

Disruptive climate policy from wells to wheels: Integrating demand- and supply-side climate governance in oil-producing states

by

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This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Statement of contributions

Paper 1 was co-authored with Dr. Angela Carter. I was the lead author on this piece, leading on research design, data collection, analysis, interpretation of findings, manuscript preparation, and revisions, in collaboration with Dr. Carter throughout.

Papers 2 and 3 were solely authored by me. I developed the research questions and methodology, conducted the literature review, data collection, and analysis, and prepared the manuscripts.

The introductory and concluding chapters were written solely by me. This dissertation and the associated manuscripts were completed under the supervision of Dr. Angela Carter. After Dr. Carter transitioned from the University of Waterloo to Memorial University, Dr. Daniel Henstra graciously served as supervisor to fulfill the University of Waterloo's administrative requirements.

Abstract

Fossil fuel-producing states occupy a paradoxical position within climate governance. Many have adopted increasingly ambitious climate policies, including net-zero commitments, renewable energy deployment strategies, and transportation electrification programs. Yet many of these same jurisdictions continue to expand fossil fuel production and export infrastructure. As a result, climate ambition and fossil fuel dependence increasingly proceed in parallel. This tension raises a critical governance challenge: how can fossil fuel-producing states accomplish deep decarbonization while simultaneously reducing their economic, political, and institutional dependence on oil and gas?

This dissertation examines that question through three interconnected manuscripts that explore the relationship between demand-side and supply-side climate governance in fossil fuel-producing states. Situated within global environmental governance and drawing on comparative political economy, carbon lock-in, and sustainability transitions scholarship, the dissertation applies an analytical framework centred on institutions, interests, and ideas to examine the political conditions that enable or constrain deeper transitions away from fossil fuels, particularly oil.

The first article, published in *International Environmental Agreements: Politics, Law and Economics* in 2024, examines Denmark's emergence as a global first-mover in supply-side climate governance through its decision to phase out future oil and gas extraction in the North Sea. The analysis addresses the political, institutional, and ideational conditions that enabled an explicit fossil fuel phase-out policy to emerge in a fossil fuel-producing economy. The findings show that supply-side climate governance is politically feasible and emphasize the role of national first movers in shaping emerging forms of global fossil fuel governance.

The second article, accepted with revisions at *Energy Research & Social Science* in June 2026, explores the demand side of climate governance through a comparative examination of transportation electrification in Norway and Canada. The findings show that ambitious demand-side decarbonization can substantially reduce emissions, boost technological change, and build durable political support for climate action. However, transportation electrification does not automatically reduce fossil fuel production. Rather, the analysis shows that demand-side transitions can create important political, economic, and institutional conditions for broader transition while remaining compatible with continued extraction under existing political-economic arrangements.

Building on these findings, the third article, accepted with revisions at *The Extractive Industries and Society Journal* in June 2026, examines Canada's challenge of integrating demand-side and supply-side climate policy within a deeply carbon-intensive federal political economy. Drawing on insights from Denmark and Norway, the analysis demonstrates how institutions, interests, and ideas persist to reproduce fossil fuel dependence while identifying pathways for aligning both sides of the climate policy "scissors" within a broader decarbonization strategy.

Collectively, the dissertation argues that deep decarbonization in fossil fuel-producing states requires more than reducing emissions or constraining fossil fuel production in isolation. It requires transforming the institutions, interests, and ideas that reproduce fossil fuel dependence and politically integrating demand-side and supply-side climate governance. In doing so, the dissertation contributes to scholarship on carbon lock-in and transition politics by shifting attention from explaining the persistence of fossil fuel dependence toward understanding the political conditions under which fossil

fuel-producing states may begin to move beyond it. The findings further suggest that demand-side transitions may create political and economic conditions that increase the feasibility of future supply-side climate governance, pointing toward a potential sequencing dynamic in pathways toward deep decarbonization.

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List of Abbreviations

AFFN	Anti-fossil fuel norm
BEV	Battery electric vehicle
BOGA	Beyond Oil and Gas Alliance
CCUS	Carbon capture, utilization and storage
CER	Canada Energy Regulator
CO ₂	Carbon dioxide
COP	Conference of the Parties
CSO	Civil society organization
ECCC	Environment and Climate Change Canada
ENGO	Environmental non-governmental organization
EU	European Union
EV	Electric vehicle
FFNPT	Fossil Fuel Non-Proliferation Treaty
FFZ	Fossil-free zone
GHG	Greenhouse gas
GPFG	Government Pension Fund Global
ICEV	Internal combustion engine vehicle
IEA	International Energy Agency
IO	International organization
IPCC	Intergovernmental Panel on Climate Change
KIIG	Keep it in the ground
LNG	Liquefied natural gas
LULUCF	Land Use, Land-Use Change, and Forestry
Mt CO ₂ eq	Million tonnes of carbon dioxide equivalent
NDC	Nationally Determined Contributions
NGO	Non-governmental organization
NL	Newfoundland and Labrador
NSA	North Sea Agreement
OGD	Oil Gas Denmark
SEI	Stockholm Environment Institute
TAFF	Transitioning Away from Fossil Fuels
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value-Added Tax
ZEV	Zero-emission vehicle

Introduction

1.1 Climate change, fossil fuel dependence, and the challenge of transitioning away from oil

Climate change is now recognized as one of the defining governance challenges of the twenty-first century. Yet despite decades of international climate negotiations, increasingly ambitious national climate commitments, expanding policy frameworks, and accelerating technological innovation, global greenhouse gas (GHG) emissions remain at levels incompatible with limiting warming to 1.5°C above pre-industrial levels, as per the ambitions set out in the Paris Agreement (Intergovernmental Panel on Climate Change [IPCC], 2023; Stockholm Environment Institute [SEI] et al., 2025; The United Nations Framework Convention on Climate Change [UNFCCC], 2015; United Nations Environment Programme [UNEP], 2026). This largely reflects the global community's failure to address the root sources of emissions driving the climate crisis.

Fossil fuels—coal, oil, and gas—are the lead drivers of climate change (Friedlingstein et al., 2026). To avoid an intensifying climate crisis, the global energy system must transition away from fossil fuels by restricting fossil fuel supply and demand. The scientific consensus surrounding the urgency of a global fossil fuel phaseout is clear. The IPCC has repeatedly concluded that pathways consistent with limiting warming to 1.5°C require rapid, deep, and sustained reductions in fossil fuel use over the coming decades (IPCC, 2023). Existing and planned fossil fuel production already exceeds the remaining carbon budget compatible with the Paris Agreement, meaning significant shares of coal, oil, and gas reserves must remain unburned (SEI et al., 2025; Trout et al., 2022; Welsby et al., 2021). At the same time, climate scientists increasingly warn that continued dependence on fossil fuels risks destabilizing Earth systems and breaching critical planetary boundaries (Gaffney et al., 2021; Richardson et al., 2023).

Yet fossil fuels continue to underpin the global energy system. Their continued extraction and combustion shape not only global emissions trajectories but also economic development, geopolitical power, industrial strategy, and environmental governance across scales. As both a material energy source and a political-economic foundation, fossil fuels remain deeply embedded in contemporary governance systems, making a transition away from them especially difficult—even as the scientific and political imperative grows increasingly urgent.

Therefore, while the scientific imperative to transition away from fossil fuels is increasingly clear, the political pathways for such a transition remain deeply contested. In many economies, fossil fuels are embedded within systems of employment, infrastructure, public finance, industrial development, and state formation. They shape national development trajectories and are deeply entangled with political institutions, economic interests, and dominant ideas about prosperity, growth, and security. Particularly in oil-producing economies, fossil fuel production often remains central to export earnings, fiscal stability, regional development, labour markets, and national identity. These relationships create powerful economic and political dependencies that make transition difficult, even where climate ambition is strong.

This tension between the need to phase out fossil fuel production and use and fossil fuels' prominence in global societies is increasingly taut in contemporary climate governance. Governments around the

world now routinely position themselves as climate leaders through emissions-reduction targets, net-zero commitments, renewable energy deployment, electric vehicle (EV) policies, and industrial decarbonization strategies. Yet many of these same governments continue to approve new oil and gas development, expand export infrastructure, and support continued exploration and extraction. Climate ambition and fossil fuel expansion increasingly proceed in parallel (International Energy Agency [IEA], 2023; SEI et al., 2025; Slothuus, 2026a), yet are at odds.

This contradiction is especially pronounced in major fossil fuel-producing states such as Canada. These countries often possess the financial, technological, and institutional capacity to lead climate action (Duan et al., 2020; Slothuus, 2025), yet remain economically and politically tied to continued oil and gas production. Therefore, their challenge is not simply to reduce emissions, but to pursue deep decarbonization while simultaneously transitioning away from dependence on fossil fuel production itself. This dissertation examines that challenge.

1.2 Situating the dissertation in global environmental governance

This research is situated within the field of global environmental governance, and more specifically within scholarship on global climate and energy governance. Climate change is inherently a global environmental governance problem. GHG emissions cross territorial borders, while climate impacts are distributed unevenly across places, populations, and generations (Parsons et al., 2025). Climate change is embedded in global systems of energy production, trade, finance, transportation, and industrial development. Likewise, responses to climate change emerge through interactions among states, international institutions, markets, civil society, and transnational governance networks (Bernstein et al., 2009; Bulkeley et al., 2012; Li & Yaakop, 2025). Therefore, governing climate change requires coordination across multiple scales and among diverse actors operating through overlapping institutional arrangements (Bernstein, 2020; Hale, 2020; Keohane & Victor, 2016).

While some climate action can be pursued domestically, the broader transformation away from fossil fuels necessarily requires coordination beyond the state. Changes to the global energy landscape that align with the Paris Agreement unfold through transnational systems of extraction, production, finance, trade, infrastructure, and governance. Fossil fuel production decisions made within one jurisdiction can shape emissions trajectories, economic expectations, and political possibilities well beyond national borders. This is especially true for oil, the focus of this dissertation, where production, trade, and consumption are deeply internationalized. Decisions about fossil fuel development in producer states therefore affect not only domestic emissions pathways but also broader global climate and energy governance processes.

Over the past several decades, the climate governance architecture has evolved considerably. While the UNFCCC remains central, climate governance today extends beyond formal intergovernmental negotiations. It increasingly includes national and subnational governments, cities, businesses, international and civil society organizations (CSOs), non-governmental organizations (NGOs), advocacy coalitions, grassroots initiatives, financial institutions, and hybrid governance initiatives operating simultaneously across multiple scales (Jordan et al., 2018).

This increasingly fragmented and dynamic governance landscape is often understood through the lens of polycentric governance. Ostrom and colleagues originally developed polycentric governance to describe systems with multiple overlapping centres of authority rather than a single centralized governing institution (Ostrom et al., 1961). Climate governance increasingly reflects this structure, with

authority dispersed across formal and informal institutions, state and non-state actors, and local, national, and international scales (Dorsch & Flachslund, 2017; Jordan et al., 2018; Morrison et al., 2019). Polycentric governance provides a useful framework for understanding climate governance because it recognizes both complexity and unevenness. It helps explain how governance authority is distributed, how policy experimentation occurs, how ideas and norms diffuse across jurisdictions, and why climate governance often produces fragmented and contradictory outcomes.

Yet despite this increasingly polycentric governance landscape, states remain foundational actors. States continue to exercise primary authority over energy systems, natural resource governance, infrastructure planning, industrial regulation, and climate policy implementation (Marquardt et al., 2024). Through nationally determined contributions (NDCs) under the Paris Agreement, states remain central to setting climate commitments and implementing decarbonization pathways. Their role is especially consequential in fossil fuel governance, where decisions on exploration, extraction, production, export infrastructure, and phase-out remain overwhelmingly shaped by domestic institutions and national political economy. As a result, fossil fuel-producing states occupy a uniquely influential position within broader global climate and energy governance systems. Decisions made within producer states carry implications well beyond national borders.

1.3 Demand-side climate governance and the rise of supply-side climate policy

For much of the modern climate governance era, climate policy has focused primarily on reducing emissions associated with fossil fuel consumption. Since the UNFCCC's establishment in 1992, dominant mitigation frameworks have centred on measures such as carbon pricing, emissions trading systems, energy efficiency standards, fuel economy regulations, and transportation electrification (Aykut et al., 2017; Green & Denniss, 2018). These demand-oriented approaches have developed alongside policies supporting renewable electricity generation, alternative energy infrastructure, and low-carbon industrial development. Although these interventions can reduce fossil fuel consumption, they also expand alternative energy supply and may pursue broader industrial, economic, and energy security objectives. Their role in decarbonization cannot be understood solely through a distinction between policies targeting fossil fuel consumption and those restricting fossil fuel extraction. While these policies do not fit neatly within a binary distinction between fossil fuel demand and supply, that distinction remains important for understanding which dimensions of fossil fuel dependence climate governance directly addresses.

Despite this broader range of climate and energy interventions, climate governance has historically paid considerably greater attention to emissions from fossil fuel consumption than to fossil fuel production itself (Fæhn et al., 2017; Green & Denniss, 2018; Lazarus et al., 2015). Reducing fossil fuel demand does not necessarily constrain supply (Sinn, 2015). In fossil fuel-producing states in particular, domestic emissions reductions may coexist with continued extraction and export expansion. In response to these limitations, new forms of global climate and energy governance increasingly seek to address fossil fuel supply directly. International initiatives such as the Beyond Oil and Gas Alliance (BOGA) and the Fossil Fuel Non-Proliferation Treaty (FFNPT) campaign attempt to normalize fossil fuel phase-out within global climate governance and establish new international norms surrounding managed decline pathways. Alongside these pressures, a growing body of scholarly and political attention has been channelled toward supply-side climate policy. Supply-side approaches seek to constrain fossil fuel exploration, extraction, and production directly through measures such as exploration bans, production caps, subsidy reform, managed decline strategies, and restrictions on fossil fuel finance (Carter &

McKenzie, 2020; Lazarus et al., 2015; Lazarus & van Asselt, 2018; Le Billon & Kristoffersen, 2020; Muttitt et al., 2016; Newell & Carter, 2024).

The distinction between demand- and supply-side climate policy used throughout this dissertation refers specifically to fossil fuel consumption and production, rather than to energy demand and supply more generally. Demand-side fossil fuel policies seek to reduce fossil fuel consumption, whereas fossil fuel supply-side policies directly constrain exploration, extraction, or production. However, many interventions supporting decarbonization do not fall exclusively within either category. Renewable electricity development, energy storage, industrial policy, and changes in electricity and heating infrastructure may expand alternative energy supply, reduce fossil fuel consumption, or do both. These policies can also influence the political economy of transition by creating new industries, ownership structures, employment opportunities, and constituencies. Accordingly, the analysis distinguishes direct restrictions on fossil fuel extraction from broader policies that may change the economic and political conditions under which such restrictions become feasible.

Recent developments in international climate politics reflect this shift. The final outcome negotiated at the United Nations (UN) 28th Climate Change Conference, colloquially referred to as the 28th Conference of the Parties (COP28), marked the first explicit reference in a UN climate agreement to “transitioning away from fossil fuels in energy systems” (UNFCCC, 2023b). More recently, the First Conference on Transitioning Away from Fossil Fuels (TAFF), held in Colombia in 2026, further signalled a shift from broad recognition of the need for a fossil fuel transition to practical questions of implementation, sequencing, political feasibility, and justice. Nearly 60 countries, along with UN bodies (UNEP, Office of the High Commissioner for Human Rights, and International Labour Organization), phase-out coalitions and initiatives (BOGA, the FFNPT Initiative, and the Power Past Coal Alliance), subnational networks and civil society and other stakeholders, came together to build momentum toward developing roadmaps away from fossil fuel production and use and, more broadly, to loosen the grip fossil fuels maintain on economies, legal frameworks, and energy systems.

These international developments build on supply-side action already emerging across multiple scales of governance. Indigenous Peoples and communities have led efforts to resist and constrain fossil fuel extraction (Carter & McKenzie, 2020; D. Goldtooth et al., 2021), and civil society movements have pushed fossil fuel production more firmly onto the climate policy agenda. National first movers have begun adopting restrictions on new exploration and production (Gaulin & Le Billon, 2022), while subnational governments have demonstrated that significant supply-side action can also emerge below the national level. For example, Québec moved beyond restricting future development by legislating an end to hydrocarbon exploration and production and revoking existing exploration and production licences (Bill 21, *An Act Mainly to End Petroleum Exploration and Production and the Public Financing of Those Activities*, 2022). Together, these developments demonstrate that directly constraining fossil fuel supply is no longer a theoretical policy proposition, but an emerging and growing component of contemporary climate governance.

Yet these emerging supply-side successes remain limited relative to the scale of the challenge, especially explicitly winding down existing production (Green et al., 2024). Restrictions on exploration and extraction, licence cancellations or revocations, and emerging commitments to managed decline show that governments can directly govern fossil fuel supply. But such measures remain exceptions in a global energy system where fossil fuel production continues to expand. Understanding how this contradiction persists—and how it may be politically disrupted—has become increasingly urgent and is the focus of a new field of research.

1.4 Cutting with both sides of the climate policy scissors

A growing body of scholarship argues that effective climate mitigation requires constraining both fossil fuel demand and fossil fuel supply simultaneously. Green and Denniss describe combining both policy approaches as cutting emissions with “both sides of the climate policy scissors” (2018). This concept provides an important foundation for this dissertation.

Demand-side climate policy reduces fossil fuel use through substitution, efficiency, and emissions reduction. This has long been the focus of global and national climate policy. However, researchers have observed that even as demand-side climate policy improves and climate ambition advances, fossil fuel extraction and production can continue (Harrison & Bang, 2022; Lazarus & van Asselt, 2018; Mehling, 2023; Sinn, 2015). Demand-side transitions may proceed without weakening support for fossil fuel production. Domestic emissions may fall while oil and gas production continues or expands for export. Electrification may advance while carbon-intensive political economies remain structurally intact. This gap has prompted greater attention to policy approaches that directly address fossil fuel production, alongside efforts to reduce consumption; hence, the development of “supply-side climate policy” that constrains continued extraction and addresses the structural conditions that reproduce carbon-intensive development pathways.

Understanding the political-economic relationship between demand-side and supply-side climate governance, therefore, represents a critical and underexplored challenge within climate governance scholarship. This dissertation takes up that challenge by examining not only how both sides of the climate policy scissors operate, but also the political and institutional conditions under which they may become mutually reinforcing in fossil fuel-producing states.

1.5 Political economy of deep decarbonization

This dissertation is grounded in political economy approaches to decarbonization and informed by interdisciplinary scholarship on sustainability transitions. While climate mitigation has historically emphasized technological innovation, efficiency gains, and the deployment of low-carbon alternatives, technological change alone is unlikely to deliver the scale and speed of transformation required to meet climate goals (Geels et al., 2017; Roberts et al., 2018; Stoddard et al., 2021). Carbon-intensive systems, such as transportation and energy production, are embedded and reproduced through broader economic, political, and social structures (Seto et al., 2016; Unruh, 2000, 2002).

The concept of carbon lock-in helps explain this persistence. Fossil fuel dependence becomes entrenched over time through mutually reinforcing infrastructure, institutions, markets, policy frameworks, and social expectations (Mitchell, 2013; Seto et al., 2016; Unruh, 2002). These dynamics shape investment, governance, and behaviour, making transition both politically and materially difficult (Green et al., 2024). Therefore, decarbonization requires not only technological substitutions, but political and structural changes capable of disrupting the conditions that reproduce fossil fuel dependence.

While carbon lock-in helps explain the persistence of fossil fuel dependence, research on sustainability transitions focuses on how entrenched systems can begin to change. Increasingly, this literature emphasizes the inherently political nature of such transformations (Bernstein & Hoffmann, 2018; Hamid et al., 2022; Rosenbloom et al., 2018). This research directs attention beyond technological change to the political conditions that enable or constrain deeper transformation.

Comparative political economy research further explains why climate policy develops unevenly across political and institutional contexts. Climate policy is not simply about identifying effective instruments, but also about navigating how costs and benefits are distributed among competing actors. Aklin and Mildemberger (2020) emphasize the distributive conflicts underlying climate politics, while Finnegan (2022) demonstrates how electoral institutions and systems of interest group intermediation influence governments' capacity to pursue long-term climate policy. Proportional electoral systems can reduce the electoral risks associated with imposing near-term costs, while institutionalized negotiation between governments and organized interests can facilitate compensation and reduce opposition to policy change. Related research identifies insulation from political opposition and compensation for affected groups as key institutional mechanisms that shape energy transitions (Finnegan et al., 2026; Meckling et al., 2022). These findings suggest that the political feasibility of decarbonization depends not only on the strength of climate commitments, but also on the institutional arrangements through which policy costs are negotiated and competing interests exercise influence.

These institutional dynamics are closely connected to the economic interests affected by climate policy. Colgan et al. (2021) argue that climate change presents an existential challenge to the value of fossil fuel assets, helping explain the political resistance of actors whose economic position depends on continued extraction. Mildemberger (2020) similarly demonstrates how carbon-intensive industries can retain political influence through their relationships with business and labour organizations, including across competing political parties. At the same time, low-carbon industrial development can generate new economic constituencies and political support for climate policy (Meckling et al., 2015; Stokes, 2020). However, the emergence of these interests does not necessarily weaken support for fossil fuel production. In export-oriented economies, constituencies supporting domestic decarbonization may develop alongside powerful industries invested in continued extraction. Understanding whether these interests become politically connected, remain separate, or come into conflict is central to explaining the relationship between demand- and supply-side climate governance.

To examine these dynamics, the dissertation draws on a comparative political economy framework centred on institutions, interests, and ideas (P. A. Hall, 1997; Phillips & Castle, 2022). Institutions refer to the formal and informal rules, political structures, and established relationships through which policy decisions are made and implemented. Interests encompass the actors and constituencies with material or political stakes in particular outcomes, whose influence depends on their capacity to organize and shape political decisions. Ideas, meanwhile, influence how political actors understand climate change, economic development, and the feasibility of transitioning away from fossil fuels. As Hall (1993) demonstrates, established policy paradigms shape how problems are defined and which policy responses are considered appropriate. In fossil fuel-producing states, dominant narratives linking extraction to prosperity, employment, and energy security can therefore help legitimize continued production, even alongside ambitious domestic climate commitments. These ideas are not fixed, however, and political actors, including environmental movements, may challenge them as they advance alternative understandings of climate responsibility and economic development. Together, institutions, interests, and ideas help explain how fossil fuel dependence is maintained, contested, and potentially disrupted.

Applied to fossil fuel-producing states, this framework helps explain why decarbonization can advance unevenly across sectors while economic and political dependence on extraction persists. It also provides a basis for examining the conditions under which these arrangements may be challenged, and whether progress in reducing fossil fuel consumption can contribute to broader changes in fossil fuel production governance.

1.6 Research focus and outline of the dissertation

This dissertation contributes to scholarship on global climate governance, fossil fuel transitions, and comparative political economy by examining the political relationship between demand- and supply-side climate governance within fossil fuel-producing states. Collectively, the articles move from demonstrating that supply-side climate governance is politically possible to identifying the limits of demand-side decarbonization alone, and to examining how fossil fuel-producing states may begin to overcome carbon lock-in by integrating demand- and supply-side climate governance.

While a growing body of scholarship argues that effective decarbonization requires movement on both sides of the climate policy scissors, relatively limited research examines whether demand-side transitions weaken support for fossil fuel production, how supply-side climate policy becomes politically feasible in fossil fuel-producing economies, or how the two approaches can become politically integrated within carbon-intensive political economies. This dissertation addresses these questions by analyzing Denmark, Norway, and Canada. The dissertation addresses this broader challenge through three interconnected manuscripts. Together, the articles develop an overarching argument about transition in fossil fuel-producing states. While the dissertation adopts a broadly comparative approach, the analytical role of comparison differs across the three papers.

The first article, published in *International Environmental Agreements: Politics, Law and Economics* in 2024, employs an in-depth single-case analysis of Denmark as a global first mover in supply-side climate governance. It studies Denmark as an analytically significant case, showing how an explicit fossil fuel phase-out policy is politically possible in a fossil fuel-producing economy. This article situates Denmark as one of the earliest and most prominent examples of national supply-side climate leadership through its decision to phase out future oil and gas extraction in the North Sea. It identifies the political, economical, institutional, and ideational conditions that enabled an explicit fossil fuel phase-out policy to emerge in a major oil-producing state. In doing so, it demonstrates that supply-side climate leadership is politically possible within oil-producing economies and contributes to a broader understanding of how national first movers shape emerging forms of global fossil fuel governance.

The second article turns to demand-side climate governance through a comparative analysis of transportation electrification in Norway and Canada. Norway is taken as a leading example of reducing domestic reliance on oil via demand-side climate policies, particularly vehicle electrification. It examines whether ambitious vehicle electrification contributes to a fossil fuel transition in oil and gas-exporting economies. The Norwegian case demonstrates that transportation electrification can substantially reduce domestic emissions, lower oil demand, and build durable political support for decarbonization. At the same time, these advances do not automatically reduce fossil fuel production. Instead, these cases show that demand-side progress can coexist with continued fossil fuel production, raising questions about whether, and under what conditions, electrification might drive political, economic, or institutional changes that support a broader transition. Such changes cannot be assumed to produce supply-side restraint without explicit policies governing extraction.

The third article directs these comparative insights toward understanding Canada's challenge of integrating demand- and supply-side climate policy within a deeply carbon-intensive federal political economy. Building on the lessons of Denmark's supply-side transition and Norway's demand-side transformation, the article examines why Canada has struggled to align ambitious climate commitments with meaningful constraints on fossil fuel production. Framing Canada as a hard case, it analyzes how institutions, interests, and ideas continue to reinforce fossil fuel dependence and sustain a dual-track

model of climate governance in which domestic decarbonization advances alongside continued oil and gas expansion. The article then moves beyond diagnosis to identify politically feasible pathways for integrating both sides of the climate policy scissors, exploring how demand-side momentum might generate the institutional, economic, and ideational conditions necessary to support supply-side restraint and, ultimately, a pathway toward managed decline.

The three articles progress analytically from establishing the political feasibility of supply-side climate governance in the first article, to demonstrating the limits of demand-side decarbonization when pursued in isolation in the second, and finally to weaving these insights together to examine how demand- and supply-side approaches can be politically integrated in practice within fossil fuel-producing states with a focus on Canada, a critically important case in the global effort to address climate change.

Together, the three papers show that reducing fossil fuel consumption and constraining fossil fuel production can follow distinct political trajectories. The dissertation argues that integrating these dimensions of climate governance requires attention to the institutions, interests, and ideas sustaining fossil fuel dependence. It further advances a conditional proposition: demand-side decarbonization and the development of alternative energy systems may improve the political feasibility of supply-side restraint by reducing incumbent dependence, strengthening alternative economic constituencies, and linking these efforts to decisions governing extraction. However, these effects are neither automatic nor necessarily sequential, and explicit supply-side policy remains necessary to constrain production.

1.7 Research design and methodological considerations

This dissertation uses a qualitative comparative political economy approach to examine the political and economic conditions that enable or constrain integrating demand- and supply-side climate governance in fossil fuel-producing states. The interpretive and explanatory research design seeks to understand how political institutions, organized interests, and dominant ideas shape policy development, political contestation, and opportunities for change (P. A. Hall, 1997; Otto et al., 2020; Phillips & Castle, 2022; Wagner & Lima, 2024). Rather than seeking universal causal relationships through statistical inference, the research uses theoretically informed comparison and triangulates documentary, interview, and descriptive statistical evidence to examine how carbon lock-in is reproduced and how the political conditions sustaining fossil fuel dependence may be challenged.

This research adopts an interpretive and explanatory approach to comparative political economy, recognizing that political, economic, and social conditions shape climate and energy transitions and vary across contexts. My previous professional experience in the automotive industry also informed this approach; I worked there for approximately ten years before pursuing graduate studies. This experience gave me insight into the complexities of industrial production and organizational change and contributed to my interest in the political and economic dimensions of decarbonization. While this background shaped my research interests and the questions I pursued, this dissertation's analysis is grounded in the documentary and interview evidence examined across the three papers.

The three papers employ complementary but distinct comparative logics. Paper 1 examines Denmark as a significant case of explicit fossil fuel supply-side restraint, investigating the political, economic, and institutional conditions surrounding the adoption of its North Sea Agreement. Paper 2 compares Norway and Canada to assess whether ambitious transportation electrification alters the political-economic conditions sustaining fossil fuel production or remains compatible with continued extraction.

Paper 3 draws on these analyses to examine Canada as a hard case of demand- and supply-side policy integration, using Denmark and Norway as contrasting cases from which to identify potential mechanisms, enabling conditions, and barriers. The cases were selected for their analytical relevance to the research questions rather than as a representative sample of fossil fuel-producing states. Consequently, the comparative findings are intended to inform theoretical understanding and identify potentially transferable political-economic dynamics, rather than establish a generalizable or predetermined pathway toward fossil fuel phase-out.

The comparative analysis is structured around three dimensions: the institutional arrangements governing climate and resource policy, the organization and political influence of competing economic interests, and the ideas through which fossil fuel dependence and climate leadership are understood. These dimensions provide a common basis for examining the cases while recognizing important differences in their political economies. Norway and Denmark operate within comparatively centralized political systems, whereas Canada's federal structure divides authority over climate policy and natural resources across levels of government. The cases also differ in the economic significance of fossil fuel production, the organization of incumbent and emerging industries, and the opportunities available to political actors seeking to advance climate policy. These differences limit the direct transferability of policy experiences across jurisdictions. The comparison therefore aims not to identify a single model for Canada to follow, but to examine how specific institutional arrangements, interest configurations, and political ideas shape the feasibility of demand- and supply-side climate governance.

The dissertation draws on multiple forms of empirical evidence. Documentary analysis includes climate and energy legislation, government strategies, regulatory materials, parliamentary records, industry and civil society publications, academic scholarship, and related policy documents. Semi-structured interviews provide insight into the perspectives and experiences of actors involved in, or knowledgeable about, climate and energy governance. Interview participants were selected purposively, with snowball sampling used to identify additional relevant perspectives. Interview material was interpreted in relation to the dissertation's analytical framework, with attention to institutional arrangements, organized interests, political coalitions, and dominant narratives. Descriptive statistics concerning emissions, transportation electrification, fossil fuel production, and energy systems provide contextual evidence about policy trajectories. These quantitative indicators support the comparative interpretation but do not constitute a separate quantitative causal analysis.

As an integrated dissertation, the three papers draw on related and, in some instances, overlapping empirical material. The documentary and interview evidence was assembled to address interconnected questions about fossil fuel dependence, demand-side decarbonization, and supply-side governance. Accordingly, some evidence informs more than one manuscript, while other material is specific to an individual paper's research question and analytical focus. Where evidence is shared, its use across papers should be understood as complementary interpretation rather than independent empirical corroboration. The integrative argument therefore rests on the synthesis of related analyses, not on three wholly independent empirical tests of a single causal proposition.

Several considerations shape how the findings were interpreted. Purposive interview samples provide access to relevant expertise and policy experience, but they are not statistically representative of the actors involved in fossil fuel governance. The distribution of interviewees across countries and stakeholder categories also affects how thoroughly particular perspectives can be examined. This is especially important in Canada, where fossil fuel governance is shaped by significant regional variation, federal–provincial divisions, and the interests of Indigenous governments, industry, labour, and

communities directly affected by extraction. Documentary triangulation strengthens the contextual interpretation of interview evidence but cannot fully compensate for perspectives that are not directly represented.

Finally, the comparative design does not establish that demand-side decarbonization causes subsequent fossil fuel supply restraint. Norway demonstrates that substantial domestic demand-side progress can coexist with continued oil and gas production, while Denmark illustrates the feasibility of explicit extraction restrictions under a different constellation of political-economic conditions. The potential relationship between alternative energy development, changing economic constituencies, and future supply-side commitments is therefore advanced as a conditional proposition rather than a demonstrated causal sequence. Further comparative and longitudinal research is needed to assess the mechanisms and circumstances under which these dimensions of climate governance become politically integrated.

Research questions

This dissertation examines how fossil fuel-producing states can achieve deep decarbonization while simultaneously reducing their economic, political, and institutional dependence on oil. The overarching question is: How can fossil fuel-producing states politically integrate demand- and supply-side climate policy to achieve deep decarbonization while transitioning away from fossil fuel dependence? To address this broader question, the dissertation is organized into three interrelated papers with more specific foci.

Paper 1: From national ban to global climate policy renewal: Denmark's path to leading on oil extraction phase-out

This article asks: under what conditions does supply-side climate policy become politically feasible in fossil fuel-producing states? It explores how Denmark emerged as a global first mover in oil extraction phase-out policy despite its status as a major oil-producing state, and what this reveals about the enabling conditions for supply-side climate leadership and emerging forms of global fossil fuel governance. What can earlier supply-side leaders, such as Denmark, reveal about the broader possibilities for advancing fossil fuel phase-out through national and global climate governance?

Paper 2: Electrifying transportation to accelerate a global oil phase-out? Contradictions and potential from Norway and Canada

This paper asks: how can demand-side climate policy contribute to a broader fossil fuel transition in oil-producing states? It examines to what extent does transportation electrification shape broader pathways of fossil fuel transition in fossil fuel-producing economies, and whether ambitious demand-side decarbonization weakens support for continued oil production, or unfolds alongside continued extraction and export expansion. More specifically, this second paper asks how institutions, interests, and dominant political ideas shape whether transportation electrification contributes to broader fossil fuel decline—or remains disconnected from supply-side transition.

Paper 3: Cutting Canada’s carbon binds with both arms of the climate scissors: Drawing on insights from global first movers

The final paper centres on how demand- and supply-side climate policies can be politically integrated in carbon-locked, fossil fuel-producing states such as Canada. Its core questions investigate the institutional, interest-based, and ideational barriers that prevent Canada from aligning both “blades” of the climate policy scissors, and what political pathways might enable a more coherent and integrated transition away from fossil fuels. What political conditions are required to align demand-side and supply-side climate policy within carbon-intensive political economies? How do institutions, interests, and ideas continue to reproduce fossil fuel dependence in Canada, and under what conditions can they begin to shift? Drawing on lessons from Denmark and Norway, this third paper assesses pathways for integrating demand-side decarbonization and supply-side climate governance into a broader transition strategy in fossil fuel-producing states.

As the conclusion synthesizes, the dissertation argues that deep decarbonization requires more than reducing territorial emissions or accelerating the deployment of clean technologies. Instead, it requires broader political, economic, and institutional transformation that weakens dependence on fossil fuel production itself. Demand-side decarbonization remains essential while supply-side climate policy is increasingly unavoidable. Neither is sufficient in isolation. Durable transition in fossil fuel-producing states depends not simply on pursuing both simultaneously, but on understanding the political conditions under which demand-side and supply-side climate policies can become mutually reinforcing. In this way, the dissertation argues that the transition away from fossil fuels, specifically oil, is not solely a technological or environmental challenge, but fundamentally a political one.

Paper 1: From national ban to global climate policy renewal: Denmark’s path to leading on oil extraction phase-out

This manuscript was published in 2024. Citation: Greene, Sarah and Angela Carter. 2024. “From national ban to global climate policy renewal: Denmark’s path to co-leading an end to oil extraction.” International Environmental Agreements: Politics, Law and Economics 24, 121-39. <https://doi.org/10.1007/s10784-024-09625-1>

2.1 Abstract

Denmark is the first major oil-producing state—the largest oil producer in the European Union to date—to withdraw from future oil production. In 2020, the Danish Parliament passed the North Sea Agreement (NSA), which established 2050 as the end date for all offshore oil and gas production and, at the same time, cancelled the eighth licensing round and all future tender rounds for hydrocarbon exploration and extraction. While essential in Denmark’s ambitious domestic climate commitments, this national ban is also a keystone in a vital turn in global supply-side climate policy as Denmark endeavours to encourage other states to curtail fossil fuel production via its lead role in the Beyond Oil and Gas Alliance (BOGA). This paper explores the origins and development of Denmark’s NSA. Focusing on specific conditions that enabled the development of the national ban, this case study examines how Denmark’s national climate policy reinforces burgeoning global anti-fossil fuel norms (AFFN) and serves as a model for other states seeking to implement supply-side climate policies. It concludes with an analysis of opportunities for extending Danish leadership in aligning oil production with the imperative of a net-zero world.

2.2 Introduction

National bans on oil exploration and production are an emerging policy pathway states pursue to align with the *Paris Agreement*'s aim to limit global temperature increase to 1.5 °C (Carter & McKenzie, 2020; Le Billon & Kristoffersen, 2020). The “first-mover” states that implement these “keep it in the ground” (KIIG) policies demonstrate the climate and socio-economic benefits of phasing out oil production. Yet, we lack a coherent understanding of how and why states create and enact these transformative policies and how the experiences of early adopters can be leveraged globally. To address this gap, here we focus on the case of Denmark, a prominent KIIG first mover.

Denmark is the first major oil-producing state—the largest oil producer in the European Union (EU) to date—to withdraw from future oil production. In 2020, the Danish Parliament passed the North Sea Agreement (NSA), which established 2050 as the end date for all offshore oil and gas production and, at the same time, cancelled the eighth licensing round and all future tender rounds for hydrocarbon exploration and extraction. While many states that have enacted bans on fossil fuel production have only a small oil and gas sector, Denmark's sector is well developed, and the country has significant fossil fuel reserves. Denmark, therefore, could serve as a model for other states reliant on oil and gas extraction that seek to align energy policy with climate objectives. Moreover, Denmark has brought its national ban to the international stage by co-leading the Beyond Oil and Gas Alliance (BOGA). As such, Denmark's KIIG policy has become a keystone in advancing global supply-side climate policies and norms.

Using the framework developed by Carter and McKenzie (2020), this analysis traces the development of Denmark's NSA by attending to core interacting political-economic and socio-cultural conditions. These include the role of broad-based constituencies supporting leaving fossil fuels in the ground with backing from international organizations (IOs), policy actors leveraging political opportunities and using domestically resonant message framing around the risks and benefits of phasing out oil production, as well as well-placed norm entrepreneurs lending legitimacy to supply-side climate policy. We also note unfolding political-economic trends—mounting evidence of a declining oil sector, success developing an offshore wind sector, and a comparatively weaker pro-oil lobby—that facilitated Denmark moving early to phase out oil production. We conclude with both the challenges of Denmark's supply-side climate policy leadership, as well as how it has contributed to burgeoning global “anti-fossil fuel norms” (AFFNs) prohibiting fossil fuel development (Green, 2018). While the conditions surrounding Denmark's ban are not easily transferable to all oil-producing states, understanding Denmark's experience directs attention towards key issues where policy advocacy and action are needed to amplify further phase-out initiatives: diversifying the economy, analysing the risks of *status quo* oil production dependence, and loosening the hold of the pro-oil lobby.

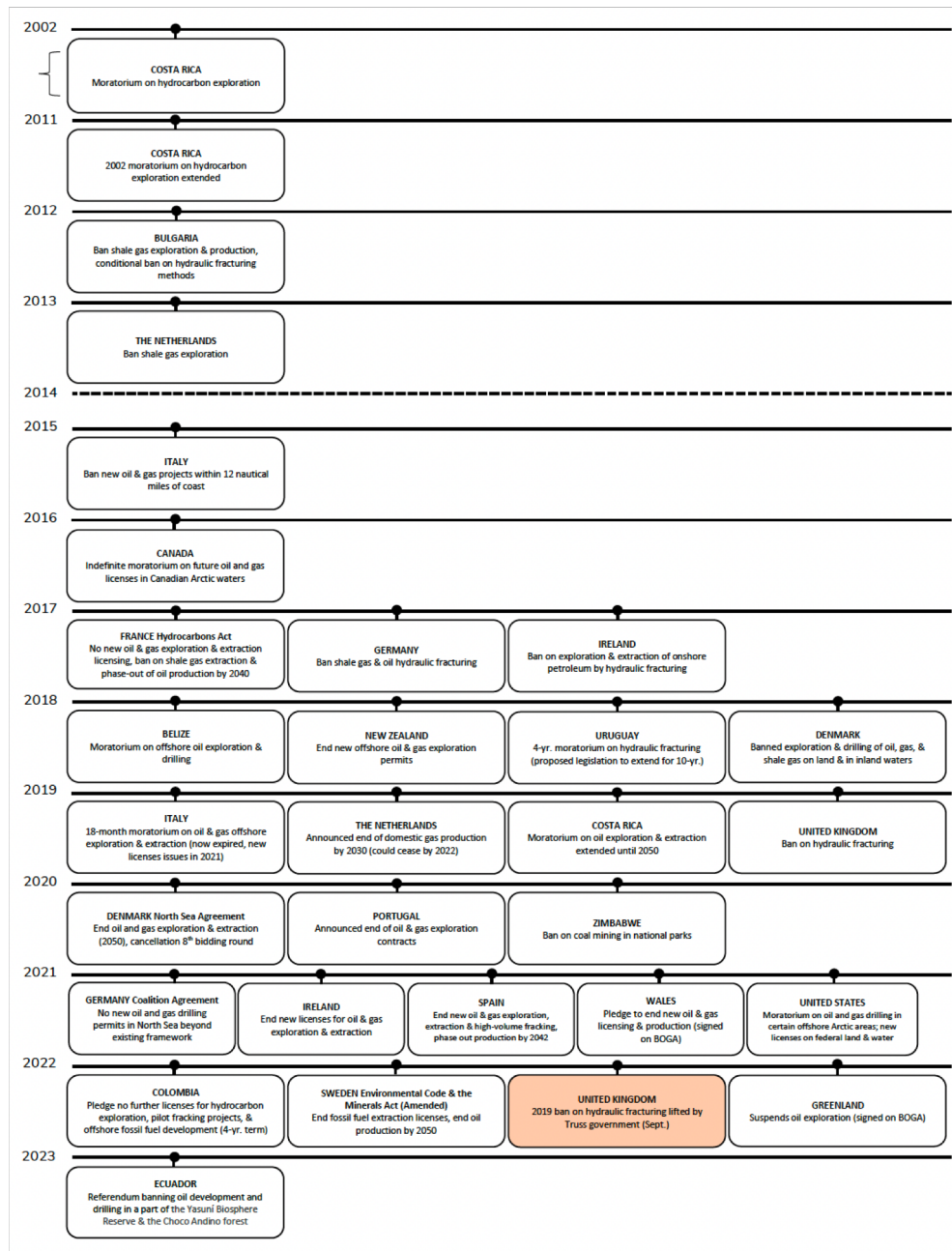
2.3 The rise of national bans

Global governance institutions and frameworks coordinating decarbonization efforts, led by the United Nations Framework Convention on Climate Change (UNFCCC), have primarily focused on demand-side emission reductions, mainly via carbon taxes and cap-and-trade schemes (Green & Denniss, 2018). This approach holds states responsible for greenhouse gas (GHG) emissions primarily within their own territory. As Newell and Carter outline in the first article of this issue, UNFCCC negotiations have focused on controlling emissions where fossil fuels are consumed and have largely ignored fossil fuel supply until recently. The market has been left to curb emissions associated with fossil fuel extraction (Aykut et al., 2017; Muttitt et al., 2016). However, markets have been slow to respond to the urgency

of climate change, and global carbon emissions have continued to rise. Instead, oil and gas firms make unprecedented profits, their lobbying capacity and influence grow, and the industry's hold on the global energy landscape intensifies (Carroll, 2021). For example, fossil fuel delegations increasingly participate in United Nations (UN) climate conferences, and public relations efforts work to entrench further "*petrocultures*" in major producing states (Daggett, 2018; Szeman, 2019). Put simply, fossil fuel firms have an outsized influence on climate policy.

Yet despite these barriers, communities have contested fossil fuel production to protect health and sovereignty and, more recently, out of concern for the climate crisis (Carter & McKenzie, 2020). Community efforts have motivated a growing wave of national bans (outlined in Figure 1), starting in 2002 with Costa Rica's moratorium on hydrocarbon exploration. These national efforts are also being consolidated through international initiatives like the BOGA and the Fossil Fuel Non-proliferation Treaty (FFNPT) (see Figure 3), which disrupt the fossil fuel industry's stronghold on the public imagination. These global initiatives open new normative and policy spaces in international climate debates.

Figure 2.1. National bans and moratoriums on fossil fuel exploration and extraction

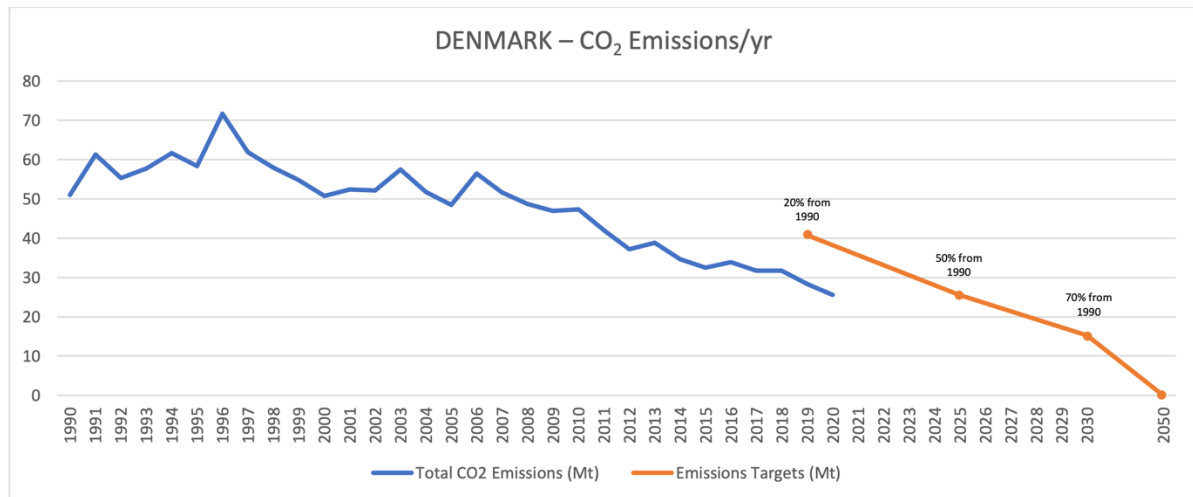


2.4 Origins of Denmark’s supply-side climate policy leadership

The decision to phase out oil and gas production in Denmark originated in great part from the country’s strengthening climate ambition . In 2013, the Danish government released the *Climate Policy Plan* to reduce GHG emissions by 40 percent in 2020 compared to 1990 and outlined the proposal for the government’s first *Climate Change Act*, which the Danish Parliament adopted in 2014. The Act established a 40 percent emissions reduction target by 2020 and the general goal of becoming a “low-emission society” by 2050 (IEA, 2020). These early targets inspired actual reductions: Denmark reduced emissions by 23 percent between 2005 and 2018, surpassing the emissions reductions of the EU as a whole (Climate Change Performance Index, 2023; Morgado Simões & Andreo Victoria, 2021).

Then, following the drought in the summer of 2018, along with local and international climate strikes taking place in 2019 (more on this below), for the first time in Danish history, climate change was the top concern in the 2019 federal election, with polls indicating that 46 percent of voters ranked climate change as their top priority (Holstein, 2019; Madsen et al., 2023, p. 2).¹ All parties brought forward platforms foregrounding strong climate targets. After being elected, the Social Democrats led the development of the *Climate Act*, passed in 2020, introducing binding targets to reduce domestic GHG emissions to 70 percent below 1990 levels by 2030 and for carbon neutrality by 2050 (Climate Act, 2020), a target it is likely to achieve (Figure 2). Denmark’s emission reduction commitments surpass even the European Commission’s ambitious proposal to enhance emission reductions under its REPowerEU Plan, which aims to reduce emissions by 58-60 percent below 1990 levels by 2030 (Climate Action Tracker, 2022).

Figure 2.2. Denmark’s actual and target CO₂ emissions per year



To meet its emission goals, Denmark has aggressively targeted fossil fuel use and production, addressing both emissions from energy demand and supply. In this way, Danish decarbonization efforts involve both increasingly progressive climate goals and shifts in the energy sector (Jørgensen et al., 2017; Meibom et al., 2013). In 2012, Denmark’s *Energy Agreement* included a 2050 target of 100 percent renewable energy in the transportation and energy sectors (IEA, 2020). Then, in 2018, Denmark

¹ This is an increase from the previous election in 2017, when only 27 percent of voters ranked climate change as a concern.

committed to phase out coal-fired electricity by 2030 (Powering Past Coal Alliance, 2021) — it was an inaugural member of the Powering Past Coal Alliance, formed in 2017 (Powering Past Coal Alliance, 2022).

Yet Denmark's road to decarbonization requires more than building out renewable energy or phasing out coal-fired power: it also requires curtailing the supply of oil and gas, both domestically and internationally. As one interviewee noted concerning the NSA, "We are a small country, but we have an ambition to influence climate policy on the planet. So, if we want that, it's not enough to build wind turbines. We are good at that, but we also need to take other important steps, and if we don't do it — if we give this round [the eighth licensing round for oil and gas in the North Sea] — we will be giving licenses going into the [20]50s and maybe even [20]60s, *after* we've decided to become carbon neutral" (interviewee #16).

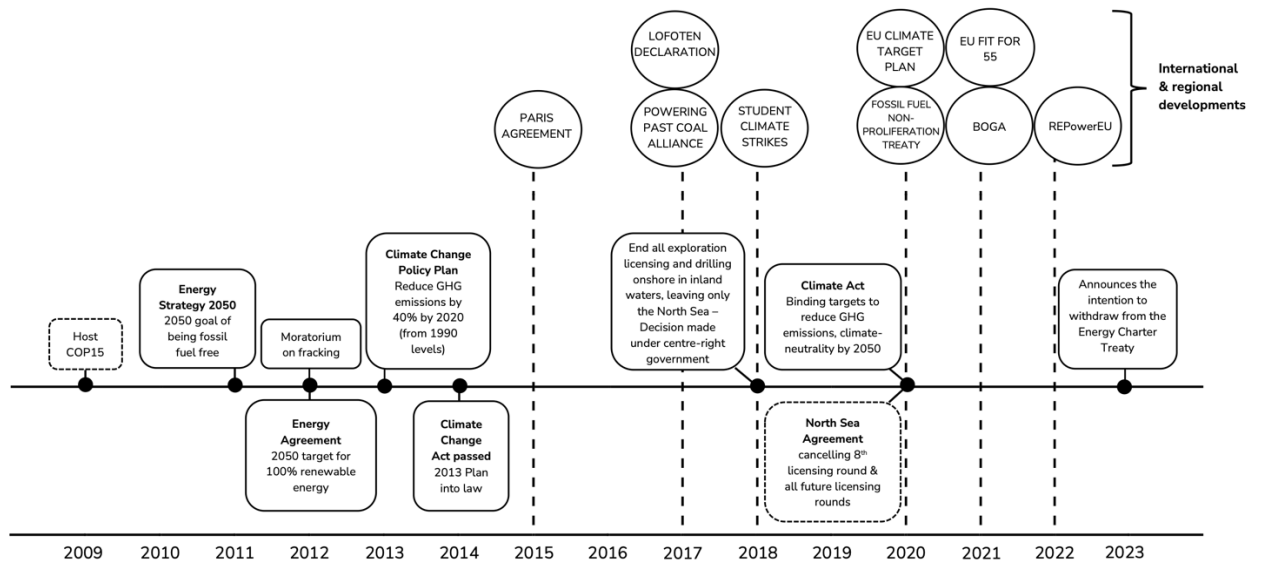
Foregrounding supply-side climate policy and in tandem with the 2020 *Climate Act*, the Danish Parliament approved the 2020 NSA and subsequent amendments to the *Danish Subsoil Act*, cancelling the eighth licensing round and all future rounds (Act Amending the Act on the Use of Denmark's Subsoil, 2021; Danish Ministry of Climate, Energy and Utilities, 2020a). The *Climate Act* served as a foundation for the NSA. As Interviewee #3 explains, "[We] got a broad spectrum of parties to support the *Climate Act*, which put the 70 percent target into law. But above the 70 percent target, it also put into law that we need to be a zero-emission country by no later than 2050. When it comes to the 2050 target, new [oil] drillings would impact that target. So, there is a huge leverage, a huge level of pressure on the parties, who [had all] adopted the 2050 target."

Political parties and civil society organizations (CSO) pressured Danish government officials for decades, actively opposing oil production and additional licences given the intensifying climate crisis (interviewee #2, #3, #16). Upon taking office in 2019, Minister of Climate, Energy and Utilities Dan Jørgensen — who was personally concerned about the environment, aware of this public pressure, and willing to take bold climate action within the already ambitious framework that led to the *Climate Act* — took the unprecedented decision to pause the eighth oil and gas licensing round. Until this point, licensing rounds were habitually approved and had never been questioned or revoked by a Minister (interviewee #8, #15, #16). The pause allowed time for the ministry to conduct an in-depth economic and environmental assessment of the consequences and trade-offs of pursuing further exploration and extraction permits and hold a formal discussion about it, incorporating input from the Prime Minister and various other vital ministers, such as the Minister of Finance (interviewee #8, #11, #15). As one interviewee who had worked closely with the Minister observed, "[Jørgensen] wanted to know what the facts are. How many people are employed? What are the tax implications? That really deep analysis of what is actually happening in the North Sea to see whether a ban would be possible... And there were two issues. One was the ban in the long run, and the second part was that there was an ongoing licensing round [the eighth round] that was open and had not been closed yet" (interviewee #15).

In response to the evidence gathered, Minister Jørgensen cancelled the eighth licensing round and, through the 2020 NSA, cancelled all future rounds for hydrocarbon exploration and extraction and committed to cease all offshore oil and gas production by 2050 (see Figure 3 for key moments in Denmark's supply-side policy progression, overlaid with ongoing international and regional milestones). This was no small decision, given how Denmark's economy had benefited significantly from its oil and gas sector. Between 1972, when Denmark started producing fossil fuels, and 2020, the state received approximately DKK 544 billion in revenue from the oil and gas sector (Nordsøfonden, n.d.). Moreover, the country has considerable oil and gas reserves — 400 million barrels in proven oil reserves and 1 trillion cubic feet of natural gas reserves (BP, 2021, pp. 16, 24) — with substantial public

revenue potential. Due to the NSA, the Danish government is estimated to be abdicating approximately DKK 13 billion in unrealized state revenue from oil and gas production (Krawchenko & Gordon, 2022, p. 7). What led to Denmark's globally unprecedented decision to leave significant oil and gas reserves, and therefore public revenue, in the ground? And how might Denmark's process inform supply-side policy in other major producing jurisdictions around the world?

Figure 2.3. National, regional, and international milestones relating to Denmark's KIIG policy progression



2.5 Analytical frameworks and methodological approach

Global decarbonization acceleration literature advances a series of interrelated concepts helpful in understanding why rapid transformation and transitions occur. This relatively recent theoretical and analytical research explores how interacting socio-cultural, political-economic, and technological interventions can trigger broad shifts that might ensure climatic stability by 2050, with noteworthy contributions emphasizing the politics of deep decarbonization (Bernstein & Hoffmann, 2018; Hamid et al., 2022; Otto et al., 2020; Rosenbloom & Meadowcroft, 2022; Rosenbloom & Rinscheid, 2020). Decarbonization is theorized to be aided by unpredictable and often exogenous conditions, such as energy insecurity generated from geopolitical disruptions like the invasion of Ukraine by Russia, ambitious emissions reductions arising from external actors, the emergence of politically or culturally influential norm entrepreneurs, or rapidly shifting landscapes, such as citizen responses to an abrupt ecological crisis. Each of these conditions could provide opportunities for shifts in comparative power, spur the evolution of ideas, and create new spaces for developing innovative policies at the national and international levels. Empirical work that seeks to identify the characteristics of initiatives that can be – and are being – used to advance system-wide decarbonization shifts and changes, particularly supply-side climate policies such as national bans on fossil fuel exploration and extraction, has built on this theoretical research.

To identify the conditions under which national bans are developing with the aim of amplifying them globally, we used a comparative framework created by Carter and McKenzie (2020). After surveying the burgeoning supply-side climate policy literature, Carter and McKenzie identified KIIG-enabling conditions. KIIG policies likely originate from small-scale, locally oriented campaigns focused on a singular impact or issue. Moreover, support for broad KIIG policy is likely to be coordinated via diverse organizations across society, some of which are connected to IOs with more resources and tested strategies. These horizontally connected (across a constituency) and vertically integrated (with IOs) coalitions could then seize – or create – political openings for policy influence. This could mean intervening in predictable or institutional processes, such as elections or consultations; amplifying unpredictable exogenous openings, such as climate disasters or the release of new research; or shifting political attention by organizing large-scale protests or civil demonstrations. In this framework, national KIIG policies are also fostered by “norm entrepreneurs”: well-placed, influential individuals who originate and lend legitimacy and credibility to AFFNs forwarded by social movements (Carter & McKenzie, 2020; Green, 2018; Piggot, 2017). These entrepreneurs can offer enhanced political access to particular organizations and coalitions within the broader KIIG movement (Jørgensen et al., 2017; Meibom et al., 2013). Essential throughout these movements and policies is an emotionally resonant framing of the KIIG issue, with messages that amplify a collective sense of (in)justice, emphasize local risks, and offer a clear, straightforward solution with a vision of an optimistic post-fossil fuel future (Green, 2018; Healy et al., 2019).

We also engage with Green’s AFFN framework (2018b) to understand what Denmark’s KIIG policy means for Denmark in the future, how the conditions that led to Denmark’s ban develop AFFNs, how such norms are being spread, and how they may be affecting other states. While Carter and McKenzie provide a useful framework for understanding the domestic unfolding of national bans on oil and gas exploration and extraction, Green’s theoretical contribution illuminates how national-level AFFNs are amplified, spread, and ultimately influence other states and the broader climate regime and energy landscape. Exploring how AFFNs amplify through domestic and international mechanisms, such as BOGA, helps explain how Denmark leverages the NSA to institutionalize an oil-and-gas phase-out beyond its borders. AFFNs are likely to spread throughout the international system via alliance-building and network formation as a pathway for international socialization, having an important effect on how states conduct their rational calculations or their identity around their role in limiting the production of fossil fuels. Examining Denmark as a case study through Green’s norm-based theory helps uncover the NSA’s discursive, ideational, and symbolic dimensions and the amplification of AFFNs through their institutionalization within the climate regime.

Together, these frameworks serve to understand how national bans such as Denmark’s can spur change across a heavily interconnected system and, when stabilized by government policies, can be scaled to other levels of influence (Otto et al., 2020). These frameworks help develop an understanding of how intervention at the state and local level can also be diffused across other levels of influence, creating guidelines and standards to boost ambitions within any given jurisdiction and beyond.

These theoretical foundations inform the mixed-methods approach used for this research, which combined literature reviews and qualitative research via semi-structured interviews. Beginning in 2021, we developed a profile of Denmark and a chronology of Danish energy and climate policy. We created a compilation and analysis of over 200 relevant reports and data from the Danish government, those operating in the climate governance space, civil society, researchers, media, and industry sources since the early 2000s related to Denmark’s energy and climate landscape. The literature review included compiling and analyzing relevant government, industry, and civil society statistical data (i.e., on fossil fuel production, revenues, and economic activity from the sector, and on fossil fuel proponents, CSOs,

and green sector associations), and conducting a media review of issue coverage (gathering key articles from relevant traditional and media outlets), looking for key themes and factors that lead to the enactment and implementation of the Danish ban. Additionally, through the literature review, we identified critical actors in the development of the 2020 NSA, whom we contacted for interviews.

In 2022, we conducted virtual and in-person interviews with a diverse sample of 17 experts as they relate to state and international climate and energy policy and the fossil fuel industry, such as lead policy actors, policymakers, researchers, civil society members, activists, and industry and labour representatives (see Table 2 below for an outline of interviewees' primary affiliations). These interviews, with questions focused on the origins and development of the NSA, aimed to understand the factors that encouraged or hindered the development of Denmark's ban on future fossil fuel exploration and extraction and its global impact. Additionally, these interviews assisted in gaining a first-hand understanding of the relationship between the various stakeholders in Denmark's climate and energy landscape, as well as the political context and the institutional characteristics that enabled the ban. Though vulnerable to interviewer bias and social desirability bias (Sovacool et al., 2018), this method for data collection allows for a more interdisciplinary perspective, permitting access to individual understandings, explanations, and meanings of fossil fuel production and phase-out.

2.6 National conditions for a globally-inspiring ban

Denmark became a leading global example of transitioning away from oil and gas production to meet ambitious decarbonization goals by implementing a ban on production through a constellation of conditions identified in Carter and McKenzie (2020) (captured in Table 1). First, the ban emerged from more localized campaigns against fossil fuel extraction that originated in part from longstanding Danish campaigns opposing nuclear energy. Anti-nuclear campaigns active in the 1970s and 1980s informed Denmark's anti-fracking movement, demonstrating bottom-up victories characterized by scientifically founded critiques, political dialogue, non-partisanship, and peaceful demonstrations. Anti-fracking campaigns, growing in 2015 over concerns about public health, primarily fracking's threats to groundwater quality, in turn, laid the groundwork for the NSA. Danish activists leading anti-fracking campaigns enlarged that movement to denounce fossil fuel extraction more generally, arguing that continued production clashed with Denmark's "green" reputation and prevented the country from meeting its climate commitments.

Second, proposals to ban fossil fuel extraction were advanced by a diversity of grassroots initiatives that were, as a third condition, also connected to IOs. Within Denmark, lead groups included student organizations such as the Green Student Movement and the Danish 92 Group, a growing coalition of environmental and development non-governmental organizations (NGOs). These networks applied increasing pressure on the newly elected government to prove their climate ambitions by ending oil and gas exploration (Pedersen et al., 2019; Seidelin, 2020). Meanwhile, Denmark's ban was fostered by connections between these domestic networks and IOs. Groups advocating a fossil fuel ban, such as Greenpeace and NOAH, maintained close ties with their European and international counterparts and acted as a conduit to external resources and a bridge to IOs, such as 350.org, Oil Change International, and Greenpeace International. These connections were exemplified in the Danish Climate Movement becoming a member of 350.org and sections of NOAH joining German actions around anti-fossil fuel extraction efforts. These IOs offered support to policy actors at essential moments in the ban's progression. For example, a 2019 report from Oil Change International that examines the role of Danish oil and gas production in a Paris-aligned global carbon budget was used by political parties, such as the Alternative party, to argue the incompatibility of North Sea oil and gas extraction with climate

obligations before the Minister of Climate, Energy and Utilities. Reasoning that if Denmark failed to curtail its North Sea extraction, it would either a) export oil and gas, creating overseas emissions that would overshadow any success in domestic emissions reductions or b) not meet its emissions targets and increase domestic consumption of oil and gas that would not be Paris-aligned (Tucker, 2019), the report served as vital substantiation for the cancellation of the eighth licensing round.

Fourth, local campaigns and coordinating groups capitalized on critical processes and moments that helped bring the idea of a ban to the forefront of policy debate. Such moments include leveraging the collective disappointment over the outcomes of the 15th Conference of the Parties (COP) hosted by Denmark in Copenhagen in 2009 to pressure the Danish Government to restore its climate reputation with increasingly ambitious climate commitments. Another event that took place that was utilized by local campaigns and groups was the drought in the summer of 2018. The direct experience of extreme heat and its health and economic impacts — for example, the Danish agriculture industry enduring a direct loss of DKK 4.1 billion attributed to unseasonably hot weather (Schou, 2019) — raised public awareness across Denmark about the need to take aggressive action to reduce emissions. Additionally, as student climate strikes took place worldwide in 2019, Danish campaigns and groups were using the messaging and international coverage to attract local attention and garner civic engagement around such events to make clear to politicians how highly climate change issues were a top priority.

Fifth, norm entrepreneurs added to this momentum. An outstanding example is Minister Dan Jørgensen, Denmark's Minister for Climate, Energy and Utilities at the time of the ban. Minister Jørgensen has not only driven the transition based on Danish issues of climate, employment, and economics but has looked for opportunities to leverage the Danish example internationally via the BOGA. Danish business community leaders were also notable. Under the leadership of then CEO Anders Eldrup, the Danish Oil and Natural Gas (DONG) company — formed initially to lead Denmark's oil and gas development in the North Sea and focused exclusively on oil and gas extraction — announced in 2008 that it would transform itself into a renewable energy company focused on offshore wind. By 2017, the company had ended its oil and gas business lines to work solely in green energy and became Ørsted.

Sixth, the ban in Denmark was spurred by resonant ideas that appealed to the Danish people. These include an emphasis on the local risks of waning demand and profits from fossil fuels as global energy systems shifted, leaving the country exposed to threats to jobs, the economy, and the environment. At the same time, political actors advancing the notion of banning oil and gas extraction noted the opportunity to grow domestic jobs in the near-to-long term by leveraging existing workforce skills and competitive strengths while positioning Denmark at the centre of international politics, setting a vital example for how small and oil-dependent states can make a big difference. Denmark has decades of experience with wind energy — one interviewee noted that turbines are “a part of us”: “There is a DNA going 40-50 years back” (interviewee #6). Refocusing on that strength amid an increasingly precarious oil and gas sector was therefore a salient argument for advancing this policy.

Table 2.1. Ban-supporting conditions, as per Carter and McKenzie (2020)

CONDITION:		EXAMPLES:
MOVEMENT SCALE-UP	Bans built from small-scale, locally-oriented campaigns	○ Anti-nuclear campaigns informed anti-fracking movements, enlarged to anti-fossil fuel extraction generally
HORIZONTAL INTEGRATION WITHIN A STATE	Bans develop from coordination among a diverse set of organizations across society	○ Danish Group 92, 25 Danish NGOs working on issues related to the environment and development, called for the banning of production in the North Sea ○ Green Student Movement
VERTICAL INTEGRATION WITH IOS	Bans fostered by connections between domestic and IOs	○ Support for domestic policy actors from 350.org, Greenpeace International, and Oil Change International
SEIZING OR CREATING POLITICAL OPENINGS	Predictable or unpredictable processes or events launch bans to the forefront of policy debate	○ COP15 hosted in Copenhagen (2009), setting aspirations for more ambitious climate obligations to restore Danish reputation as a global climate leader and formalized international climate action ○ 2018 summer drought ○ Student strikes 2018-2019 raising awareness of the urgency for climate action ○ 2019 General Election
NORM ENTREPRENEURS	Well-placed individuals within or outside government lend legitimacy, credibility, and political access to ban proponents	○ Dan Jørgensen, Minister of Climate, Energy and Utilities at the time the NSA ○ Anders Eldrup, CEO of DONG/DONG Energy (2001-12) as it shifted from oil and gas to offshore wind
RESONANT FRAMING	Bans are helped by messaging that conveys a sense of (in)justice, local risks, straightforward solutions, and a vision of an optimistic post-fossil fuel future	○ Avoiding socio-economic risks of continuing with a declining oil and gas sector ○ Seizing socio-economic and environmental benefits of energy transition, especially wind energy with which Denmark has longstanding experience ○ Denmark as a global climate leader, setting an international example

This constellation of conditions identified by Carter and McKenzie (2020) explains in great part the rise of KIIG policies in Denmark. Curtailing Denmark's oil and gas production arose from movement scale-up, which was supported by horizontally and vertically integrated constituencies that seized critical leverage points, such as political openings and opportunities. Well-placed norm entrepreneurs

aided these efforts and were also bolstered and sustained by resonant messaging and ideas. However, case analysis highlighted other conditions that were fundamental to the development of Denmark's globally outstanding ban on oil and gas production: responses to energy security challenges occurring over several decades, which included the development of a strong wind energy sector, as well as evidence of a decline in Denmark's oil and gas sector that posed threats to public revenue and employment. These two factors also opened space for Denmark's ban on future oil and gas extraction via the NSA.

The origins of Denmark's ban could be traced back to early efforts to decarbonize the country's energy. In response to the 1970s oil crisis, Denmark focused on transitioning to renewable energy that would be economically viable and create jobs and other community benefits (interviewee #4 and #16). This was particularly salient for the Port of Esbjerg, where most oil and gas activity and jobs are centred, and which has already undergone a major transition from fishing to oil and gas production and is now actively transitioning to be a domestic and global supplier of wind energy and renewable expertise. As one interviewee explained, Esbjerg has moved from fish to energy – fossil-based, then renewable. Early movement into new energy sectors gave the country a competitive edge. It delivers economic benefits to Denmark: “We industrialized these industries ahead of other states and so are able to export them. In Esbjerg, we see the first movement of wind going from being a local Danish thing, to being a European thing, to now a global thing” (interviewee #6). Today, Esbjerg is the primary site of the country's unprecedented large-scale offshore wind project activity.

Denmark was able to draw on its historical experience with wind energy to refocus the energy sector from oil and gas to wind—a pivot that was urgently needed given the trajectory of the oil and gas sector. While Denmark has long been a major oil and gas producer and benefited enormously from the revenues of that sector, in recent years, policymakers became aware that continuing to depend on this sector was an economic risk. Combined oil and gas production in Denmark peaked in 2005 (Hall, 2020, p. 4). Oil production has decreased on average 10 percent per year since 2005, contracting by 16 percent in 2017-2018 (OECD, 2023). In 2017-2018, gas production declined 15 percent after decreasing steadily since 2010 by an average of 10 percent (OECD, 2020, 2023). Over the next 15-20 years, Denmark's low oil and gas production was forecasted to continue falling, with existing fields to be largely depleted by 2040 (Danish Energy Agency, 2018, pp. 6-9; Sperling et al., 2021).

Firms were also withdrawing from Denmark's offshore oil sector. Before the cancellation of the eighth licensing round in 2020, oil companies were already hesitating to pursue new contracts in the Danish North Sea. In response to the eighth licensing round opening for applicants in 2018, the Danish Energy Agency received only 5 applications from 4 companies (Danish Energy Agency, 2019) — a considerable drop in interest from the previous licensing round in 2014, which garnered 25 applications from 15 companies (Danish Energy Agency, 2014). Then, by 2020, prior to the eighth licensing round being formally cancelled, only one party, Ardent Oil, was poised to submit two applications; Lundin Norway and Mol Dania had followed Total's earlier example and had withdrawn their applications (Falkengaard & Kristensen, 2020).

Declining production and fluctuating oil prices translated into sustained reductions in state revenue from oil and gas production (Danish Energy Agency, 2020). In 2014, state revenue was down by almost 15 percent from the year prior, a trend projected to continue with diminishing productivity and persistent price volatility (Danish Energy Agency, 2020). The Danish Ministry of Finance's 2019 report estimated that oil and gas revenue would continue to decline (Danish Ministry of Finance, 2019). Similarly, employment in the sector was falling (Sperling et al., 2021, p. 20).

Waning firm interest in future exploration and production in the North Sea and declining jobs and public revenues solidified public and political support for Denmark's focus on developing renewable energy and transitioning oil and gas workers to that growing sector (Madsen et al., 2023). In contrast to the economic declines and volatility of Denmark's oil and gas industry, its renewable energy sector was growing to the point of more than offsetting losses from oil and gas in terms of public revenue and employment, as well as contributing significantly to energy supply. Just before the NSA, the wind industry was contributing substantial revenues to the state, with DKK 13.8 billion in 2018 (State of Green, 2021). In 2019, Denmark's wind industry alone directly employed 33,159 people, compared to only 1,565 employed in the oil and gas sector (State of Green, 2021; Statista, 2022). As oil and gas employment was projected to continue falling, the renewable energy sector is anticipated to add 50,000 jobs annually until 2050 (Mathiesen et al., 2015, p. 139). As for energy supply, in 2021, fossil fuel sources comprised less than 30 percent of Denmark's electricity production, while renewable energy production increased by approximately 300 percent, with wind sources making up the largest share in both primary energy consumption and electricity (IEA, 2021).

At the same time, given firms' gradual withdrawal from the sector, policymakers in Denmark were not exposed to the kind of pro-oil and gas lobby that inhibits ambitious climate policy and transitions in other major producing states (Carroll, 2021; Madsen et al., 2023). The industry association Oil Gas Denmark (OGD)² did argue against the NSA across media platforms, noting how the ban would result in Denmark foregoing DKK 250 billion in revenue and arguing that the overall contribution of Denmark's fossil fuel industry to the global climate crisis is virtually negligible compared to other states (Blædel Lorenzen, 2019; Næsby, 2019). Also used to substantiate the continuation of Denmark's oil and gas production was the claim that climate change requires a global rather than national response, citing the need for demand-side policy. However, as pressure for supply-side climate policy grew alongside evidence of a declining oil and gas sector, support for status quo fossil fuel production was not defensible. Even OGD rebranded itself as Danish Offshore to reflect the shift.

2.7 Conclusion: Challenging – and leveraging – Denmark's ban

Since the 2015 *Paris Agreement*—which made no mention of fossil fuels, the leading contributors to global GHG emissions—a growing wave of states and subnational actors have moved to curtail fossil fuel production. Denmark's ban is outstanding among them, yet it is not without caveats. The NSA is limited in two ways, arguably making it incompatible with the *Paris Agreement* (Greenpeace International, 2020; Severin Hansen et al., 2022). Correcting these limitations is an opportunity for Denmark to extend its leadership in global oil phase-out policy.

First, Denmark's 2050 end date for oil and gas production is considered too late to align with climate goals. Climate activists and organizations, such as Oil Change International, advocate existing production ending earlier than 2050 — at least by 2042 — to be aligned with the *Paris Agreement* (Severin Hansen et al., 2022; Sperling et al., 2021). The NSA indicates a non-negotiable 2050 end date (Danish Ministry of Climate, Energy and Utilities, 2020a) to provide predictability and time for firms, workers, and other stakeholders to transition (Madsen et al., 2023). This glide path to 2050 was a key condition to securing widespread consent for the NSA in parliament with minimal pushback from firms already operating in the Danish North Sea (interviewee #16). Indeed, the NSA created favourable

² Now called Danish Offshore, Oil Gas Denmark was founded in 2012 and represents the corporations and stakeholders within Denmark's oil and gas sector in the North Sea, including sub-suppliers and service companies.

conditions for firms with existing licenses already operating in the Danish North Sea.³ It effectively created a monopoly for only these firms to continue oil and gas activity (with the potential to expand their production – more on this below) until 2050. Given the political negotiations required around the NSA, adjusting the 2050 end date would no doubt be contentious. However, as supply-side climate policy continues to advance globally and as public demand for bold climate action continues to grow (notably, in 2022, the Canadian province of Québec ended new and *existing* oil and gas production with firm compensation), it is not difficult to imagine growing pressure for policymakers to strengthen the NSA to include an expedited phase out date (Severin Hansen et al., 2022).

Second, although the NSA cancelled the eighth licensing round and all future licensing rounds, fossil fuel companies currently operating in the Danish North Sea can still expand production. Though the NSA resulted in the decommissioning of the Åben Dør area between the west coast of Jutland and the bidding round around the council,⁴ effectively removing an area of 23,380 km³ from further exploration and extraction, via Denmark’s “open-door” procedure under the *Subsoil Act* (Danish Energy Agency, 2018a), developers continue to be able to apply for new fossil fuel ventures. This procedure permits exploration and extraction within a defined license area in the Danish North Sea, where fossil fuel discovery was previously made. An example is the Elly and Luke finds, estimated to hold gas volumes worth DKK 5.2 billion.

This gives developers relative flexibility to decide on location, production capacity and infrastructure. Moreover, “mini-rounds” of oil and gas licences allow for unsolicited applications from a project developer – a developer can initiate an application for a license in a currently unlicensed area within a designated perimeter of the Danish North Sea, while “neighbour-block” procedures allow an existing licensee to bid for an area adjacent to a current license when a geological or production-related reason exists. Together, these procedures allow for continued fossil fuel exploration and expansion in the Danish North Sea until 2050, even while new licensing rounds for future production are banned. Civil society, activists, environmentalists, researchers, and NGOs argue Denmark must close these loopholes and revoke *existing* licenses to ensure its ban is aligned with the *Paris Agreement* (Madsen et al., 2023; Severin Hansen et al., 2022).

These are important criticisms of Denmark’s supply-side climate policy and signal opportunities for the country to ramp up its leadership on sunseting oil production. Yet even so, Denmark’s NSA undoubtedly makes an important contribution to global climate policy as it helps build a global moral norm around curtailing oil and gas production, that is, anti-fossil fuel norms (AFFNs). Denmark’s ban in itself challenges and enlarges what constitutes appropriate climate policy and opens new terrain for climate mitigation (Green, 2018): it is a globally unprecedented ban, particularly given Denmark’s status as a major oil-producing nation. Yet the importance of leveraging Denmark’s ban far beyond its borders is widely acknowledged across the community of policy actors advocating the ban. While the ban is politically important in Denmark, as one interviewee noted, “Denmark only matters when we are part of the bigger ecosystem” (interviewee #13). From the outset, the NSA aimed to exert global change. Indeed, the NSA specifically leverages domestic policy on the international stage, contributing to the global socialization of these norms. The agreement includes a commitment for Denmark to co-lead the BOGA, a historic multilateral initiative advancing national and subnational oil and gas extraction bans.

³ The Danish government established a voluntary agreement with those companies that might be affected by the end date (Danish Ministry of Climate, Energy and Utilities, 2020, p. 2). When the agreement came to fruition, the government had to negotiate with just one company with a license to produce in the Danish North Sea until 2052, two years past the intended deadline, as confirmed in the seventh licensing. The company agreed to shorten its production timeline to 2050 to harmonize with the end date of the proposed NSA. Only Wintershall Noordzee B.V. has a license to operate until January 2050.

⁴ 6° 15' east longitude.

The formation of “climate clubs” is critically important to driving Paris-aligned climate and energy policy (van Asselt and Newell 2022).

Denmark can now expand its supply-side climate policy leadership, further enacting AFFNs, by establishing fossil-free zones (FFZs): geographical areas completely absent of any exploration, extraction, transportation, treatment, and consumption of fossil fuels that are protected, enhanced, and expanded through national law and international agreements (Green, 2022, p. 1357). Intended to be complementary to the global anti-fossil fuel efforts already being undertaken by Denmark via BOGA, FFZs offer a new opportunity to advance decarbonization policy.

Denmark is vital in rejuvenating global energy and climate policy for a Paris-aligned world. As documented here, this case analysis highlights the ban-supportive conditions – conditions that could inform the adoption of these policy innovations in other jurisdictions. These included the dynamics of 1) a diverse civil society movement across Denmark that was 2) informed by earlier anti-nuclear and anti-fracking campaigns that were scaled up to fossil fuel production generally. These movements 3) reached out to IOs for support to advance phase-out policy and 4) seized on critical political openings, notably an election after droughts and climate strikes. This movement was joined by 5) well-placed leadership within and outside government who similarly 6) framed the need for phase-out in a way that resonated with the Danish people. The broader political-economic context also opened space for the ban. On one hand, the Danish government sought to understand and acknowledge the growing evidence that the oil sector was in decline – oil production was sliding, and firm interest in new investment was waning, threatening public revenue and jobs. On the other, Denmark’s decades-long effort to find non-oil energy security, in great part by developing a strong wind energy sector, provided a clear path to economic renewal post-oil. Meanwhile, the Danish government’s efforts to phase out oil production were not blocked by a strong oil and gas lobby. Indeed, firms wholly focused on fossil fuel production, like Ørsted, pivoted to invest in renewables.

The Denmark case shows that civic and norm entrepreneur engagement with phase-out policy unfolding in particular political-economic circumstances facilitated the adoption of oil production phase out policy. Is this constellation of ban-supportive conditions replicable in other oil-producing jurisdictions? Diverse civil society movements calling for oil bans, supported by experienced IOs, are growing globally and are connecting with norm entrepreneurs who provide legitimacy to their domestically-resonant justifications for phase-out. Yet Denmark is perhaps uniquely positioned to phase out oil production thanks to its particular historical experience with transitioning to wind energy: a non-oil-dependent economic path was already evident and credible, not speculative. Also, the pro-oil lobby in Denmark was relatively weak or easily appeased, and major oil firms had already decided to pivot to renewable energy. Other oil-producing states may not yet share these advantages. Denmark’s trajectory is instructive in underscoring the importance of 1) analyzing and raising public awareness about the fate of the oil sector, particularly in light of the imminent decline in global oil demand (Dusyk et al., 2023); and the impact of these trends on public revenue and jobs; 2) developing non-oil sectors that can credibly replace the revenue and jobs from oil; 3) reducing or overcoming the entrenched power of oil proponents (aided by the rise of a competing non-oil sector). Denmark’s experience is therefore helpful in directing attention to where policy action should be focused to further amplify phase-out initiatives.

Table 2.2. List of interviewees

Interviewee code	Primary affiliation
1	Academic researcher
2	Environmental non-governmental organization (ENGO) representative
3	Climate advisor
4	Labour union representative
5	Business association representative
6	Business association representative
7	ENGO representative
8	Parliamentary advisor
9	ENGO representative
10	Political advisor
11	Political advisor
12	Industry policy director
13	ENGO representative
14	Academic researcher & activist
15	Parliamentary advisor
16	Appointed political representative
17	Trade organization representative

Paper 2: Electrifying transportation to accelerate a global oil phase-out? Contradictions and potential from Norway and Canada

The following manuscript has been accepted with revisions by Energy Research & Social Science.

3.1 Abstract

This article examines how demand- and supply-side climate policies interact through a comparative analysis of vehicle electrification in two major oil-producing states, Norway and Canada. While electric vehicle (EV) policies are increasingly presented as evidence of climate leadership, they primarily target fossil fuel consumption rather than production. Drawing on a framework centred on institutions, interests, and ideas, the article investigates whether ambitious vehicle electrification policies contribute to broader fossil fuel phase-out in major fossil fuel-producing states.

Using document analysis and semi-structured interviews, the study examines how transportation electrification interacts with ongoing oil production in two high-income oil-exporting economies. The findings show that EV policies can substantially reduce domestic transportation emissions and fossil fuel demand while coexisting with continued fossil fuel extraction and expanded exports. In both Norway and Canada, territorial emissions accounting frameworks, export-oriented production models, and dominant narratives surrounding energy security and economic stability help insulate supply-side interests from domestic decarbonization pressures.

The article argues that demand-side climate policies alone cannot achieve durable decarbonization in export-oriented fossil fuel economies. Rather than undermining supply-side climate action, transportation electrification remains essential to climate mitigation. However, meaningful fossil fuel phase-out and long-term climate and economic security require mutually reinforcing demand- and supply-side climate policies operating in parallel.

3.2 Introduction

Electrifying transportation has become a key pillar of national climate strategies to align domestic greenhouse gas (GHG) emissions reductions with the Paris Agreement's objective of limiting global warming to 1.5°C. In particular, zero-emission vehicle⁵ (ZEV) mandates, consumer subsidies, and investments in charging infrastructure are widely promoted as the most effective climate instruments for mitigating transport-related emissions (International Energy Agency [IEA], 2024, 2025a; Smith, 2022). By accelerating the diffusion of electric vehicles (EVs), these measures aim to displace fossil fuel-dependent internal combustion engine vehicles (ICEVs), thereby reducing road-transport emissions such as carbon dioxide (CO₂), nitrogen oxides, and particulate matter.

As EV adoption accelerates globally (IEA, 2026a), vehicle electrification has increasingly been framed as evidence of national climate ambition and leadership (Bosse, 2025; Climate Change Performance Index [CCPI], 2025; Jaeger, 2025; Lempp, 2025).⁶ Yet growing scholarship argues that such demand-

⁵ Zero-emission vehicles are those that produce no tailpipe emissions while in operation. ZEVs include: battery electric vehicles (BEVs), plug-in hybrid electric vehicles, and hydrogen fuel cell vehicles.

⁶ Countries identified as having the highest percentage share of passenger EV sales (Jaeger, 2025) also rank some of the highest in terms of climate performance, with explicit reference in most cases to EV policies driving the country's ranking (CCPI, 2026).

side climate policies alone are insufficient to achieve emissions reductions at the pace and scale required to meet international climate targets (Gaulin & Le Billon, 2020; Lazarus et al., 2015; Muttitt, 2025; Muttitt et al., 2016; Welsby et al., 2021). Alongside reducing fossil fuel demand, deep decarbonization also requires supply-side climate policies that constrain fossil fuel exploration, extraction, and production—a shift increasingly described as the need to use “both sides of the climate policy scissors” simultaneously (Green & Denniss, 2018; Prest, 2022). Without parallel supply-side action, reductions in domestic fossil fuel consumption may coexist with continued—or expanded—production for export markets.

Despite the developing consensus that both sides of the scissors must be used to cut emissions, relatively little is known about how such demand-side climate measures interact with the political and economic dynamics of supply-side policies—particularly in countries that remain major fossil fuel producers. In oil-exporting economies, declining domestic demand for oil due to electrification could, in principle, either weaken political support for continued extraction or, alternatively, encourage export-oriented production strategies. Which of these dynamics prevails, how and why, remains empirically underexplored.

This article addresses this gap by comparatively analyzing Norway and Canada, two high-income oil and gas-producing states pursuing ambitious vehicle electrification policies alongside continued oil expansion. Norway has achieved the world’s highest EV market share through extensive consumer incentives and infrastructure investments, while Canada has implemented federal ZEV mandates and industrial strategies to advance electrification and domestic EV manufacturing. Yet in both countries, ambitious demand-side climate policy has unfolded alongside persistent commitments to fossil fuel extraction and export.

This raises a central puzzle in the political economy of decarbonization: to what extent do strong demand-side climate policies influence, challenge, or inadvertently accommodate the continued production of fossil fuels in major petro-states? Existing theory suggests that durable emissions reductions require mutually reinforcing progress on both sides of climate policy (demand and supply), yet the empirical relationship remains unevenly understood.

Drawing on comparative political economy and qualitative analysis supported by descriptive statistical evidence on climate, energy, and transportation policy, this article demonstrates that while EV policies effectively reduce domestic fossil fuel consumption in the transportation sector, particularly in Norway, they do not necessarily weaken—and may even coexist comfortably with and be supportive of—the institutional, economic, and political foundations of continued fossil fuel extraction and sectoral interests. In both Norway and Canada, transport electrification has coexisted with continued oil expansion, underscoring the limits of relying solely on demand-side climate policy. Rather than suggesting that demand-side measures undermine supply-side action, the cases demonstrate that durable decarbonization and long-term climate and economic security require mutually reinforcing demand- and supply-side climate policies operating in parallel.

Firstly, the article outlines the conceptual foundations and analytical framework. A review of relevant literature on demand- and supply-side climate policy identifies the conceptual and empirical gap this research confronts. Subsequent sections provide background on the Norwegian and Canadian cases, followed by a comparative analysis of their EV policy instruments and their relationship to national oil production trends. The conclusion reflects on the implications of these findings for states seeking to reconcile ambitious demand-side climate initiatives with credible fossil fuel phase-out strategies.

3.3 Conceptual foundations and analytical framework

3.3.1 From demand-side climate governance to “both sides of the climate policy scissors”

For decades, climate governance has focused primarily on demand-side policies to reduce GHG emissions from goods and services. These measures include carbon pricing, emissions trading systems, and energy efficiency standards. Such policies aim to cut emissions by reducing fossil fuel demand while accelerating the adoption of lower-carbon technologies and infrastructure. Driven by the urgent need to reduce transport-related emissions, the EV transition has become a major scholarly focus as a demand-side climate measure, with a significant and rapidly growing body of research across various disciplines (for example, Brad et al., 2025; Jiang et al., 2022; Meckling & Nahm, 2021).

Despite the widespread adoption of demand-side instruments, emissions reductions have not occurred at the pace or scale required to meet the Paris Agreement’s temperature goals (IPCC, 2023; United Nations Environment Programme, 2026; Welsby et al., 2021). Fossil fuel production and consumption have continued to expand globally, supported by ongoing state subsidies, infrastructure investment, and export-oriented development strategies (Friedlingstein et al., 2026; SEI et al., 2025). In 2024, fossil fuels received about five times as much public financial support as renewables, totalling more than USD 1.2 trillion (Do et al., 2026). These trends have contributed to growing recognition that reducing fossil fuel demand alone is insufficient to achieve deep decarbonization.

In response, a growing body of scholarship has turned toward supply-side climate policy, which focuses on constraining the upstream exploration, extraction, production, and financing of fossil fuels (Erickson et al., 2018; Gaulin & Le Billon, 2020; Green & Denniss, 2018; Lazarus & van Asselt, 2018; Newell & Carter, 2024; Newell & Daley, 2024; Prest, 2022). Supply-side measures include restricting new fossil fuel licensing rounds, limiting production, removing producer subsidies, restricting fossil fuel finance, and pursuing managed decline strategies. This literature argues that durable emissions reductions require addressing both fossil fuel consumption and production simultaneously (as outlined in Table 3).

Green and Denniss (2018) conceptualize this dual approach as “cutting with both sides of the climate policy scissors.” The metaphor captures the argument that demand- and supply-side climate policies are most effective when pursued in parallel (Prest, 2022). Demand-side measures help reduce fossil fuel consumption and create conditions for technological substitution, while supply-side measures constrain continued fossil fuel expansion and reduce the risks of carbon lock-in, leakage, and emissions displacement. “Enabling substitution” refers to policies that facilitate the replacement of fossil fuel-dependent systems with lower-carbon alternatives, such as EVs replacing ICEVs or renewable electricity replacing fossil fuel generation. A range of actors pursue these policies, including states, firms, international organizations, and social movements, though governments remain central in shaping both the demand- and supply-sides of climate governance.

Table 3.1. Examples of fossil fuel demand- and supply-side climate policies

	DEMAND-SIDE		SUPPLY-SIDE	
	RESTRICTIVE	ENABLING SUBSTITUTION	RESTRICTIVE	ENABLING SUBSTITUTION

REGULATION & POLICY APPROACHES	CO ₂ emissions standards	Low-carbon infrastructure development	Production/export quotas	Grant leases for renewable development
	Codes, emissions standards & labelling		Stop resource development (bans/moratoriums)	Support resource development & related infrastructure
	Restrict finance		Stop certain technologies (i.e., fracking)	
			End leases of land & water	
ECONOMIC INSTRUMENTS			Halt infrastructure development (i.e., pipelines)	
			Environment impact assessments	
	Carbon and fuel use taxes	Offsets or credits	Reduce/eliminate fossil fuel subsidies	Subsidies for low-carbon R&D
	Cap & trade system	Subsidies (renewable energy & technologies)	Stop funding for production & expansion (by bank & credit agencies, etc.)	Invest in renewable energy technologies (i.e., long-term contracts)
	Carbon border adjustment mechanisms	Consumer subsidies (low-carbon/energy-efficient alternatives)	Tax emissions, production, export, & capital	Low-carbon infrastructure development
	Subsidies		Offsets or provisions to resource owners to not develop	
LEGAL & DIRECT-ACTION MEASURES			Cap & trade system for production & associated emissions	
	Protests, blockades, physical interferences	Investment towards low-carbon projects & technology development	Divestment from fossil fuel-related activities	Investment towards low-carbon project development
	Emissions reports		Extraction-based emissions reporting	
	Emissions standards		Protests, blockade, physical interferences	
			Legal contestations	

Adopted from: Gaulin & Le Billon, 2020; Green & Denniss, 2018; Lazarus & van Asselt, 2018; Newell & Carter, 2024

This growing emphasis on supply-side climate governance has increasingly extended beyond academic literature into international climate institutions and conferences. Most notably, the 2023 United Nations (UN) Conference of the Parties (COP28) outcome agreement called for a global “transition away” from fossil fuels. Framed by UN Climate Change Executive Secretary Simon Stiell as “the beginning of the end” of the fossil fuel era, the agreement reflected growing international recognition that meeting climate targets required not only reducing emissions from fossil fuel use, but also constraining fossil fuel production itself (United Nations Framework Convention on Climate Change [UNFCCC], 2023a, 2023b). In 2026, the First Conference on Transitioning Away from Fossil Fuels brought together 57 countries⁷ to agree to develop national roadmaps away from fossil fuels and leave with new tools to overcome economic dependence on fossil fuels and address harmful subsidies and carbon-intensive trade.

⁷ The 57 participating state at the first Conference Away from Fossil Fuels represented 48 percent of global GDP, 30 percent of the world’s population, and 20 percent of global fossil fuel production (Fossil Fuel Treaty Initiative, 2026).

Recent supply-side research and resulting policy approaches are driven by insights that the economic and political institutions, interests, and ideas supporting fossil fuel production perpetuate, and even increase, fossil fuel use (Lazarus & van Asselt, 2018; Mitchell, 2013). This makes it even harder to achieve tangible climate action through demand-side approaches alone. Existing research suggests that parallel demand- and supply-side approaches may reduce emissions more effectively than either strategy alone because they improve policy credibility, minimize carbon leakage, and reinforce decarbonization pathways (Fæhn et al., 2017; Lazarus & van Asselt, 2018; Prest, 2022). Demand-side measures can reduce the political and economic costs of restricting fossil fuel production, while supply-side policies can prevent emissions reductions achieved through lower domestic consumption from being offset by expanded exports or production elsewhere. Yet, despite growing theoretical support for this paired approach, important empirical questions remain unsolved.

To date, the literature has examined how such a twofold movement occurs only in limited ways, including the timing, the order of policy operations, and the interactions between the two policy arms and their collective impact on emissions reductions (Fæhn et al., 2017; Prest, 2022). In particular, we still know relatively little about how demand- and supply-side climate policies interact politically and economically in fossil fuel-producing states. Existing scholarship has paid limited attention to the sequencing, interaction, and political feasibility of parallel climate policy approaches in economies where fossil fuel industries remain economically and politically influential.

These questions are especially important in fossil fuel-producing economies such as Norway and Canada, where oil and gas industries retain substantial political and financial influence. Green and Denniss (2018) argue that supply-side climate instruments may prove politically feasible because they target concentrated industries and can mobilize moral clarity around fossil fuel expansion. However, this argument may not travel evenly across political-economic contexts. In fossil fuel-dependent economies, powerful producer interests may constrain supply-side climate action or reshape broader decarbonization strategies to protect continued extraction (Belliveau, 2025; Oil Change International, 2023). Examining how ambitious demand-side climate policies interact with these entrenched supply-side interests, therefore, remains critical to understanding the possibilities and limits of contemporary decarbonization pathways.

3.3.2 Analytical framework and methodological approach

To examine whether transportation electrification can contribute to broader fossil fuel phase-out, this article employs a comparative political economy framework centred on institutions, interests, and ideas (3Is) (P. A. Hall, 1997; Phillips & Castle, 2022; Shearer et al., 2016; Wagner & Lima, 2024). This analytical approach builds comprehensive, multi-dimensional understandings of change (or stability) by analyzing how institutional structures, organized interests, and dominant societal ideas interact to shape outcomes. By analyzing institutions, key actors' interests, and ideas, this approach acknowledges multiple realities and offers a more complete, multidimensional understanding of policy outcomes, which can be applied effectively to transportation and environmental policy analysis (Purdon, 2015).

Institutions can reinforce established development pathways through path dependence (Pierson, 2000), while incumbent industries can mobilize economic and political power to resist transitions that threaten existing arrangements (Geels, 2014). Dominant policy paradigms further influence how political actors understand policy problems and evaluate potential solutions (P. A. Hall, 1993). These dimensions reinforce one another: institutions shape the distribution of economic and political benefits, organized interests influence policy development, and prevailing ideas legitimize or challenge established arrangements. However, political-economic relationships are not necessarily fixed. Policy interventions

can generate feedback effects, creating new constituencies and institutional commitments that strengthen support for subsequent low-carbon policies (Aklin & Urpelainen, 2013).

Recent scholarship has applied these perspectives to the relationship between climate ambition and fossil fuel production. In their comparative analysis of Norway and Canada, Harrison and Bang (2022) show how ambitious climate commitments can coexist with continued oil and gas extraction, sustained by institutional divisions, economic interests, and narratives that legitimize fossil fuel production. Janzwood et al. (Janzwood et al., Forthcoming) apply the 3Is framework to examine divergent territorial emissions and fossil fuel production policies across Canadian provinces, emphasizing the roles of federalism, economic dependence, organized interests, and political ideas. Together, these contributions demonstrate how the political-economic conditions supporting domestic emissions reductions may differ from those required to constrain fossil fuel supply.

Building on this scholarship, this article applies and extends the 3Is framework to investigate whether demand-side climate policies can reshape the political-economic conditions sustaining fossil fuel production. Specifically, it examines whether transportation electrification generates institutional changes, emerging political and economic constituencies, and shifting narratives that could create more favourable conditions for restrictive supply-side governance. Alternatively, these developments may remain concentrated within transportation decarbonization, allowing continued oil extraction to coexist with ambitious EV policies. The institutional dimension examines whether EV policies alter established climate and fossil fuel governance arrangements; the interest-based dimension considers whether electrification generates constituencies supportive of broader fossil fuel phase-out; and the ideational dimension explores whether narratives surrounding electrification challenge or reinforce the legitimacy of continued extraction. Together, these dimensions provide an analytical basis for examining both the persistence of fossil fuel dependence and the potential for demand-side climate policies to alter the political-economic conditions sustaining it.

Norway and Canada were selected as comparative cases because both are high-income, northern, fossil fuel-producing and exporting states pursuing transportation electrification, yet they differ in their institutional arrangements, political economies, and approaches to EV governance. Norway has pursued a long-standing, consumer-oriented electrification strategy supported by fiscal incentives and relatively consistent political support, whereas Canada's approach has relied more heavily on regulatory mandates, automotive industrial policy, and differentiated federal and provincial priorities. Both countries generate substantial shares of their electricity from low-carbon sources, particularly hydropower, providing relatively favourable conditions for reducing transportation emissions through electrification (CER, 2026; IEA, n.d.).

Comparative political economy scholarship provides further insight into how institutional arrangements shape the adoption and durability of climate policy. Finnegan (2022, 2023) examines how electoral institutions, political competition, and relationships between governments and organized interests influence the political feasibility of policies that impose concentrated or immediately visible costs. Meckling et al. (2022) similarly identify institutional mechanisms through which governments can manage opposition and sustain policy commitments during economic transformation. These perspectives suggest that institutional arrangements influence not only governments' capacity to advance decarbonization, but also how policy costs are negotiated, competing interests exercise influence, and political support is maintained over time. Applied to fossil fuel-producing states, they direct attention to whether the institutions supporting demand-side climate policies also facilitate

broader changes in fossil fuel governance, or instead allow domestic decarbonization and continued extraction to remain politically and institutionally separate.

The study used a qualitative comparative research design, combining documentary analysis and semi-structured interviews with descriptive statistics on transportation electrification, fossil fuel production, and emissions trajectories. The statistical evidence is used to contextualize policy developments and support comparative interpretation rather than to estimate independent causal effects. Between 2022 and 2025, more than 300 Norwegian and Canadian national and subnational policy documents, legislative materials, reports, datasets, industry publications, media sources, and academic studies were analyzed to examine transportation electrification, fossil fuel production, and their underlying political-economic dynamics. This documentary analysis also informed the identification of relevant organizations and interview participants.

Participants were selected through purposive sampling, supplemented by snowball sampling, to capture perspectives across government, industry, labour, research, and civil society. In 2025, 32 virtual and in-person semi-structured interviews were conducted with individuals possessing knowledge of or direct involvement in climate, transportation, energy, fossil fuel production, and vehicle electrification policy and politics. Interviews explored how these policies developed and evolved, with particular attention to the institutions, interests, and ideas shaping the relationship between demand- and supply-side climate governance. Participants are identified by interview codes and broad institutional roles to preserve anonymity (Table 2).

Interview evidence was examined alongside documentary sources to identify recurring themes, differences in perspectives, and areas of convergence or disagreement. The comparative analysis is organized around the three dimensions of the analytical framework, examining how institutional arrangements, competing interests, and dominant narratives shape the relationship between transportation electrification and continued fossil fuel production. Policy developments following the 2025 interviews are assessed through subsequent documentary evidence rather than attributed retrospectively to interview participants.

Table 3.2. List of interviewees

Interviewee code	Role
CAN1	Distinguished academic in Canadian political economy
CAN2	Lead representative of a national ENGO
CAN3	Senior policy advisor at a prominent non-profit think tank
CAN4	Primary researcher of a national labour union
CAN5	Provincial political actor
CAN6	Senior representative at a Canadian business association
CAN7	Senior manager and policy advisor in climate solutions at a Canadian ENGO
CAN8	Senior researcher for a Canadian ENGO
CAN9	Political advisor on international affairs for a provincial government
CAN10	Senior advisor on climate change and energy transition for a provincial government
CAN11	Economic analyst for the Government of Canada
CAN12	Leading academic researcher in Political Science
CAN13	Provincial political actor
NOR1	Representative for the Norwegian Ministry of Climate and Environment
NOR2	Sustainability lead for the City of Bergen
NOR3	Head of research for a national science organization

NOR4	Political actor
NOR5	Academic in urban and regional planning
NOR6	Distinguished academic in energy and environment
NOR7	Political scientist
NOR8	Representative for the Norwegian Electric Vehicle Association
NOR9	Researcher at a national ENGO
NOR10	Manager at a national consumer organization
NOR11	Research leader at a national research institute
NOR13	Civil society representative and activist
NOR14	Researcher in Norwegian transportation
NOR15	Advisor in transportation at a leading national ENGO
NOR16	Representative from national oil and gas industry
NOR17	Primary researcher at a national labour organization
NOR18	Environmentalist and researcher
NOR19	Norwegian public official at the Norwegian Ministry of Transport

3.4 National climate, transportation, and oil production contexts

The following section briefly outlines the climate, transportation, and fossil fuel production contexts in Norway and Canada before turning to a comparative political economy analysis of how institutions, interests, and ideas shape the relationship between vehicle electrification and continued oil production. Table 5 below summarizes EV governance in Norway and Canada.

Table 3.3. EV governance in Norway and Canada

Policy Dimension	Norway	Canada (Trudeau-era Framework, ~2019-2025)	Canada (Carney-era Revisions, 2025-2026)
Primary climate objective	Reduce domestic transportation emissions through rapid electrification (Norwegian Ministry of Climate and Environment, 2021)	Reduce transportation emissions while accelerating EV adoption and domestic manufacturing	Maintain transportation decarbonization while increasing policy flexibility and protecting industrial competitiveness (Employment and Social Development Canada, 2026)
Broader political-economic objective	Decarbonize domestic transport while maintaining fossil fuel exports and revenues (Norwegian Ministry of Climate and Environment, 2021; Solsvik & Buli, 2026)	Position Canada as both a climate leader and North American EV manufacturing hub (Environment and Climate Change Canada, 2022)	Balance decarbonization, affordability, trade pressures, and industrial competitiveness amid economic and geopolitical uncertainty (Department of Finance Canada, 2025)
Core governance approach	Stable, long-term consumer-oriented demand-side transition (Norsk elbilforening, 2024)	Regulatory and industrial demand-side transition (Environment and Climate Change Canada, 2023b)	Flexible emissions-based transition emphasizing industrial adaption (Prime Minister of Canada, 2026c)
National EV/ZEV target	100% of new passenger vehicle sales to be zero-emissions by 2025 (Ministry of Transport [Samferdselsdepartementet],	100% of new light-duty vehicle sales to be ZEVs by 2035, with interim mandates (Environment and Climate Change Canada, 2023b)	Original EV mandate paused/revised; new emissions-based standards intended to achieve equivalent of ~75% EV adoption by 2035 and 90% by 2040 (Employment and Social

	2024; Norsk elbilforening, 2024)		Development Canada, 2026; Transport Canada, 2026a)
Regulatory strategy	Strong and stable EV incentives with long-term policy continuity (Aasness & Odeck, 2015; Figenbaum, 2017; Norsk elbilforening, 2024)	EV Availability Standard (EVAS) requiring increasing annual ZEV sales targets (Environment and Climate Change Canada, 2023b)	EVAS paused and later repealed/replaced with emissions-intensity standards and regulatory flexibility (Transport Canada, 2025, 2026a)
Consumer purchase incentives	Extensive and long-standing tax exemptions and incentives since the 1990s (Norsk elbilforening, 2024)	Federal iZEV rebates up to CAD \$5,000 (Transport Canada, 2026b)	Rebates reinstated through new CAD \$2.3 billion affordability program; incentives phased downward over time (Transport Canada, 2026a)
Taxation approach	Heavy taxation of ICE vehicles combined with EV exemptions creates strong cost advantage (Figenbaum, 2017; Norsk elbilforening, 2024)	Purchase subsidies and ZEV sales regulations, with limited emissions-based taxation of ICEVs (Canada Revenue Agency, 2026; Environment and Climate Change Canada, 2023c)	Continued reliance on targeted EV purchase incentives and strengthened vehicle emissions standards, rather than broad, emissions-differentiated taxation of ICEV purchases (Transport Canada, 2026a)
Charging infrastructure strategy	Extensive nationwide fast-charging network, supported by early public investment and increasingly market-driven deployment, with national measures to improve accessibility and interoperability (Ministry of Transport, 2023; Ministry of Transport and Communications, 2025)	Federal funding for charging infrastructure through ZEVIP and Canada Infrastructure Bank financing, supporting public, residential, workplace, and fleet charging deployment (Natural Resources Canada, 2023, 2025b)	Expanded charging infrastructure financing through a proposed national strategy and \$1.5 billion Canada Infrastructure Bank initiative, integrated with a broader automotive industrial strategy (Innovation, Science and Economic Development Canada, 2026; Natural Resources Canada, 2026a, 2026b)
Role of industrial policy	EV adoption driven primarily by consumer-oriented fiscal policies rather than protection of domestic automotive manufacturing, alongside emerging battery-industry ambitions (Adomaitis, 2025b; Ministry of Industry, 2022; Norwegian Board of Technology [Teknologirådet], 2022)	Proactive industrial policy to attract EV and battery manufacturing investment, develop domestic critical mineral supply chains, and strengthen automotive competitiveness (Giswold, 2023; Ministry of Energy and Natural Resources, 2024)	Greater emphasis on protecting and transforming domestic automotive manufacturing, securing investment and employment, and strengthening supply chain resilience amid US tariffs and trade uncertainty (Employment and Social Development Canada, 2026; Innovation, Science and Economic Development Canada, 2026)
Trade and geopolitical dimensions	EV deployment primarily oriented toward domestic adoption, with comparatively limited trade protection measures targeting imported EVs (Adomaitis, 2025a; Ministry of Transport and Communications, 2025)	Increasing alignment with North American automotive trade priorities, including a 100 percent surtax on Chinese-made EVs to protect domestic manufacturing and emerging battery supply chains (Department of Finance Canada, 2024; Global Affairs Canada, 2025)	Great emphasis on trade diversification, and industrial resilience amid US tariffs, including selective reopening to Chinese EV imports through tariff-rate quota arrangements (Prime Minister of Canada, 2026b)

Relationship to fossil fuel production	Rapid domestic electrification alongside continued offshore oil and gas exploration, licensing, and export-oriented production (Ministry of Energy, 2026; Office of the Prime Minister, 2026)	Transportation electrification alongside growing oil production and federally supported oil export infrastructure (Canada Energy Regulator, 2026b)	Continued support for fossil fuel export expansion, increasingly framed through energy security and trade diversification, alongside more flexible EV regulation (Innovation, Science and Economic Development Canada, 2026; Prime Minister of Canada, 2026d, 2026a; Privy Council Office, 2026)
Treatment of exported emissions (Scope 3)	Territorial accounting excludes downstream emissions from exported oil and gas; national climate targets focus on emissions occurring within Norway (Norwegian Environmental Agency, 2026)	Territorial climate targets account for domestic fossil fuel production emissions but exclude combustion emissions from exported fuels (Environment and Climate Change Canada, 2020)	Continued territorial accounting under UNFCCC rules; exported fossil fuel combustion emissions remain outside of national emissions targets (Canadian Centre for Energy Information, 2026)
Political durability of EV policy	Broad parliamentary support and long-standing institutionalization of EV incentives, with gradual adjustments as adoption matures (Figenbaum, 2024; Ministry of Finance, 2025)	Increasing institutionalization through binding ZEV sales regulations extending to 2035, although long-term political durability remained uncertain (Environment and Climate Change Canada, 2023b)	Regulatory recalibration amid trade and industrial pressures, including replacing mandatory ZEV sales targets with more flexible emissions standards (Employment and Social Development Canada, 2026; Government of Canada, 2026b; Innovation, Science and Economic Development Canada, 2026)
Dominant political narrative	EV and climate leadership alongside responsible oil production and European energy security (Kumpu, 2025; Ministry of Transport and Communications, 2025; Office of the Prime Minister, 2025)	Climate action and clean economic growth through EV adoption, battery supply chains, and automotive modernization (Department of Finance Canada, 2023; Environment and Climate Change Canada, 2023c)	Affordability, industrial competitiveness, trade resilience, and economic sovereignty increasingly foregrounded alongside decarbonization (Employment and Social Development Canada, 2026; Innovation, Science and Economic Development Canada, 2026)
Key political economy dynamic	Institutionalized electrification coexists with entrenched petro-interests, allowing demand-side progress without equivalent supply-side restrictions (Harrison & Bang, 2022; <i>Paradoxes of Norway's Energy Transition</i> , n.d.; Rahman et al., 2026)	EV industrial policy advances alongside continued fossil fuel development, with competing industrial and regional interests complicating demand-supply integration (Canada, 2023)	EV governance increasingly shaped by industrial competitiveness, affordability, and trade pressures, while fossil fuel development remains a separate policy priority (Employment and Social Development Canada, 2026; Innovation, Science and Economic Development Canada, 2026)
Major implications	Demonstrates that ambitious demand-side decarbonization can coexist with continued	Illustrates the challenges of aligning ambitious transportation electrification	Underscores the political contingency of demand-side climate governance, as

for climate governance	fossil fuel production and expansion, highlighting the limits of electrification without explicit supply-side governance (Rahman et al., 2026)	and green industrial policy with continued fossil fuel dependence and competing regional and industrial interests (Canada, 2023)	regulatory commitments are recalibrated in response to industrial, affordability, and geopolitical pressures while fossil fuel supply remains a separate policy priority (Prime Minister of Canada, 2025, 2026c)
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Source: In addition to the policies and documents cited, Table 5 is compiled from the author’s synthesis of speeches and interviews

3.4.1 Norway’s ‘low-carbon’ economy

Norway has positioned itself as an international climate leader while remaining one of the world’s largest oil and gas exporters (CCPI, 2025). Under its enhanced nationally determined contributions, Norway committed to reducing GHG emissions by at least 70-75 percent below 1990 levels by 2035 (Climate Change Act [Lov Om Klimamål (Klimaloven)], 2025; UNFCCC, 2025). Although Norway has no national net-zero emissions commitment by 2050, it has commitments and frameworks that support an economy-wide transition to a “low-emissions society” by 2050 (UNFCCC, 2022). Norway has directed considerable policy attention toward reducing transportation emissions as part of its legally established goal of becoming a low-emissions society by 2050. Nevertheless, transport remained a leading source of emissions in 2023, accounting for 37 percent of Norway’s energy-related CO₂ emissions (IEA, 2026b). Road transportation alone accounted for approximately 16.8 percent of Norway’s total domestic greenhouse-gas emissions in 2024, producing 7.5 million tonnes of CO₂-equivalent (Statistics Norway, 2026). 45 shows emissions reduction targets relative to actual emissions.

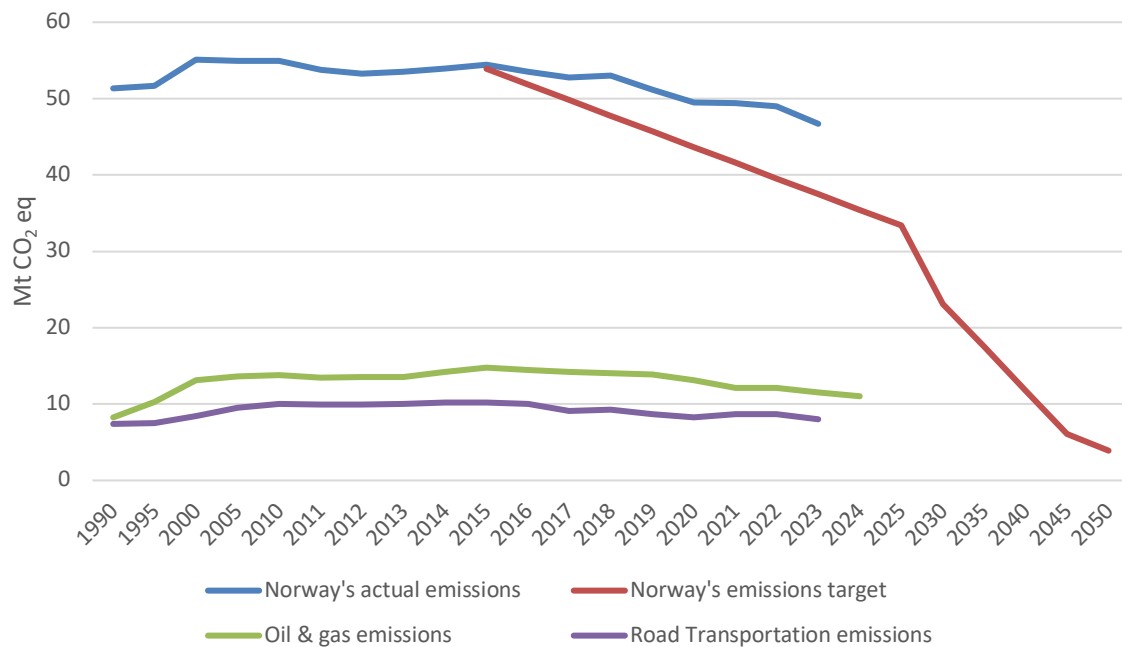
Against the backdrop of decarbonizing road transportation as a central component of Norway’s domestic climate strategy, Norway has become a prominent leader in vehicle electrification. Extensive consumer incentives, exemptions from purchase taxes and the value-added tax (VAT), road toll exemptions, preferential parking, and substantial investments in charging infrastructure have accelerated EV adoption across the passenger vehicle fleet. By 2024, BEVs accounted for the vast majority of new passenger vehicle sales (Norwegian Electric Vehicle Association, 2025). Norway’s largely hydroelectric power system has also enabled transportation electrification, generating visible territorial emissions reductions in the domestic transport sector.

Additionally, emissions from oil and gas extraction remain significant in Norway’s broader emissions profile; they are the country’s largest single emissions source (Rønning, 2025; Statistics Norway, 2026). In 2024, oil and gas extraction generated approximately 11.0 million tonnes of CO₂-equivalent (about 24.7 percent of Norway’s total domestic GHG emissions) (Statistics Norway, 2026). In the same year, fugitive emissions from oil and gas activities, including flaring, venting, and methane leakage, accounted for about 4 percent of Norway’s national GHG emissions and 6 percent of emissions within the energy sector (Rønning, 2025). Although fugitive emissions have declined since 1990, partly due to flaring taxes and technical mitigation measures, oil and gas extraction continues to play a central, and emissions-intensive, role in Norway’s economy.

Despite reducing domestic oil demand through transportation electrification, Norway has not pursued a corresponding supply-side transition (Solsvik & Buli, 2026). Petroleum production reached about 240 million standard cubic metres of oil equivalent in 2024, the country’s highest level since 2009, and gas

production also hit a record high (Norwegian Offshore Directorate, 2025). Petroleum revenues remain central to state finances and export earnings, while recent industry investment forecasts project continued high levels of offshore oil and gas development over the coming decade. In light of this, the government has continued to expand exploration acreage and award new production licences to sustain production beyond 2030 (Ministry of Energy, 2025), illustrating how demand-side decarbonization can coexist with continued fossil fuel expansion.

Figure 3.1. Norway GHG target trajectories (2015-2050) and total emissions with indirect CO₂ and without Land Use, Land-Use Change, and Forestry (LULUCF) (1990-2024)



Source: Climate Change Act [Lov Om Klimamål (Klimaloven)], 2025; Norwegian Climate Foundation, 2025; Norwegian Petroleum, 2025; Rønning, 2025; UNFCCC, 2025

Importantly, the relatively stable profile of Norway's oil and gas emissions shown in Figure 4 does not capture the substantially larger downstream emissions generated through the combustion of exported Norwegian oil and gas abroad. Under UNFCCC territorial emissions accounting rules, countries report emissions produced within their national borders rather than emissions associated with the end use of exported fossil fuels (UNFCCC, 2018). As a result, the emissions generated when Norwegian-produced oil and gas are combusted internationally are attributed to consuming countries rather than to Norway itself.

This accounting framework is significant in the Norwegian context because the vast majority of the country's petroleum production is exported (Norwegian Petroleum, 2026a). Consequently, Norway can achieve measurable reductions in domestic territorial emissions—including through transportation electrification—while continuing to produce and export large volumes of fossil fuels whose downstream combustion contributes substantially to global GHG emissions. Similar dynamics are present in Canada and other fossil fuel-exporting states, where standard emissions accounting practices can make national decarbonization progress appear more substantial despite continued contributions to global fossil fuel supply.

3.4.2 Canada's 'net-zero' future

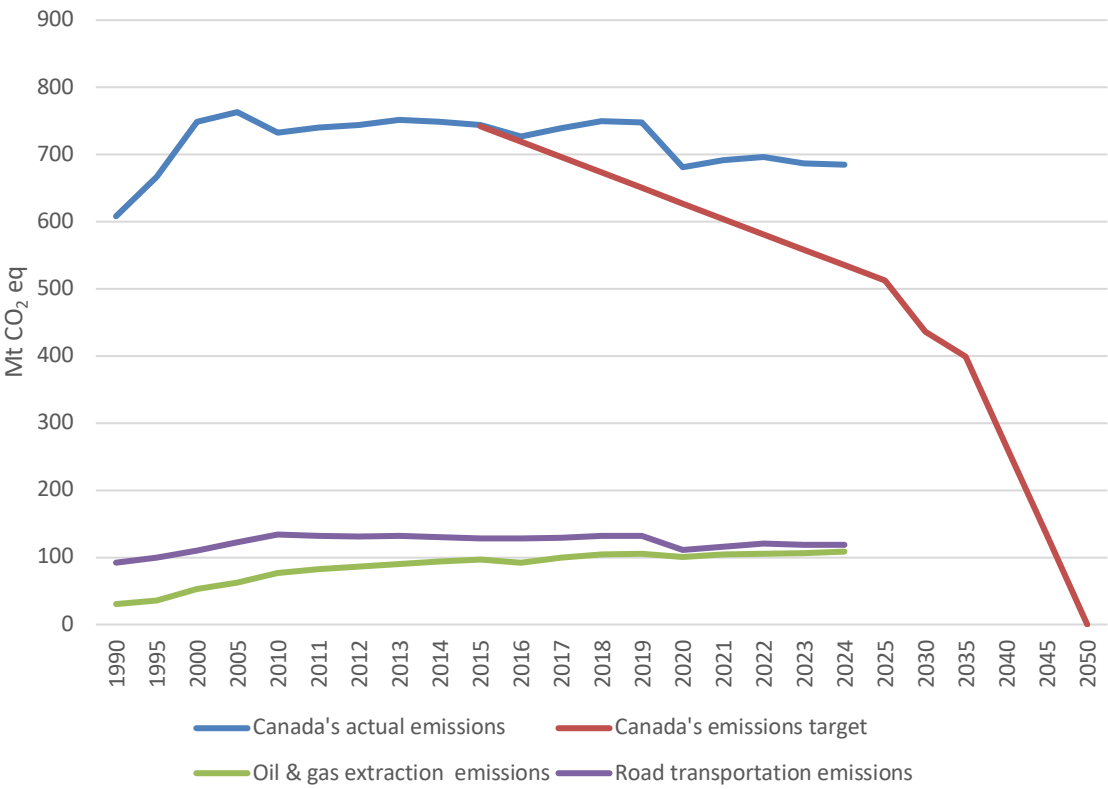
Canada similarly combines ambitious climate commitments and transportation electrification initiatives with continued reliance on fossil fuels for production and exports. Under the Paris Agreement, Canada committed to reducing GHG emissions by 40–45 percent below 2005 levels by 2030 and to achieving net-zero emissions by 2050 (Government of Canada, 2025b). Transportation remains the country's second-largest source of emissions, accounting for approximately one-quarter of national GHG emissions (ECCC, 2025). Passenger road transportation is a major component of Canadian oil demand. In 2023, motor gasoline (the primary fuel used by on-road passenger vehicles) accounted for 32 percent of Canada's total petroleum and other-liquid consumption (CER, 2023; EIA, 2024). Figure 5 compares Canada's emissions-reduction targets with actual emissions trends in oil and gas and road transportation sectors.

In response to Canada's high road-related emissions, federal and provincial governments have introduced a range of transportation electrification measures. These include federal purchase incentives for ZEVs, investments in charging infrastructure, and industrial subsidies supporting EV and battery manufacturing. Provinces such as Québec and British Columbia have also implemented complementary mandates and incentive programs. Transportation electrification has consequently become a major pillar of Canada's climate policy and industrial strategy.

At the same time, Canada remains a major producer and exporter of oil and natural gas (Natural Resources Canada, 2024, 2025a). Oil production is concentrated heavily in Alberta's oil sands sector, which represents one of the world's largest proven crude oil reserves. The oil and gas sector continues to contribute significantly to exports, government revenues (Statistics Canada, 2026), and regional economies, particularly in western Canada.

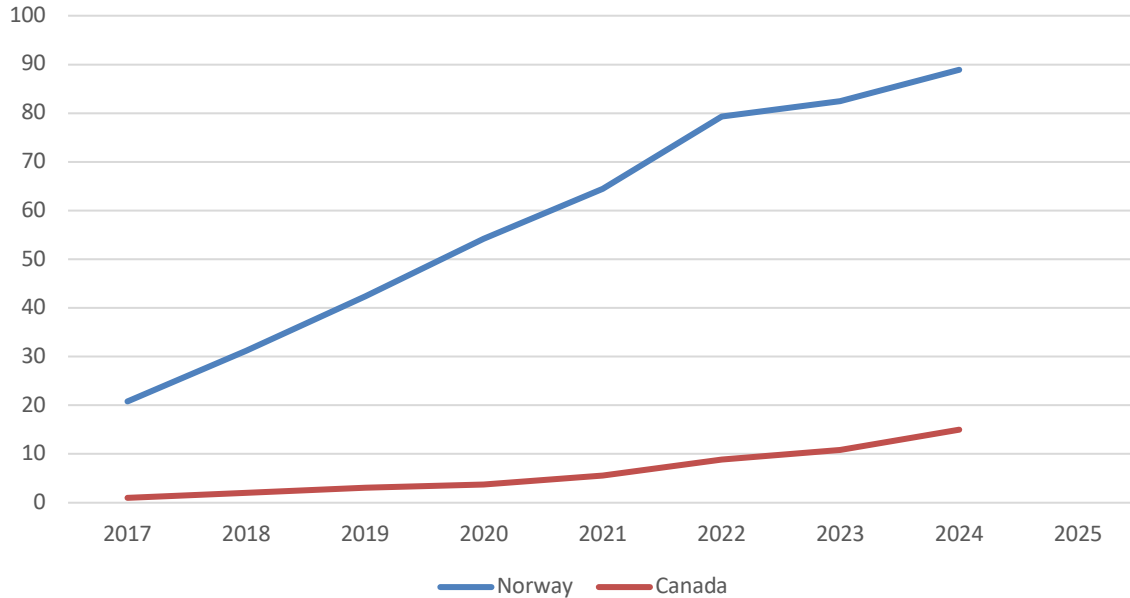
As in Norway, Canada reports emissions under UNFCCC territorial accounting rules, which include emissions produced domestically but exclude downstream emissions generated through the combustion of exported fossil fuels abroad. Because a substantial share of Canadian oil and gas production is exported, emissions associated with the end use of these fuels are counted in importing countries rather than within Canada's domestic inventory. As a result, domestic emissions reductions achieved through transportation electrification and other climate measures may coexist with continued growth in fossil fuel exports and the associated downstream global emissions.

Figure 3.2. Canada GHG target trajectories (2015-2050) and total emissions with indirect CO₂ and without LULUCF (1990-2024)



Source: (Government of Canada, 2020, 2026a)

Figure 3.3. Market shares of electric passenger vehicles in Norway and Canada



Source: (Norwegian Electric Car Association, 2023; Statistics Canada, 2022; Transport Canada, 2024)

As shown in Figure 6, Norway's EV transition accelerated substantially earlier and more rapidly than Canada's. By the early 2020s, BEVs represented the dominant share of new passenger vehicle sales in Norway, whereas EV adoption in Canada remained substantially lower and more regionally uneven. These divergent electrification trajectories emerged despite both countries pursuing national climate targets while continuing to produce oil and gas. The following section examines these dynamics through a comparative political economy analysis centred on institutions, interests, and ideas.

3.5 Parallel decarbonization and fossil fuel expansion

3.5.1 Institutions: Electrification within fossil fuel political economies

The Norwegian and Canadian cases demonstrate how institutional structures shape the relationship between transportation electrification and fossil fuel production differently across political-economic contexts. In both countries, vehicle electrification policies operate within broader institutional arrangements that continue to support oil and gas extraction.

Norway's EV transition was enabled through a highly coordinated and durable policy architecture that combined fiscal incentives, infrastructure deployment, and long-term political consistency. Beginning in the 1990s and expanding substantially over the 2000s and 2010s, Norway introduced exemptions from purchase taxes and VAT for EVs, reduced road tolls and ferry fees, preferential parking access, and large-scale investments in charging infrastructure. Together, these measures significantly reduced the relative cost and inconvenience associated with EV ownership compared to ICEVs. Importantly, many interview participants emphasized that these policies remained in place across successive governments and were supported by broad cross-party political consensus, creating long-term policy predictability that accelerated consumer adoption and market transformation.

Norway's electrification strategy also benefited from institutional conditions that reduced distributional conflict around transportation decarbonization. Extensive fossil fuel revenues enabled the state to subsidize EV adoption without imposing major visible costs on consumers. At the same time, Norway's largely hydroelectric electricity system enabled the framing of electrification as both environmentally effective and nationally advantageous (Interviewees NOR8, NOR9, NOR14). Several interviewees described EV policy as politically "low conflict" because it did not directly challenge Norway's export-oriented oil and gas economy (Interviewees NOR7, NOR8, NOR9, NOR14, NOR17, NOR19). Therefore, transportation electrification could advance rapidly while remaining institutionally separated from debates surrounding oil and gas production.

Viewed through a comparative political economy lens, Norway's experience illustrates how institutional arrangements can make ambitious climate policy politically durable when its distributional costs are limited or manageable. Sustained fiscal incentives, cross-party support, and state capacity helped reduce opposition to transportation electrification and maintain policy continuity across governments. These conditions are consistent with the institutional mechanisms identified by Finnegan (2022, 2023) and Meckling et al. (2022), particularly the importance of managing policy costs and sustaining political support. However, this institutional capacity has focused primarily on transforming domestic transportation rather than constraining oil and gas extraction. Norway's experience suggests that institutions capable of sustaining ambitious demand-side policies do not necessarily generate equivalent political commitments to supply-side restraint.

Canada's EV policy architecture has developed more unevenly across jurisdictions and over time. Federal ZEV mandates, consumer rebates, and infrastructure investments expanded substantially during the 2020s, alongside large industrial subsidies supporting battery and EV manufacturing. However, implementation remained fragmented across provincial governments, each with different economic interests, electricity systems, and climate policy priorities. Provinces such as Québec and British Columbia emerged as leaders in EV deployment through stronger mandates and incentive programs, while other provinces adopted more limited approaches or actively resisted broader climate policy expansion (Interviewees CAN5, CAN13).

Unlike Norway, Canadian EV policy has also become closely tied to industrial strategy and economic competitiveness. Federal support for battery supply chains, critical mineral extraction, and EV manufacturing has frequently been framed as not only climate policy, but also as economic modernization, employment creation, and competition with the United States (Department of Finance Canada, 2025; Employment and Social Development Canada, 2026; Service Canada, 2022). Several interviewees (CAN7, CAN10, CAN11) noted that this industrial framing helped broaden political support for electrification, but likewise reinforced the separation between transportation decarbonization and fossil fuel production policy. Electrification was frequently presented as compatible with continued oil and gas expansion rather than as part of a broader fossil fuel phase-out strategy.

Canada's experience illustrates a different institutional configuration. Federalism creates opportunities for provincial experimentation, as demonstrated by the more ambitious electrification policies adopted in Québec and British Columbia, but it also distributes authority across governments with divergent economic priorities and political commitments. These differences complicate the development of a consistent national policy framework and create opportunities for opposition to climate measures perceived as threatening established regional industries. From a comparative political economy perspective, these challenges concern not only the distribution of jurisdictional authority, but also

governments' capacity to sustain policy commitments, manage competing interests, and coordinate decarbonization across sectors. Canada's uneven electrification trajectory therefore reflects institutional constraints on policy durability and coordination, while the continued political and economic significance of petroleum production presents additional barriers to integrating demand- and supply-side climate governance.

These contrasting institutional pathways highlight a key distinction between the capacity to advance domestic decarbonization and the capacity, or political willingness, to constrain fossil fuel production. Norway's relatively durable electrification regime and Canada's more contested, regionally differentiated approach have both developed within governance arrangements that continue to accommodate oil and gas extraction. In Norway, territorial emissions accounting reinforces this separation by excluding emissions from exported fossil fuels from national inventories, while official narratives of cleaner production and energy security help sustain the legitimacy of continued extraction (The Norwegian Ministries, 2025). Despite their institutional differences, neither country's transportation electrification strategy has been systematically connected to policies requiring a managed decline in fossil fuel production.

Recent policy developments further illustrate the comparatively fragile and contested nature of Canada's EV transition. Under Prime Minister Mark Carney, the federal government paused and later reintroduced consumer EV purchase incentives while simultaneously repealing Canada's national ZEV sales mandate and replacing it with strengthened vehicle emissions standards and industrial support measures (Employment and Social Development Canada, 2026; Government of Canada, 2026b). These policy shifts did not represent a wholesale retreat from transportation electrification, but rather a recalibration of Canada's EV strategy toward industrial competitiveness, consumer affordability, and regulatory flexibility. Several interviewees emphasized that EV policy in Canada remains more politically vulnerable to changing economic conditions, regional tensions, and industry pressures than in Norway, where electrification has become more deeply institutionalized across the political spectrum (Interviewees CAN1, CAN10, CAN12, NOR5, NOR18).

Despite these institutional differences, both Norway and Canada exemplify a “mitigate at home, produce for export” model of fossil fuel governance. In each case, governments pursue territorial GHG reductions through carbon pricing, sector-specific regulation, and electrification strategies, while simultaneously maintaining—or actively enabling—oil and gas exploration, production, and export capacity. This policy configuration reflects an implicit separation between responsibility for domestic emissions and the climate consequences of exported fossil fuels, which national mitigation efforts treat as exogenous. In both cases, supply-side continuity is justified on grounds of economic stability, energy security, and the prospect of cleaner production (Global Affairs Canada, 2023; Ministry of Petroleum and Energy, 2022; Natural Resources Canada, 2022; The Norwegian Ministries, 2025), yet this coexistence generates a structural tension within climate policy: domestic decarbonization proceeds alongside sustained contributions to global fossil fuel supply, raising questions about the compatibility of demand- and supply-side climate objectives.

These institutional dynamics also shape the long-term trajectories of oil and gas production in both countries. In Norway, government projections and industry assessments continue to anticipate sustained high levels of oil and gas production over the coming years, supported by ongoing exploration, field development, and export-oriented investment strategies (Norwegian Petroleum, 2026). Similarly, CER-produced Canadian energy scenarios continued to project growth in oil and gas production across

several modelled pathways, particularly where global demand for fossil fuels remains robust (CER, 2026).

These projected production trends matter because they show that transportation electrification has not been accompanied by the expected near-term decline in fossil fuel production. Instead, electrification policies are being institutionalized alongside assumptions of continued fossil fuel extraction and export dependence. In both cases, domestic decarbonization strategies coexist with long-term planning frameworks that continue to position oil and gas production as economically and politically central.

3.5.2 Interests: Fossil fuel power and climate policy constraints

Recent supply-side climate scholarship demonstrates that incumbent fossil fuel interests shape not only whether climate action proceeds, but also the forms it takes (Carter, 2020; Lazarus & van Asselt, 2018; Slothuus, 2026a; Szeman, 2019). In export-oriented petro-states, these interests may accommodate, or even support, demand-side measures such as transportation electrification when they generate new economic opportunities without directly constraining extraction. They are considerably more likely to resist policies that threaten continued production, investment, and export revenues. This pattern is evident in both Norway and Canada, although it operates differently in each case. Norwegian oil and gas interests have largely coexisted with transportation electrification, whereas Canadian fossil fuel interests and allied political actors have more actively contested climate measures perceived to threaten the sector's long-term viability.

The persistence of fossil fuel production alongside transportation electrification also reflects how organized interests distribute political and economic power. Mildenerger (2020) shows how carbon-intensive industries can exert influence through relationships with business organizations, labour, and political parties, while Colgan et al. (2021) highlight the political conflicts around threats to the future value of fossil fuel assets. These insights help explain why support for reducing domestic oil consumption does not necessarily extend to restricting oil and gas production. The constituencies benefiting from electrification are not necessarily those bearing the costs of extraction limits, and their political priorities may differ. In Norway, this distinction is particularly important because the state and fossil fuel industry retain substantial economic interests in exports even as consumers and emerging low-carbon actors benefit from EV adoption. In Canada, the political influence of fossil fuel production is further shaped by its regional concentration and relationships with provincial governments, industry associations, and employment interests.

In Norway, EV policies generated relatively limited resistance from fossil fuel interests because electrification was not perceived as a direct threat to export-oriented oil and gas production. Several interviewees described Norwegian climate governance as characterized by a compartmentalization between domestic decarbonization and the continued extraction of fossil fuels (Interviewees NOR1, NOR3, NOR7, NOR9, NOR16). This separation reduced political conflict over transportation electrification and helped build broad political support for EV adoption.

In Canada, by contrast, fossil fuel interests have more actively contested climate policies perceived to threaten the long-term viability of oil and gas production. Industry organizations, provincial governments, and allied political actors frequently frame supply-side climate measures as threats to affordability, employment, competitiveness, and energy security. Several interviewees noted that while EV subsidies and battery investments are often supported when framed as industrial development opportunities, explicit restrictions on oil and gas production generate substantially greater political

resistance (Interviewees CAN1, CAN 4, CAN 6, CAN7). These dynamics highlight a key limitation of relying solely on demand-side climate policy. Reductions in domestic oil demand generated through transportation electrification do not necessarily weaken the political or economic foundations of fossil fuel extraction in export-oriented fossil fuel economies.

3.5.3 Ideas: Climate Leadership, Petroculture, and Fossil Fuel Legitimacy

Ideas and dominant narratives shape how people understand, justify, and politically reconcile transportation electrification and continued fossil fuel production. In fossil fuel-producing states, prevailing understandings of national prosperity, energy security, and environmental responsibility influence climate policy (Anfinsen et al., 2019; Kumpu, 2025; Ryghaug & Skjølsvold, 2023). Petrocultures scholarship demonstrates that fossil fuels are embedded in everyday practices, political identities, and understandings of economic and social development, extending their influence beyond immediate material interests (Daggett, 2018; Szeman, 2019; Wilson et al., 2017). These ideas shape whether low-carbon technologies are understood as complements to, or potential replacements for, continued fossil fuel production.

In Norway, fossil fuel production has historically been closely associated with national prosperity, public welfare, and economic security. Bang and Lahn (2020) demonstrate how the sector has been legitimized through its contribution to the welfare state, while emerging narratives concerning climate risks and the long-term economic implications of fossil fuel dependence have increasingly challenged this understanding. Nevertheless, these competing narratives have not produced corresponding restrictions on oil and gas extraction. Proponents of continued production cite the comparatively low emissions intensity of Norwegian oil and gas (Buli & Adomaitis, 2026; Rystad Energy, 2021), European energy security (Filks & Jacobsen, 2026), and the potential for Norwegian exports to displace more emissions-intensive alternatives abroad. These arguments allow ambitious domestic decarbonization policies, including transportation electrification, to coexist with continued extraction under a broader narrative of responsible climate and energy governance.

Corporate communications and sponsorships help circulate these narratives. Equinor, Norway's majority state-owned energy company, has invested in advertising, educational partnerships, and cultural and sporting sponsorships that associate the company with technological innovation and societal development. For example, its longstanding *Morgendagens helter* (Heroes of Tomorrow) program supports science education, sport, and culture (Equinor, 2023). Such activities have drawn scrutiny through discussions of *petroganda*, promotional and cultural practices that normalize fossil fuel industries (Westervelt & Taft, 2023). Klimakultur (2025) has questioned the legitimizing effects of Equinor's sponsorships, while a 2023 United Kingdom Advertising Standards Authority ruling identified misleading environmental claims in an Equinor advertisement (Advertising Standards Authority, 2023). Although these examples do not establish effects on public opinion or policy decisions, they illustrate how corporate communications can reproduce narratives of environmental responsibility and societal contribution.

In Canada, fossil fuel production is similarly embedded within narratives of economic prosperity, national development, and energy security, although these ideas are more geographically and politically contested. Carter (2020) demonstrates how oil-dependent development trajectories in Alberta, Saskatchewan, and Newfoundland and Labrador (NL) have shaped provincial political priorities and reinforced support for continued extraction. Petrocultures scholarship further highlights how oil and gas shape social practices and political identities (Wilson et al., 2017), while Daggett's (2018) concept

of *petro-masculinity* illustrates how fossil fuel systems can become associated with identity, autonomy, and political authority. Together, these perspectives help explain why resistance to fossil fuel phase-out can extend beyond immediate economic interests.

These narratives are reinforced and adapted through industry communications and public policy. In Canada's oil sands sector, the Pathways Alliance, representing six major producers, has promoted technological approaches to reduce production emissions while maintaining oil's continued role. An analysis of the alliance's communications identifies indicators of net-zero greenwashing, illustrating how climate ambition can be framed around emissions-management technologies without challenging extraction (Aronczyk et al., 2024). Similar narratives are evident in NL, where Equinor's proposed Bay du Nord development has been defended through claims concerning comparatively low production emissions, employment, and regional economic development (Executive Council of Industry, Energy and Technology, 2022; Impact Assessment Agency of Canada, 2022). Equinor's Canadian educational and community sponsorships also link the company to innovation and regional opportunity (Equinor, 2026; Equinor Canada Ltd., 2021).

These ideas also shape how transportation electrification is understood and contested within Canada's uneven political economy. EV policies have been framed as opportunities for industrial modernization, investment, and employment in automotive manufacturing and battery supply chains, particularly in Ontario and Québec. However, electrification also challenges established cultural attachments to fossil-fuelled automobility and economic arrangements built around internal combustion engine vehicle (ICEV) production. These cultural dimensions intersect with material concerns surrounding job displacement, skills transitions, and the future of domestic manufacturing. Labour organizations such as Unifor have therefore emphasized employment protections, retraining, and domestic investment in negotiations over the transition to EV production (Dupuis et al., 2026; Unifor, 2023). Such positions do not necessarily oppose electrification, but demonstrate how support for technological change depends on competing understandings of economic security and a just transition. Alongside debates over affordability, consumer choice, and government intervention, these dynamics make the political environment for transportation electrification more contested than in Norway. Yet even where electrification is framed as an industrial opportunity, it does not necessarily challenge the legitimacy of continued fossil fuel extraction.

Fossil fuel-related narratives are neither uniform nor uncontested. Emerging arguments concerning carbon risk, economic diversification, and the environmental consequences of extraction challenge established understandings of fossil fuel-dependent prosperity in both countries (Bang & Lahn, 2020; Carter, 2020). However, the emergence of competing narratives does not, in itself, ensure political support for policies restricting fossil fuel supply.

Together, these dynamics suggest that transportation electrification does not necessarily transform the ideas underpinning fossil fuel dependence. In Norway, EVs have become an established symbol of technological progress and climate leadership without displacing narratives that legitimize continued oil production. In Canada, electrification remains politically contested, while extraction remains associated with prosperity and energy security. The comparison therefore reveals an important ideational limitation of demand-side climate policy: the political normalization of low-carbon technologies does not necessarily undermine the narratives legitimizing fossil fuel production. Demand-side decarbonization and continued fossil fuel extraction may be justified through distinct, and sometimes mutually reinforcing, understandings of economic prosperity, technological progress, and climate responsibility. For transportation electrification to support a broader fossil fuel phase-out,

the ideas supporting demand-side transformation must also become politically linked to arguments for restricting production, rather than simply legitimizing continued extraction alongside domestic emissions reductions.

3.6 Discussion

The Norwegian and Canadian cases complicate the assumption that ambitious demand-side climate policies can alter conditions and lay the foundation (reshaping institutions, interests, and ideas) for more ambitious climate action, such as a broader fossil fuel phase-out. While transportation electrification can substantially reduce domestic fossil fuel consumption and transportation emissions, these reductions do not automatically translate into declining oil production in major fossil fuel-exporting economies integrated into global energy markets. In both countries, oil production remains largely oriented toward export markets rather than solely toward domestic transportation demand. As domestic oil consumption declines through electrification, production can therefore continue—or even expand—through export substitution unless explicit supply-side constraints are introduced.

The Norwegian and Canadian cases also demonstrate that the design and institutional embedding of EV policy instruments matter significantly for the durability and effectiveness of climate policy. Norway's EV policy architecture relied on long-term, stable, and highly visible consumer incentives—including VAT exemptions, registration tax exemptions, toll reductions, charging infrastructure investments, and broader transportation benefits—which collectively normalized EV adoption and reduced political resistance to electrification. These policies were layered gradually over decades and supported by a relatively broad political consensus, making electrification institutionally durable and socially embedded. Canada's EV policy framework, by contrast, has been more fragmented and politically contingent. Federal consumer incentives, ZEV mandates, and industrial subsidies accelerated EV market growth, yet these measures remained vulnerable to electoral turnover, intergovernmental conflict, shifting industrial priorities, and competing regional economic interests tied to fossil fuel production. As a result, Canada's electrification trajectory has been more uneven and politically unstable despite growing EV uptake.

These differences reveal both the strengths and limitations of demand-side climate instruments in fossil fuel-producing economies. EV incentives and mandates can accelerate the technological transition, reduce transportation emissions, stimulate industrial development, and create new political constituencies that support decarbonization. However, without supply-side constraints, such measures may coexist with continued fossil fuel expansion rather than displace it. Demand-side climate success may, under certain institutional conditions, therefore stabilize rather than disrupt fossil fuel political economies. In both Norway and Canada, transportation electrification enhanced domestic climate credibility and reduced territorial emissions while leaving the broader structures supporting fossil fuel extraction largely intact. Territorial emissions accounting frameworks, export-oriented production models, and dominant political narratives around energy security and economic stability all helped separate transportation decarbonization from questions about continued oil and gas expansion.

Together, the Norwegian and Canadian cases demonstrate that demand-side climate leadership can coexist with fossil fuel expansion, but that this coexistence is neither accidental nor neutral. It reflects deliberate political choices about whose interests are protected, which emissions count, and what forms of climate action are deemed feasible. Recognizing and confronting these dynamics is essential if electrification is to serve as a genuine pathway to decarbonization rather than a mechanism for redistributing fossil fuel consumption across borders. Reversals and recalibrations within Canada's EV

policy framework further demonstrate that demand-side climate measures remain politically contingent and unevenly institutionalized in fossil fuel-producing economies.

This dynamic is particularly important in fossil fuel-exporting economies because reductions in domestic oil demand do not necessarily diminish incentives to continue producing. As domestic transportation systems electrify, producers may increasingly orient extraction toward export markets rather than domestic consumption. This trend is reflected in production outlooks in both Canada and Norway, where official scenarios and industry projections continue to anticipate sustained or increasing oil and gas production despite accelerating domestic decarbonization efforts. Without complementary supply-side constraints, emissions reductions from electrification risk being partially offset by continued or expanded fossil fuel exports and downstream combustion elsewhere.

Yet there are also important reasons for cautious optimism. Thanks to decades of climate science, we now understand the causes of climate change more clearly than ever before. This knowledge has also strengthened our understanding of what meaningful decarbonization requires. The transition away from fossil fuels is neither a simple technological substitution nor a one-size-fits-all policy exercise. Particularly within fossil fuel-producing economies such as Norway and Canada, the pathways forward are politically and economically complex. But they are no longer mysterious. A growing body of research shows that durable climate mitigation requires moving away from fossil fuel dependence through parallel demand- and supply-side transformations.

Importantly, recent developments in supply-side climate governance offer a significant source of political and institutional optimism. Over the past decade, supply-side climate policy has evolved from a relatively marginal area of climate governance into an increasingly mainstream component of international climate discussions. This shift is evident in growing attention to fossil fuel subsidy reform, production caps, moratoriums on new exploration, managed decline strategies, and initiatives such as the Fossil Fuel Non-Proliferation Treaty and the First Conference on Transitioning Away from Fossil Fuels in 2026. Together, these developments signal that constraining fossil fuel production is increasingly viewed not as politically unimaginable, but as a necessary component of climate governance.

Importantly, emerging first movers also demonstrate that supply-side transition pathways can be built incrementally (Carter & McKenzie, 2020; Newell & Carter, 2024). Recent research highlights how governments can develop “stepping stones” toward more ambitious restrictions on fossil fuel exploration, extraction, and production through measures such as ending new licensing rounds, reforming subsidies, restricting finance, or introducing partial moratoriums (McKenzie & Carter, 2021; Slothuus, 2026b). These policies may seem politically difficult in fossil fuel-dependent economies, yet studies increasingly show that even fossil fuel-reliant states have the institutional, technical, economic, and social capacity to begin restructuring energy systems over time (Greene & Carter, 2024).

Each national and subnational jurisdiction implementing supply-side climate measures contributes to a growing network of policy experimentation and institutional learning. In this way, climate governance evolves not through a single universal model, but through the gradual construction of multiple transition pathways adapted to different political-economic contexts. Just as demand-side EV policies diffused internationally over time, supply-side climate governance may similarly expand through cumulative policy learning, norm development (Green, 2018), and institutional emulation.

The Norwegian and Canadian cases also reinforce a third critical insight: fossil fuel dependence is not simply an economic condition. It is embedded within interconnected institutions, interests, and ideas that continually reinforce one another. Fossil fuel reliance persists not only because oil and gas generate revenue and employment, but because political institutions, infrastructure systems, industrial strategies, cultural norms, and energy-security narratives have developed around them over decades.

These dynamics operate in constant feedback loops; intervention in one area can spur broader change. Geopolitical instability affecting fossil fuel supply routes, for example, can raise energy prices and simultaneously change the economic attractiveness of renewable alternatives, shifting behavioural patterns, such as consumers pivoting from ICEVs to EVs. Concerns about affordability and energy security may strengthen and accelerate investment in electrification, renewable energy, and energy-independence strategies. Similarly, industrial investments in EV manufacturing and renewable infrastructure can gradually reshape labour markets, political coalitions, and public expectations surrounding low-carbon transitions. Changes in one domain, therefore, reverberate across the others.

This interconnectedness helps explain why transportation electrification alone cannot fully dislodge fossil fuel dependence in export-oriented fossil-fueled economies. Demand-side policies reduce fossil fuel consumption and normalize low-carbon alternatives, but without complementary supply-side measures, the institutional and political foundations of fossil fuel production may remain largely intact. Conversely, supply-side restrictions implemented without broader low-carbon alternatives and transition supports may generate political resistance and distributional conflict.

The broader lesson from Norway and Canada, then, is not that demand-side climate policy has failed, nor that supply-side climate policy is politically impossible. Rather, the cases show that durable decarbonization requires approaches that can simultaneously reshape the institutions, interests, and ideas that sustain fossil fuel dependence. Transportation electrification remains essential. But meaningful fossil fuel phase-out and long-term climate and economic security will ultimately depend on linking demand-side transitions with credible, equitable, and politically durable supply-side strategies.

3.7 Conclusion

This article examined the relationship between transportation electrification and fossil fuel production through a comparative political economy analysis of Norway and Canada. Drawing on a framework centred on institutions, interests, and ideas, the analysis explored whether ambitious demand-side climate policies contribute to broader fossil fuel phase-out in major fossil fuel-producing states. The findings demonstrate that while EV policies can effectively reduce domestic fossil fuel consumption and transportation emissions, they do not necessarily weaken the institutional, economic, or political foundations supporting continued fossil fuel extraction. In both Norway and Canada, transportation electrification advanced alongside continued commitments to oil and gas production for export markets, though through distinct political-economic pathways.

Norway institutionalized a relatively stable coexistence between domestic decarbonization and continued oil expansion, enabled by hydroelectricity, fiscal capacity, territorial emissions accounting, and broad political consensus around electrification. By contrast, Canada showed greater political fragmentation and contestation over electrification policy because of regional cleavages, pressures from industrial restructuring, and the continued influence of fossil fuel interests.

The article contributes to debates on climate governance and the political economy of decarbonization by showing that demand-side climate leadership alone cannot ensure a fossil fuel phase-out. Instead, the findings highlight the importance of examining how transportation electrification interacts with the institutions, interests, and ideas that continue to sustain fossil fuel production in export-oriented fossil fuel economies.

Ultimately, achieving durable decarbonization and long-term climate and economic security will require mutually reinforcing demand- and supply-side climate policies operating in parallel. Electrifying transportation may, therefore, reduce domestic dependence on oil without necessarily accelerating a broader transition away from fossil fuel production. In major fossil fuel-exporting economies, achieving meaningful decarbonization will depend not only on replacing fossil fuel consumption, but also on confronting the political and economic structures that continue to sustain fossil fuel extraction itself.

Paper 3: Cutting Canada's carbon binds with both arms of the climate scissors: Drawing on insights from global first movers

The following manuscript has been accepted with revisions by The Extractive Industries and Society Journal.

4.1 Abstract

Canada exhibits a structural contradiction between ambitious climate commitments and continued fossil fuel expansion. While federal climate policy increasingly advances decarbonization through electrification, emissions-reduction strategies, and clean-technology investment, oil and gas production continues to grow. This tension reflects a broader challenge facing fossil fuel-producing states: how to pursue deep decarbonization while remaining economically, politically, and institutionally tied to extraction.

This article examines that challenge through the lens of the “climate scissors,” which conceptualizes durable decarbonization as requiring simultaneous movement on two reinforcing blades: demand-side transformation and supply-side restraint. Drawing on comparative insights from Norway and Denmark, it explores how each side has advanced under conditions of fossil fuel dependence and what these cases reveal for Canada. Norway offers a leading example of durable demand-side transformation through transportation electrification, while Denmark demonstrates how explicit supply-side restraint can become politically feasible through its phase-out of future North Sea oil and gas extraction.

Using a comparative political economy framework centred on institutions, interests, and ideas, and drawing on policy and documentary analysis, descriptive quantitative data, and 50 semi-structured interviews across Canada, Norway, and Denmark, the article examines Canada as a hard case of climate policy coherence. It argues that durable decarbonization in fossil fuel-producing states requires politically viable strategies that align demand-side decarbonization with credible pathways to constrain fossil fuel production, and advances a framework for moving from carbon lock-in toward policy coherence and managed decline.

4.2 Introduction

Canada exhibits a structural contradiction between its climate commitments and its continued expansion of fossil fuel extraction. As a signatory to the 2015 Paris Agreement, Canada has committed to ambitiously reducing domestic greenhouse gas (GHG) emissions, achieving net-zero emissions by 2050 (Canadian Net-Zero Emissions Accountability Act (S.C. 2021, c. 22), 2021; Environment and Climate Change Canada, 2022). Even so, it remains one of the world's largest oil and gas producers and exporters. This contradiction is especially acute in the oil sands, whose lifecycle emissions carry a globally significant carbon toll.

Canada's predicament is best understood through the metaphor of the climate scissors: durable decarbonization requires simultaneous movement on two reinforcing blades—demand-side transformation and supply-side restraint. Recent climate governance scholarship increasingly points to the need for both (Asheim, 2013; Green & Denniss, 2018; Newell & Carter, 2024; Newell & Daley, 2024). Yet progress on advancing both blades has been uneven. Federal climate policy increasingly supports decarbonization through electrification, emissions-reduction strategies, and clean technology

investment, while policies aimed at directly constraining fossil fuel production remain limited and politically contested. The result is a dual-track and inherently contradictory model: mitigation measures at home, paired with continued production, predominantly for export.

This dualism is neither unique to Canada nor inherently incoherent. To better understand how the two sides of the climate scissors operate—and why they are so difficult to align—this article draws on comparative insights from Norway and Denmark: two high-income, developed northern democracies with strong climate targets and high capacities for transition, with significant economic ties to fossil fuel production. Both have advanced ambitious climate policy, but through different pathways. Norway represents a leading case of durable demand-side transformation through transportation electrification, while Denmark, also advancing demand-side climate policies, offers a leading example of politically feasible supply-side restraint through its phase-out of future North Sea oil and gas extraction (Greene & Carter, 2024). Each case illuminates mechanisms of political agency, coalition-building, and institutional design that enable climate ambition under conditions of resource dependence.

Building on insights from these first movers, this article shifts the analytical lens from diagnosing opportunities and constraints to identifying political pathways. Rather than treating Canada's fossil fuel dependence as an immutable structural, economic, and ideational barrier, it asks how and under what conditions Canada can simultaneously develop meaningful demand- and supply-side climate policy that endures. The core puzzle is not whether both blades are necessary—they are—but why Canada has struggled to align them in mutually reinforcing ways. Canada's quandary is, therefore, not simply a policy contradiction; it is a systemic challenge of policy coherence in which demand-side ambitions continue to unfold alongside ongoing fossil fuel expansion.

To address this puzzle, the article integrates the climate scissors framework alongside scholarship on carbon lock-in and supply-side climate governance. It then outlines the 3Is lens—institutions, interests, and ideas—to examine how fossil fuel dependence is reproduced and how it may be politically unsettled, as well as the comparative case methodology and case selection. The article then turns to Canada as a hard case: a fossil fuel-producing federal state in which deep economic reliance on oil and gas, fragmented climate and resource governance, and entrenched political and ideational support for extraction make alignment between demand- and supply-side climate policy especially difficult. It then synthesizes causal lessons from the case studies of Denmark and Norway, distilling the mechanisms by which each advanced one of the scissors' arms. Norway demonstrates how incentive-driven vehicle electrification can become politically durable when embedded within broader systems of consumer adoption, infrastructure deployment, and long-term policy stability. Denmark demonstrates how credible supply restraint can emerge through declining dependence, broad political coalition-building, and climate leadership framing.

This article asks what it would take — specifically in terms of institutional coordination, coalition-building across competing economic interests, and shifts in dominant political narratives around fossil fuel dependence and climate leadership — to sharpen both in Canada simultaneously. It concludes by examining whether, and under what political-economic conditions, demand-side transformation and alternative energy development might contribute to future supply-side restraint. The comparison also highlights the possibility that domestic decarbonization can reinforce the political separation between climate policy and export-oriented fossil fuel production, underscoring the need for deliberate institutional coordination and explicit policies governing extraction. In doing so, the article moves beyond a call to “do both” and advances a politically grounded pathway to integrate the two blades of the climate scissors in a way that enables managed decline.

4.3 Theorizing unlocking fossil fuel lock-in

Fossil fuels—coal, oil, and gas—remain the dominant driver of climate change and account for the majority of global carbon dioxide emissions. For high-income producer states such as Canada, aligning with a 1.5°C carbon budget requires not only reducing domestic fossil fuel demand but also constraining supply. A growing body of scholarship argues that substantial shares of existing fossil fuel reserves must remain unextracted to meet global temperature goals (Muttitt et al., 2016; Welsby et al., 2021). Yet climate policy has historically focused far more heavily on reducing emissions from consumption than on limiting production itself. This tension has helped catalyze renewed scholarly attention to supply-side climate policy.

Deep decarbonization in fossil fuel-producing states, therefore, requires more than scaling clean technologies; it demands political strategies capable of destabilizing entrenched systems of extraction. Green and Denniss conceptualize this dual imperative as “cutting with both sides of the scissors”: climate stability depends on reducing fossil fuel demand while simultaneously constraining fossil fuel supply (Green & Denniss, 2018). Scientific assessments reinforce this logic. The Intergovernmental Panel on Climate Change (IPCC) concludes that limiting warming to 1.5°C requires steep and sustained declines in fossil fuel use (IPCC, 2023). The global community recognized this at the United Nations Framework Convention on Climate Change’s (UNFCCC) 28th Conference of the Parties (COP28), which concluded with a historic consensus agreement explicitly calling for a transition away from fossil fuels in energy systems to achieve net-zero by 2050 (UNFCCC, 2023).

Momentum behind this shift has continued beyond COP28. At the first conference on Transitioning Away from Fossil Fuels (TAFF), in Colombia in 2026, representatives from 57 countries met to break through decades of international gridlock and begin developing pathways to phase out fossil fuel production and use. Yet despite this growing international recognition, global oil production and consumption remain inconsistent with climate stabilization pathways (SEI et al., 2025), while annual United Nations (UN) climate negotiations continue to struggle to translate ambition into clear mechanisms for phasing out fossil fuels. The disjuncture reflects not merely policy insufficiency, but structural carbon lock-in.

Carbon lock-in scholarship demonstrates how long-life infrastructure, fiscal dependence, and political coalitions embed fossil fuels within economic and governance systems (Carbon Tracker, 2011; Erickson, 2018; Erickson & Lazarus, 2015; Seto et al., 2016; Unruh, 2000, 2002). Under such conditions, demand-side policies alone—carbon pricing, electrification incentives, emissions standards—may reduce territorial emissions without altering the political economy of extraction. This is why Lazarus and van Asselt (2018) argue that supply-side climate policy is a necessary complement, targeting the upstream decisions that determine future production trajectories.

This insight has catalyzed a growing literature on supply-side climate policy. Recent research argues that production-restricting measures can directly shape expectations about the long-term viability of fossil fuel assets, altering investor behaviour and accelerating transition (Green et al., 2024; Pellegrini & Arsel, 2022). Scholarship has identified the enabling conditions under which supply-side policies—such as exploration bans and phase-out commitments—become politically feasible, including sectoral decline, coalition-building, and credible transition pathways (Carter & McKenzie, 2020; Newell et al., 2022; Newell & Carter, 2024). Comparative analysis of producer states (Harrison & Bang, 2022; Lemphers, 2019) and subnational jurisdictions (Carter, 2020; Janzwood, 2025; Janzwood et al., Forthcoming) further demonstrates that institutional design and party competition critically shape

whether supply restraint is framed as an economic threat or modernization strategy. Moreover, Greene and Carter (2024) show how Denmark’s oil phase-out became politically normalized through cross-party agreements and norm entrepreneurship, illustrating how supply-side measures can shift from symbolic to durable.

Taken together, this scholarship converges on a central insight: supply- and demand-side policies are individually necessary but politically insufficient if pursued in isolation. What remains under-theorized is how the two interact in fossil fuel-exporting states characterized by deep carbon lock-in. To address this gap, this article integrates the climate scissors framework with comparative political economy approaches using a 3Is lens—institutions, interests, and ideas (P. A. Hall, 1997; Janzwood et al., Forthcoming; Shearer et al., 2016; Wagner & Lima, 2024).

Institutions shape the structural terrain of decarbonization. In Canada, federalism divides climate authority from resource control, embedding extraction within provincial political economies. Financial regulations, leasing regimes, and export infrastructures further institutionalize production pathways. These arrangements complicate translating national emissions targets into credible supply restraint.

Interests structure political contestation. Fossil fuel firms, pipeline operators, and major financial institutions possess concentrated stakes in continued expansion, while clean technology and renewable energy constituencies remain comparatively diffuse. Upstream actors often wield disproportionate influence because supply-side policy directly threatens their assets (Belliveau, 2025). Without countervailing coalitions, demand-side progress may therefore coexist with continued production growth (Harrison & Bang, 2022; Janzwood et al., 2026).

Ideas legitimize or destabilize fossil fuel dependence. Resource nationalism, prosperity narratives, and petrocultural identities can naturalize extraction as economically indispensable. Conversely, norm entrepreneurship—such as Denmark’s promotion of anti-fossil fuel norms through international alliances—can delegitimize new exploration and shift expectations about the future of oil. Greene and Carter (2024) show that when supply restraint is framed as moral leadership and economic modernization rather than sacrifice, it can become politically normalized.

This integrated framework permits a fuller understanding of Canada’s “carbon bind” as an interaction effect across these three dimensions. The dual-track model—mitigating domestically while expanding exports—persists because institutional fragmentation, entrenched interests, and legitimizing ideas reinforce one another. Demand-side advances do not automatically erode supply-side power; in fact, they may extend production under narratives of lower emissions intensity.

4.4 Analyzing lock-in/unlocking:

To examine why Canada has struggled to align the two “blades” of the climate scissors—and under what conditions such alignment might become politically feasible—this article employs a qualitative comparative case study design supported by descriptive statistical evidence. The aim is to generate policy insights for application in Canada, a hard case of entrenched carbon dependence. Canada represents a fossil fuel-producing federal state that remains off track to meet its climate commitments, with globally significant oil sands production, pronounced regional fiscal dependence on hydrocarbons, and fragmented jurisdiction over climate and resource governance. These conditions make alignment

between demand- and supply-side climate policy especially politically difficult, while also making Canada an analytically important case through which to study pathways toward policy coherence.

The comparison is structured around institutional arrangements, organized interests, and dominant political ideas, rather than treating Denmark and Norway as directly transferable policy models. Denmark's experience of supply-side restraint emerged amid declining oil and gas dependence, a comparatively weaker fossil fuel lobby, and established alternative energy industries. Norway, by contrast, combines durable transportation electrification with a politically and economically influential fossil fuel sector oriented toward exports. Canada differs from both cases through its federal division of climate and resource authority, the concentration of fossil fuel production in particular provinces, and the substantial political and economic influence of incumbent industries. These differences matter because the conditions supporting particular policies in one jurisdiction may be absent or politically contested in another. Therefore, the comparison identifies potential mechanisms and constraints rather than assuming that institutional arrangements, political coalitions, or transition pathways can be replicated across countries.

Norway and Denmark were selected as comparative cases to inform the Canadian case. The three cases share analytically important structural characteristics. Each is a high-income, developed northern democracy embedded in the Organisation for Economic Co-operation and Development institutions and international climate governance regimes. Each is a current—or, in Denmark's case, historically significant—oil-producing state with strong economic and political ties to the sector. All three have contributed disproportionately to cumulative GHG emissions while possessing comparatively high fiscal, institutional, and technological capacity to lead in decarbonization. Equity-based carbon budget analyses suggest that, to align with a 1.5°C pathway, high-income oil producers such as these three must sharply reduce oil output this decade and approach a full phase-out shortly thereafter (Calverley & Anderson, 2022). Canada, Norway, and Denmark therefore represent cases with high responsibility and the capacity to lead the phase-out of oil.

There are, however, marked differences in how Norway and Denmark have responded to these imperatives—and it is from these differences that policy insights of relevance can be drawn and applied to Canada. Norway is examined primarily as a leading case of demand-side transformation, having built one of the world's most successful electric vehicle (EV) transitions through sustained political commitment, consumer incentives, and extensive charging infrastructure, while maintaining offshore oil and gas production. Denmark, in contrast, is examined primarily as a case of supply-side climate governance. While Denmark has made important progress on demand-side decarbonization—particularly through renewable energy expansion and broader climate planning—it is included here principally because it represents a global first mover in explicitly constraining fossil fuel supply. Its 2020 decision to end new oil and gas exploration licensing in the North Sea and commit to a long-term pathway away from extraction marked a significant departure from conventional producer-state climate policy. Denmark, therefore, offers a particularly valuable case for examining how supply-side restraint can become politically feasible in a fossil fuel-producing economy.

To analyze these cases, the research design combined systematic policy and documentary analyses, descriptive quantitative analyses, and semi-structured interviews conducted between 2021 and 2026. First, a comprehensive profile of national and subnational climate and energy policy was developed for Canada, Norway, and Denmark. For Canada, particular attention was paid to federal and provincial climate legislation, zero-emission vehicle mandates, fossil fuel regulatory frameworks, and Nationally Determined Contributions submitted under the UNFCCC. For Norway, the analysis traced the

evolution of electrification policies and fossil fuel production governance; for Denmark, it examined the 2020 decision to end new exploration licensing.

Across the three cases, more than 500 documents were compiled and analyzed, including legislation, regulatory texts, government strategy documents, parliamentary debates, industry and labour publications, civil society reports, academic scholarship, and media coverage. Documentary analysis focused on policy sequencing, institutional constraints, actor coalitions, and discursive framings surrounding supply- and demand-side measures.

Second, descriptive quantitative data was used to contextualize policy trajectories. Data was drawn from national statistical agencies and authoritative international organizations, including the IPCC, the International Energy Agency, and the International Renewable Energy Agency. This data was used to track trends in fossil fuel production, transport-sector emissions, EV uptake, renewable energy deployment, and overall emissions trajectories. Quantitative trends were overlaid with policy timelines to assess alignment—or misalignment—between decarbonization commitments and fossil fuel expansion. While this study does not employ formal energy systems modelling, descriptive statistics provide empirical grounding for the political economy analysis.

Third, semi-structured interviews were conducted with 51 experts across the three cases (11 in Canada, 23 in Norway, 17 in Denmark—See Table 6). Participants included senior and mid-level government officials, policymakers, academic researchers, civil society representatives, industry actors, and labour representatives. Interviews were conducted virtually and in person and focused on the origins and evolution of energy and climate policy, EV and transport decarbonization efforts, the political economy of fossil fuel production, federal–subnational dynamics (particularly in Canada), and perceived barriers to, and opportunities for, supply-side reform. Interviews were coded thematically, with attention to institutional constraints, coalition dynamics, policy feedback effects, and discursive framing. While interview-based research is subject to potential interviewer and social desirability bias, triangulation with documentary and quantitative sources helps mitigate these limitations and enhance robustness.

The Canadian interview sample comprised 11 participants and was intended to provide targeted insights into climate and energy policy development rather than a comprehensive or representative account of Canada's fossil fuel political economy. This distinction matters given the country's regional diversity, federal–provincial divisions, and the concentration of oil and gas production in certain provinces. The sample cannot independently establish the positions of all relevant provincial governments, Indigenous governments, upstream producers, labour organizations, or communities directly affected by extraction, but does try to capture leading experts and key voices across the national context. The analysis develops conclusions about Canada's broader institutional arrangements, economic interests, and political coalitions by combining interviews, documentary evidence, and existing scholarship, rather than inferring them from the interview sample alone. The analysis identifies and interprets political-economic dynamics and potential pathways for change, while recognizing the need for further research involving a broader range of actors and producing-region perspectives.

Table 4.1. List of interviewees

Interviewee code	Primary affiliation
CAN1-AC	Academic researcher
CAN2-ENGO	Environmental non-governmental organization (ENGO) representative
CAN3-ENGO	ENGO representative
CAN4-LO	Labour union representative

CAN5-POL	Political actor
CAN6-LO	Business association
CAN7-ENGO	ENGO representative
CAN8-ENGO	ENGO representative
CAN9-PO	Political advisor
CAN10-CSO	Civil society organization (CSO) representative
CAN11-PO	Political advisor
NOR1-LO	Business association
NOR2-AC	Academic researcher/scientist
NOR3-POL	Political actor
NOR4-AC	Academic researcher
NOR5-AC	Academic researcher
NOR6-LO	Industry representative
NOR7-AC	Research director
NOR8-POL	Policy advisor
NOR9-ENGO	ENGO representative
NOR10-AC	Academic researcher
NOR11-AC	Academic researcher
NOR12-POL	Government official
NOR13-AC	Academic researcher
NOR14-CSO	CSO representative
NOR15-AC	Academic researcher
NOR16-ENGO	ENGO representative
NOR17-AC	Academic researcher
NOR18-AC	Academic researcher
NOR19-AC	Academic researcher
NOR20-LO	Industry representative
NOR21-POL	Politician
NOR22-CSO	CSO representative
NOR23-AC	Academic researcher
DK1-AC	Academic researcher
DK2-ENGO	ENGO representative
DK3-POL	Climate advisor
DK4-LO	Labour union representative
DK5-LO	Business association representative
DK6-LO	Business association representative
DK7-ENGO	ENGO representative
DK8-POL	Parliamentary advisor
DK9-ENGO	ENGO representative
DK10-POL	Political advisor
DK11-POL	Political advisor
DK12-POL	Industry policy director
DK13-ENGO	ENGO representative
DK14-AC	Academic researcher & activist
DK15-POL	Parliamentary advisor
DK16-POL	Appointed political representative
DK17-LO	Trade organization representative

4.5 Canada's carbon lock-in

Canada bears significant responsibility for reducing emissions, particularly by phasing out fossil fuels. This responsibility to lead the transition away from fossil fuels stems from its historical emissions debt, its current status as a top global oil and gas producer, and the growing indirect emissions associated with its exports (Calverley & Anderson, 2022; Duan et al., 2020; Motlaghzadeh et al., 2025). Yet Canada represents a particularly hard case for advancing demand- and supply-side climate policy simultaneously. As a high-income liberal democracy with strong institutional capacity, abundant renewable energy resources, and formal national climate commitments aligned with the Paris

Agreement, Canada appears well positioned to lead a low-carbon transition. However, it remains off track to meet its legislated emissions targets while continuing to expand oil and gas production (Canadian Climate Institute, 2024; Environment and Climate Change Canada [ECCC], 2023). This contradiction is especially acute in the Alberta oil sands, whose lifecycle emissions are globally significant (Finkel, 2018) and increasingly central to international debates over climate responsibility and fossil fuel phase-out (Erickson, 2018).

Canada's status as a major oil producer, combined with its repeated failure to reconcile domestic climate ambition with continued upstream expansion, makes it a hard case for climate policy coherence. In this context, a hard case refers to a jurisdiction where structural, economic, political, and ideational conditions that align demand-side decarbonization with supply-side restraint are particularly hard to achieve. Canada's challenge is not simply one of policy design. Rather, it reflects deeper forms of carbon lock-in embedded across institutions, organized interests, and dominant political narratives (P. A. Hall, 1997; Janzwood et al., 2026; MacArthur, 2014; Seto et al., 2016; Unruh, 2000, 2002). These mutually reinforcing dynamics help explain why climate policy progress has advanced in some domains, such as a national EV Affordability Program (Transport Canada, 2026a), clean electricity regulations, and end-use fuel switching initiatives (i.e. heat pump programs) (Canadian Climate Institute, 2026), while remaining limited where policy directly threatens fossil fuel production (strengthening methane regulations and emissions caps for the fossil fuel sector). Prime Minister Mark Carney's Climate Competitiveness Strategy focuses "on driving investment, not on prohibitions" (Government of Canada, 2025a).

4.5.1 Institutional cleavages: Federalism and fragmented climate authority

One of the central barriers to climate policy coherence in Canada is the federation's fragmented distribution of authority. While the federal government holds important regulatory and fiscal tools over climate governance—including the *Canadian Net-Zero Emissions Accountability Act*, carbon pricing, vehicle emissions standards, and methane regulations—provinces retain significant jurisdiction over natural resources and energy development under the *Constitution Act, 1867* (Carter, 2020). This division has created persistent tension between national emissions-reduction commitments and provincial development strategies tied to continued extraction.

The result is a highly uneven climate governance landscape. Provinces such as Québec and British Columbia have advanced ambitious electrification policies and clean electricity development, seen strong EV uptake, and have abundant hydroelectricity and less dependence on upstream oil and gas revenues. By contrast, Alberta, Saskatchewan, and Newfoundland and Labrador (NL) remain more structurally tied to extraction-led growth and continue to frame oil and gas expansion as economically indispensable (Carter, 2020; Greene & Carter, Forthcoming; Harrison, 2013; Janzwood et al., Forthcoming).

These tensions remain visible in contemporary federal policy. Under Prime Minister Mark Carney, climate and energy governance has increasingly been framed through the interconnected goals of economic growth, national competitiveness, and federal cohesion. Recent federal policy has paired major investments in clean electricity, EV supply chains, battery manufacturing, and critical minerals with renewed political and financial support for oil and gas infrastructure—including carbon capture, utilization and storage (CCUS), liquid natural gas (LNG) export development, and pipeline expansion tied to national economic strategy. This orientation has become particularly significant amid renewed efforts to strengthen federal relations with Alberta, where tensions over climate policy, resource

development, and economic autonomy have intensified alongside public discussions of western alienation and separatism.

In this context, continued support for pipelines and LNG has been framed not only as economic policy but also as a national unity policy—positioned as necessary to maintain employment, secure investment, expand export capacity, and preserve cohesion within the federation. The federal emphasis on “Canada Strong” economic development reflects this broader balancing act: pursuing decarbonization while simultaneously reinforcing Canada’s position as a global energy producer. Rather than resolving the tension between climate ambition and extraction, this political strategy often manages it through accommodation. The result is an institutional landscape in which climate governance and resource governance continue to operate through partially separate—and often contradictory—policy logics.

4.5.2 Interest obstruction: Fossil fuel power and carbon lock-in

Canada’s carbon lock-in is also sustained through organized economic interests with a direct material stake in continued fossil fuel expansion (Carroll, 2021; Graham et al., 2026). The oil and gas sector remains deeply embedded in Canada’s political economy through exports, emphasis on employment, infrastructure investments, fiscal revenues, capital investment, and development strategies—particularly in Alberta, Saskatchewan, and NL. These relationships create strong incentives to maintain long-term extraction expectations even as climate commitments accelerate and projections of global oil and gas demand wane.

This dynamic is reinforced through finance. Canadian banks and financial institutions continue to direct significant capital toward pipelines, LNG terminals, offshore development, oil sands infrastructure, and related upstream expansion. Since the Paris Agreement, Canada’s major banks have remained among the world’s largest fossil fuel financiers (Banking on Climate Chaos, 2025). These investments do not merely reflect existing dependence; they actively reproduce it by embedding future extraction assumptions into infrastructure planning, employment expectations, and regional economies.

Fossil fuel incumbents have also adapted strategically within climate politics. Rather than rejecting climate policy outright, major actors increasingly advocate for climate approaches compatible with continued extraction. Organizations such as the Pathways Alliance and the Canadian Association of Petroleum Producers (CAPP) have emphasized emissions-intensity reductions, methane abatement, CCUS, and “decarbonized barrels” while continuing to defend long-term fossil fuel production (InfluenceMap, 2026; Llaverio-Pasquina et al., 2025). While such strategies may reduce emissions in some areas, they also narrow political debate around technological decarbonization rather than production decline.

This creates an uneven politics of transition: demand-side climate policies that align with competitiveness, industrial policy, or clean growth can advance politically, while supply-side measures that directly constrain extraction remain far more contested.

4.5.3 Ideational barriers: Petroculture, prosperity, and the politics of feasibility

Beyond institutions and organized interests, dominant ideas shape what is politically imaginable within Canada’s climate transition. Scholars of petroculture have shown how fossil fuels become embedded

not only in infrastructure and political economy, but also in identity, everyday life, and collective imaginaries of prosperity and national development (Carroll, 2021; Szeman, 2019; Szeman & Boyer, 2017). In Canada, oil and gas are frequently framed as central to employment, affordability, regional well-being, national sovereignty, and geopolitical relevance (CAPP, 2026; Hatch, 2021; The Quarterly: The World Needs Canadian Energy, 2025). These narratives are especially powerful in producing provinces, where extraction is often closely tied to place-based identity and economic security.

These narratives increasingly operate through climate accommodation rather than overt climate denial. Fossil fuel expansion is commonly framed as compatible with climate action through claims around “ethical oil,” emissions-intensity improvements, CCUS, and LNG exports as a transitional fuel capable of displacing coal abroad (Solomun et al., 2025). Within this framing, continued extraction is positioned not as contradictory to climate leadership, but as part of Canada’s climate solution. This framing is politically consequential because it lets demand-side climate policy advance without undermining the legitimacy of fossil fuel production. EV adoption, battery manufacturing, and clean technology investments can be framed as innovation, modernization, and economic opportunity, while avoiding more direct confrontation over the decline in oil and gas production.

Taken together, these institutional, interest-based, and ideational dynamics reinforce Canada’s broader carbon lock-in. They help explain why demand-side progress has advanced in important ways while supply-side climate policy remains politically constrained. They also clarify why Canada is such an important case for studying climate policy coherence: not because it is uniquely resistant to climate action, but because it illustrates how ambitious climate policy can coexist with continued fossil fuel expansion within a carbon-intensive political economy.

Understanding these barriers is essential before turning to comparative lessons from Norway and Denmark. If those cases illuminate how each arm of the climate scissors can advance, Canada reveals why aligning both remains politically difficult—and why unlocking that relationship requires more than policy ambition alone.

4.6 Lessons from global first movers: Policy pathways for unlocking Canada’s carbon lock-in

Comparative insights from Norway and Denmark offer an important analytical lens for considering how Canada might begin to loosen the political and structural conditions that reinforce its carbon lock-in. While neither case directly transfers to Canada, each shows how ambitious climate policy can become politically durable in a fossil fuel-producing economy. Crucially, however, they illuminate different dimensions of transition. Norway provides a leading example of successful demand-side transformation through transportation electrification, while Denmark offers a globally significant example of explicit supply-side restraint. Read together, they reveal not a singular model for decarbonization, but two distinct political pathways through which each arm of the climate scissors can advance. For Canada, they reveal what sequencing, coalition-building, policy durability, and the conditions for making climate ambition politically feasible look like.

4.6.1 Norway and the politics of durable demand-side transformation

Norway offers one of the clearest examples globally of successful demand-side decarbonization through transport electrification. Its EV transition did not emerge from a single policy intervention or

a short-term climate strategy, but from decades of cumulative policy layering that systematically made low-carbon mobility economically attractive, socially normalized, and politically durable. Beginning in the 1990s, successive governments introduced and maintained a broad package of incentives, including exemptions from purchase and registration taxes, reduced tolls and ferry fees, preferential parking access, access to bus lanes, and sustained investment in charging infrastructure (Norsk elbilforening, 2024). These policies were further reinforced by comparatively high taxes on internal combustion engine vehicles (ICEVs) and fuel, fundamentally shifting the economics of vehicle ownership.

The durability of Norway's EV transition lies not simply in the generosity of individual incentives but in the consistency with which electrification was pursued over time. Across changing governments, policy remained sufficiently stable for consumers, foreign automakers, utilities, and infrastructure providers to plan for electrification as the future of mobility. This long-term policy certainty helped create a self-reinforcing transition dynamic: growing EV adoption justified further expansion of charging infrastructure, which increased consumer confidence and vehicle uptake, further accelerating market transformation. Electrification became embedded not only in climate policy but across taxation policy, transportation planning, infrastructure development, and broader economic governance.

Norway also succeeded in making EVs the economically rational and socially normalized choice. Rather than relying on consumer environmentalism alone, policy fundamentally altered the cost-benefit calculation of ownership. EVs became practical, affordable, and increasingly mainstream. This contrasts with Canada, where federal and provincial support has expanded in recent years but has historically been more fragmented and less consistent across jurisdictions. Consumer incentives have shifted with political leadership, charging infrastructure remains unevenly distributed—particularly across rural and northern regions—and EV adoption continues to face barriers related to affordability, geography, housing form, and market access. While Canada has made meaningful progress, Norway shows how policy durability, integrated infrastructure planning, and stable economic signals can accelerate transport electrification at scale.

Yet Norway also reveals the limits of demand-side climate leadership when pursued in isolation. Despite world-leading success in vehicle electrification and declining domestic transport emissions, oil and gas production remains central to the national economy. Norway continues to expand offshore oil and gas extraction, with exports accounting for the overwhelming majority of production. Because most fossil fuels are produced for export rather than domestic consumption, reductions in domestic oil demand have not translated into equivalent supply-side constraints. Demand-side transformation has therefore coexisted with continued fossil fuel expansion.

Importantly, Norway's Government Pension Fund Global (GPF) adds another dimension to the political economy sustaining the country's fossil fuel sector. As Cleary (2016) documents, Norway's fossil fuel governance model enabled the state to retain substantial control over resource development and capture revenues for long-term public benefit. The GPF institutionalized this arrangement by converting oil and gas revenues into internationally diversified financial assets, linking the country's resource wealth to the long-term financing of public expenditure. Norway's Ministry of Finance (2026) estimates that transfers from the fund will finance approximately 27 percent of the central government budget in 2026. While this accumulated wealth provides considerable fiscal capacity to manage a transition away from oil and gas production, the fund has also become embedded in Norway's broader political and economic settlement. Its success reinforces a narrative that frames fossil fuel development as responsible resource stewardship, allowing defenders to argue that continued extraction contributes

to public welfare and intergenerational prosperity. As Ryggvik and Kristoffersen (2015) show, Norway's oil and gas wealth has been accompanied by the entrenchment of powerful political and economic interests, while scholarship on the fund's intergenerational mandate questions whether its emphasis on safeguarding financial wealth adequately accounts for the climate consequences of continued extraction.

This tension is particularly apparent in Norway's approach to international climate finance and responsible investment. Through the GPFG, Norway has expanded its involvement in renewable energy infrastructure abroad, including wind and solar investments in European markets, while pursuing climate-related shareholder engagement and investment stewardship (Norges Bank Investment Management, 2025). Yet these activities remain institutionally separate from decisions governing domestic oil and gas production. Indeed, unlisted renewable energy infrastructure accounted for only 0.1 percent of the fund's portfolio at the end of 2024, and the fund's mandate prioritizes financial returns rather than achieving national climate policy objectives. This distinction raises questions about whether Norway's international investment activities and reputation for responsible fossil fuel wealth management help sustain the political legitimacy of continued extraction, even as the country supports decarbonization elsewhere. Rather than directly driving continued production, the fund may help sustain a political-economic arrangement in which financial diversification, climate-oriented investment, and oil and gas expansion remain mutually compatible. Norway's experience illustrates a further challenge for supply-side transition: accumulated fossil fuel wealth can provide the material capacity to manage production decline without necessarily generating the political incentives to pursue it. As one interviewee noted, “Norwegians will only move away from oil and gas if they find a one-for-one replacement for the revenues oil and gas create because they won’t walk away from the wealth and lifestyle it’s created and continues to promise. Such a thing doesn’t exist” (Interviewee #4).

Norway's experience also suggests that successful domestic decarbonization may help insulate export-oriented fossil fuel production from political pressure. By reducing emissions associated with domestic transportation while preserving petroleum revenues and employment, electrification can strengthen the country's climate leadership credentials without requiring corresponding restrictions on extraction (Slothuus, 2026a). This does not establish that EV policy causes continued oil and gas production, but it demonstrates how demand-side progress can remain politically compatible with an enduring fossil fuel export strategy.

This tension makes Norway especially instructive for the Canadian case. Norway demonstrates what ambitious, durable demand-side policy can achieve when supported through stable incentives, infrastructure investment, and long-term policy alignment. At the same time, it illustrates that electrification alone does not necessarily weaken fossil fuel production systems or disrupt the broader political economy of extraction. For Canada, Norway offers both a model of successful transport decarbonization and a cautionary example of the political limits of relying on demand-side climate policy in isolation. Its central lesson is not only that demand-side transition is possible, but that without complementary supply-side measures, even highly successful electrification may leave the structural foundations of fossil fuel dependence largely intact.

4.6.2 Denmark and the politics of supply-side restraint

Where Norway provides lessons in durable demand-side transformation, Denmark offers a rare and politically significant example of supply-side climate leadership. Denmark's analytical value lies primarily in its explicit decision to constrain fossil fuel production through policy. In 2020, the Danish

Parliament adopted the North Sea Agreement, ending all future oil and gas licensing rounds and committing to phase out extraction in the North Sea by 2050 (Danish Ministry of Climate, Energy and Utilities, 2020b). In doing so, Denmark became the first major oil-producing state—and the largest oil producer in the European Union at the time—to formally commit to ending future oil and gas extraction. This decision marked a significant departure from conventional climate policy in producer states, where mitigation strategies have historically focused overwhelmingly on reducing emissions from consumption while leaving production largely untouched. Denmark demonstrates that explicit supply-side restraint can become politically feasible in a fossil fuel-producing economy—but only under particular political and economic conditions.

As Paper 1 shows, Denmark's decision to constrain North Sea extraction emerged from a convergence of political, institutional, and economic conditions rather than as a direct consequence of prior demand-side decarbonization (Greene & Carter, 2024). Declining oil and gas production and economic dependence, comparatively weaker resistance from incumbent fossil fuel interests, ambitious climate legislation, sustained civil society mobilization, and political leadership contributed to the feasibility of the North Sea Agreement. Denmark's longer history of energy transition provides important additional context. In response to the oil crises of the 1970s, Danish energy policy pursued not only reduced dependence on imported oil, but also the development of alternative energy industries and institutions (Madsen et al., 2023). Support for wind energy included policies that facilitated local and cooperative ownership, along with measures to encourage investment and the emergence of new energy producers (IRENA & Global Wind Energy Council, 2013; Johansen, 2021b). Changes in district heating, collective energy infrastructure, and energy efficiency further reshaped how energy was supplied and consumed (Johansen, 2021a, 2022). These interventions were not simply demand-side climate measures. They combined alternative energy supply development, industrial strategy, new ownership arrangements, and changes in energy consumption, showing how energy policy can restructure the interests, institutions, and ideas that govern and support an energy system. Alongside the declining economic importance of North Sea oil and gas and the comparatively limited political strength of incumbent extraction interests, Denmark's established alternative energy sector provided a credible economic context for debating a future beyond oil and gas. The Danish case highlights how changing incumbent-sector conditions, alternative economic opportunities, political mobilization, and institutional arrangements made explicit supply-side restraint politically feasible.

Denmark is particularly instructive because its phase-out was politically normalized through narrative. Supply restraint was positioned not as national decline, but as modernization, international leadership, and alignment with Denmark's long-term economic and climate future. This framing later extended beyond the domestic level through Denmark's co-founding leadership in the Beyond Oil and Gas Alliance, in which its national policy became part of a broader effort to advance anti-fossil-fuel norms internationally.

For Canada, Denmark offers critical lessons on the politics of supply-side transition. It suggests that explicit fossil fuel restraint becomes more politically viable when governments can articulate credible economic alternatives, when climate policy is tied to a broader vision of modernization and competitiveness, and when political leadership reframes the phase-out not as a loss but as strategic future-building. While Canada's political economy differs significantly from Denmark's, the Danish case demonstrates that supply-side policy can move from political marginality to a credible commitment to governance under the right institutional and political conditions.

4.6.3 Translating comparative lessons to the Canadian hard case

Taken together, Norway and Denmark illustrate that the two blades of the climate scissors can advance—but often through distinct political pathways and under different enabling conditions. Norway demonstrates how demand-side transformation can become durable through long-term policy consistency, infrastructure investment, consumer incentives, and positive policy feedback. Denmark demonstrates how supply-side restraint can become politically feasible through coalition-building, reduced dependence, political leadership, and reframing the fossil fuel phase-out as both a matter of climate responsibility and economic modernization. For Canada, the central lesson is not replication, but strategic adaptation. Canada’s federal structure, regional cleavages, scale of production, and depth of economic reliance on oil and gas make it a more difficult case than either of its comparators. Yet these cases remain analytically valuable precisely because they illuminate mechanisms that may be adapted to the Canadian context.

The comparison reveals important limits to the assumption that demand-side decarbonization will generate subsequent supply-side restraint. Norway demonstrates that mature transportation electrification can coexist with continued oil production, particularly where extraction remains oriented toward international markets rather than domestic consumption. Denmark illustrates a different pathway, in which explicit restrictions on extraction emerged through changing fossil fuel-sector conditions, alternative economic development, political mobilization, and supportive institutional arrangements (Greene & Carter, 2024). Neither case establishes a general causal sequence from demand reduction to supply restriction. Rather, their contrasting experiences suggest that the relationship between these policy domains depends on whether the political and economic effects of low-carbon transitions extend into the governance of fossil fuel production.

Several political-economic conditions seem particularly relevant to understanding whether progress in low-carbon development might restrain fossil fuel supply. First, the orientation of fossil fuel production matters. Where extraction is predominantly export-oriented, reductions in domestic consumption may have limited influence on production incentives, allowing demand-side decarbonization to advance without challenging continued extraction. Second, the degree of economic and fiscal dependence on fossil fuel production shapes the political costs of restricting supply, as illustrated by Denmark’s declining oil and gas sector and comparatively weaker incumbent industry opposition. Third, alternative energy development, ownership arrangements, and employment opportunities may diversify regional economies and create new economic constituencies. Denmark’s earlier investments in wind energy, cooperative ownership, and changes in electricity and heating systems illustrate how alternative energy development can reshape economic opportunities and institutional arrangements beyond simply reducing fossil fuel consumption. However, these alternatives do not necessarily generate political support for restricting extraction. Their influence depends on whether new economic interests become politically organized and connected to decisions governing fossil fuel production. Finally, institutional relationships across climate, industrial, fiscal, and resource governance, along with political leadership and competing ideas about prosperity and energy security, shape whether these changes translate into opportunities for explicit supply-side commitments.

For Canada, these conditions highlight both the challenges of overcoming carbon lock-in and potential opportunities for more integrated climate governance. Québec’s legislated prohibition on oil and gas exploration and production shows that explicit supply-side restraint is possible at the subnational level, though it should not be seen as the inevitable outcome of earlier demand-side decarbonization. In NL and Nova Scotia, expanding offshore energy governance to include renewable energy offers an

opportunity to examine whether alternative industries, workforce diversification, and changing institutional arrangements could reduce dependence on fossil fuel development over time. In Alberta and Saskatchewan, where fossil fuel production remains deeply embedded in regional economies and political institutions, the challenge is more pronounced: alternative economic development would need to be considered alongside employment security, fiscal dependence, and the political influence of incumbent producers. These examples do not establish that low-carbon development necessarily produces support for extraction restrictions, nor do the comparative cases identify a predetermined sequence through which such restrictions emerge. Rather, they point toward opportunities to investigate how changing economic conditions, institutional arrangements, and political coalitions might make explicit fossil fuel supply restraint more feasible within Canada's diverse provincial political economies.

4.7 Unlocking Canada's carbon lock-in: Pathways for reconstruction in a hard case

If Canada's climate challenge is rooted in mutually reinforcing forms of carbon lock-in, then the comparative insights from Norway and Denmark suggest that these dynamics are not fixed but politically constructed and therefore politically contestable. Neither case offers a model Canada can directly replicate. Canada's scale of fossil fuel production, federal political structure, regional economic dependence, and deep integration of oil and gas into national development make it a unique case relative to the others. Yet together, Norway and Denmark reveal important mechanisms through which progress on one side of the climate scissors can begin to create pressure on the other. Read together, they offer not a blueprint for replication, but a politically grounded pathway for transforming the conditions that currently reproduce Canada's carbon bind.

The theoretical proposition is that demand-side decarbonization and the development of alternative energy systems may increase the political feasibility of restraining fossil fuel supply when their economic, institutional, and political effects connect to decisions governing extraction. Such connections cannot be assumed to emerge automatically from low-carbon technological change. For Canada, the challenge is to identify how deliberate institutional coordination, shifts in organized economic interests, and alternative narratives of prosperity and climate leadership might disrupt existing forms of carbon lock-in. The following sections consider these potential pathways without assuming that supply-side restrictions must follow demand-side transformation in a fixed sequence.

4.7.1 Flipping institutional cleavages: From fragmentation to policy coherence

The first challenge is institutional. As outlined earlier, Canada's climate and resource governance remains deeply fragmented. Federal climate policy and provincial resource governance frequently operate through separate—and often competing—political and regulatory systems. This fragmentation has enabled climate ambition to advance through emissions-reduction policies while allowing continued fossil fuel expansion to proceed in parallel. The result is not policy absence, but institutional incoherence.

The Norwegian and Danish cases suggest that durable climate policy depends on stronger institutional alignment between decarbonization goals and broader economic governance. In Norway, electrification became durable because EV policy was embedded within fiscal policy, taxation structures, infrastructure planning, and transportation governance over time. In Denmark, supply-side restraint

became possible because climate targets, energy governance, and political decision-making around the North Sea became institutionally linked.

For Canada, unlocking carbon lock-in requires greater coordination among federal climate policy, industrial strategy, provincial economic planning, and long-term resource governance. This does not require eliminating all federal-provincial tension—an unlikely outcome in the Canadian federation—but it does require stronger institutional mechanisms that let demand-side progress begin to shape upstream decision-making. Canada will need greater coordination across clean electricity planning, transportation electrification, industrial decarbonization, fiscal transition supports, and regional economic diversification to move beyond managing contradictions toward climate policy coherence.

Over time, accelerated demand-side transition may itself create institutional openings. Large-scale electrification increases pressure for grid expansion, transmission planning, charging infrastructure deployment, battery supply chain investment, and industrial coordination. These emerging policy domains may offer new institutional entry points through which climate governance becomes increasingly integrated with economic planning—creating space for broader transition governance beyond emissions reduction alone.

4.7.2 Rebalancing interests: From fossil fuel entrenchment to transition coalitions

Canada's carbon lock-in is equally sustained through organized interests with material stakes in continued fossil fuel expansion. Oil and gas producers, pipeline firms, financial institutions, export infrastructure developers, and regional governments remain deeply invested in preserving long-term extraction. These interests continue to shape investment patterns, public policy debates, and political resistance to supply-side reform. Yet the comparative cases suggest that interests are not fixed. They can shift as new sectors emerge, economic expectations evolve, and transitions generate new constituencies with material stakes in decarbonization.

Norway shows that demand-side policies can create constituencies invested in maintaining low-carbon transitions without necessarily generating political opposition to fossil fuel production. Electrification has benefited consumers, utilities, charging infrastructure providers, and other actors whose interests support continued EV adoption. Yet these constituencies have not emerged as a comparable political force to restrict oil and gas extraction. Rather, Norway's experience suggests that the political benefits of domestic decarbonization can coexist with, and potentially help insulate, an export-oriented fossil fuel sector from broader climate policy pressures. Therefore, the relevant question for Canada is not simply whether new low-carbon interests emerge, but whether they become politically organized around objectives that extend to fossil fuel supply restraint.

A similar dynamic is emerging in Canada. Expansion in EV manufacturing, battery production, critical minerals extraction, charging infrastructure, clean electricity development, and related industrial supply chains is creating new economic coalitions tied to low-carbon growth. These sectors increasingly represent employment, regional development, and investment opportunities beyond fossil fuel extraction. Over time, their political influence may begin to counterbalance fossil fuel incumbents' dominance.

Denmark offers a parallel lesson from the supply-side. Its North Sea phase-out became politically viable in part because oil and gas no longer held the same central economic role they once had. As relative dependence declined and alternative economic pathways strengthened, resistance to supply-side

restraint weakened. This suggests that reducing Canada's structural dependence on future fossil fuel expansion is not only an economic challenge, but a political one. However, the political interests capable of challenging fossil fuel dependence extend beyond emerging low-carbon industries. Environmental organizations, Indigenous-led movements, community groups, and climate activists can also play important roles in contesting continued extraction. Activism can shape political conflict around fossil fuel industries, highlighting the importance of organized opposition in challenging incumbent interests (Cheon & Urpelainen, 2018). Unlike constituencies whose support for decarbonization may rest primarily on new economic opportunities, climate movements can directly challenge the legitimacy of continued fossil fuel production. Through public mobilization, advocacy, and efforts to put extraction on the climate policy agenda, these actors may help shift political attention from reducing emissions from fossil fuel use to restricting production itself. Their influence nevertheless depends on political opportunities, access to decision-makers, and their capacity to build broader coalitions capable of advancing policy change.

For Canada, unlocking carbon lock-in may therefore require building stronger coalitions across labour, clean industry, climate advocates, Indigenous governments, municipalities, and regional development actors around a shared economic vision of transition. The political challenge is not simply to constrain fossil fuel power directly, but to strengthen alternative interests capable of reshaping the balance of power over time.

4.7.3 Reframing ideas: From extraction as prosperity to climate leadership through managed decline

The final barrier is ideational. Canada's fossil fuel dependence is sustained not only by infrastructure and economic interests but also by powerful narratives linking extraction to prosperity, employment, national unity, and economic security. Oil and gas remain deeply embedded within dominant political understandings of national development and Canada's place in the global economy. These narratives are particularly resilient because they increasingly coexist with climate ambition. Fossil fuel expansion is often framed not as contradictory to climate action but as compatible with it through CCUS, emissions-intensity reductions, LNG exports, and claims of "responsibly produced" oil. Under this framing, domestic climate leadership can proceed without directly confronting the future of extraction itself.

Denmark demonstrates that these narratives can shift. Its supply-side transition became politically possible when it reframed fossil fuel restraint not as sacrifice or economic decline, but as modernization, international climate leadership, and responsible future planning. Political leaders, civil society actors, and state institutions helped normalize the idea that ending new oil and gas expansion was consistent with economic credibility and national ambition. Climate movements can also drive this shift by challenging the distinction between responsibility for domestic emissions and responsibility for continued fossil fuel production (Greene & Carter, 2024; Slothuus, 2026a). By framing extraction as a climate governance issue rather than solely an economic or resource development decision, activists and civil society organizations can contest established understandings of climate leadership. Such efforts may also introduce a moral dimension to debates over fossil fuel production, emphasizing the responsibilities of wealthy producing states and the consequences of continued extraction for communities and countries facing disproportionate climate impacts. In this way, climate activism operates not only through political mobilization but also by shifting which policy choices are considered legitimate, necessary, or feasible.

Canada may need a similar ideational shift. Climate leadership cannot remain defined exclusively through domestic emissions reductions while excluding responsibility for production trajectories and exported emissions. Understanding climate leadership requires confronting not only domestic fossil fuel consumption, but also how continued expansion shapes global climate outcomes.

This does not require immediate consensus around fossil fuel phase-out. Rather, it requires broadening what becomes politically imaginable. It means reframing climate leadership to include long-term planning for declining production, economic diversification, and the deliberate management of transition in producing regions. In this sense, the political challenge is not simply replacing one narrative with another, but opening space for new narratives of prosperity, competitiveness, and national leadership beyond continued extraction.

4.8 From carbon lock-in to managed decline

Comparative evidence shows that Canada's pathway beyond carbon lock-in cannot rely solely on demand-side decarbonization, nor on the expectation that low-carbon technological development will eventually build political support for restricting extraction. Norway shows that substantial reductions in domestic oil consumption can coexist with continued export-oriented production, while Denmark illustrates how explicit supply-side restraint can become feasible through converging declines in fossil fuel dependence, alternative development pathways, organized political support, and institutional opportunities. These contrasting experiences underscore the importance of deliberately linking low-carbon development to decisions governing fossil fuel production.

For Canada, this requires a broader transition approach than accelerating transportation electrification or expanding clean industrial investment in isolation. Such policies can reduce domestic fossil fuel consumption and create alternative economic opportunities, but their contribution to supply-side transformation depends on whether they also reduce dependence on future extraction, support constituencies capable of advancing managed decline, and become integrated with fiscal, labour, and regional development policy. In producing regions where employment, public revenues, and investment remain closely tied to fossil fuel exports, these connections are particularly consequential. Accelerated demand-side transformation—particularly electrification—can do more than reduce territorial emissions. It can diversify the economy, reshape investor expectations about long-term oil demand, expand low-carbon constituencies, and weaken assumptions of indefinite fossil fuel growth. Over time, these shifts may make more explicit supply-side measures politically feasible, including production limits, restrictions on future expansion, and pathways toward managed decline. Explicit supply-side measures, including restrictions on new exploration and development, can be part of a coordinated transition strategy alongside economic diversification and demand reduction, rather than treated as outcomes that must wait for their completion (Green et al., 2024).

In this sense, the challenge facing Canada is no longer whether both blades of the climate scissors are necessary, but how to make them politically mutually reinforcing. Unlocking carbon lock-in requires more than stronger climate targets or new policy instruments. It requires transforming institutional incentives, rebalancing the political economy of transition, and reshaping the dominant ideas through which people understand climate leadership and prosperity.

Seen through this lens, Canada's status as a hard case is precisely what makes it analytically important. If a pathway can be identified through which a deeply carbon-dependent federal producer-state begins

to align demand-side decarbonization with credible supply-side constraints, the implications reach beyond Canada itself. The question is therefore not simply how Canada lowers emissions, but how a fossil fuel-producing state might move from climate contradiction to policy coherence—and from carbon lock-in to managed decline.

4.9 Conclusion

Despite increasingly ambitious emissions-reduction targets, major investments in electrification and clean technology, and growing political recognition of the climate crisis, Canada continues to expand oil and gas production and infrastructure. The result is a dual-track and inherently contradictory model of climate governance: mitigation efforts at home paired with continued fossil fuel expansion, predominantly for export. This contradiction reflects more than policy inconsistency alone. It reveals a deeper form of carbon lock-in embedded across institutions, organized interests, and dominant political discourses. Canada's challenge is, therefore, not simply technical, but political. The central argument advanced here is that durable decarbonization in fossil fuel-producing states depends on combining demand-side transformation with supply-side restraint—moving both blades of the climate scissors simultaneously and in mutually reinforcing ways.

To explore this challenge, the article examined Canada as a hard case of climate policy coherence alongside comparative insights from Norway and Denmark. Norway demonstrated how demand-side transformation can become politically durable through long-term policy consistency, infrastructure investment, and positive policy feedback that normalizes electrification and creates new constituencies for transition. Yet it also illustrated the limits of demand-side policy when pursued in isolation, as domestic decarbonization continued even as large-scale fossil fuel production and exports continued.

Denmark, by contrast, demonstrated how explicit supply-side climate policy can become politically feasible within a fossil fuel-producing economy. Its decision to end future oil and gas licensing in the North Sea and commit to a phase-out pathway reflected not only climate ambition but also the convergence of institutional coordination, declining sectoral dependence, political leadership, coalition-building, and ideational reframing. Denmark's importance lies in showing that supply-side restraint can shift from political marginality to durable governance commitment when embedded in a vision of modernization and climate leadership.

Taken together, these cases suggest that the challenge facing fossil fuel-producing states is no longer whether decarbonization is necessary, but whether governments can develop politically durable pathways that correspond climate objectives with the managed decline of fossil fuel production. Norway and Denmark each advanced one arm of the climate scissors. The Canadian challenge is how to generate conditions under which movement on one blade begins to unlock movement on the other.

The analysis advanced here suggests that unlocking carbon lock-in requires more than stronger climate targets or isolated policy steps. It requires transforming the institutional incentives, rebalancing the political economy of transition, and reshaping the dominant ideas through which prosperity, energy security, and climate leadership are understood. Demand-side policies such as transportation electrification may play a particularly important strategic role because they can generate reinforcing feedback that alters infrastructure investment, consumer expectations, industrial strategy, and political coalitions over time. Under certain conditions, these dynamics may begin to weaken the long-term political foundations of fossil fuel dependence and increase the feasibility of supply-side restraint.

At the same time, the article demonstrates that demand-side transformation alone is insufficient. Electrification does not automatically constrain extraction, particularly in major exporting states where domestic consumption and upstream production remain politically and economically disconnected. This is why integrating supply-side governance toward climate policy becomes increasingly important as decarbonization advances. The Canadian case demonstrates the risks of relying on emissions reductions while leaving the political economy of fossil fuel expansion largely intact.

The implication is that climate leadership in fossil fuel-producing states can no longer be understood solely in terms of territorial emissions reductions. As international climate politics increasingly turns to fossil fuel phase-out and the managed decline of production, producer states face growing pressure not only to decarbonize domestic economies, but to confront the future of extraction itself. Recent international momentum—from the emergence of the Beyond Oil and Gas Alliance to the outcome of COP28 and TAFF calling for a transition away from fossil fuels in energy systems—signals that supply-side governance is moving from the margins toward the centre of global climate governance. These developments increasingly position fossil fuel production itself as a core site of climate politics.

For Canada, this creates both pressure and possibility. Canada remains deeply constrained by regional dependence, federal fragmentation, and the political power of the oil and gas sector. Yet it also has many of the institutional, financial, technological, and political conditions needed to begin building an alternative pathway. Continued progress in transportation electrification, battery manufacturing, clean electricity, industrial decarbonization, and regional economic diversification may offer more than emissions reductions alone; these developments may help generate the economic and political foundations required to make supply-side policy ever more feasible over time.

The analysis finds that the challenge facing fossil-fuel-producing states is not simply whether to pursue demand-side and supply-side climate policies together, but how to sequence and integrate them politically over time. The principal challenge, then, is one of sequencing. The transition away from fossil fuel dependence is unlikely to begin through supply-side restriction alone in a deeply carbon-dependent producer state such as Canada in the absence of widesweeping political and economic transformation. But neither can demand-side transformation alone resolve the contradictions of continued expansion. The Canadian opportunity may lie in strategically linking the two: using demand-side momentum to generate new institutions, new coalitions, and new economic trajectories that make supply-side constraints politically viable. The pathway toward managed decline, therefore, may not begin with supply-side restriction alone, but with creating the conditions that allow it to emerge and endure. In this sense, electrification is not only an emissions strategy—it may also be part of a political track toward managed decline.

Seen through this lens, Canada's importance extends beyond its national context. If a major fossil fuel-producing federal state can align demand-side decarbonization with credible long-term supply-side restraint, it would offer important lessons for producer states confronting similar tensions between climate ambition and continued extraction. The challenge facing Canada is no longer whether transition is necessary, but whether it can convert climate commitment into a politically durable pathway beyond fossil fuel dependence. Its ability to do so may shape not only its own climate future, but the evolving global politics of transitioning away from fossil fuels.

Conclusion

This dissertation began with a central climate governance puzzle: while governments increasingly adopt ambitious climate commitments and pursue decarbonization through electrification, renewable energy deployment, and emissions-reduction targets, many fossil fuel-producing states continue to expand oil and gas production. Climate ambition and fossil fuel expansion, though contradictory, proceed in tandem. This contradiction raises a critical question for both scholars and policy experts: under what conditions can fossil fuel-producing states attain deep decarbonization while reducing their dependence on fossil fuel extraction?

Answering this question requires moving past conventional debates over whether demand-side or supply-side climate policies matter more. Instead, it requires the kind of analysis these papers undertake: examining the political conditions needed for deep decarbonization within fossil fuel-producing states. More specifically, this dissertation has explored how demand-side and supply-side climate policies emerge, interact, and potentially become politically integrated within carbon-intensive political economies. Whilst technological innovation and emissions reductions are necessary, transitions away from fossil fuel dependence persist, ultimately shaped by institutional arrangements, political interests, and dominant ideas regarding economic development, energy security, and climate responsibility.

The first article examined Denmark as a global first mover in supply-side climate governance. The Danish case showed that explicit fossil fuel phase-out policies can become politically feasible even in fossil fuel-producing states. Denmark's decision to end future oil and gas extraction in the North Sea challenged assumptions that producer economies are inevitably committed to continued extraction and showed that under particular political, institutional, and ideational conditions, supply-side climate governance can emerge and shape broader international climate governance debates.

The second turned to the demand-side of climate governance through a comparative study of transportation electrification in Norway and Canada. The findings demonstrated that ambitious demand-side decarbonization can substantially reduce emissions, accelerate low-carbon technological change, reshape consumer behaviour, and build durable political support for climate action. Norway's experience, in particular, illustrates the revolutionary potential of transportation electrification in a fossil fuel-producing economy. At the same time, the analysis showed that demand-side transitions do not automatically reduce fossil fuel production. Rather than undermining electrification's value, this finding reveals both its strengths and limits. Transportation electrification can build important political, economic, and institutional foundations for a transition away from fossil fuels, but it requires additional efforts to translate these gains into explicit reductions in fossil fuel production and dependence.

Building on these insights, the third article examined Canada's challenge of integrating demand-side and supply-side climate governance. Drawing on lessons from Denmark and Norway, it argued that deep decarbonization requires more than pursuing both approaches simultaneously. Rather, it requires confronting the institutional structures, political interests, and dominant ideas that continue to reinforce fossil fuel dependence. In doing so, the article identified pathways through which demand-side transformation and supply-side restraint may become politically aligned within fossil fuel-producing states.

Taken together, the three articles develop a cumulative argument about the political conditions needed for deep decarbonization. The first demonstrates that supply-side climate governance is politically possible. The second shows that demand-side transitions alone are insufficient because fossil fuel systems remain institutionally and politically entrenched. The third argues that achieving a durable transition, therefore, requires confronting and transforming those entrenched institutions, interests, and ideas.

Viewed collectively, the dissertation suggests that the challenge facing fossil fuel-producing states, particularly oil producers, is no longer simply how to reduce emissions. Rather, it is about aligning climate ambition with political and economic transitions that can move beyond reliance on oil, its production, and its consumption. Understanding how that alignment becomes politically possible is the principal contribution of this dissertation.

5.1 Advancing theories of carbon lock-in and transition politics

This dissertation contributes to scholarship on carbon lock-in, sustainability transitions, and global climate governance by extending existing explanations of fossil fuel dependence to a broader understanding of transition politics in fossil fuel-producing states.

A central insight emerging from the literature on carbon lock-in is that fossil fuel dependence, particularly oil, is not simply the result of market forces or technological path dependence. Rather, carbon-intensive systems are reproduced through reinforcing institutions, interests, and ideas that embed fossil fuels within political-economic systems. Existing scholarship has helped explain why fossil fuel dependence endures despite growing scientific consensus, expanding climate commitments, and the increasing availability of clean energy technologies. The cases examined throughout this dissertation further support these insights. Across Denmark, Norway, and Canada, fossil fuel production remained closely connected to economic development strategies, political institutions, public revenues, labour markets, and national narratives regarding prosperity and energy security.

However, while existing scholarship offers compelling explanations for continuity and persistence, it offers comparatively less insight into the political conditions that weaken carbon lock-in. Much of the literature explains why fossil-fuel-producing states struggle to transition beyond extraction; it devotes less attention to how transitions become politically possible. This dissertation addresses that gap.

The studies show that institutions, interests, and ideas should be understood not only as mechanisms that reproduce fossil fuel dependence, but also as potential sites of transformation. The Danish case shows that supply-side climate governance can emerge when shifting political coalitions, changing economic opportunities, shifting public narratives, and supportive institutional arrangements align to challenge the legitimacy of continued fossil fuel expansion. Denmark, therefore, illustrates that carbon lock-in is neither fixed nor inevitable. Under particular political conditions, fossil-fuel-producing states can begin to pursue policies explicitly aimed at constraining production.

The findings from Norway and Canada further refine existing understandings of transition processes. While the literature often treats demand-side and supply-side climate governance as distinct policy domains, the analysis finds they are more closely connected than many recognize. Transportation electrification has shown strong potential to reduce emissions, spur technological innovation, reshape infrastructure systems, and build public support for climate action. Yet these transformations did not automatically reduce fossil fuel production. This finding supports scholarship on the durability of

carbon lock-in and offers a key theoretical insight: demand-side transitions may create enabling conditions for a broader low-carbon transition without, on their own, overcoming fossil fuel dependence.

Building on these conclusions, the dissertation contributes to debates on transition politics by advancing a conditional proposition concerning the relationship between demand-side decarbonization, alternative energy development, and fossil fuel supply-side governance. Rather than treating demand- and supply-side policies as competing approaches or assuming that progress in one necessarily produces change in the other, the comparative examination directs attention toward the political-economic conditions under which they might become mutually reinforcing. Transportation electrification, alternative energy supply development, clean industrial strategies, and economic transformation may change institutions, interests, and ideas in ways that increase the political feasibility of restraining fossil fuel supply. However, whether these developments alter the incentives and political coalitions sustaining extraction depends on factors such as export orientation, fiscal dependence, incumbent political influence, and the institutional connections among climate, industrial, and fossil fuel governance.

This proposition contributes to existing theories of decarbonization by focusing on how the conditions sustaining carbon lock-in might change over time. Denmark demonstrates that explicit supply-side restrictions can become politically feasible when declining fossil fuel dependence, alternative economic opportunities, political mobilization, and favourable institutional conditions converge. Norway demonstrates that ambitious demand-side transformation can remain politically disconnected from continued extraction. Together, these cases suggest that pathways beyond carbon lock-in are neither automatic nor necessarily sequential. Instead, they require deliberate political action to link low-carbon transformation to explicit decisions governing fossil fuel production. Establishing when and how these connections emerge remains an important task for future research.

More broadly, the dissertation contributes to global climate governance scholarship by exposing the limitations of governance regimes that focus primarily on territorial emissions while paying comparatively less attention to fossil fuel production. The evidence shows that producer states can reach notable progress on demand-side decarbonization while remaining deeply connected to fossil fuel extraction. Consequently, understanding deep decarbonization necessitates examining not only emissions outcomes but also the political and institutional conditions that sustain or challenge continued production.

Taken together, the dissertation advances a central theoretical proposition: deep decarbonization in fossil-fuel-producing states depends not simply on reducing emissions or constraining production in isolation, but on transforming the institutions, interests, and ideas that reproduce fossil fuel dependence and aligning demand-side and supply-side climate governance amid processes of political and economic transition. By identifying how these dynamics interact across several national contexts, the dissertation adds to a growing body of scholarship seeking to understand not only why fossil fuel dependence persists, but how fossil-fuel-producing states might ultimately move beyond it.

Table 5.1. Synthesis of findings and implications for integrating demand- and supply-side climate governance

Dimension	Paper 1: Denmark	Paper 2: Norway and Canada	Paper 3: Implications for Canada
Central question	What political conditions enabled Denmark to adopt an explicit oil and gas phase-out policy?	Why has transportation electrification advanced without corresponding restrictions on oil and gas production?	How might demand- and supply-side climate governance be integrated in a major fossil fuel-producing state?
Principal finding	Supply-side restrictions became politically feasible through a combination of changing economic conditions, political commitments, and institutional opportunities	Demand-side decarbonization can coexist with continued oil and gas extraction, particularly where production serves export markets	Overcoming carbon lock-in requires deliberate efforts to change the political conditions supporting continued fossil fuel extraction
Institutions	Political agreements and governance arrangements enabled a long-term phase-out commitment, while protecting existing production during the transition	Institutions supporting EV adoption operate alongside established oil and gas governance arrangements	Greater coordination is needed across transportation, industrial, climate, and resource governance, including federal–provincial responsibilities
Interests	Declining oil and gas production prospects, alternative economic opportunities, and political coalitions helped make restrictions more feasible	Emerging low-carbon constituencies do not necessarily challenge established oil and gas interests or export revenues	Economic diversification, alternative employment, and coalition-building may help reduce opposition to supply-side measures
Ideas	Climate leadership and a managed transition helped establish political legitimacy for restricting future extraction	Narratives of domestic climate leadership can coexist with continued oil and gas production justified through economic and energy-security arguments	Political narratives must connect economic security and prosperity with a managed reduction in fossil fuel dependence
Relationship between demand and supply	Broader low-carbon development helped shape the political-economic context for supply-side restraint, without establishing a universal sequence	Progress in reducing domestic oil demand does not automatically constrain export-oriented oil and gas production	Demand-side measures may help create enabling conditions, but explicit supply-side commitments remain necessary
Broader lesson	Supply-side policy becomes more feasible when political, economic, and institutional conditions align	Demand-side success alone is insufficient to overcome carbon lock-in associated with continued oil and gas production	Policy integration requires deliberate coordination, institutional change, and attention to context-specific political opportunities

5.2 Limitations and Future Research

This research has several limitations worth acknowledging. First, the dissertation focuses on three affluent, democratic, fossil-fuel-producing states and therefore does not capture the full diversity of political-economic conditions shaping fossil-fuel transitions globally. Denmark, Norway, and Canada provide analytically valuable but distinctive cases, with institutional capacities, economic structures, and political arrangements that differ considerably from those of lower-income, more resource-dependent, or authoritarian producer states. Consequently, the findings should not be interpreted as establishing a universally applicable pathway for integrating demand- and supply-side climate governance.

Second, the research relies on purposively selected interview participants with expertise and experience who offer valuable insights into climate and energy governance but do not represent the full range of actors involved in fossil fuel transitions. This limitation is especially important in Canada, where regional variation, federal–provincial relations, and the interests of industry, labour, Indigenous governments, and communities directly affected by extraction shape fossil fuel governance. The Canadian interview sample provides targeted perspectives rather than full representation of these actors or regions. Although documentary evidence and existing scholarship help contextualize these circumstances, they cannot fully substitute for direct engagement with all relevant constituencies. Future research would benefit from more extensive interviews with provincial policymakers, upstream producers, Indigenous governments, workers, and communities in fossil fuel-producing regions.

Third, the three manuscripts draw on complementary, but partially overlapping empirical material. Some interviews and documentary sources informed multiple analyses, although each paper uses evidence adapted to its specific research questions. Accordingly, the dissertation's integrative conclusions synthesize related analyses rather than three independent empirical tests of the same causal relationship. Furthermore, descriptive statistical evidence supports interpretations of policy trajectories but does not independently establish causal relationships between specific policies and policy results.

These considerations are especially important for the dissertation's proposed relationship between demand-side transformation and fossil fuel supply restraint. The comparative evidence shows that domestic decarbonization and continued extraction can coexist, as Norway illustrates, and that explicit supply-side restrictions can become politically feasible under certain conditions, as Denmark demonstrates. However, the research does not establish that demand-side decarbonization necessarily produces subsequent restrictions on fossil fuel extraction. The potential contribution of alternative energy development, economic diversification, new political constituencies, and institutional reform to supply-side restraint is a conditional proposition calling for further investigation.

Finally, the dissertation examines a quickly evolving governance landscape in which important political and economic developments continue beyond the period studied. Its demand-side analysis also focuses primarily on transportation electrification, whereas transitions in electricity generation, heating, heavy industry, aviation, and shipping may involve different institutional arrangements, interests, and political dynamics. Future research could examine whether and under what conditions alternative energy supply development, industrial policy, new ownership structures, and changes in regional economic dependence contribute to explicit restrictions on fossil fuel production. Comparative and longitudinal research across a wider range of producer states would be particularly valuable for assessing these relationships, alongside greater attention to producer responsibility, exported emissions, transition justice, and the distribution of transition costs and benefits.

5.3 Implications for Global Climate Governance

The findings carry important implications for global environmental governance. Historically, international climate governance has focused primarily on managing emissions rather than directly governing fossil fuel production. This emphasis is reflected in the architecture of the UNFCCC and Paris Agreement, which evaluate progress primarily through territorial emissions accounting.

The cases examined throughout this dissertation reveal important limitations in this approach. Producer states may achieve substantial domestic emissions reductions while continuing to export large quantities of fossil fuels. Norway provides perhaps the clearest example. Although often celebrated as a global climate leader for its domestic decarbonization achievements, the country remains one of the world's largest exporters of oil and gas. This disconnect highlights the limitations of evaluating climate leadership solely through territorial emissions accounting. Domestic emissions reductions remain critically important, but they provide only a partial picture of a state's broader contribution to global decarbonization.

This observation points toward what may be understood as a fossil fuel governance gap within climate governance systems. While international institutions have become increasingly effective at governing emissions, comparatively little attention has historically been devoted to governing fossil fuel production itself. Yet recent developments suggest this may be changing. The emergence of the Beyond Oil and Gas Alliance, the inclusion of language on transitioning away from fossil fuels at COP28, and the first Conference on Transitioning Away from Fossil Fuels held in Colombia in 2024 all signal growing recognition that climate governance must engage more directly with questions of production, phase-out, and managed decline.

Taken together, these developments suggest climate governance may be entering a new phase. Increasingly, the challenge is no longer simply reducing emissions, but governing the transition itself. Climate leadership is being redefined beyond renewable energy deployment, EV adoption, and domestic emissions reductions toward questions of fossil fuel phase-out, transition justice, and global responsibility.

This dissertation began from the observation that fossil fuels remained largely absent from climate governance despite being the primary driver of climate change. For much of the modern climate governance era, international efforts focused on managing emissions while leaving fossil fuel production largely outside formal governance discussions. The findings suggest this situation may be changing. Increasingly, fossil fuel production itself has become a subject of political contestation and governance innovation. Questions of phase-out, managed decline, transition justice, and producer responsibility are moving from the margins of climate politics toward its centre. This shift reflects a broader evolution in how we understand climate change. Climate governance is increasingly becoming transition governance.

This transformation has important implications for how climate leadership is defined. Historically, leadership was measured primarily through domestic emissions reductions and technological innovation. While these indicators remain important, they are increasingly accompanied by questions concerning fossil fuel production, export dependence, and responsibility for managing transition. The cases examined throughout this dissertation suggest that future climate leadership may be judged not only by how effectively states decarbonize their own economies, but by how they contribute to broader efforts to move beyond fossil fuel dependence.

Ultimately, the future of global climate governance may depend less on whether fossil fuel-producing states reduce domestic emissions and more on whether they are willing and able to confront the institutional, economic, and ideational structures sustaining continued fossil fuel expansion. The transition away from fossil fuels is therefore not simply a technological challenge. It is fundamentally a governance challenge. This dissertation has sought to understand the political conditions that make that transition possible. As climate governance increasingly turns toward questions of production, phase-out, and managed decline, understanding those conditions may become one of the defining challenges of global environmental governance in the decades ahead.

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Appendix: Supplementary Methodological Details

This appendix provides additional information on the research procedures employed across the three papers comprising this dissertation. Although each paper addresses a distinct research question, the studies share a qualitative approach that combines documentary analysis with semi-structured interviews with actors involved in climate and energy policy. The following sections outline the research ethics approvals, participant recruitment, interview procedures, and analytical approaches associated with each study.

1.1 Paper 1: Denmark's national oil and gas phase-out

1.1.1 Research ethics and project context

The research for Paper 1 was conducted under the University of Waterloo research ethics protocol #40495, *Mapping Policy Pathways to Keeping Fossil Fuels in the Ground*, initially approved on March 4, 2019. Dr. Angela Carter led the project, with Dr. Imre Szeman as a co-investigator, and it was supported by research funding from the Social Sciences and Humanities Research Council of Canada (SSHRC). I participated as a student investigator. The research examined the political, economic, institutional, and socio-cultural conditions enabling governments to adopt policies restricting fossil fuel exploration and extraction.

1.1.2 Participant selection and recruitment

Interview participants were identified through purposive sampling, informed by preliminary reviews of academic literature, government and policy documents, media coverage, and publicly available information on Denmark's oil and gas sector and climate policy. This process helped identify individuals and organizations involved in, or knowledgeable about, the development of Denmark's decision to end future oil and gas licensing and establish a production phase-out date.

Potential participants included policymakers, researchers, environmental and civil society organizations, industry representatives, and other actors with relevant expertise. Initial contacts were made using publicly available professional contact information. Recruitment was supplemented by snowball sampling, in which interview participants and other contacts suggested additional individuals or organizations whose perspectives could contribute to the research. The objective was to capture a range of perspectives on the political conditions surrounding Denmark's policy decision rather than to obtain a statistically representative sample.

1.1.3 Interview procedures and themes

Semi-structured interviews examined the development of Denmark's oil and gas phase-out policy and the factors that enabled or constrained its adoption. Interviews were generally scheduled for one hour, although their actual duration ranged from approximately 45 to 90 minutes. Interviews were conducted both in person and remotely, depending on participant availability and location. Interview questions explored the political and historical context surrounding the policy decision; the roles of relevant institutions and political actors; the interests of industry and civil society organizations; and the influence of public narratives on climate change, energy production, and economic development. Questions also considered the significance of Denmark's policy for broader efforts to restrict fossil fuel extraction. The semi-structured format allowed for follow-up questions and additional discussion of issues raised by participants. Participants were provided with information about the research and consent procedures, with the use of interview material governed by their individual consent.

1.1.4 Transcription and analysis

Interview material was transcribed verbatim and examined alongside documentary evidence, including government policies, political agreements, industry publications, academic research, and relevant media coverage. The analysis drew on the theoretical framework developed by Carter and McKenzie (2020), which identifies political conditions relevant to adopting policies that restrict fossil fuel extraction. This provided a deductive basis for examining institutional arrangements, organized interests, and political ideas associated with Denmark's policy decision. The analysis also remained attentive to additional explanations emerging from interviews and documentary evidence, allowing empirical findings to inform and refine the interpretation of the case. The analysis compared evidence from different sources to develop an account of the political conditions that enabled Denmark's adoption of supply-side climate policy, while recognizing that interview accounts reflected participants' particular positions and experiences.

1.2 Paper 2: Transportation electrification in Norway and Canada

1.2.1 Research ethics and project context

The research for Paper 2 was conducted under University of Waterloo research ethics protocol #46990, *Disruptive Climate Policy from Wells to Wheels: Global Governance Insights from National First Movers*, initially approved on December 18, 2024. I served as the student investigator, with Dr. Daniel Henstra listed as principal investigator and faculty supervisor. The research was supported by a SSHRC Doctoral Fellowship and the Balsillie School of International Affairs Global Governance Fellowship. The study examined the political-economic conditions shaping transportation electrification in Norway and Canada, with particular attention to whether progress in reducing domestic oil consumption contributes to broader efforts to restrict fossil fuel production.

1.2.2 Participant selection and recruitment

Participants were selected purposively on the basis of their professional involvement in, or knowledge of, transportation electrification, climate policy, energy governance, and the petroleum sector in

Norway and Canada. Potential interviewees were identified through academic literature, government and policy documents, media coverage, organizational websites, and publicly available professional information.

Participants included individuals associated with government, academia, civil society, environmental organizations, industry, and other relevant policy communities. Participants were recruited through direct outreach using professional contact information and, where appropriate, social media. Snowball sampling was also employed, with participants invited to identify other individuals or organizations whose expertise or experiences could inform the comparison. The recruitment strategy sought to incorporate perspectives from actors involved in transportation electrification as well as those knowledgeable about fossil fuel production and broader climate policy. This was important for examining how political conditions supporting demand-side decarbonization relate to those influencing continued petroleum extraction.

1.2.3 Interview procedures and themes

Semi-structured interviews were conducted during 2024–2025, including interviews undertaken during fieldwork in Norway and remotely with participants in Norway and Canada. Interviews were generally scheduled for one hour, with actual durations ranging from approximately 45 to 90 minutes. The interviews examined the development of transportation electrification policies, the roles of governments and political institutions, the influence of industry and other organized interests, and the ideas shaping public and political support for electric vehicles. Questions also addressed the relationship between domestic transportation policy and continued petroleum production, including whether participants perceived opportunities or barriers to connecting demand- and supply-side climate governance. The semi-structured format allowed researchers to adapt questions to participants' expertise and permitted follow-up discussion of issues that emerged during the interviews. Participants were provided with information about the research and consent procedures, and the recording and use of interview material were subject to individual consent.

1.2.4 Transcription and analysis

Interviews were transcribed verbatim and analyzed alongside government policy documents, legislation, industry reports, academic literature, and other relevant materials. The documentary analysis included more than 300 policy and related documents, while the interview component comprised 32 semi-structured interviews across the Norway–Canada research. The analysis was guided by the institutions, interests, and ideas framework, which provided a common structure for examining the political-economic conditions influencing transportation electrification in both countries. This constituted a deductive element of the analysis, allowing evidence to be examined in relation to established theoretical categories. At the same time, the analysis remained open to themes and explanations emerging from participants' accounts and documentary evidence, including the political separation between domestic decarbonization and export-oriented petroleum production. The findings emerged from comparisons of interview accounts, documentary evidence, and descriptive policy and transportation statistics. The analysis sought to identify similarities and differences between the two cases without treating the evidence as sufficient to establish independent causal effects of particular institutions or policies.

1.3 Paper 3: Integrating demand- and supply-side climate governance in Canada

1.3.1 Research ethics and relationship to the preceding studies

Paper 3 draws on the research conducted under University of Waterloo ethics protocol #46990, alongside findings and documentary evidence developed through the preceding papers. As an integrative study, it does not constitute an entirely separate set of interviews or an independent third sample. Instead, it brings together evidence from Denmark, Norway, and Canada to examine the political-economic conditions under which Canada might move beyond carbon lock-in. The study was supported by the same SSHRC and Balsillie School of International Affairs doctoral funding associated with the broader dissertation research.

1.3.2 Evidence selection and comparative approach

The study draws on academic literature, government and policy documents, relevant descriptive statistics, and interview evidence collected through the dissertation research. These materials were selected for their relevance to the institutional, economic, and political conditions shaping demand- and supply-side climate governance in Canada. Denmark and Norway were examined as contrasting cases of supply- and demand-side climate policy development. These cases provided evidence to identify potential lessons and limitations for Canada, accounting for differences in political institutions, fossil fuel dependence, industrial structures, and organized interests. Where interview evidence overlapped with that used in Papers 1 and 2, it was reconsidered in relation to Paper 3's distinct research question. The same interviews were not treated as additional or independent observations simply because they informed more than one paper.

1.3.3 Interview themes and analytical approach

The interview evidence informing Paper 3 addressed the political and institutional conditions shaping climate policy, the influence of incumbent fossil fuel interests, the development of alternative economic constituencies, and the political ideas supporting or challenging continued extraction. The analysis paid particular attention to the relationship between domestic decarbonization and fossil fuel production, and to the potential for policy integration in Canada. The analysis used the institutions, interests, and ideas framework to organize and compare findings across the three cases. This provided a deductive structure for examining the conditions sustaining carbon lock-in and the political opportunities for change. The synthesis also drew on explanations emerging from the empirical studies, particularly the finding that demand-side decarbonization does not automatically generate political support for restricting fossil fuel production. The analysis aimed to develop theoretically informed propositions about the conditions under which demand- and supply-side climate governance might be integrated. It did not seek to establish a predetermined sequence of policy development or demonstrate a causal relationship between transportation electrification and subsequent restrictions on fossil fuel extraction.

1.3.4 Methodological limitations

The three papers employ purposive qualitative research designs intended to provide detailed insight into particular political-economic contexts. Interview participants were selected for their knowledge

and involvement rather than to represent the broader populations of the countries examined. The studies also differ in their empirical focus, and some evidence contributes to more than one paper. These characteristics limit the extent to which findings can be generalized or interpreted as evidence of causal relationships. The comparative approach instead supports the identification of political-economic mechanisms, contextual differences, and potential conditions relevant to future climate policy development.