toner. 1985. *The Politics of Energy: The Development and Implementation of the NEP*. New York: Methuen, Xvii, 523 p.: ill.
- Egan, Phil. 2015. *Sarnia's First Refinery*. Sarnia: Sarnia Historical Society, [https://www.sarniahistoricalsociety.com/story/sarnias-first-refinery/#:~:text=\(2015\)%20In%20his%201961%20book,%E2%80%9Cfirst%20of%20Sarnia's%20refineries.%E2%80%9D](https://www.sarniahistoricalsociety.com/story/sarnias-first-refinery/#:~:text=(2015)%20In%20his%201961%20book,%E2%80%9Cfirst%20of%20Sarnia's%20refineries.%E2%80%9D)
- Finnemore, Martha, and Kathryn Sikkink. 1998. 'International Norm Dynamics and Political Change', *International Organization*, 52: 887-917.
- Freeman, Christopher, and Francisco Louçã. 2001. *As Time Goes by from the Industrial Revolutions to the Information Revolution*. Oxford New York: Oxford University Press, Xv, 407 p.
- Freeman, Chris, and Francisco Louça. 2001. *As Time Goes by: From the Industrial Revolutions to the Information Revolution*. New York: Oxford University Press, Xv, 407 p.: ill.

- Gertler, Meric S., and David A. Wolfe. 2004. "Ontario's Regional Innovation System: The Evolution of Knowledge-Based Institutional Assets." In *Regional Innovation Systems, 2nd. Ed.*, eds Philip Cooke, Hans-Joachim Braczyk, and Martin Heidenreich. London: Taylor and Francis, 91–124.
- Glyn, Andrew, Alan Hughes, Alain Lipietz, and Ajit Singh. 1990. "The Rise and Fall of the Golden Age." In *The Golden Age of Capitalism: Reinterpreting the Postwar Experience*, eds Stephen A. Marglin and Juliet B. Schor. Oxford: Clarendon Press, 39–125.
- Goracinova, Elena, Patrick Galvin, and David A. Wolfe. 2022. "Emerging Models of Networked Industrial Policy: Comparative Trends in Automotive Policy in the US and Germany," *International Journal of Automotive Technology and Management* 22:(1): 29-51. <http://dx.doi.org/10.1504/IJATM.2022.122096>
- Gourevitch, Peter. 1986. *Politics in Hard Times: Comparative Responses to International Economic Crisis*. Ithaca and London: Cornell University Press.
- Government of Canada. 1972. *Foreign Direct Investment in Canada*. Ottawa: Information Canada.
- Government of Ontario. 2019. *Driving Prosperity: The Future of Ontario's Auto Sector*. Toronto: Ministry of Economic Development, Trade and Job Creation, <https://files.ontario.ca/auto-strategy-en-final.pdf>.
- Grillitsch, Markus, and Markku Sotarauta. 2020. "Trinity of Change Agency, Regional Development Paths and Opportunity Spaces." *Progress in Human Geography* 44(4, January): 704–23.
- Haley, Brendan. 2011. "From Staples Trap to Carbon Trap: Canada's Peculiar Form of Carbon Lock-In." *Studies in Political Economy* 88 (Autumn):97–132.

- Haley, Brendan. 2015. 'Low-carbon innovation from a hydroelectric base: The case of electric vehicles in Québec', *Environmental Innovation and Societal Transitions*, 14: 5-25.
- Hassink, Robert, Arne Isaksen, and Michaela Trippel. 2019. "Towards a Comprehensive Understanding of Regional Industrial Path Development." *Regional Studies* 53(11): 1636–45.
- International Energy Agency. 2020. "World Energy Outlook." In. Paris: International Energy Agency.
- International Energy Agency. 2021. *Global EV Outlook 2021*. Paris: IEA Publications.
- Janigan, Mary. 2012. *Let the Eastern Bastards Freeze in the Dark: The West Versus the Rest Since Confederation*. Toronto: Knopf Canada, Xii, 426 p.: ill.
- Jarratt, Emma. 2020. "Fiat Chrysler and Unifor Announce \$1.5 Billion Investment to Build EVs in Windsor." *Electric Autonomy*, 15 October.
- Jarratt, Emma. 2021. "Vying for Canada's Flagship Battery Manufacturing Facility." *Electric Autonomy*, 5 March.
- Jarratt, Emma. 2023. "Magna pouring \$471 million into EV supply chain in Ontario." *Electric Autonomy*. 15 February.
- Jetin, Bruno. 2020. "Who Will Control the Electric Vehicle Market?" *International Journal of Automotive Technology and Management* 20(2): 156–77.
- Johnston, Tim. 2021. "Lack of Domestic EV Battery Supply Will Require Automakers to Be Creative to Comply with USMCA." *Electric Autonomy*, 7 January.
- Kellogg, Paul. 2015. 'Priarie Capitalism Revisited: Canada, Bitumen, and the Resource Colony Question', *Journal of Canadian Studies*, 49: 222-55.

- Lemphers, Nathan, David A. Wolfe, Matthew Hoffmann, and Steven Bernstein. 2021. 'Electromobility as an innovation and decarbonization catalyst in California, Norway, and Québec', *Energy Research & Social Science*.
- Linamar. 2021. "Linamar First Quarter Earnings More than Double Q1 2020 on Strong Markets & Market Share Gains." 6 May 2021.
<https://linamar.com/de/sites/default/files/press/Q1%202021%20Press%20Release.pdf>
- Lion Electric. 2021. "Lion Electric Announces the Construction of its Battery Manufacturing Plant and Innovation Center in Quebec." 15 March 2021. <https://www.newswire.ca/news-releases/lion-electric-announces-the-construction-of-its-battery-manufacturing-plant-and-innovation-center-in-quebec-826634300.html>
- Klier, Thomas, and James Rubenstein. 2013. "Restructuring of the U.S. Auto Industry in the 2008–2009 Recession." *Economic Development Quarterly* 27(2, May): 144–59.
- Legatos, Jasmin. 2021. "GM's New Electric Delivery Vans Will Be Made in Canada." *Electric Autonomy*, 18 January.
- Mackinnon, Danny. 2012. "Beyond Strategic Coupling: Reassessing the Firm-Region Nexus in Global Production Networks." *Journal of Economic Geography* 12(1, January): 227–45.
- Mackinnon, Danny, Stuart Dawley, Andy Pike, and Andrew Cumbers. 2019. "Rethinking Path Creation: A Geographic Political Economy Approach." *Economic Geography* 95(2): 113–35.
- Markard, Jochen, Rob Raven, and Bernhard Truffer. 2012. "Sustainability Transitions: An Emerging Field of Research and Its Prospects." *Research Policy* 41(6, July): 955–67.
- Mathews, John A. 2013. "The Renewable Energies Technology Surge: A New Techno-Economic Paradigm in the Making?" *Futures* 46 (February):10–22.

- Mintz, Jack M., Ted Morton, and Tom Flanagan. 2020. *Moment of Truth: How to Think About Alberta's Future* (Sutherland House: Toronto).
- Mordue, Greig. 2020. "Shifting Patterns in the Application of Industrial Policy." *International Journal of Automotive Technology and Management* 20(1): 50–75.
- Mordue, Greig, and Danish Karmally. 2020. "Frontier Technologies in Non-Core Automotive Regions: Autonomous Vehicle R&D in Canada." *Canadian Public Policy* 46(1, March): 73–93.
- Mordue, Greig, and Brendan Sweeney. 2017. "The Commodisation of Automotive Assembly: Canada as a Cautionary Tale." *International Journal of Automotive Technology and Management* 17(2): 169–89.
- Mordue, Greig, and Brendan Sweeney. 2020. "Neither Core Nor Periphery: The Search for Competitive Advantage in the Automotive Semi-Periphery." *Growth and Change* 51(1, March): 34–57.
- Nelles, H.V. 1974. *The Politics of Development: Forests, Mines and Hydro-Electric Power in Ontario, 1849–1941*. Toronto: Macmillan of Canada.
- OECD. 2002. *OECD Territorial Reviews: Canada*. Paris: Organisation for Economic Co-operation and Development.
- Ohmae, Kenichi. 1995. *The End of the Nation State: The Rise of Regional Economies*. New York: The Free Press.
- Office of the Premier, Ontario. 2022. "Canada's First All-Electric Vehicle Manufacturing Facility Opens in Ontario." Toronto: Government of Ontario. 05 December.
- Office of the Premier, Ontario. 2023. "Volkswagen's New Electric Vehicle Battery Plant Will Create Thousands of New Jobs." Toronto: Government of Ontario. 21 April.

- Perez, Carlota. 1983. "Structural Change and Assimilation of New Technologies in the Economic and Social Systems." *Futures* 15(5): 357–75.
- Pisano, Gary P., and Willy C. Shih. 2009. "Restoring American Competitiveness." *Harvard Business Review*, July-August.
- Pisano, Gary P., and Willy C. Shih. 2012. "Does America Really Need Manufacturing?" *Harvard Business Review*, March.
- Proff, Heike. 2020. "Editorial." *International Journal of Automotive Technology and Management* 20(4): 341–48.
- RBC Economics. 2021. "Trading Places: Canada's place in a changing global economy." In Toronto: RBC Economics.
- Rea, K.J. 1985. *The Prosperous Years: The Economic History of Ontario, 1939–1975*. Buffalo: University of Toronto Press, Xiv, 287 p.
- Richards, John, and Larry Pratt. 1979. *Prairie Capitalism: Power and Influence in the New West*. Toronto: McClelland and Stewart.
- Rodríguez-Pose, Andrés. 2018. 'The revenge of the places that don't matter (and what to do about it)', *Cambridge Journal of Regions, Economy and Society*, 11: 189-209.
- Sabel, Charles F., and David G. Victor. 2015. 'Governing global problems under uncertainty: making bottom-up climate policy work', *Climatic Change*, 144: 15-27.
- Sharpe, Ben, Nic Lutsey, Cedric Smith, and Carolyn Kim. 2020. *Power Play: Canada's Role in the Electric Vehicle Transition*. White Paper. Washington, DC: International Council on Clean Transportation.

- Simeon, Richard, and Ian Robinson. 1990. *State, Society, and the Development of Canadian Federalism*. The Collected research studies, vol. 71. Toronto; Buffalo: University of Toronto Press, Xvii, 381 p.
- Stevenson, Garth. 1977. "Federalism and the Political Economy of the Canadian State." In *The Canadian State: Political Economy and Political Power*, ed. Leo Panitch. Toronto and Buffalo: University of Toronto Press, 71–100.
- Stevenson, Garth. 2009. 5th ed. *Unfulfilled Union: Canadian Federalism and National Unity*. Ithaca, NY: McGill-Queen's University Press, Xvi, 328 p.
- Storper, Michael. 1997. *The Regional World: Territorial Development in a Global Economy*. New York and London: The Guilford Press.
- Supreme Court of Canada. 2021. "References re Greenhouse Gas Pollution Pricing Act." In Ottawa.
- Sweeney, Brendan A. 2020. *Canada's Automotive Industry: A Decade in Review*. London, ON: Trillium Network for Advanced Manufacturing.
- Thompson, Lori. 2021. "Shifting Gears: Unprecedented Investments Driving the Change to a Greener Auto Sector in Ontario." *Plant*, 10 February.
- Tombe, Trevor. 2021. Budget 2021: A missed opportunity (again). *CBC News*, 26 February. <https://www.cbc.ca/news/canada/calgary/road-ahead-alberta-budget-2021-missed-opportunity-trevor-tombe-1.5929244>
- Tripl, Michaela, Simon Baumgartinger-Seiringer, Alexandra Frangenheim, Arne Isaksen, and Jan Ole Rypestøl. 2020. 'Unravelling green regional industrial path development: Regional preconditions, asset modification and agency', *Geoforum*, 111: 189-97.

- Trippl, Michaela, Simon Baumgartinger-Seiringer, Elena Goracinova, and David A. Wolfe. 2021. "Automotive Regions in Transition: Preparing for Connected and Automated Vehicles." *Environment and Planning A: Economy and Space*.
- Trippl, Michaela, et al. 2020. "Unravelling Green Regional Industrial Path Development: Regional Preconditions, Asset Modification and Agency." *Geoforum*.
- Varcoe, Chris. 2019. "NDP Doubling Down on Energy Subsidies a Risky Investment Bet." *Calgary Herald*, 21 March.
- Weber, K. Matthias, and Harald Rohrer. 2012. "Legitimizing Research, Technology and Innovation Policies for Transformative Change." *Research Policy* 41(6, July): 1037–47.
- CO).
- Wolfe, David A. 1978. "Economic Growth and Foreign Investment: A Perspective on Canadian Economic Policy, 1945–1957." *Journal of Canadian Studies* 13(1, Spring): 3–20.
- Woyntowicz, Dan. 2020. "Electric Vehicle Assembly Deals Put Canada in the Race." *Electric Autonomy*, 20 October.
- Yates, Charlotte, and John Holmes. 2019. *The Future of the Canadian Auto Industry*. Ottawa: Canadian Centre for Policy Alternatives.
- Yergin, Daniel. 2020. *The New Map: Energy, Climate, and the Clash of Nations*. New York: Penguin Press, Xx, 492 pages, 32 unnumbered pages of plates: illustrations.
- Yeung, Henry Wai-chung. 2020. "Regional Worlds; from Related Variety in Regional Diversification to Strategic Coupling in Global Production Networks." *Regional Studies*.
- Zysman, John. 1994. "How Institutions Create Historically Rooted Trajectories of Growth." *Industrial and Corporate Change* 3(1): 243–83.

Zysman, John. 1996. "The Myth of a 'Global' Economy: Enduring National Foundations and Emerging Regional Realities." *New Political Economy* 1(2): 157–84.