Canada-U.S. Green Bilateralism:

Targeting Cooperation for Climate Mitigation

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KEY FINDINGS:

1. Across our chosen policy areas, bilateral cooperation takes place via a broad array of distinct cooperative channels and structures, fragmenting continental climate policy efforts.
2. The architecture supporting bilateral climate cooperation is lightweight and vulnerable to domestic political headwinds.
3. It would be difficult to change the bilateral dynamics on issues like black carbon and ground-level ozone pollution, where cooperative structures are entrenched and linked to other environmental problems, i.e., air pollution.
4. There are clear economic, political and technological rationales for deepening cooperation across the border for carbon capture and storage technologies, electrified transportation, and methane reductions.
5. Canada and the U.S. should consider a "cluster" strategy for pursuing continental vehicle electrification (across vehicle manufacture, battery manufacture and recycling, and charging infrastructure) as the four components need to be built out in an integrated fashion.

Under the Biden administration and the Trudeau government, the U.S. and Canadian commitment to bilateral cooperation on climate is both strong and comprehensive. This stands in stark contrast to the complete lack of engagement under the previous Trump government and the decidedly uncomfortable Harper/Obama relationship on climate.

As noted in Canada's climate plan, *A Healthy Environment and a Healthy Economy* (Government of Canada 2020:7), "there is an opportunity to collaborate with the incoming United States administration on strong cross-border climate action that can better position the North American economy, as well as Canadian workers and companies so that they can continue to be globally competitive." At their first Summit in February 2021, the U.S. President and Canadian Prime Minister confirmed their "renewed partnership," and committed to "work in tandem, and encourage others to achieve net zero emissions no later than 2050" (The White House 2021b). The two countries established the High Level Climate Ministerial to coordinate cooperation in order to "explore opportunities to align policies and approaches to create jobs, while tackling climate change and inequality, and enhancing adaptation and resilience to climate impacts" (The White House 2021b).

This paper undertakes several tasks in order to determine the most promising areas for climate policy cooperation between Canada and the United States. First, we compare climate mitigation programs and policies in Canada and the United States, as well as bilateral statements, to pinpoint areas where there appears to be the closest policy alignment, at least on paper. This strategy yields three climate policy areas where American and Canadian policy aims are similar and where cooperation seems likely: carbon capture and storage technologies (CCS), reduction of short-lived climate pollutants, or SLCPs (methane, black carbon, ozone, and hydrofluorocarbons), and electrification of transport (vehicles, batteries, with some reflections on battery recycling and charging infrastructure).

The analysis then tests the cooperative potential in each area by establishing the presence or absence of six attributes in programming (across both countries and bilaterally): 1) strong political commitment; 2) established and institutionalized bilateral relations; 3) presence of strategic domestic policy partners; 4) authorities/regulatory frameworks to support action; 5) low or no technological barriers to quick implementation; and 6) alignment with international relations and initiatives. Lastly, we discuss the mitigation potential of the different policies, recognizing that while conditions may be in place for close cooperation, policies may differ in terms of whether they are likely to result in actual greenhouse gas (GHG) reductions in the near term.

This paper finds that, in general, the architecture supporting bilateral cooperation is lightweight and vulnerable to domestic political headwinds. Relatedly, in most areas—including some SLCPs (methane and HFCs) and components of the electric vehicle system—bilateral interactions are not functionally intense or well institutionalized. Other policy areas, such as black carbon, ground-level ozone, and vehicle standards, benefit from being situated within bilateral cooperative structures that are well developed but primarily linked to *other* environmental policy regimes (such as transboundary air quality). There appears to be little coordination or clustering within or across issue areas in terms of how bilateral cooperation is organized, although this paper notes several areas where clustering might be possible. Instead, across our chosen policy areas, bilateral cooperation takes place via a broad array of distinct cooperative channels and structures, fragmenting continental climate policy efforts. Finally, this paper reflects on the prospects for more integrated strategies that build on close economic and trade relations, particularly in this current moment when climate policy aspirations and political will are readily available.

CLIMATE POLICY LEGACIES AND DYNAMICS IN NORTH AMERICA

Climate policy in Canada and the U.S. have shown similar domestic trajectories of seesawing between ambition and retrenchment and, bilaterally, alignment and misalignment (Olive and VanNijnatten forthcoming).

While Canada seemed as though it might be a climate policy leader in the earliest international negotiations to reduce GHG reductions in the 1990s, its public commitments have not, until recently, been matched by tough policies and programs that could kick-start a green transition. Under a succession of progressive but pro-trade Liberal governments over the 1990s to mid-2000s, Canada took baby steps in terms of climate policy. When the Conservatives took over the reins of government in 2006 under the leadership of Stephen Harper, climate policy took a backseat to turning Canada into an 'energy superpower.' Meanwhile, in the U.S., the George W. Bush administration was similarly disinterested in climate mitigation and made only minimal efforts to encourage clean energy technologies toward the end of his tenure.

In 2008, however, Democratic presidential candidate Barack Obama campaigned hard on a more ambitious environmental agenda, and his ascent to the presidency signaled a quick turn in the direction of climate action at home and leadership internationally. While the Obama administration never succeeded in getting congressional action on GHG reductions, it moved full-speed ahead to pursue emission reductions—particularly from coal-burning power plants and vehicle emissions—through regulatory regime-building based on provisions in the 1990 *Clean Air Act* as well as through executive orders. The Canadian Harper administration was reluctantly pulled along by Obama's ambitions, eventually agreeing to match U.S. reduction commitments, to align vehicle emissions policies with American standards, and to make some cooperative headway on clean energy supports.

With the Harper government's defeat in 2015 at the hands of the pro-environment Liberals, the newly minted Prime Minister Justin Trudeau and his cabinet moved quickly to put in place the planks for an ambitious national climate strategy. Canada adopted a leadership role at the UN Paris Summit that same year, and Trudeau then proceeded to hash out a domestic implementation plan with the provinces in 2016 to meet Canada's international reduction target. The resulting *Pan Canadian Framework on Clean Growth and Climate Change* was anchored by a federal commitment to a carbon pricing regime that would hit $50/ton by 2022. This was an unprecedented action, never taken by any previous federal government in Canada. During their one year of overlapping leadership, Trudeau and Obama enthusiastically announced joint initiatives on climate and clean energy—also including Mexico, which had proven to be an early mover on climate policy, in their efforts. The future for North American climate action seemed bright indeed.

As we know, however, the election of Donald Trump in late 2016 abruptly changed the climate policy landscape on the continent. The new administration was pro-coal, pro-fracking, pro-oil, and anti-environmental "red tape" and regulation, and efforts to tear down the GHG emissions reduction regulatory regime put in place under President Obama were initiated right away (Olive and VanNijnatten forthcoming). Against these strong headwinds blowing from south of the border which emboldened conservative critics, the Trudeau government nevertheless steamed ahead, raising the carbon price by $15/ton per year over 2023–2030 (in the face of court challenges from several provinces), rolling out an immense green infrastructure and public transit program, and putting serious public monies into new clean energy and industrial technologies. The *Greenhouse Gas Pollution Pricing Act* was passed in 2018, providing a firm legislative basis for the carbon pricing regime; vehicle emissions standards were tightened; regulations limiting methane emissions from the oil and gas sector were put in place; and a Clean Fuel

Standard was developed. The national climate strategy was further solidified in the *Healthy Environment, Healthy Economy* (HEHE) strategy, released in December 2020, which pulls together a wide variety of climate programs. And, with the July 2021 passage of the *Canadian Net Zero Emissions Accountability Act*, the current and future governments will be held accountable for meeting emission reduction targets.

After the 2020 presidential election, a decidedly climate-ambitious President Biden moved into the White House. The new administration quickly established an architecture for supporting and coordinating climate policy at the highest levels, with a White House Office of Domestic Climate Policy, a National Climate Advisor, and a National Climate Task Force composed of senior officials from across 21 federal agencies and departments (The White House 2021a). It also created a number of interagency Working Groups to identify opportunities that can contribute to the national goal of a Net Zero economy by 2050.[1] However, the Biden administration faces challenging conditions in terms of moving ahead on climate mitigation. First, there is not yet a full administrative team in place to undertake climate action; the confirmation of political appointments has been very slow (Tenpas 2021), and the administration must also rebuild an Environmental Protection Agency that was demoralized and de-staffed under the Trump administration (Dennis and Grandoni 2021). In addition, Biden faces opposition in Congress, very little room for compromise in the Senate, and infighting within the Democratic Party between progressives and moderates on how ambitious the 'Build Back Better' agenda should be.

Looking across the history of the Canada-U.S. environmental relationship, though, the current period seems to offer considerable promise in terms of joint action on climate change. But this window of opportunity may not be open for long, given the impending midterm elections in the U.S. and the sheer scale of the climate mitigation task. Neither country's climate policies and commitments are compatible with staying within the Paris Agreement's 1.5 C temperature limit (Climate Action Tracker 2021), although the U.S. has done a better job than Canada of actually reducing GHG emissions. While net emissions in the U.S. declined 13 percent over 2005–2019 (US EPA 2021), Canada's emissions have continued to gradually increase since the 2007–2008 recession (ECCC 2021). Quick and effective action is necessary, and coordinating Canadian and American efforts on climate mitigation makes sense in the context of the "multi-layered economic ties" (Government of Canada 2021), the close trade relationship, and the integrated transportation and energy systems between the two countries. Reinforcing supply chain security has also received increased attention from both governments, given the experience with disruptions due to the COVID pandemic. A cross-border strategy is needed to ensure that GHG emissions are not simply pushed around the continent, but actually reduced, and that North America uses its combined forces to secure a place in the global race for market share in clean tech.

Notably, Mexico is no longer part of these climate discussions; while the U.S.-Mexico relationship has yet to recover from the Trump years, the current Mexican President, Andres Manuel Lopez Obrador, has also abandoned the climate pledges of the previous administration and is instead doubling down on fossil fuel development. While the rationale for including Mexico in climate policy efforts on the continent is clear, given the industrial and energy integration across the U.S.-Mexico border as well as the supply chains that in many sectors run continent-wide, constructive cooperation on climate is very challenging at the present time.

So where, then, should Canada and the U.S. focus their cooperative climate efforts in order to ensure that they have maximum impact?

1 Examples include the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization, the Interagency Working Group on the Social Cost of Greenhouse Gases, and the White House Environmental Justice Interagency Council.

CLIMATE STRATEGIES AND POLICY COOPERATION

The key challenge associated with climate policy-making is that it is difficult to decide where to aim one's policy tools, given that climate change, as a "super wicked problem" (Levin et al. 2012), encompasses almost all arenas where government is active. Because of the multi-causal nature of climate change, the interdependencies across society, the economy and politics in terms of energy, and the constantly evolving understanding of sources and impacts, a conventional sector-by-sector approach to thinking about mitigation is simply not effective.

Instead, climate policy analysts generally focus on mitigation strategies, or the ways in which atmospheric GHGs are to be stabilized or reduced by moving the economy and society away from a carbon-based energy system. Primary mitigation strategies include: achieving higher levels of *energy efficiency*; *fuel switching* to less carbon-intensive fuels (natural gas, biofuels, hydrogen) or zero-carbon energy technologies (solar, wind, electrification); and *carbon capture and storage technologies* (direct air capture and sequestration, bioenergy with carbon capture and sequestration, as well as land management strategies for low carbon agriculture and sinks) (Center for Sustainable Systems 2020). *Pollutant-specific schemes* can also foster reduction efforts by emitters across different sources and sectors, and across subnational jurisdictions through regulatory frameworks.

In Table 1, we lay out Canadian, American, and bilateral policies and programs by mitigation strategy. The listed initiatives are not intended to be exhaustive but rather to indicate what strategies are being prioritized by governments. We then identify those that we believe merit closer examination of bilateral cooperation potential after triangulating the key commitments in the climate plans and programming of the two countries as well as the priorities identified in recent bilateral forums and documents. Organized in this way, we can see several policy areas for potential cooperation where there appears to be alignment across the Canadian, American, and bilateral strategies, at least on paper. We focus on three in this study: carbon capture and sequestration (CCS), reducing the 'Wicked Four' short-lived climate pollutants (methane, HFCs, black carbon, and ground-level ozone), and the electric vehicle 'quadfecta' as we are calling it here (electric vehicles and batteries plus charging infrastructure and battery recycling).

In making our choices, we note that not all mitigation efforts are particularly well suited to cross-border cooperation. Fuel switching, infrastructure and residential retrofits, tree planting initiatives, localized sink management, and power generation methods, for example, all fall under this umbrella. Climate-smart agriculture is another example—for now. While such mitigation strategies are very important, initiatives in these areas are characterized by diverse domestic realities and sensitivities, as well as divided jurisdiction, such that they do not translate well into action by high-level bilateral actors.

We also do not address carbon pricing or carbon border adjustments in this analysis. Carbon pricing is an important consideration in any conversation on mitigation strategies, but there is little basis for cooperation between the two countries at this time. First, while Canada's carbon pricing system is now entrenched within the country's statutory and regulatory framework, carbon pricing is not on the political agenda in the U.S and is unlikely to emerge as a viable policy option in the immediate term given the current political landscape. Further, given the multidimensional nature of Canada's carbon tax regime, under which provinces can develop their own tax strategies as long as they align with national reduction target minimums, cooperation across the border would, in any case, be very complex.

Carbon border adjustment regimes may prove to be a different story, but we are choosing to proceed with caution in terms of including this as a potential focus for bilateral cooperation at present. These adjustments are essentially carbon taxes applied to goods entering a domestic market as a competitiveness safeguard. Import fees are levied by carbon-taxing countries on select goods manufactured in countries that do not require mitigation by producers. They are also designed to combat carbon leakage, which occurs when businesses (as a result of costs related to climate policy) transfer production to countries with more relaxed restraints. Droege and Fischer (2020) note that such provisions are incredibly complex, as they "must make numerous, complicated regulatory choices, including scope of applicability (i.e., which policies, goods, sectors, countries), methodology for assessing the carbon content of products, type and price of the adjustment, exemptions or modifications for products from any specific countries, and use of the resulting revenues." Given the close Canada-U.S. economic integration in many sectors, carbon border adjustments may in the future be a strong avenue for cooperation due to the apparent leveling of the playing field between continental production chains and foreign imports. However, while both countries appear to be putting some thought into how adjustments might fit into domestic policy approaches[2], the U.S. will have to resolve many uncertainties in its own GHG reduction regime to be able to apply such mechanisms against others.

2 In July 2021, Democratic lawmakers introduced the "Fair, Affordable, Innovative, and Resilient Transition and Competition Act" (FAIR Transition and Competition Act) as a means to "reframe trade around climate values." https://www.coons.senate.gov/imo/media/doc/one_pager__fair_transition_and_competition_act_-_117.pdf. The FAIR Transition and Competition Act would establish a border carbon adjustment on carbon-intensive imports to account for the cost incurred by U.S. businesses to comply with laws and regulations limiting GHGs. Beginning in 2024, imports of products with carbon-intensive production processes (steel, aluminum, petroleum, natural gas, etc.) would be targeted and subsequent revenues would be fed back into the administration of the program, alongside grants to support other climate adaptation policies. https://www.coons.senate.gov/imo/media/doc/GAI21718.pdf pg. 8. In the fall of 2020, the Canadian government announced its intention to explore the potential of carbon border adjustments as a means to help meet climate targets while ensuring that the environment for businesses remained fair. HEHE (p.176) outlined a two-phase consultation process to support the objective, with the first phase getting underway in August 2021.

Table 1: Climate Policy Priorities—U.S., Canada, and Bilateral

	U.S. Climate Plans and Strategies	Canadian Climate Plans and Strategies	Can-U.S. Bilateral Priorities
Energy Efficiency	• U.S. can reduce carbon pollution from the transportation sector by reducing tailpipe emissions and boosting the efficiency of cars and trucks • Commitment to federal procurement of ZEV	• Work to align Canada's Light Duty Vehicle regulations with the most stringent performance standards in North America post-2025, whether at the United States federal or state level • Focus on federal procurement of ZEV	• The U.S. and Canada commit to working collaboratively, including with sub-national governments, on stringent short- and long-term vehicle standards to improve fuel efficiency and reduce greenhouse gases from all vehicles—light-, medium-, and heavy-duty
Carbon Capture and Sequestration	• $531.5M for Carbon Capture, Utilization and Storage and Power Systems in FY 2022 Congressional Budget • 45Q tax credit allows industrial manufacturers that capture carbon from operations to earn up to $50 per metric ton of CO2 stored permanently or $35 if the CO2 is put to use (such as in EOR projects) • Number of Acts introduced to Congress (CATCH, ACCESS, GREEN, CCUS Tax Credits Amendments Act, Clean Energy for America Act)	• Budget 2021 introduces an investment tax credit for capital invested in CCUS projects with the goal of reducing emissions by at least 15 megatons of CO2 annually (not intended for EOR projects) • $220M over the next five years for advancing CCUS technologies • Clean Fuel Standard establishes a credit market that includes projects which reduce the lifecycle carbon intensity of fossil fuels (e.g., carbon capture and storage, on-site renewable electricity, co-processing)	• Memorandum of Understanding (MOU) on the reliability and security of the North American energy infrastructure between the U.S. Department of Energy and the Department of Natural Resources Canada to enhance cooperation on sustainable and equitable energy transitions, clean energy innovation, connectivity, and low-carbon transportation. • Mutual recognition that CCUS is the only currently available technology with the potential to generate negative emissions

	U.S. Climate Plans and Strategies	Canadian Climate Plans and Strategies	Can-U.S. Bilateral Priorities
Electric Vehicle Quadfecta— ZEVs and Charging Infrastructure	• ZEV sales targets of 40-50% by 2030, all vehicle production ZEV by 2040 • All-electric and plug-in hybrid cars purchased in or after 2010 may be eligible for a federal income tax credit of up to $7,500 • Clean Energy for America Act has been introduced to increase ZEV tax credits, eliminate existing EV cap, provide 30% credit for industry retooling and facility construction • Bipartisan Infrastructure Framework earmarks $7.5 billion for public charging infrastructure with the goal to build a national network of 500,000 EV chargers • DOT National Alternative Fuels Corridor Designations • federal procurement of ZEVs	• ZEV sales targets of 10% by 2025, 30% by 2030, and 100% by 2040 • Incentives for Zero-Emission Vehicles (iZEV) program provides a rebate of up to $5,000 on light-duty ZEVs • Zero Emission Vehicle Infrastructure Program (ZEVIP) is a 5-year $280M program ending in 2024 to address the lack of charging and refueling stations • Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative (EVAFID) offers repayable contributions to support the construction of an EV fast charging, coast-to-coast network • Budget 2021 proposes to expand eligibility under Classes 43.1 and 43.2 to include hydrogen refueling equipment • Federal procurement of ZEVs	• Agreed to renew and update the existing MOU on energy between the U.S. DOE and the Department of Natural Resources Canada to enhance cooperation on sustainable and equitable energy transitions, clean energy innovation, connectivity, and low-carbon transportation • Agreed to take aligned and accelerated policy actions, including efforts to achieve a zero-emissions vehicle future in road transport, aviation, and maritime sectors • Developing a set of codes and standards for retail ZEV charging and fueling stations. This would include accreditation and inspection frameworks
Electric Vehicle Quadfecta— Batteries, Critical Minerals and Battery Recycling	• Federal Consortium on Advanced Batteries (FCAB) developed the National Blueprint for Lithium Batteries, a 10-year government-wide plan to urgently develop a domestic lithium battery supply chain • Federal Energy Management Program (FEMP) evaluating the current opportunity for deploying battery storage at federal sites • Advanced Technology Vehicles Manufacturing Loan Program (ATVM) can make loans to manufacturers of vehicle battery cells and packs for re-equipping, expanding or establishing such manufacturing facilities	• Minerals and Metals Plan • Budget 2021 proposes to rovide $9.6M starting in 2021–22, to create a Critical Battery Minerals Centre of Excellence at NRCan, to coordinate federal policy and programs and help implement the Canada-U.S. Joint Action Plan • Budget 2021 proposes to provide $36.8M 2021–22, with $10.9 million in remaining amortization, to NRCan, for federal research and development to advance critical battery mineral processing and refining expertise. • Battery tech development under the Energy Innovation Program (EIP) and Clean Growth Program (CGP)	• Shared commitment to build battery development and production supply chains in the Roadmap for a Renewed U.S.-Canada Partnership • Agreed to strengthen cooperation under the Energy Resource Governance Initiative (ERGI) to foster international cooperation on the minerals and metals making the energy transition possible. Net Zero industrial transformation, batteries for zero-emissions vehicles, and renewable energy storage. • Canada-U.S. Joint Action Plan for Critical Minerals
Pollutant-Specific Commitments under the "Wicked Four"—Methane, Black Carbon, and Ground Level Ozone/ Ozone Depleting Substances (ODS)	• Clean Air Act (CAA) requires EPA to set National Ambient Air Quality Standards (NAAQS) for six principal pollutants: carbon monoxide, lead, nitrous oxide, ozone, and sulfur dioxide • Strict new EPA proposals for methane regulations targeting the oil and gas sector in the works • Emissions standards for new engines, diesel particulate filters (DPFs) in conjunction with ultra-low sulfur diesel fuel such as EPA's National Clean Diesel Campaign and the SmartWay Transport Partnership Program • AgSTAR promotes use of biogas recovery systems to reduce methane emissions from livestock waste	• Strategy on SLCPs complementary to the PCF, guides future actions in reducing SLCPs, including black carbon and methane, as well as ground-level ozone and hydrofluorocarbons (48 commitments under five pillars for enhanced action) • Air Quality Program supports objectives to track and reduce emissions of air pollutants, including black carbon from various sources, as well as reductions of other air pollutant emissions • Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds for the Upstream Oil and Gas Sector	• Shared commitment to reducing oil and gas methane emissions in the Roadmap for a Renewed U.S Canada Partnership • Alignment in new Net Zero Producers Forum which creates pragmatic Net Zero strategies, including methane abatement, advancing the circular carbon economy approach, development and deployment of clean energy and carbon capture and storage technologies, and diversification from reliance on hydrocarbon revenues • Alignment in multilateral forums (Global Methane Initiative/Pledge, Climate and Clean Air Coalition, Arctic Council Expert Group on Black Carbon and Methane)

	U.S. Climate Plans and Strategies	Canadian Climate Plans and Strategies	Can-U.S. Bilateral Priorities
Low/Zero Carbon Energy Systems	• -Commitment to achieve 100% carbon-free electricity by 2035 • -Support for new sources of hydrogen—produced from renewable energy, nuclear energy, or waste—to power industrial facilities. • Advanced small modular reactors are a key part of the Department's goal to develop safe, clean, and affordable nuclear power options.	• -Commitment to achieve Net Zero electricity by 2050 • -Regulations in place to phase-out coal-fired electricity by 2030 • -Commitment to eliminate subsidies for fossil fuels • -Plan for reducing diesel in remote areas • -Investments in grid modernization • Small Modular Reactor (SMR) Action Plan launched	• -Build the necessary supply chains to make Canada and the United States global leaders in all aspects of battery development and production—Net Zero industrial transformation, batteries for zero-emissions vehicles, and renewable energy storage • -Canada and U.S. working with EU and UK on SMR strategy
Pollutant-Specific Commitments under the "Wicked Four" - HFCs	• -Title VI of the CAA contains a phase-out schedule for ODS as well as several implementation strategies to avoid releases of ODS into the atmosphere • -CAA Section 612 authorized EPA to establish Significant New Alternatives Policy (SNAP) to approve safer substitutes for ODS • -CAA Section 608 requires EPA to establish a refrigerant management program requiring reductions of use and emissions of certain ODS to the lowest achievable level • -American Innovation and Manufacturing (AIM) Act directs EPA to address the environmental impact of HFCs through phasing down (85% over next 15 years) production and consumption, maximizing reclamation and minimizing releases from equipment, and facilitating the transition to next-generation technologies through sector-based restrictions	• -Regulations Amending the Ozone-depleting Substances and Halocarbon Alternatives (alongside their amendments) aim to reduce the supply of HFCs that enter into Canada and the demand for HFCs in manufactured products • -10% phase down beginning in 2019 with further reduction steps in 2024, 2029, and 2034 in order to achieve an 85% reduction in HFC consumption by 2036 • -Prohibitions, by specific dates, on the manufacture and import of certain products and equipment that contain, or are designed to contain, HFCs and HFC blends, with a global warming potential above a specific limit	• -United States and Canada both party to the Montreal Protocol to protect the ozone layer • -The Kigali Amendment to the Montreal Protocol, which calls for an 80% reduction in HFC consumption by 2047, has been ratified by Canada but ratification is still moving through the U.S. Senate at the time of writing
Land Management Strategies—Carbon Sinks	• The United States seeks to reduce emissions from forests and agriculture and enhance carbon sinks through nature-based solutions for ecosystems, forests and agricultural soils • D of Agric to consult on climate-smart agric practices • Commitment to conserve 30% of lands and oceans by 2030	• Commitment to invest $631 million over 10 years to work with partners to restore and enhance wetlands, peatlands, grasslands, and agricultural lands to boost carbon sequestration • Provide $98.4 million over 10 years to establish a new Natural Climate Solutions for Agriculture Fund • More than $3 bil set aside for tree planting • Commitment to protect 25% of lands and oceans	• U.S. and Canada agreed to work together on environmental restoration and conservation efforts, and to advancing "nature-based climate solutions."

Sources: Department of Finance Canada 2021; Environment and Climate Change Canada 2020; The White House 2021a; The White House 2021b; The White House 2021d.

ASSESSING CLIMATE POLICY COOPERATION

The analysis here tests the bilateral cooperation and mitigation potential of the three strategic policy areas outlined above. We apply six attributes that are identified across the climate policy and Canada-U.S. relations literatures to discover alignments and opportunities that are likely to contribute to effective and sustainable joint action. We then discuss the actual mitigation potential of these policy areas, attempting to highlight those that are most likely to yield not only quick, but also effective, GHG reductions. For ease of comparison, we have developed indicators for each attribute which use a simple Yes/No/Mixed response to indicate their presence/absence (see Table 2 for the full list of indicators across the six attributes).[3]

1. Strength of political commitment

Both U.S. and Canadian climate policy have been subject to the whipsaw of opposing partisan stances and government change over recent decades, and the political commitment needed to make the deep-seated changes to the carbon-based economy has waxed and (more often) waned (VanNijnatten and López-Vallejo 2018). 'Political will' is a critical ingredient in driving forward the demanding policies required to reduce carbon pollution at the scale and speed required, and evidence of real political commitment sends signals to economic actors that they will be rewarded for changing their behavior—or penalized if they don't (Averchenkova and Bassi 2016).

Currently, Canada and the U.S. have made climate mitigation a top priority, second only to the COVID public health and economic crisis. The two countries have ambitious emissions reductions targets; Canada has committed to a 40–42% reduction from 2005 levels by 2030 (Prime Minister of Canada 2021b) and the U.S. to a 50–52% reduction (The White House 2021a). Canada's climate plan of action is more firmly institutionalized, with the Net Zero Emissions Accountability Act laying out the accountability and reporting mechanisms that must be followed to meet 5-year targets, and concrete funding allocations having already been rolled out or committed to across a full range of programs. The carbon pricing regime legislated in 2018, further strengthened in December 2020, and upheld by the Supreme Court in January 2021, also signifies a clear commitment to (and accountability for) emissions reductions.[4]

The Biden administration is not likely to be able to achieve legislative endorsement of its climate target and full range of policies, and is probing all avenues for executive action without Congress, especially on clean power generation (Grandoni and Rom 2021). Nor has it been able to get the full funds it has requested from Congress for its 'Build Back Better' programming. Indeed, the compromise Infrastructure Investment and Jobs Act bill passed by Senate, and now the House, which was the subject of heavy partisan negotiations, contains far less funding for climate than originally envisioned; instead, the more targeted funding for climate-related projects has been hived off into a separate bill still undergoing congressional wrangling. Further, carbon pricing is simply not on the political agenda in the U.S. Still, the scale of the Biden administration's Climate Plan is huge, with its climate aspirations permeating all economic, social, foreign, and national security programming (The White House 2021c), and Biden played a key role at the COP 26 Meeting in Glasgow in supporting international mitigation efforts.

We will assess political commitment in particular climate policy areas by examining policy statements, press releases, and agency documents alongside ascertaining whether funding has been requested and/or allocated. The timing and scale of funding allocations are also important in terms of judging commitments.

3 Detailed tables for all indicators, outlining the empirical information used to make each determination, are available in the appendices.

4 Note, however, that some economic actors—including farmers, fishers, and remote power plants operators—are exempt from some provisions of the carbon pricing system.

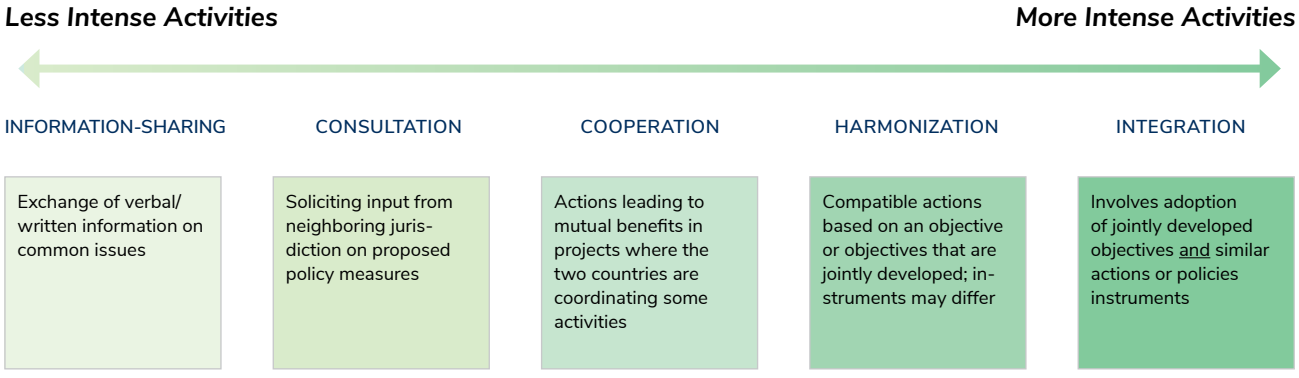
2. Established bilateral working relations

Certainly, it is easier to initiate bilateral climate policy cooperation in areas where the two governments have already engaged in collaborative action and the infrastructure to do so already exists. Canada and the U.S. have well-established bilateral energy ties, including those through the Clean Energy Dialogue initiated under the Harper and Obama administrations, and they have a solid history of interagency cooperation on regulatory harmonization through the bilateral Regulatory Cooperation Council (RCC) and NAFTA committees on standards-related measures (Craik and VanNijnatten 2016), work that is being carried forward under CUSMA. Important in terms of cooperative architecture are bilateral institutions that move beyond ad hoc mechanisms to forums that are more permanent, are established under an executive agreement or MOU, and operate with accountability mechanisms (e.g., reporting requirements).

To this point, while the Canada-U.S. bilateral environmental regime for water and air consists of both formal agreements and institutions, as well as longstanding interagency ties, climate cooperation has thus far been quite limited, and has been undertaken under ad hoc bilateral coordinating architectures (VanNijnatten and Johns 2020). Under initiatives such as the Clean Energy Dialogue (CED) and the RCC, executive branch MOUs guided science and technology as well as regulatory cooperation through senior central agency officials and working groups of agency bureaucrats and business interests (Craik and VanNijnatten 2016). The CED (defunct during the Trump administration and now apparently replaced by/subsumed under coordinating structures under the Renewed Partnership initiative) had focused on things such as carbon capture and storage projects, more efficient electricity grids featuring greater use of renewables, and clean energy R&D.

Understanding the functional intensity of transboundary institutions also serves as an indicator of the extent to which the two governments are engaged in deeper forms of collaboration. VanNijnatten (2006) provides a method for measuring the functional intensity of transboundary institutions on a spectrum ranging from less intense activities (such as information sharing and consultation), to more intense activities (such as cooperation, harmonization, and even integration). Of interest are those bilateral activities that move beyond merely sharing information or consulting one another on policy strategies; we are looking for—at the very least—cooperation that involves joint activity to undertake a project or program. In other words, are the two countries actually doing something *together*, rather than making similar commitments and then working to achieve those aims in parallel?

Figure 1



3. The presence of strategic domestic policy partners in both countries

The 2015 Paris Agreement formally recognized the critical role of non-state actors, including civil society organizations and private sector interests, as well as subnational governments, such as cities and regions, in supporting climate change policy and governance. By the same token, opposition to climate action from large economic actors can do much to hinder progress (Vesa 2020). In both Canada and the U.S., national governments have faced determined opposition, particularly from large energy-intensive industries such as the oil and gas industry, the power generation industry, and the vehicle manufacturing industry (Macdonald and VanNijnatten 2020).

In addition, federalism is a key factor in climate policy formulation and implementation in both countries (Harrison 2013), and states and provinces have occupied the full spectrum between climate policy leaders and laggards (Macdonald 2020; Rabe 2008), with the balance shifting—especially in Canada—over time. These shifts have accompanied partisan transitions at both levels of government, which can lead to abrupt policy changes between climate policy ambition vs. retrenchment, and/or to policy delays when provinces or states challenge federal legislation or regulation. While we cannot provide a full investigation into provincial/state policy actions in the three areas under examination, we can provide an indication of the degree to which federal/executive-level actors face headwinds at home from their jurisdictional counterparts, or whether there is a 'meeting of the minds' across levels of government.

The measures for this indicator, then, attempt to gauge the political landscape in each country and whether domestic conditions are favorable for supporting and following through on commitments made in national bilateral forums.

4. Regulatory frameworks to support action

Because climate change requires action across all sectors of the economy and society, as well as coordination across multiple governmental and nongovernmental stakeholders—and all of this over a longer time frame—effective regulatory frameworks are needed to guide action through political cycles and varied economic conditions. Where there are existing authorities to act, governments in Canada and the U.S. are in a better position to enhance climate policy action at home and can more easily commit within bilateral forums. This has been aptly demonstrated in bilateral action regarding transboundary air pollution, which required that clear legislative mandates be put in place before bilateral commitments on acid rain, for example, could be made in 1991. In this vein, Townshend and Matthews (2013) have argued that national framework legislation on climate change functions as an "enabler that creates the political space" for an international deal.

Reich (2021) notes that, where there is robust federal powers to regulate in areas related to climate change, yet autonomy at the subnational level allowing for regulatory innovation, federalism can support effective climate change action. In the U.S., the December 2009 ruling by the U.S. EPA that GHGs endanger human health provided the Obama (and now the Biden) administration with the means to take executive action to regulate GHG emissions under the 1990 Clean Air Act, even in the face of congressional refusal to act on climate change. While there are very real questions about the durability of executive action in the face of shifting political leadership and a more conservative federal judiciary (Thompson et al. 2020), administrative actions built atop the 2009 ruling would take some time to unravel. In Canada, in March 2021, the Supreme Court ruled that the federal government acted within the scope of its constitutional jurisdiction when it implemented a carbon tax on individual provinces and, more generally, that provinces are not in a position to claim jurisdiction over climate change, given the problem of regulatory spillovers. This ruling has—at the very least—solidified the federal claim that it can act in this area.

For this indicator, we will examine whether there are authorities and regulatory frameworks in place to take action in the individual policy areas under consideration and, moreover, whether the policy instruments used in the countries are complementary enough to facilitate joint action.

5. Low or no technological barriers to quick implementation

There is no doubt that innovative technologies are critical for our response to climate change, yet much of the required technology is untested, not ready for use, or not yet fully commercialized. Advancing technologies from the R&D stage through to commercialization and large-scale application across different locations is a long, expensive, and arduous process (Rau et al. 2010). Even where technology is in place to support emissions reductions in a particular sector, there are always additional components or functions that require new, more efficient technology. In terms of bilateral climate relations, we can envision effective cooperation either where the technology already exists and joint action can be quickly taken, or where there is a possibility that bilateral cooperation can contribute to the development and/or application of new technologies.

In terms of our measures for this indicator, we use the term 'technological readiness' in a looser sense than the innovation literature (which lays out specific 'levels' of technological maturity)[5] to examine whether the technology is available to a wide range of markets and across geographic locations in North America. In other words, if Canada and the U.S. were to impose emissions reductions on a particular industrial or economic function, does the technology readily exist for the regulated entity to comply? In addition, for those areas where additional technological innovation is needed to realize emission reductions, do the governments have a plan or related research programs in place to fill those gaps?[6]

6. Joint action in international bodies

Canada and the U.S. have a history of aligning their environmental policy responses in international forums—national air pollutant regulations and Nationally Determined Contributions for GHGs under the UNFCCC regime are good examples. Bilateral agreements and MOUs often include references to joint participation in international forums or even to coordinating strategies. The 2016 Leaders' Statement on a North American Climate, Clean Energy, and Environment Partnership, for example, stated that the three North American leaders would "work together and with international partners to support developing country partners in their mitigation and adaptation efforts. They will also support robust implementation of the Paris Agreement's transparency and carbon markets-related provisions, and will develop mid-century, long-term low-greenhouse gas emissions development strategies this year." The more recent 2021 Roadmap for a Renewed U.S.-Canada Partnership document notes that the two countries will "coordinate cooperation between the United States and Canada to increase ambition aligned to the Paris Agreement and Net Zero objectives." Joint action with Mexico is not foreseen; as discussed above, the current Mexican administration has shown little interest in climate action.

We use only one measure for this indicator, namely, whether the two countries are active in the same international forums in order to advance their policy goals on the global stage.

5 See, for example, https://www.sciencedirect.com/topics/engineering/technology-readiness-level.

6 See, for example, https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TEC_column_M/33933c6ccb7744bc8fd643feb0f8032a/82af010d-04f14a84b9d24c5379514053.pdf

7. 'Net Zero' potential of cooperative actions

It is important that our analysis does not lose sight of the actual goal of bilateral climate cooperation. Scientists have been very clear about what this goal should be: to avoid the worst climate impacts, GHG emissions will need to drop by half from 2010 levels by 2030 and reach Net Zero around mid-century (World Resources Institute 2019). This means that human-caused emissions (such as those from fossil-fueled vehicles and factories) need to be reduced as close to zero as possible, and any remaining GHG emissions must be counterbalanced by carbon removal and sequestration technologies.

Both Canada and the U.S. have endorsed the goal of achieving Net Zero GHG emissions by 2050, and they have set out aligned (though slightly different) goals to achieve Net Zero in the power sector. Certainly, making a determination of Net Zero potential is complex, given the different drivers and various pathways to Net Zero, including fuel switching (through electrification and biofuels, for example), energy efficiency, cleaner power generation, reducing industrial process emissions (such as fugitive methane), carbon capture and storage, and direct air capture. Further, it is clear that there are trade-offs to be made depending on the pathway chosen, e.g., greater public funding into CCS may mean there are fewer funds available for other pursuits like battery technology development. In addition, we are interested in timing here; will the cooperative action result in GHG mitigation soon, or sometime in the future? Because of the complexity of this indicator, we provide reflective, rather than indicator analysis, for each of the strategic policy areas.

FULL INDICATOR SET FOR BILATERAL CLIMATE COOPERATION POTENTIAL

Taken together, then, the 13 indicators under six attributes are applied to each of the three policy clusters (see Table 2 below). In addition, as noted above, we provide some discussion of the mitigation potential of bilateral cooperation in each area.

Table 2: Indicators for Assessing the Potential of Bilateral Climate Cooperation

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes/No	Yes/No	Yes/No
2. Political commitment—budget allocations	Yes/No	Yes/No	
3. Pre-existing bilateral cooperation			Yes/No
4. Bilateral cooperative institutionalized			Yes/No
5. Functionally intense interaction			Yes/No
6. Bipartisan/Multi-party support	Yes/No	Yes/No	
7. Congruence in national-subnational approaches	Yes/No	Yes/No	
8. Tangible support— regulated actors	Yes/No	Yes/No	
9. Legislative authorities in place	Yes/No	Yes/No	
10. Similar policy instruments			Yes/No
11. Technological readiness			Yes/No
12. Technology strategy in place	Yes/No	Yes/No	
13. Joint membership in international bodies			Yes/No

PRESENT NOT PRESENT MIXED

CASE ANALYSIS

Carbon Capture and Storage

Both the Canadian and American governments have committed to supporting the development and application of carbon capture and storage technologies (see Table 3 below for indicator findings). Canada's HEHE climate plan notes that a CCS strategy will be developed, and provisions have been made that specifically reference CCS efforts in Canada's new Clean Fuel Standard. Canada's most recent Budget 2021 allocates $133 mil CA to CCS technologies in 2021–22, increasing to 1,943 mil by 2026–27. This is the first significant budget allocation since the Harper government funded several CCS projects in the 2000s. For its part, the U.S. has made significant allocations to the CCS program in the Department of Energy since 1997 (Folger 2018), and the most recent budget request for FY2022 is an impressive $531.5M for Carbon Capture, Utilization, and Storage and Power Systems.

The 45Q tax credit is the key enabler for the deployment of broad carbon management technologies in the U.S. The 117th Session of Congress is currently prioritizing the enhancement of the 45Q credit to drive greater private investment in carbon management projects. Supporters of CCS hope to do so by providing a direct pay option for the federal credit, extending the commence construction window for an additional ten years to establish an investment horizon, and enhancing 45Q credit values for industrial and power plant carbon capture and direct air capture.[7] Current work is concerned with the inefficiency of the existing CCS regime. It appears that 45Q credit values are not offering enough incentive to ensure that early deployment in pertinent industries is cost effective. At the same time, carbon thresholds established in the current 45Q program are becoming a hindrance for future development, given that a number of facilities lack the necessary scale to meet the qualifying conditions of the credit. To augment these efforts, the Storing CO2 and Lowering Emissions (SCALE) Act has also been introduced. This bill would enable deployment of the CO2 transport and storage infrastructure necessary to achieve Net Zero emissions targets. The goal is that federal low-interest loans and grants authorized by the SCALE Act will leverage private capital to finance the buildout of shared CO2 transport infrastructure networks and saline geologic storage hubs to achieve economies of scale and reduce overall costs.[8]

7 https://carboncapturecoalition.org/wp-content/uploads/2021/09/Proposed-AJP-and-Infrastructure-Investments-1.pdf

8 https://www.catf.us/wp-content/uploads/2021/03/CATF-SCALE-Act-Fact-Sheet-03.12.21.pdf

Table 3: CCS Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—climate plan documents, recognized in Clean Fuel Standard	Yes—climate plan, Department of Energy plans	Yes—Canada-US MOU on Energy Cooperation, commits to enhanced coop on CCUS
2. Political commitment—budget allocations	Yes—**allocations** in Budget 2021 beginning with 133 mil in 2021–22 to 1,943 mil in 2026–27	Yes—ongoing DOE allocations and FY2022 **request** for $531.5M Carbon Capture, Utilization, and Storage and Power Systems	
3. Pre-existing bilateral cooperation			Yes—through PCOR Partnership; Carbon Capture and Storage Working Group under Clean energy Dialogue
4. Bilateral cooperative institutionalized			Yes—PCOR has been in place for 23 years, though operates as a loose network; interagency ties long-term; now technical expert groups under 2021 MOU on energy cooperation
5. Functionally intense interaction			Mixed—cooperation under PCOR focuses primarily on info-sharing and consultation, there is little in the way of cooperation on joint projects
6. Bipartisan/Multi-party support	Yes—the two main parties (Liberals and Conservatives as Official Opposition) support CCS, NDP and Bloc ambiguous and Greens opposed	Yes—congressional consensus among Republicans and Democrats in House and Senate, but Progressives in Democratic Party wary	
7. Congruence in national-subnational approaches	Yes—feds supporting direct capture (not EOR) through tax credits but leave the door open to provincial support for EOR	Yes—both progressive (CA) and conservative (ND, WY) states are engaged with feds on direct capture and EOR; primary focus has been on EOR but Biden admin pushing system toward DAC	
8. Tangible support—regulated actors	Yes—this is the preferred mitigation technology for oil & gas and other heavy industry; industry pushing for EOR	Yes—though industry pushing for EOR	
9. Legislative authorities in place	Yes—but fragmented across scales, agencies, and infrastructure components	Yes—but fragmented across scales, agencies, and infrastructure components	
10. Similar policy instruments			Yes—both countries using tax incentives; project-specific funding; funding for research on component technologies (considerably more in US)
11. Technological readiness			No—significant obstacles to commercialization of component technologies; cost-prohibitive; current focus on one-off projects
12. Technology strategy in place	Yes—Canada has CO2 Capture and Storage Technology Roadmap 2008; new plan under development	Yes—Carbon Sequestration Technology Roadmap 2007 plan; updated 2010; another update underway	
13. Joint membership in international bodies			Yes—CSLF, Global CCS Institute, International CCS Centre, IEA

Although there are only broad references to CCS in the February 2021 'Renewed Partnership' document, the two countries have since signed an MOU on Energy Cooperation which specifically mentions joint work on CCS. Moreover, we know that these recent commitments build on earlier work undertaken by working groups under the CED (Harper-Obama); the U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership (Trudeau-Obama); and through the PCOR Partnership, an initiative funded by the U.S. Department of Energy involving private sector and agency partners that is focused on accelerating the commercial deployment of CCS. It is thus clear from these ongoing and structured interactions that there is an institutional architecture in place to support joint efforts to facilitate further CCS research and deployment.

One might also observe that the political landscape in both countries appears favorable for further CCS development, with bipartisan support in the U.S. Congress and support in Canada from both the governing Liberals and the Conservatives as Official Opposition. Although there is concerted opposition from large segments of the ENGO community as well as more progressive wings of the partisan left in both countries, this is one of those rare issues where national and subnational governments have much in common, though they may differ ideologically, and the regulated actors are eager to cooperate with government, particularly as carbon pricing and regulatory regimes are tightened. Further, the international community views CCS as a necessary tool in the pursuit of net-zero emissions, and Canada and the U.S. are leading participants in global efforts to develop and deploy related technologies. At first glance, then, CCS appears to be a prime candidate for intensified bilateral cooperation under the Trudeau and Biden administrations.

However, the situation is not quite as clear when we probe more deeply. First, bilateral interactions seem to have become *less* functionally intense, now focusing primarily on information-sharing and consultation. Earlier, the governments had collaborated on the Weyburn, SK pilot project whereby CO2 from North Dakota is piped to the Canadian site for sequestration, and joint work was carried out on the regional characterization of underground CO2 storage potential across North America through PCOR. Considering the relative success of the Weyburn project, one can imagine that this effort might incentivize future endeavors, though this does not appear to have been the case. The recent completion of the Alberta Carbon Trunk Line, which was designed with excess capacity in mind, has the ability to connect additional facilities and storage reservoirs in the future as demand increases. This provides a clear signal to American policy-makers that Canada is taking carbon capture quite seriously, and that there is room to expand and collaborate on new and developing systems and facilities.

In terms of whether the legislative and regulatory authorities are in place in each country to support action, such authorities do exist, although the mandates which have bearing on CCS infrastructure are fragmented across national and subnational governments, across various regulatory aims, i.e., pipeline infrastructure, injection permitting, facility permitting, etc., and thus across agencies. Neither country appears to have a plan in place for facilitating the myriad regulatory approvals required, especially if a network approach were used by governments, whereby multiple sites dedicated to source, hub (key for collection and distribution), and sink functions were clustered together. Both countries have provided project-specific funding for demonstration facilities as well as support for the work of PCOR in exploring the suitability of certain geological regions for storage. Indeed,

the technology has not been widely commercialized in North America and remains cost-prohibitive without significant government support (Abdullah et al., 2021). Both governments have outdated technology roadmaps for CCS (2007 in the U.S., 2008 in Canada), although these are apparently being updated.

On the question of the mitigation potential of CCS, the discussion moves into decidedly murky waters. Developed countries, the International Panel on Climate Change, as well as the International Energy Agency, have all accepted that CCS has a necessary role to play in reaching Net Zero emissions. However, most of the environmental community argues that spending more money on cost-prohibitive, one-off projects serves only to delay the inevitable transition away from fossil fuels and drains away public funds that should be used for truly green technology applications. The problem is that CCS is not yet commercially deployable across heavy-emitting industries.

It is also worth noting the difference between carbon capture for the purpose of enhanced oil recovery (EOR) vs. carbon capture for the purpose of direct storage only. In dedicated storage projects, CO2 is injected into a carefully selected sediment formation to permanently store it underground. With EOR, compressed CO2 is injected into an existing oil-bearing reservoir to increase the efficiency of the production process and a portion of the CO2 will be brought back to the surface with the oil, where it is then separated and reinjected into the same reservoir. There is no question that storage-only projects provide more mitigation potential than EOR, and yet the majority of CCS applications in both countries are for EOR. Again, the concern here is that CCS for EOR is merely postponing the needed transition away from fossil fuels. It should be noted that the Trudeau government's proposed tax credit is not intended for EOR projects (though Alberta and Saskatchewan do support EOR), and the U.S. tax credit favors dedicated storage projects but is also applicable for EOR projects.

In terms of achieving the net-zero ambitions of both governments, then, CCS requires large amounts of funding for individual projects that could only be implemented and yield reduced emissions over the longer term. While there may be considerable potential for carbon removal using these technologies, the two governments do not currently have an integrated vision for realizing this potential.

SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGIES—WORKING TOGETHER ON "THE WICKED FOUR"?

The rationale for swift action on SLCPs is clear—and this strategic policy area provides an interesting comparison with the CCS analysis, in all respects. SLCPs are known as "climate forcers"; although they remain in the atmosphere for a shorter period of time, compared with CO2, their global warming potential is often far greater and efforts to reduce emissions of SLCPs will yield quick mitigation results, unlike action on CCS. Table 4 compares SLCPs with GHG in this regard.

Methane, which is emitted from oil and gas recovery as well as agriculture and landfill operations, is up to 86X more potent than CO2 over a 20-year period. Black carbon, or soot, as a component of fine particulate air pollution (PM2.5), has impacts on weather patterns and sunshine, accelerates the melting of snow and ice, and has serious human health impacts. Hydrofluorocarbons (HFCs) are human-made chemicals that are used in air conditioning and refrigeration, aerosols, and solvents. HFCs make up a small fraction of current GHGs but are hundreds to thousands of times more potent than CO2. Finally, ground-level ozone, which is formed when nitrogen oxides and volatile organic compounds (VOCs) react in the presence of sunlight and stagnant air, is a significant contributor to climate change but also has a host of effects on human health and agricultural production. Together, scientists calculate that SLCPs are responsible for up to 45% of current global warming to date.[9] In this section, we discuss the potential for Canada-US cooperation on each of the SLCPs, in more abbreviated fashion (see full indicator results in Tables 5–8).

Table 4: Global Warming Potential of SLCPs

SHORT-LIVED CLIMATE POLLUTANTS			
Pollutant	**Atmosphere Lifetime**	**Potential Warming Power**	**Sources**
Carbon Dioxide (Baseline)	100–1,000 years	1x	Transportation, electricity, industry, commercial, residential, and agricultural sectors
HFCs	15 years (average)	1,500x	Residential, commercial, mobile, unitary, and industrial air conditioning and refrigeration, foam agents, aerosols, fire extinguishers, and solvents
Methane	12 years	86x	Agriculture, fossil fuel operations, waste operations
Black Carbon	Up to 2 weeks	900x	Household energy, transport, agriculture, industrial production, waste operations, fossil fuel operations, large-scale combustion
Ozone	Hours-days	Varies	Any combination of sunlight with methane, carbon monoxide, non-methane volatile organic compounds, or nitrogen oxides leads to the formation of ozone

Source: Clean Air and Climate Coalition https://www.ccacoalition.org/en

9 See introductory report from the Center for Climate and Energy Solutions https://www.c2es.org/content/short-lived-climate-pollutants/

Methane:

The methane case provides an example of bilateral interaction where there is shared ambition and a clear bilateral vision, but the two countries are working primarily in parallel with one another. Both countries have affirmed their support for methane emission reductions in the oil and gas sector, which constitutes the largest share of emissions. They are attempting to tackle landfill emissions at home (though there are some political bumps along the road) and are exploring mechanisms for reducing emissions from the agricultural sector, which constitute the second largest share of methane emissions. In addition, both countries have announced funding for methane emissions technologies; while Canada has included support for methane reductions in a $104.6 million package of funding for cleaner transportation and waste management, the U.S. has allocated $35 million to a dedicated methane reductions fund. Additional funding in both countries is focused on a wide range of technologies and practices to reduce routine venting and flaring.

There is some history in terms of a bilateral commitment to methane reductions in the oil and gas sector, beginning with Obama and Trudeau under the 2016 Joint Statement on Climate, Energy and Arctic Leadership, and now again under the April 2021 Joint Statement by the U.S. EPA and ECCC on joint environmental efforts. However, these interactions do not appear to be bilaterally institutionalized or functionally intense, as the two countries are working primarily within the Global Methane Institute, sharing information on reduction technologies and encouraging uptake of best practices globally.

The political and policy landscape in the two countries is also quite different. In Canada, the conditions for steep methane reductions appear to be favorable, while the U.S. is struggling with long-entrenched domestic opposition, from both industry and the states (Rabe 2021). Regulatory frameworks for oil and gas are already in place in Canada, and steeper restrictions are being put in place by the Trudeau government. The Canadian federal government has signed equivalency agreements with the provinces for implementation of national standards for methane releases from oil and gas facilities, which has resulted in relatively major changes to how emissions are addressed in new and existing wells (Rabe 2021). Moreover, there is support across party lines for reductions from organic sources in Canada (agriculture and landfills), although it should be noted that regulations on the oil and gas industry are not included in the Conservative Party's climate plan.

In the U.S., the Obama administration had put methane regulations in place, but these were rescinded under President Trump toward the end of his administration. This move was "disapproved" by Congress after the 2020 election and the regulations are being re-instituted, but they are likely to face the same entrenched opposition from almost all oil and gas producing states that any federal efforts to regulate methane emissions have encountered for decades. Most opposed efforts by the Obama EPA to move forward with a methane reduction initiative; only Colorado and New Mexico have moved toward reduction regimes, while California and Pennsylvania have taken baby steps toward addressing methane emissions (Rabe 2021). The Democrats have been barely able to attract support from enough Republicans to pass methane-related measures; the majority of Republicans are opposed, and there is little prospect of additional, significant action. The possible exception may be a fee levied on methane emissions, such as that included in the Methane Emissions Reduction Act under committee discussion in the Senate (S.645).

On the up-side, various cost-effective technologies exist for achieving reductions, and the two governments are engaged in a wide variety of research and pilot programs both at home and in international forums. Bilaterally, however, the two governments do not seem to be doing much *together*.

Table 5: Methane Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—commitments made in PCF, HE/HE plan, Ministerial press statements (ECCC and NRCan); endorsement of 'Zero Routine Flaring by 2030' Initiative	Yes—included in Biden Climate Plan; press statements and published regulatory agenda of EPA Administrator	Yes—first under 2016 U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership; 2017 North American Climate Leaders' Dialogue; 2021 Renewed Partnership; April 2021 joint statement by EPA Administrator and Environment Minister
2. Political commitment—budget allocations	Yes—methane reductions included in a Budget 2021 allocation of $104.6 million over five years, starting in 2021–22; $27 mil for Agricultural Greenhouse Gases Program (AGGP) 2016–2021	Yes—$35 million in funding for technologies to reduce methane emissions	
3. Pre-existing bilateral cooperation			Yes—Obama-Trudeau Joint Statement included methane partnership
4. Bilateral cooperative institutionalized			Not really—communication under the High Level Ministerial process, but Canada and U.S. working together within Global Methane Initiative structures; no bilateral forums focused particularly on methane
5. Functionally intense interaction			No—focuses on taking parallel action, not joint action
6. Bipartisan/Multi-party support	Yes—all parties supportive	No—Trump administration attempted to derail Obama regulations; most Republicans in current Congress do not support EPA regs, somewhat more support for BLM regs	
7. Congruence in national-subnational approaches	Yes—federal-provincial equivalency agreements for AB, BC, SK who have developed complementary methane regulations; Can-AB coop under Canada Emission Reduction Innovation Network; BC Methane Emissions Research Collaborative; AB, SK, BC flaring initiatives complementary	No—EPA methane regs based on earlier CO state regs but state opposition to any federal action in this area	
8. Tangible support—regulated actors	Mixed—large oil and gas companies supportive; not agriculture	No—large oil and gas companies opposed and only minor agricultural players are interested in reductions	
9. Legislative authorities in place	Yes—Methane is considered toxic under the Canadian Environmental Protection Act, 1999 (CEPA), 2020 Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)	Yes—EPA and BLM methane regulations rescinded by Trump admin, but being put back in place	
10. Similar policy instruments			Yes—focus on regulatory frameworks for oil and gas, landfills, and agriculture but also a host of cooperative programs for encouraging industry progress
11. Technological readiness			Yes—a variety of solutions exist for oil and gas and landfills but additional research underway in both countries on reduction technologies; more difficult for agricultural sector
12. Technology strategy in place	Yes—several research programs in place	Yes—phased research program in place	
13. Joint membership in international bodies			Yes—Net Zero Producers Forum Climate and Clean Air Coalition Global Methane Initiative Expert Group on Black Carbon and Methane

Black Carbon:

Discussions of black carbon generally focus on emissions of fine particulate matter, known as PM2.5, the largest sources of which are on- and off-road diesel engines and home firewood burning, with some contributions from marine and rail transportation as well as flaring in the upstream oil and gas industry. PM2.5 has long been a matter of discussion—domestically, bilaterally, and internationally—given its transboundary impacts (it can be transported long distances by air) and human health effects. The commitment to address PM2.5 can be seen in the air quality strategies of the two countries, their policies regarding the Arctic, and the tenor of North American Leaders' discussions. The regulatory framework in the two countries is already built out and well-funded, with aligned standards on diesel engines, passenger vehicles, and wood-burning appliances. While there continues to be opposition to further tightening PM2.5 standards from various regulated and more conservative political actors in both countries (but especially in the U.S.), most serious debates about whether to regulate, or not, have now been settled in favor of reduction. Certainly, the significant human health (rather than only environmental) impacts of PM2.5 are well-established and have served as a strong rationale for regulating this pollutant. In addition, reduction technologies exist for large sources and have been widely commercialized. More problematic are retrofits for smaller sources throughout North America, especially diesel used in home heating and wood burning, and it is on this gap that considerable research and policy effort is now focused in both countries.

The alignment of actions on PM2.5 by Canada and the U.S.—along with considerable pollution reductions—can be attributed to close interagency relations on air quality, under the auspices of the 1991 U.S.-Canada Air Quality Agreement and its working groups. While PM2.5 is not a matter of specific commitments in the Annexes to the Agreement (as ground-level ozone and acid rain are), the two countries have carried out a joint scientific assessment of the cross-border transport and environmental impacts of PM2.5 (2013) and there have been discussions about adding PM2.5 to the Agreement. However, another important arena of bilateral activity is in the Arctic, where Canada and the U.S., as members of the Arctic Council, are party to the Framework for Action on Enhanced Black Carbon and Methane Emissions Reductions. This requires biennial reporting on emissions as well as joint initiatives for addressing northern sources. On PM2.5, then, bilateral cooperation is better developed and institutionalized.

Table 6: Black Carbon Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—highlighted as priority in CCCR, PCF, 2017 Strategy on Short-Lived Climate Pollutants, 2019 Arctic and Northern Policy Framework, National Report on Black Carbon and Methane	Yes—included as priority in President Biden's Leaders Summit on Climate	Yes—under 2016 U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership; 2017 North American Climate Leaders' Dialogue
2. Political commitment—budget allocations	Yes—PM reductions included in program and regulatory allocations based on source	Yes—PM reductions included in program and regulatory allocations based on source	
3. Pre-existing bilateral cooperation			Yes—mentioned only in passing in the Obama-Trudeau Joint Statement; but PM2.5 gets bilateral focus under U.S.-Canada Air Quality Agreement
4. Bilateral cooperation institutionalized			Yes—Canada and U.S .have working institutions and processes associated with U.S.-Can Air Quality Agreement
5. Functionally intense interaction			Yes—joint science assessment, intentional regulatory alignment
6. Bipartisan/Multi-party support	Yes—both Liberals and Conservatives support more stringent emission standards	Mixed—opposition to more stringent standards from Republican policy-makers and legislators	
7. Congruence in national-subnational approaches	Yes—national ambient air quality standards (NAAQS) for PM2.5 under CEPA (replaced earlier Canada-wide standards), 2020 Diesel Regs, and vehicle efficiency standards	Yes—NAAQS for PM2.5 under Clean Air Act, 2020 Off-road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations, other vehicle efficiency standards	
8. Tangible support—regulated actors	Mixed—sources varied, many stakeholders implicated	Mixed—sources varied, many stakeholders implicated and in opposition	
9. Legislative authorities in place	Yes—PM2.5 is considered toxic under the Canadian Environmental Protection Act, 1999 (CEPA), Ambient Air Quality Standards (NAAQS) for PM2.5 took effect in 2015	Yes—2012 NAAQS under Clean Air Act, Biden administration tightening regs now	
10. Similar policy instruments			Yes—alignment of regulatory frameworks for largest PM2.5 sources; on- and off-road diesel engines, residential wood-burning appliances, passenger vehicles
11. Technological readiness			Yes—a variety of low-cost technical solutions exist for PM2.5 emissions and widely used across sectors; continuing research in both countries, some joint
12. Technology strategy in place	Yes—high-quality research programs in place, emerging out of Health Canada's Air Quality Benefits Assessment Tool	Yes—high-quality research programs in place, informed by Report to Congress on Black Carbon	
13. Joint action in international bodies			Yes —Net Zero Producers Forum; Climate and Clean Air Coalition – Expert Group on Black Carbon and Methane; UNECE LRTAP; Arctic Council Expert Group on Black Carbon and Methane

Ground-level Ozone:

In some respects, the ground-level ozone case looks quite similar to the black carbon/PM2.5 story. For this pollutant, too, the regulatory framework in both countries is well developed, grounded in legislative authority, and has already led to considerable improvements in terms of both ozone levels and emissions of constituent substances, nitrous oxides, and volatile organic compounds. Various control technologies are in place and widely used across different emissions sources, although research on new approaches is ongoing. In terms of joint action, Canada and the U.S. have several decades of bilateral cooperation behind them, under the 1991 Air Quality Agreement and, in particular, the Ozone Annex that was added to the Agreement in 2000. This cooperation has involved both joint scientific assessments as well as work on understanding and achieving compatibility of standards. Thus, bilateral cooperation on ground-level ozone, as with black carbon, takes place via a very different and more well-established set of channels as opposed to methane. Further, the two countries have long worked together in international forums, especially the UNECE's Convention on Long Range Transboundary Air Pollution.

However, a significant obstacle to further progress on this SLCP is the entrenched political opposition in the U.S. to more stringent limits on stationary sources, especially coal plants, and on vehicle emissions. In Canada, the debate over vehicle emissions appears more or less settled, and the national regulations on coal plant emissions/phase-outs established by the Harper Conservatives, and now tightened by the Trudeau Liberals, appear now to be water under the political bridge. In an interesting shift in the U.S., the automobile industry was divided on whether to oppose the more stringent vehicle emission standards introduced by the Obama administration (and adopted by Canada), but, at present, almost all of the big players have agreed to move toward California's 'compromise' (yet more stringent) standards. Indeed, California's role in pushing the entire national vehicle emissions system toward higher levels of stringency, stemming its unique ability to request ongoing waivers from the federal government to move beyond national air emissions regulations, cannot be overstated—and this influence extends across the border to Canada (Rabe 2019).

The power industry, however, has continued to dig in its heels. The saga of Obama's Clean Power Plan, dismantled by Trump, highlights the difficult road ahead in terms of addressing power plant emissions, which contribute to both ground-level ozone and climate change. The Biden administration will need to rely on the same levers pumped by the Obama administration to reduce power sector emissions, namely regulatory action under a 1990 Clean Air Act—which is itself showing its age. And its efforts will be greatly complicated by the decision of the U.S. Supreme Court to hear a case brought forward by 20 states opposed to stringent power plants emissions requirements (Hurley and Volcovici 2021).

Table 7: Ground-level Ozone Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Not really—has faded into background, included in 2017 Strategy on Short-Lived Climate Pollutants but no public statements	Not really—presumably included as one of the "other potent short-lived climate pollutants" in April 2021 Climate Plan, but little political focus	Yes—continuing commitment under the 1991 U.S.-Canada Air Quality Agreement – Ozone Annex; joint commitment to reduce transport emissions in Joint Statement by EPA and ECCC on Environment and Climate Change
2. Political commitment—budget allocations	Yes—regular program and regulatory allocations based on source	Yes—regular program and regulatory allocations based on source	
3. Pre-existing bilateral cooperation			Yes—major focus under the U.S.-Canada Air Quality Agreement, negotiations on an Ozone Annex
4. Bilateral cooperation institutionalized			Yes – Canada and U.S. have working institutions and processes associated with U.S.-Can Air Quality Agreement
5. Functionally intense interaction			Yes – joint science assessment and airshed characterization, intentional regulatory alignment
6. Bipartisan/Multi-party support	Yes—both Liberals and Conservatives support more stringent NOx and VOC emission standards; vehicle emission standards – some debate about power plants limits	No—opposition to more stringent standards from Republican policy-makers and legislators, especially re. power sector and vehicle emissions	
7. Congruence in national-subnational approaches	Yes—national ambient air quality standards (NAAQS) for NOx and VOCs under CEPA (replaced earlier Canada-wide standards) for stationary and mobile sources; fed-provincial Air Quality Mgmt System	Yes—NAAQS for NOx and VOCs under Clean Air Act, for stationary sources and vehicle emission standards; NOx Budget Trading System, but now Clean Air Interstate Rule	
8. Tangible support—regulated actors	Mixed—sources varied, many stakeholders implicated, continuing debate over power generation	No—sources varied, many stakeholders implicated, entrenched opposition to regulations on power plants	
9. Legislative authorities in place	Yes—NOx and VOCs are considered toxic under the Canadian Environmental Protection Act, 1999 (CEPA), Ambient Air Quality Standards (NAAQS) for ozone 2015, tightened in 2020	Yes—2012 NAAQS for ozone under Clean Air Act; NOx Budget Trading Program, now replaced by Clean Air Interstate Rule BUT coming ruling by Supreme Court may change this	
10. Similar policy instruments			Yes—regulatory alignment on ozone rules and vehicle emission standards. But, emission rules for power plants vary – especially coal plants
11. Technological readiness			Yes—a variety of low-cost technical solutions exist for NOx reductions for stationary and mobile sources
12. Technology strategy in place	Yes—high-quality research programs in place, Health Canada's Air Quality Benefits Assessment Tool	Yes—high-quality research programs in place	
13. Joint action in international bodies			Yes—UNECE LRTAP process

HFCs:

HFCs present us with yet another different case when compared with the other SLCPs. First, the domestic political and regulatory conditions in both countries are primed for relatively quick action on HFCs. Both countries have committed to the Kigali Amendment of the Montreal Protocol to phase out HFCs (though the U.S. has not yet ratified), and they have also made domestic and bilateral policy pronouncements. Moreover, Canada has national legislation and regulations in place to reduce the import, manufacture, and use of HFCs and the U.S. has passed legislation under which a more consistent regulatory regime will shortly be put in place, to replace a patchwork of regulations developed at the state level. In addition, although different industry sectors are variously positioned in terms of phasing out HFCs in both countries, key stakeholders support reductions or have already transitioned to alternatives, with strong support from the environmental community. Certainly, the fear of losing market access under the Kigali Amendment played a role here.

However, while both Canada and the U.S. are committed to the cause of reducing HFCs, their most significant actions have been taken in multilateral, not bilateral, forums. Other than the Obama-Trudeau joint commitment to address HFCs in 2016, they have focused cooperative activity on the Kigali process and on the work of the Clean Air and Climate Coalition, which is aimed at global SLCP reductions, especially in developing countries.

Table 8: HFCs Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—PCF, Canadian ratification of Kigali Amendment 2017, in force 2019; Strategy on SLCPs; HEHE	Yes—Obama signed Kigali Amendment in 2016; Biden sending it for ratification, EPA proposed rule in May 2021	Yes—Canada and U.S. committed to update public procurement processes to transition away from high-GWP HFCs whenever feasible in the U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership
2. Political commitment—budget allocations	Yes—support of regulatory process	Yes—support for regulatory process	
3. Pre-existing bilateral cooperation			No—multilateral cooperation through Montreal Protocol
4. Bilateral cooperation institutionalized			No—institutions exist for multilateral, rather than bilateral, action
5. Functionally intense interaction			No—the two countries working in parallel
6. Bipartisan/Multi-party support	Yes—all major parties support Kigali	Yes—bipartisan support for American Manufacturing and Innovation Act, Kigali amendment not yet ratified	
7. Congruence in national-subnational approaches	Yes—national "Ozone-depleting Substances and Halocarbon Alternatives Regulations" (2016) control consumption of HFCs, phase-down of the manufacture, import and export of HFCs; Quebec moving ahead more quickly	Not yet—some states already regulated (CA, U.S. Climate Alliance,), but EPA regulations on HFC leaks, end uses, phasedowns under development	
8. Tangible support—regulated actors	Yes—major companies on board, though some concern with base calculations for phase-in of regulations	Yes—coalition including ENGOs and trade groups (air conditioning, refrigeration) supported American Manufacturing and Innovation Act	
9. Legislative authorities in place	Yes—"Ozone-depleting Substances and Halocarbon Alternatives Regulations" (2016) under CEPA	Yes—American Manufacturing and Innovation Act passed in Dec 2020	
10. Similar policy instruments			Yes—regulatory frameworks likely to convergence but moving at different rates to phase-outs
11. Technological readiness			Yes—for new products; alternatives to HFCs in use by some companies
12. Technology strategy in place	Mixed—Technology demonstration and support in place but not R&D program	Yes—DOE has research strategy for low-HFC heating and cooling; retrofits for existing products at earlier stage in terms of available technologies	
13. Joint action in international bodies			Yes—Kigali Amendment to Montreal Protocol; Climate and Clean Air Coalition active on HFCs

SLCPs and Bilateral Cooperation

Overall, the mitigation case for SLCPs is very clear: actions taken to reduce methane, black carbon, ground-level ozone, and HFCs will deliver quicker and deeper mitigation action than CO2 and, when compared with CCS, considerably more environmental benefit up front. The domestic and shared commitments by Canada and the U.S. to act on all of these pollutants sends important signals into the continental economic system, reinforcing for a broad range of stakeholders the pitfalls of not moving forward on reductions. However, the analysis here has also shown that the two countries are often differently positioned in terms of domestic political support (with more opposition in the U.S. across all four pollutants) and the regulatory process is at different stages. Both of these conditions need to be in place before bilateral commitments can be realized. This finding verifies what we have learned from earlier studies of Canada-U.S. bilateral environmental relations, i.e., the most successful initiatives have been built on a backdrop of firm domestic policy frameworks.

It is also clear that the two countries interact through different channels across the four pollutants. For black carbon and ground-level ozone, bilateral cooperation is well institutionalized and strong, seated within the structures and processes associated with the U.S.-Canada Air Quality Agreement; however, these are not focused on SLCPs per se but on transboundary air pollutant transport in particular (i.e., Northeastern and Great Lakes regions). For HFCs, the two countries work alongside one another, not bilaterally, but within multilateral forums. Methane provides probably the best example of bilateral interactions aimed directly at SLCP reduction, but at present the interactions are not functionally intense.

ELECTRIFICATION OF TRANSPORT—COOPERATION ON THE 'QUADFECTA'

There can be no doubt that the United States and Canada are now engaged in a global race to secure the conditions for reliable supply chains and favorable manufacturing conditions for zero-emission vehicles, especially electric vehicles (EVs).

It is also clear that they are starting from behind and trying to play catch-up; China, other Asian countries, and Europe are further along in developing infrastructure for the manufacture of EVs and the batteries that power these vehicles.[10] Both countries have made the electrification of transport—vehicle manufacturing, battery production, and charging infrastructure—a core plank of their domestic climate and economic plans. In addition, there are musings about getting in on the ground floor of the battery recycling business, as concerns grow about the life-cycle implications of critical minerals mining and the low supply of these minerals, as well as the impacts of cell manufacturing. Importantly, given that transportation is responsible for approximately a quarter of GHG emissions in both countries[11], any efforts to get fossil fuel combustion vehicles off the road will yield immediate emission reductions, in a manner similar to SLCPs.

This section applies the cooperation indicators to electric vehicles and battery production (see Tables 9 and 10), and also provides some brief reflections on charging infrastructure and battery recycling, which are not currently the subject of active bilateral aspirations but will require significant action as the electric vehicle economy develops in North America.

10 For example, see https://about.bnef.com/blog/china-dominates-the-lithium-ion-battery-supply-chain-but-europe-is-on-the-rise/

11 See https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html and https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#:~:text=Transportation%20(29%20percent%20of%202019,ships%2C%20trains%2C%20and%20planes

Electric Vehicles

Canadian and American plans and programming for electric vehicles are constructed on similar core policy planks. First, both countries have committed to targets for sales of electric cars; the Biden administration is aiming for 50% by 2030, Canada for 100% by 2035. Second, both administrations have endorsed tighter fuel economy and GHG emissions standards for combustion vehicles. Together, these two policies are intended to put pressure on automakers to rapidly shift production toward EVs and away from gas- and diesel-powered cars and heavier vehicles. Moreover, both countries are using a mix of consumer incentives, business tax incentives, testing and assessment support, as well as R&D project development, to back up their commitments. In both countries, there is also a complex mix of policy choices at the subnational level, although the ZEV (zero-emission vehicle) Task Force in the U.S. has attempted to coordinate the efforts of some states on this front. A key difference is that Canada is already in the process of regulating the 100% EV target, which is unlikely south of the border. And, in an important shift, the largest North American automakers have thrown their support behind the move to electrify their fleets. Overall, then, policy and regulatory conditions seem generally to have come into a productive alignment across the two countries, making the outlook for bilateral cooperation in this area quite promising.

Yet bilateral cooperation has been proceeding down different paths, according to these two main policy planks. The April 2021 joint statement from the U.S. EPA and Environment and Climate Change Canada commits the two countries to "working collaboratively, including with sub-national governments, on stringent short- and long-term vehicle standards to improve fuel efficiency and reduce greenhouse gases from all vehicles—light-, medium- and heavy-duty." This builds on a history of collaboration between the two countries on vehicle fuel economy and emission standards, which was most active during the Obama-Harper years and involved interagency efforts to ensure compatible standards (Rabe 2019; VanNijnatten 2013). When the Trump administration sought to loosen the standards, Canada nevertheless moved forward with a further tightening of rules, in conversation with California and the 13 other states that follow California's emissions rules. Now, with the aspirational alignment between the Biden and Trudeau administrations, further work on ensuring stringent and aligned standards can move forward along well-worn tracks. Biden's most recent announcement that the administration will proceed in stages to tighten standards reinforces the commonalities.

We might contrast this with the commitment by the two governments in the Renewed Partnership document to "take aligned and accelerated policy actions, including efforts to achieve a zero-emissions vehicle future." Here, the architecture for joint action is not yet in place and the target actions and channels remain to be identified. For example, the two governments want to "renew and update the existing Memorandum of Understanding (MOU) on energy between the U.S. Department of Energy and the Department of Natural Resources Canada to enhance cooperation on sustainable and equitable energy transitions, clean energy innovations, and connectivity and *low-carbon modes of transportation*" [italics added], yet the MOU (originally dating from 2014 and updated in 2016) does not actually deal with transportation (Loney and Jones 2021). Clearly, given the integrated nature of automotive manufacturing in the USMCA, as well as the economic and environmental desirability of localizing supply chains and production, working together to increase the supply of electric vehicles on the continent is necessary. Indeed, the speed of the shift to electrified transport will be determined by competitiveness and market forces, and this is an area where coordination between Canada and the U.S. would be of immense benefit for the continental market. However, the means for achieving coordination in this respect do not yet appear to be in place—and recent 'Buy American' pronouncements emanating from the Biden administration are not helpful.

Table 9: Electric Vehicle Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—100% EVs by 2035; PCF; HEHE;	Yes—Biden Climate Plan (fleet procurement, incentives, tax support), but not legislative mandate; 100% EVs by 2035	Some—"the U.S. and Canada commit to working collaboratively, including with sub-national governments, on stringent short- and long-term vehicle standards to improve fuel efficiency and reduce greenhouse gases from all vehicles – light-, medium- and heavy-duty." (Joint statement from EPA and ECCC)
2. Political commitment—budget allocations	Yes—$287 million over two years, starting in 2020–21, for incentives; $2.75 billion to electrify transit fleets; support for two plants in ON	Yes—billions in proposed incentives, tax system supports	
3. Pre-existing bilateral cooperation			Mixed—aligned standard-setting for vehicle emission/fuel economy standards (VEFES); Can-CA MOU on VEFES – nothing on ZEVs yet
4. Bilateral cooperation institutionalized			Not yet on ZEVs; well-developed cooperation on VEFES
5. Functionally intense interaction			Yes on VEFES; Not yet on ZEVs
6. Bipartisan/Multi-party support	Yes—Liberals leading the charge, Conservatives include ZEV in their plan, other opposition parties supportive	No—Republicans oppose infrastructure spending on EV incentives and charging infrastructure; impose fees on EVs	
7. Congruence in national-subnational approaches	No—separate and differing fed and prov'l consumer incentives; intergovernmental cooperation on support for manufacturing	No—separate and differing fed and prov'l consumer incentives (though 45 states have them); some intergovernmental cooperation on R&D, support for manufacturing; ZEV Task Force (CA and 14 other states)	
8. Tangible support—regulated actors	Mixed—long-time opposition from major automakers but large player changing sides (GM)	Mixed—continued opposition from some automakers although alignments are shifting	
9. Legislative authorities in place	Yes—and regulatory mandates forthcoming	Coming—existing authorities and bills proposed: Clean Energy for America Act; Electric Cars Act of 2021	
10. Similar policy instruments			Mixed—both using consumer incentives, business tax incentives, testing and assessment support; Canada more focused on medium-heavy trucks and has imposed ZEV mandate
11. Technological readiness			Developing rapidly—various models commercially available but challenges remain with battery energy density, powertrain design, weight, AI systems
12. Technology strategy in place	Yes—government support for industry research	Yes—government support for industry research	
13. Joint action in international bodies			Partly—Canada involved in global ZE-MHDV truck campaign

Electric Battery Supply Chains and Production

The two leaders also agreed to "work together to build the necessary supply chains to make Canada and the United States global leaders in all aspects of battery development and production." A key focus here is to secure the critical minerals necessary for greatly increased battery production through the strengthening of the Canada-U.S. Joint Action Plan on Critical Minerals. This aspect of the bilateral climate relationship features a diplomatic, political, and policy landscape where conditions also appear very favorable. Diplomatically, the interests of the two countries are nicely aligned (in sum, the U.S. wants and needs what Canada wishes to provide); in fact, Canada has considerable leverage here, as it possesses reserves of all the critical minerals (currently) needed in advanced battery production and is a global mining giant. However, key actors in Canada are attempting to ensure that the country is also able to develop some value-added, i.e., battery production capacity, from their critical mineral wealth—and not simply just export the raw minerals.

Political interests in both countries are supportive of electric battery-powered transport; Republicans are even pressing for quicker action on minerals mining and procurement, and Conservatives in Canada recommend putting a billion dollars of support into battery production. Certainly, there are concerns in both countries about the environmental effects of mining and manufacturing activities, and there are already skirmishes in both countries about new mines on public lands. But the debate has centered mainly on how to engage in these activities in a sustainable manner and—especially in Canada—with the support of indigenous peoples. Further, the public resources directed into battery R&D, technology projects, and specific facilities is impressive. In Canada's Budget 2021, more than $46 million was earmarked for battery programming, including the creation of a new Critical Battery Minerals Centre of Excellence at Natural Resources Canada, which will guide implementation of the Canada-U.S. Joint Action Plan. However, battery technology and project development is being carried out under numerous program umbrellas in both Canada and the U.S.

It is important to note that both countries have been slow getting off the starting block and it will be a heavy lift to get battery production scaled up, with attention to all stages of the production cycle (which Canada calls a 'mines to mobility' approach). It is clear that the "innovation ecosystem" for battery development in both countries is more than a bit messy at present, with subnational governments engaged in varying activities, and more coordination is evidently required. The fact that the technology is quickly evolving and not yet cost-competitive is an added complication. What the two countries will do together, other than set aligned targets and send policy signals (which are not inconsiderable), is not quite clear. In fact, the relationship between the two countries seems to be shaping up as more competitive than cooperative, as each tries to carve out a slice of the global battery market and challenge China's dominance.

Table 10: EV Batteries Cooperation Indicators

	CANADA	UNITED STATES	BILATERAL/NORTH AMERICA
1. Political commitment—prioritization in speeches, documents	Yes—HEHE "to position Canada as global leader in battery production"; Canadian Metals and Minerals Plan	Yes—Biden Climate Plan; Executive Order 14017; National Blueprint for Lithium Batteries; Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals	Yes—Canada-U.S. Joint Action Plan on Critical Minerals: "securing supply chains for critical minerals"
2. Political commitment—budget allocations	Yes—Net Zero Accelerator Strategic Innovation Fund; Energy Innovation Fund; Budget 2021 has $9.6 mil for NRCan Critical Battery Minerals Centre of Excellence; and $36.8 million for federal R&D	Yes—FY22 budget $200 million to support battery technology research, development, and demonstration; Advanced Technology Vehicles Manufacturing Loan Program	
3. Pre-existing bilateral cooperation			Some—cooperation on critical minerals initiated under Trump-Trudeau
4. Bilateral cooperation institutionalized			Developing—MOU on critical minerals, will require working structures
5. Functionally intense interaction			Developing—joint projects for R&D, supply chain modeling and increased support for industry
6. Bipartisan/Multi-party support	Yes—Liberals leading the charge; all opposition parties support EV battery supports in their platforms	Yes—Republicans support critical minerals mining expansion to support batteries, renewables	
7. Congruence in national-subnational approaches	Developing—provinces working to solidify their role in battery value chain but varied; feds undertaking coordination and harmonization of rules; Quebec already has emerging cluster	No—decentralized approach; ZEV Task Force. Potentially more congruence as Biden admin puts in place supports for battery supply chain	
8. Tangible support—regulated actors	Mixed—long-time opposition from major automakers but large player changing sides - GM	Mixed—continued opposition from some automakers although alignments are shifting	
9. Legislative authorities in place	Yes—and regulatory mandates forthcoming	Proposed—new bills proposed under existing authorities: Clean Energy for America Act; Electric Cars Act of 2021	
10. Similar policy instruments			Mixed—both using consumer incentives, business tax incentives, testing and assessment support; Canada more focused on medium-heavy trucks and has imposed ZEV mandate
11. Technological readiness			Developing rapidly—various models commercially available but challenges remain with battery energy density, powertrain design, weight, AI systems
12. Technology strategy in place	Yes—government support for industry research	Yes—government support for industry research	
13. Joint action in international bodies			Yes—Energy Resource Governance Initiative

Charging Infrastructure

There is a key aspect of the electric roll-out that requires substantial government investment if ambitious targets for the electrification of transport are to be achieved—charging infrastructure. Clearly, the infrastructure needs to be in place to support the switch to EVs. Both countries are pushing hard on this. Canada's Budget 2021 states that since 2016, the government has invested $376.4 million and has initiated work to build nearly 6,000 charging and refueling stations with partners all across the country. The Biden administration has requested $174 billion to create 500,000 charging stations across the U.S., although the compromise infrastructure bill passed by Congress cut in half the monies originally requested. Substantial monies are also being funneled into expanding and updating the electricity grid. Considerable deliberation is underway within both countries regarding how to move charging infrastructure into residential, private, and commercial locations as well. These discussions are largely domestic.

Cooperative action on this front would be mutually beneficial for trade purposes as well as for travel and tourism. There is a commitment to develop and implement a set of codes and standards for retail EV charging and fueling stations in North America. This would include accreditation and inspection frameworks needed to ensure the standards are adhered to at the vast network of charging and refueling stations across the continent. However, it is not yet clear how this harmonization will happen. Moreover, coordination in terms of charging infrastructure along the main trade corridors and border crossings would be useful, although we have not yet found any evidence that this is under discussion.

Battery Recycling

Battery recycling is a newer, but increasingly salient, policy conversation that is playing out all across the continent. In the Renewed Partnership Roadmap, Biden and Trudeau identified the battery supply chain as a collaborative opportunity for the two nations, but details on how recycling fits into that picture are scant. Both countries are studying this at home, however: Biden's team put out the 100 Day Supply Chain Review; Clean Energy Canada released a set of recommendations in *Turning Talk into Action: Building Canada's Battery Supply Chain*; and Propulsion Quebec has contributed a study of *Extended Producer Responsibility for Electric Vehicle Lithium-Ion Batteries*. Neither country has a regulatory or non-regulatory regime for recycling vehicle batteries in place and considerable work needs to be done, particularly in terms of coordination with provinces in Canada, and states in the U.S. Yet, given what will be the integrated nature of supply chains for raw materials in battery production and end use in vehicles and other products, recycling infrastructure will need to follow suit.

OBSERVATIONS ON CANADA-UNITED STATES COOPERATION

1. Most of the bilateral climate cooperation architecture is lightweight—and vulnerable.

The previously established mode of bilateral interactions on climate, energy, and regulatory cooperation, whereby Leaders' Summits put in place a set of broader aims that are intended to guide the more targeted actions of agency officials, is also characteristic of climate cooperation under Biden and Trudeau thus far. There is more continuity than change in the way that the two countries are building out the current bilateral climate policy framework, as can be seen across all cases studied here. The High Level Climate Ministerial that has been established to carry out the tasks outlined in the Roadmap for a Renewed Partnership is similar to the Clean Energy Dialogue architecture, under which working committees carried out specific tasks and a light reporting structure connected the committees to the Leaders. While the structure is directed by the most senior levels of the executive branch, it does not possess the policy solidity or longevity of a full executive agreement such as the U.S.-Canada Air Quality Agreement or the even more comprehensive Great Lakes Water Quality Agreement, which lays out a series of tasks that governments must do *together* on a regular basis and creates an architecture for doing so.

In particular, the High Level Climate Ministerial architecture is likely to be vulnerable to the shifting whims of the political executive in both countries. As discussed earlier in this paper, domestic political debates have direct bearing on whether, and how far, the two countries can push cooperation. Particularly in the U.S. at present, political opposition to many climate initiatives places significant constraints on follow-through for joint Canada-U.S. commitments, as does the slow pace of appointments to key posts that would power climate cooperation forward. This is unlikely to change anytime soon. In Canada, by contrast, those actors who oppose ambitious climate action are on increasingly unstable ground, and the political calculus of opposition conservative parties and regimes may change in response. The 2021 federal election, though climate policy did not figure as prominently in debates as one might have expected, nevertheless showed that a majority of Canadians support moving forward with a more activist climate policy agenda. In the U.S., however, there is no such consensus, and the political obstacles remain considerable.

2. Bilateral interaction in almost all areas are not functionally intense.

Given the close and generally harmonious relationship between the two countries over the past century, and the track record of cooperation established on Great Lakes water management as well as transboundary air issues, one might expect more functionally intense interactions on climate under the Biden and Trudeau administrations. This does not yet seem to be the case, however. Though all of our cases show a true meeting of the minds across the political executives of the two countries in terms of policy aspirations, interactions are trending toward less intense activities, such as the sharing of information and best practices, working toward complementary (though not necessarily the same) policy goals. These goals are then implemented in different ways at home, coordinating policy signals to private actors and taking action alongside one another in international forums.

This suggests the two countries are currently working primarily in parallel to one another, rather than together to carry out joint projects. The methane reductions case is a good example of this; the two governments have made reductions of this SLCP a priority, and they are utilizing complementary tools (regulation, research, and sharing of best practices), but there is little in the way of joint programming or projects.

The SLCP cases of PM2.5 and ground-level ozone show more functionally intense bilateral activity, but this is largely because the two administrations have been working together for three decades under a formal executive agreement (U.S.-Canada Air Quality Agreement), they have well- developed scientific relationships, and—in a link to the previous point—they have already put regulatory frameworks in place domestically. There is also a solid progress-reporting regime in place. Further, the active harmonization of vehicle efficiency and emission standards shows what can happen with more intense collaboration. This

suggests that more formalized architecture to support bilateral relations can yield sustained results that have staying power during partisan shifts in government.

If we question why moving in parallel has more often than not proven to be the case, economic dynamics and cost must figure into explanations. With respect to HFCs (given the enormous industry consequences), batteries, EVs, and critical minerals, for example, there are significant monies to be made and eager domestic sectors to be leveraged. More importantly, however, all of these represent emerging domains and there is a chance to gain competitive advantage as clean transitions are being made. It therefore makes sense for Canada and the U.S. to make broad commitments at an executive level, but perhaps not seek a fervent melding of the sectors and industries that intend to ensure their respective green transitions are profitable.

The CCS case is interesting in this regard. Given the potential scale and complexity of CCS facilities and their associated storage networks, we would suggest that, should both nations be on board, large-scale deployment of necessary CCS technology is especially well suited for partnership, even more so within the North American context. Since the Weyburn project and the regional characterization of storage potential sites have been completed, it is not clear why the two countries are not doing more together; as international partners, they could benefit from their truly unique position in the CCS domain. Instead, they do not seem to be undertaking joint R&D or shared projects, but rather sharing information on domestic technology and policies.

Economics aside, the second side of the confounding reality is the problematic nature of federalism within the context of climate policy action. What we can see in both the Canadian and American cases is that federalism often acts as a bulwark that impedes the potential for greater cooperation on a national level. Because climate solutions involve a diverse number of interest groups and stakeholder perspectives at a domestic level, it is difficult to envisage bilateral cooperation when there remains infighting between jurisdictions on best practices moving forward. In this sense, both governments almost have to run in parallel with each other, because they are not yet in a position to focus on or commit to real cooperation. The ideological divides between Republicans and Democrats, and to a lesser extent Liberals and Conservatives, reinforce these dynamics.

3. There appears to be little coordination or clustering within or across issue areas.

It is also useful to comment on the possible mitigation benefits derived from linking policies into 'cooperation clusters' where active coordination of goals, instruments, and implementation arrangements across several policies that are using a similar mitigation strategy may contribute to the effective functioning of each of them. In this respect, the analysis provides slim pickings. It would seem to make little sense for the two countries to engage bilaterally on a multi-SLCP "cluster" strategy, for example, given that interactions on the four pollutants occur via different channels, to varying extents, and using different tools. The four pollutants also seem to have their own political logic and implicate different sets of constituencies. While coordination on ground-level ozone and black carbon/PM2.5 take place through well-developed bilateral pathways and involve compatible regulatory frameworks, the locus of activity on methane and HFCs is domestic and international, with bilateral interactions figuring less prominently. What this means is that one of the policy strategies most likely to result in quick and meaningful emission reductions has no comprehensive institutional hardware that harnesses political will to activities on the ground through policy and accountability frameworks.

The electric quadfecta features four policy components that should be built out in interlocked fashion, yet, this does not yet seem to be the case. Each component requires varying roles for public sector regulation and private sector activity (i.e., electric car development and sales vs. charging infrastructure); they are at different stages of technological development; and they have received different levels of bilateral interest (i.e., batteries vs. recycling). Yet, they cannot be developed in isolation from one another, and the loose and light structure of the High Level Climate Ministerial will likely do little to provide more integration across the four areas.

4. More integrated strategies that build on close economic ties are needed, but are not yet under development.

Many of the climate policy cases we profile here—with the exception of SLCPs—will require not only technological development across multiple components, but also complex economic planning and policy coordination in order to insert new products into existing infrastructures, or to transition to new products *and* new infrastructures. This requires more integrated and complex policy architectures than merely replacing HFCs with refrigerant alternatives, for example. Moreover, given the close economic and trade ties between Canada and the U.S., it makes sense for the two countries to build these complex policy architectures in such a way that their domestic regimes intersect constructively (rather than merely working in parallel). This goal is echoed in the HEHE report, which calls for collaboration with the U.S. "on strong cross-border climate action that can better position the North American economy … to be globally competitive." Moreover, the on-again, off-again interest of the Biden administration in carbon border adjustments will require that some thinking goes into the complementary carbon treatment of products and manufacturing processes across the two countries. The 'whole-of-government' approach being adopted *within* each country on climate policy needs to be adopted *across* the two countries as well.

The analysis from our cases suggests several possibilities for a more continentally integrated approach—though none seem to be under active consideration by governments currently. If we take the example of the electric quadfecta, the auto industry is highly competitive, locked into a global market that is in constant flux—and which is now in transition. And yet significant components of an electrified transportation system require public infrastructure and regulation. In light of this complex reality, what is the cross-border vision for making EVs available to consumers; for ensuring the harmonization of accreditation and inspection frameworks for a continental network of charging and refueling stations; for a charging infrastructure along the main trade corridors and at border crossings; for a cross-border plan for recycling infrastructure? If the transportation industry is continental (and it is), the electrification of transport will need to be continental as well. Canadian and American officials would do well to sit down with experts, industry, and other stakeholders to formulate a broader plan—and an appropriate bilateral cooperative architecture—to support this continental vision.

The CCS case provides another interesting example here. A cross-border approach to CCS networks, which lowers the barriers to entry for all CCS partners, including for emitters who then do not need to develop their own separate transportation and storage solutions, is an option for consideration. One model for this is the cross-border carbon dioxide networks being put in place under the auspices of the European Climate, Infrastructure and Environment Executive Agency (CINEA). And, given the integrated nature of the agricultural trade relationship, might an integrated carbon offset system make sense, as implied above?

Methane reduction from oil and gas installations is also ripe for deeper levels of cooperation, particularly in shared regions and in the Arctic. As Barry Rabe (2021) notes, there are some signs that there are "a growing number of firms in the United States and Canada that invested heavily in mitigation technologies and [have begun] to position themselves as more environmentally responsible producers of gas for commercial use." They may thus have more in common with one another than with the laggard firms in their own country, especially as European countries move toward integrating methane emissions into the entire natural gas value chain. And laggards may be noting the shifting winds as more than 90 countries sign a pact to reduce methane emissions at COP26 (Reuters 2021). Organizing monitoring frameworks by region and addressing concerns that methane emissions are being underreported by firms in both countries (Beer 2021) are additional avenues for cooperation.

CONCLUSION

The analysis provided here highlights the constant balancing act involved in reconciling domestic political realities, continental economic pressures, and global environmental dynamics.

Canada and the U.S. have been working on some of the policy issues we profile here for a considerable amount of time, but others are quite new to the bilateral agenda. While it might be difficult to change the dynamics of issues like black carbon and ground-level ozone pollution, where cooperative structures are entrenched, CCS, electrified transportation, and methane reductions may provide openings for new forms of cooperation across the border. Further, those areas in which technology is still emerging may be more pliable.

A critical ingredient in following through on bilateral aspirations to reduce carbon pollution at the scale and speed required—across all of the policy areas we examine here—is political leadership. Canada and the U.S. are fortunate to have administrations that are taking the climate crisis seriously, and bilateral environmental cooperation has in the past been relatively successful. However, the two administrations will need to use the current moment to solidify and intensify the linkages between them in order to make progress on addressing climate change in North America.

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DETAILED EVIDENCE FOR INDICATORS—CCS

Political commitment—prioritization in speeches, documents—YES

Canada: CCS included as action item in the Healthy Environment Healthy Economy Strengthened Climate Plan; provision made for CCS in new federal Clean Fuel Standard under Compliance category 1: undertaking projects that reduce the lifecycle carbon intensity of fossil fuels (e.g., carbon capture and storage, on-site renewable electricity, co-processing); Alberta's TIER program

U.S: Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies

https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/

Bilateral: Canada-U.S. MOU on Energy Cooperation signed June 2021 increase bilateral cooperation on sustainable and equitable energy transitions, clean energy innovation, connectivity and low-carbon transportation—including carbon capture, utilization and storage https://www.canada.ca/en/natural-resources-canada/news/2021/06/canada-strengthens-energy-partnership-with-the-united-states.html

Political commitment—budget allocations —YES

Canada: Budget 2021 (p.188) allocates funding to CCS—from 133 mil in 2021–22 to 1,943 mil in 2026–27; first significant funding since 2010 Economic Action Plan announced $1 billion over five years under the Clean Energy Fund to support research, development, and demonstration of promising clean energy technologies, including carbon capture and storage technologies, support for three major CCS projects ($120 Million for Shell Quest, $315.8 million for Transalta Keephills, and $30 million for Alberta Trunk Line). file:///C:/Users/dvannijnatten/Downloads/budget-2021-en.pdf

U.S: FY2022 request for $531.5M Carbon Capture, Utilization and Storage and Power Systems: Carbon capture $150 mil; carbon utilization $38 mil; carbon storage $117 mil; Advanced Energy and Hydrogen Systems ($82M)

https://www.energy.gov/sites/default/files/2021-06/doe-fy2022-budget-volume-3.2-v3.pdf

Pre-existing bilateral cooperation—YES

PCOR https://undeerc.org/pcor/Partnership.aspx

Carbon Capture and Storage Working Group of Clean Energy Dialogue https://www.canada.ca/en/environment-climate-change/corporate/international-affairs/partnerships-countries-regions/north-america/canada-united-states-clean-energy-dialogue.html

Bilateral cooperation institutionalized—YES

Canada-U.S. Clean Energy Dialogue Annual Summits and working group structures

https://www.canada.ca/en/environment-climate-change/corporate/international-affairs/partnerships-countries-regions/north-america/canada-united-states-clean-energy-dialogue.html

Technical groups under 2021 MOU on energy cooperation

https://nrcan.canada.ca/energy/resources/international-energy-cooperation/memorandum-understanding/23749

Functionally intense cooperation—NO

PCOR and Clean Energy Dialogue work focusing mainly on sharing information and research, encouraging complementarity of policy regimes

Bipartisan/Multi-party support—MIXED

Note there are opponents of CCS in both countries: https://www.commondreams.org/news/2021/07/19/false-solution-500-groups-urge-us-canadian-leaders-reject-carbon-capture

Canada: Liberal government endorses and funds; Conservative Party (Official Opposition) endorses; Green Party opposed (has 2 MPs); NDP opposed.

U.S: Yes. Both Republicans and Democrats supportive of supporting CCUS, although Progressive wing of Democrats are wary. E.g., Bipartisan Budget Act of 2018 (P.L. 115–123) which expanded and extended the 45Q tax credit; CCS also endorsed in House Select Committee on the Climate Crisis

https://climatecrisis.house.gov/sites/climatecrisis.house.gov/files/Climate%20Crisis%20Action%20Plan.pdf

https://thehill.com/policy/energy-environment/482772-house-republicans-propose-carbon-capture-and-sequestration

Congruence in national-subnational approaches

Canada: The consultation will include key provincial governments, encouraging them to create complementary measures for CCUS projects in their jurisdictions; Canada-Alberta working group established for CCS https://www.theglobeandmail.com/business/article-alberta-ottawa-launch-carbon-capture-group/

U.S: no evidence of congruence

Tangible support—regulated actors

Industries participating in PCOR and Global CCS Institute with Canadian and American Officials

Canada: Major CCS projects done as partnerships with industry

U.S: Major CCS projects done as partnerships with industry

Legislative and regulatory authorities in place—YES

But regulatory regimes fragmented in both countries, across scale and CCS components. Abdullah et al. (2021) noted that states like Texas and Oklahoma "have laws in place to clarify the regulatory context for much of the value-chain of CCS, from plant construction to pipeline development to sequestration." Others, like California, do not.

Similar policy instruments—YES

Canada: "Budget 2021 proposes to introduce an investment tax credit for capital invested in CCUS projects with the goal of reducing emissions by at least 15 megatonnes of CO2 annually. This measure will come into effect in 2022...It is not intended that the investment tax credit be available for Enhanced Oil Recovery projects"; project-specific funding; support for research on new technologies

U.S: 45Q tax credit incentivizes (created 2008, expanded in 2018), dedicated geologic CO_2 storage and also enhanced oil recovery, but at a lower price per CO_2 unit (note policy difference on EOR with Canada); project-specific funding; support for research on new technologies

Technological readiness—NO

- Study of 39 CCS projects in US highlight 80% failure to commercialize (A. Abdulla, R. Hanna, K.R. Schell, O. Babacan, and D.G. Victor)

- Additional analysis: https://www.osti.gov/servlets/purl/1245759

- Particular obstacles remain in terms of component technologies; very capital intensive and to date exists in a "one-off" project environment

Technology strategy in place

Canada: Yes. CO2 Capture and Storage Technology Roadmap from—but outdated (2008) https://www.cslforum.org/cslf/sites/default/files/documents/SaudiArabia/T2_4_CSLF_CCSTRM_Saudi_Jan08.pdf

Another plan being developed https://www.theglobeandmail.com/business/article-alberta-ottawa-launch-carbon-capture-group/

U.S: Yes. Carbon Sequestration Technology Roadmap and Program Plan 2007 http://cepac.cheme.cmu.edu/pasi2008/slides/siirola/library/reading/2007Roadmap.pdf

Updated Roadmap 2011 https://www.energy.gov/fe/articles/new-roadmap-updates-status-doe-carbon-capture-and-storage-rdd

Carbon Storage Plan 2013 https://www.netl.doe.gov/sites/default/files/netl-file/Program-Plan-Carbon-Storage_0.pdf

Joint membership in international bodies—YES

Carbon Sequestration Leadership Forum – ministerial-level forum; Canada and US are members of Mission Innovation subcommittee https://www.cslforum.org/cslf/

International CCS Knowledge Centre – Canadian-based but has US stakeholders https://ccsknowledge.com/

Global CCS Institute (U.S. and Alberta) https://www.globalccsinstitute.com/?s=canada

International Energy Agency - https://www.iea.org/reports/ccus-in-clean-energy-transitions/a-new-era-for-ccus

Similar international strategies—YES

Examples:

Canada-China https://ccsknowledge.com/news/china-canada-collaboration-on-co2-capture-for-cement

U.S.-China https://www.wri.org/insights/china-and-united-states-accelerate-efforts-carbon-capture-and-storage

https://www.state.gov/u-s-china-joint-statement-addressing-the-climate-crisis/

https://www.globalccsinstitute.com/news-media/insights/ccus-and-international-collaboration-essential-for-china-to-achieve-carbon-neutrality/

DETAILED EVIDENCE FOR INDICATORS—METHANE

Political commitment—prioritization in speeches, documents—YES

Canada: https://www.canada.ca/en/environment-climate-change/news/2020/12/a-healthy-environment-and-a-healthy-economy.html

U.S: https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/

https://www.reuters.com/business/environment/biden-admins-methane-emission-curbs-exceed-obamas-epa-chief-2021-04-09/

Bilateral: first under 2016 U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership; now under 2021 Renewed Partnership; April 2021 joint statement by EPA Administrator and Environment Minister

https://obamawhitehouse.archives.gov/the-press-office/2016/03/10/us-canada-joint-statement-climate-energy-and-arctic-leadership

https://www.whitehouse.gov/briefing-room/statements-releases/2021/02/23/roadmap-for-a-renewed-u-s-canada-partnership/

https://www.epa.gov/newsreleases/joint-statement-us-environmental-protection-agency-and-environment-and-climate-change

Political commitment—budget allocations—YES

Canada: Budget 2021 proposes to provide $104.6 million over five years, starting in 2021–22, with $2.8 million in remaining amortization, to ECCC to strengthen greenhouse gas emissions regulations for light and heavy duty vehicles and off-road residential equipment, **to establish national methane regulations for large landfills**, and to undertake additional actions to reduce and better use waste at these sites (p.165). This is in addition to earlier budgetary outlays to put oil and gas regs in place.

U.S: U.S. DOE announces $35 million in funding for technologies to reduce methane emissions

https://www.energy.gov/articles/doe-announces-35-million-technologies-reduce-methane-emissions

Pre-existing bilateral cooperation—YES

https://obamawhitehouse.archives.gov/the-press-office/2016/03/10/us-canada-joint-statement-climate-energy-and-arctic-leadership

Bilateral cooperation institutionalized—NO

https://www.epa.gov/newsreleases/joint-statement-us-environmental-protection-agency-and-environment-and-climate-change

Functionally intense cooperation—NO

https://www.epa.gov/newsreleases/joint-statement-us-environmental-protection-agency-and-environment-and-climate-change

Bipartisan/Multi-party support—NO (U.S.), YES (Can)

Canada: Conservatives favour capturing methane emissions from organic sources and turning it into fuel https://cpcassets.conservative.ca/wp-content/uploads/2021/04/15104504/24068610becf2561.pdf

NDP favours more stringent regs on oil and gas industry https://www.ndp.ca/news/ndp-statement-minister-mckennas-announcement-carbon-tax-breaks

U.S: https://thehill.com/policy/energy-environment/550818-here-are-the-three-republicans-who-voted-to-undo-trumps-methane

https://www.cnbc.com/2021/06/25/congress-acts-to-reinstate-methane-rules-loosened-by-trump.html

https://www.brookings.edu/blog/fixgov/2021/06/24/when-climate-policy-works-hfcs-and-the-case-of-short-lived-climate-pollutants/

Congruence in national-subnational approaches

Canada: YES—equivalency agreements for methane emission regs signed with provinces https://www.canada.ca/en/environment-climate-change/news/2020/11/government-of-canada-working-with-provinces-to-reduce-methane-emissions-from-oil-and-gas-operations.html

Other joint program: The Canadian Emission Reduction Innovation Network is a methane-focused initiative launched by NRCAN and AB under the Energy Innovation Program; the British Columbia Oil and Gas Methane Emissions Research Collaborative (MERC) is a joint initiative between industry, government, regulators, and non-profits. MERC is advancing research on methane emissions from the oil and gas sector to support efforts to achieve British Columbia's methane emission reduction targets; The Canadian Greenhouse Gas Measurement Program operates stations that precisely monitor atmospheric levels of GHGs carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) in all regions of the country;

U.S: YES—federal methane rules modelled on earliest rules from Colorado https://www.cred.org/colorado-leads-methane-emissions-regulation/

https://www.americanprogress.org/issues/green/reports/2020/04/30/484163/states-laying-road-map-climate-leadership/

Tangible support—regulated actors

Canada: Yes—especially large companies, and especially after the delayed phase in announced in 2017 https://www.cbc.ca/news/canada/calgary/canada-climate-change-methane-emissions-oilsands-catherine-mckenna-1.4130885

U.S: Yes—large oil and gas companies opposed Trump methane reg repeal https://www.sierraclub.org/sierra/why-epa-really-repealing-methane-emissions-regulations; though some smaller companies opposed

Legislative and regulatory authorities in place—YES

Canada: Yes—Liberals have developed regulatory framework for methane emissions reduction though implementation was delayed - Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds for the Upstream Oil and Gas Sector (came into force on January 1, 2020)

U.S: NO—Rulemaking relayed by Trump, revised rules will be proposed in September https://www.epa.gov/system/files/documents/2021-07/qa_cra_for_2020_oil_and_gas_policy_rule.6.30.2021.pdf

But a wide range of voluntary programs in place

Similar policy instruments—YES

Both countries have focused on regulating oil and gas emissions first, now turning to landfills. Agriculture is not yet regulated and both countries considering alternative instruments and incentives to change agric practices

https://publications.gc.ca/collections/collection_2018/eccc/En4-299-2017-eng.pdf

https://publications.gc.ca/collections/collection_2021/eccc/En11-18-2021-eng.pdf

https://www.unep.org/news-and-stories/press-release/global-assessment-urgent-steps-must-be-taken-reduce-methane

https://www.iatp.org/time-us-eu-regulate-factory-farms-greenhouse-gas

https://hillnotes.ca/2018/02/13/joint-action-to-reduce-methane-emissions-canada-and-the-united-states/

Technological readiness—YES

Although additional technologies under development

Technology strategy in place

Canada: British Columbia Oil and Gas Methane Emissions Research Collaborative (MERC) is a joint initiative between industry, government, regulators, and non-profits; Petroleum Technology Alliance Canada (PTAC) is a non-for-profit facilitator that promotes research and technology collaboration in the Canadian oil and gas sector; Methane Emissions Reduction Network within PTAC is a dedicated hub for the sharing of information on all things related to methane reductions in the oil and gas sector; Canadian Emission Reduction Innovation Network is a methane-focused initiative launched by NRCAN and AB under the Energy Innovation Program.

U.S: https://www.energy.gov/articles/doe-announces-35-million-technologies-reduce-methane-emissions

Joint membership in international bodies—YES

Net Zero Producers Forum

The Global Methane Initiative (GMI) is a voluntary, multilateral partnership that aims to reduce methane emissions and advance the recovery and use of methane as a fuel source. 45 partner countries, and over 1300 network members from the private secto, research community, development banks and other governmental and non-governmental organizations. The GMI focuses on three major sources of methane globally – oil and gas, biogas (including landfills, wastewater, and agriculture) and coal mining. Canada has co-chaired the GMI Steering Committee since 2016, and also co-chairs the GMI sub-committees for oil & gas and biogas. In April 2018, Canada hosted the 2018 Global Methane Forum in Toronto, which was organized by the GMI in partnership with the Climate and Clean Air Coalition.

The Climate and Clean Air Coalition (CCAC) is a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions, and civil society organizations. The CCAC is committed to improving air quality and protecting the climate through actions to reduce short-lived climate pollutants, including black carbon and methane. The CCAC works to reduce SLCPs through initiatives that target specific sectors, such as waste, brick manufacturing, household energy, oil and gas, efficient cooling and agriculture, as well as cross-cutting initiatives in finance, health, and support for national policy and action planning.

The Expert Group on Black Carbon and Methane (EGBCM) was established by the Arctic Council in 2015 to review, analyze, and assess progress toward the reduction of black carbon and methane emissions across the Arctic and in regions that influence the Arctic. 2021 Third Summary on Progress and Recommendations

Similar international strategies—YES

DETAILED EVIDENCE FOR INDICATORS—BLACK CARBON

Political commitment—prioritization in speeches, documents—YES

Canada: brief mention in https://www.canada.ca/en/environment-climate-change/news/2020/12/a-healthy-environment-and-a-healthy-economy.html; Arctic and Northern Policy Framework https://www.rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587; Strategy on Short-Lived Climate Pollutants https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/short-lived-climate-pollutants.html#slcp_glo

U.S: Not specifically mentioned in White House plan: https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/

Commitments in April 2021 statement from Leader's summit

https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/23/fact-sheet-president-bidens-leaders-summit-on-climate/

Bilateral: first under 2016 U.S.-Canada Joint Statement on Climate, Energy and Arctic Leadership

https://obamawhitehouse.archives.gov/the-press-office/2016/03/10/us-canada-joint-statement-climate-energy-and-arctic-leadership (mention of emissions from Arctic shipping)

not mentioned in https://www.whitehouse.gov/briefing-room/statements-releases/2021/02/23/roadmap-for-a-renewed-u-s-canada-partnership/

Pre-existing bilateral cooperation—YES

https://www.epa.gov/sites/default/files/2016-09/documents/pm_transboundary_assessment_2013_downloaded_27sept16.pdf

https://unece.org/fileadmin/DAM////env/documents/2008/EB/wg5/WGS42/Statement%20on%20the%20US%20and%20Canada%20Air%20Quality%20Agreement.pdf

Bilateral cooperation institutionalized—YES

U.S.-Canada Air Quality Committee – discussions of PM Annex

Tradition of joint scientific assessment

Interagency coordination on vehicle standards (DOE and ECC)

Functionally intense cooperation—YES

On science assessment, control technologies, and coordination of standards

Bipartisan/Multi-party support—YES (U.S.), YES (Can)

In both countries, the regulatory debate has been long settled

Congruence in national-subnational approaches

Canada: YES—national ambient air quality standards for PM2.5 under CEPA replaced earlier Canada-wide standards, Diesel Regs, and vehicle efficiency standards

U.S: YES—national ambient air quality standards for PM2.5 under Clean Air Act, Diesel Regs, and vehicle efficiency standards

Legislative and regulatory authorities in place—YES

Canada: Yes—https://wedocs.unep.org/bitstream/handle/20.500.11822/17162/1/Canada.pdf

https://unece.org/DAM/trans/doc/2014/itc/Diesel_Engines_Exhausts.pdf

https://laws-lois.justice.gc.ca/eng/regulations/SOR-2020-258/page-1.html

U.S: Yes—National Ambient Air Quality Standards (NAAQS)

https://unece.org/DAM/trans/doc/2014/itc/Diesel_Engines_Exhausts.pdf

https://www.environmentallawandpolicy.com/2021/01/epa-declines-to-revise-air-quality-standards-for-particulate-matter-and-ozone/

https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201304&RIN=2060-AQ48

Similar policy instruments—YES

NAAQS for PM2.5, diesel regulations, regulations on burning

Technological readiness—YES

Several decades of research on control strategies but additional technologies constantly under development. Continuing debate about cost-effectiveness

https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NRMRL&dirEntryId=65338

https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NRMRL&dirEntryId=65338

Technology strategy in place

Both countries have ongoing and well-developed research programs for PM2.5 reductions, both in the public sector and at research bodies, for example:

- https://www.epa.gov/air-sensor-toolbox/evaluation-emerging-air-sensor-performance
- https://19january2017snapshot.epa.gov/www3/airquality/blackcarbon/2012report/fullreport.pdf
- Health Canada's Air Quality Benefits Assessment Tool https://greatlakesecho.org/2019/06/10/research-on-air-quality-in-canada-sets-the-bar-high-for-many-countries/

Joint action in international bodies—YES

Net Zero Producers Forum

The Climate and Clean Air Coalition (CCAC) is a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations. The CCAC is committed to improving air quality and protecting the climate through actions to reduce short-lived climate pollutants, including black carbon and methane. The CCAC works to reduce SLCPs through initiatives that target specific sectors, such as waste, brick manufacturing, household energy, oil and gas, efficient cooling and agriculture, as well as cross-cutting initiatives in finance, health, and support for national policy and action planning.

The Expert Group on Black Carbon and Methane (EGBCM) was established by the Arctic Council in 2015 to review, analyze, and assess progress toward the reduction of black carbon and methane emissions across the Arctic and in regions that influence the Arctic. 2021 Third Summary on Progress and Recommendations

PM2.5 efforts under LRTAP

https://unece.org/environment/press/unece-convention-long-range-transboundary-air-pollution-aims-reduce-black-carbon

https://unece.org/climate-change/news/emission-reductions-domestic-heating-and-agricultural-waste-burning-will-help

DETAILED EVIDENCE FOR INDICATORS—HFCS

Political commitment—prioritization in speeches, documents—YES

Canada: Canadian ratification of Kigali Amendment to Montreal Protocol https://www.canada.ca/en/environment-climate-change/news/2017/11/canada_ratifies_globalagreementtoreducepowerfulgreenhousegasesan.html

Strategy on SLCPs https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/short-lived-climate-pollutants.html#slcp_glo

HEHE https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf

U.S: https://www.nrdc.org/experts/alex-hillbrand/biden-announces-move-ratify-kigali-amendment-hfcs#:~:text=The%20Kigali%20Amendment%20is%20a,HFCs%20over%20the%20coming%20decades.&text=Once%20the%20State%20Department%20submits,move%20forward%20with%20Kigali%20ratification.

Bilateral: https://publications.gc.ca/collections/collection_2018/eccc/En4-299-2017-eng.pdf

Bipartisan/Multi-party support—Yes, both

https://www.nrdc.org/experts/alex-hillbrand/biden-announces-move-ratify-kigali-amendment-hfcs#:~:text=The%20Kigali%20Amendment%20is%20a,HFCs%20over%20the%20coming%20decades.&text=Once%20the%20State%20Department%20submits,move%20forward%20with%20Kigali%20ratification.

Congruence in national-subnational approaches

Canada: YES—https://www.willsonintl.com/news/requirements-concerning-the-importation-and-exportation-of-ozone-depleting-substances-and-halocarbon-alternatives-and-certain-products-containing-or-designed-to-contain-these-substances/

U.S: Not yet—https://www.brookings.edu/blog/fixgov/2021/06/24/when-climate-policy-works-hfcs-and-the-case-of-short-lived-climate-pollutants/

Tangible support—regulated actors

https://www.nrdc.org/experts/david-doniger/hfc-phasedown-marks-top-climate-win-116th-congress The bill was championed by dozens of senators and representatives in both parties and backed by a coalition ranging from the Natural Resources Defense Council to the U.S. Chamber of Commerce.

https://www.brookings.edu/blog/fixgov/2021/06/24/when-climate-policy-works-hfcs-and-the-case-of-short-lived-climate-pollutants/

Legislative and regulatory authorities in place—YES

Canada—https://gazette.gc.ca/rp-pr/p1/2016/2016-11-26/html/reg1-eng.html

https://publications.gc.ca/collections/collection_2018/eccc/En4-299-2017-eng.pdf

Regulations Amending the Ozone-depleting Substances and Halocarbon Alternatives Regulations (alongside the amendments)

U.S: Yes, under Title VI of the Clean Air Act

Recent legislation https://www.brookings.edu/blog/fixgov/2021/06/24/when-climate-policy-works-hfcs-and-the-case-of-short-lived-climate-pollutants/

https://www.nrdc.org/experts/alex-hillbrand/biden-announces-move-ratify-kigali-amendment-hfcs#:~:text=The%20Kigali%20Amendment%20is%20a,HFCs%20over%20the%20coming%20decades.&text=Once%20the%20State%20Department%20submits,move%20forward%20with%20Kigali%20ratification.

https://www.reuters.com/business/energy/us-epa-proposes-rule-phase-down-hfcs-by-85-over-next-15-years-2021-05-03/

Similar policy instruments—YES

Convergence—moves to limit the HFCs coming into country and being used in manufacturing

https://publications.gc.ca/collections/collection_2018/eccc/En4-299-2017-eng.pdf

https://www.nrdc.org/experts/david-doniger/hfc-phasedown-marks-top-climate-win-116th-congress

Technological readiness—YES

See https://www.brookings.edu/blog/fixgov/2021/06/24/when-climate-policy-works-hfcs-and-the-case-of-short-lived-climate-pollutants/

https://www.c2es.org/site/assets/uploads/2016/10/not-in-kind-alternatives-high-global-warming-hfcs.pdf

https://www.epa.gov/sites/default/files/2015-09/documents/epa_hfc_residential_light_commercial_ac.pdf

Technology strategy in place

Canada: No evidence that strategy in place

U.S: Yes—https://www.energy.gov/eere/buildings/road-zero-does-next-generation-heating-and-cooling-rd-strategy

Joint action in international bodies—YES

https://www.ccacoalition.org/en/initiatives/hfc

DETAILED EVIDENCE FOR INDICATORS—EVS

Political commitment—prioritization in speeches, documents—YES on all

Canada: https://mcmillan.ca/insights/canadas-new-mandatory-100-zev-target-is-a-rapid-charge-forward-what-we-think-this-announcement-means-for-oems-canadian-industry-and-more/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=LinkedIn-integration

U.S: https://www.reuters.com/article/us-usa-biden-autos-idUSKBN29U2LW

https://electrek.co/2021/03/31/biden-proposes-174-billion-investment-electric-vehicles/

https://www.nytimes.com/2021/08/05/climate/biden-tailpipe-emissions-electric-vehicles.html?action=click&module=Top%20Stories&pgtype=Homepage

Political commitment—budget allocations—YES both

https://www.nytimes.com/2021/08/05/climate/biden-tailpipe-emissions-electric-vehicles.html?action=click&module=Top%20Stories&pgtype=Homepage

Bipartisan/Multi-party support—NO (U.S.), YES (Can)

https://www.cnbc.com/2021/05/27/republican-infrastructure-offer-slashes-biden-electric-vehicle-spending.html

https://www.msnbc.com/rachel-maddow-show/republicans-eye-new-fees-electric-vehicle-owners-n1270707

https://insideclimatenews.org/news/29042021/biden-electric-vehicles-republicans-culture-wars/

https://cpcassets.conservative.ca/wp-content/uploads/2021/04/15104504/24068610becf2561.pdf

Congruence in national-subnational approaches

Canada: NO—https://electricautonomy.ca/2021/06/08/newfoundland-and-labrador-ev-rebate/

https://regina.ctvnews.ca/while-sask-taxes-ev-owners-some-canadian-provinces-are-offering-cash-1.5380138

5 provinces have incentives; ON holding out; SK taxing EV owners

https://mcmillan.ca/insights/canadas-new-mandatory-100-zev-target-is-a-rapid-charge-forward-what-we-think-this-announcement-means-for-oems-canadian-industry-and-more/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=LinkedIn-integration

U.S: NO—wide range of incentives and supports across states.

See tool

https://www.nescaum.org/documents/multistate-truck-zev-mou-media-release-20200714.pdf/

https://www.nescaum.org/documents/2018-zev-action-plan.pdf/

https://www.forbes.com/sites/energyinnovation/2020/09/30/why-electric-vehicles-will-likely-emerge-as-californias-top-manufacturing-export-in-2020/?sh=76f8f848351c**Tangible support—regulated actors—Yes in both**

https://www.caranddriver.com/news/g35562831/ev-plans-automakers-timeline/

https://www.greencarreports.com/news/1130507_environmental-groups-carmakers-opposing-california-standards-ev-mandate

https://www.nytimes.com/2021/08/05/climate/biden-tailpipe-emissions-electric-vehicles.html?action=click&module=Top%20Stories&pgtype=Homepage

https://www.bnnbloomberg.ca/canada-s-ev-agenda-gets-supercharged-by-biden-ford-and-gm-green-plans-1.1556043

Legislative and regulatory authorities in place—YES

Canada—https://electricautonomy.ca/2021/06/29/federal-zev-mandate-2035/#:~:text=Canada's%20federal%20government%20is%20replacing,years%2C%20to%202035%20from%202040.

https://www.canada.ca/en/environment-climate-change/news/2021/02/government-of-canada-review-of-fuel-efficiency-standards-confirms-the-economic-and-environmental-benefits-of-ambitious-action.html

U.S—https://www.nytimes.com/2021/08/05/climate/biden-tailpipe-emissions-electric-vehicles.html?action=click&module=Top%20Stories&pgtype=Homepage

Technological readiness—Developing

https://www.techdesignforums.com/practice/technique/overcoming-systemic-design-challenges-for-evs/

file:///C:/Users/dvannijnatten/Downloads/smartcities-04-00022.pdf

Technology strategy in place

R&D mainly in private sector but supported by government

Joint action in international bodies—Minimal

DETAILED EVIDENCE FOR INDICATORS—EV BATTERIES

Political commitment—prioritization in speeches, documents—YES on all

Canada: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP_The_Plan-EN.pdf

https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf

U.S: https://www.federalregister.gov/documents/2021/03/01/2021-04280/americas-supply-chains

https://www.energy.gov/sites/default/files/2021-06/FCAB%20National%20Blueprint%20Lithium%20Batteries%200621_0.pdf

Bilateral: http://saskmining.ca/ckfinder/userfiles/files/Plenary%20Session%201%20Update%20on%20Canada-US%20Action%20Plan%20(Hilary%20Morgan).pdf

https://www.canada.ca/en/natural-resources-canada/news/2020/01/canada-and-us-finalize-joint-action-plan-on-critical-minerals-collaboration.html

Political commitment—budget allocations—YES both

https://www.ic.gc.ca/eic/site/125.nsf/eng/00039.html

https://www.nrcan.gc.ca/science-and-data/funding-partnerships/funding-opportunities/funding-grants-incentives/energy-innovation-program/18876

https://www.nrcan.gc.ca/climate-change/canadas-green-future/clean-growth-programs/20254

Pre-existing bilateral cooperation—NO

Bilateral cooperation institutionalized—Developing

https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/22/fact-sheet-securing-a-made-in-america-supply-chain-for-critical-minerals/

https://ca.usembassy.gov/united-states-and-canada-sign-memorandum-of-understanding-on-critical-energy-minerals/

Functionally intense cooperation—Developing

https://www.canada.ca/en/natural-resources-canada/news/2020/01/canada-and-us-finalize-joint-action-plan-on-critical-minerals-collaboration.html

https://www.reuters.com/article/us-usa-mining-canada-exclusive-idUSKBN2BA2AJ

Bipartisan/Multi-party support—YES (U.S.), YES (Can)

https://www.coloradopolitics.com/news/republicans-call-on-biden-to-back-quicker-approval-for-critical-minerals-mines/article_21a31e0b-f861-575f-b258-7d36c86cd556.html

https://cpcassets.conservative.ca/wp-content/uploads/2021/04/15104504/24068610becf2561.pdf

Congruence in national-subnational approaches

Canada: Developing https://www.rncanengagenrcan.ca/sites/default/files/what_we_heard_report_final_eng.pdf

U.S: NO—wide range of incentives and supports across states

Tangible support—regulated actors

https://www.caranddriver.com/news/g35562831/ev-plans-automakers-timeline/

https://www.greencarreports.com/news/1130507_environmental-groups-carmakers-opposing-california-standards-ev-mandate

Legislative and regulatory authorities in place—YES

https://electricautonomy.ca/2021/06/29/federal-zev-mandate-2035/#:~:text=Canada's%20federal%20government%20is%20replacing,years%2C%20to%202035%20from%202040.

https://www.canada.ca/en/environment-climate-change/news/2021/02/government-of-canada-review-of-fuel-efficiency-standards-confirms-the-economic-and-environmental-benefits-of-ambitious-action.html

Technological readiness—Developing

https://www.techdesignforums.com/practice/technique/overcoming-systemic-design-challenges-for-evs/

file:///C:/Users/dvannijnatten/Downloads/smartcities-04-00022.pdf

Technology strategy in place

R&D mainly in private sector but supported by government

Joint action in international bodies—Yes

https://www.canada.ca/en/natural-resources-canada/news/2020/01/canada-and-us-finalize-joint-action-plan-on-critical-minerals-collaboration.html

https://www.canada.ca/en/natural-resources-canada/news/2019/12/canada-joins-the-energy-resource-governance-initiative.html

DETAILED EVIDENCE FOR INDICATORS — CLIMATE SMART AGRICULTURE

Political commitment - prioritization in speeches, documents—YES on all

Canada: https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf

https://www.canada.ca/en/agriculture-agri-food/news/2021/03/accelerating-the-adoption-of-climate-smart-best-practices-in-agriculture.html

https://www.sasktoday.ca/north/agriculture/agriculture-key-to-meeting-paris-goals-but-documents-suggest-feds-avoiding-change-4163966

U.S: https://www.cnbc.com/2021/02/12/bidens-climate-change-plan-pay-farmers-to-cut-carbon-footprint.html

https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf

Bilateral: https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cusma-aceum/final_ea-ee_finale.aspx?lang=eng

https://www.canada.ca/en/agriculture-agri-food/news/2021/03/minister-bibeau-holds-first-bilateral-discussion-with-us-secretary-of-agriculture-vilsack.html

Political commitment—budget allocations—YES both

https://www.corporateknights.com/channels/natural-capital/building-back-better-nature-based-climate-solutions-15899733/

Pre-existing bilateral cooperation—Minimal

https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cusma-aceum/final_ea-ee_finale.aspx?lang=eng

Bilateral cooperation institutionalized—NO

Some institutions under CUSMA https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cusma-aceum/final_ea-ee_finale.aspx?lang=eng

Functionally intense cooperation—NO

Bipartisan/Multi-party support—YES (U.S.), YES (Can)

Canada: Conservatives would spend $3 billion on land mgmt practices https://cpcassets.conservative.ca/wp-content/uploads/2021/04/15104504/24068610becf2561.pdf

https://www.nationalobserver.com/2021/04/16/news/heres-how-federal-parties-climate-plans-stack-up

U.S: https://www.reuters.com/article/us-usa-climatechange-agriculture-idUSKBN23B23J

https://www.agriculture.com/news/business/republican-senators-question-usda-funds-for-climate-mitigation

Tangible support—regulated actors

Canada: https://static1.squarespace.com/static/5dc5869672cac01e07a8d14d/t/602eab0d76c2852b0c4de76b/1613671182008/FCS-Climate_action_in_agriculture_around_the_world.pdf

U.S: Shifting—https://newrepublic.com/article/161926/farming-lobby-cunning-plan-fight-climate-changeand-regulation

https://www.politico.com/news/2021/03/29/biden-carbon-bank-proposal-478224

Legislative and regulatory authorities in place—YES

Canada: Yes—draft regulations to establish the Federal Greenhouse Gas Offset System https://www.canada.ca/en/environment-climate-change/news/2021/03/government-of-canada-announces-next-step-in-creation-of-domestic-carbon-offset-to-further-support-clean-growth.html

U.S: Contested https://www.agriculture.com/news/business/republican-senators-question-usda-funds-for-climate-mitigation

Similar policy instruments—Developing

https://www.politico.com/news/2021/03/29/biden-carbon-bank-proposal-478224

https://static1.squarespace.com/static/5dc5869672cac01e07a8d14d/t/602eab0d76c2852b0c4de76b/1613671182008/FCS-Climate_action_in_agriculture_around_the_world.pdf

https://www.corporateknights.com/channels/natural-capital/building-back-better-nature-based-climate-solutions-15899733/

Technological readiness—Developing

Carbon sequestration from agriculture complex and largely unproven on large scale

https://theconversation.com/to-make-agriculture-more-climate-friendly-carbon-farming-needs-clear-rules-160243

Joint action in international bodies—Yes

http://www.fao.org/gacsa/en/

Canada-U.S. Green Bilateralism:

Targeting Cooperation for Climate Mitigation

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Mark McWhinney is a PhD student at Carleton University in Ottawa. His research is focused on the coalescence of climate change and defence imperatives, particularly through procurement and policy.

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THE NORTH AMERICAN COLLOQUIUM

The North American Colloquium (NAC) is a collaborative venture between the Autonomous National University of Mexico, University of Toronto, and University of Michigan. Established in 2018, the NAC brings together leading academic analysts and practitioners from Mexico, Canada and the United States to address key social and policy issues facing all three countries. Each year, the three partner universities select a theme, and one serves as the host to convene joint activities throughout the year.