GREEN MASSACHUSETTS? CARBON REDUCTION
Goals and Strategies, and the Changing Role of Canadian Hydropower

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ABSTRACT

In the last 15 years, Canadian hydropower has played a key role in Massachusetts' carbon reduction goals. There has been considerable debate about what that role should be. We frame the story of this debate with a focus on the key events and decision-makers in order to provide a narrative for contextualizing the events in which the articles in this special edition were written. We employ a close reading of key documents and policy to assemble a chronological account of the evolution of Hydro-Québec in Massachusetts' energy future. In 2008, the Massachusetts Global Warming Solutions Act established an agenda of reducing emissions across the state by setting emissions reductions targets, later set at 25 and 80 percent below the 1990 level by 2020 and 2050 respectively. State reports suggested expanding hydropower imports from the provincially owned hydroelectric company Hydro-Québec. As 2020 approached, the Baker Administration signed the Energy Diversity Act of 2016 requiring utilities to enter contracts to buy clean energy, expecting to replace fossil fuel generation with Hydro-Québec electricity. We compare the key rationales as they evolve in state publications and policy, and environmental advocates' publications. We conclude with three lessons derived from the outcome of this history: (1) new blocks of clean energy are needed to reach emissions targets, (2) accessing new electricity generation will bring similar debates, (3) Massachusetts' decarbonization desires remain tied to Québec.

Key words: Massachusetts, Hydroelectric Imports, Greenhouse Gas Emissions, Hydro-Québec

Introduction

In its 2010 Clean Energy and Climate Plan, the state of Massachusetts set a 2020 deadline to reduce greenhouse gas (GHG) emissions statewide by 25 percent from 1990 levels (Breslow 2010). This target grew out of the Global Warming Solutions Act of 2008, which required the state to set a GHG emissions reduction target for 2020 (Massachusetts General Court 2008 §3(b)).

Achieving this 30-year reduction in GHG emissions required dramatic changes in energy use and infrastructure. Many of these changes had already started by 2010 when the 2020 target was set. Starting at the end of the 1990s, electric generation underwent a major fuel switch in New England, which shares a regional grid and market from which Massachusetts draws most of its electricity. Prior to this switch, natural gas "was a mere 15 percent of the region's fuel used to generate electricity in 2000. By 2014, natural gas had jumped to over 45 percent" (O'Connor 2015, 23). New natural gas-fired power plants emitted "almost 30 percent less carbon dioxide (the leading contributor to climate change) than oil fired plants and 45 percent less than coal-fired plants" (Stein 2004). According to the U.S. Energy Information Administration "electric operators in New England have been both generating more electricity from natural gas and importing more hydroelectric generation from Québec over the past decade" (Grubert and Booth 2014). Even with this headstart on the 2020 goal, over the last 10 years, the 25 percent reduction target sparked a heated debate.

By 2015, new comprehensive data showed that the state would achieve well over 20 percent GHG emissions reductions by 2020. However, it also became apparent that it would be challenged to reach the mandated 25 percent reduction from 1990 levels by 2020 (GWSP 2016). The extra percentage points and the looming goal of 80 percent reduction by 2050 became the focus of an intense bout of policy reports, advocacy, a lawsuit, new regulation, and new legislation.

As reliance on natural gas rose and coal and oil plants were retired, Massachusetts faced the challenge of providing energy "in the winter when large amounts of natural gas are always needed for space heating" (O'Connor 2015, 23). This seasonal pattern causes price spikes and necessitates firing "oil plants...to maintain electric system reliability" (O'Connor 2015, 23). Expanding hydroelectric imports from Hydro-Québec, a Canadian provincial electrical company, was seen as attractive, because "Canadian hydro resources are extensive and have low operating costs" (Breslow 2010, 45). New England began importing Hydro-Québec electricity through a transmission line in 1990 (Swain 2019). In 2015, Hydro-Québec had "a massive hydropower portfolio of 38,000 megawatts," but the transmission line was at capacity (O'Connor 2015, 26). Building on the existing relationship with Hydro-Québec in order to bring more hydroelectricity to Massachusetts through a new transmission line was an early strategy in Massachusetts' plan to reach its emissions reduction goal (Breslow 2010). Stakeholders from Hydro-Québec, New England utility companies, and Massachusetts government officials advocated for this approach, and worked to bring hydropower to Massachusetts in order to replace the state's remaining fossil fuel generation and reduce GHG emissions (Kuser 2017).

Under pressure from a Conservation Law Foundation lawsuit, the state issued a request for proposals that would lead to a plan to build a high-voltage transmission line connecting Hydro-Québec to southern New England (CLF 2016; Kuser 2017). Hydro-Québec worked with Massachusetts utility companies to push expansion of hydropower exports in response to Massachusetts' request for proposals (Kuser 2017; Nolan and Rinaldi, this issue). When Eversource's Northern Pass transmission line project was rejected by the state of New

Hampshire (Nolan and Rinaldi, this issue; Kroot, this issue), Massachusetts looked to the New England Clean Energy Connect transmission line through Maine (Mass DOER 2018). Delayed by local opposition in both states, no such line has been completed by the end of 2020. Nonetheless, a future transmission line is likely to play an important role in the Clean Energy and Climate Plan's even more ambitious target, a 2050 goal of 80 percent reductions from 1990.

This article traces the evolution of Massachusetts' carbon reduction strategies following the Global Warming Solutions Act of 2008 (GWSA), specifically the focus on hydropower imports from Hydro-Québec. We researched the context for the GWSA and the plan for achieving these carbon reduction goals published in 2010. Progress reports published by the state of Massachusetts and scorecards published by the Environmental League of Massachusetts provide two perspectives on the work done in the state over the course of the first twelve years of the GWSA. Key decisions and events in the first half of the timeline of this story include a transition to a Republican governor and a lawsuit by the Conservation Law Foundation. In the latter half of this timeline, Massachusetts passed the 2016 Energy Diversity Act, requiring Massachusetts utilities to solicit long-term contracts for clean energy generation, along with six additional clean energy regulations. When the Northern Pass transmission line through New Hampshire was rejected, the Massachusetts Department of Utilities approved the decision to move forward with the Clean Energy Connect transmission line through Maine. This chronological framework allows us to perform a close reading of policy and stakeholder publications in order to reveal the rationales behind state strategies, critiques by environmental groups, key decisions and future implications of the debate around Canadian hydropower imports.

Following our chronology, we offer an analysis section that identifies the key patterns in this history. State publications and legislative action indicates that hydroelectric imports were attractive for the potentially short timeframe for accessing new electricity, the cost-effectiveness, and the balance that hydroelectric imports could provide in a renewable energy system. On the other hand, environmental groups emphasized the difficulty that routing a new transmission line posed and advocated for a breadth of solutions in order to reach Massachusetts' emissions goals. Advocates worried that a focus on efforts to build a new transmission line would distract from more local renewable infrastructure development. They also highlighted concerns with the very categorization of large hydroelectric as low-emissions, pushing the state to properly account for carbon emissions associated with reservoirs and flooding from dams (GWSP 2014; 2016). Additional stakeholders within and outside of the state of Massachusetts advocated for and against importing additional hydroelectric power, including local energy generators and the utilities involved in building the envisioned transmission line.

This chronology provides important context for other articles in this special edition that explore the public controversies around transmission of imported Canadian hydropower in New Hampshire (Nolan and Rinaldi, this issue; Kroot, this issue) and Maine, and some of the impacts of Hydro-Québec on rivers and First Nations in Canada (see Desmeules and Guimond, this issue).

Designing a Plan for Emissions Reductions in Massachusetts

Massachusetts has long been a leader in reducing environmental impacts from electricity generation (Vogel, this issue). For example, the state made energy efficiency a central focus in 1987 with the New England Energy Policy Council's "Power to Spare" report (Cohen 1987). Since then, Massachusetts' energy efficiency initiatives have remained strong "through Republican and Democratic administrations and [have] reduced consumption by one third from projections" (Cowell 2012). Massachusetts Renewable Portfolio Standards were "created by the Electricity Restructuring Act of 1997 and activated by regulations in 2002" and require "Massachusetts Retail Electricity Suppliers to obtain from qualified sources certain percentages of the electricity needed to supply their retail customers" (Mass DOER 2018). Massachusetts is also part of the Northeast's Regional Greenhouse Gas Initiative, "the nation's first market-based cap-and-trade program to reduce carbon dioxide emissions from power plants" (Kimmel and Burt 2009, 312). In 2007, Governor Patrick announced "a bold step to make Massachusetts the first state to recognize the interdependence of energy and the environment, combining the state's environmental agencies and energy agencies into one cabinet level secretariat, the reconstituted Executive Office of Energy and Environmental Affairs" (Kimmel and Burt 2009, 296). This reorganization was intended to allow new collaboration and progress in the field of energy and environmental policy in Massachusetts, and preceded the state's adoption of binding emissions reduction targets.

While a federal emissions cap has yet to pass in the United States, several states have taken their own steps to set GHG emissions reductions targets (GWSP 2014). The Patrick administration promoted an emissions target as an attractive policy to meet climate goals while promoting economic growth through innovation and renewable energy development (Murphy 2010).

The Global Warming Solutions Act of 2008

The GWSA was one of five major environmental laws passed by the Deval Patrick administration in 2008 (Kimmel and Burt 2009). At its core, the GWSA required the Massachusetts Executive Office of Energy and Environmental Affairs to establish an emissions reduction goal across all economic sectors between 10 and 25 percent below the 1990 emissions levels by 2020, as well as a long-term goal of 80 percent GHG reduction by 2050 (Breslow 2010).

The first step required by the GWSA was detailing greenhouse gas emissions in Massachusetts in 1990 and using this data to set a short-term emissions reduction goal for 2020. Section 2(a) of the GWSA outlines the Department of Environmental Protection's new responsibilities to "monitor and regulate emissions of greenhouse gases with the goal of reducing those emissions." This monitoring was accomplished with a regional greenhouse gas registry and reporting system collecting data from greenhouse gas emitters and periodic updates on progress and reported data. Section 3(a) of the GWSA established mandatory reporting of the state's largest sources of emissions by 1 January 2009, as well as requiring the Department of Environmental Protection to assess the 1990 GHG baseline and 2020 projections.

Language in the GWSA suggests the involvement of other New England states and close Canadian provinces in reaching GHG emissions reduction goals. The law states in Section 7(c): "[T]he executive office and the department may work with the participating regional greenhouse gas initiative states and other interested states and Canadian Provinces to develop a plan…to facilitate the achievement of the greenhouse gas emissions limits." The greenhouse gas registry was also designed to include 'leakage,' or increase in emissions outside the state that might be caused by decreases in state emissions, including "transmission and distribution line losses from electricity generated within the state or imported from outside the Commonwealth" (Massachusetts General Court 2008 §1; §5). These sections suggest regional involvement in meeting Massachusetts' climate goals and create a framework for importing hydroelectricity from Hydro-Québec.

The next step in implementation was to decide on a target and develop a plan. By 1 January 2011, the state was required to have established a 2020 emissions target and a plan for achieving it.

Clean Energy and Climate Plan, 2010: Designing a Plan to Meet Emissions Reductions Goals in 2020 and 2050

On 29 December 2010, the state published the Massachusetts Clean Energy and Climate Plan (CECP) for 2020 (Breslow 2010). This report detailed emissions data collected and analyzed since 2008 and the potential strategies for reaching a 2020 GHG emissions goal. The CECP prioritized reducing emissions, improving air quality, and setting a national example. But the plan also emphasized the economic development opportunities of environmental leadership, leading Massachusetts to "become more energy independent, and jump start its economy with new technologies, new companies, and new jobs" (Breslow 2010, 12). After two years of deliberation, public comment, predictions, and technical assessment, Massachusetts set the GHG emissions reduction goal for 2020 at 25 percent emissions reduction from 1990 levels (Breslow 2010, ES-1).

Through the CECP, we begin to trace the state's explicit interest in expanding hydropower imports. The Secretary of Energy and Environmental Affairs announced the state's interest in expanding transmission lines, which were already providing "8.5 percent of New England's electric consumption," that could bring additional Canadian hydropower to Massachusetts (Breslow 2010, 45). The report suggested taking advantage of "inexpensive clean power" available in Québec by creating a new transmission line through northern New England (Breslow 2010, 45). This transmission line was expected to provide up to "1,200 MW of clean energy and up to 5 million tons of emissions reduction in the Commonwealth," or "15 percent of Massachusetts' present electricity demand" (Breslow 2010, 45). The plan anticipated challenges with this project stemming from the transmission lines, which "involve federal, state and local permitting, and often raise siting concerns, with potential delays from legal action" (Breslow 2010, 46). The state asserted that expanded hydropower imports could reach Massachusetts through a transmission line through New Hampshire, "the Northern Pass transmission line being developed by two Massachusetts utilities, NSTAR and Northeast

Utilities, in partnership with Hydro-Québec" (45). At that point, clean energy imports (i.e., Canadian hydropower) were expected to provide 5.4 percent of Massachusetts' overall 25 percent GHG emissions reductions from 1990 levels (Breslow 2010, ES-6).

The "hundreds of jobs" created by a new transmission line aligned with the state's goal of new job creation (Breslow 2010, 45). The authors of the CECP acknowledged that "while the vast majority of these jobs will be in New Hampshire and Québec, it is likely to have spillover effects in Massachusetts" (2010, 45).

The CECP did acknowledge that "not every one of these policies must be implemented to its fullest extent in order to achieve the 2020 mandate" (Breslow 2010, ES-8). Given variations in predictions and Business as Usual emissions levels, the state was expected to reassess which strategies based on state mandated progress reports every five years for the purpose of tracking emissions reductions (Breslow 2010, ES-5). But the desirability of importing Canadian hydropower had been explicitly endorsed as a promising strategy on the basis of significant short-term emissions reductions, cost and economic development goals.

History: Changing Projections and Strategies for GHG Emissions Reductions

With the CECP for 2020 released, the state now had to move forward with a host of policies and programs to reach its 2020 target of 25 percent reduction of GHG emissions from 1990 levels. To demonstrate its progress, the state was required to release reports on the 2008 GWSA every five years, as well as an update the 2010 CECP. This requirement meant a major report was published every two or three years, four in total by the time the 2020 deadline would be reached, including: GWSA Progress Reports in 2013 and 2018, and CECP Updates in 2015 and 2020. Each report showed a change in the state's view of the role that Hydro-Québec imports would play in reaching the 25 percent GHG reduction target for 2020.

Each report was also an opportunity for scrutiny. As the state issued report after report, a coalition of environmental groups, led by the Environmental League of Massachusetts, calling themselves the Global Warming Solutions Project (GWSP) both encouraged and critiqued the state's actions and plans. Two "scorecards" written for two different governors in 2014 and 2016 suggested growing concern. This concern was echoed by a 2014 lawsuit from the Conservation Law Foundation accusing the state of violating the requirements of the GWSA. In 2016, the state Supreme Judicial Court ruled in favor of the plaintiffs. In response, the state passed legislation that could fund a transmission line to bring Hydro-Québec power to Massachusetts, and new clean energy standards to further incentivize it. Even so, by 2018, it was clear that no such transmission line would be built by 2020. The percentage targets had to be calculated and met without Hydro-Québec power. Hydro-Québec power was still embraced as part of its 2050 goals.

This section describes each of these reports and policy developments in turn, highlighting changes in the way the state and environmentalists portrayed importing power from Québec

within the context of plans to meet the 2020 target of 25 percent reduction of GHG emissions from 1990 levels, and the evolution of state policy. The following section will summarize the key stakeholders' arguments and actions and their evolutions, and lessons from this history.

Global Warming Solutions Act Progress Report, 2013

In December 2013, the Executive Office of Energy and Environmental Affairs released a five-year progress report on the GWSA (Mass EEA 2013). Among the accomplishments listed were: growing "Massachusetts' clean energy sector...by 11.8 percent in 2012" and developing a "new Clean Energy and Climate Performance Management System to track and document progress on GHG reduction strategies" (Mass EEA 2013, 6). The 2013 Five-Year Progress Report emphasized the goals of "cost-effective," "efficient" energy, and "economic growth" (Mass EEA 2013). The EEA progress report reasserted that a "key tenet of the Patrick Administration's vision on climate change is that aggressive action to reduce global warming emissions can advance economic growth." (Mass EEA 2013, 2).

The Five-Year Progress Report acknowledged "that more can and must be done to position the state to achieve the 2020 emissions limit and move onto a trajectory consistent with a minimum 80 percent reduction in emission levels by 2050" (Mass EEA 2013, 7). Among the emphases on what should be done: import a large new block of Canadian hydropower. The Patrick Administration was driven to pursue hydroelectric imports because of the pressure to "increase the pace of GWSA implementation" to meet the 2020 deadline (Mass EEA 2013, 8-9).

The Mass EEA (2013, 43) report itself drew attention to the renaming of one of eight key strategies, from "Clean Energy Imports" to "New Clean Energy Resources." Expanding clean energy resources beyond imports reflected a "broad approach to expanding regional access to new, large scale, clean energy resources such as large hydro and both onshore and offshore wind energy" (Mass EEA 2013, 43). This goal was given a "medium" likelihood of meeting the 2020 target, and an anticipated emissions reduction of 5.3 percent (down only slightly from the original projection of 5.4 percent in 2010) (Mass EEA 2013, 6-7). Wind power was promoted as "the Commonwealth's largest indigenous energy resource" (Mass EEA 2013, 9). Hydropower imports still held potential, but the 2013 Five-Year Progress Report made it clear that the state was expanding its search for new energy resources.

Among the initial strategies for GHG emissions in the GWSA, some progress was slow due to "a reduction in state resources available to implement them," while others led to emissions reductions that "occurred much faster than initially anticipated" (Mass EEA 2013, 8). For example, cost effective energy efficiency, which was expected to account for 7.3 percent of emissions reductions in the 2010 CECP, had fallen to 7.1 percent by 2015, as "electric savings fell short of the annual goals implied by the 2020 Plan" (Mass EEA 2013, 34). Slow progress and a low likelihood of timely implementation for some of the original strategies served as a driver for importing hydropower from Hydro-Québec.

Regionally, in 2013, New England governors came to an agreement to work together to secure affordable, clean, and reliable energy. Governor Patrick, along with the other five New England governors, agreed that "the New England States believe that investments in local renewable generation, combined heat and power, and renewable and competitively-priced heating for buildings will support local markets and result in additional cost savings, new jobs and economic opportunities, and environmental gains" (Malloy et al 2013, 1). At this point in 2013, there were a number of directions for Massachusetts to go in order to reach its goal to reduce 25 percent of emissions by 2020.

Global Warming Solutions Project's 2014 Scorecard: Questioning the Timeline and Emissions Reductions of Hydropower Imports

In 2014, the Environmental League of Massachusetts organized the aforementioned Global Warming Solutions Project (GWSP), a coalition of local and regional environmental advocacy groups. The GWSP released its own report, or "Scorecard," assessing Massachusetts' progress since the GWSA was passed (GWSP 2014). Unlike the state's report, the Scorecard projected that Massachusetts would meet "four-fifths of the legal mandate," or 20 percent reductions below 1990 levels, not the required 25 (GWSP 2014, ES-ii).

The GWSP report recommended a number of policies that could close this gap and push Massachusetts beyond the required 25 percent emissions reduction. Their first recommendation was to dramatically increase energy efficiency investments by making sure utilities actually met their targets, include the cost of carbon emissions in calculating cost-effective efficiency investments, and adopting a higher buildings "stretch code" for towns designated as Green Communities. The coalition also suggested developing "appropriately-sited, cost-effective transmission lines to bring additional renewable power into Massachusetts" and adding renewable thermal energy to the Alternative Energy Portfolio Standard. In the category of transportation and land use, the scorecard suggested a mileage reduction pilot program, "smart driving education," zoning reform legislation, regulation to prevent an increase in motor fuel emissions, and regulation to improve bicycling, transit and walking. From non-energy emissions, the scorecard suggested legislation to "reduce methane leaks from the natural gas distribution system" and promulgate regulations to reduce refrigerant leakage (GWSP 2014, 7-9).

The GWSP brought attention to critiques of the Northern Pass projects' ability to provide the amount of electricity initially suggested by the 2010 Clean Energy and Climate Plan. Of the 1,200 MW line, the scorecard assumes, for lack of better data, that only "two-thirds of the power goes to Massachusetts", with "some percentage going to at least Northeast Utilities' subsidiary in Connecticut" (GWSP 2014, 18). This "would yield approximately a 3.0 percent cut in overall GHG emissions in 2020," in contrast to the state's anticipated 5.4 percent cut (GWSP 2014, 19).

The GWSP called into question the timeline for achieving new hydropower imports from Hydro-Québec, determining it would be "unlikely that a line could be completed and in operation by 2020 along with zero carbon resources that would feed the line" (2014, 18).

Alternatively, the scorecard suggests, "other sources of low- or zero-carbon power could become available in time, such as wind power from northern Maine or other hydropower from eastern Canada (Newfoundland and Labrador, for example), but the state's Five Year Review does not present evidence of their likelihood" (GWSP 2014, 18). Based on the scorecard's estimated 10 percent likelihood of a new transmission line bringing 3 percent of emission reductions, the GWSP (2014, 19) concluded that strategy would lead to "only a 0.3 percent cut in the state's emissions in 2020, rather than the 5.4 percent forecast in the 2020 Plan."

The GWSP also identified concerns with "the assumption of the delivery of zero-carbon power" from Canadian hydropower (GWSP 2014, 19). The GWSP wanted to know "what fraction of Canadian imports is likely to come from already-existing hydroelectric facilities and what fraction would require new dams and flooding" (2014, 19). If new dams were built and "additional land is flooded in order to provide for Massachusetts' power needs, the GHG increases from the flooding should be added to our state's overall emissions" (GWSP 2014, 19). Even existing dams "result in permanently taking those forests out of commission as carbon 'sinks'... and this lost GHG reduction capacity must be taken into account" (GWSP 2014, 19). The coalition's critique of the Commonwealth's emissions reductions projections, its timeline for transmission line permitting and construction, and its carbon accounting methodologies contradicts the optimism of Massachusetts politicians and policy-makers.

In concert with the Scorecard, the Conservation Law Foundation filed a lawsuit against the Commonwealth of Massachusetts for its "lack of action on the GWSA" (Samenfeld-Specht 2018, 6). The Conservation Law Foundation, a New-England based regional foundation dedicated to conservation through litigation and policy, "had fought hard to pass the GWSA back in 2008" (GWSP 2014, 6) and continued to advocate for environmental action as a member of the GWSP (GWSP 2014). The Conservation Law Foundation believed "the State's lack of action had begun to endanger the GWSA's first legal milestone: to cut climate pollution by 20 percent below 1990 levels by 2020" (GWSP 2014, 6). The organization felt that legal action was necessary in order to ensure "that Massachusetts will continue to lead the region, and the nation, in fighting climate change" (GWSP 2014, 7).

Clean Energy and Climate Plan Update, 2015: State Government Optimism Under a New Administration

In early 2015, there was a change in leadership in Massachusetts from the Patrick Administration (D) to the Baker Administration (R). The legislature remained Democratic in both chambers, however. That year, the Executive Office of Energy and Environmental Affairs published a Five-Year Update of the Massachusetts CECP for 2020 originally released in 2010. Secretary of Energy and Environmental Affairs Matthew A. Beaton did not express the same doubts as the GWSP. He wrote, "a greenhouse gas (GHG) emissions reduction of at least 25 percent by 2020 is attainable...[F]ull implementation of this Clean Energy and Climate Plan (CECP) Update will set the Commonwealth on course for a sustained, vibrant state economy with environmentally responsible economic growth" (Mass EEA 2015, V). Previous reports, including the 2010 Clean Energy and Climate Plan, anticipated that not all of the strategies

would or could be fully implemented. Beaton's statement suggested a new urgency in achieving full implementation in order to meet the legally binding reductions requirements.

It was in this report that imports of Canadian hydropower rose to the top of the plan. Although every policy was stressed in order to reach approaching targets, "this CECP Update identified two policies in particular that when fully implemented will result in immediate and substantial benefits: the import of cost-effective, low-carbon hydroelectric power generation and Class-1 renewable resources; and vehicle GHG emissions standards" (Mass EEA 2015). It was evident that Canadian hydropower would be of particular importance, although the expected emissions reductions had dropped from 5.4 percent (2010) to 5.3 percent (2013), and then to 4.2 percent in 2015. Without this policy, the calculation of predicted improvements suggested there was a risk of failing to meet the 2020 emissions target. This renewed emphasis on the Clean Energy Imports policy was marked by a return to the language of "Clean Energy Imports," instead of using the "New Clean Energy Resources" strategy named in the 2013 GWSA Progress Report (Mass EEA 2013, 2015).

Additionally, the report stated that slow progress in other areas of emissions reductions put pressure on the state to find a single, large block of emissions reductions. Cost effective energy efficiency solutions, which were expected to account for 7.3 percent of reductions in 2010, then 7.1 percent in 2013, were only expected to account for a 5.8 percent reduction (Mass EEA 2015, 12). As the deadline got closer, all available strategies for reaching the 2020 goal were becoming important, and failure to reach some goals put more pressure on clean energy imports.

2016 Scorecard: Global Warming Solutions Project's Growing Caution

Following the 2015 CECP Report, the GWSP released another "Scorecard" assessing the progress made towards GWSA targets. In contrast to the Baker administration's confidence and reinvigorated support for Canadian hydropower imports, there was a growing tone of urgency in the 2016 Scorecard. The GWSP reported that "without new policy action, Massachusetts is not likely to achieve our 2020 requirement of 25 percent below 1990 levels and remain on track to achieve the 2050 requirement of 80 percent below 1990 levels" (GWSP 2016, 5).

The nonprofit coalition again highlighted the concerns over transmission line project approval and emphasized Secretary of Energy and Environmental Affairs Beaton's own assessment that without "the incorporation of at least 1,200 megawatts of hydropower into our generation mix, it will be very difficult to meet our 2020 goals the 2020 GHG reduction requirements without large-scale hydropower imports from Canada" (Metzger 2016, 1). As a keystone part of the Baker Administration's plan to meet the 2020 goal, the coalition cautioned that "it is not clear that the transmission would be in service in time to deliver the full 4.2 percent" (GWSP 2016, 10).

The report also re-emphasized the difficulty of accounting for the carbon emissions of large-scale hydroelectric power, given the "initial 'pulse' of GHG emissions from the organic matter that is submerged and then decomposes" when a new dam is built (GWSP 2016, 24).

Additionally, the report stated that this administration's focus on hydropower threatened to "undermine or delay development of in-region renewable energy resources, such as onshore and offshore wind" (GWSP 2016, 10). This critique was especially important, the report argued, in the context of the long-term goals that the Massachusetts government had laid out for achieving future GHG emissions reductions. If hydropower imports played an even bigger role in meeting 2050 emissions goals, "potentially up to 2400 MW of hydropower," the GWSP (2016, 24) warned that this scenario could crowd out in-region wind production from transmission line access. The concern that reliance on imported hydropower could have long-lasting impacts by undermining the development of a diverse, regional renewable sources undercut the state's goals of energy independence and job creation (GWSP 2016; Breslow 2010).

Conservation Law Foundation Lawsuit: 2016 Update and State Response

In May 2016, the Massachusetts Supreme Judicial Court released its ruling on the 2014 lawsuit brought by the Conservation Law Foundation in conjunction with the Massachusetts Energy Consumers Alliance and four teenage plaintiffs. The Conservation Law Foundation argued that the state had failed to uphold section 3 (d) of the GWSA, which required that "the department shall promulgate regulations establishing a desired level of declining annual aggregate emission limits for sources or categories of sources that emit greenhouse gas emissions" (GWSA 2008). Conservation Law Foundation's lead lawyer Jenny Rushlow determined this to mean, "the DEP has discretion over which carbon sources to regulate, but not whether to regulate" (WBUR News Room 2016). The state argued, "sulfur hexafluoride, RGGI, and LEV regulations satisfy the mandate" (*Kain v. Department of Environmental Protection* 2016, 3). According to the Massachusetts Supreme Judicial Court, these regulations were insufficient-- "Massachusetts has failed to meet its legal obligation to set and enforce annual limits on greenhouse gas emissions" (WBUR News Room 2016). In its ruling, the Massachusetts Supreme Judicial Court affirmed that the Department of Environmental Protection must:

> ...promulgate regulations that address multiple sources or categories of sources of greenhouse gas emissions, impose a limit on emissions that may be released, limit the aggregate emissions released from each group of regulated sources or categories of sources, set emission limits for each year, and set limits that decline on an annual basis. (Kain & others vs. Department of Environmental Protection 2016, 39).

In other words, the Department of Environmental Protection would have to pass regulations. Those regulations would need to identify a total amount of GHG emissions -- measured in carbon dioxide equivalents, not just a percent -- that would be reduced, and designate an amount that would come from each sector. That amount would set a regulatory limit. The amount would need to go down in each sector each year, and the total reduction following these limits must reach the 2020 target.

The decision was critical to spurring new action from the government of Massachusetts, given the approaching deadline. Shortly after the ruling, "the Department of Environmental Protection reached out to CLF and asked for input on the proposed regulations" (Samenfeld-Specht 2018, 7). In September 2016, Governor Baker issued Executive Order 569, *Establishing an Integrated Climate Change Strategy for the State*. The executive order required the Department of Environmental Protection to pass regulations by 11 August 2017 to meet the requirements of the GWSA as affirmed by *Kain*. The order also required the Secretary of Energy and Environmental Affairs to publish a Climate Adaptation Plan and a comprehensive energy plan within two years. The executive order mandated a number of emissions reports, revised GWSA requirements for agencies like the Massachusetts Department of Transportation, and directed that the state continue to lead in the "reform of regional wholesale electric energy and capacity markets to ensure that state mandates for clean energy are achieved in the most cost-effective manner" (Baker 2016).

Advancing Canadian Hydropower Imports to Massachusetts, Part 1: 2016 Energy Diversity Act

The court ruling also led to a reinvigorated enthusiasm for Canadian hydropower. A June 2016 editorial in the Boston Globe posited that the slow progress of wind power, combined with the Supreme Judicial Court's ruling holding the state to a strict reading of the 2020 goal, solidified the importance of Canadian hydropower in meeting the state's 2020 goals (Editors 2016b). This solution, supported by both former Governor Patrick (D) and current Governor Baker (R), would also allow Massachusetts to make critical progress towards the requisite 80 percent reductions by 2050 (Editors 2016a, 2016b). With pressure mounting from multiple stakeholders, hydropower became increasingly important to Massachusetts' success in emissions reductions and efficient electrification.

Even before Baker issued his Executive Order, there was already a push in the Massachusetts legislature to act. However, legislators and lobbyists disagreed over the role of hydropower versus New England-based renewable power, and also over adding new electricity versus reducing carbon emissions in other sectors. Under time pressure, electricity was seen as the relatively low-hanging fruit compared to major changes in transportation, buildings, or land use. At the end of the legislative session, a more inclusive Senate bill was set aside for a simpler House bill that focused on clean electricity. Among the choices for clean electricity, the bill also offered a compromise: it would mandate both offshore wind *and* "clean energy" from either northern New England wind farms or Canadian hydropower (Chesto 2016).

In August 2016, the Massachusetts legislature passed an *Act to Promote Energy Diversity*. This legislation was a clear response to the 2020 GWSA goals and the Conservation Law Foundation lawsuit. The clean energy portion of the law required Massachusetts investor-owned electric utilities to "solicit proposals for clean energy generation and, provided that reasonable proposals have been received,..enter into cost-effective long-term contracts for clean energy generation" (Massachusetts General Court 2016 §12). There was a parallel requirement to solicit proposals for offshore wind.

The language of the Energy Diversity Act of 2016 "gave utilities a role in developing the request for proposals as well as a role in selecting the winning proposal" (Environmental League of Massachusetts (ELM 2018) Specifically, the three Massachusetts investor-owned distribution utilities, Eversource, National Grid, and Unitil, together with the Massachusetts Department of Energy Resources, would release a Request for Proposals for clean energy. Proposals could be for new generation, or they could be for transmission lines that would connect to an existing generation source. The same team that wrote the proposals would then evaluate them: the three utilities and the Department of Energy Resources. After a winning bid was selected, the distribution companies were to "enter into a contract with the winning bidders for their apportioned share of the market products being purchased from the project" (Massachusetts General Court 2016 §83D(g)). Each utility would purchase a portion of the power proportional to how many customers each utility had.

The Energy Diversity Act had specific criteria that were required for winning bids. These illuminate the broader desired purposes of Massachusetts lawmakers and advocates. These criteria included: enhanced electricity reliability; guaranteed energy delivery in winter months, along with contributing to reducing winter electricity price spikes; cost effectiveness for electric customers, with cost-effectiveness "taking into consideration potential economic and environmental benefits to the ratepayers"; project viability in a commercially reasonable timeframe; and where feasible, the creation and fostering of employment and economic development in Massachusetts. In addition to these requirements, preference was to go to proposals that combined "new Class I renewable portfolio eligible resources and firm hydroelectric generation" and would benefit "low-income ratepayers in the commonwealth without adding cost to the project." As described later in this paper, these would be important factors in the review of the contract by the Massachusetts Department of Public Utilities in 2019.

The utilities and the Department of Energy released their request for proposals in March 2017(Mass DOER et al 2017). In January 2018, the Massachusetts government announced its decision to move forward with Eversource's Northern Pass transmission line, which "would bring up to 1,100 megawatts of electricity from power producer Hydro-Québec" (Chesto and Abel 2018).

Within the state, "the choice of Eversource and Hydro-Québec instantly drew fire from the New England Power Generators Association and from environmental groups" (Chesto and Abel 2018). While Secretary Beaton assured that an "independent evaluator was hired to oversee the process," critics were skeptical. They pointed out that the "law required that the big electric utilities be involved in the decision-making process," including Eversource, and the winning project was an Eversource project (Chesto and Abel 2018).

The even bigger controversy, however, was in New Hampshire itself. Activists in and beyond the state had been fighting against the line for years. (Kroot, this issue; Nolan and Rinaldi, this issue). In February 2018, barely after a week after Massachusetts announced it the winner, the state of New Hampshire rejected Massachusetts' top choice transmission line, Northern Pass, setting back plans to get Hydro-Québec's power to Massachusetts.

When it became clear that Northern Pass would not be going through, the project fell to the distribution companies' next best choice from the request for proposals, a transmission line through Maine called New England Clean Energy Connect, spearheaded by Avangrid through its subsidiary Central Maine Power (Chesto 2018). Power purchase agreements and transmission service agreements were later signed in June 2018 (Mass DPU 2019).

Advancing Canadian Hydropower Imports to Massachusetts, Part 2: 2017 Clean Energy Regulations

As the solicitation for clean energy imports that came out of the Energy Diversity Act wound its way slowly through local, state and federal permitting processes, there was another way that Massachusetts law moved to advance imports of Canadian hydropower. This time, it was amidst a wider set of decarbonization initiatives: the rulemaking that was required by the GWSA and the Supreme Judicial Court's *Kain* decision. A total of six regulations grew out of the Kain decision and the governor's Executive Order. Two of these dealt with transportation, one with natural gas leaks, and one with sulfur hexafluoride emissions from large machinery. That left two that dealt with electricity. One required reductions from carbon dioxide emissions from fossil-fuel electric generating facilities (Mass DEP 2016).

The sixth regulation was a new "Clean Energy Standard" (CES) which would be added to the existing renewable portfolio standard. Electric suppliers would now be required to acquire "clean energy," which was defined as Class I Renewable Portfolio Standard energy (Class I renewables was a set of preferred kinds of renewable energy built since 1997 that did not include large hydropower) or other energy that produced less than half the emissions of a new natural gas plant. Beyond this, the regulations specified that any other generation "that is retained pursuant to" the clean energy Request for Proposals from the Energy Diversity Act were clean energy generation. In other words, this was a second state commitment to put the financial support of electric customers into bringing new Hydro-Québec power to Massachusetts. This regulation was passed in December 2017 (CMR 2017 7.75(2) and (6) Clean Energy Standard).

2018 Global Warming Solutions Project

The selection committee had selected Northern Pass in part because it was the farthest along among the proposals in terms of permits and planning, and thus most likely to be completed by the 2020 deadline. With the demise of the Northern Pass transmission line and the turn to the New England Clean Energy Connect Line through Maine, the Environmental League of Massachusetts' GWSP was vindicated in its longstanding doubt: a new large block of Canadian hydropower would not be brought to Massachusetts by the end of 2020. Despite the passage of the *Energy Diversity Act* and the new *Kain*-inspired regulations, the Environmental League of Massachusetts' 2018 yearly Report Card, published in collaboration with many of the same organizations that participated in the GWSP, asserted that they were "disappointed that the Commonwealth is lagging in many areas where we should be leading" (ELM 2018, 2). According to the League (ELM 2018, 2-3), leadership was "falling short" and "agency staff are stretched extremely thin and only have time to be reactive rather than proactive in addressing the many issues before them."

The League criticized the Energy Diversity Act selection committee's decision to select Northern Pass' transmission line, which "would transmit only large hydropower and no Class 1 renewable resources." The League questioned this "hydro-only" transmission line, when "a more diversified approach could have been a boost to the domestic renewable energy sector." Avangrid's New England Clean Energy Connect transmission line would "also transmit only large Canadian hydropower and includes no solar or wind energy." The focus on hydropower was described in the report as "a missed opportunity to develop a more diversified set of renewable resources such as on-shore wind and solar." While the report did not oppose importing hydropower, there was clear disagreement with the selection of a "hydro-only" approach to reducing carbon emissions (ELM 2018, 11).

The League's recommendation for renewable energy in Massachusetts was to bolster programs in Massachusetts like the SMART (solar) program and increase Renewable Portfolio Standards, and "ensure that the next phase in the development of offshore wind moves forward quickly" (ELM 2018, 12). Finally, the League began to look beyond the 2020 goal and assess Massachusetts' ability to reach its 2050 emission reduction goal. The League suggested that the state "Support efforts to extend the GWSA regulations to 2050" and "set a goal of a 50 percent emissions reduction from 1990 levels by 2030 to be on the path to meet reductions of 80 percent by 2050." While the League was not encouraged by the progress of hydropower imports thus far, they encouraged Massachusetts to promote wind as "a major source of energy for New England" and approved the state's decision to "to procure viable and cost-effective energy storage." Both of these solutions would set Massachusetts on a better track to not only meet the 2020 goals, but also the long-term 80 percent emissions reduction goal (ELM 2018, 14).

GWSA 10-Year Progress Report, 2018

In 2018 the Massachusetts Executive Office of Energy and Environmental Affairs (Mass EEA) published the GWSA 10-Year Progress Report (Mass EEA 2018). Despite the demise of Northern Pass and the GWSP's critiques, the state in 2018 proclaimed success and confidence. In 2018, "the latest statewide GHG inventory by MassDEP shows that GHG emissions in 2016 were 21.4 percent below the 1990 baseline level." Based on these levels, the 2018 Mass EEA Report claimed Massachusetts was "on track to meet the 2020 emissions limit of the GWSA" (Mass EEA 2018, 10).

In this report, it remained clear that the state intended to expand hydroelectricity imports, if not in time to reach its 25 percent reduction target by 2020, then to meet its 80 percent reduction target by 2050. Previously "Clean Energy imports," in the 2018 Mass EEA report "this policy is renamed to Clean Energy Procurement to reflect the procurement of hydroelectricity resources and offshore wind, both of which will be online in the 2020s" (50). The report emphasized the importance of hydroelectric imports for achieving emissions reductions beyond 2020:

> ...[R]eductions after 2020 will require actions to 'reduce, decarbonize, and electrify' the energy system, with electrification driving significant electricity demand. Recognizing that emissions could increase if this demand is not met using clean

> generation... New clean energy from Canadian hydroelectric generation and large-scale wind energy are the keystone of the Commonwealth's strategy for further reducing GHG emissions from energy generation. (Mass EEA 2018, 46).

Looking forward, then, large-scale renewable power remained central to Massachusetts' plans to meet its 2050 target, and importing Canadian power continued to play an important role, as did Massachusetts-based renewable development.

Advancing Canadian Hydropower Imports to Massachusetts, Part 3: 2019 NECEC approval

In June 2019, the Massachusetts Department of Public Utilities approved the New England Clean Energy Connect line proposed power purchase agreements (Mass DPU 2019). A number of stakeholders participated as intervenors and "limited participants." Critical questions were raised by the Massachusetts Attorney General's Office; by environmental groups including the Acadia Center, the Conservation Law Foundation, and the Sierra Club; by owners and representatives of existing New England merchant generators, including the New England Power Generators Association and NextEra; and by trade groups of energy-consuming businesses, including the Associated Industries of Massachusetts, The Energy Consortium, and the Western Massachusetts Industrial Group. Defending the agreements on each point were the Massachusetts Department of Energy Resource and the parties to the agreement: Hydro-Québec and its partner, utility Central Maine Power, owned by Avangrid; and the three Massachusetts distribution utilities.

A major part of the docket reviewed whether the contracts fulfilled the Energy Diversity Act's criteria. A brief review helps to reveal the deeper questions over importing Canadian hydropower to Massachusetts, and the position this crucial state regulator took. It is worth noting that the approval was later challenged but upheld by the Massachusetts Supreme Judicial Court (Gheorghiu 2020).

One key question was: Was the Hydro-Québec power to be delivered via the power purchase agreements incremental? The legislature had specifically allowed hydroelectric generation as eligible, so the question of methane emissions from reservoirs did not come up. The Department of Public Utilities ruled that under the statute's definition of firm, "hydroelectric generation provided without interruption for one or more discrete periods designated in a long-term contract, including....though [sic] the diversity of multiple units," Hydro-Québec power was firm. And, because it was firm, it was incremental, as past imports have largely been "through non-firm commercial deliveries that fluctuate depending on market conditions and transmission constraints" (Mass DPU 2019, 18-64, 18-65, 18-66: 29, 59).

Another key question was whether the Hydro-Québec imports through the power purchase agreements would *guarantee energy delivery in winter months, and help reduce winter electricity price spikes*. NextEra, an electric services company, argued that the supply obligations and ability to deliver hydroelectric power set by the Power Purchase Agreement (PPA) cannot "guarantee winter delivery and reduce winter price spikes" (Mass DPU 2019, 69). New England Power Generators Association similarly argued that there was "no basis for the Department to

conclude that the PPAs will guarantee energy delivery in the winter months as required" (Mass DPU 2019, 70). The Department of Public Utilities ruled yes, because the power purchase agreements included scheduled guaranteed deliveries for each month of the 20-year contract, including December, January and February.

A third question was whether the contracts would *enhance electric system reliability*. Several stakeholders said this was questionable because of the transmission constraints between northern and southern New England. The Department of Public Utilities ruled that because New England is an interconnected regional grid, delivery to Maine counted as improving reliability.

Was the project viable in a *reasonable timeframe*? Yes, because the generation is already being produced, and the contracts for transmission have critical milestones, require justification for any extensions, and provisions for fines if the commercial operation is not achieved on time. The due date for commercial operation was 13 December 2022, with limited allowances for delays.

Perhaps most important to a public utility commission, were the power purchase agreements *cost-effectiv*e for electric customers? The distribution utilities had employed a consultant to predict future cost of energy, environmental attributes and transmission, who had estimated that the "total cost of the energy and environmental attributes will be below the market value of energy and CECs over the term of the contracts by a value of $3.962 billion" (Mass DPU 2019, 109). Representatives of potential competitors to this new Hydro-Québec power from the New England Power Generators Association and NextEra argued there would need to be additional transmission lines built to bring the power from Maine to Massachusetts, which would cost an additional $5 to $10 billion, making the projects not cost-effective. The Department of Public Utilities found the consultant's report to be reasonable, disagreed with the need for new transmission between Maine and southern New England, and asserted that the distribution utilities had shown that there were other qualitative benefits as well, "including benefits related to reliability, environmental impacts, employment, and economic development" (Mass DPU 2019, 110). Employment and economic development would come through the construction of the new transmission line, and the economic benefits of reduced-cost power.

Thus, in this key legal arena, the import of new Hydro-Québec power was supported as a strategy for GHG reductions in the state of Massachusetts.

Advancing Canadian Hydropower Imports to Massachusetts, Part 4: 2020 Clean Existing Energy Regulations

In summer 2020, Massachusetts adopted an amendment to the 2017 Clean Energy Standard: it added a standard for clean *existing* energy (CES-E) built before the publication of the original, 2010 Massachusetts Clean Energy and Climate Plan. To qualify, a generation unit "must demonstrate that it... [i]s located in either Massachusetts, New Hampshire, Connecticut, or Eastern Canada (Québec or Newfoundland and Labrador); and... [c]ommenced commercial operation before January 1, 2011; and... "[i]s a nuclear or hydroelectric generation unit with a nameplate capacity greater than 30 MW" (310 CMR 7.75 Clean Energy Standard, 2020).

This standard was not related to the newly contracted New England Clean Energy Connect line, but it was still aimed to use imports of Canadian hydropower to help achieve the GHG emissions reduction targets from the Clean Energy and Climate Plan. It would support continued imports of Canadian hydropower through older transmission lines -- either from Hydro-Québec, or possibly from Newfoundland and Labrador, via either Québec or New Brunswick. The amendments would also support payments to retain nuclear power plants within the regional grid. As the Department of Environmental Protection's background document explained, the revised standards would help:

> ensure compliance with the 2020 emissions limit... under the authority of the GWSA, which requires Massachusetts to reduce statewide GHG emissions by 25 percent relative to a 1990 baseline.... The CES-E is important to "lock-in" the contribution of these existing resources to Massachusetts' clean energy supply in 2020 and beyond (Mass DEP 2019).

Clean Energy and Climate Plan Update & Legislation, 2020-21: 2050 Roadmap

In 2020, Baker announced his "intent to pursue the more aggressive net zero target to further reduce emissions" (Mass EEA 2020a) Secretary Kathleen A. Theoharides of the Executive Office of Energy and Environmental Affairs determined "that net zero emissions by 2050... is a reasonable and appropriate 2050 statewide emissions limit necessary to adequately protect the health, economy, people and natural resources of the Commonwealth" (Mass EEA 2020a). This new 2050 goal, up from the original GWSA mandate of 80 percent emissions reduction, was the focus of planning for the 2050 Decarbonization Roadmap report (Mass EEA 2020b). In the 2050 Decarbonization Roadmap, published in December 2020, the state encouraged "an integrated portfolio of clean energy" in which "resources needed to ensure a reliable electricity supply during such a sustained low-wind period include clean electricity imported over interstate transmission lines" (Mass EEA 2020b, 62). This report affirmed that the anticipated "New England Clean Energy Connect 100 percent Hydro project will provide 9.5 Terawatt-hours of clean hydropower and increase regional transmission capacity by more than 1 GW" (63). Looking beyond 2020, Massachusetts policymakers continued to see Canadian hydropower as important to balancing regional renewable energy sources.

As we were finishing up this article, on 26 March 2021, Governor Baker signed *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy*. While still focused on reducing GHG emissions, unlike the earlier legislation and regulations reviewed above, it did not focus on imported Canadian hydropower as a centerpiece. Rather it focused on acquisition of new offshore wind energy, increasing the Renewable Portfolio Standard, various kinds of efficiency, electrification of transportation and heating, solar incentives, and environmental justice. Like the 2050 Decarbonization Plan, it aimed for net-zero emissions in Massachusetts by 2050 (Massachusetts General Court 2021; Office of Governor Charlie Baker and Lt. Governor Karyn Polito 2021; Walton 2021). Meantime, the New England Clean Energy Connect line faced new hurdles in Maine (Wade 2021).

Analysis: Stances and Strategies on Importing Canadian Hydropower to Meet Massachusetts GHG Emissions Reduction Targets

In this section we analyze first, Massachusetts' approach, strategy and action relative to importing Canadian hydropower as a strategy to meet its GHG reduction targets; next, those of the GWSP and the Environmental League of Massachusetts; and finally, some other considerations that have been part of this debate and evolution that are also important to this story.

Understanding Massachusetts' Drive for Hydro-Québec Power

The history we have detailed shows Massachusetts' continuing emphasis from 2008 to 2020 on importing Canadian hydropower, primarily from Hydro-Québec. It was often embraced as a linchpin strategy to reduce GHG emissions and reach the state's ambitious GHG emissions reduction targets. This emphasis showed up in a series of state reports, and was codified into state law in legislation in 2016 and regulations in 2017 and 2020. Nonetheless, there were evolving roles and rationales for this emphasis, and in the most recent legislation, in 2021, it is largely missing. How can we understand both the emphasis and its evolution?

The policy reports published by the state promoted three key rationales for expanding hydroelectric imports as a key strategy for meeting state GHG emissions reductions targets. State reports cited (1) Canadian hydropower's ability to meet a tight timeline for emissions reductions targets, (2) the cost-effectiveness of hydroelectric imports, and (3) the ability of hydropower to provide balance in a renewable energy system. The balance among these, and the way they were used to support particular strategies, shifted over time. This evolution also showed up in the way that Canadian hydropower was included, or not, in legislation, regulations, and the Department of Public Utilities decision on the New England Clean Energy Connect long-term contracts.

First, across all the state reports, hydroelectric imports were promoted as a relatively fast and achievable means of emissions reductions. This was emphasized particularly strongly in the earlier reports. Massachusetts established "the most aggressive set of measures to address climate change of any state in the country," according to the state's 2013 progress report, tied to a strict timeline of reaching the first short term goal by 2020 (Mass EEA 2013, 1). State publications prior to the 2018 progress report posited that expanded hydroelectric imports would be achievable in time to provide emissions reductions for the 2020 goal. However, between the establishment of Massachusetts' carbon reductions goals and the first deadline of 2020, numerous other emissions reductions strategies were slow to get off the ground. Emissions reductions from energy efficiency consistently underperformed (Mass EEA 2015, 12). Cape Wind, which was supposed to generate 468 MW of power, and was slated to be "the first offshore wind project in the United States, and ... create 600 to 1,000 jobs" (Breslow 2010, 4) faced costly resistance and litigation from powerful land-owners, indigenous communities, and wildlife agencies before eventually being abandoned (Swain 2019). In light of these delays, Hydro-Québec's existing relationship to Massachusetts and its already-existing

capacity to export hydroelectricity were cited as factors that could help bring these expanded imports online by the 2020 deadline (Mass EEA 2015, 92). While the state acknowledged the uncertainty of "siting concerns, with potential delays from legal action," the reports also noted "several competing transmission projects" already in development (92). In the 2010, 2013, and 2015 reports and plans, the state's narrative thus promoted hydroelectric imports as an achievable source of emissions reductions within the strict 2020 timeline.

Later, however, these claims grew less enthusiastic and less optimistic. By 2018, the state's reports were not counting new Hydro-Québec imports in their plans for meeting the 2020 targets. This was because of the delays that came from New Hampshire's rejection of the Northern Pass transmission line.

Even then, however, Massachusetts policymakers continued to believe that Hydro-Québec power could be brought to the New England grid relatively quickly compared to other not-yet-built generation. This was apparent in the language of the 2016 Energy Diversity Act, and especially in the Department of Public Utility's 2019 approval of long-term contracts with the New England Clean Energy Connect line, as they deemed that the project, whose initial contract deadline was 2022 but might be delayed for specific reasons, was viable within a reasonable timeframe.

The second rationale supporting expanding hydroelectric imports as a key strategy for meeting state GHG emissions reductions targets was the cost-effectiveness of hydroelectric imports. Our investigation of Massachusetts carbon reduction policy highlights recurring references to the promise of hydropower imports providing cost-effective energy and price stability. State policies and progress reports consistently identified hydropower imports from Hydro-Québec as "inexpensive clean power" (Breslow 2010, 45). The 2010 CECP suggested that hydroelectric imports would present "no additional costs...to ratepayers or taxpayers" (45). The 2010 CECP and subsequent 2015 update promoted hydroelectric imports' ability to improve energy price stability (Breslow 2010; Mass EEA 2015, 92). The 2015 Update also continued to argue that a competitive bidding process to select long-term contracts to deliver this power would "minimize costs to ratepayers" (Mass EEA 2015, 92). The contracts between Massachusetts utilities and Avangrid, signed in 2018, was for the "purchase of 9.45 million MWh of electricity from Hydro-Québec each year" through Avangrid's New England Clean Energy Connect transmission line. For this electricity, "utilities owned by Eversource, National Grid and Unitil will pay a total levelized price of $0.059/kilowatt hour" (Walton 2018). The Department of Public Utilities' approval of these contracts hinged in part on its judgment that these contracts would reduce electric customers' bills. Comments from intervenors and participants in the Department of Public Utilities also suggest that concerns about cost relative to other power options was a key part of whether parties believed that hydropower imports through the New England Clean Energy Connect line were desirable (Mass DPU 2019).

The third major rationale for hydropower imports as a key strategy for Massachusetts to meet GHG emissions reductions goals was that Canadian hydropower could help alleviate imbalances and strains in the resource mix at particularly crucial times. This rationale became more important over time, almost inversely with the declining emphasis on timeliness. A transmission line connecting Massachusetts to more hydroelectricity was consistently promoted

by the state as a source of seasonal balance in Massachusetts' energy system. More recently, it has been emphasized as an important resource in optimizing renewable energy resources across the region. The narrative that hydropower can provide balance in Massachusetts' energy system was repeated throughout publications, particularly as the state began to think beyond 2020. The original CECP promoted additional hydropower imports' ability to "significantly improve the region's fuel diversity, improving energy security and price stability" (Breslow 2010, ES-2). Two of the criteria for approval of long-term contracts under the 2016 Energy Diversity Act related to this issue: guaranteed winter delivery, and help reducing winter price spikes. Winter electric reliability and price spikes have been important concerns for some years since the region turned predominantly to natural gas generation. This is because New England produces none of its own natural gas, and in deep winter cold, the gas supplies imported to the region are needed for heat, and an inadequate supply is left for electric generation. This leads to electricity price spikes and use of fuel oil, a more GHG-emitting option (see e.g. NERC 2020). The 2018 state progress report highlighted that "the NECEC Project will be particularly beneficial during the winter months when the region experiences high energy prices due to reliance on natural gas for both electricity and heating" (Mass EEA 2018, 52).

In the more recent legislation, rulemaking and reports, the state began to focus also on the ability of hydropower to balance out intermittent renewable power. The 2016 Energy Diversity Act allowed for clean energy proposals in which hydropower would "firm up" Class I renewable resources, many of which are wind power. The 2050 Decarbonization Roadmap suggested that the construction of a transmission line connecting Québec to Massachusetts would allow the state "to export offshore wind power to Québec can enable the optimal use of hydropower and offshore wind resources across the broader Northeastern region" (Mass EEA 2020, 65). The state maintained that, "to affordably and reliably operate an electricity grid based on variable renewable generation, a balanced portfolio of clean generation technologies shared across a broad geographical region is needed" (Mass EEA 2020, 23).

Environmental Advocates' Concerns with Hydroelectric Imports

While the state of Massachusetts advanced imports of Canadian hydropower as a key strategy for meeting state GHG emissions reductions targets, environmentalists treaded more carefully, voicing enthusiasm for the goal of reduced emissions, but not necessarily the strategy of hydropower imports. Behind the scenes, environmental groups and their allies were not always of the same opinion; some, like the Union of Concerned Scientists, supported importing Canadian hydropower (Kimmell 2019), while others, like Sierra Club Massachusetts, were opposed (Norton 2017). One of the leading environmental groups, the Conservation Law Foundation, opposed Northern Pass but then helped negotiate an agreement to support the New England Clean Energy Connect (O'Neill 2019). Amidst this array of opinions, the Environmental League of Massachusetts and the larger GWSP coalition sought to bridge these differences for maximum influence. In reading these coalitions' reports and policy scorecards, we identified three repeated concerns with the policy of expanding hydroelectric imports. Two were in almost direct opposition to the state's positions.

The coalitions' most consistent -- and prescient -- criticism was that hydropower imports could not be acquired in time for the 2020 target. Already in their 2014 climate scorecard, the GWSP raised concerns with the state's narrative that a new transmission line could be completed by the 2020 deadline. Citing the Northern Pass project, which "was specifically identified in the 2020 Plan," the scorecard highlighted "significant challenges" that threatened to delay developments (GWSP 2014, 18). The GWSP described the challenge of overcoming "all the necessary political, regulatory and financial hurdles within the next couple of years" (2014, 18; see also Breslow 2010, 45). This concern was highlighted again in the GWSP's 2016 report, questioning the state's assertion that one of the "several competing transmission projects" in their 2015 progress report could bring 4.2 percent of emissions reductions by 2020 (2016, 92).

If the state was overly optimistic about hydropower imports, that put policymakers' rosy estimates about meeting the 2020 target into question. While the state argued Canadian hydropower would help balance other renewables, environmental advocates cautioned that relying on expanding hydroelectric imports to bring the necessary emissions reduction by the 2020 deadline could delay progress on in-state and regional renewable energy development. In 2016, the scorecard expressed concerns that "calling for imports of hydropower alone, would likely undermine or delay development of in-region renewable energy resources, such as onshore and offshore wind" (GWSP 2016, 10). This was specifically in relation to legislation submitted to the Massachusetts Senate by Baker, S. 1965, enabling "electric companies to enter into 20+ year contracts for up to 2400 MW of hydropower" (23) -- a precursor bill to the 2016 Energy Diversity Act. In this scorecard, the GWSP seemed to see hydropower imports as a necessary part of a decarbonization path for the state and region. They suggested that hydroelectric imports would be important for the 2050 mandate. Still, they were not enthusiastic. They emphasized that "any long-term contracts for clean energy supply must include a significant percentage of Renewable Portfolio Standard (RPS) eligible resources, especially onshore wind to avoid crowding these resources out of transmission opportunities" (GWSP 2016, 24).

One member of the GWSP, the Conservation Law Foundation, found other means besides reports and scorecards to force the state to speed up on a range of measures. Their 2016 victory in the state Supreme Judicial Court forced more rapid-fire legislation and rulemaking in state government. The environmentalists' ambivalence about hydropower imports as probably necessary in the long run, but no silver bullet, was reflected in the policy that emerged from the lawsuit. This included the 2016 Energy Diversity Act's mandate for long-term contracts for both wind and "clean" power, and the clean energy regulations that followed in 2017 and 2020. In both the 2016 legislation and 2017 and 2020 regulations, the state avoided defining large hydropower as renewable, but explicitly defined it as mandated "clean" energy to include imported energy from large hydropower.

This was significant because earlier, the GWSP had repeatedly expressed concerns with the classification of large hydroelectric power as "very low-emissions" (GWSP 2014, 2016; see also Breslow 2010, 45). A 2012 study by Synapse Energy Economics Inc. cited by the GWSP noted that "there is not yet scientific consensus on methods for estimating GHG emissions from hydropower" (Steinhurst et al. 2012, 15). This study identified significant sources of

carbon emission from hydropower in "newly flooded reservoirs... due to the decomposition of biomass covered by the flooded reservoir" as well as "the elimination of a terrestrial biological community and its replacement by an aquatic biological community" (Steinhurst et al. 2012, 15). Environmental advocates presented concerns in 2014 with both existing dams and the possibility of future dam construction, with inconclusive information about "what fraction of Canadian imports is likely to come from already-existing hydroelectric facilities and what fraction would require new dams and flooding" (GWSP 2014, 19). Advocates argued that these emissions "must be properly accounted for when tallying lifecycle emissions reductions from hydropower facilities" (GWSP 2016, 24). Still, most Massachusetts groups seemed to have come to accept that large hydropower would be counted as low-emitting, and was preferred over fossil fuel generation. We infer this from their lack of protest on this point in the Department of Public Utilities deliberation over the New England Clean Energy Connect line in 2019 and in the comments on the clean energy revisions in 2020.

Conclusions: The Role of Canadian Hydropower in Massachusetts' Future Efforts to Meet GHG Reduction Targets

In this article, we aimed to provide a narrative for understanding the stakeholders and rationales that have been involved with Massachusetts' push to bring Canadian hydropower, and particularly Hydro-Québec power, to the state as a key strategy to meet its GHG emissions reduction targets. Our paper provides context for understanding where the state is in 2021, and the story behind the other articles in this special edition.

By mandating greenhouse gas emissions reductions from 1990s levels of 25 percent by 2020 and 80 percent by 2050, the state of Massachusetts embraced a massive political, economic, and social challenge. Reaching these levels of carbon emissions on such a tight timeline required a transition to non-fossil-fuel sources of energy or a dramatic reduction in greenhouse gas emissions usage across sectors, or both. While energy reduction strategies across sectors were included in the plan for reaching both the 2020 and 2050 goals, relying only on reduction without a large increase in non-fossil-fuel energy would require dramatic social and economic change. The state reports and legislative and regulatory action identified in this history highlight the state's determination and its rationales to continue replacing fossil-fuel energy sources with low-emissions power. Connecting Massachusetts with existing generation in Québec through a transmission line was an attractive policy action for state policy makers for its cost-effectiveness, apparent speed to completion, and ability to provide balance to a renewable energy system.

Still, how much, when, *how*, or even *whether* Hydro-Québec power would play a major role in meeting Massachusetts' GHG emissions reduction targets was still unknown in the first half of the 2010s. The 2016 Energy Diversity Act and subsequent clean energy regulations, as well as the Massachusetts Department of Public Utilities' 2019 approval of the New England Clean Energy Connect line, helped answer some of these questions. Even now in 2021, however, the import of large volumes of Hydro-Québec power that was expected following the 2016 Energy Diversity Act, the 2018 selection of the New England Clean Energy Connect line, and its 2019 approval by the Massachusetts Department of Public Utilities, still awaits further approvals.

Massachusetts' difficulty in importing a large new block of Hydro-Québec power demonstrates the complexity of replacing fossil-fuel generation with clean power. "Clean" power has to come from somewhere, be transmitted from there to its destination, and someone has to build that transmission and pay for it. Despite the fact that large hydropower is now defined in Massachusetts policy as "clean," many environmental advocates in the state questioned whether it was a desirable policy option to reach GHG emissions reduction targets. They asked whether large hydropower would actually result in the level of emissions reductions expected by the state and raised concerns that it would draw resources and focus away from in-state and local renewable generation development.

But importing large hydropower from Hydro-Québec has been controversial for Massachusetts not only because of Massachusetts-based questions about the emissions reductions it could bring. It has also been difficult because electricity needs to pass through continually interconnected transmission lines, and those need to be sited in physical locations that cross both country and state(s) borders. Massachusetts legislators and the companies that aimed to build the transmission lines did not acknowledge the full potential of complexities of running a transmission line through New Hampshire or Maine. While environmentalists foretold the challenges, state leaders remained blithe until near the end of the timeline.

This history provides three key lessons that will be valuable as Massachusetts looks to its 2050 emissions deadlines. First, reaching the 2050 emissions target will require significantly more new blocks of low-emission electricity generation. Due to the emissions reductions that followed the regional fuel switch to natural gas, Massachusetts was at a significant advantage when beginning its work in 2010 to reduce emissions by 25 percent from the 1990 level (ISO NE 2017). Achieving the levels of emissions reductions needed to reach the 80 percent reduction mandate by 2050–now net zero, in the brand-new 2021 climate roadmap law–will require new strategies and blocks of low-emissions energy, which may come in the form of Canadian hydroelectric imports. While opponents in Maine are still organizing drives for referenda that could stop it, the transmission line through Maine has been permitted and is scheduled to be completed by the end of 2023. In addition, Massachusetts continues to plan for significant wind and solar development. This will not only require transmission infrastructure but new generation infrastructure.

The second lesson is that accessing new electricity generation will bring debates, both in the state of Massachusetts and at the site of generation and transmission, which is likely to slow the progress of new development. As much as state priorities and interests changed in the years since the GWSA, the needs and input of additional stakeholders have evolved. Importing large new volumes of hydropower would change the balance of energy generators in southern New England, favoring customers but potentially hurting existing generators (Vogel, this issue). Balancing the needs of different stakeholders and advocates has caused significant delay, both within and outside Massachusetts. We suspect that whether through the New England Clean Energy Connect or another route, new Hydro-Québec electricity will eventually flow to New England, but it will continue not to be the easy fix state leaders thought it might be. Future transmission and generation infrastructure development can be expected to encounter similar debate in order to balance the needs of stakeholders and legislative and regulatory mandates.

Third, Massachusetts' plan to achieve decarbonization by 2050, as outlined in the 2050 Decarbonization Roadmap (Mass EEA 2020b) and expected in the new climate roadmap law, will involve Canadian hydroelectricity imports; therefore, Massachusetts' decarbonization desires will continue to impact the future of Northern New England and Québec. The Decarbonization Roadmap, published at the end of 2020 by the Baker administration, suggested that the state's goal was to establish a "balanced regional electric grid dominated by renewables" (Mass EEA 2020b). To satisfy this, new developments in wind, solar, electricity storage, and "several new high-voltage transmissions lines to Canada and New York that will allow sharing of low-cost clean energy, including hydropower, with the Commonwealth's neighbors in the Northeast" would be needed (Mass EEA 2020b, 23). As the other papers in this special issue show, GHG reduction imperatives in Massachusetts thus have wide implications for distant rivers and First Nations in Québec and the people and landscapes of northern New England . As it stands in 2021, Massachusetts' decarbonization goals remain tied to Canadian hydropower, and Hydro-Québec interests will continue to remain tied to Massachusetts.

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