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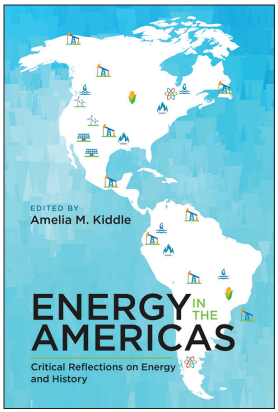

ENERGY IN THE AMERICAS: CRITICAL REFLECTIONS ON ENERGY AND HISTORY

Edited by Amelia M. Kiddle

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Current Concerns: Canadian–United States Energy Relations and the St. Lawrence and Niagara Megaprojects

Daniel Macfarlane

Until the 1950s, Canadian-US energy relations predominantly revolved around hydroelectricity exports from Ontario. The transnational construction of the Niagara and St. Lawrence hydroelectric megaprojects in the 1950s represents a significant watershed in North America's shared electricity history. The St. Lawrence and Niagara Rivers are international rivers, bisecting the state of New York and the province of Ontario, which necessitated the involvement of various federal governments and subnational entities (i.e., state and provincial governments and their respective power utilities), the utilization of many of the same engineers and workers, and oversight by the International Joint Commission.

The St. Lawrence Seaway and Power Project, built between 1954 and 1959, was the product of half a century of negotiations. It is one of the largest transborder projects ever undertaken by two countries and is considered one of the great civil engineering achievements of the twentieth century. The seaway technically runs 181.5 miles, from Montreal to Lake Erie, and features numerous dams, two of which generate hydroelectricity. Its importance was not restricted to its physical scale. In 1961 political

scientist James Eayrs labelled the St. Lawrence negotiations one of the "most difficult and most momentous" issues for Canadian foreign policy.[1] It was the longest continually running issue in US congressional history. As the authors of a text on Canadian-US relations declared, "nothing represents the bilateral [Canada-US] relationship during the cold war better than that seaway."[2] Schemes to remake Niagara Falls were part of the St. Lawrence negotiations in the first half of the twentieth century. The 1950 Niagara Diversion Treaty was the result of several decades of binational attempts to plumb Niagara Falls for greater hydro production while "enhancing" the waterfall's appearance. This treaty authorized bilateral engineering works that enabled huge amounts of water to be diverted and used at downstream hydroelectric power plants while also manipulating the river and waterfalls in order to maintain their scenic appeal.

Important conceptual differences had tangible impacts on how Canada and the United States approached the creation and distribution of electricity from these border waters of the Great Lakes–St. Lawrence Basin.[3] In this chapter I argue that the history of the Niagara and St. Lawrence power projects, in addition to demonstrating the importance of hydroelectricity for the evolution of North American domestic and transborder energy forms, relations, and exports over the first half of the twentieth century, reveals important similarities and differences in Canadian and US conceptions of the interrelationship between identity, electricity, natural resources, technology, and nation—and province—building.[4] The role of private versus public development, and the involvement of subnational governments and actors, are also a key factor in the historical development of energy regimes in the Americas. Canadian nationalism and identity attached a different significance to hydroelectric developments and exports than did their US variants, and I suggest that a Canadian "hydraulic nationalism" is apparent in the intertwined evolution of these two projects.

This hydraulic nationalism shared many elements with the various forms of Latin American resource nationalism, generally linked to fossil fuels, identified in this volume (and in the Canadian hydroelectric case, energy has been most commonly treated as a common and/or political good, according to the typologies that Heidrich identifies in chapter 1 of this volume).[5] Moreover, as was the case with Canadian hydroelectricity,

the United States directly and indirectly shaped the energy regimes of many Latin American countries. At various times, a number of nations in the Americas were subject to US energy imperialism; however, we should not overstate the one-sided nature of such relationships, since many countries concluded that it was in their best interests to integrate or trade with the United States.

How does the materiality of hydro-power production and distribution distinguish it from fossil fuels, and affect the trajectory of Canadian and Latin American energy regimes? One way to bridge the gap between energy types is by invoking Timothy Mitchell's notion of "carbon democracy"—the idea that the materiality of fossil fuels has shaped democracy and political economy in various countries. Here, I borrow from Mitchell to suggest "hydro democracy" as a concept for considering Canada's hydroelectric relationship with the United States.

Developing Hydroelectricity

Hydroelectricity in North America dates to the end of the nineteenth century. Niagara Falls quickly became the focal point of continental hydro production and distribution on a large scale: a number of private hydroelectric plants were in place before the end of the century on both sides of the border, aided by technological improvements (e.g., alternating current) that allowed electricity to be transmitted over longer distances. The world's first international electricity interconnection occurred here in 1901.[6] The United States outpaced Canada in terms of initial industrial and hydroelectric development around Niagara; in reaction to the heavier industrialization on the New York side, the US public was more vocal about the degradation of the Falls' vista than their Canadian neighbours.[7] US concerns about preserving scenic beauty also stemmed from a desire to preserve the country's hydro monopoly at the Falls, and from worries that the Canadian side of the cataract was more attractive than its US counterpart.[8] Given coal shortages in Ontario in the early twentieth century, that provinces was less concerned about the scenic beauty of the Niagara Falls and more focused on its potential for power. In this period, however, Ontario did not have the capacity to fully develop its own hydroelectric resources but relied on US capital and technology. This reliance

foreshadowed US involvement in future Canadian and Latin American oil and petroleum developments, as Pratt and others in this volume show. But here the story diverges, for Ontario did quickly develop the capacity, though it kept exporting much of its electricity to the United States. This, too, mirrors aspects of Canada-US and Latin America–US fossil fuel relations, as well as aspects of oil development in Western Canada, for hydroelectric development in Central/Eastern Canada also involved a unique intermingling of public and private entities (e.g., state involvement, regulation of marketing of private industry). Much like the future continental oil trade that Chastko describes in this volume, infrastructure bound Canada and the United States together physically when it came to electricity trade—and in this context, it is worth noting that the politics of the Keystone XL pipeline have been compared with the leadup to the St. Lawrence Seaway.[9] Moreover, both hydroelectric and fossil fuel developments have been central to federalism and nation/province/state building in the Americas.

The first powerhouse on the Canadian side at Niagara was completed in 1901, and two others were completed within a few years. These were subsidiaries of US companies, and the majority of the electricity produced at these plants was sent across the river to the United States. Indeed, much of the electricity was exported because there was little market for it in Canada at that point.[10] Several other cross-border interconnections soon followed, each involving the long-term exportation of electricity from Canada to one isolated customer on the US side (e.g., an eighty-five-year export contract for 56 megawatts to the Aluminum Company of America from the Les Cedres generating station on the St. Lawrence in Quebec).[11] Under the Liberal government of Wilfrid Laurier, Canada adopted a laissez-faire approach to electricity exports, and by 1910 about one-third of Canada's electricity was being exported.[12]

Many Canadians resented this state of affairs, however, and the desire to keep power and develop industry helped lead to the creation in 1906 of a provincially owned power utility, the Hydro-Electric Power Commission of Ontario (also known as HEPCO or Ontario Hydro). This commission would begin with the distribution of electricity, but over the following decades, Ontario Hydro subsequently acquired the aforementioned private Niagara generating stations, built several of its own massive hydroelectric

facilities along the Niagara River, and expanded the hydroelectric transmission network throughout Ontario (while still continuing exports to the United States).

The same concerns that led to the creation of HEPCO were also linked to the federal passage of the Exportation of Power and Fluids and Importation of Gas Act of 1907. The act required Canadian power exporters to secure an annual licence, gave the federal Parliament the authority to levy an export duty on hydroelectricity, prohibited hydro power from being sold at a lower price in the United States, and featured a recall clause allowing exports to be quickly revoked if the power was required in Canada. The 1907 act would undergo minor modifications in 1925 and 1955, with the export duty abolished in 1963.[13] South of the border, the US president had the power to authorize the construction of border facilities that could be used to export electricity, but it was not until 1935, when the Federal Power Act created the Federal Power Commission (Federal Energy Regulatory Commission as of 1977), that the US government was given the authority to license exports.

Public discontent with the despoiling of the Niagara landscape had led the US Congress to enact the 1906 Burton Act limiting Niagara diversions to 15,600 cubic feet per second (CFS). Concerns about Niagara and St. Lawrence developments also contributed to the formation of the Boundary Waters Treaty of 1909, which created the International Joint Commission (IJC) and put further limits on Niagara diversions; henceforth, water could be diverted from above the Falls at a rate of 36,000 CFS by Ontario and 20,000 CFS by New York.[14]

During the First World War, the limits on the diversion of Niagara water imposed by the United States via the Burton Act were lifted and all the water that could be utilized was made available for power diversion. Domestic Canadian opposition to electricity exports to the United States reached a fever pitch during the war, resulting in what Karl Froschauer has called the "Repatriation Crisis," which involved various studies into the nature of Canadian electrical development and exports, such as the Drayton Report.[15] Internal opposition continued during the interwar period, but the Canadian government was reluctant to take any strong action because the country still depended on coal imported from the United States. In 1925, the Mackenzie King government enacted a minor duty on

electricity sold to the United States. Though this duty "was too low to have immediate repercussions on the ability of companies to export hydro-electric power," according to Janet Martin-Nielsen, "it marked the beginning of a gradual change in the style of Canadian electricity exports. As the Canadian and U.S. electricity grids became increasingly interconnected in the interwar years, electricity trade between the two countries changed from unidirectional firm power sales from Canada to the United States to interruptible power sales in both directions."[16]

Hydro Democracy

As of 1920, hydro represented 97 per cent of the electricity produced in Canada and 20 per cent in the United States. Mexico, of course, also shares border waters with the United States, and those two nations had also developed formal transboundary water governance institutions. Yet Mexico shares only a handful of cross-border interconnections with the United States, and it has not integrated its electricity grid with the United States to nearly the same extent as has Canada. This is in part a function of Mexico's comparative lack of hydroelectric developments and its much smaller available electrical generating capacity; as a result, the US-Mexico energy relationship is much more heavily predicated on petroleum, as Linda B. Hall's chapter in this volume shows.[17] While Canada and the United States take turns at their border being the upstream/downstream riparian, or have major water bodies such as the Great Lakes that form rather than cross this border, the United States is in a more powerful position than Mexico when it comes to these countries' shared waters.[18]

Electricity is restricted to movement via a physical grid, whereas other energy stocks such as fossil fuels can move via various intermodal transport mechanisms. This means that although a country like Venezuela needs the appropriate infrastructure to move petroleum to the United States or Canada, this is much easier than constructing the infrastructure for international electricity transmission. The practical result is that there are no electricity imports or exports between the United States and Latin American nations outside of Mexico.

Energy is a commodity unlike any other; electricity and fossil fuels are the magic elixirs of modern society. Energy scholars have separated

energy regimes into "stocks" and "flows," with the latter generally consisting of "organic" energy—e.g., wood, water, and human/animal muscle power—while stocks (coal, petroleum, electricity) are generally also considered "mineral" energy forms.[19] Unlike carbon sources of energy, such as coal and petroleum, which are non-renewable stocks of fossil fuels, society harnesses the renewable flows of hydro power from rivers and transforms them into electricity.[20] Since it involves both water and electricity, the material aspects and realities of producing hydroelectricity make it a hybrid energy regime: both flow and stock, both mineral and organic. [21]

In *Carbon Democracy: Political Power in the Age of Oil*, Timothy Mitchell argues that the ways we access energy flows and stocks (in his case, coal and then oil) substantially shape governing structures.[22] According to Mitchell, coal was a catalyst for democracy because worker control of the mine environment allowed unions to exercise political agency and make democratic claims. Along with oil, coal broke the ecological constraints of an organic energy economy and allowed for the belief in unlimited economic growth.[23] Unlike coal, however, the spatial and material aspects of oil lent themselves to less democratic and more elite control. Granted, as Mitchell—along with scholars such as Christopher Jones, Andreas Malm, and Ruth Sandwell—makes clear, energy transitions are highly contingent.[24]

Hydro power enhanced democracy in Canada in certain ways, both tangible and symbolic, while undermining or negating it in other ways. The public control of hydro power provided the energy-based affluence for a growth society—i.e., cheap power—and this allowed individuals to increase their material and economic positions (and arguably escape the "resource curse," or at least aspects of it; see Triner's chapter in this volume) and better participate in a liberal democratic society; this, in turn, helped create the platform for social democratic governance that enjoyed wide public consent for interventionist policies that claimed to fairly, and liberally, apportion resources.[25] Moreover, most of Canada's early hydro power came from its border with the United States, and integration with the United States initiated a unique type of energy diplomacy that had profound implications for democracy and political economy.[26] At the same time, hydro power gave Canada the ability to domestically produce the necessary electricity, which meant it did not need to rely as heavily on

foreign energy, such as American coal. Akin to energy and hydroelectric production in countries like Brazil, in the Canadian case hydro-power development was part of enhancing autonomy and "natural security," even if out of self-interest the country continued to tie itself, energy-wise, to the United States.[27]

The material realities of working with water and electricity shaped democratic opportunities: for example, as the technological and spatial scale of hydroelectric projects increased, hydro democracy also served as a means of limiting the rights and claims of those situated closest to hydro developments, particularly Indigenous groups, ostensibly in the name of the greater good and wider public interest. Hydroelectric development involved sacrificing hinterland watershed environments for metropolitan benefits. Indeed, First Peoples have borne the disproportionate brunt of hydroelectric development, and energy development and extraction in general, across the Americas.[28] In the case of Canadian hydro power, this "hydraulic imperialism" partly stems from the fact that water sites that attracted Indigenous groups for such things as fishing and settlement also make for viable hydroelectric installations. But the bigger factor is settler society's propensity to view Indigenous groups as second-class citizens whose disenfranchisement—always framed in terms of "progress"—is to the collective benefit of the nation. Conversely, in other parts of the Americas, this resource imperialism often comes from foreign governments and companies.

Like fossil fuel networks, the environmental transformations required to build hydroelectric systems involved significant initial capital investments to construct and maintain technological infrastructures, such as dams, generating stations, and electric grids.[29] Hydro power, like coal and oil energy networks, attracted investors and financiers with the availability of large rents, and these individuals used their economic influence to shape the development of governing structures.[30] In Canada, this significant investment, and the attendant risks, often necessitated state involvement in hydroelectric development as hydro installations grew in size.

Megaprojects

The 1920 Federal Power Water Act moved the limits of the United States' Niagara diversion to those set by the Boundary Waters Treaty. While some limitations were instituted on the volume of diversions between the two world wars, further expansion of hydro production facilities on both sides of the Niagara Gorge took place, including the construction of lengthy diversion conduits. Canada and the United States accelerated their various undertakings, transnational boards, and studies aimed at maintaining or increasing power diversions without sacrificing the great cataract's scenic appeal. The Canada-US Niagara Convention and Protocol was signed in 1929, outlining remedial works that would disperse water to insure an unbroken crestline in all seasons while enshrining hydro diversions. However, it did not receive congressional assent in the United States.

Serious governmental consideration of a bilaterally constructed deep waterway in the St. Lawrence also dates back to the end of the nineteenth century. After its formation, HEPCO forwarded a number of different plans for hydroelectric dams on the St. Lawrence, as did various private and public entities in the United States. Binational engineering studies conducted after the First World War solidified such schemes, and the idea of a deep waterway became intertwined with power development. However, in Canada this was caught up in provincial-federal disputes about constitutional rights around hydro-power development. Moreover, between 1926 and 1931, Ontario signed a series of contracts with different Quebec power companies to furnish the province with electricity. As a result, both the Quebec and Ontario governments were uninterested in developing hydroelectric power from the St. Lawrence as long as these contracts remained in effect. There were similar disputes in the United States over which level of government held the rights to the electricity harvested from the St. Lawrence. At Governor Franklin D. Roosevelt's instigation, the New York legislature created the Power Authority of the State of New York (PASNY) in 1931. The following year, Canada and the United States signed the Great Lakes Waterway Treaty, a comprehensive agreement outlining not only the St. Lawrence project but also a range of other border water issues in the Great Lakes–St. Lawrence Basin. The treaty, however, failed to pass the US Congress due to the range of interests opposed to the

project, such as railways, utilities, private power, and port cities on the East Coast and Gulf of Mexico.

The new Ontario premier, Mitch Hepburn, was opposed to development of the St. Lawrence, but he did seek power through additional diversions at Niagara Falls. Despite Franklin Roosevelt's continued desire for a St. Lawrence development after he became US president, Ontario and Quebec's opposition forestalled any progress until the Second World War. With the war rendering the need for electricity acute, Canada and the United States arrived at an executive agreement, rather than a treaty, that covered much of the same ground as the 1932 St. Lawrence accord, including terms for Niagara Falls. But the United States' entry into the war prevented this agreement from coming to fruition. Nonetheless, the two countries agreed that the limits on the amount of water diverted at Niagara Falls for wartime needs could be temporarily increased outside of the agreement. By June 1941, the first of this extra water was being diverted, and further withdrawals were subsequently allowed during the war, rising to a total diversion of 54,000 CFS for Canada and 32,500 CFS for the United States. In early January 1942, both countries agreed to split the cost of constructing a stone-filled weir—a submerged dam—in the Chippawa–Grass Island Pool about a mile above the Falls.

In the immediate postwar years, a variety of economic and defence factors further emphasized the necessity of a seaway and power project on the St. Lawrence. These included the need for hydroelectricity for industrial and defence production; the ability of a deep waterway to transport the recently discovered iron ore deposits from the Ungava district in Labrador and Northern Quebec to Great Lakes steel mills; the possibility of protected inland shipbuilding on the Great Lakes; and the economic and trade stimulation that a seaway would bring.[31] But the 1941 St. Lawrence agreement remained stalled in the US Congress. In 1949, with Ontario experiencing major power shortages, the Liberal government of Louis St. Laurent realized that an "all-Canadian" waterway might be viable and would not need the permission of the Congress. But the cost of an all-Canadian seaway was only feasible if it was built in conjunction with an Ontario–New York power dam. In 1948, New York and Ontario had each asked their respective federal governments for permission to forward to the IJC a "power priority plan" whereby the province and state would

build a hydro dam separate from a deep waterway system. This scheme had initially been opposed by both President Harry Truman and Prime Minister St. Laurent. But the Canadians reversed their position, since this Ontario–New York plan would accommodate the all-Canadian waterway approach.

Ottawa began taking steps to condition public opinion on both sides of the border for the possibility of an all-Canadian seaway. A waterway entirely in Canadian territory quickly resonated with the Canadian public and continued to build momentum throughout the 1950s; in fact, the proposal soon boomeranged, with the St. Laurent government feeling strong pressure to pursue a wholly Canadian waterway in order to satisfy popular demand for such a system. An all-Canadian seaway, however, clearly threatened important US national security and economic interests. Truman was opposed to any St. Lawrence project that was not a joint Canada-US endeavour.[32] Although the St. Lawrence waterway would certainly further Canadian-US integration when completed, the environmental diplomacy leading to the St. Lawrence Seaway and Power Project demonstrates the asymmetry and conflicting national interests that often characterized the Canada-US relationship, even in the early Cold War.

In the 1940s, hydro was still responsible for about 90 per cent of the electricity generated in Canada. Canada has traditionally been among the top—if not at the top—of global per capita users of energy in general and electricity specifically. Today, Canada is said to be the third-largest producer of hydroelectricity in the world, behind only China and another country from the Americas: Brazil. Granted, we should not forget that prior to the Second World War, though hydro power was the source of most of the electricity consumed in Canada and Ontario, this was primarily by industry and manufacturing; hydroelectricity still accounted for a fairly minor percentage of the energy consumed in *households* across the nation, especially outside of urban areas, which remained reliant on power derived from the organic energy regime (i.e., coal and wood) much longer than was the case in, say, the United States and the United Kingdom, though not for as long as in Latin American countries.[33] Indeed, hydro power's influence on Ontario's political economy and statist evolution has been out of proportion to its actual statistical significance in the province's energy portfolio.[34]

The wartime diversions from the Niagara River had continued on a temporary basis after the end of the war. With the need for energy reaching acute levels, the two countries sought to arrive at a permanent accord. Consequently, the Niagara Diversion Treaty was signed in 1950.[35] The accord called for remedial works—jointly built by HEPCO, PASNY, and the US Army Corps of Engineers, and approved by the IJC—and virtually equalized water diversions while restricting the flow of water over Niagara Falls to no less than 100,000 CFS during daylight hours (of what the treaty deemed the tourist season: 8:00 a.m. to 10:00 p.m. from April to mid-September, and from 8:00 a.m. to 8:00 p.m. during the fall), and no less than 50,000 CFS during the remainder of the year. This meant that either half, or only a quarter, of the Niagara River's water would henceforth go over the Falls. Construction of the remedial works began in earnest in early 1954. A 1,550-foot control structure was built into the river from the Canadian shore, featuring thirteen sluices equipped with control gates. The purpose of this structure was to control water levels in the Chippawa–Grass Island Pool in order to adequately supply the water intake works for both countries' diversions; it also sought to spread out the water for aesthetic purposes and because flows concentrated in certain places caused more erosion damage.

The Horseshoe Falls were designated for significant modification too. Excavation took place along the flanks (64,000 cubic yards of rock on the Canadian flank; 24,000 cubic yards on the US flank) in order to create a better distribution of flow and an unbroken crestline at all times. To compensate for erosion, crest fills (100 feet on the Canadian shore and 300 feet on the US side) were undertaken, parts of which would be fenced and landscaped in order to provide prime public vantage points. On the Ontario side, the diverted water went to the enormous reservoir feeding the newly completed Sir Adam Beck No. 2 Generating Station, which was beside Beck No. 1 station. By 1961, New York had completed the controversial Robert Moses Niagara Power Plant across the gorge (which generated 2.4 megawatts—the largest at the time in the Western world).

The overarching goal was to create an uninterrupted "curtain of water" over the precipice that displayed a pleasing consistency and colour. The remedial works were also intended to reduce "spray problems" as excessive mist had apparently been scaring off visitors to the tunnels behind

Figure 5.1 Hydroelectric Landscape of Niagara Falls.

Source: Created by Rajiv Rawat, Anders Sandberg, and Daniel Macfarlane.

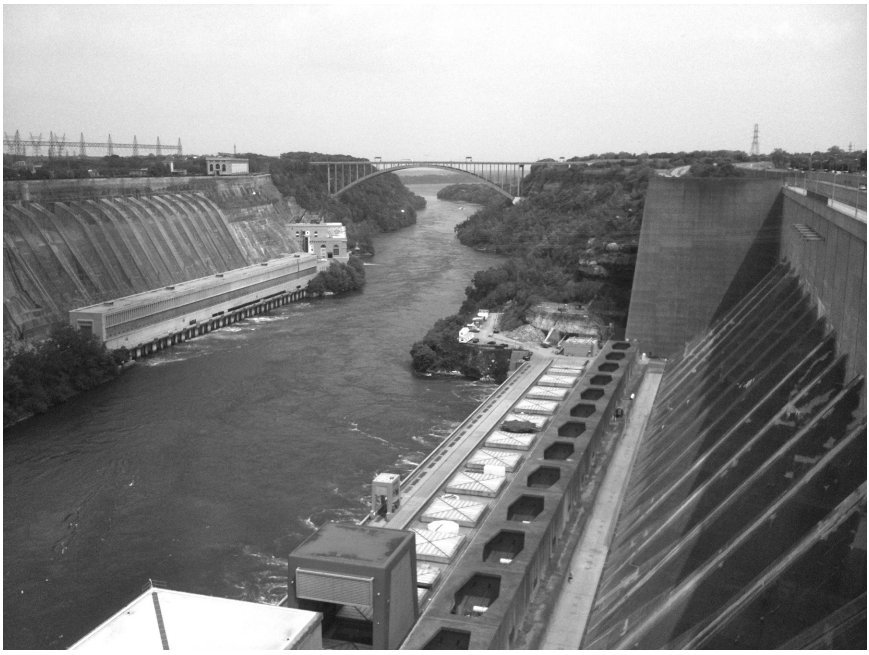

Figure 5.2 Beck Stations (left) and Moses Station (right)

Source: Photo by author.

the Horseshoe Falls. This speaks to the commodification of the Niagara experience, a process that was inextricably intertwined with the other tourist trappings prevalent at Niagara Falls: nature should be sanitized, made predictable and orderly, and packaged for easy consumption.

Returning to the St. Lawrence impasse, which continued while work got underway at the Falls, the New York share of the St. Lawrence hydro works, to be built by PASNY, needed a licence from the US Federal Power Commission (FPC). But the FPC refused to license the undertaking. Although the body was supposedly free of partisan political influence, its commissioners were presidential appointees. It was clear that the White House was impacting the FPC's decision, and that it would continue to do so. To be fair, US interference was also partially the result of Washington's misreading of Canada's intentions to proceed alone with the waterway,

a situation to which Ottawa had contributed by sending mixed messages about its commitment to proceed unilaterally. Since the hydroelectric works were needed in order to make a Canadian waterway a reality, Ottawa was essentially caught in a catch-22. The Canadian government tentatively left the door open to US participation in the hopes that this would allow the hydro aspect to commence. Dwight Eisenhower, who became president in January 1953, was non-committal about the seaway until several months into his term. In May 1953, his cabinet finally came out in favour of US involvement, primarily for defence reasons. The FPC, unsurprisingly, did a volte-face and quickly approved a licence for New York. However, sectional and regional interests then conspired to exploit the appeals process so as to further delay a start on the St. Lawrence project until 1954, when Congress finally approved US participation via the Wiley-Dondero Bills.

In the end, the Canadian prime minister consented to US involvement chiefly because of the negative ramifications for the Canadian-US relationship that would likely result if Canada resisted. Through a 1954 bilateral St. Lawrence agreement, rather than a treaty, Canada reluctantly acquiesced in the construction of a joint project, although not before it extracted concessions from the United States during the ensuing negotiations, such as the placement of the Iroquois lock and Ottawa's right to later build an all-Canadian seaway. Really, the two nations were agreeing to build separate facilities that would function together.

The construction of the St. Lawrence Seaway and Power Project wrought huge changes in the St. Lawrence Basin. The Moses-Saunders powerhouse, a gravity power dam with thirty-two turbine/generator units, was a bilateral project, with the Canadian and US halves meeting in the middle, that generated a combined 1.8 megawatts. The Beauharnois power dam, which had been finished in the early 1930s, became part of the St. Lawrence project. The seaway cost $470.3 million (with Canada paying $336.5 million and the United States $133.8 million) and, including the cost of the power phase, the bill for the entire project was over $1 billion. Lake St. Lawrence inundated some 20,000 acres of land on the Canadian side, along with another 18,000 acres on the US shore, flooding out many communities and a wide range of infrastructure.

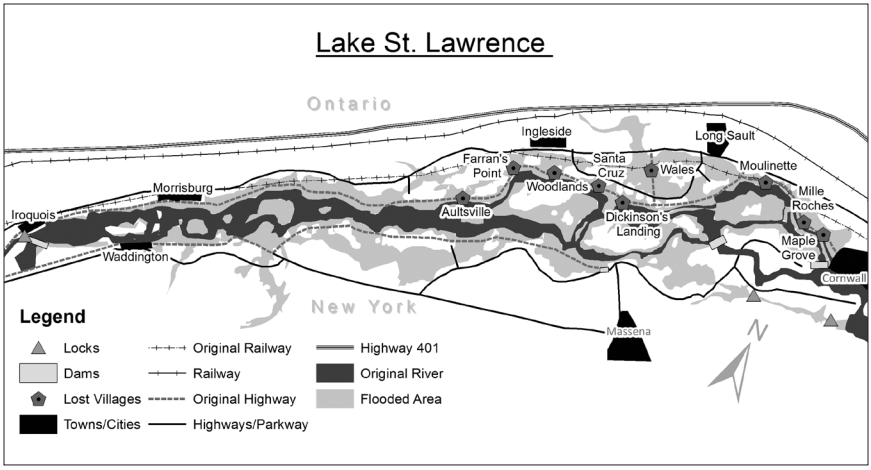

Figure 5.3 Lake St. Lawrence

Source: By the author.

Figure 5.4 Moses-Saunders Powerhouse

Source: Photo by the author

The creation of Lake St. Lawrence, which served as the reservoir for the Moses-Saunders hydroelectric dam while also deepening the water for navigation, required the largest rehabilitation project in Canadian history. On the Canadian side of the International Rapids section, 225 farms, a number of communities (often referred to as the Lost Villages), 18 cemeteries, approximately 1,000 cottages, and over 100 kilometres of the main east–west highway and main line railway were relocated, and major works (e.g., bridges) were required in the river at Montreal. So as not to create navigation and other difficulties in the new lake, everything had to be moved, razed, or flattened, including trees and, as mentioned, cemeteries.[36] Many people chose to transport their residences via special vehicles to the new communities created to house the displaced residents.

For many, mass displacement in the St. Lawrence Valley was a small price to pay for the production of electricity and the increased accessibility of iron ore deposits. Flooding out thousands of people in the Lost Villages and surrounding rural areas (including Mohawk reserves) was justified in the name of progress and for the benefit of the wider nation. The reorganization and resettlement of those affected by the power development would be for their own benefit as they would be placed in consolidated new towns—instead of scattered about in inefficient villages, hamlets, and farms—with modern living standards and services. Instead of the previous towns spread along the waterfront—set out in a long and narrow grid—the new communities were based on the latest planning principles and utilized curved streets and crescents, with the major services and amenities grouped strategically together in centralized plazas, with schools, churches, and parks placed to facilitate easier and safer access.[37]

Ontario Hydro repeatedly went door-to-door and held numerous public and town hall meetings.[38] The utility compromised on certain aspects of the relocation—the most prominent example being the concession to use house-movers so that people could keep their original residence (granted, the Ontario Hydro chairman was keen to do this because moving houses was also cheaper than building new ones).[39] At the insistence of the provincial government, the amount of compensation for forceful taking was increased and a commission for appeals established (though it usually reflected Ontario Hydro's assessments).[40] Nevertheless, there was a societal deference to government, which in turn reflected a deference to

experts and engineers. For the involved governments, as well as for the general public, the idea that it was all a sacrifice worth making was pervasive. There were certainly those who resisted in various ways, but for many the project carried an aura of inevitability. Moreover, those dislocated by the power pool generally expected that the St. Lawrence project would bring with it great prosperity, and therefore bought into the general logic of progress.

The Canadian and US governments used the St. Lawrence and Niagara projects as spectacles to demonstrate their power and legitimacy to the citizenry. Sampling, polling, surveying, testing, and modelling were extensively used, for, as fundamental techniques of a high modernist approach, they allowed the state to control information, set the terms of debate, and manufacture consent; if people knew the facts, the thinking went, the rationality of the project would inevitably compel them to accept its logic.[41] The residents of the Lost Villages were repeatedly promised that the Upper St. Lawrence region would become a great industrial area, even though this proved to be an empty promise. Ontario Hydro created observation platforms and millions of people came to watch the construction. Many residents of the area acquired employment on the project. On the New York side, the head of PASNY, the infamous planner Robert Moses, made a deal with Alcoa for about one-quarter of the power from the eponymous powerhouse, and Reynolds Metal and General Motors opened factories in the area and signed power supply contracts. These three industries cumulatively accounted for over half of the US share of power from the St. Lawrence development.

Government experts viewed nature as something to be controlled and ordered through technology, with little to no consideration of the wider environmental impact. Because of the engineer's cultural prestige, this view extended to the state and society. The rhetoric used by experts and governments focused on defeating, dominating, exploiting, and mastering the river. A megaproject ethos is also revealed by the language that was *not* used: namely, acknowledgement of the environmental limits and repercussions inherent in a project on the scale of the St. Lawrence Seaway and Power Project.

The engineering prowess and brute force used to radically reconfigure a riparian landscape may have made the St. Lawrence Seaway and Power

Project seem like a human-made artifact, but in reality its transformation forged a new enviro-technical system: the St. Lawrence (and Niagara Falls) was now both artificial and natural, a technology and an environment.[42] There have been enormous environmental repercussions since the 1950s. Water flowing downriver became more polluted after the creation of the seaway. Along with pollution caused directly by construction, large amounts of decomposing plant life released mercury into the water, and water released methane into the atmosphere. Submerged infrastructure also leeched various types of toxins, such as oil, fertilizers, and other contaminants. The St. Lawrence Seaway and Power Project reconfigured the local ecosystem and disrupted its aquaculture by restricting the mobility of certain species. Biologist Richard Carignan even contends that the project created three separate channels or ecosystems along the river around Montreal, in contrast to the unified habitat that existed before construction began.[43] Dams blocked the movement of eels, which could no longer traverse the length of the river until authorities added eel ladders to the Moses-Saunders dam in 1974 and the Beauharnois dam in 1994.

For both the Niagara and St. Lawrence projects, engineers employed scale hydraulic models that replicated long stretches of rivers in minute detail: the topography, the shoreline, the river channels and contours, the cataracts and rapids, and the turbulence and velocity of the currents. This appears to be the first time that such models were used this extensively for a civil engineering project in Canada. Building on the Niagara modelling experience, the same agencies and many of the same engineers were moved to the St. Lawrence models. The reliance on models was emblematic of a faith in high modernist technology; yet there were many model mistakes, and when extrapolated onto a larger scale, seemingly small errors could have significant ramifications.[44]

The Niagara and the St. Lawrence hydroelectric developments had a tremendous impact on Canadian electricity exports to the United States. Since the Second World War, non-firm (i.e., interruptible) power sales have characterized the Canada-US electricity trade, with some exceptions.[45] Up to the 1960s, the majority of the power exported from Canada to the United States was via Ontario, and St. Lawrence and Niagara power had played the leading role in shaping the Ontario and federal governments' approaches to electricity exports. These two megaprojects thus entrenched

Canadian-US energy relations and paved the way for the development of transborder electricity grids that proliferated in the 1960s (as of 1975, there were sixty-five international interconnections, with a total transfer capability of over 6,000 megawatts) and the Canadian allowance of long-term firm power (as part of the Columbia River Treaty arrangements).[46] Moreover, electricity exchanges between Canada and the United States helped pave the way for the oil and gas trade to move from what Paul Chastko calls "informal continentalism" to the contemporary "integrated, harmonized, and liberalized energy trade."[47]

Conclusion

When imagining the landscape changes that tend to result from energy development, most picture the despoiled fossil fuel zones spread across the Americas and discussed in many other contributions to this volume, rather than tourist locales such as the Niagara and St. Lawrence Rivers. But both were "energy landscapes" since fundamental aspects of their shape and appearance were determined by the exigencies of producing hydro power, and thus even these major tourist draws are in some ways sacrifice zones for energy production.

Both the Niagara and St. Lawrence river systems are important sites of Canada's historical development and nation building vis-à-vis the United States, and they figure heavily in the transportation and industrial development of the Canada-US borderlands. The creation of the St. Lawrence and Niagara projects speaks to transborder ideas about technology and the environment, but also to the ways that national identities were bound up in such ideas. Canadian and US identities have strong ties to their respective landscapes and environmental-determinist forms of explanatory development paradigms (e.g., the frontier thesis in the United States, the metropolitan-hinterland, staples, and Laurentian theses in Canada). Yet it has been suggested that Canadians tend to see nature in more antagonistic terms. Some commentators argue that this stems from Canadians' conception of themselves as a small population struggling against a vast, foreboding, cold, and hostile landscape,[48] and other factors that serve as partial explanations for different Canadian and US views of nature can be identified.[49]

Hydroelectricity in particular was seen as a means of delivering Canada from its "hewer of wood servitude to American industry and its bondage to American coal."[50] US Americans have a longer history of using technology to dominate the natural environment. By comparison, technology was historically seen by many Canadian nationalists as the means by which the United States could dominate and control Canada. However, technology was a "double-edged sword," for by the mid-twentieth century Canadian access to modern technology—which could be used to conquer the hostile environment—held out the potential for the nation to evolve independently of the United States, rather than further integrating the two countries.[51] Many Latin American countries have been similarly ambivalent about aligning their energy resources with the United States, though the past century suggests they had greater reason to fear American encroachment than did Canada.

The St. Lawrence River was historically seen as a national, rather than a shared, river (further enabled by the fact that the river's lower section is wholly within Canada). This view of the St. Lawrence as a strictly "Canadian" river manifested itself in the attempts for an all-Canadian seaway. The St. Lawrence River holds an exalted and iconic place in the Canadian national imagination, as the waterway served as the crucible of Canadian settlement and development.[52] Canadian historiography, particularly of the Anglo-Canadian variety, is replete with notions of the river narrative and aquatic symbolism.[53] The Laurentian thesis, for example, holds that the St. Lawrence River was the dominant element shaping the physical, political, economic, and cultural evolution of Canada. At the height of its popularity in the 1950s, the Laurentian thesis helped sustain the conception of the St. Lawrence watershed as the defining and fundamental aspect of Canadian history and identity, and for this reason it infused the notion of an all-Canadian seaway with the same nationalist importance and symbolism.[54] The seaway effectively served as a conduit for many different expressions of Canadian nationalism, which can be subsumed under the term "hydraulic nationalism."[55]

Hydraulic and technological nationalisms were also apparent in the Niagara projects. Niagara appealed to Canadian nationalists for various reasons (many of which could equally apply to the St. Lawrence), including Niagara's proximity to the Canadian heartland, its connection to the

St. Lawrence–Great Lakes system, its proximity to many sites of Canadian resistance to US encroachment in the War of 1812, and because of uniquely Canadian views of the environment. Put another way, Niagara Falls was Canada's front door, and America's back door; the same metaphor could apply to the St. Lawrence.[56] The US federal government and the State of New York were, like the Canadian and Ontario governments, most attracted by the power they could get from Niagara, though this had stronger nationalist motivations for Canada and more imperialist motivations for the United States. It was the technological control of Niagara Falls for hydroelectric development that resonated most strongly with Canadian nationalists. As was the case with the St. Lawrence, the hydro power of the Niagara River was a strong nationalist expression, the full usage of the nation's natural birthright. Though the Niagara works were a joint undertaking with the United States, this was as much a legal and practical necessity as the result of a desire to co-operate. For some Canadians, such technological development and resource exploitation would allow for greater integration with the United States; others, however, saw this as a means to make Canada more fully self-sufficient and no longer reliant on the United States.

The vitality of publicly operated hydroelectric utilities helped condition Canadians for an interventionist state. It also appears that hydroelectricity, at least in the public imagination, allowed for more effective claims for a just and egalitarian world than did oil, even if it did become, like fossil fuels, a mode of governance that employed popular consent as a means of limiting claims for greater equality and justice by dividing up common resources. Because hydro power in Canada was mostly produced by the state, it was able to resist certain facets of neoliberalism—for example, privatization and deregulation—longer than fossil fuels.[57] During the twentieth century, hydro power was the only energy system in Canada that rivalled the mineral energy of fossil fuels.[58] Both hydro power and fossil fuels involved elaborate socio-technical systems, which in turn influenced the governance of the countries that developed and shared them. Canada in the twenty-first century has been labelled a "Petro state";[59] however, it might be said that Canada (Central Canada especially) was first a "hydro state."

NOTES

1 James Eayrs, *The Art of the Possible: Government and Foreign Policy in Canada* (Toronto: University of Toronto Press, 1961), 157.

2 John Herd Thompson and Stephen J. Randall, *Canada and the United States: Ambivalent Allies*, 3rd ed. (Montreal: McGill-Queen's University Press, 2002), 213.

3 Quebec also exported electricity, both from within and outside the St. Lawrence Basin, and in the second half of the twentieth century "hydraulic nationalism" may well have been most clearly on display in that province.

4 For a comparative elaboration, see Daniel Macfarlane, "Dam the Consequences: Hydropolitics, Nationalism, and the Niagara-St. Lawrence Projects," in *Border Flows: A Century of the Canadian-American Water Relationship*, ed. Lynne Heasley and Daniel Macfarlane (Calgary: University of Calgary Press, 2016), 123–50.

5 Similar to Latin American countries such as Colombia, in the last few decades hydroelectric production in Ontario has taken the route of neoliberalism and privatization, whereas Quebec and British Columbia have maintained public hydroelectric utilities, and Latin American countries such as Peru, Mexico, and Argentina have shifted to energy as a common good.

6 J. C. Molburg, J. A. Kavicky, and K. C. Picel, *The Design, Construction, and Operation of Long-Distance High Voltage Electricity Transmission Technologies* (Lemont, IL: Argonne National Laboratory, 2007).

7 Alfred Runte, "Beyond the Spectacular: The Niagara Falls Preservation Campaign," *New York Historical Society Quarterly*, no. 57 (January 1973): 30–50.

8 H. V. Nelles, *The Politics of Development: Forests, Mines, and Hydro-Electric Power in Ontario*, 2nd ed. (Montreal: McGill-Queen's University Press, 2005), 312–13, 374–5.

9 Graeme Wynn, foreword to *Negotiating a River: Canada, the US, and the Creation of the St. Lawrence Seaway*, by Daniel Macfarlane (Vancouver: UBC Press, 2014), xxiii.

10 Mark Perlgut, *Electricity across the Border: the U.S.-Canadian Experience* (New York: C. D. Howe Research Institute, 1978), 10.

11 Perlgut, *Electricity across the Border*, 11–12.

12 Janet Martin-Nielsen, "South over the Wires: Hydroelectricity Exports from Canada, 1900–1925," *Water History* 1, no. 2 (2009): 109–29.

13 For more on the 1907 act and its subsequent modifications, see Martin-Nielsen, "South over the Wires," and Perlgut, *Electricity across the Border*.

14 The apparent Canadian advantage reflected US-owned plants and their exportation of electricity to the United States. See John N. Jackson with John Burtniak and Gregory P. Stein, *The Mighty Niagara: One River—Two Frontiers* (Amherst, NY: Prometheus Books, 2003), 212.

15 Karl Froschauer, *White Gold: Hydroelectric Power in Canada* (Vancouver: UBC Press, 1999).

16 Martin-Nielsen, "South over the Wires," 126–7. See also A. E. D. Grauer, "The Export of Electricity from Canada" in *Canadian Issues: Essays in Honour of Henry F. Angus*, ed. R. M. Clark (Toronto: University of Toronto Press, 1961), 276.

17 For a statistical overview of electricity generation and exchange within and between the United States, Canada, and Mexico, see United States Congressional Research Service, "Cross-Border Energy Trade in North America: Present and Potential," EveryCRSReport.com, 30 January 2017, https://www.everycrsreport.com/reports/R44747.html#_Toc473645486.

18 This is exemplified by the initial US application of the Harmon Doctrine, followed by the quick abandonment of this judicial principle, in the country's water relations with Canada, as well as by the history of Colorado River allocations.

19 Christopher Jones treats hydroelectricity as stock and part of the mineral energy regime, whereas R. W. Sandwell, emphasizing its renewable and flowing features, places it within the organic energy regime. Christopher F. Jones, *Routes of Power: Energy and Modern America* (Cambridge, MA: Harvard University Press, 2014); R. W. Sandwell, ed., *Powering Up Canada: The History of Power, Fuel, and Energy from 1600* (Montreal: McGill-Queen's University Press, 2016); E. A. Wrigley, *Energy and the English Industrial Revolution* (Cambridge: Cambridge University Press, 2010).

20 Owing to spatio-temporal realities, flowing water produces power that needs to be used on demand and at a scale that justifies the construction and maintenance of the system designed to convert and deliver that power as electricity. Fossil fuels can be removed from their place of origin and then burned and utilized at a desired location. But hydroelectricity typically has to be generated at the site of falling water, and the resulting electricity can only be transported if and where transmission wires make that possible (granted, hydro power generally isn't exposed to the same supply problems as fossil fuels). Water volumes and flow rates cap the amount of energy that could be produced by any particular hydro station, though the spread of massive electricity grids have allowed electricity to be pooled over large swaths of North America. Daniel Macfarlane and Andrew Watson, "Hydro Democracy: Water Power and Political Power in Ontario," *Scientia Canadensis* 40, no. 1 (2018): 1–18.

21 For an elaboration on the concept of "hydro democracy" with a focus on Ontario, see Macfarlane and Watson, "Hydro Democracy."

22 Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York: Verso, 2011).

23 Wrigley, *Energy and the English Industrial Revolution*; E. A. Wrigley, *The Path to Sustained Growth: England's Transition from an Organic Economy to an Industrial Revolution* (Cambridge: Cambridge University Press, 2016).

24 Jones, *Routes of Power*; Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (New York: Verso, 2016); R. W. Sandwell, "Pedagogies of the Unimpressed: Re-educating Ontario Women for the Modern Energy Regime, 1900–1940," *Ontario History* 107, no. 1 (Spring 2015): 36–59; and R. W. Sandwell, "People, Place and Power: Rural Electrification in Canada, 1890–1950," in *Transforming the Countryside: the Electrification of Rural Britain*, ed. Paul Brassley, Jeremy Burchardt, and Karen Sayer (New York: Routledge, 2017), 178–204.

25 In this sense, our adoption of Mitchell's concept of carbon democracy contributes to a wider historiographical debate on the nature and influence of liberalism in Canada. See Ian McKay, "The Liberal Order Framework: A Prospectus for a Reconnaissance of Canadian History," *Canadian Historical Review* 81, no. 4 (2000): 617–45; Stephane Castonguay and Darin Kinsey, "The Nature of the Liberal Order: State Formation, Conservation, and the Government of Non-humans in Canada," in *Liberalism and Hegemony: Debating the Canadian Liberal Revolution*, ed. Jean-Francois Constant and Michel Ducharme (Toronto: University of Toronto Press, 2009), 221–45; James Murton, *Creating a Modern Countryside: Liberalism and Land Resettlement in British Columbia* (Vancouver: UBC Press, 2007); Shannon Stunden Bower, *Wet Prairie: People, Land, and Water in Agricultural Manitoba* (Vancouver: UBC Press, 2011); Macfarlane, *Negotiating a River*.

26 Heasley and Macfarlane, *Border Flows*; Froschauer, *White Gold*.

27 The concept of "natural security" is taken from Daniel Macfarlane, "Natural Security: Canada-US Environmental Diplomacy," in *Undiplomatic History: The New Study of Canada and the World*, ed. Asa McKercher and Philip Van Huizen (Montreal: McGill-Queens University Press, 2019), 107–36.

28 A number of historians in Canada have explored the relationship between the consequences of hydro-power development for rural and Indigenous communities and environments, and the benefits enjoyed by urban residents and economies. See Brittany Luby, "From Milk-Medicine to Public (Re)Education Programs: An Examination of Anishinabek Mothers' Responses to Hydro-electric Flooding in the Treaty #3 District, 1900–1975," *Canadian Bulletin of Medical History* 32, no. 2 (2015): 363–89; Daniel Macfarlane and Peter Kitay, "Hydraulic Imperialism: Hydro-electric Development and Treaty 9 in the Abitibi Region," *American Review of Canadian Studies* 46, no. 3 (2016): 380–97; Caroline Desbiens, *Power from the North: Territory, Identity, and the Culture of Hydro-electricity in Quebec* (Vancouver: UBC Press, 2014); Matthew Evenden, *Fish versus Power: An Environmental History of the Fraser River* (Cambridge: Cambridge University Press, 2004); Matthew Evenden, *Allied Power: Mobilizing Hydro-electricity during Canada's Second World War* (Toronto: University of Toronto Press, 2015); Tina Loo and Meg Stanley, "An Environmental History of Progress: Damming the Peace and Columbia Rivers," *Canadian Historical Review* 92, no. 3 (September 2011): 399–427.

29 Thomas Park Hughes, *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore: Johns Hopkins University Press, 1993); David E. Nye, *Electrifying America: Social Meanings of a New Technology, 1880–1940*, new ed. (Cambridge, MA: MIT Press, 1992); David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1996); Harold L. Platt, *The Electric City: Energy and the Growth of the Chicago Area, 1880–1930* (Chicago: University of Chicago Press, 1991); Paul Hirt, *The Wired Northwest: The History of Electric Power, 1870s–1970s* (Lawrence: University Press of Kansas, 2012); Gretchen Bakke, *The Grid: The Fraying Wires between Americans and Our Energy Future* (New York: Bloomsbury, 2016); Julie A. Cohn, *The Grid: Biography of an American Technology* (Cambridge, MA: MIT Press, 2017).

30 Once the up-front capital costs were paid off, hydro power tended to be even cheaper per unit of production than coal and oil.

31 On the history of the St. Lawrence Seaway and Power Project, see Macfarlane, *Negotiating a River*.

32 Dwight D. Eisenhower Library and Archives, Columbia University Oral History Project, OH 177, Oral History Interview with N. R. Danielian (1972), 15; NARA II, RG 59, file 711.42157 SA 29/11-148 to 711.4216/10-1447, box 3304, Memorandum from Harry Truman to George C. Marshall, 3 December 1948.

33 In 1941, oil represented 17 per cent, coal 53 per cent, and electricity 6 per cent of total energy consumed. See Richard W. Unger and John Thistle, *Energy Consumption in Canada in the 19th and 20th Centuries: A Statistical Outline* (Naples: Consiglio Nazionale delle Riecerche-Instituto di Studi sulle Società del Mediterraneo, 2013). In terms of household rather than total national consumption, data from the Dominion Bureau of Statistics shows that (unlike the United States) Canadians were consuming very little electricity in their homes before the Second World War. On wood and biomass use for energy, see Joshua MacFadyen, "Hewers of Wood: A History of Wood Energy in Canada," in *Powering Up Canada: The History of Power, Fuel, and Energy from 1600*, ed. R. W. Sandwell (Montreal: McGill-Queen's University Press, 2016), 129–61. As Ruth Sandwell argues, Canada was an outlier compared to other industrialized countries because of the extent to which Canadians had "free" and widespread access to the organic energy regime through the generous homesteading system, cheap and often marginal agricultural lands at great distances from state surveillance, and the persistence of a dominant rural population more interested in "getting by" than in "getting rich." See R. W. Sandwell, *Canada's Rural Majority: Households, Environments, and Economies, 1870–1940* (Toronto: University of Toronto Press, 2016); R. W. Sandwell, introduction to *Powering Up Canada*; R. W. Sandwell, "Mapping Fuel Use in Canada: Exploring the Social History of Canadians' Great Fuel Transformation," in *Historical GIS in Canada*, ed. Jennifer Bonnell and Marcel Fortin (Calgary: University of Calgary Press, 2014), 239–70.

34 Macfarlane and Watson, "Hydro Democracy."

35 For the full history of the modern remaking of Niagara Falls for the purposes of both energy and beauty, see Daniel Macfarlane, *Fixing Niagara Falls: Environment, Energy, and Engineers at the World's Most Famous Waterfall* (Vancouver: UBC Press, 2020).

36 Ontario's process of rehabilitation evolved over several years. For an example of considerations about how to handle the Lost Villages, see Hydro-Electric Power Commission of Ontario (HEPCO), SPP Series, *Report of Meeting in Morrisburg (August 9, 1956), Outstanding Problems Related to the Rehabilitation Problem in the St. Lawrence Seaway Valley* (Toronto: Ontario Department of Planning and Development, August 31, 1956); Government of Ontario, RG 34-3, container 27R, file: St. Lawrence Waterway, file: St. Lawrence Seaway, 1948–June 1954, Memorandum to Bunnell, Subject: Preliminary Survey, St. Lawrence Area (September 13, 14, 15, 16, 17, 1954), September 23, 1954.

37 Writing as the St. Lawrence project was completed, Peter Stokes, who was critical of many elements of the rehabilitation, contends that the "the improvement of the loop streets are unappreciated since the previous towns weren't large enough to appreciate the traffic hazards of the old grid system." See Peter Stokes, "St. Lawrence, a Criticism," *Canadian Architect* 3, no. 2 (February 1958): 43–8. See also Sarah Bowser, "The Planner's Part," *Canadian Architect* 3, no. 2 (February 1958): 38–40.

38 For example, HEPCO, SPP series, St. Lawrence Rehabilitation: Meeting at Osnabruck, November 23, 1954; HEPCO, SPP series, St. Lawrence Rehabilitation: Meeting at Osnabruck, November 23, 1954.

39 HEPCO, SPP series, Report on the Acquisition of Lands and Related Matters for the St. Lawrence Power Project (By Property Office), 1955–56; HEPCO, SPP series, Supplementary Report to James S. Duncan (Chairman, and HEPCO Commissioners), "The Acquisition of Lands and Related Matters for the St. Lawrence Power Project," January 2, 1957.

40 Government of Ontario, RG 19-61-1—Municipal Affairs, Research Branch—Special Studies, St. Lawrence Seaway Study, Box 21, file 14.1.5—Minutes of Meetings—St. Lawrence Seaway #1, Memorandum of Meeting Re: Iroquois, December 21, 1954; HEPCO, SPP series, Report on the Acquisition of Lands and Related Matters for the St. Lawrence Power Project (By Property Office), 1955–56.

41 HEPCO, SPP series, Memorandum to Lamport: House to House Survey—Village of Farran's Point, February 10, 1955; HEPCO, SPP series, Memorandum to Carrick: Property Transactions—St. Lawrence Seaway, July 12, 1954. See also Tina Loo, "People in the Way: Modernity, Environment, and Society on the Arrow Lakes," *BC Studies*, nos. 142/143 (Summer/Autumn 2004): 169–71; Loo and Stanley, "An Environmental History of Progress," 399–427.

42 Sara B. Pritchard and Thomas Zeller, "The Nature of Industrialization," in *The Illusory Boundary: Environment and Technology in History*, ed. Stephen Cutcliffe and Martin Reuss (Charlottesville: University of Virginia Press, 2010), 70; Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge, MA: Harvard University Press, 2011).

43 Richard Carignan, "Dynamiques écologiques/Ecosystem Dynamics, Panel: Rivières & Fleuves/Rivers" (paper presented to the conference Positionner le Québec dans l'histoire environnementale mondiale/Positioning Quebec in Global Environmental History, Montreal, 3 September 2005); Gregory G. Beck and Bruce Littlejohn, *Voices for the Watershed: Environmental Issues in the Great Lakes–St. Lawrence Drainage Basin* (Montreal: McGill-Queen's University Press, 2000).

44 For more on the engineering and model process, see Macfarlane, *Negotiating a River*, ch. 6.

45 Martin-Nielsen, "South over the Wires," 126–7.

46 Perlgut, *Electricity across the Border*, 11. See also Cohn, *The Grid*.

47 Paul Chastko, *Developing Alberta's Oil Sands: From Karl Clark to Kyoto* (Calgary: University of Calgary Press, 2004), ch. 8.

48 In a chapter on Canadian-US differences, Donald Worster cites Marilyn Dubasak, Margaret Atwood, and Northrop Frye in support of this hostility argument. See Donald Worster, "Wild, Tame, and Free: Comparing Canadian and U.S. Views of Nature," in *Parallel Destinies: Canadian-American Relations West of the Rockies*, ed. John M. Findlay and Kenneth S. Coates (Montreal: McGill-Queen's Press, 2002), 246–75.

49 These include cultural differences (e.g., the fusion between freedom/liberty and wilderness in US thinking), the greater Canadian reliance on extractive industries, a relatively greater abundance of wilderness, and lack of federal control over land in Canada. See Worster, "Wild, Tame, and Free," 257–60, and George Altmeyer, "Three Ideas of Nature in Canada, 1893–1914," in *Consuming Canada: Readings in Environmental History*, ed. Chad Gaffield and Pam Gaffield (Toronto: Copp Clark, 1995), 96–118.

50 Christopher Armstrong and H. V. Nelles, *Monopoly's Moment: The Organization and Regulation of Canadian Utilities, 1830–1930* (Philadelphia: Temple University Press, 1986), 237–8.

51 R. Douglas Francis, *The Technological Imperative in Canada: An Intellectual History* (Vancouver: UBC Press, 2009), 2; Marco Adria, *Technology and Nationalism* (Montreal: McGill-Queen's University Press, 2010), 45.

52 Carolyn Johns, Introduction to *Canadian Water Politics: Conflicts and Institutions*, ed. Mark Sproule-Jones, Carolyn Johns, and B. Timothy Heinmiller (Montreal: McGill-Queen's University Press, 2008), 4; Jean Manore, "Rivers as Text: From Pre-modern to Post-modern Understandings of Development, Technology and the Environment in Canada and Abroad," in *A History of Water*, vol. 3, *The World of Water*, ed. Terje Tvedt and Eva Jakobsson (London: I. B. Tauris, 2006), 229.

53 Johns, Introduction to *Canadian Water Politics*, 4; Manore, "Rivers as Text," 229.

54 The sense of identification with, and ownership of, the St. Lawrence resulted in Canadians' fear of US encroachment on the river, particularly in the context of nationalist reactions against their nation's subservient role as a mere raw material exporter to the United States. An all-Canadian seaway project, along with other contemporary transportation projects such as the Trans-Canada Highway, were framed as nation-building parallels to the transcontinental railways of the late nineteenth century.

55 Andrew Biro uses the term "hydrological nationalism." See his "Half-Empty or Half-Full? Water Politics and the Canadian National Imaginary," in *Eau Canada: The Future of Canada's Water*, ed. Karen Bakker (Vancouver: UBC Press, 2007), 323.

56 Some of these, including the "door" metaphor, are taken from Patrick McGreevy, *The Wall of Mirrors: Nationalism and Perceptions of the Border at Niagara Falls* (Orono, ME: Canadian-American Center, University of Maine, 1991), 1–3; See also McGreevy, *Imagining Niagara*.

57 Matthew Huber, *Lifeblood: Oil, Freedom and the Forces of Capital* (Minneapolis: University of Minnesota Press, 2013), 5.

58 Unger and Thistle, *Energy Consumption in Canada*, appendix 1; Sam H. Schurr and Bruce C. Netchert, *Energy in the American Economy, 1850–1922* (Baltimore: John Hopkins University Press, 1960), 22.

59 According to the *Collins Dictionary*, "petro state" is a derogatory term for a small oil-rich country in which institutions are weak, and wealth and power are concentrated in the hands of a few; I prefer to use the term in reference to any state in which oil plays an outsized role in politics and political economy.