Sustainability-Based Framework Development and Specification for Coal Phase-out Policy: Just Transition and Sustainability Requirements in the Canadian Context

by

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Author's declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Following the Paris Agreement and the commitment to the NDCs (Nationally Determined Contributions) by its members, Canada has reinforced the engagement with a decrease of fossil fuel consumption through a federal policy to phase-out coal by 2030. This thesis analyzes the necessary sustainability criteria reliant on socio-ecological and economic aspects to assess national coal phase-out policy with particular attention to the Canadian case.

The research discusses the specification of essential sustainability-based criteria for national coal phase-out policy with just transition and sustainability requirements and integrates other specific sustainability criteria, illuminated by the Canadian case study. The proposed sustainability framework for coal phase-out policy instruments brings to light the necessity of an integrative approach, embedding essential issues for sustainable national climate change policy such as equity and just transition principles in alliance with environmental requirements. This research identifies the benefits of an integrative and robust sustainability framework to promote environmental progress and equity for transition processes to a low carbon economy.

This thesis work aims to answer three central research questions: Firstly, what specific requirements are needed to ensure a coal phase-out policy is aligned with contributions to sustainability, with particular attention to climate change mitigation and just transition? Secondly, what can be learned from coal phase-out experiences already implemented globally in terms of strategies and tools applied, challenges, barriers, and drivers for coal phase-out? Thirdly, how can the characteristics of the Canadian design and implementation of coal phase-out policy inform the development and specification of a sustainability-based framework for informing national coal phase-out policies?

To address these questions, the thesis builds on Gibson et al.'s (2005) sustainability assessment framework and adapts it to coal phase-out policies. The resulting framework comprises five key categories: socio-ecological system integrity and compliance with fundamental climate change mitigation objectives, livelihood sufficiency, affordability, equity, and opportunity, social dialogue, participatory decision-making, and democratic governance, Adaptability, precaution, and monitoring for long-term sustainability, and Governance accountability, inter-jurisdictional collaboration, and government support.

The framework is tested through application to the Canadian case study, which not only validates and enhances its criteria but also provides context-specific insights. The study emphasizes multi-level governance, inclusive engagement, transition fuel challenges, community vulnerability, and establishment of governance bodies as crucial aspects in coal phase-out policy.

In conclusion, this research contributes a holistic sustainability-based framework for assessing and guiding coal phase-out policies. Its application to the Canadian case underscores its practical value while

acknowledging the need for context-specific adaptation. By promoting an integrated approach that encompasses social, economic, and environmental dimensions, the framework offers a pathway towards sustainable and equitable coal phase-out, essential for a low carbon future.

Keywords: decarbonization; sustainability; assessment; just transition; coal

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CHAPTER 1. Introduction

Why and how should our society be preparing for a decarbonized future? Finding answers to this question has become increasingly pressing in recent years because of deepening climate concerns. According to the IPCC (Intergovernmental Panel on Climate Change) reports and conclusions, which have also informed the Paris Agreement resolutions, there is a need to limit the global temperature increase within 1.5°C or well below 2°C above pre-industrial levels. Meeting these objectives for limiting global warming entails reaching net-zero CO_2 emissions globally around 2050, according to the IPCC (IPCC, 2022). Furthermore, IPCC's 1.5°C proposed pathways with no or limited overshoot generally include a faster decline in the carbon intensity of electricity by 2030 and foresee the need of increasing the share of electricity supplied by renewables to 59–97% (minimum-maximum range) by 2050 (IPCC, 2018). With these imperatives in mind, countries must begin a long-term and relatively fast-paced journey towards decarbonizing the energy sector.

The transition to a decarbonized future not only addresses the urgent climate concerns highlighted by the IPCC but also provides an opportunity to reshape our unsustainable socioeconomic development approach, as emphasized by Raworth (2012), by striving for more equitable and harmonious socioecological systems for human wellbeing and survival.

1.1 Climate change mitigation context

Given the challenges humanity will face and has already been facing by the climate crisis, crucial aspects related to climate mitigation efforts, including programs and policies, need to be acknowledged.

Firstly, the primary characteristic of climate mitigation processes lies in understanding each region and each country's specific social, economic, and ecological context. One of the main challenges with the global negotiations on climate change and greenhouse (GHG) emissions has been to accommodate the context of different countries and the global common need to reduce GHG emissions drastically.

As stated by an OECD report (OECD, 2015), all countries are at different starting points and their social, economic indicators vary widely, as well as their GHG emissions per capita. Annual GDP per capita ranges from USD 2 300 in India to USD 69 600 in Luxembourg, while GHG yearly emissions per capita range from 1.5 tCO2e in India to 24 tCO2e in Australia (OECD, 2015). Given the need to limit global warming to 1.5ºC / 2°C, as per the IPCC reports, all countries will need to cut their emissions in crucial sectors to meet these requirements, but the sectors involved differ.

According to the UNFCCC, industry related GHG emissions derive from the use of energy and industrial processes. These processes comprise activities such as the production of cement, iron, steel, aluminum, and other manufacturing industries. The industrial processes account for both direct GHG

emissions and indirect emissions associated with energy inputs. The indirect emissions are included under the energy sector for the purpose of GHG inventories under the UNFCCC (OECD, 2015). The energy sector, including power generation and transport, accounts for over 70% of total GHG emissions for most OECD member countries (OECD, 2015). Metallurgical coal plays a vital role in this sector since it is a fossil fuel energy source for iron and steel production, among others.

Industrial processes' emissions from OECD member countries have decreased since 1990 but still account on average for 8% of national emissions. However, the decrease of emissions mentioned has been notably compensated by increasing industrial emissions in other economies, mainly in Asia, due to exports and imports (OECD, 2015).

According to the IPCC's (2018) energy sector pathways to limit global warming to 1.5ºC with limited or no overshoot, the use of carbon capture and storage (CCS) would allow the electricity generation share of gas to be approximately 8% of global electricity in 2050. To reach the net-zero objective, this 8% would have to be offset by equivalent permanent new GHG sequestration. Simultaneously, in this pathway, as per the IPCC report, the use of coal would go through a steep reduction and would be reduced to close to 0% (0–2% interquartile range) in the generation of electricity. In this setting, coal phase-out initiatives encompassing the electricity sector have started to rise and will likely become a trend if the global community aims to reach the necessary GHG emissions reduction.

1.2 The Paris Agreement and the "Net-Zero" objective

The Paris Agreement was signed during the 21st Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015. According to Viñuales et al. (2017), the negotiations initiated under the 2011 Durban Platform for Enhanced Action revealed significant underlying political divisions and tensions that were intricately concealed within the mandate's language. Although there are various interpretations of the Paris Agreement's tangible achievements, some evident characteristics of this accord are worthy of notice.

The process of negotiations and previous meetings to build the agreement were set a few years before 2015. Particularly at COP20 in Lima, there was a discussion on the idea of each state's submission of intended nationally determined contributions (INDCs) (Clémençon, 2016). In the context of COP20, Clémençon (2016) suggests that implementing this type of movement could simplify the process of reaching a comprehensive agreement, given that countries' commitments would already be disclosed. Although the agreement aimed to encourage all Convention states to participate, obstacles arose in achieving this objective. The European Union made it clear that binding emissions reduction commitments were essential, asserting that no agreement would be forged without them (Clémençon, 2016).

However, although the accord set a broad and global commitment within the Convention with a legally binding agreement of the UNFCCC parties, the document faced critique from various authors. Viñuales et al. (2017) argue that the Paris Agreement does not definitively resolve the tensions that emerge in various critical areas, including mitigation, adaptation, and the diverse strategies to facilitate implementation, particularly with regard to financial aspects. Instead, they contend that these tensions are deeply embedded within the agreement's text, suggesting that their resolution may depend on the agreement's future implementation and operation (Viñuales et al., 2017). In contrast, Santos (2017) argues that the Paris Agreement was able to "further coordinate different principles with the acceptance of all, achieving results which were more satisfactory in terms of compatibility between the international agreement and the preservation of national sovereignties" (Santos, 2017).

In their analysis, Nasiritousi and Bäckstrand (2019) argue that the Paris Agreement represents a shift in global climate policy. It moves away from the previous top-down, legally binding approach with fixed emission targets and timelines, towards a bottom-up, decentralized, and voluntary system where states pledge and review their reduction targets. In the decentralization of global climate change governance following the Paris Agreement, the discussion and assessment of national policy and commitments towards climate change mitigation practices become paramount. Countries and communities will require a notable transformation of social and economic systems to implement the Paris Agreement resolutions.

However, it is essential to highlight that the Paris Agreement brought the commitment of countries to keep global warming to 1.5ºC or well below 2ºC, and, most importantly, the need for emissions to reach net-zero around 2050. The net-zero commitment was clarified by the Special Report released by the IPCC in 2018, following the invitation to provide a report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways contained in the Decision of the 21st Conference of Parties (COP21) of the UNFCCC. The report concludes, amongst other issues, that pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO_2 emissions demand a decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range) (IPCC, 2018).

Practically, from a sustainability assessment perspective, the great advantage of the Paris agreement was to pave the way to the net-zero objective. Compared to the old approach of accounting for emissions below levels in some previous year, net-zero by 2050 is much clearer, more accurate, easier to translate into demands to delineate pathways to compliance, and to set carbon prices or carbon budgets sufficient to force adequate change within the remaining time.

All in all, the agreement is a legally binding international agreement on climate change. It relies on a 5- year cycle of increasingly ambitious climate engagement carried out by countries as they submit their plans for climate action known as nationally determined contributions (NDCs).

In 2021, the 26th UNFCCC Conference of the Parties (COP26) and the negotiations between parties brought relevant results regarding net-zero commitments and pledges regarding decarbonization efforts. Targets aiming at net-zero by midcentury were communicated by 74 countries (Schumer, 2021) by the end of the 26th conference. However, although each NDC update must be more progressive than the earlier submitted, countries such as Australia, Indonesia, Russia, Singapore, Switzerland, Thailand, and Vietnam have resubmitted the same target as 2015. Some of them even submitted a less ambitious one, as is the case of Brazil and Mexico (Climate Action Tracker, 2021). Among the top ten emitters, Japan, Canada, and the European Union have set legally binding net-zero commitments. Sweden and Germany set legally binding net-zero targets for 2045. France, Denmark, Spain, Hungary, and Luxemburg have set theirs for 2050 (Carver, 2021). Also, there has been progress concerning the acceleration of efforts to phase down unabated coal power[1] and phase out subsidies for fossil fuels. The "Powering Past Coal Alliance", co-founded by Canada, now has 165 members including the 28 members that joined during COP26 (PPCA, 2021).

According to Burke and Fischel (2020), "a 2016 Climate Analytics study estimated that when coal-fired power plants in operation, under construction or planned are added together, they will produce an emissions overshoot of the 1.5°C guardrail of astonishing magnitude—317% of the Paris budget". In this context, the current trend towards coal phase-out policy could play an essential role as national policies start shaping new perspectives for climate change mitigation.

1.3 Coal phase-out

According to a 2020 report by Ritchie et al., coal is responsible for more CO_2 emissions than other fossil fuels such as oil and gas. Fulfilling the needs of mitigating climate change impacts and limiting the global temperature to 1.5°C has globally motivated a collective approach towards phasing out coal as a source of energy production.

Coal has been used in a variety of sectors and industrial processes. However, most initiatives and policies concerning coal phase-out have targeted only the electricity sector. That is, eliminating coal-powered electricity generation. To keep global warming within 1.5 °C of pre-industrial levels, the use of coal power by 2030 needs to be drastically reduced, and in most scenarios, a complete cessation must be achieved by 2050 (Jakob et al., 2020).

Relevant initiatives to phase-out coal include not only a variety of national policy instruments by European countries (such as the UK and Germany) but also multi-lateral partnerships such as the "Powering Past Coal Alliance" (PPCA), launched in 2017 at the UNFCCC Conference of the Parties.

[1] "Unabated coal-fired power" refers to the generation of electricity using coal as fuel without any reduction or mitigation of the associated impacts, such as greenhouse gas emissions or air pollutants.

In some countries, such as the UK and Germany, hard coal mining has been uneconomic for decades; therefore phasing out coal for power production and coal mining have been equally targeted (Brauers et al., 2020). However, the member countries in the PPCA (including countries out of the European continent such as Mexico and Canada) are focusing only on phasing out coal for power production, thus acknowledging that coal mining has not been in the center of attention for coal phase-out. Some of the reasons for PPCA members to phase out coal rely on the fact that PPCA members utilize less coal, have older power stations, and tend to have wealthier and more transparent, independent governments (Jewell et al., 2019).

Nonetheless, in 2021, during COP26 in Glasgow (the 26th UNFCCC Conference in 2021), the PPCA initiative welcomed 28 new members. Ukraine, Chile, Singapore, Mauritius, Azerbaijan, Slovenia and Estonia head list of members, and almost two-thirds of OECD & EU governments are now PPCA members and on the way to phasing out coal by 2030 (PPCA, 2021). According to the UNFCCC (2021), new commitments were announced by at least 23 countries to phase out coal power, including Indonesia, Vietnam, Poland, South Korea, Egypt, Spain, Nepal. In Germany, the parliament passed on legislation implementing Germany's coal exit plan in July 2020. According to the Coal Phase-Out Act, by 2030, only 8 GW of coal and 9 GW of lignite power plants are expected to remain, and the phase-out of coal-fired power production should be completed by 2038 (Gagnebin, 2020; .Wehrmann, 2020).

Canada committed to a coal phase-out of coal-fired electricity by 2030. The Regulations passed on in the country in 2018 require an emissions limit of 420 t of CO2/GWh of electricity produced by electricity generating units fueled by coal, coal derivatives, and petroleum coke. This standard targets electricity, demanding it to permanently shift to lower- or non-emitting types of generation and it is considered to be performance level equivalent to gas (Government of Canada, 2018).

There are also remarkable examples from provincial, state, or municipal jurisdictions, as is the case of California in The United States, targeting a phase-out of coal-powered electricity generation and electricity imports by 2025. In Canada, the case of the province of Ontario is known for successfully implementing a policy to put an end to coal use in 2014. Also, in China, a long coal phase-out process was introduced in the city of Beijing in 1997. All those cases were motivated by diverse issues such as public health impacts, economically inviable coal power production, intentional innovative or green positioning of government, and climate change mitigation commitments.

These initiatives and commitments show that phasing out coal represents a growing trend among countries and governments tackling the reduction or complete elimination of fossil fuels. However, the specific context and motives for making such a transition are not always connected to climate change mitigation efforts.

Furthermore, the socio-economic context for phasing out coal is not trivial. As stated by Mayer et al. (2020), there are concerns, especially in "rural areas that have historically relied upon the coal industry for jobs and economic development, where a 'just transition' may be needed to soften the impact of rapid sociotechnical shifts away from carbon-based energies" (Mayer et al., p.1).

1.4 Context of sustainability and complexity

The interdependence of social, economic, and environmental factors is crucial to understanding how to build future sustainable development paths. Assessing environmental issues while also considering social conditions and the economic perspective is a way to comprehend the dynamics and broadness of sustainability challenges in order to move forward towards more robust solutions.

Moreover, it is relevant to consider that the different planetary boundaries are profoundly interconnected and deeply related to social and economic issues. Sterner et al. (2019) emphasized that due to the vast scope of human activities, a multitude of global environmental challenges has emerged. These problems frequently exhibit intricate interdependencies between their origins and potential solutions, which can result in environmental problem displacement. Over the past five decades, numerous affluent nations have witnessed notable enhancements in their local environments. However, these improvements have frequently come at the cost of degradation occurring in other regions. Such a statement confirms that boundaries are interconnected, and there are also multiple-scale challenges and solutions to be considered.

Due to the complexity of socio-ecological systems and their interdependencies, it is crucial to apply interdisciplinary approaches to assess human endeavors in enterprises and policies, also accounting for feedback mechanisms and multiple-scale assessment towards solutions, for example, related to policy design (Sterner et al., 2019). In a broad perspective, this means searching for optimal progress towards one specific issue without consideration of its implication for other dimensions and boundaries may contribute to disastrous consequences to other ecosystems and socioenvironmental issues.

Regarding the complexity of sustainability challenges, one could argue that it lies in the future perspective embedded in the concept of sustainable development and its relationship to multiple-scale approaches. The uncertainty behind future challenges and their impacts on ecosystems and society are often responsible for disbelief or lack of interest in seeking forceful solutions. Furthermore, instruments such as policy and governance regimes need to navigate important actors' disbelief and connect global and local scales towards common goals.

The design and implementation of policies, therefore, need to be assessed in light of the uncertainty and interconnectedness of aspects and dimensions (e.g., planetary boundaries and social and economic boundaries), aiming to avoid trade-offs and taking advantage of synergies (Sterner et al., 2019). This context

of sustainability and complexity will be the basis for elaboration on sustainability-based criteria to assess coal phase-out policy.

1.5 Sustainability Assessment

The term sustainability was coined in 1987 when the Brundtland Commission defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987, p.41). Many authors, business analysts, and public opinion leaders have discussed the various facets of the sustainability concept from this point on. Villeneuve et al. (2017) advocate sustainable development (SD) as an alternative to GDP-driven economic growth. They highlight sustainable development's significance in redefining development beyond mere economic expansion, emphasizing the integration of economic progress, social justice, and environmental conservation. Purvis et al. (2018) note that this trinity is often depicted as three overlapping spheres, representing society, environment, and economy, with sustainability at the intersection.

Although the term was mainly established after the Brundtland Commission, Purvis et al. (2018) argue that the idea of sustainability as a concept to critique the dominance of economic growth arose in the 1970s after the oil crises and the publication of "Limits to Growth" by Meadows et al. in 1972. Some critical thinkers from this era claimed that the capitalist-driven economic expansion in the Western world posed a fundamental challenge to achieving both ecological and social sustainability, necessitating substantial structural reforms (Purvis et al., 2018).

A recent approach to the term "sustainability" has furthered the concept beyond the pillars of economic development while ensuring social justice and environmental conservation.

According to Belyakov (2019), sustainability fundamentally pertains to ensuring the ongoing satisfaction of humanity's fundamental needs without causing the worldwide ecosystem to collapse. Furthermore, Purvis et al. (2018) argue that the three-pillar concept of sustainability did not originate from a single source but instead evolved gradually from critical discussions within early academic literature concerning the economic status quo. This concept emerged as a result of both social and ecological perspectives, as well as the United Nations' pursuit of reconciling economic growth as a solution to social and ecological challenges (Purvis et al., 2018).

A relevant critique to the perspective of sustainability's three pillars was stated by Gibson (2006a). According to Gibson, the triple bottom line approach seems to promote a focus on finding a balance and making compromises, which, while occasionally necessary, should be viewed as a last resort rather than the default objective (Gibson, 2006a). Furthermore, Gibson contends that the traditional practice of defining sustainability within distinct categories such as ecology, politics, society, economics, and culture only serves to perpetuate fragmentation (Gibson, 2006a).

An updated approach to understand how sustainability or sustainable development may be ensured lies in recognizing the interdependence of human and ecological well-being. Our human society's advancement may only be possible when comprehended as an interconnected system with all other socioecological systems in a harmonic balance.

The understanding of sustainability assessment as a perspective of integrated socioecological systems also includes a few considerations, based on Gibson's (2006) work:

• To foster sustainability, there needs to be alignment and mutual support for development both in the short and the long term.

• The complexity of socioecological systems and their interactions and feedback systems calls for precaution in any particular endeavor likely to disturb the interconnections.

• Balancing losses and gains in different social, economic or ecological variables should not be pursued as a primary effort. Instead, multiple reinforcing gains must be prioritized over compromises and trade-offs. Trade-offs may be acceptable as a last resort when there are no better options left.

• Minimizing negative impacts alone will not drive us towards sustainability. There needs to be a continuous generation of positive effects and improvements towards integrating human, social, economic, and environmental well-being.

This integrated perspective on sustainability assessment will guide this research work along with other essential concepts. Additionally, Gibson's integrative approach incorporating respect for socioecological systems' complexity will be essential in this research (Gibson, 2006). The relationship between complex socio-ecological systems with our society's socio-economic development is paramount to establishing adequate assessment frameworks for this research.

1.6 Problem context

Although there is clear evidence that coal as an energy source has a crucial impact on greenhouse gas emissions and is properly seen as a villain for climate change, there is a need to explore the spectrum of diverse socioeconomic impacts related to a strategy to phase out coal. In this setting, developing and specifying sustainability criteria covering long as well as short term socio-ecological and economic aspects for coal phase-out policy provides a valuable contribution. Furthermore, the alliance of environmental goals with requirements for a just transition process may support an integrated framework for informing climate mitigation policies.

Developing a sustainability-based assessment framework for coal phase-out is vital due to its lasting impact on livelihoods and essential sustainability components. It is deeply related to a series of issues such as climate change, health, mining economies, energy markets. Lessons from history, like

Margaret Thatcher's coal approach[2], highlight the risks of poorly managed transitions, leading to conflict and discord. Failed transitions highlight the potential suffering of victims and unintended negative outcomes.

A comprehensive assessment framework is not only theoretical, but it can also be practical, seeking to prevent such repercussions and prioritizing lasting well-being. The transition to a decarbonized future must be planned and structured while considering the effects of this process on communities that depend on the fossil fuel industry.

Furthermore, climate policy must align with broader sustainability goals and contribute to the comprehensive set of interconnected United Nations Sustainable Development Goals (SDGs), treating them as an integrated package. This approach, rooted in sustainability-based criteria and considerations, ensures that climate initiatives and transitions support overarching sustainability objectives. To guide identification and evaluation of policy options, an approach based on sustainability requirements is advocated, drawing from existing literature (Bond et al., 2012; Cooper & Gibson, 2022; Gaudreau, 2013; R. Gibson, 2016; R. B. Gibson, 2006, 2012a, 2012b). Such sustainability requirements-based assessments extend beyond projects to encompass sectoral policy plans, regional and strategic program applications. Applications of this tool include diverse cases, not only for project assessments in mining, hydrocarbon extraction, transportation, and hydropower (Cooper & Gibson, 2022), but also in rural food and agriculture (Gaudreau, 2016), national poverty reduction strategies (Hugé & Hens, 2007) or energy systems (Vargas, 2022; Gaudreau, 2013). The tool is widespread in the literature and has breadth of application, being adaptable, applicable across diverse contexts, and effective in its generic nature and customization possibilities (Cooper & Gibson, 2022).

1.7 Core thesis questions

In light of the context explained above, the research for this thesis aimed to develop and specify sustainability-based assessment criteria for phase-out policy. The framework developed in this research intended to integrate other specific contextual criteria, illuminated by the analysis of the Canadian case. The proposed framework seeks to embed critical sustainability criteria and requirements aligned with just transition and climate change mitigation objectives as a basis for informing national coal phase-out policy. For the purpose of this work, the central focus of the coal phase-out policy assessment will be on the

[2] The failed British miners' strike under Thatcher exemplifies a conflicted, tumultuous transition. She aimed to privatize coal and steel, weakening unions. The 1984 strike erupted against coal cuts by the National Coal Board, led by the National Union of Mineworkers. Intense picketing caused mine closures and clashes with police. The strike ended in 1985 without concessions, impacting unions and coal mining, leaving community scars, government resentment, and reduced union power. This case underscores the intricate interplay of economic, social, and political aspects in transitions, yielding lasting societal impacts.

industrial use of thermal coal for electricity generation. However, coal mining associated impacts from the phase out of coal-fired power are also covered where there is sufficient data and literature available.

The exclusion of metallurgical coal from the scope of this thesis is primarily related to its status as a non-target for coal phase-out efforts so far. The focus of this research mainly revolves around thermal coal, which serves as a source of power for electricity generation. Importantly, thermal coal's role goes beyond power generation, as it has ties to various sectors heavily reliant on electricity, such as infrastructure development and transportation. By concentrating on the decarbonization of electricity through the thermal coal phase-out, potential collaborative effects with these interconnected sectors can be explored, therefore contributing to a more comprehensive and impactful transition towards sustainability. Metallurgical coal's industrial usage in steel production, and its distinct stakeholders and regulations justify its exclusion from this research. By focusing efforts on thermal coal and electricity generation, the framework can provide a more concentrated analysis of policy measures, societal impacts, and pathways for achieving sustainable energy transitions in line with climate objectives.

Three central questions will guide this research:

1. What specific requirements are needed to ensure that a coal phase-out policy is aligned with contributions to sustainability, with particular attention to climate change mitigation and just transition.

2. What can be learned from coal phase-out experiences already implemented globally in terms of strategies and tools applied, challenges, barriers and drivers for coal phase-out?

3. How can the characteristics of the Canadian design and implementation of coal phase-out policy inform the development and specification of a sustainability-based framework for informing national coal phase-out policies?

1.8 Research methods

The research will apply qualitative methods to analyze the data. Firstly, a literature review will be conducted covering peer-reviewed articles and grey literature on the core themes for the conceptual framework: sustainable development, sustainability assessment, climate change mitigation, transformations towards sustainability and just transition. The literature review also aims to assess the literature available on coal phase-out policy discussions and experiences globally. The results will support building a framework with preliminary sustainability-based assessment criteria specified for the context of coal phase-out policy. This framework will then be specified using insights from a case study of coal phase-out policy in the Canadian jurisdiction. Although the framework is intended for future applications regarding national coal phase-out policy, experience so far in the Canadian case provides a significantly rich base for a case study illustrating the entrenched relationships between federal and provincial policies and programs for coal phase-out. In this context, the Canadian case will represent both the federal and provincial coal phase-

out policies and programs. The case study will rely predominantly on official document research and literature review.

1.8.1 Literature selection and analysis

Based on the research questions previously presented, I elaborated on the purpose and objectives of the literature review within this research.

In the context of coal phase-out, conducting a comprehensive literature review is an essential approach for gathering relevant theoretical and contextual data. A literature review can be considered a stand-alone research project or integrated into a larger study as a research method (Onwegbuzie & Frels, 2016). In this case, the literature review serves as a means to establish the foundations and background information necessary for understanding the issue and associated challenges and concerns. This work aligns with the guidelines proposed by Onwegbuzie and Frels (2016) for crafting a literature review, which involves selecting a topic based on the researcher's perspective, conducting searches across various sources such as books, journals, theses, magazines, newspapers, and websites, organizing and categorizing the gathered information, conducting analysis and synthesis, and finally, writing the review.

The literature review was not a stand-alone method in this project but rather a first step to provide an initial basis for creating an assessment framework. Therefore, I designed the main objectives for this research step, aligned with the research questions. The review aims to address preliminary sustainability criteria for coal phase-out policy assessment as well as the specific considerations below:

i. What current evidence suggests are essential requirements for climate policy assessment from the perspective of sustainability and just transition and climate change mitigation.

ii. The global history of coal phase-out policy experiences and discussions in terms of implementation and design - focusing on thermal coal electricity generation and thermal coal mining.

In this sense, the literature review is aligned with the research questions, but its purpose is related to broader issues for investigation. Moreover, the outcome of the initial literature review will be the conceptual basis for a sustainability-based framework to assess coal phase-out policies.

For this study on coal phase-out, three main areas of knowledge were identified: climate change mitigation policies and strategies (focusing on phasing out of coal) and sustainability, sustainability-based assessment, and transformations towards sustainability. Relevant data for these areas were collected through directed searches using key terms. The databases used included Scopus, OMNI as available through the University of Waterloo Library, and Google Scholar. Whenever necessary, Google search tool was also used, as grey literature (especially NGO and research institute reports) may not be comprehensively available in the previous databases.

The keyword searches covered terms listed below and associated variations:

1. "Climate change mitigation" AND "phase out coal"
2. "Sustainability-based assessment" AND "transformations"
3. "Coal dependency" AND "energy transition "
4. "History" AND "coal use" AND "impacts"
5. "Coal phase-out" AND "transition"
6. "Sustainable development" AND "history" AND "pillars"
7. "Sustainability assessment" AND "framework" AND "strategic environmental assessment"
8. "Transitions" AND "sustainability transformation"
9. "Climate change" AND "social justice"
10. "Just transition" AND "climate change" AND "policy"

The search terms were further refined to address the specific needs of each segment of the thesis and snowballing was also applied since cross references were also searched throughout the literature review.

The combination of main ideas and insights from the literature review formed the starting point for creating a specific assessment framework focused on sustainable outcomes for coal phase-out policy. For example, by examining literature on climate change mitigation and coal phase-out experiences (Chapter 2), the main challenges, motives and concerns associated with the transition away from coal were identified. This contributed to understanding the complex interactions between players and areas of concern impacting on sustainability issues.

The review of literature on sustainability and impact assessment, especially on sustainability-based assessment (Chapter 3) contributed key considerations for sustainability-based assessments and recognized goals aiming at positive outcomes for sustainability. The insights from Chapter 2 and Chapter 3 combined were used to build the initial framework with key sustainability criteria specified to coal phase-out policy.

The literature review also provided background information, historical context, and characteristics of the case study chosen for specification and testing of the initial framework. The preliminary framework for coal phase-out policy served as a foundation for tailoring the framework to the case study's specific characteristics and incorporating valuable insights from the Canadian experience.

1.8.2 Framework development

According to Gibson (2006), designing sustainability assessments involves integrating insights, components, and lessons from planning and assessment initiatives. It's challenging to incorporate case-specific considerations, requiring desk research to identify relevant sources like policy documents, stakeholder deliberations, and local information (Gibson, 2006). Gibson states there are three options for structuring integrated criteria: core assessment categories, case/context issue categories, or hybrid models.

This research is based on a hybrid model since the sustainability-based assessment framework development derives both from core assessment categories synthesized from the literature as well as issues identified throughout the analysis of the case and context.

Primarily, the framework will focus on sustainability-based criteria to inform design and evaluation of thermal coal phase-out policies, and coal mining associated impacts as available in the literature review. The literature review will inform the creation of this framework, synthesizing the essential sustainability assessment criteria and requirements to ensure just transition and sufficient climate change mitigation to meet global obligations. It will also encompass further requirements and objectives related to coal phase-out (e.g., ensuring that the substitutes for coal are more desirable from a local as well as global sustainability perspective). The framework criteria will be described in-depth, as well as their relevance to the context of coal phase-out policy.

The steps for framework specification for coal phase-out and further specification to the Canadian case and context, along with the case study approach, are explained in chapters 4 and 5 (sections 4.1, 4.2, 5.3, 5.4).

The framework's design as a result of the literature review and specified to the case and context may identify possible implications of the study's results for policy, practice, or research.

1.8.3 Case selection and analysis

The case study selection for this research involved careful consideration of factors aligned with a sustainability-based assessment framework for evaluating coal phase-out policies, informing future policymaking. Canada's coal phase-out policies, sustainability implications, and data availability were evaluated for relevance and scope. The choice was based on Canada's unique energy landscape, federal and provincial efforts to phase out coal, and its alignment with climate commitments including the Paris Agreement, along with availability richness of data and varying regional approaches. This selection doesn't disregard other valuable potential cases globally. More details on the case selection are provided in section 5.3.1.

The case study involved a review of documents, articles, and policy briefs aiming to comprehend the scope and the content of the coal-phase-out policies in each jurisdiction, their objectives, and expected results, as well as the stages of implementation, stakeholder inclusion, and underlying governance processes. The case study approach and methods used were further explained in chapter 5 (sections 5.3, 5.3.2, 5.3.2.1, 5.3.2.2).

The primary focus of the specified framework and case study has been to examine particular government policies and initiatives, at both the national and local levels, that are directly relevant to coal phase-out for climate change mitigation (e.g., policy commitments to phase-out coal fired power in the

federal and provincial jurisdictions) and just transition in coal phase-out (e.g., programs for re-skilling workers, funding for affected coal workers and local economic development in coal communities, governance structures to tackle the transition away from coal). However, it is clear that the range of policies that may affect just transition and climate change in the context of coal phase-out is likely to be much wider. In this setting, while recognizing that the research cannot cover all potentially influential policies and programs due to time and other limitations, the thesis intends to serve as an initial exploration, drawing important insights from the limited range of directly relevant policies it has analyzed and developing a basic framework for policy evaluation. This foundational work could then pave the way for more extensive and ambitious research in the future.

1.9 Limitations

This research is not meant to represent an exhaustive review of the literature on coal phase-out policy and sustainability assessment criteria for climate mitigation instruments. The timeline of the research (Master's thesis project) will restrict its scope and depth, particularly in the number of case studies selected. Furthermore, it needs to be acknowledged that the literature review will be restricted to the databases used in this research (mainly focusing on Scopus, University of Waterloo Library and Google Scholar, although search terms were also applied to Google search engine) and the available sources within these databases.

Regarding the case study approach, although it can provide a rich analysis of the coal phase-out implementation within its specific context, the characteristics found in each case cannot be generalized for other cases of coal phase-out. The proposed sustainability assessment framework relies on generic criteria, and such criteria must be specified for each case and context. As this research aims not to prove the effectiveness of an intervention but mostly to understand coal phase-out policy experiences and associated desirable sustainability requirements, the exploratory literature review and application of a framework to context-specific case studies remain appropriate. The case studies will support the discussion as a method to understand how this framework could be applied in specific contexts of coal phase-out policy. Both the generic criteria and the specifications will be value-laden and open to debate.

Ultimately, the literature review and document analysis for the case studies rely on publicly available information and documents written in the English language, thus acknowledging that literature published in non-English languages could add more insights and breadth to this work. To further this research and analyze other case studies, the use of non-English written documents could improve access to more specific data from each national jurisdiction.

1.10 Organization of the Thesis

Chapter 2 focuses on introducing the role played by coal phase-out in the broader context of climate change mitigation. It explores the dependency on coal and the barriers to transitioning to alternative energy sources (section 2.2.1). The chapter also covers background information on coal use, its historical context, and the associated concerns related to climate change (section 2.3), a brief review of coal phase-out initiatives, including relevant cases and policies (2.4.1) and issues and concerns related to coal phase-out. Lastly, it provides a summary of strategies to manage the transition away from coal (sections 2.4.2-2.4.3) and examines the challenges and drivers influencing the coal phase-out process (section 2.4.4).

Chapter 3 focuses on sustainability assessment and its relationship to climate change mitigation. It begins with the history and definitions of sustainable development, including its connection with economic growth (section 3.2). Different sustainability assessment approaches, criteria, and processes are explored, with a specific focus on sustainability assessment frameworks (in particular the one by Gibson et al. (2005)) and strategic environmental assessment (section 3.3). Additionally, the chapter discusses next-generation assessment processes (section 3.4) and the role of sustainability in transformation (section 3.5). It also examines the intersection of climate change and social justice (section 3.6) and dives into the concept of a just transition, its history, frameworks, and challenges (section 3.7).

Chapter 4 outlines key aspects of the sustainability-based assessment framework for coal phase-out policy. It defines preliminary sustainability-based assessment requirements (section 4.2). These include considerations for socio-ecological integrity, climate objectives, livelihoods and opportunity, equity, social dialogue, adaptability, and governance (sections 4.2.1-4.2.5). The chapter summarizes these criteria and discusses trade-off rules (sections 4.3-4.4), providing insights into their specification and integration (section 4.5). The chapter concludes by summarizing relevant findings and insights (4.6), contributing to the broader context of coal phase-out policy and sustainability, and providing the preliminary criteria to be further specified to the Canadian case.

Chapter 5 outlines the case study approach and methods. It explains the case study selection and methods, including literature review and official document research (sections 5.2, 5.2.1, 5.2.2). The chapter also details the specification of the framework (section 5.3) and addresses methodological limitations (section 5.4).

Chapters 6 and 7 are dedicated to the Canadian case study. Chapter 6 focuses on the Canadian case of coal phase-out at the federal level and provincial level as it related to specific provinces impacted by the coal phase-out initiatives. It provides background context on coal production, usage, and power generation, with a summarized review of the case of coal phase-out in Ontario. The chapter explores existing coal phase-out policy instruments and programs, political contexts in different provinces, and impacts on coal mining. Chapter 7 examines just transition initiatives accompanying coal phase-out in Canada. It highlights

federal and provincial efforts, particularly in the provinces of Alberta and Saskatchewan, and the impacted Atlantic provinces. The chapter contemplates strengths and gaps in implementation, including the role of the federal Just Transition Task Force, funding issues, and governance systems for a smooth transition away from coal-fired power generation.

Finally, chapter 8 presents a sustainability-based assessment framework tailored to the Canadian context for coal phase-out policy. It goes through the categories and specified criteria on socio-ecological system integrity and climate change mitigation (section 8.1), livelihood sufficiency and equity (section 8.2), participatory decision-making (section 8.3), adaptability, precaution, and monitoring for long-term sustainability (section 8.4), and governance support and considerations for a just transition (section 8.5). The chapter summarizes framework criteria specific to Canadian coal phase-out policy (section 8.6) and addresses trade-off considerations (section 8.7). Concluding insights are provided in section 8.8.

Lastly, chapter 9 provides a summary of the thesis, including research question answers (section 9.1.1). It outlines the sustainability-based assessment framework for coal phase-out policy (section 9.2) and summarizes case findings (section 9.3). The chapter also discusses implications for practice and theory, and future research areas.

CHAPTER 2. Climate change mitigation and coal phase-out

2.1 Introduction

This chapter focuses on coal phase-out's importance in climate mitigation and sustainability. It provides a quick history of coal use, including concerns about its contributions to climate change and the emergence of phase-out initiatives. The advantages and problems of coal use are explored, considering economic, social, ecological, and health-related aspects. The chapter highlights the need for coal phase-out due to its significant role in climate change, presenting the historical evolution of phase-out initiatives, highlighting motives, tools, and participants. In addition, this chapter presents the current status of coal consumption and reserves, along with various approaches taken to phase out coal-fired generation.

Lastly, sustainability-related issues and opportunities are examined, drawing from literature and experiences with the phase-out of coal-fired power. The chapter concludes with a summary of challenges and their implications for a sustainability-based framework, paving the way for the following chapter examining sustainability-based assessment frameworks.

2.2 Coal phase-out in the broader context of climate change mitigation

IPCC reports have continuously addressed the urgency to tackle climate change mitigation and adaptation measures. In the recent IPCC report, published in 2021, the main concern was the need to keep overall temperature increase well below 2^{o} C above pre-industrial levels and, most importantly, the dominant role of fossil fuel consumption in this challenge. The Paris Agreement launched in 2015 by the UNFCCC (COP 21) did not specifically mention the part that fossil fuel producers and consumers must play in mitigating climate change effects. However, the conference of the parties in 2021, following the sixth assessment report by the IPCC, issued a “code red” for humanity and included the reduction of fossil fuels-based emissions as paramount to reaching the expected carbon budget (*IPCC Report*, 2021).

Rockström et al. (2017) propose that gross anthropogenic carbon-dioxide (CO2) emissions must be reduced by half every decade from 2020, along with an urgent rise in carbon removal to reach net-zero emissions by 2050. According to the sixth assessment report by the IPCC, global efforts to reach net zero CO2 and GHG emissions involve transitioning from fossil fuels to low- or zero-carbon energy sources like renewables or fossil fuels with Carbon Capture and Storage (CCS) (*AR6 Synthesis Report*, n.d.). Other measures include improving efficiency, reducing non-CO2 GHG emissions, and implementing carbon dioxide removal (*AR6 Synthesis Report*, n.d.). Net zero CO2 energy systems require reduced fossil fuel use, limited use of unabated fossil fuels, carbon capture and storage, emissions-free electricity systems, electrification, energy conservation, efficiency, and integration across the energy system (*AR6 Synthesis Report*, n.d.).

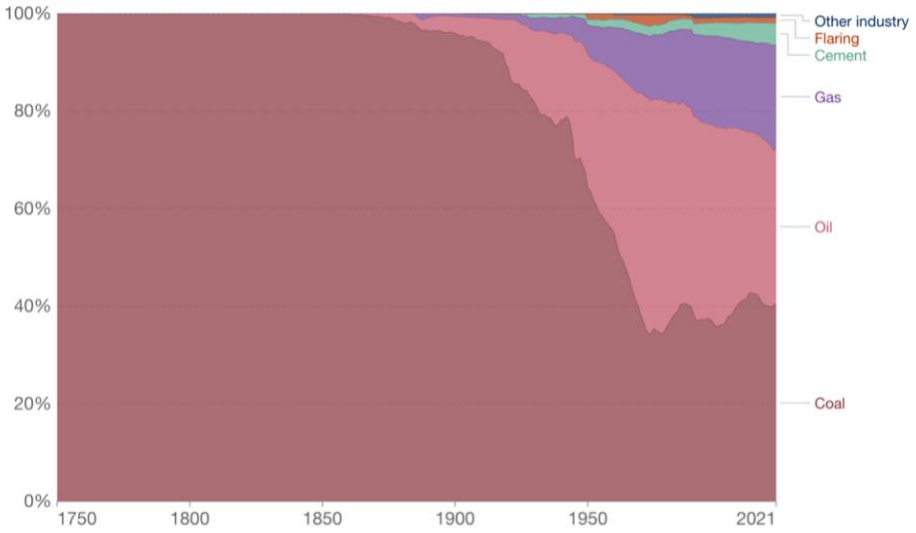
In the context of of climate change mitigation through net-zero targets and steep decline in GHG emissions, fossil fuels play a critical role since fossil fuel and industry represented approximately 91% of emissions in 2022 (compared to 9% for land-use) (Friedlingstein et al., 2022). Also, they are a crucial input in our current industrial and electricity production structures, and energy is a significant factor in the modern economy (Zheng et al., 2019). The increasing consumption of fossil fueled energy has been driving GHG emissions to unprecedented levels.

In 2019, fossil fuels still accounted for over 75% of the global primary energy supply (IEA, 2021). Although renewable energy consumption has risen, it has not yet resulted in a significant reduction in fossil fuel share in energy demand (IEA, 2021).

Among other fossil fuels, coal can be considered the worst fossil fuel type from a climate perspective due to its contribution to CO2 emissions. In 2020, it accounted for 40% of global CO2 emissions associated with energy and industrial production, followed by over 30% of CO2 emissions by oil (see figure below) (Ritchie et al., 2020a). According to Climate Transparency (2019), coal-fired power plants were the largest single contributor to emissions' growth in 2018, and it has the highest CO2 emissions per capita (Ritchie et al., 2020a). In addition, the Annex III of the 5th IPCC Assessment Report stated that coal had the highest specific emissions per energy unit generated (gCO2eq/kWh) among electricity supply technologies (Schlömer et al., 2014).

An additional factor contributing to the fossil fuel related GHG emissions status lies in fossil fuel reserves. Johnsson et al. (2019) stated that, based on IEA reports (IEA, 2017), the aggregated global fossil-fuel reserves correspond to two to five times the remaining carbon budget. Adding up to the arguments on coal significance in this issue, around 80 percent of coal reserves should be kept in the ground from 2010 to 2050 to meet the target of remaining well below 2ºC of temperature rise (Edwards, 2019). For reference, only a third of oil reserves or half of the gas reserves would need to remain unused in this timeframe (Edwards, 2019). In this sense, coal's importance has significantly intensified as its interconnection with climate change becomes more evident every day.

Figure 1 - Global CO2 emissions from energy and industrial production by fuel or industry type



From: Ritchie et al., 2020

Regarding the coal reserves still available for extraction or considered recoverable, they are around about 1.05 trillion metric tonnes and five countries had about 75% of the world's proven coal reserves by the end of 2020 (EIA, 2021). These five countries are the United States with a 22% share of proved coal reserves, Russia with 15%, Australia and China with 14%, and India with 10% (EIA, 2021). The list of countries with the largest coal reserves overlaps with the world's top coal producers: China, Indonesia, the United States, Australia, India, Russia, and South Africa representing roughly 90% of the global production (Diluiso et al., 2021).

2.2.1 Coal dependency and barriers to the energy transition

Although coal has been broadly recognized as a villain for climate change mitigation purposes, several G20 countries still rely on coal as part of their economy, as exports and/or imports, in production or consumption for industrial use (as fuel to produce steel or cement, for example) and/or for power generation (Climate Transparency, 2019). Moreover, developing countries are still expected to have a rise in economic growth, contributing to more energy and fossil fuel consumption. According to Zheng et al. (2019), the majority of the BRICS countries (leading emerging economies such as Brazil, Russia, India, China, and South Africa) are in an increasing GHG emissions path due to fast economic growth and weak climate change mitigation policies in the energy sector. As seen in the table below, emerging economies such as India, China and South Africa are among the top ten countries with highest coal-related CO2 emissions.

Table 1 - Annual CO2 emissions from coal in 2021 per country (in tonnes)

1.	China	7,955,985,400.00 t	18.	Philippines	74,912,240.00 t
2.	India	1,802,312,000.00 t	19.	Thailand	70,646,940.00 t
3.	United States	1,002,299,970.00 t	20.	Brazil	68,229,890.00 t
4.	Japan	418,820,480.00 t	21.	Pakistan	59,956,544.00 t
5.	Russia	380,227,140.00 t	22.	Czechia	51,777,950.00 t
6.	South Africa	370,266,530.00 t	23.	North Korea	50,454,110.00 t
7.	Indonesia	303,153,570.00 t	24.	Mongolia	44,400,090.00 t
8.	South Korea	283,908,350.00 t	25.	Canada	43,862,080.00 t
9.	Germany	230,221,060.00 t	26.	France	28,877,788.00 t
10.	Vietnam	196,518,370.00 t	27.	Morocco	27,844,790.00 t
11.	Kazakhstan	180,818,460.00 t	28.	Chile	26,184,922.00 t
12.	Poland	179,501,980.00 t	29.	Italy	23,999,726.00 t
13.	Turkey	162,562,340.00 t	30.	UK	23,689,726.00 t
14.	Taiwan	154,887,140.00 t	31.	Netherlands	23,000,830.00 t
15.	Australia	150,958,380.00 t	32.	Bulgaria	20,853,566.00 t
16.	Ukraine	101,829,704.00 t	33.	Mexico	19,360,576.00 t
17.	Malaysia	85,794,770.00 t	34.	Spain	18,575,482.00 t

Adapted from: Ritchie et al., 2020.

Also, China, Indonesia, India, Australia and the United States were the top five coal producing countries (by volume) in 2021. In Europe, Germany and Poland play a relevant role as coal producers although there have been efforts to phase out coal-fired power in the region. Canada is 12th coal producing country and relies more on other fossil fuels such as oil and gas, although it still accounts for relevant cumulative GHG emissions (Evans, 2021), GHG emissions per capita (Ritchie et al., 2020) and coal production per capita (Our World in Data, 2022). Currently, emerging economies along with the United States are the dominant players in coal production and consumption. Taiwan, Japan and South Korea are the only relevant coal consumers that do not appear in the top producing countries list.

Table 2 - Top 15 coal producing countries and top 15 consumers

Top producers	Top consumers
1. China	1. China
2. Indonesia	2. India
3. India	3. United States
4. Australia	4. Japan
5. United States	5. Indonesia

6. Russia	6. South Africa
7. South Africa	7. Russia
8. Kazakhstan	8. South Korea
9. Poland	9. Germany
10. Colombia	10. Vietnam
11. Germany	11. Poland
12. Canada	12. Turkey
13. Vietnam	13. Taiwan
14. North Korea	14. Australia
15. Turkey	15. Kazakhstan

Adapted from: Coal production, Our World in Data, 2022 and Coal consumption, Our World in Data, 2023[3]

Furthermore, according to Birol and Malpass (2021), most of the world's existing coal-fired power generation is concentrated in emerging and developing economies. For instance, approximately 60 percent of the electricity generated in China, India, and Indonesia relies on coal (Birol & Malpass, 2021). Similarly, almost 90 percent of the new coal power plants under development globally are also located in emerging and developing economies, predominantly in Asia (Birol & Malpass, 2021). In advanced economies, however, coal consumption reached its peak in 2007, although it still accounts for an average of 20 percent of the electricity mix in these countries (Birol & Malpass, 2021).

Coal production is also based on the coal trade. The coal trade is dominated by the demand for electricity and heat, not by steel production or industrial processes (IEA, 2022). Thermal coal (used for electricity) accounts for over 70% of the coal trade (IEA, 2022). As for the most important exporters, Australia and Indonesia remain the most important players (IEA, 2022).

Key coal-producing and consuming countries have not set ambitious emission reduction targets in line with the Paris Agreement and IPCC objectives (Diluiso et al., 2021). In G20 countries, around 30% of energy supply comes from coal, with South Africa, China, India, and Australia having the highest coal shares (Climate Transparency, 2019). Although there was a decline in coal use between 2012 and 2017, followed by a rebound since 2021, coal-fired energy generation declined in 2020 due to the COVID-19 pandemic (Climate Transparency, 2019; IEA, 2021). However, the approval of new coal-fired plants, particularly in China, poses a challenge to achieving net-zero emissions by 2050 (IEA, 2021). Global coal production has also increased since 2017, and the rise in natural gas prices has led to a switch to coal for electricity generation in some markets (IEA, 2021; Natural Resources Canada, 2021).

[3] The reported data nclude commercial solid fuels only, i.e., bituminous coal and anthracite (hard coal), and lignite and brown (sub-bituminous) coal, and other commercial solid fuels. Coal converted to liquid or gaseous fuels is excluded, but includes coal consumed in transformation processes is included.

From a historical perspective, coal can be considered paradoxical. It has been part of social and economic life for a long time, and it has pushed modern industrialization as energy intensity continuously increased to power the industrial machine and deliver consumers' expectations in modern life (Edwards, 2019; Freese, 2016) The increase in coal production also produced significant social impacts. Transporting and burning coal and the industrial production it supported began to require a large number of workers and associated political consciousness (Edwards, 2019; Mitchell, 2009). Now, however, the continuing and increasing use of coal power threatens the development it has helped to shape as it becomes the most significant source of GHG emissions and a driver of climate change while also impacting health and social conditions in surrounding communities (Edwards, 2019). Unabated coal-fired power generation must decrease annually by 11% until 2030 and be completely phased out by 2040 to achieve net zero emissions by 2050 (IEA, 2021).

The phase-out of coal is a crucial step in addressing climate change and achieving global net-zero emissions targets. Fossil fuel consumption, particularly coal, contributes significantly to greenhouse gas emissions and rising temperatures. The urgency highlighted in recent IPCC reports emphasize the need to reduce fossil fuel-based emissions to stay within the carbon budget. Coal, being the worst fossil fuel in terms of CO2 emissions, still plays a major part in the world's energy production, as many countries use it to generate electricity and for industrial purposes. Transitioning away from coal presents challenges, especially in countries with growing economies, but it is essential for a sustainable future and effective climate change mitigation.

2.3 Background on coal use and associated concerns

Coal has long been a significant energy source worldwide, but its use raises environmental, social and health concerns. The following sections provide information to understand the background and associated concerns of coal use, as it is an essential aspect in evaluating the need for transition to cleaner and more sustainable energy alternatives.

2.3.1 Brief history of coal use

Coal, a sedimentary rock derived from plant and mineral material, transforms over millions of years through pressure and heat (Hendryx et al., 2020; Schweinfurth, 2003). This nonrenewable fossil fuel is categorized by its mineral content, with various coal types based on carbon content and energy output (*Coal Explained - U.S. Energy Information Administration (EIA),* n.d.).

These coal types serve diverse purposes: anthracite for metals, bituminous and sub-bituminous for electricity and materials, and lignite for power or synthetic natural gas (*Glossary - U.S. Energy Information Administration (EIA),* n.d.). Coal's presence and its effects while used by humans can be seen, as cited by

Finkelman et al. (2021) (pg.3), as "nature's version of Dr. Jekyll and Mr. Hyde." This complex sedimentary rock has played a unique role in the development of what we could call modern society and the industrial revolution while concurrently causing massive impacts on human health and the environment, and it continues to do so.

Dating back to ancient civilizations, coal's significance led to its mining industry's growth from the sixteenth century, spurring the Industrial Revolution (Pain, 2017). Coal-fired power plants emerged in the nineteenth century, coinciding with the rise of electricity and automobiles (The History of Energy in the UK | National Grid Group, n.d.; Pain, 2017).

Concerns about the finite nature of fossil fuels and their environmental and health impacts began to arise. Coal mining has long been associated with health risks for workers, including diseases like "black lung disease" resulting from inhalation of particulate matter (Finkelman et al., 2002). According to the United States Department of Labor, over fifty-five thousand coal workers died on the job in the United States during the coal boom between 1900 and 1923 (Kahle, 2023). The impact of coal on ecosystems and human health throughout its lifecycle will be further discussed in the following section.

2.3.2 Associated concerns with coal use

The impacts on the environment and human health derived from coal use have become continuously more evident through the years. The most discussed effects in the literature are related to coal combustion pollutants, such as is the case of climate change, poor water quality, air pollution, human diseases, and mortality. (Hendryx et al., 2020).

Coal mining, washing, transportation, and combustion have significant impacts on human health and the environment. According to Hendryx et al. (2020), the "coal continuum" encompasses three phases: mining, transportation, processing, and waste disposal. Some mining techniques can be highly destructive. Mountaintop removal mining, for example, result in the destruction of mountains and the burial of streams, posing additional risks (Hendryx et al., 2020, pg. 8). There is usually a practice of clearcutting forests, either burning them or discarding them in nearby valleys, and then removing 800 feet of the mountain using explosives. The rock and soil remains are discarded on valley sides, burying headwater streams (Hendryx et al., 2020). Surface mining includes, for example, open pit and mountain top removal mining and those tend to get more attention for threats to public health due to the closeness and exposure of risks to communities (Hendryx et al., 2020).

Also, workers in coal mines may face occupational hazards such as black lung disease and silicosis due to dust inhalation (Finkelman et al., 2021). Historically, other occupational risks have involved in mining included mine disasters such as gas explosions or roof collapses.

Transportation of coal, a crucial stage in its journey, contributes to local air pollution through diesel emissions (Burt et al., 2013). Once coal reaches its destination, it undergoes combustion for electricity

generation and industrial use, releasing pollutants into the environment. This includes nitrogen oxides, sulfur dioxide, particulate matter, and heavy metals, which have significant implications for air quality and human health (Hendryx et al., 2020; Finkelman et al., 2021). The residual ash generated during the coal burning process, namely fly ash and bottom ash, presents environmental concerns such as air and water pollution and the potential for ash disposal ponds to rupture (*Coal and the Environment - U.S. Energy Information Administration (EIA)*, 2022). Nowadays, fly ash release is more controlled due to environmental regulations that require pollution control measures to capture fly ash emissions (*Coal and the Environment - U.S. Energy Information Administration (EIA)*, 2022).

After the mining process, coal can be a resource for electricity generation or industrial use, for example, in steel production and for other residential uses. Thermal coal is the type of coal mined to be used in electricity generation and heating, while metallurgical coal is usually a resource for industrial purposes, specifically for manufacturing steel.

Notably, the combustion of coal produces nanoparticles that can contribute to heart disease mortality risk, exceeding the impact of average air pollution particles (Finkelman et al., 2021). Mercury emissions, a direct result of coal combustion, contaminate the environment and pose risks through bioaccumulation in the food chain. This can lead to human poisoning, particularly affecting subsistence fishers and pregnant women (Schweinfurth, 2003; Burt et al., 2013). In the "coal continuum" for electricity generation, coal combustion is regarded as the activity that generates the most adverse impacts on health and the environment.

Coal-fired power and related activities have severe impacts on human health, but these costs are often not included in the price of coal-fired electricity. Internalizing the health costs would significantly increase the price of electricity (Burt et al., 2013). Water quality is also affected throughout the coal lifecycle, from extraction to disposal, impacting surface and groundwater (Finkelman et al., 2021). Furthermore, coal mining also leads to land alteration, ecosystem disruption, and biodiversity loss (Finkelman et al., 2021). It is important to recognize the uncertainties surrounding the dynamics and interconnectedness of human and biophysical systems, as well as the cumulative and interactive consequences of coal use (Finkelman et al., 2021). While the immediate impacts of coal are well-known, the long-term consequences may not be fully understood or predictable.

These effects highlight the environmental and health consequences associated with coal throughout its lifecycle. From extraction to combustion, each phase contributes to direct and indirect impacts on water, air, land, ecosystems, and animal and human health (Finkelman et al., 2021). The impacts of coal use in all its lifecycle can disproportionately affect vulnerable communities and populations (Hendryx et al., 2020). Morrice and Colagiuri (2013) state that injustices and disproportionate effects felt by communities adjacent to coal mining activities can include unsafe locally grown produce for human consumption due to

contaminated water, decrease of income for those selling local produce, restricted outdoor activities including swimming, unpleasant odor and dirtiness of clothes washed in the local water supply, demand for water use planning and bottled water and the associated additional costs. Hence, the effects on health and ecosystems are understood as unequal and weighing on socioeconomically disadvantaged communities around the world and the health problems previously mentioned are felt more strongly by vulnerable communities, contributing to worsening health inequities (Hendryx et al., 2020).

2.3.3 Coal use as a serious contributor to climate change and the need for coal phase-out

Beyond all the effects previously discussed, climate change is also a crucial impact of coal use. Coal is considered the most carbon-intensive among fossil fuels (Edwards, 2019). Although a decline in global coal use has occurred in the past six years – a significant decrease of 2.8%. in 2015, followed by a decrease of 6.3% in 2016 – after many years of growth (Edwards, 2019), coal still accounts for 40% of global CO2 emissions from energy use (Jakob et al., 2020; Edwards, 2019). In this setting, making the necessary shift away from fossil fuels to reach the 1.5 to 2ºC temperature increase target in 2030 (per the Paris Agreement) will require that over 80 percent of current coal reserves remain unused (Edwards, 2019).

In terms of the direct impacts of coal use on climate change, coal mining and combustion cause the emission of carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4), which is also a potent greenhouse gas. These gases magnify the planet's natural greenhouse effect and have contributed to the temperature rise, and fossil fuel emissions have been the major contributor to anthropogenic emissions since the 1950s (Finkelman et al., 2021). Coal-fired power generation is still regarded as the single largest emitter and source of global temperature increase (Finkelman et al., 2021).

The global temperature increase is understood as a powerful trigger for a series of severe impacts, e.g., polar ice and arctic permafrost melting. The consequences of this temperature rise may also intensify the burden on public health and environmental governance systems, among others, which is particularly critical in low-income countries that do not have enough resources to respond in a timely manner (Burt et al., 2013). These effects relate to disturbances in many interconnected human and biophysical systems. They may include disruptions in food chains (with altering ecosystems and affecting crops), the spread of diseases related to climate conditions (e.g., tick, mosquitos, food and water pathogens), growth in ground-level ozone and smog impacting public health systems, extreme weather including a growing number of extremely hot days, which can cause heat-related mortality, and mass migrations due to climate-related conflicts over stress on water, food, shelter, sanitation, and healthcare resources (Burt et al., 2013). In this context, strategies to reduce the cost and burden of climate change impacts due to fossil fuel use, particularly coal, become paramount.

The main findings highlight the urgent need for coal phase-out. Coal phase-out is essential not only for climate change mitigation but also due to multiple benefits. Beyond reducing greenhouse gas emissions, coal phase-out can lead to improved air quality, enhanced public health, and increased employment opportunities in clean energy sectors. Addressing inequities within and among nations is also crucial to ensure a just transition for affected communities and ensure that the burdens and benefits of coal phase-out are shared equitably.

2.4 Brief review of coal phase-out initiatives

According to the Coal 2021 report by IEA, coal consumption is set to decline in developed countries while an increase will happen in developing and emerging economies. Thus, in the United States and Europe, coal will likely decline through 2024 after a rebound in 2021, and China and India will likely increase their coal consumption (IEA, 2021). China's overall coal consumption is around half of the global total, and its power generation accounts for one-third of global coal consumption (IEA, 2021).

Furthermore, a 2020 Climate Transparency report reveals that among G20 countries, support is provided to either the domestic coal or gas sectors (Climate Transparency, 2020). The report also shows that although the primary energy supply in the G20 became less carbon-intensive, fossil fuels continue to dominate the energy mix, accounting for 81.5% (Climate Transparency, 2020). Nonetheless, significant declines in coal consumption were observed in the UK, Germany, Canada, and the USA, with increases in natural gas and oil use compensating for the reduction, except in the case of the UK. Also, in the G20, Canada, France, Germany, Italy, and the UK have established coal phase-out targets, while other such as Brazil and the European Union have implemented policies to reduce coal consumption (Climate Transparency, 2020).

Notably, eighteen countries have recently committed to phasing out coal-fired power. These countries include Portugal, which is phasing out from 2021 onwards, and Chile, with phase-out expected from 2040, among others (Climate Transparency, 2019).

The future scenario looks promising in Europe. Among European countries with coal in their energy mix, currently, only five (Poland, Turkey, Kosovo, Serbia, and Bosnia and Herzegovina) do not have official phase-out discussions yet (Europe Beyond Coal, 2022) while four G7 countries (Canada, France, Italy, and the UK) have already committed to phasing out coal-fired energy generation by 2030 (Whitley et al., 2018).

Still on the European context, Rentier et al. (2019) stated that from 1990 to 2017, the progress in escaping coal lock-in varied greatly among Poland, Spain, Germany, and the UK, although they had similar degrees of coal lock in 1990. The authors highlight that the UK has made significant progress, surpassing Spain and Germany, while Poland had minimal progress (Rentier et al., 2019). Two inspiring achievements

of the UK were the first full day in 135 years when no coal-fired power was used (Littlecott and Webb, 2017; Whitley et al., 2018), and the UK's overall carbon emissions from fossil fuels in 2017 returning to a level last seen in 1890 (Whitley et al., 2018). Also, in Europe, Germany has committed to awarding EUR 4.35 billion to lignite power plant companies as compensation for earlier investments and incentivizing closing the coal plants before 2030 (IEA, 2021).

Countries announcing a phase-out by 2030 or sooner account for a total of 35.4 gigawatts of coal power capacity, which represents 21% of Europe's coal plants currently in operation (IEA, 2021). Germany's commitment to coal phase-out by 2038 represents 17 gigawatts more to be retired after 2030 (Europe Beyond Coal, 2020). Although current phase-out commitments still account for a small share of the global coal-fired power capacity and have very different characteristics according to the context of each country, these experiences of different jurisdictions in phasing out coal can be informative for other countries (IEA, 2021).

A recent development in Russia has, however, led to some uncertainty in the global energy prices, exports and imports. An article in *Politico* showed that Vladimir Putin's war on Ukraine has unexpectedly benefited coal, which had been on the decline due to climate concerns. EU countries have decided to stop buying Russian coal by August 2022, relying instead on their own coal resources and trying to reduce its reliance on Russian energy imports, starting with coal (Wanat, 2022). However, EU countries have also been keeping coal-fired power plants operating longer to make up for potential gas shortages from Russia (Wanat, 2022). However, i this reliance on coal is likely temporary, as the EU is committed to reducing emissions and achieving climate neutrality (Wanat, 2022). Countries like Greece, Italy, Poland, Germany, the Czech Republic, and Romania are adjusting their energy plans to address immediate security concerns while also increasing investments in renewable energy (Wanat, 2022). Although coal has seen a temporary boost, experts warn that a rapid transition to cleaner and more reliable renewables remains crucial to meet climate goals (Wanat, 2022).

Meanwhile, Japan announced in 2020 a commitment to phase out less-efficient coal-fired power plants by 2030, meaning that more than two-thirds of its 140 operating coal-fired power plants will be retired (IEA, 2021).

Various studies in the literature explore coal phase-out initiatives. Highlights related to the key motivations behind transitions away from coal include rising coal production costs, declining alternative energy prices, and local environmental concerns (Diluiso et al., 2021). Diluiso et al. also identify structural changes in coal-dependent regions and rising unemployment as major challenges to the coal phase-out (Diluiso et al., 2021) while Ohlendorf et al. (2022) state that coal-dependent countries show moderate adoption of climate policy legislation, existing fossil fuel subsidies, and institutions vulnerable to corruption (Ohlendorf et al., 2022).

2.4.1 Cases and policies for coal phase-out efforts

As previously stated, an increasing number of countries are committed to phasing out coal – especially coal-fired power plants. Phasing out coal production specifically targeting coal mining is not clearly pursued under the current pledges. However, a recent systematic map by Diluiso et al. (2021) exploring studies related to coal phase-out identified a lack of evidence for the Global South and developing countries (Diluiso et al., 2021). A plausible interpretation would be that coal investments are important for these regions to provide cheap and reliable electricity, simultaneously being supported by "influential vested interests (Diluiso et al., 2021).

Another relevant takeaway from the survey carried out by Diluiso et al. (2021) concerns the different applications of coal transitions in various jurisdictions. The literature on coal phase-out covers i "supply-side" and "demand-side" interventions and cases where both approaches are applied. Demand-side policies in the climate change mitigation context are considered interventions to reduce GHG emissions indirectly by reducing coal-based energy consumption, for example by providing incentives to favor non-fossil generation alternatives (Collins and Mendelevitch, 2015). Demand-side policies include carbon pricing instruments, like carbon taxes, or cap-and-trade schemes (Collins and Mendelevitch, 2015). Carbon pricing and taxes put a price on carbon emissions, making them more expensive, and encouraging businesses to reduce their carbon footprint. A carbon tax charges a fee for each unit of emitted CO2, while cap-and-trade sets a limit on emissions and allows trading of allowances. Other demand-side policies include taxing energy use, imposing emissions standards, and requiring the use of low-emissions (or zero-emissions) energy sources (Collins and Mendelevitch, 2015). An issue with demand-side policies, however, is carbon leakage. Carbon leakage occurs when emissions-intensive activities move to jurisdictions that are not committed to climate mitigation policies and agreements (Collins and Mendelevitch, 2015). As a result, emission reductions achieved by committed jurisdictions are partially offset by increased emissions in non-committed jurisdictions (Collins and Mendelevitch, 2015). Collins and Mendelevitch (2015) further elaborate on the lack of progress in demand-side policies and highlight a growing body of literature focusing on supply-side measures to address coal.

An example of supply-side policy approach involves directly reducing or eliminating coal production by the gradual closure of the entire coal industry – e.g., coal mines as well as power-plants (Collins and Mendelevitch, 2015). According to Piggot et al. (2020), governments are increasingly recognizing the need to align climate mitigation plans with energy production strategies, driving the implementation of supply-side climate policies that limit coal production (Piggot et al., 2020). Non-state actors as well as governments are involved in these approaches, such as in investor divestment campaigns and community initiatives to develop transition plans (Piggot et al., 2020).

Diluiso et al. (2021) discussed seven cases of countries focusing on supply-side transitions (Bulgaria, Japan, Republic of Korea, Russian Federation, Slovenia, South Africa, and Sweden), and issues discussed in these cases included absolute declines of coal production, mine closures, and the relative decline of coal in energy production (Diluiso et al., 2021). The authors also examined cases from 19 countries comprised of Latin American countries, Australia, and Denmark focused on demand-side coal transitions (Diluiso et al., 2021). Moreover, studies covering demand and supply-side coal transitions were found for 14 countries by Diluiso et al., (2021), most of which went through relative and absolute declines in coal production and consumption. These countries are mainly in Europe (Belgium, Poland, Czech Republic, France, Germany, Italy, Netherlands, Spain, Portugal, Romania, UK), but also include Canada, China, and the United States. Although almost all these countries have experienced a decline in coal production and consumption – a vital factor deriving from demand and supply-side driven transitions, China is a particular case (Diluiso et al., 2021).

In China, the transition is mostly relative: an absolute decrease in coal consumption has only happened recently, and there is no evidence of a continuous absolute decline in coal production. Moreover, mine closures reported in China were fundamentally fostered by a reform in the coal industry towards sustainability, efficiency, and safety improvements through coal resource consolidation and mining sector upgrades (Diluiso et al., 2021).

Among the European countries, the cases of Germany and the UK have relevant similarities. These two countries have relied on coal for a long time for electricity generation, and both have been significant players in coal production (Diluiso et al., 2021). The coal industry in both countries has encountered relevant challenges, including old coal infrastructure. and hard coal (anthracite) mining being unprofitable for the past decades. These issues have also caused both countries to become increasingly dependent on coal imports (Diluiso et al., 2021).

According to Brauers et al. (2018), Germany has witnessed a significant decline in coal production and consumption, necessitating policy measures. Reductions in subsidies led to the phased-out production of hard coal by 2018 (Brauers et al., 2018). In Germany, for the past 60 years the coal mining industry has gone through a steady decline in production, and the last hard coal mine was closed in the end of 2018 (Diluiso et al., 2021). Unlike other old industrial regions like the UK, Furnaro et al. (2021) state that Germany's transition away from hard coal production in the 1960s was managed in a socially compatible manner, with coal workers either entering early retirement or finding follow-up employment to safeguard their socioeconomic status. However, Germany still generated 26% of its electricity using coal at that time (Diluiso et al., 2021). When lignite production in eastern Germany decreased after reunification, causing job losses, policies mitigated social impacts, but rural regions still face challenges (Brauers et al., 2018). Over time, hard coal consumption remained stable in the country, but power plants shifted from domestic

to imported coal (Brauers et al., 2020). Despite retirements, new coal power plants were built because renewables were not expected to meet energy demands and there were false expectations from the nuclear phase-out (Brauers et al., 2020).

In response to mounting civil society pressure and the coal regions' calls for financial aid, the German government established the 'Commission on Growth, Structural Change, and Employment' in 2018. This commission, also known as the 'coal commission,' comprised representatives from unions, energy companies, industry, NGOs, and residents of coal regions (Brauers et al., 2020). By the late 2010s, hard coal's share in the electricity mix decreased by half, reaching 9% in 2019, leading to low utilization rates (Brauers et al., 2020). The German Coal Commission was established to facilitate a coal phase-out and just transition (Pinker, 2020). Their recommendations, published in January 2019, included phasing out coal by 2038 (with a review in 2032), early closures of 12 GW of capacity by 2022, reducing capacity to 17 GW by 2030, €40 billion investment in transition measures, compensation for energy users and power plant operators, and potential preservation of the Hambach Forest (Pinker, 2020). The report also suggests numerous projects and generous funds for regional transition measures (Pinker, 2020). The Act to Reduce and End Coal-Fired Power Generation in Germany was implemented in 2020 aiming to gradually reduce and ultimately phase out the generation of power from hard coal and lignite sources (SMARD, 2021). Lastly, Revierwende project was initiated by German Trade Union Confederation in 2021 to support a just transition in German coal regions (Revierwende, 2021). It focuses on strengthening worker participation, an inclusive approach, and enabling knowledge transfer (Revierwende, 2021). With regional offices, it currently offers support, networking, and training to workers and unions, focusing on decent work and collective bargaining agreements (Revierwende, 2021).

The UK is also unique among G7 nations because it plans to shut down all its coal power plants. By 2025, a total of 25GW of coal power capacity will be closed, gradually over 15 years (Littlecott, 2016). In November 2015, the UK government announced plans to end unabated coal power generation by 2025 and published proposals open for consultation in November 2016, receiving 5,939 responses from various stakeholders (The U.K. Department of Business, Energy and Industrial Strategy, 2018). After reviewing feedback and conducting analyses, the government confirmed in 2017 that it would regulate the closure of unabated coal power generation units by 2025, aiming to reduce carbon dioxide emissions, improve air quality, provide market certainty for cleaner and flexible capacity, and ensure security of energy supply (The U.K. Department of Business, Energy and Industrial Strategy, 2018). Littlecott (2016) stated that the reason behind this decision was that most of the UK's remaining coal plants were old and needed to be retired. In fact, from 2010 to 2016, 12GW of older plants had already been closed due to stricter pollution regulations (Littlecott, 2016). The legislation tackled coal-fired power generation. Although coal mining has declined since 1960s in the UK (Macalister et al., 2015), the government approved the construction of

a new coal mine in Whitehaven, Cumbria, despite objections locally and globally (Harvey, 2022). The project will create jobs and produce coking coal for steelmaking but also generate 400,000 tonnes of greenhouse gas emissions annually (Harvey, 2022). Most of the coal will be exported as UK steel producers prefer greener alternatives (Harvey, 2022). Yet, the government claims the mine aligns with climate legislation and will shut down by 2049 although a legal challenge is expected due to concerns about breaching climate targets (Harvey, 2022).

Also, in 2017, the UK and Canada founded the Powering Past Coal Alliance (PPCA) to support and stimulate other countries to phase-out coal (Diluiso et al., 2021; *More than 20 Countries Launch Global Alliance to Phase Out Coal | UNFCCC*, 2017). Over 20 countries, such as France, Finland, and Mexico, along with businesses and civil society organizations, have joined the initiative (*More than 20 Countries Launch Global Alliance to Phase Out Coal | UNFCCC*, 2017). However, according to Blondeel et al. (2020), countries that do not rely much on coal and have plans to phase it out are more likely to join the PPCA. A study of 38 countries by Blondeel et al. (2020) shows that membership to the PPCA is common for those with a phase-out plan and strong climate action, or a plan and no major coal industry. Countries without climate leadership or a phase-out plan, or with a strong coal industry, are less likely to join (Blondeel et al., 2020). For Blondeel et al., (2020), the PPCA could go beyond expanding its membership and prioritize technical diplomacy, which would involve exchanging knowledge and best practices with experts and specialists to support domestic coal phase-outs. Maintaining political momentum and integrating efforts to ban coal activities globally are crucial for a successful initiative, potentially functioning as the precursor to the demand-side pillar of a regime to completely eliminate thermal coal use and production (Blondeel et al., 2020). Furthermore, over 40 countries pledged to phase out coal, at the United Nations climate summit in Glasgow (UN Climate Change Conference UK, 2021). However, major coal consumers including China, India, Australia, and the United States did not join the agreement (Plumer & Friedman, 2021).

At the same time, Canada committed to phasing out coal-fired electricity by 2030 although the decline of coal generation began before this commitment, with its share dropping from 16% in 2005 to 9% in 2016 (Pinker, 2020). Hydroelectricity and nuclear power have long competed with coal, and with renewables now account for 67% of Canada's electricity generation (Pinker, 2020). The economic factors, including the lower cost of natural gas, also contributed to the shift away from coal in the country's electricity sector (Pinker, 2020). Although Canada as a country does not rely heavily on coal, four Canadian provinces are still dependent on the coal fired power and coal mining industry. These are Saskatchewan, Nova Scotia, New Brunswick and Alberta which is now switching from coal to gas. In this context, coordination between federal and provincial jurisdictions is essential for the coal phase-out. In Canada, a Just Transition Task Force was launched in 2018 (Environment and Climate Change Canada, 2018) to

address the challenges of coal phase-outs in specific communities (Krawchenko & Gordon, 2021). This external group of experts provided 10 recommendations to the government, emphasizing coordinated multi-level government efforts, income and labor market support, community investments, and local infrastructure development (Krawchenko & Gordon, 2021). To support these recommendations, the government funded the establishment of locally driven transition centers and identified and prioritized infrastructure projects in affected communities (Krawchenko & Gordon, 2021). These initiatives aim to provide comprehensive services such as re-employment support, training, and social assistance to community members (Krawchenko & Gordon, 2021). More details on the Canadian case and the challenges faced by federal and provincial jurisdictions will be addressed in chapters 5 and 6.

According to Diluiso et al. (2021), only countries with interventions targeting both supply-side and demand-side transitions have been identified as successful in decreasing their coal dependency when compared to historical data on coal production and consumption. Examples of these countries include Canada, Germany, and the UK (Diluiso et al., 2021). Prest (2022) states that leakage, or the problem of shifting emissions to other countries, can be prevented by implementing supply- and demand-side policies together. If both policies are pursued with equal ambition, they can complement each other, avoiding any impact on global fossil fuel prices and leakage. However, if only one type of policy is implemented, leakage will persist. Prest (2022) emphasizes that supply and demand policies should be seen as partners that work together, rather than as competing options.

Concurrently, in countries where only supply-side or only demand-side driven transitions have been targeted, proper coal phase-out is less likely to be effective. Australia, for example, has been reducing its dependency on coal for electricity generation but remains one of the key players in coal production and export worldwide (Diluiso et al., 2021). Different but also unsuccessful examples are Japan and the Republic of Korea, which have implemented mine closures, but coal imports have increased to supply national internal demand (Diluiso et al., 2021).

Also, Diluiso et al. (2021) stated that regulatory instruments tend to attract less opposition than price instruments, and their consequence for specific industries such as mining or power generation can be more predictable (Diluiso et al., 2021). The regulatory intervention most commonly implemented to directly or indirectly promote coal phase-out involves environmental regulation aiming at reducing air pollution (Diluiso et al., 2021).

A summary table of relevant cases of coal phase-out and approaches taken is presented below in section 2.4.3.

2.4.2 Issues and concerns associated with the coal phase-out

Potential adverse outcomes of the transition away from coal include local socioeconomic changes. A structural change that often follows the coal transition is generally connected to losses in the job market,

decreased population, and outmigration in coal regions. Local job losses are a significant concern, and while renewable energy investments can potentially offset job losses on a larger scale, the impact on coal communities' social and cultural identity remains a challenge (Diluiso et al., 2021, citing Ram et al., 2020). Jakob et al. (2020) state that a coal phase-out requires considering social objectives and priorities. The authors highlight that the idea of a 'just transition' is crucial, but phase out discussions often only focus on creating jobs, neglecting other factors like regional economies, energy prices, and broader impacts (Jakob et al., 2020). Jakob et al. (2020) state that for a successful coal phase-out, a fair and realistic transition that provides good jobs, economic opportunities, and regional growth while minimizing harm to consumers and energy-intensive industries is needed. Evidence surveyed by Diluiso et al. (2021) also indicated that issues such as loss of identity, social capital, and social values are experienced as a result of the coal transition (Diluiso et al., 2021). For these reasons, incentivizing a new identity and livelihood alternatives for coal regions through investments in new industries and long-term alternatives can be crucial for successful coal transitions (Diluiso et al., 2021).

Vögele et al. (2023) stated that although a phase-out of coal-fired power plants can have negative impacts on income and employment in coal-exporting countries, it also brings several positive effects. These include better water management, conservation of biodiversity, reduced release of pollutants, and overall societal improvements (Vögele et al., 2023). Also, positive outcomes of coal transitions are predominantly related to immediate public health benefits regarding air pollution reduction and longer-term global contributions to climate change mitigation (Diluiso et al., 2021). This statement is aligned with findings from studies on the prevalence of health and environmental co-benefits compared to the policy costs of a coal phase-out (Diluiso et al., 2021).

In summary, transitioning away from coal has both adverse and positive effects. Adverse impacts include local socioeconomic changes and challenges to the social identity of coal communities. However, a fair and realistic transition is crucial. Positive outcomes of the transition away from coal include improved water management, biodiversity conservation, pollution reduction, and societal benefits. Coal transitions also offer short-term health benefits and contribute to climate change mitigation. Investing in new industries and long-term alternatives is essential for successful transitions in coal regions.

2.4.3 Summary of strategies to manage the transition away from coal

Various compensation schemes, investment policies and economic diversification initiatives have been implemented to manage the transformations needed in coal transitions (Diluiso et al., 2021). The most common policies to manage the transition found by Diluiso et al. (2021) include strategies aimed at restoring mining sites and reshaping the surrounding landscape and handling the transition's socioeconomic costs.

Diluiso et al. (2021) highlighted the importance of soft location factors like healthcare, education, culture, and leisure in attracting and retaining people in coal communities. Germany's investment of $40 billion in communities near closed coal mines and the US' plan for clean energy investments indicate efforts to protect workers and communities during the transition (Diluiso et al., 2021).

Also, regarding the critical actors involved in coal transitions and their relative importance, studies surveyed by Diluiso et al. (2021) show that the engagement of policymakers in facilitating coal transitions is regarded as an essential part of the transformative process. Furthermore, Diluiso et al. (2021) argue that a multi-level governance approach providing a national transition perspective and the local context may be crucial since subnational levels by themselves "often lack sufficient financial means and expertise".

A study by Wong et al. (2022) regarding lessons learned from coal phase-out experiences in Europe reported that the decline of the coal industry has created job market gaps. Former coal regions still lag behind in health, growth, and employment while attracting new businesses and retaining skilled workers is challenging, particularly in rural areas with limited infrastructure (Wong et al., 2022). Investment in education, transport, and environmental restoration were stated as crucial aspects for economic restructuring and creating secure jobs while visioning, broad participation, and bottom-up projects have shown success in managing structural change in coal regions (Wong et al., 2022).

Finally, it is highly important to acknowledge the complexity involved in coal phase-out processes. Although early coal phase-out can be considered not only urgent but also cost-effective, structuring the transition away from coal to ensure well-being and justice for all affected parties and simultaneously diminishing the influence of established entities (via alterations in governance and regulatory frameworks) is not a trivial task (Diluiso et al., 2021). More than that, transition processes away from coal need to ensure there is no lock-in[4] related to other fossil fuels (e.g., moving from coal to natural gas for electricity generation), creating new dependencies (Diluiso et al., 2021). In some places, investing in natural gas infrastructure has been seen as a way to transition to renewable energy and reduce climate impact compared to coal and oil; however, there is growing debate about whether expanding natural gas use is the right approach due to its contribution to climate change (Kemfert et al., 2022). Kemfert et al. (2022) challenge the idea of natural gas as a bridge fuel, arguing that its climate impact has been underestimated, that investing in natural gas can make it harder to achieve climate goals, and that natural gas generation projects carry economic risks, especially because of potential new carbon lock-in and stranded assets.

The table below highlights relevant cases of coal phase-out associated with key motivations, context and a brief survey of approaches taken and associated policies.

[4] Carbon lock-in happens when systems heavily reliant on fossil fuels continue to persist, causing a delay or even preventing the transition to low-carbon alternatives (Sato et al., 2021).

Table 3 - Summary of cases of coal phase-out and approaches taken

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
UK			
Decision announced in 2015, expected to be completed by 2025, later adjusted to 2024.	Coal production and unabated coal power generation in the UK.	• Coal production in the UK has been declining since its peak in 1913. • The share of coal in the UK's power generation mix declined from over 60% in 1990 to around 2% in 2020. • Declining export markets, shifting political and public support, and worsening economics led to the decline of coal in the UK. • Competition from renewable energy sources and the introduction of a carbon tax in 2010 played a role. • the UK was the first country to phase-out unabated coal power generation.	• The UK government's decision to phase out unabated coal power generation by 2025 • Introduction of a carbon tax in 2010 to incentivize cleaner energy sources. • Shifting towards renewable energy and reducing reliance on coal-fired power generation • Efforts to manage the negative impacts of the declining coal industry, although primarily reactionary. • Ongoing discussions and actions related to just transitions to support coal mining communities and mitigate social and economic challenges. • Coal mining communities were highly impacted by sudden mine closures and received little immediate support from the government. • Former coal mining communities still represent significantly lower welfare than the rest of the country. • In 2020, the UK announced it will end direct government support for the fossil fuel energy sector abroad.
GERMANY			
"The Act to Reduce and End Coal-Fired Power Generation"" enacted in 2020, expected complete phase-out by 2038.	Phase-out of hard coal and lignite power generation in Germany.	• Hard coal production decline started in the 1960s and the last hard coal mines were closed in 2018. • Increasing costs and the removal of subsidies led to hard coal production decline. • Germany's decision to phase out nuclear power increased the reliance on coal. • Pressure from the EU, civil society, and coal regions encouraged stronger climate mitigation efforts. • Need to transition towards cleaner energy sources to reduce greenhouse gas emissions and address climate change. • The coal commission's recommended phased approach includes ending new coal-fired power plants, gradually withdrawing existing plants by 2038, and assessing the possibility of an earlier phase-out by 2035.	• The Act was implemented with the primary goal of gradually reducing and ultimately phasing out the generation of power from hard coal and lignite sources. • The legislation aimed to achieve this transition in a socially responsible and economically viable manner. • In addition to reducing greenhouse gas emissions, the Act sought to promote the adoption of alternative energy sources. • The law also included provisions for the government to evaluate the possibility of advancing the decommissioning timeline to 2035. • Establishment of the Coal Commission in 2018 with its recommendations to phase out coal-fired power generation by 2038 expected along with the expansion of renewable energy to 65% of generation by 2030. • Recommendations from the commission also include alleviating hardships for affected individuals, and monitoring and adjusting measures to achieve climate targets, compensation, protections for workers, and dialogue for socially acceptable implementation.
CANADA			
Regulations Amending the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of	Federal phase-out of coal-fired electricity generation	• Coal power phase-out was motivated by climate change commitments, coal's declining competitiveness, carbon pricing, lower natural gas prices, the	• New regulation on emissions reductions setting a phase-out date for unabated coal fired power by 2030. • Focused on coal-fired power but later implementing a ban of coal imports and restrictions to coal mining, having new projects

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
Electricity Regulations: SOR/2018-263 in 2018, expected by 2030		availability of competitive renewable options.	and expansions going through federal assessment with policy statement claiming coal mining projects are not aligned with Canada's climate commitments. • The Task Force for Just Transition comprised of representatives of industry, labor, government, was established in 2018, focused on dialogue with stakeholders and setting recommendation reports. • Prairies Economic Development Canada funded three coal-transition centers, and regional development agencies supported 67 projects for skills development and economic diversification in affected communities. • "Net Zero Accountability Act" with commitment to achieving net-zero emissions by 2050, improving transparency and accountability by the government (2021) The act set a legally binding process, five-year emissions-reduction targets and requires planning and report on progress.
DENMARK			
Danish Energy Agreement in 2011, expected by 2030	Phasing coal out of Danish power plants	• Denmark has significantly reduced its reliance on coal for electricity generation, with coal accounting for 83% in 1994 and 34% in 2014. • Denmark's transition away from coal is driven by climate change concerns, energy security, and commitment to renewable energy and emission reductions (including commitment to emission reductions within the EU).	• The Danish Energy Agreement for 2012-2020 involved the phase-out of coal-fired electricity generation and included conversion of coal to biomass in large power plants. • Denmark has set targets to make 100% of its energy supply renewable by 2050, with short-term goals for renewable electricity consumption. • Danish Energy Agreement established a framework in 2012 for climate and energy policy until 2020, with a goal of achieving 35% renewable energy in gross energy consumption by 2020. • Green heating measures include converting large-scale power plants from coal to biomass and promoting new renewable technologies such as geothermal energy and large heat pumps. • Denmark supports renewable energy and has seen favorable results with wind capacity providing over 100% of energy needs on certain days. • Energy-efficiency measures are planned to meet increasing demand, assist users with the transition to a green economy, and offset job losses associated with fossil fuel use.
FRANCE			
France announced its coal phase-out in 2016, set in 2019 under the country's energy and climate law. The original plan aimed to end coal-fired electricity by 2022, but due to Russian war energy	Phasing out coal mining and stopping public financing for coal.	• Declining demand for domestic coal due to higher costs compared to imported coal. • Heavy investment in nuclear energy during the 1970s further reduced domestic coal demand. • France committed to meeting international climate change obligations, particularly within the EU.	• Cooperative dialogues and stakeholder engagement. • Aid packages and support for workers transitioning from the coal sector.(e.g., aid package negotiated in 1994, providing miners with 85% of salary until age 45 and 80% thereafter until retirement, with health and social benefits maintained). • Promotion and support for renewable energy implementation.

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
crisis, two coal plants remain active.		• Pressure to take action on climate change increased after hosting the COP meeting in 2015. • Law passed in 2019 in France aiming carbon-neutrality by 2050 led to the phase-out of remaining four coal-fired power plants by 2022. • Coal still contributes around 3% of electricity generation, while nuclear plants' share is 60%.	• Energy efficiency measures, including zero interest loans and new building code rules. • France's 2019 climate law targeting phasing out fossil fuels, promoting renewables, and combating energy-inefficient homes, with a focus on carbon neutrality by 2050 and reduction in fossil fuel consumption by 2030. • Measures outlined in 2019 focused on renovating poorly insulated homes, installing solar panels on new buildings and parking shades, supporting the hydrogen sector, and renovating energy-inefficient homes within ten years. • Goal of 33% of energy from renewable sources by 2030 and aligned with the EU's commitment to a 40% reduction in GHG emissions by 2030 • Assistance for laid-off workers, economic and environmental recovery of regions through Program 174.
ITALY			
Commitment to phase out coal by 2025 was outlined in Italy's National Energy and Climate Plan (NECP) submitted to the European Commission in 2019.	The focus of the phase-out is coal power generation.	• Italy aims to reduce carbon emissions, promote cleaner energy sources, and align with climate goals. • Italy has been gradually reducing coal-fired generation and promoting renewable energy sources in its energy mix. • The shift in energy policy, especially after the adoption of the National Energy Strategy (NES) in 2013, has been a driving force behind this transition.	• Italy is using regulations, incentives, and investments to encourage the use of renewable energy and natural gas while discouraging coal power. • Supporting renewable energy projects and offering incentives to transition away from coal. Italy aims to replace coal-fired generation with increased natural gas generation and the expansion of renewables, particularly wind and solar. • The National Energy Strategy (NES) and the National Energy and Climate Plan (NECP) provide the framework for implementing these measures. • Italy's overarching objective is to achieve deep decarbonization of the energy sector by 2040, including a full phase-out of coal generation by the end of 2025. • The NECP outlines specific goals, such as increasing RES electricity generation, developing energy infrastructure, and deploying gas-fueled power stations for flexibility and security of energy supply. • Infrastructure and economic recovery in coal regions, support from Just Transition Fund (EU)
SPAIN			
Spain's national energy and climate plan (NECP) was submitted in 2020, with a coal phase-out expected by 2030.	Hard coal and lignite in Spain's energy sector.	• Coal production in Spain has been declining since its peak in 1986, lignite production ceased in 2007. Spain closed most of its coal mines in 2018. • Declining coal production (due to market conditions, EU policies, and national policy, leading to power plant closures) and its decreasing contribution to Spain's	• Spain's energy and climate plan aims for 23% emissions cuts by 2030 and carbon neutrality by 2050, including increasing renewable energy capacity and phasing out coal power. • Subsidies to coal mining companies reduced to enhance competitiveness (Coal Activity Framework 2013-2018). • Just Transition Strategy announced in 2019 to address the negative impacts of the coal phase-out.

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
		energy mix (3% of total energy and 2% of electricity in 2020). • Shift towards cleaner energy sources and reducing greenhouse gas emissions was a relevant driver. Spain's leftwing administration, under Pedro Sánchez, prioritized environmental policies. Increasing awareness of environmental, health, and climate costs associated with coal mining. • Challenges include attracting modern industries, opportunities for youth in former mining towns, inefficient management of funds for economic reactivation with monitoring and accountability concerns.	• Agreement with unions included early retirement for miners, re-skilling and environmental restoration. (Agreement for a Fair Energy Transition for thermal power plants in closure) • Abolition of the "sunshine tax" on the solar industry. • Efforts to reduce greenhouse gas emissions and align with international climate goals. • Early retirement schemes for miners over 48 years old and re-skilling programs to transition miners to green industries. • Environmental restoration in pit communities affected by mine closures. • Infrastructure, environmental and economic recovery of coal regions and support for laid-off workers through funds managed by Just Transition Institute, Institute for Energy, Fundación Biodiversidad (national), Just Transition Fund (EU, Recovery and Resilience Facility (EU). • Conversion of former mines into museums and tourist destinations.
CHILE			
Bill drafted and presented in January 2020. Phasing out coal power plants in Chile by 2040	Coal-fired electricity generation-installation and operation of coal-fired thermoelectric plants throughout the country.	• 40% of the electricity generated in Chile came from coal in 2015, ranking first in Latin America • Coal consumption tripled in Chile over 20 years, reaching 13.3 billion short tons in 2021 • Urgency to decouple economic growth from coal consumption • Goal of reaching carbon neutrality by 2050. • National Energy Policy 2050 approved in 2017 included targets for renewable power generation of 60% by 2035 and 70% by 2050. • Abundance of solar and wind resources, with record low costs for generating power from solar photovoltaic panels. • The utility company Enel announced the closure of its last coal power plant in the country in 2022.	• Implementation of a ban on power plants less than 30 years old by December 31, 2025. The objective is to phase out or reconvert all coal-fired power plants by 2040. • Ministry of energy designed several prospective scenarios, contemplating two main options to replace coal (using renewable energy, or reconverting coal units to biomass or gas). • Chile's updated NDC under the Paris Agreement, submitted in April 2020 includes social pillar aligning climate actions with the SDGs, emphasizing just transition and decarbonization. • As of 2021, five power plants have closed in Chile, amounting to nearly 20% of the country's coal-fired power plants. Minister Jobet announced retirement of 65% of coal plants by 2025. • The Chilean coal commission, chaired by the Ministry of Energy, evaluated the effects of the coal phase-out and discussed the timeline and conditions for the phase-out in 2019. The composition of the coal commission included power sector companies, NGOs, the public sector, civil society organizations, industry associations, municipalities, academia, and consumer representatives. German organizations such as Agora Energiewende provided technical expertise and analysis on issues related to solar energy, environmental impacts, health consequences, and reconversion options for coal-fired power plants.
NEW ZEALAND			

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
Ban on new coal boilers and a phase-out of existing ones by 2037	Coal boilers (process heat)	• New Zealand's last two coal-fired units were originally planned to close by the end of 2018, but the closure was delayed due to increased demand. These units can use both coal and gas as fuel, and they have been decreasing their coal supplies. • The New Zealand Energy Strategy, aims to transition New Zealand to a net-zero carbon economy by 2050, focusing on energy affordability, security, supporting economic development while moving away from fossil fuels and increasing renewable electricity and low-emission alternatives. The strategy will explore future scenarios and set a path towards its objectives.	• The National Direction on industrial greenhouse gas emissions was established to introduce policies to decarbonize process heat, including a ban on new coal boilers and a phase-out of existing ones by 2037, along with the requirement for emission reduction plans and adoption of best practices. • The GIDI (Government Investment in Decarbonising Industry) Fund supports decarbonization of industrial process heat and provides government co-investment to New Zealand businesses committed to decarbonization goals. • The New Zealand Energy Efficiency and Conservation Strategy (NZEECS) set the policy direction for energy efficiency, conservation, and renewable energy, focusing on inclusive energy systems, increased investment in low emissions technologies, and creating opportunities. • The Just Transition Initiative was implemented to transition to a low-emissions economy by 2050, using a just and inclusive approach involving multiple agencies and partnerships. • The Just Transition Unit (JTU) and Just Transitions Partnerships (JTP) have supported the transition process, particularly in the Taranaki region after the government's decision to end offshore oil and gas exploration.
BEIJING			
The coal phase-out in Beijing began in 2014 and is ongoing.	Beijing is phasing out coal, including coal-fired power plants and coal mines.	• Coal is a major contributor to air pollution and fine particulate matter (PM2.5). • Phasing out coal is part of Beijing's efforts to improve environmental performance and transition to a low-carbon economy. • Heavy smog and environmental degradation caused by coal combustion have raised public concerns about health and quality of life. • Beijing aims to shift from an industrial-dominated economy to a service-industry dominated one, making coal phase-out necessary.	• Closure of coal-fired power plants and small, inefficient coal mines, reducing coal use and carbon emissions. • Transition to clean energy sources through the replacement of coal-fired facilities with other alternatives like natural gas. • Retrofitting existing coal-burning boilers with natural gas to reduce emissions. • Ecological recovery projects in abandoned mine sites to improve water conservation and ecosystems. • Financial support and incentives for facility upgrades, worker training, and social security for affected coal mine workers. • National policies on industrial adjustment, energy conservation, and emission reduction. • The central and local governments have implemented measures to control air pollution, including coal consumption caps and emission reductions. • China has committed to reducing its greenhouse gas emissions and increasing the share of non-fossil fuel energy sources. • Beijing has implemented a carbon cap-and-trade system to regulate and reduce carbon emissions in industrial, power, and building sectors
CALIFORNIA			

Starting date / period	Focus of the phase-out	Main reasons / Motives / Context	Approaches taken and complementary policies
Clean Power Plan 2006, expected by 2025	Phase-out of coal-fired electricity generation in-state and phase-out of coal-fired electricity imports to California	• Lack of recoverable coal reserves in California • Low percentage of in-state electricity generation coming from coal (1.5 to 2.5%) • California's culture of being "green and innovative" • Implementation of carbon cap-and-trade system and AB 32 (Global Warming Solutions Act of 2006), requiring California to lower its greenhouse gas emissions to 1990 levels by 2020 and specifically mentioning the need to stop investing in coal-fired power plants as part of emission reduction efforts.	• Senate Bill 1368 setting emissions standard for baseload generation (minimum amount of electricity needed to meet the constant, essential power demand in a region) at 1,100 lbs of carbon dioxide per MWh • Utilities accelerated their shift away from coal-based generation. • Legislation required state employee funds to divest from companies focused on coal electricity. California continued expanding its use of renewable energy sources. • The Clean Power Plan by the U.S. Environmental Protection Agency led to the retirement and conversion of coal-fired plants. • Improving air quality and reducing pollution in California were also priorities.

Adapted from Gass et al. (2016) and various sources[5]

Other cases covered in the literature include the Canadian provinces of Alberta and Ontario (further discussed in the Canadian case chapters 5 and 6), and the cases of Eastern European countries such as Poland. Poland has recently released (in 2021) its energy policy until 2040 (PEP2040) aiming for a just and inclusive transition to a zero-emissions system, including offshore wind capacity and a nuclear power plant by 2033 (*Energy Policy of Poland until 2040 (PEP2040) – Policies*, 2022). Key goals include reducing coal-fired power generation, increasing renewable electricity, and reducing greenhouse gas emissions (*Energy Policy of Poland until 2040 (PEP2040) – Policies*, 2022). The plan behind the energy policy limits to a maximum of 56% share of coal-fired power generation and estimated exit date of 2049 (*Energy Policy of Poland until 2040 (PEP2040) – Policies*, 2022). While there is some attention to reducing emissions and reliance on coal, it does not show an accelerated move away from the coal power industry.

Based on this brief survey, the most common approaches taken by countries and regions for coal phase-out include gradual reduction and phasing out of coal-fired power generation, shifting towards

[5]("Chile," 2021; Consultation on the Early Phase Out of Unabated Coal Generation in Great Britain - Department for Business, Energy and Industrial Strategy - Citizen Space, n.d.; Danish Energy Agreement for 2012-2020 – Policies, n.d.; Decarbonising Process Heat | Ministry of Business, Innovation & Employment, n.d.; Decarbonization Plan for the Electrical System – Policies, n.d.; Energy Strategies for New Zealand | Ministry of Business, Innovation & Employment, n.d.; Europe's Coal Exit - Beyond Fossil Fuels : Beyond Fossil Fuels, n.d.; Just Transition in the German Coal Mining Regions - Revierwende, 2022; Just Transition Strategy – Policies, n.d.; Loi du 8 novembre 2019 relative à l'énergie et au climat, n.d.; More than 20 Countries Launch Global Alliance to Phase Out Coal | UNFCCC, 2017; National Energy Policy 2050 | Climate Policy Database, n.d.; "Necessary Evil," 2022; Our Last Coal-Fired Power Plant in Chile Has Been Shut Down, 2022; "Russia's War Is a Short-Term Win for Coal," 2022; SMARD | Coal Phase-out under KVBG Act, n.d.; Spain Finally Sends 2030 Climate Plan to Brussels, 2020; UK Decision to End Support for Fossil Fuels Sector Overseas – Policies, n.d.; Unlocking Our Energy Productivity and Renewable Potential - New Zealand Energy Efficiency and Conservation Strategy 2017-2022, n.d.; Felix, 2019; Feng et al., 2023; Fermeglia et al., 2020; Furnaro et al., 2021; Gass et al., 2016; Harvey & editor, 2022; Hauser & Schröer, n.d.; https://magnet.cl, n.d.; Nacke et al., 2023; Neslen, 2018; Rentier et al., 2019; Steigenberger, 2019; Wong et al., 2022.

renewable energy sources, and implementing policies to incentivize cleaner energy. Just transition efforts, such as support for affected workers and mitigation of social and economic challenges, are also noticeable. Environmental restoration in coal mining communities and the allocation of funds for economic recovery and infrastructure development in coal regions are additional strategies. Other measures involve promoting energy efficiency, compliance with global climate goals and agreements, and repurposing former coal mines. These approaches collectively aim to achieve a socially responsible and economically viable transition away from coal while addressing climate targets and the needs of affected communities.

While some countries are also focusing on phasing out coal mining and stopping public financing for coal, the primary emphasis is on transitioning the power generation sector away from coal towards cleaner energy sources.

2.4.4 Challenges and drivers of the coal phase-out

Based on the survey of approaches presented in the former section, countries and regions undergoing coal phase-out face several common challenges. Negative impacts on coal mining communities, such as sudden mine closures and inadequate government support, have led to unemployment and lower quality of life in these regions. The social and economic adjustments required during the transition pose significant challenges needing proactive measures to support affected workers and communities. Additionally, shifting towards alternative energy sources and reducing reliance on coal-fired power generation requires substantial investments and infrastructure upgrades. Ensuring a just transition is crucial, and ongoing efforts include dialogues with stakeholders, protecting workers' rights, and implementing economic and environmental recovery programs. Financial considerations, including providing compensation and support for affected workers and managing the costs associated with the transition, are key challenges that need to be addressed. Environmental concerns, such as promoting restoration in affected communities and meeting emissions reduction targets, must also be taken into account. These challenges highlight the complexity of the coal phase-out process and emphasize the importance of comprehensive policies, early and proactive stakeholder engagement, and support mechanisms to ensure a just and sustainable transition.

Furthermore, Diluiso et al. (2021) report on a significant barrier to the transition away from coal being the economic dependence on the coal industry, especially in coal communities and regional economies. However, a decrease in profitability of coal-fired power compared to renewables and other alternatives is also mentioned, in contrast to past assumptions about the relative affordability of coal-fired electricity (Diluiso et al., 2021). The issue of coal support by interest groups is also predominantly a barrier to transition out of coal since stakeholders favoring the coal industry were reported more often than interest

groups fighting against coal (Diluiso et al., 2021). Also, a lack of effective structural and climate policies can be a barrier to coal transitions (Diluiso et al., 2021).

Regarding drivers for the transition away from coal, the survey of cases and literature shows that the transition from coal is driven by economic concerns, climate change mitigation, renewable energy promotion, adverse health and environmental impacts, and government policies. Factors such as decreasing demand for coal, rising costs, and the removal of subsidies have made coal uneconomical. Also, climate change commitments and the need to reduce greenhouse gas emissions motivate the shift towards cleaner energy sources, enabling the promotion of renewable energy. Shifting to cleaner energy sources further address environmental and health impacts which have also shown to be driving the coal phase-out

Additional potential drivers of coal phase-out include the development of new alternative energies (even nonrenewable sources), reduced prices for these new sources, access to technological innovations (Diluiso et al., 2021).

Lastly, government policies, including carbon taxes and commitments to international climate goals, play a significant role as motives for the transition. Overall, these drivers collectively contribute to the global move away from coal and towards more sustainable energy alternatives.

2.5 Conclusions

In conclusion, the phase-out of coal and efforts to address climate change involve significant changes that come with their own set of problems and opportunities. Transitioning away from coal power generation is a crucial step towards sustainability.

During the process of coal phase-out, a range of key sustainability-related issues emerge that are drawn from academic literature and real-world experiences. These include addressing the environmental impact of coal use, such as air pollution and greenhouse gas emissions, and seizing the opportunity to transition to cleaner energy sources. Economic considerations become paramount, with challenges related to the implications for coal-dependent regions and industries, focusing on strategies for supporting economic transitions, fostering job creation, and promoting sustainable development in affected communities. Social equity plays a crucial role in ensuring a just transition for coal workers and impacted communities, necessitating retraining programs, alternative employment options, and social support mechanisms to mitigate the social adverse impacts. Additionally, energy security is a concern, highlighting the importance of exploring diversified and sustainable energy alternatives to meet upcoming demand.

Furthermore, the cases and experiences discussed in this chapter highlight the complexity of the transition away from coal. With the interconnections between stakeholders, governance structures and global and local challenges, a well-structured and coordinated approach along with long-term planning relying on clear targets and milestones is necessary to ensure a smooth transition. Also engaging multiple

authorities and stakeholders, including national and local governments, industries, communities, and environmental organizations, and sharing knowledge and learning from past experiences helps informing decision-making and replicating successful strategies for effective coal phase-out. A comprehensive framework may address these key issues and provide guidance for achieving sustainable outcomes from the coal phase-out.

Lastly, while this chapter focused on coal phase-out and its impact on climate action, it is important to recognize that these changes are part of a larger shift towards sustainability. Chapter 3 will explore these transformations in more detail, providing a deeper understanding of the broader context and implications. By considering the connections between coal phase-out, climate change, and the wider sustainability agenda, we can navigate the path towards a more sustainable and resilient future.

CHAPTER 3. Sustainability assessment and application to climate change mitigation

3.1 Introduction

This chapter explores sustainability assessment and its relevance to climate change mitigation in the broader context of sustainability. It begins by exploring the historical context and definitions of sustainable development. Subsequently, the chapter examines sustainability assessment approaches at the strategic level, including its concepts, criteria, and different frameworks. Also, special attention is given to sustainability-based assessment processes and their role in fostering transformative actions and sustainable development.

Furthermore, the chapter explores the intersection of sustainability and transformation, addressing associated climate change, social justice issues and energy transition issues. By drawing insights from these aspects, the chapter serves as a foundation for developing a robust sustainability-based framework to assess climate change mitigation policies, in particular directed at coal phase-out.

3.2 Sustainable development history and definitions

Sustainability assessment has been recognized as a field of theory, research, and practice due to the establishment of sustainable development and sustainability as essential concepts linking human society and the environment. The concept of sustainable development originated in the 1980s (WCED, 1987), with its definitions debated across academic literature, conferences, and professional works (Mensah, 2019; Redclift and Springett, 2015). The 1972 Limits to Growth report by the Club of Rome is also foundational in shaping this concept (Purvis et al., 2019), emphasizing the necessity of a sustainable global system (Meadows et al., 1972).

Despite the familiarity of the term, sustainable development's definitions remain ambiguous (Mensah, 2019). Mensah, (2019) defines sustainability as the capacity to sustain entities, processes, or outcomes over time, reflecting its intergenerational focus. The widely recognized interpretation of sustainable development is found in the Brundtland Report (WCED, 1987), defining it as development that fulfills present needs without compromising future generations' abilities to meet their needs. This perspective intertwines human needs, environmental boundaries, and technological status (Mensah, 2019).

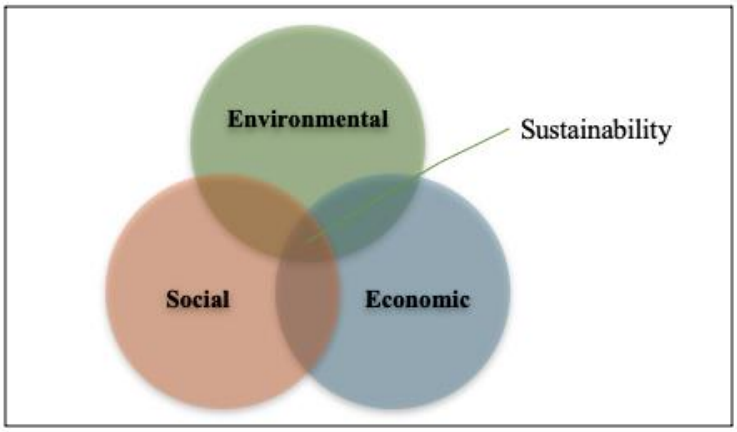
Nonetheless, criticism of sustainable development persists, particularly concerning the relationship between sustainability and economic growth and the notion of three pillars representing sustainability.

3.2.1 Sustainable development, three pillars and beyond

A common figure used to illustrate the concept of sustainability is the depiction of three spheres

representing three different pillars – social, environmental, and economic – with their intersection representing sustainability or sustainability-enhancing decisions – similar to a Venn diagram format (see Figure 1 below). The "Triple Bottom Line" is another term used to define sustainability as a concept of three components. Coined in 1994 by John Elkington, the founder of a British consultancy called SustainAbility, the "Triple Bottom Line" depicted sustainability at the intersection of the social, environmental, and economic dimensions (Elkington, 2018; Elkington, 1999).

Figure 2 - The three pillars of sustainability



Adapted from Elkington, 1997

The idea of the three pillars or bottom lines is extensively used in the literature (Purvis et al., 2019) and is widely known across corporate, government, and NGO networks. However, the literature also covers different perspectives on these three pillars, some favouring three distinct dimensions and others taking a systems approach (Purvis et al., 2019) that considers the interconnections between these dimensions and potential trade-offs. Purvis et al. (2019) argue that an approach to the interactions, trade-offs, and "mutual reinforcements" is still not an issue of agreement among scholars due to disagreements about the role of the economic pillar.

However, impacts in the social, environmental, and economic dimensions are very much integrated and interrelated. For instance, if a worker relies on a coal mining job and the mines are closed due to a coal phase-out policy, it would affect the worker's income and their family's access to resources. Moreover, mine closure and rehabilitation can significantly impact local biodiversity, lead to improved air and water quality, and mitigate carbon emissions and climate change impacts. This simple example illustrates how these dimensions are closely intertwined.

Gibson (2006a) states that in experience with pillar-based sustainability initiatives, the three dimensions have often been addressed separately, reflecting and reinforcing a fragmented view of issues that are in reality interconnected. Also, it may become more challenging in assessment processes to make

the interconnection between these dimensions if they were treated in silos from the beginning (Gibson, 2006). Similarly, Lehtonen (2004) states that the key challenges of sustainable development lie in the interfaces—synergies and trade-offs—between its different dimensions and questions the utility of analyzing dimensions of sustainability separately.

Furthermore, the triple bottom line approach tends to lead to an interpretation that the three dimensions are generally in conflict and need to be "balanced" through distributed trade-offs. The alternative is a more integrated approach that seeks to design initiatives and systems that avoid trade-offs and deliver mutually supporting gains in all dimensions. Holden et al. (2017) also propose a model that contrasts with the three-pillar model of sustainable development - which seeks to balance social, environmental, and economic objectives. Instead, their model is based on three moral imperatives: meeting human needs, ensuring social equity, and respecting environmental limits while arguing that sustainable development constitutes a set of constraints on human behavior, including constraints on economic activity (Holden et al., 2017).

While trade-offs may often be unavoidable, they should be regarded as a last resort (Gibson, 2006a). Putting sustainability into practice means engaging with multiple organizations, entities, and sectors with different expertise, looking at the full range of present and future needs, objectives, and alternatives for action and precaution (Gibson, 2006). Such endeavors are less likely to occur and be successful with a silo-minded approach.

A recent example of a more elaborated and integrated set of sustainability criteria is the Agenda 2030, or the Sustainable Development Goals developed by the United Nations (see Figure 2 below).

This agenda is meant to be achieved by 2030 globally through partnerships between private and public organizations, civil society and NGOs, governments, and communities. It centers on 17 different goals tackling different issues. Although the goals are typically depicted in 17 separate boxes (see figure below), they are all meant to be achieved at the same time, calling for an integrated approach and ensuring equity since the Agenda 2030's fundamental commitment revolves around leaving no one behind (UNSDG, 2023).

Figure 3 - The Sustainable Development Goals

From: UNSDG, 2023

Based on the discussed arguments and different perspectives on sustainability considerations, a more integrated approach toward sustainability would rely on recognizing the core generic requirements for progress towards sustainability, acknowledging these requirements interact, and striving to identify opportunities for mutually reinforcing benefits across all areas, while also avoiding trade-offs (Gibson, 2006).

In summary, the definition of sustainable development must acknowledge core issues such as the need to ensure equity, development as a process beyond economic growth, and environmental issues entrenched in socioeconomic policy and decision-making (Redclift & Springett, 2015), with ongoing pressure on planetary boundaries subject to human endeavors. Also, sustainability could be better represented by more specific and interactive requirements beyond the description of social, environmental, and economic pillars since various interconnected issues exist among these areas of concern. An essential perspective on this matter in the literature can be drawn from Gibson's research on sustainability assessment and sustainability criteria, discussed further in the next section.

3.3. Sustainability assessment approaches, including criteria and processes

In this section, the chapter examines sustainability assessment approaches, criteria, and processes, with a specific focus on the strategic level. It explores the historical context, concept, and various frameworks related to sustainability assessment. Furthermore, it discusses the purpose and applications of sustainability assessment, emphasizing its role in guiding decision-making and promoting sustainable practices.

3.3.1 Sustainability assessment origin and purpose

Sustainability assessment has been broadly addressed in the literature, although authors have used a variety of terms to terms for the practice (including sustainability appraisal, sustainability assessment,

sustainability impact assessment, and integrated assessment) (Bond et al., 2012). Following Hacking and Guthrie (2008) the following discussion will adopt sustainability assessment as the umbrella term covering various types of assessment practice.

Bond et al. (2012) define sustainability assessment as a process to lead decision-making in the direction of sustainability. Such processes may be applied to projects, plans, programs and policies. Sustainability assessment is also considered a particular form of impact assessment, and the application of sustainability assessment varies internationally mostly due to distinct regulatory and legislative scenarios and different governance arrangements and structures (Bond et al., 2012).

According to Bond & Morrison-Saunders (2011), the origin of sustainability assessment (SA) goes back to the Rio Earth Summit in 1992 and its sustainable development strategies. At this point, addressing sustainable development became a common expectation for Impact Assessment (IA) or Environmental Impact Assessment (EIA) practitioners. Environmental assessment is one of the various names applied to a process developed to guide decision-making and implementation of various undertakings with particular attention to environmental issues. Although there are adaptations in the procedural steps, range of undertakings, stakeholder participation, and scope of assessment, the fundamental goal of environmental assessment has stayed the same – changing the decision-making process to incorporate serious attention to matters previously given too little notice (Gibson et al., 2005). In the absence of assessment obligations, deliberations and decisions on projects, programs, and policies tend to focus on economic and technical issues (and political factors in the case of governmental decisions). Legislated environmental assessment requirements have played a crucial role in shifting the decision-making process to consider a broader range of concerns, particularly environmental issues, as much as technical and economic ones (Gibson et al., 2005). Sustainability-based assessment pushes the breadth of attention further to include the full suite of considerations and interactions affecting prospects for viable and desirable futures.

The emergence of different forms of impact assessment, now including sustainability assessment, also showed the necessity to develop better analytical approaches and deliberative processes to address the multiple issues and pillars encompassed by sustainability (Bond et al., 2012). Gibson et al. (2005) also state that environmental assessment has been maturing for over 30 years in the direction of sustainability assessment, while remaining flexible enough for adjustment to various applications.

Although environmental impact assessment and sustainability assessment share a history, environmental impact assessment was initially developed to encourage or require mitigation of significant adverse impacts from proposed processes and projects while sustainability assessments typically adopt a broader and longer perspective and aim for positive contributions to lasting wellbeing The purpose of sustainability assessment can be understood more distinctively as as means to pursue sustainability while recognizing sustainability needs to be defined in light of specific contexts of application (Bond & Morrison-

Saunders, 2011; Bond et al., 2012; Gibson et al., 2005). Furthermore, although the text of the first legislation in environmental impact assessment (National Environmental Policy Act – NEPA, in the USA) suggested that it would function as a tool for rational decision-making, current approaches are expected to combine conventional reasoning with differently constructed framings of sustainability, recognizing that sustainable outcomes can be conceived differently depending on stakeholders' distinct perspectives and particular contexts (Bond & Morrison-Saunders, 2011).

Gibson (2012) highlights that sustainability imperatives must be met in environmental impact assessment approaches, and sustainability assessment processes should explicitly aim for sustainable outcomes. The focus on mitigation alone is insufficient as it fails to address the interconnected social, economic, and environmental effects leading to unsustainability trends (Gibson, 2012). Instead, sustainability assessment must safeguard positive contributions to better livelihoods, preserved ecosystems, and a secure future (Bond et al., 2012; Gibson, 2006). A systemic approach, rather than solely considering the three pillars of sustainable development, is recommended to achieve net sustainability gains in the long term (Bond et al., 2012; Gibson et al., 2005; Gibson, 2006). Also, sustainability assessment must ensure there is engagement with relevant and affected stakeholders early in the assessment process to build a vision of the sustainable outcomes expected for the particular case and context (Pope et al., 2004; Pope & Grace, 2006; Bond et al., 2012).

The advantages of sustainability assessment rely on an effective approach considering the interacting social, ecologic, and economic issues and long-term effects of specific projects and undertakings. As a broad, holistic and integrative approach, sustainability assessment helps to assess different alternatives while treating trade-offs as a last resort (Bond et al., 2012; Gibson, 2006). However, Bond et al. (2012) state that a potential limitation in sustainability assessment processes could be related to the implied need for extended, robust, and costly engagement strategies to achieve the indispensable "pluralism" and to ensure due consideration of intergenerational impacts. Sustainability assessment's ambitious scope (across issues and into the future through multiple perspectives), demanding deliberative processes and high expectations (for positive contributions to sustainability) represent a profound challenge to conventional practice and to conventional projects, plans, policies, governing bodies and other established interests. Due to deeply entrenched short term interests, intergenerational equity is still considered to be weak in sustainability assessment (Bond et al., 2012). Bond and Morrison-Saunders (2011) observe that assessment practice tends to be limited by time horizons within policy and planning that seldom go beyond accounting for 10 to 20 years. The differences in long-term thinking, which are influenced by diverse cultural backgrounds, have been recognized as a significant concern (Bond et al., 2012) (e.g., the perspective of indigenous communities regarding long-term timescales may differ from dominant Western viewpoint).

An additional concern regarding sustainability assessment practice is related to follow-up and monitoring, which have been a weak aspect of assessment performance but are especially important in sustainability-based assessment processes to Integrate learning into practical application. If monitoring is not sufficiently implemented in sustainability assessment, future practitioners are unable to learn from experience and design sustainability assessment processes differently with needed improvements (Bond et al., 2012).

Lastly, a known threat to sustainability assessment practice is using sustainability assessment as a "symbolic process": when the best alternative considered through the assessment process is still expected to have net adverse effects on prospects for sustainability.

In this setting, a sustainability assessment process entails long-term thinking, integrated considerations of all significant issues, and a context-specific approach to achieve a positive contribution to sustainability (Gibson et al., 2005). To this end, understanding the essential key factors is needed so that a set of sustainability-based criteria can be used in assessment processes leading to decision-making in light of sustainability-based comparative evaluation of multiple alternatives (Gibson et al., 2005). The following section will discuss sustainability-based criteria, frameworks, and related considerations.

3.3.1.1 Sustainability assessment frameworks

According to Pope et al. (2004), a conception of sustainability assessment that is effective as an instrument for change requires a "clear vision of what sustainability means," and this vision would need to be transformed into a set of sustainability criteria. These criteria need to support clearly and effectively a decision-making process aiming at sustainability-enhancing rather than unsustainable outcomes (Pope et al., 2004). In addition, the authors argue that sustainability assessment is a tool to be also used as a process to assess the sustainability effects of existing practices retrospectively. In other words, it can be used for both proposed undertakings and existing practices (Pope et al., 2004). Furthermore, Pope et al. (2004) highlight that sustainability assessment should not be a tool to assess merely whether the proposed activity would meet particular targets but rather an evaluation against criteria based on sustainability as a societal objective, which can successfully distinguish between outcomes that contribute to or hinder progress towards sustainability. These authors also suggest that a principles-based assessment would be preferable over the perspective of the "triple bottom line." (Pope et al., 2004)

Likewise, Winfield et al. (2010) suggest applying a set of sustainability-based criteria to guide assessments aiming at sustainable outcomes and a positive contribution to sustainability. These sustainability criteria must apply to all planning initiatives involving specific requirements with attention to issues and opportunities specific to the case and context (Winfield et al., 2010). In this setting, the sustainability criteria should include specified requirements for each project, program, or policy (Winfield

et al., 2010). The authors also argue that priorities should be identified in the planning and implementation phases for projects contributing to sustainability. Furthermore, trade-off rules must be set to guide decisions where conflicts might occur, avoiding compromising specific components at the expense of others within the sustainability criteria (Winfield et al., 2010). Moreover, Gibson et al. (2005) argue that criteria lists, and frameworks can also be presented as fundamental objectives, essential principles, key challenges, or central strategy components, not aiming to represent a final word. They can and should be seen as a basic set of sustainability considerations to be specified for each case, and context since physical and social conditions surrounding each proposed activity varies significantly (Gibson et al., 2005).

According to Morrison-Saunders et al. (2014), sustainability assessment can be understood as a process aimed at guiding decision-making towards sustainability, but these authors distinguish sustainability assessment from other impact assessments, stating that sustainability assessment explicitly articulates the concept of sustainability, while other forms of impact assessment might not. Furthermore, Morrison-Saunders et al. (2014) refer to three existing models of sustainability assessment discussed by Pope et al. (2004). These models include environmental impact assessment-driven integrated assessment, objectives-led integrated assessment, and assessment for sustainability (Morrison-Saunders et al., 2014). Morrison-Saunders et al. (2014) state that the first two models adopt a simple and narrow view of sustainability, focusing on the "triple bottom line" - environmental, social, and economic aspects, although they are still practical and commonly used. On the other hand, the authors claim that the third model proposed by Pope et al. (2004) presents a more comprehensive and holistic approach, but it lacks practical examples to illustrate its application (Morrison-Saunders et al., 2014).

Ultimately, Morrison-Saunders et al. (2014) advise a more recent conceptualization of sustainability assessment, which involves evaluating the contribution to sustainability of a proposal. This approach has been put into practice in some Canadian cases and aligns with the work of Gibson (2006). Compared to the assessment for sustainability model, this newer approach focuses on assessing whether a proposal is sustainable enough, rather determining if it is sustainable or not (Morrison-Saunders, 2014).

Recently, there has been a growing trend of including sustainability assessment in impact assessment practices (Majekolagbe, 2022). For instance, Canada requires the assessment of sustainability outcomes and has also provided guidelines on the assessment process, released in 2020 (Government of Canada, 2020). However, these guidelines fall short of the framework proposed by Gibson et al. (2005) (Majekolagbe, 2022).

The framework of core generic sustainability criteria used as the basis of this research is taken from Gibson et al. (2005), *Sustainability Assessment: Criteria and Processes*. This framework was developed through an extensive literature review and synthesis of research in sustainability while also addressing insights from environmental impact assessment practice.

The proposed eight core generic criteria and list of trade-off rules are meant to be applicable to a broad range of cases and contexts. As mentioned, trade-offs may be unavoidable in various cases, but they must be treated as a last resort. To this end, in Gibson et al.'s framework, trade-off rules require explaining potential trade-offs and support paths to minimize conflicts and avoid displacement of harmful effects to future generations (Winfield et al., 2010).

Another highly relevant characteristic in Gibson et al.'s framework lies in considering the criteria as a package where all requirements are equally important and positive effects ought to be achieved in all areas since they are interconnected and can be mutually supporting (Winfield et al., 2010; Gibson et al., 2005).

The approach set out by Gibson et al. (2005) and elaborated in Gibson (2016) covers substantive criteria (related to sustainability outcomes) and trade-offs and process design features. In the sustainability assessment literature, it is also possible to find frameworks and sustainability assessment criteria covering only substantive features. However, others cover substantive and process features, and there is research on ideal characteristics in the design and implementation of legislated sustainability assessment regimes (Sinclair et al., 2021; Doelle and Sinclair, 2021; Sinclair et al., 2022).

The sustainability assessment framework encompasses interrelated process and substance criteria and this integration comes from the essential harmony between means and ends. Criteria such as empowering individuals to participate in decisions, resonates with both sustainability principles and the precautionary approach and exemplifies integrated process and substance criteria. Although applications have separated substance and process criteria, examples in the literature work with integrating these dimensions (e.g., work done by Gibson et al., 2005; Sinclair et al., 2021; Doelle and Sinclair, 2021; Sinclair et al., 2022).

The list set out in table, below, is an updated and simplified version of a set of widely recognized requirements initially synthesized from the broader literature in Gibson, et al. (2005).

Table 4 - Key generic requirements for progress towards sustainability

Life support: Establish and maintain the long-term integrity and irreplaceable functions of ecological and socio-biophysical systems
Livelihoods: Ensure that everyone and every community has enough for a decent life and opportunities to seek improvements
Intragenerational equity: Reduce inequities in sufficiency and opportunity between advantaged and disadvantaged.
Intergenerational equity: Preserve or enhance the opportunities and capabilities of future generations to live sustainably.
Resource maintenance and efficiency: Reduce extractive damage, avoid waste and cut overall material and energy use per unit of benefit.

Understanding, commitment and engagement: Build the capacity, motivation and habitual inclination of individuals, communities and other bodies to pursue lasting wellbeing. **Precaution and adaptation:** Respect uncertainty, plan to learn, design for surprise, and manage for adaptation. **Immediate and long-term integration:** Act on all requirements for sustainability at once, seeking mutually supportive benefits and multiple gains.

From Gibson, et al. (2005, ch.5).

Essential aspects in this framework relate to the interconnectedness among the criteria, treating them as a package. Also, precaution and adaptation are critical issues since complexity is part of our current society and entrenched in socioecological systems. Furthermore, the framework highlights the issue of equity, across generations and within the same generation. It also emphasizes the involvement and active participation of all relevant stakeholders in decision-making processes, with democratic and shared governance throughout assessment processes.

Lastly, a unique feature in Gibson et al.'s framework is the incorporation of trade-off rules. In light of potential and likely trade-offs between different issues within the decision-making processes, transparent rules for trade-off decisions are needed to embed recognition that trade-offs are a last resort when progress towards sustainability depends on positive steps to meet all the criteria requirements. The trade-off rules set out in Table 5, below, foster avoiding negative impacts and maximizing net gains. Also, in the case of unavoidable trade-offs, the rules of this framework place the burden of justification and explanation on the trade-off proponent, to encourage efforts to avoid sustainability trade-offs through better initial design of new undertakings.

Table 5 - Basic sustainability assessment trade-off rules as presented in Gibson et al. (2005)

Maximum net gains Any acceptable trade-off or set of trade-offs must deliver net progress towards meeting the requirements for sustainability; it must seek mutually reinforcing, cumulative and lasting contributions and must favour achievement of the most positive feasible overall result, while avoiding significant adverse effects.
Burden of argument on trade-off proponent Trade-off compromises that involve acceptance of adverse effects in sustainability-related areas are undesirable unless proven (or reasonably established) otherwise; the burden of justification falls on the proponent of the trade-off.
Avoidance of significant adverse effects

No trade-off that involves a significant adverse effect on any sustainability requirement area (for example, any effect that might undermine the integrity of a viable socio-ecological system) can be justified unless the alternative is acceptance of an even more significant adverse effect. Generally, then, no compromise or trade-off is acceptable if it entails further decline or risk of decline in a major area of existing concern (for example, as set out in official international, national or other sustainability strategies or accords, or as identified in open public processes at the local level), or if it endangers prospects for resolving problems properly identified as global, national and/or local priorities. Similarly, no trade-off is acceptable if it deepens problems in any requirement area (integrity, equity, and so on) where further decline in the existing situation may imperil the long-term viability of the whole, even if compensations of other kinds, or in other places are offered (for example, if inequities are already deep, there may be no ecological rehabilitation or efficiency compensation for introduction of significantly greater inequities). No enhancement can be permitted as an acceptable trade-off against incomplete mitigation of significant adverse effects if stronger mitigation efforts are feasible.
Burden of argument on trade-off proponent Trade-off compromises that involve acceptance of adverse effects in sustainability-related areas are undesirable unless proven (or reasonably established) otherwise; the burden of justification falls on the proponent of the trade-off.
Protection of the future No displacement of a significant adverse effect from the present to the future can be justified unless the alternative is displacement of an even more significant negative effect from the present to the future.
Explicit justification All trade-offs must be accompanied by an explicit justification based on openly identified, context-specific priorities as well as the sustainability decision criteria and the general trade-off rules. Justifications will be assisted by the presence of clarifying guides (sustainability policies, priority statements, plans based on analyses of existing stresses and desirable futures, guides to the evaluation of 'significance', and so on) that have been developed in processes as open and participative as those expected for sustainability assessments.
Open process Proposed compromises and trade-offs must be addressed and justified through processes that include open and effective involvement of all stakeholders. Relevant stakeholders include those representing sustainability-relevant positions (for example, community elders speaking for future generations) as well as those directly affected. While application of specialized expertise and technical tools can be very helpful, the decisions to be made are essentially and unavoidably value-laden and a public role is crucial.

From Gibson, et al. (2005, ch.5).

The discussion of this framework and the development of essential sustainability-based assessment criteria specified for coal phase-out will be addressed further in this chapter. Moving forward, the next section explores the field of strategic assessment and its applications, discussing its unique approach to decision-making for sustainable development.

3.3.2 Strategic assessment and applications

This section explores how strategic assessment approaches decision-making in light of sustainable development, presenting issues associated with is purpose and practice. Understanding the importance of

strategic assessments is vital for the development of a sustainability-based framework focused on the transition away from coal while making positive contributions to long-term sustainability.

The history of strategic environmental assessment in the literature dates from the late 1980s. It began as an impact assessment process dedicated to evaluating strategic level undertakings –policies, plans, and programs (PPPs) – rather than focusing solely on individual projects (Nwanekezie et al., 2022; Noble et al., 2019). Noble et al. (2019) also mention that strategic environmental assessment was initiated with an environmental assessment perspective. However, it has progressively been endorsed as a tool to help formulate policies, plans, and programs and to move institutional environment for decision-making processes toward delivering sustainability-enhancing outcomes. In recent decades, strategic environmental assessment has become part of legal requirements worldwide – in more than 60 countries, and practice has disseminated not only through legal requirements but also through requirements imposed by development banks and guidelines from organizations (Nwanekezie et al., 2022).

Experience in strategic environmental assessment has covered a range of sectors including energy sector applications involving natural gas, electric power systems, renewable energy development (Nwanekezie et al., 2022; White and Noble, 2012). Nonetheless, Nwanekezie et al. (2022) argue that the full potential of SEA in the energy sector has not been thoroughly realized. While past strategic environmental assessment has focused on assessing the impacts of energy policies and plans, Nwanekezie et al. (2022) argue that transitions and transformations in energy systems need a different approach, focusing on policy and institutional landscapes needed for a low-carbon future (Nwanekezie et al., 2022). Furthermore, Partidário (2020) states that despite initially intentions for strategic environmental assessment to provide a broader perspective and integrate environmental concerns into a sustainable development approach, practice has remained largely restricted to an environmental assessment perspective while it initially intended to provide a broader perspective and integrate environmental concerns into a sustainable development approach. Partidário (2020) argues that strategic environmental assessment limited to an environmental assessment perspective is linear and reactive, motivated by requirements for compliance with assessment obligations. In this sense, strategic assessment faces challenges in delivering broader sustainable development goals (Partidário, 2020).

The transitions or transformations now needed a call for a shift from analyzing problems to finding pathways and solutions for desirable socioecological change (Partidário, 2020). In this setting, Partidário (2020) argues that strategic impact assessment forms such as SEA and SA may collaborate to identify alternative pathways for sustainability with innovative governance solutions. Likewise, Nwanekezie et al. (2022) argue that a decision-making environment that includes identifying gaps, strengths, weaknesses, opportunities, and pressures surrounding strategic initiatives is needed to achieve sustainability transformations with suitable conditions for long-term change.

According to Noble et al. (2019), for strategic environmental assessments to be strategic, they must not only focus on PPPs, but also embed a different perspective, paying attention to the design of these initiatives and their contribution to a more sustainable and resilient future, exploring different strategic alternatives and options for decisions. Also, strategic assessments must be tightly connected to planning, providing guidance to higher and lower tiers of decision-making, while also valuing guidance from them (Noble et al., 2019). In addition, Noble et al. (2019) state that effective strategic environmental assessment needs to inform and improve "institutional decision-making culture", aiming to be integrated into the legislative and administrative contexts surrounding the development of PPPs.

Within Strategic Environmental Assessment (SEA), a sustainability-based framework is adaptable—applicable to reviewing existing policies or addressing policy gaps. The emerging concept of just transition, for example, adds a forward-looking dimension, especially in experimental contexts like Canada. With integration of retrospective analysis and future foresight, the framework allows for a holistic view.

3.3.2.1 Transitions-based strategic environmental assessment approach

Another approach in strategic environmental assessment recently discussed by Nwanekezie et al. (2021) that is particularly relevant for this research is the transitions-based strategic environmental assessment. It aims to inform and reform decision processes to facilitate fundamental changes in socio-technical, organizational, institutional, and governance systems for achieving sustainability transformations (Nwanekezie et al., 2021). For instance, in the context of transitioning an energy system, different pathways may involve shifting from fossil fuel-based to renewables-based systems or introducing renewable energy gradually or rapidly (Nwanekezie et al., 2021). Furthermore, transitions-based SEA departs focuses on assessing the decision environment, identifying constraints, opportunities, and risks of transitioning between trajectories. This approach emphasizes creating institutions to aid successful transitions and considers the distribution of opportunities and risks among different actors (Nwanekezie et al., 2021). Building on foundational strategic environmental assessment principles, five principles are cited by Nwanekezie et al. (2021) as essential for transitions-based strategic environmental assessment.

Nwanekezie et al. (2021) propose five key principles for a transitions-based strategic environmental assessment approach. Firstly, the authors emphasize the importance of having a guiding vision that outlines the long-term goals and aspirations for sustainability transitions (Nwanekezie et al., 2021). Secondly, the dynamic processes and intricate interplays principle states that SEA must recognize the dynamic and complex nature of sustainability transitions, accommodating changes and uncertainties in decision-making processes (Nwanekezie et al., 2021). Thirdly, the authors highlight the need for an institution-centered approach, considering the influence of formal and informal governance arrangements on policy outcomes (Nwanekezie et al., 2021). Fourthly, the principle of a politically sensitive assessment process,

acknowledging the political nature of strategic decision-making and identifying windows of opportunity for positive change (Nwanekezie et al., 2021). Lastly, there is a need for considering the relationships between different actors involved in sustainability decisions, aiming to promote collaborative approaches and address conflicts to achieve sustainability objectives (Nwanekezie et al., 2021). The authors cite that empowering more sustainability-oriented actors and proactive for socio-technical innovations can help accelerate strategic change and SEA can facilitate finding consensus solutions among conflicting interests (Nwanekezie et al., 2021).

Nwanekezie et al. (2021) state that strategic assessment is crucial for ambitious goals like addressing climate change. However, challenges may arise due to tensions between different jurisdictions during implementation (Nwanekezie et al., 2021). The effectiveness of these assessments can be limited by the lack of integration into formal decision-making systems. To improve their impact, SEA would have to be linked to higher-level decision-making and guide lower-tier project initiatives (Nwanekezie et al., 2021). For SEA to be influential, Nwanekezie et al. (2021) claim it must be rigorous, open, fair, and accountable.

A remarkable case of strategic assessment application related to climate change and transitions is the Scottish government's strategic assessment of onshore unconventional oil and gas (UOG) (Scottish Government, 2019). As discussed by Majekolagbe (2022), the Scottish government conducted extensive assessments and consultations over four years, validating its no-UOG policy. The assessments covered various aspects like air, water, biodiversity, and health impacts (Majekolagbe, 2022). The economic impact assessment, presented counter-narratives, highlighting potential economic benefits and lower emissions from unconventional oil and gas while the health impact assessment raised concerns from community stakeholders regarding health risks and disruptions associated with UOG development (Majekolagbe, 2022). Three options were evaluated: business as usual, pilot project, and preferred policy position, aligned with sustainability goals, showing positive environmental effects (Majekolagbe, 2022). While not ruling out future applications, new UOG licenses in Scotland are not expected (Majekolagbe, 2022). The case highlights the importance of comprehensive assessments and stakeholder involvement for a sustainable transition.

In conclusion, effective strategic assessment approach is crucial for sustainability-focused decision-making. Strategic assessments should focus on policies, plans, and programs to deliver long-term sustainability outcomes, considering the dynamic and complex nature of sustainability transitions and involving various stakeholders. A transitions-based strategic environmental assessment approach can aid in achieving fundamental changes for sustainability transformations and the Scottish government's strategic assessment of onshore unconventional oil and gas can be an example of how comprehensive assessments and stakeholder involvement can inform policy aligned with sustainability goals. Aiming for effective strategic assessments, they should be integrated into formal decision-making processes and conducted with

openness, fairness, and accountability. Adhering to these principles can greatly improve strategic assessments to contribute towards sustainable transitions.

3.4 Sustainability-based next-generation assessment processes

Impact assessment (IA) practice has long evolved for the past 50 years, owing to experience and through recognition of transformations in global and local conditions and demands (Sinclair et al., 2018). Still, researchers and practitioners have long advocated for a new generation of environmental assessments with much needed changes and advancements. The changes pledged and discussed in IA literature come mostly from experience and research on weaknesses and opportunities in IA practice, laws, and regulation to integrate complexity and sustainability (Sinclair et al., 2018).

Even though IA has delivered important contributions related to more attention to environmental concerns, shifts in decision-making processes, pushing for re-evaluations of dominant priorities and practice, transformations in the decision-making culture and integration of complex interactions within socioecological systems have been rare through IA (Gibson et al., 2016).

Gibson (2002) and Gibson and Hanna (2016), as cited by Sinclair et al. (2018) provide an example of the different stages that IA practice has gone through, culminating in a fourth and last stage that has not yet been fulfilled, as per the table 6 below. Moreover, relevant stakeholders such as indigenous nations, environmental and other non-governmental organizations, academics, and some government representatives have supported this view, advocating for the components present in Stage 4 which have not been integrated into IA practice yet (Sinclair et al., 2018).

Table 6 - Stages in the evolution of impact assessment processes

Stage 1 – Reactive pollution control responding to locally identified problems (most often air, water and soil pollution) with technical solutions and issues addressed in often closed negotiations between government and polluters.
Stage 2 – Proactive impact identification and mitigation through relatively formal impact assessment and project licensing but focused on biophysical concerns in the environment with no serious public role.
Stage 3 – Integration of broader environmental considerations in project selection and planning, but in the context of the individual activities proposed. This involves consideration of a full range of factors such as cultural, historic, and economic impacts, the examination of alternatives, and public reviews.
Stage 4 – Integrated planning and decision-making for sustainability, addressing policies and programs as well as projects and cumulative local, regional and global effects, with decision processes that empower the public, recognize uncertainties and favor precaution.

Adapted from Gibson (2002) and Gibson and Hanna (2016), as cited by Sinclair et al. (2018).

The main idea behind the next generation of assessment lies in incorporating criteria for strategic IA (or SEA), considering cumulative effects, comparing alternatives, and including sustainability requirements and trade-off rules into decision-making processes. These aspects are the most important within a package of considerations regarded in the literature as components of "the next generation assessment" and they are related to the "Stage 4" considerations in the table above (Sinclair et al., 2018).

In terms of laws and regulations, the Impact Assessment Act (IAA) enacted in 2019 in Canada has been recognized for advancements. The Impact Assessment Act introduced significant changes to the environmental assessment process at the federal level in Canada since it shifted the focus of decision-making from preventing or minimizing adverse environmental effects, as seen in the previous Canadian Environmental Assessment Act (CEAA), from 2012, to a more comprehensive impact assessment process, now involving evaluating both the positive and negative effects of a designated project (Tsuji, 2022; Government of Canada, 2019). Also, the IAA considers five key components when determining whether a development project is in the public interest: significant adverse environmental effects, mitigation measures, impacts on Indigenous peoples and their rights, climate change, and sustainability (Tsuji, 2022). Notably, the concept of sustainability in the IAA was changed, since in the CEAA, 2012's definition focused on addressing current needs while safeguarding the capacity of future generations to fulfill their own needs, and the IAA defined sustainability as "the ability to protect the environment, contribute to the social and economic well-being of the people of Canada, and preserve their health in a manner that benefits present and future generations" (Tsuji, 2022; Government of Canada, 2019). However, a review of the IAA by Gibson (2020) indicated areas of concern. The Act lacks core criteria for sustainability-based evaluations and comparative evaluation of alternatives, potentially undermining its sustainability-based assessment approach while provisions for regional and strategic assessments lack clarity, and smaller projects are not adequately covered (Gibson, 2020). Also, inter-jurisdictional collaboration receives emphasis, but uncertainties remain about substitution provisions that could submit to weaker assessment regimes (Gibson, 2020). Lastly, the Act does not fully address 'free, prior and informed consent' requirements or ensure meaningful public participation, and lacks an open data platform for assessment information, and broader engagement in effects and compliance monitoring (Gibson, 2020).

Having identified the concerns and areas for improvement in the Impact Assessment Act (IAA), as discussed in the previous text, it is evident that significant changes are necessary to achieve the goals of a next-generation assessment. Gibson et al. (2016) propose five transitions that can lead to a more effective and comprehensive assessment process. They include: aiming for the best alternative in proposals and delivering lasting wellbeing, recognizing the interdependence of social, ecological and economic factors while ensuring trade-offs are treated as a last resort, also recognizing the interconnected factors of effectiveness, efficiency and fairness while ensuring cumulative effects are addressed, and shifting IA to

become the main public forum for deliberations and decisions while applying sustainability-based criteria for projects or strategic approaches, and aiming at intergenerational sustainability and a learning culture for decision-making (Gibson et al., 2016).

In this context, Sinclair et al., (2022) have conducted a study aimed at advancing the field of Impact Assessment (IA) by proposing the concept of next-generation assessment and associated frameworks. They reviewed the existing IA literature, including works by Sadler (1996), Gibson et al. (2005), and others, to consolidate lessons and identify core elements for improved assessment regimes (Sinclair et al., 2022). The researchers developed a list of twelve essential next-generation assessment elements, with the goal of setting a framework to inform assessment improvement efforts globally. By fulfilling the needs stated within these key components, impact assessment may achieve its potential of a more "effective, efficient and fair decision-making process", being supported by clearer criteria and guidance, which would ensure more credibility for IA processes (Sinclair et al., 2018; Sinclair et al., 2022). The key elements are listed in the table below.

Table 7 - Key essential elements for next generation assessment

1. Sustainability-based assessments with explicit criteria, positive contributions to sustainability, avoidance/mitigation of adverse effects and minimization of trade-offs. Standard criteria include biophysical effects, social effects, cultural effects, fair geographic distribution of effects, fair intergenerational distribution of effects, and full transparency, justification and accountability. A key design question is the final list of criteria, and the specific trade-off rules to help decide when a net negative effect in one area can be justified by a 'greater' net benefit in another area.
2. Comparative evaluation of alternatives including the null option. Selection of appropriate alternatives and assignment of responsibility to provide the information needed to be able to assess whether the alternatives offer a better way forward than the proposed undertaking.
3. Integrated, tiered assessments covering all undertakings at the regional, strategic and project levels. Establishing the role each tier of assessment plays in sustain-ability decision-making, how their roles are properly integrated into an overall system of decision-making, and what happens at the project level when there are gaps at the regional or strategic level.
4. Assessment streams – process pathways with different substantive and procedural demands for assessment, review and decision making are available for assessment of undertakings of different character, potential significance of adverse effects and benefits, and potential for public interest and concern
5. Cumulative effects assessment All assessments emphasize attention to cumulative effects and pay attention to the respective role of each of the three tiers under criterion 3, and the development of a reasonable range of future development scenarios to inform the cumulative effects analysis with a better understanding of the interaction of the proposed undertaking with future development.

6. Cooperative project and regional/strategic assessments by all affected jurisdictions How to encourage affected jurisdictions to support and actively participate in the design and implementation of one comprehensive joint assessment involving all affected jurisdictions.
7. Co-governance with Indigenous Nations/ Communities. In the Canadian context, there is a commitment from the federal government to a Nation-to-Nation relationship with indigenous communities, and to the UN Declaration on the Rights of Indigenous People (UNDRIP). At the same time, there is continuing pressure to bring consultation with indigenous communities within the assessment process in the name of efficiency.
8. Meaningful public participation, starting early, continuing throughout Effective public participation requires flexibility and good judgment. The challenge has often been that the flexibility is too often used in the name of efficiency rather than to ensure effective engagement, particularly when it comes to engaging those with limited capacity and resources, and those whose cultural norms clash with western norms of communication and engagement.
9. Learning facilitated throughout assessment stages and processes. Realizing the potential of assessments actually serving as a vehicle for mutual learning for all involved. Changing the mindsets of proponents, government officials, and intervenors from seeing assessment processes as a battle ground to advance their interests to a mindset that recognizes that it provides a unique opportunity to develop common ground in the pursuit of the public interest.
10. Transparency and accountability Finding ways to more effectively create transparency and accountability to encourage the inevitable exercise of discretion at critical stages in the assessment process in the public interest, in the interest of sustain-ability
11. Independent follow-up – monitoring of effects and compliance, responsive adjustments, and ongoing improvement. Moving from the art of predicting effects of proposed under-takings to actually monitoring the effects of approved undertakings, we learn and adjust. Also, finding ways to ensure that we adjust the conditions of approval for implemented undertakings, and how do we learn to make better predictions for similar future proposals
12. Independent and impartial administration and assessment review Ensuring the credibility and impartiality of the process. Who is best placed to exercise discretion with respect to triggering, scope, process design, analysis and review, final decision-making and follow-up? Ensuring that those tasked with making key decisions are independent, impartial, and accountable.

Adapted from Sinclair et al., 2022.

In conclusion, the key elements above translate the main factors for advancement in IA practice, also connected to the stage 4 issues addressed by Gibson (2002) and Sinclair et al. (2018). However, Sinclair et al. (2018) state that cooperation between jurisdictions, meaningful public participation, implementing strategic assessments to inform decisions on the project level, and promoting honest and diligent application

of sustainability criteria in the decision-making process will be crucial challenges to be surmounted by the next-generation assessments (Sinclair et al., 2018).

Furthermore, next-generation assessment requirements go beyond project level assessments. Doelle and Sinclair (2021) illustrate an example of next generation assessment framework guiding assessments not just for projects but applicable to wider policies, across regional and sectoral levels.

Finally, the key factors presented in this section are closely connected to the sustainability- based criteria by Gibson et al. (2005), and all these considerations will inform the development of the sustainability-based framework for this research.

3.5 Sustainability and transformation

The urgent challenge of meeting the ambitious climate targets set by the Paris Agreement to limit global temperature increase to 1.5°C or 2°C has brought a spotlight on sustainability and transformation in both research and action. While countries have committed to achieving these targets through their Nationally Determined Contributions (NDCs), the road to implementation remains concerning. UNFCCC reported in 2022 that global greenhouse gas emissions are declining, but current efforts are inadequate to limit temperature rise to 1.5°C by the century's end (UNFCCC, 2022). The combined climate pledges of 193 Parties under the Paris Agreement may lead to around 2.5°C temperature increase by that time (UNFCCC, 2022). As a response to this challenge, there is a growing interest in exploring transformative approaches that address the complexity of interactions among social, technological, and ecological systems. This section explores the topic of sustainability and transformation, aiming to understand the essential changes necessary to promote greater equity and sustainability.

Intending to meet challenging climate targets, societal transformations for decarbonization and the related socioeconomic, environmental, political, and technological shifts, become paramount. Even more, they need to be implemented as urgently as possible. Hence, this leads to an important reflection on what transformation means and entails.

According to Patterson et al. (2017), “transformations towards sustainability” can be understood as essential changes in “socio-technical-ecological systems” that can create new configurations of interactions and related effects. These transformations are concentrated on desirable societal shifts towards more sustainable and fair futures and the interconnected reasons and explanations for such changes (Patterson et al., 2017). However, the focus on sustainability has been more recent, since transformations have been a subject in many different bodies of literature for a more extended period. (Patterson et al., 2017).

Polanyi (1944) defines transformation as changes in the human mind leading to new institutions and relationships with the state, economy, and distribution. Norgaard (2006) sees transformation as an ongoing connection between humans and the environment. Different perspectives on transformations exist,

with Scoones et al. (2020) comparing intentional human-directed transformations resulting from carefully planned interventions by policy actors to those initiated by external biophysical factors such as climate change. However, the key focus for my research lies in intentional human-led transformations. It is essential to recognize that human-directed transformations, along with their combinations, can lead to interactive feedback effects, often producing unpredicted and unintended human and environmental responses. Consequently, the human intention aspect of transformations is complex and susceptible to perform in unexpected ways and/or with unexpected results.

Patterson et al. (2017) state that transformations are complex and involve interaction among various systems (human, biophysical, technological, etc.), stating that transformation likely arises from these multiple interactions. In this sense, it cannot be viewed or dealt with adequately in a single disciplinary way.

According to Patterson et al. (2017), transformations involve complex interactions among human, biophysical, and technological systems, making them multi-disciplinary in nature (Patterson et al., 2017). Moreover, the role of social agency and the political perspective in transformative processes need to be acknowledged. Meadowcroft (2011) and van den Bergh et al. (2011) suggest that transformations towards sustainability tend to be profoundly political due to multiple actors being affected – positively or negatively – in various ways as a result of transformative processes. Also, the ways actors perceive change processes and the value-laden interpretations of each actor involved contribute to the political aspect and complexity of transformations toward sustainable futures (Patterson et al., 2017).

Although there are various approaches in the literature concerning transformations for sustainability (such as socio-technical transitions, social-ecological transformations, sustainability pathways, and transformative adaptation) (Patterson et al., 2017), some aspects of these approaches are notably more relevant to discussing decarbonization and, in particular, coal phase-out processes.

Transitions approaches often apply a sectoral perspective (e.g., energy, waste, water, food systems) while focusing on sustainable production and consumption patterns (Patterson et al., 2017). Stirling (2014) suggests that transitions are often understood as changes caused by technological innovations towards a more specific result and using more explicit frameworks of knowledge. The author also mentions how transitions are generally achieved through systematic control by established entities (Stirling, 2014). Loorbach et al. (2017) state that "transition" refers to a nonlinear shift from one dynamic equilibrium to another and is a concept widely used in various scientific disciplines, while "sustainability transitions" represent large-scale societal changes needed to address significant challenges. These transitions are disruptive and occur over decades, threatening existing stable configurations and presenting opportunities for radical, systemic change (Loorbach et al., 2017). An example is the energy transition, which involves moving from fossil fuels to renewable energy systems. Progress has been notable since the early 2000s, with the diffusion of renewable technologies coinciding with disruptions in oil and gas markets, declines in

coal usage, and challenges for fossil energy companies (Loorbach et al., 2017).

Patterson et al. (2017) view the transitions pathways approach as fostering change across various levels, involving technology, society, institutions, and the economy (Patterson et al., 2017). This approach considers not only practical and operational aspects but also strategic ones, focusing on creating visions, and reflexive ones, which involve assessing and monitoring progress towards the vision (Patterson et al., 2017). Burch et al. (2014) recognize a broad perspective, seeing the transitions approach as a profound transformation of a societal system's structures, cultures, and practices, fundamentally altering how it operates. In any case, the transitions approaches have been of particular relevance for transformations in energy systems – such as the case of coal phase-out processes. More specifically, the concept of just transition can be understood as an essential aspect of coal phase-out processes. For this reason, the integration of social justice in transformations and the concept of just transition will be discussed further in this chapter.

Other transformation approaches in the literature include socio-ecological transformations, transformative adaptation, and sustainability pathways (Patterson et al., 2017). Socio-ecological transformations draw on resilience and complex systems literature, along with the concept of "transformability" (Patterson et al., 2017), and transformability means ability to create a new system when current conditions become unsustainable due to ecological, economic, or social factors (Patterson et al., 2017). Transformative adaptation aims to actively bring about structural changes in socio-technical-ecological systems, not just incremental adjustments to environmental changes (Patterson et al., 2017) while sustainability pathways address complexity, uncertainty, and contested interests to achieve long-term transformative change (Patterson et al., 2017). Both approaches emphasize a political perspective, analyzing power structures, integrating marginalized players, and addressing vulnerability and asymmetries of power and knowledge in the transformative process (Patterson et al., 2017). Patterson et al. (2017) highlight the need to address systemic aspects of vulnerability and unsustainability for effective transformation.

Another noteworthy aspect of the sustainability pathways approach to transformations is that it considers planetary and social boundaries (Patterson et al., 2017). That is, building development pathways that lie in the "safe operating space" between planetary boundaries and necessary social conditions, as per Raworth's sustainability "doughnut" (Raworth, 2012). In the context of this research focused on coal phase-out, the energy transition aims at respecting planetary boundaries while certifying that social justice remains non-negotiable.

Transformations are therefore necessary to meet the required climate targets and complete related decarbonization processes with sustainable outcomes. However, the political feasibility of such endeavors remains a significant challenge ahead. According to Patterson et al. (2018), political feasibility in this

context can be understood as potential to deliver the scale and speed of decarbonization that is desired by society in a specific political system, and it can change overtime. The authors argue there is a need for enhancing political feasibility of these societal transformations targeting the 1.5°C temperature limit (Patterson et al., 2018). A potential way to increase political feasibility would be through incorporating a social justice focus on transformative decarbonization processes. In this sense, ensuring a smooth transition to a low-carbon future and safeguarding individuals from the challenges posed by decarbonization while promoting a fair and just post-carbon society could play a significant role in the political viability of climate change mitigation initiatives (Patterson et al., 2018).

Yet, the focus on justice in the climate change mitigation issues could also act involuntarily to increase some resistance against climate actions. Society's perceptions of equity and justice will likely influence their acceptance or refusal of liabilities in the decarbonization actions (Patterson et al., 2018). In this sense, engaging in justice-focused discourses and actions to deal with climate change issues needs to be carried out proactively as to ensure there is agreement in climate and equity initiatives towards societal transformations for sustainability (Patterson et al., 2018). Lastly, the social justice perspective broadens the debate beyond alternatives solely focusing on technical or economic issues. It becomes a guiding principle for shaping ethical and effective strategies to reduce emissions and achieve lasting benefits (Patterson et al., 2018).

At the same time, equity and justice objectives achieved through advanced decarbonization processes can be met with resistance from representatives of the status quo, such as fossil fuel companies manipulating equity-related discourse to undermine climate action (Patterson et al., 2018). For instance, Germany's energy transition (Energiewende) has faced opposition due to concerns over electricity costs, with some political groups advocating for cutting subsidies for renewable energy (Patterson et al., 2018). Other examples of potential setbacks for climate action regarding social justice framing include marginalizing NGOs with climate justice discourses seen as radical during the United Nations Conferences of the Parties (COPs) (Patterson et al., 2018).

Hence, transformation processes addressing climate mitigation and social justice may encounter resistance and lead to battles about institutional change (Patterson et al., 2018). In this context, Burch et al. (2014) argue that climate policies should encompass broader sustainability goals, integrating socioeconomic, technology, health, education, and environmental objectives, while fostering community resilience and development.

Regarding social justice in transformations, Patterson et al. (2018) state that it relates to the allocation of resources, capital, and wealth among different actors in society, raising moral questions about how this allocation occurs. Social justice plays a vital role in global climate governance, addressing the distribution of responsibilities, rights, and duties among nations (Patterson et al., 2018). Moreover, the Paris

Agreement acknowledges climate justice as relevant to climate action and highlights the importance of considering "the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities" (Paris Agreement, 2015, pg.2).

3.6 Climate change and social justice

In public discourse, the concept of social justice in climate mitigation has gained attention only recently. However, as communities, cities, and nations face the impacts of climate change, the focus on social justice issues in both mitigation and adaptation efforts has grown significantly. Extreme weather events and climate change impacts have brought forth moral concerns regarding the distribution of burdens and allocation of resources (Patterson et al., 2018).

When approaching the concepts of justice, social justice and environmental justice, scholars have pointed to the importance of recognizing several relevant dimensions or components, including especially (1) distributive justice; (2) procedural justice; (3) recognition justice (McCauley and Heffron, 2018; Tschersich and Kok, 2022). Distributive justice is related to many of the allocation and distribution issues mentioned before in this section. For example, in the context of energy and climate justice, it is essential to acknowledge how positive and negative impacts of the climate mitigation and energy transition efforts are distributed across different actors (Patterson et al., 2018). The procedural justice dimension addresses how multiple players are to be recognized and empowered to take meaningful part roles in decision- making processes – for example, how members of communities where coal mines are closing are participating in decisions regarding burdens and benefits of the energy transition. The third component of recognition justice is about recognizing the rights of different actors impacted by transformative processes and seeing that power structures might benefit some players to the detriment of others. Patterson et al. (2018) described this component as “acknowledging the existence of a highly uneven playing field”.

Although scholars commonly understand the three components as critical to the concept of justice, Tschersich and Kok (2022) add “restorative justice", which means addressing any injustices by rectifying them and incorporating preventive and forward-looking measures (Hazrati and Heffron, 2021). An example of restorative justice relates to remedying the burdens and harms caused by energy projects on the environment, government, and communities, addressing distributive injustices and ensuring fair distribution of benefits and burdens (Hazrati and Heffron, 2021).

Patterson et al. (2018) also address intergenerational justice as a key component of recognizing the rights of future generations that may not be represented in decision-making due to the current political, economic and other institutional structures.

Beyond understanding the components of justice and how they relate to transformations towards sustainability, there is a need to address two other relevant concepts central to decarbonization and

specifically to coal phase-out processes: climate justice and just transition.

The concept of climate justice has been used to address and challenge the fact that climate change disproportionately affects those who bear the least responsibility for causing it (Newell et al., 2021). Additionally, these vulnerable groups are often excluded from decision-making processes concerning climate responses, including mitigation and adaptation measures (Newell et al., 2021). It recognizes the equal rights of all countries, whether developing or developed, and communities in both the global North and global South, to be free from harmful emissions and pollution (distributional and recognitional justice). Additionally, climate justice considers the rights of future generations, ensuring that they are not unfairly burdened by the consequences of current climate actions (intergenerational justice) (Patterson et al., 2018). Moreover, the principle of "common but differentiated responsibilities" within the UNFCCC (UNFCCC, 2021) is also an example of integrating justice into the climate negotiations to address asymmetries of power between developed countries –historically responsible for most global emissions – and developing countries, with the burden of contributing to mitigation and impacted by the needs for climate change adaptation.

The idea of just transition is generally related to employing a social justice lens viewing options for designing and applying energy transition agendas and strategies. Many issues pertaining to the energy transition movement touch on justice concerns, such as energy access to all citizens, ensuring job security for workers impacted by disruptions and shifts in the energy system, and securing participation in decision-making processes regarding the transition for all affected parties (Patterson et al., 2018). Just transition will be furthered discussed in the following section.

In coal phase-out processes, including closures of coal mines and coal thermal powerplants, the just transition approach may change the focus on opposition between the environment and jobs to build a close relationship between the environmental movement and unions and workers. Patterson et al. (2018) state that the just transition perspective may "forge unusual alliances (e.g., between environmentalists, blue-collar workers, and unions)", and ensures the impacts of transformation towards sustainability will not promote unintended negative repercussions on climate action.

In summary, the concepts explored in this section could build bridges between equity, climate change and sustainability. Thus, transformations towards sustainability and decarbonization must tackle the issues of protection of vulnerable communities and affected workers and ethical and equitable participation in decision-making while delivering the rapid shift toward a decarbonized society (Patterson et al., 2018). In this sense, climate policies must be accompanied by complementary actions and policies in all dimensions of sustainability, responding to critical societal problems, including but not limited to access to energy, water, sanitation and education, gender equity, housing affordability, and job security, among others. At the same time, there needs to be an ethical, equitable and inclusive approach to building new

political structures of representation in decision- making processes. All those issues inform the proposed sustainability framework to assess and contribute to equitable and sustainable coal phase-out policies.

3.7 Just transition – history, definition and requirements

The origin of the term “just transition” goes back to the twentieth century, and it is said to have been coined by union representatives and labor activists in the United States. The term is believed to have been coined by the US labor and environmental activist Tony Mazzocchi, and initially referred to a proposed "Superfund for Workers" to aid those exposed to toxic chemicals and transition from hazardous work (Eisenberg 2019; Pinker, 2020). Mazzocchi's campaign sought to build alliances between labor and environmental justice movements, with the former focusing on economic and labor equity in energy and resource transformations (Eisenberg 2019; Pinker, 2020).

Although it came from the 1970s labor movement, the concept of just transition has already been discussed and applied by various groups within diverse fields, such as environmentalists and the environmental justice movements, international trade unions, international organizations, the private sector, and academic researchers, among others (Pinker, 2020). Also, the term has been popularized in the last few years both in academic research and in policymaking since it integrated the Paris Agreement in 2015 (Heffron, 2021; Pinker, 2020) – though it was also part of the outcome declaration of the Rio+20 Earth Summit in 2012, focusing on ensuring support for workers and labor conditions in the transition (Harrahill & Douglas, 2019).

In 2015, the International Labor Association also released a document addressing guidelines for a just transition. The guidelines were intended to be disseminated and applied at the national level by stakeholders, aiming to establish policies for a just transition to sustainable economies and societies (ILO, 2015). The resulting guidelines had the goal of providing suggestions to governments and social partners for formulating, executing, and overseeing the policy framework, while considering national contexts and priorities (ILO, 2015). The key principles for a just transition to sustainable economies by the ILO’s guidelines addressed the following issues: (a) foster social consensus and dialogue among stakeholders; (b) endorse labor rights in policies; (c) address gender dimensions with specific policies; (d) create coherent policies for economic, environmental, social, education, and labor aspects; (e) ensure a just transition framework for decent job creation and social protection; (f) tailor policies to each country's context, and (g) promote international cooperation as outlined in the UN's Rio+20 outcome document (ILO, 2015).

In academia, just transition has been advocated as an umbrella term to connect the fields of climate justice, environmental justice, and energy justice (Heffron & McCauley, 2018). Although the research communities within these three fields have a similar goal of achieving a low-carbon economy in a just and

equitable way, while recognizing we have limited time to make this happen, these researchers often work with the concept differently (Heffron & McCauley, 2018). Heffron & McCauley (2018) highlight that the "origin of the event" is the differentiation between the fields of climate justice, environmental justice, and energy justice. Climate and environmental justice research communities tend to focus on what needs to happen due to a "bad event," e.g., climate change, and what adaptation measures need to be implemented to ensure justice for the most affected. However, energy justice research is considered to focus also on addressing equity and justice issues before "the event," for example, before a new energy infrastructure project is established (or, before an existing facility is closed) (Heffron & McCauley 2018). Heffron & McCauley (2018) also recall that environmental justice has arisen in social protests in the United States, and this movement was considered successful if there was a change in policy or other legal instruments. This example can be considered one of the goals to be pursued again in the context of just transition – that is, delivering results.

In this setting, the authors emphasize the need to focus on the contribution to just transition. This approach should entail more emphasis on time, place, and "pace" so that the location where injustices happen, and the timeliness of solutions can be appropriately addressed to ensure a just transition (Heffron & McCauley, 2018). The "Just Framework" proposed by Heffron & McCauley (2018) touches on these aspects, as disclosed further ahead in this section.

Within the diversity of approaches among justice scholars, Heffron & McCauley (2018) state that the common goal of decarbonization could be more rapidly achieved through a united perspective of just transition across these research fields. This united perspective would call for a more global, human rights-focused approach rather than an approach emphasizing civil rights and more localized (Heffron & McCauley, 2018). However, as experiences may show, not only global but also national, regional and local perspectives would need to be aligned and harmonized to fulfill the just transition goal for a low carbon economy.

Nonetheless, the concept of just transition in the literature is generally sought to address social inequity and challenges resultant from transitions in fossil-fuel-dependent industries to a low- carbon economy (Harrahill & Douglas, 2019). However, there are different views on how to ensure equity and sustainability in transition processes. The concepts 'weak' and 'strong' sustainability generally convey distinct ways of achieving the transition (Harrahill & Douglas, 2019). Harrahill and Douglas (2019) state that a weak sustainability perspective concedes that different types of capital (e.g., physical, human, financial, environmental) are replaceable and can be substituted for one another. Concurrently, the strong sustainability premise lies in assuming the uniqueness and crucial roles of different forms of capital and their consequent irreplaceability (e.g., ecosystems services, social structures). Examples of "weak sustainability" within the transition policy context are usually related to passive and business-as-usual

transition processes to mitigate adverse effects, relying primarily on technological innovations without structural societal change (Harrahill & Douglas, 2019).

Heffron (2021) also mentions that different perspectives on just transition relate to the view of groups, such as researchers, practitioners (private sector), government representatives and policy- making perspectives, the general public perspective, and distinct views on justice or technology. Overall, meeting the necessary climate mitigation targets and moving to a low-carbon and resilient society is an immense challenge, and just transition adds an extra layer of complexity since there will be significant socioeconomic shifts for workers and affected communities when transitioning to other activities, new areas, and energy sources, and away from fossil fuels (Heffron, 2021).

Just transition has recently been popularized further due to the evident opposition between jobs and environmental action in areas of climate change mitigation. Thus, the just transition approach has a major role to play in this context to include socioeconomic equity into environmental decisions, build bridges between environmental law instruments and other disciplines, and to support the alliance between social and labor interests and environmental concerns (Eisenberg, 2019).

There is a substantial recent literature addressing the concept of just transition (Kumar et al., 2016), cases that are not yet delivering on the just transition, (Weller, 2019) general principles or recommendations to achieve a just transition in different scenarios (Pinker, 2020; Eisenberg, 2019; International Labor Organization, 2015), categorization and comparison of different types of transition policies (Pinker, 2020). However, a few authors have noticeably developed a more structured approach through specific frameworks to address requirements for a just transition process or policy. Two frameworks emerge as significant contributions to establish just transition generic criteria for transition processes and more specifically, transition policies. While the Just Framework by Heffron and McCauley (2018) involves a broader, more holistic approach that could be applied to a variety contexts and it has been applied to a case of extracting critical minerals (Heffron, 2021), the framework by Harrahill and Douglas (2019) specifically addresses the context of coal phase-out and the application to cases of coal-dependent regions (Alberta in Canada, North Rhine- Westphalia, in Germany and Victoria, in Australia). In this setting, these two frameworks will be briefly discussed in the following section and will inform the specified sustainability and just transition criteria in this research focusing on coal phase-out policy.

3.7.1 Frameworks for just transition

The Just Framework by Heffron and McCauley (2018) aims to support the identification of problems and research- and policy-led decisions. The framework relies on four key elements: Justice, Universal, Space and Time. See figure below.

Table 8 - The just framework adapted from Heffron & McCauley

J U S T	TRANSITION	Justice and Universal	Universal forms of justice: Distributional Procedural Restorative Recognition Cosmopolitan
		Space	Space brings in location, where are 'events' happening? (in principle, at local, national and international levels)
		Time	Time brings into transition timelines such as 2030, 2050, 2080, etc. and also 'speed' of the energy transitions (i.e. it is happening fast enough?)

Adapted from: Heffron & McCauley, 2018

Five components are considered as universal forms of justice: distributional, procedural, restorative, recognition and cosmopolitan justice. These components are different forms of justice applicable to just transitions and they involve: the distribution of the burden or benefits resultant from the transition (distributive justice), the legal steps and processes where injustices and impacts might emerge (procedural justice), and the recognition of rights of all affected stakeholders in the transition (recognition justice) (Heffron, 2021). All of these concepts are relevant to understand just transition processes and they are also discussed in other fields such as energy justice (Heffron and McCauley, 2017). They also include other forms such as cosmopolitan justice and restorative justice.

Cosmopolitan justice is related to the idea of boundaries since it involves understanding the effects beyond a country or other jurisdiction's borders (cosmopolitan justice) and broadening the perspective of justice to consider the global context (Heffron, 2021). An example could be the case of regions that are bearing the burden of climate change effects more than others although not significantly contributing to these effects. Moreover, restorative justice means that negative impacts from the energy transition should be repaired, and the enforcement of applicable laws should ensure the impacts are rectified (Heffron, 2021). It relates to regions that have been immensely impacted by mining activities and would need to be decommissioned, which involves restoring not only local ecosystems but also social structures and relationships.

The last two elements within the Just Framework relate to Space and Time. The element of space involves understanding the geographical location where impacts and injustices occur, and the different jurisdictions affected (municipal, regional, provincial, national, global). The element of time is highlighted to reinforce the relevance of the speed of transitions and practical solutions and the timelines of commitments and urgency in their implementation (e.g., Paris Agreement targets, commitments to phase-out coal fired power). All these elements are interconnected and deserve attention in cases of just transition and they are equally applicable and meaningful for the context of this research.

The framework by Harrahill and Douglas (2019) involves a more practical approach, and it is composed by specific criteria highlighted by the authors as essential aspects for successful just transition in coal dependent jurisdictions. The four specific criteria emphasized by the authors are: social dialogue, re-employability, re-training, and role of the welfare state, which can also be interpreted as a re-assertion of social welfare state. Also, two other components are discussed within the framework: investment in infrastructure and the role of local government (Harrahill and Douglas, 2019)

As briefly synthesized in the table below, the framework touches on the significant role that local, regional, and federal governments play in the just transition process since the support of governmental structure is a key aspect to avoid injustices. Government support is also involved in other elements in the framework such as re-training and re-employability since the federal and regional governments play a critical role in providing financial aid to local governments, workers, and communities throughout the process. Also, local governments have a unique part to play while facilitating the re-employability, re-training, and other assistance programs to be effectively delivered in affected communities.

Another essential criterion to be emphasized in the framework by Harrahill and Douglas (2019) is social dialogue. As discussed previously in the literature review regarding next-generation assessment and sustainability-based assessment, ensuring meaningful participation by affected parties, not only through consultation but as active parties in the decision-making process is crucial to mitigate potential injustices in energy transitions and other transformation processes. Furthermore, Harrahill and Douglas (2019) discuss recommendations applicable to two different phases in the context of phasing out of coal: before and after the transition. It also resonates with sustainability assessment criteria in the sense that elements in planning, including informed engagement, before the undertaking are as important as the key issues related to the implementation phase. The criteria assessed by the authors and the framework for the two phases can be found below.

Table 9 - Just transition criteria assessed by Harrahill and Douglas (2019)

Social dialogue	Understand whether the transition process is or has been one where those in the dominant positions (employers/central government) dictate the process of decarbonization or whether those who depend upon coal (workers/local government) are influential within the process.
Re-employability	Evaluate the nature of jobs (if any) created to substitute coal production.
Re-trainingl,k	Access to re-training is assessed in each jurisdiction to explore if and how displaced workers are assisted in preparing for re-employment.
Role of the welfare state	The degree to which there is a welfare state in place assessed in terms of the payment of compensation to workers as well as the willingness of government to invest in workers and communities.

Table 10 - Framework for attaining a just transition in coal-dependent jurisdictions (Harrahill and Douglas)

Pre-Transition Phase	Transition Phase
Establish a timeline for decarbonisation using social dialogue (to include workers, local communities, industry and government at all levels). e.g. Timeline developed for the administration of state aid for the closure of hard coal mines in Germany.	**Provide compensation to workers who have been dependent on coal for a living and facilitate re-training for the re-employment of active workers.** e.g. Victorian government provided A$22m in immediate assistance to the workforce. e.g. The 'Coal and Electricity Transition Tuition Voucher' in Alberta provides funding for workers to pursue post-secondary education.
Formulate plans for new low-carbon industries post-decarbonisation using social dialogue. e.g. Social-dialogue in North Rhine-Westphalia resulted in bottom-up regional development coalitions which provided the foundation for diversifying away from coal. e.g. The inclusion of worker representatives in negotiations ensured that coal-mining regions in Germany have undergone smoother transitions compared to other areas.	**Provide financial incentives to low carbon industries and support existing industries in transitioning to low-carbon alternatives.** e.g. The State government established Victoria's first 'special economic zone' in the Latrobe Valley which provides financial incentives for new businesses including exemptions from state and local fees and charges for property purchases and business expansions and tax deductions for those creating jobs for former workers.
Invest in community, communications and transportation infrastructure to support new jobs. e.g. Largescale funding in Victoria focused on accessibility in the form of development or upgrading of roads and rail alongside investment in community infrastructure such as sports and recreational facilities.	

From: Harrahill and Douglas (2019)

The frameworks for just transition presented in this section offer essential guidance for equitable and sustainable energy transitions. Heffron and McCauley's "Just Framework" emphasizes universal forms of justice, distributional, procedural, restorative, recognition, and cosmopolitan, considering spatial and temporal dimensions. Harrahill and Douglas' practical approach focuses on social dialogue, re-employability, re-training, and the role of the welfare state, with government support playing a key role.

These criteria are directed at meaningful engagement and support for affected communities throughout the transition process. Together, these frameworks provide comprehensive criteria for guiding just and sustainable energy transitions, and they will be essential to the development of the sustainability-based framework for coal phase-out policy discussed in chapter 4 and 8.

3.7.2 Considerations and challenges for just transitions

The key aspect behind just transitions is to ensure that workers and communities affected by the transition away from fossil fuels will not be impaired in this process. This approach moves workers and affected parties to be at the center of the discussion and policy decisions, proposing supportive action by the government and other priority stakeholders throughout the transition and afterwards (Harrahill and Douglas, 2019). Furthermore, a low carbon society can only go beyond mitigating impacts and promote positive contributions to sustainability if equity and justice are secured along with environmental well-being.

Even with the need to accelerate decarbonization processes and just transition being present in the political discourse and policies across different parts of the world, equity and justice toward affected communities are not certain. Economic interests and power imbalances currently in place still account for a significant challenge since private interests in energy production and energy policy may be barriers to advance in strong sustainability measures (Harrahill and Douglas, 2019).

3.8 Conclusions

This chapter has explored sustainability assessment's relevance to climate change mitigation, considering broader sustainability perspectives. It discussed sustainability assessment approaches and frameworks, and crucial elements for strategic and next-generation assessment.

The chapter also addressed the intersection of sustainability and transformation along with frameworks for just transition providing crucial guidance for equitable and sustainable energy transitions, emphasizing universal forms of justice. These comprehensive criteria ensure fairness and inclusivity in the transition to low-carbon economies.

As a result, a robust sustainability-based framework will be developed to assess climate change mitigation policies, with a particular focus on coal phase-out. All of these components highlighted in this chapter will inform the development of an initial sustainability-based assessment framework for coal phase-out policy and it will be further specified for the Canadian case. The preliminary sustainability-based framework categories and criteria for coal phase-out will be discussed in the following chapter.

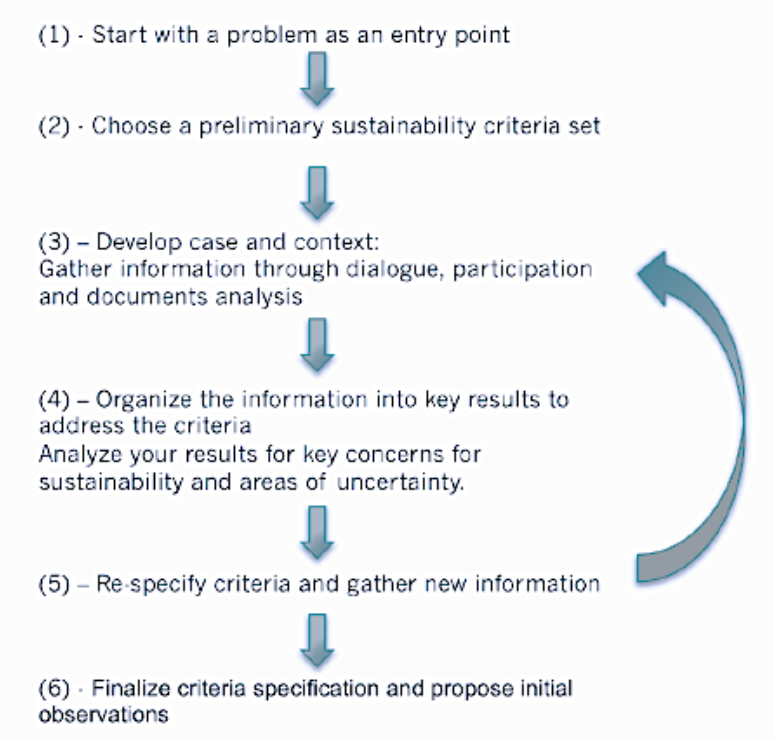
CHAPTER 4. Specification of sustainability-based assessment criteria for application to coal phase-out policy

4.1 Introduction

The discussions in the previous chapter concerning sustainable development, sustainability assessment approaches, and their historical context and applications, provide a foundation for setting out core generic criteria and processes to guide decision-making towards sustainability. Strategic level applications and next-generation processes further contribute to refining and adapting assessment methodologies to meet the challenges of sustainability and transformation. Ultimately, these efforts culminate in establishing a robust and holistic framework of sustainability-based assessment, ensuring policies and projects align with long-term sustainable development objectives.

The next step is to specify these generic criteria for application to coal phase-out policy. The specification of the sustainability-based assessment criteria will be based on the steps discussed and synthesized by Gaudreau (2013).

Figure 4 - Steps for specification of sustainability-based assessment criteria by Gaudreau



From: Gaudreau (2013)

The specification of sustainability assessment criteria starts by identifying the problem or purpose, serving as an entry point for assessment (Gaudreau, 2013). For this research, the immediate purpose of the

specified criteria is to guide assessment of the extent to which existing national coal phase-out policies (and associated plans, programs and processes) are likely to contribute to sustainability, considering diverse socioeconomic impacts and alignment with just transition and climate change mitigation expectations. More broadly, the specification work seeks to construct a sustainability-based framework for planning, evaluating, revising and implementing new as well as current national coal phase-out policies, focusing mostly on thermal coal's industrial use in electric power generation although also discussing associated coal mining impacts. The set of specified criteria can be used to guide identification and comparison of broad alternative pathways for coal-phase out and to assess and compare alternative policy options and approaches to implementation (Gaudreau, 2013). The results are to inform decision-making on future policies or programs for coal phase-out.

Following to the second step, the preliminary set of criteria serves as a basis for guiding the assessment process and organizing important concerns in the relevant case and context (Gaudreau, 2013). The criteria are organized into core categories and requirements, allowing for the inclusion of specific information from the case and context to update and refine the criteria set accordingly (Gaudreau, 2013). The preliminary set of criteria in this research is the generic set of sustainability criteria proposed by Gibson et al. (2005). However, before moving to the analysis of the Canadian case study, this preliminary set was adapted to reflect the key considerations explained in chapters 2 and 3 related to coal phase-out, sustainability assessment and transformations.

Anticipating potential issues discussed in the Canadian case, the initial set of criteria went through several iterations to ensure its applicability and relevance to the complexities of assessing coal phase-out policy's sustainable outcomes, encompassing diverse socioeconomic impacts, just transition principles, and climate change mitigation. This iterative process allowed for the identification and incorporation of crucial elements pertinent to thermal coal's electrical power generation use and coal mining-associated impacts, creating a comprehensive framework to inform planning and implementation of national coal phase-out policies.

The adjustments and adaptations to this refined set of criteria will be further explained in the section below, while the last steps of specification for the case study will be discussed in chapter 8. It is important to highlight, though, that the approach's iterative nature, informed by insights from the Canadian case, reinforces consistency and ensures a solid foundational work for future applications informing future coal phase-out policies and programs in this field.

The specified sustainability-based criteria explained further in the following sections aim to support policy development with consideration about what should be included, how alternatives are compared in light of criteria and trade-offs, aiming at options with most beneficial and least adverse impacts, reducing or eliminating trade-offs.

4.2 Preliminary sustainability-based assessment requirements for coal phase-out policy

This section introduces five sustainability-based assessment criteria categories for national coal phase-out policy, incorporating insights from the analysis in chapters 2 and 3 with support from the specification steps discussed above.

The core categories and requirements for this preliminary set of criteria encompass key sustainability, climate change and social justice issues related to coal phase-out as discussed in chapter 2 (see sections 2.3.2, 2.3.3, 2.4.2, 2.4.3, 2.4.4) and in section 3.6 (chapter 3), crucial requirements for sustainability-based and strategic assessment criteria discussed in chapter 3 (see sections 3.3.1, 3.3.2 and 3.4), with special attention to Gibson et al. (2005) sustainability-based criteria, characteristics of sustainable transitions briefly explored in section 3.5, and just transition considerations as discussed in section 3.7 with special attention to the frameworks elaborated by Harrahill and Douglas (2019) and Heffron and McCauley (2018) (see section 3.7.1).

The categories and preliminary sustainability-based assessment criteria for coal phase-out policy included both substantive and process features (similar to Gibson et al. (2005)). Process features address issues discussed previously in section 3.4 on next generation assessment (e.g., transparency and accountability, early and meaningful engagement, governance aspects). Strategic assessment elements as discussed in section in 3.3.2 have also been incorporated in the criteria explained below although in this research coal phase-out policy is being considered as a national issue, where both federal and provincial policy and programs and their interconnections are part of the scope.

As a result, five sustainability-based assessment criteria categories were developed and specified to coal phase-out policy:

1. Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives
2. Livelihood sufficiency, affordability, equity and opportunity
3. Social dialogue, participatory decision-making and democratic governance
4. Adaptability, precaution and monitoring for long-term sustainability
5. Governance accountability, inter-jurisdictional collaboration, and government support for the just transition

4.2.1 Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives

The first core category (socio-ecological system integrity and compliance with fundamental climate change mitigation objectives) aligns with criteria developed by Gibson et al. (2005) related to socio-ecological systems integrity and precaution (see section 3.3.1.1) while also incorporating the urgent need

to comply with scientifically based climate change mitigation objectives and agreements (e.g., Paris agreement and IPCC climate mitigation targets), as discussed in section 2.2. The criteria in this category are focused on maintaining the integrity of socio-ecological systems while ensuring compliance with fundamental climate change mitigation objectives. To achieve this, the transition processes must align with crucial milestones, such as meeting the climate change mitigation objectives outlined in the Paris Agreement by 2030 and 2050, as well as following recommendations from organizations like the IPCC (also highlighted in a framework to analyze climate change policies by Keeney and McDaniels (2001)).

The transition process should not only aim for short-term goals but also prepare communities to effectively address and adapt to climate change in the long run. This involves adopting a precautionary approach when transitioning to new energy sources, choosing those that promote pathways to reduce climate change impacts and contribute to a healthier environment for communities (as discussed by Gibson et al. (2005) in section 3.3.1.1 regarding precaution and intergenerational equity, and in sections in 2.4, 2.4.3 regarding carbon lock-in).

Furthermore, energy security has also been incorporated to this category since trade-offs between socio-ecological system integrity, climate objectives and energy security must be considered and potentially reduced or eliminated to ensure sustainable outcomes in the coal phase-out. Ensuring energy security and reliability while actively contributing to the decarbonization of the energy sector is a crucial aspect, as discussed in coal phase-out cases explored in section 2.4 and highlighted by in the "World Energy Trilemma Index" (World Energy Council, 2022). The transition should take into account planetary boundaries and respect ecological systems' integrity, safeguarding air quality and overall ecosystem health.

The category further incorporates elements of restorative justice (discussed in sections 3.6 and 3.7 regarding just transition and frameworks), since socio-ecological integrity entails maintaining healthy ecosystems while considering human well-being, and restorative justice can address harm caused to these ecosystems through restoration. Wong et al. (2022) also highlighted environmental restoration as a crucial aspect in his study on lessons learned from coal phase-out experiences in Europe (section 2.4.3). The criteria in this category emphasize the importance of restorative justice during the transition process, including proper decommissioning of energy production sites, responsible waste management, and returning these sites to their former use or implementing sustainable alternatives. As highlighted in section 3.7 negative impacts from the energy transition should be repaired and adverse impacts must be rectified (Heffron, 2021). Thorough environmental impact assessments are crucial to ensure the protection of viable ecological and socio-ecological systems, and a commitment to restoring and regenerating any compromised systems. By addressing these various points, the criteria aim to contribute to a sustainable and resilient transition out of coal that positively impacts both the environment and the well-being of communities.

4.2.2 Livelihood sufficiency, affordability, equity, and opportunity

The second core category is aligned with Gibson et al. (2005) livelihood sufficiency criteria (see section 3.3.1.1) and incorporates criteria from Harrahill and Douglas (2019) framework for just transition (re-employability, re-skilling, assertion welfare state role), as discussed in section 3.7.1.

The criteria are centered on ensuring that the transition away from coal considers the livelihoods and well-being of workers and communities, striving for a just and equitable transition. One of the primary goals is to secure new employment opportunities that offer the same or improved quality of life to those displaced due to the de-intensification of the coal industry. This involves providing comprehensive assistance to affected workers and communities to help them adapt to life after coal. Re-training programs and support mechanisms are essential to avoid placing an additional burden on those directly impacted by the shift. Furthermore, proactive efforts should be made to assist workers in finding employment in industries that promote environmental sustainability and do not degrade the environment. By guiding and supporting workers towards green and eco-friendly sectors, the transition process not only benefits individuals but also contributes to overall environmental preservation.

Also, as per the “Guidelines for a just transition towards environmentally sustainable economies and societies for all” by the International Labor Organization, (2015), respect for fundamental principles and workers' rights is crucial throughout this transition. Ensuring fair treatment, safe working conditions, and decent wages are essential aspects that contribute to a just transition and are included as criteria in this category.

Research insights from Weller (2019) on just transition in the coal region of the Latrobe Valley in Australia were also incorporated in this category. Weller discusses how crucial it is to improve livability in the sense that the coal communities going through the phase-out maintain and enhance its reputation as a livable community (Weller, 2019). By creating and sustaining livable communities, the transition process can promote social cohesion and inclusivity, ensuring that the well-being of residents is a top priority.

Additionally, the aspect of distributive justice and the distribution of the burden and benefits of the transition as discussed by Heffron and McCauley (2018) is included in this category. It is essential to ensure that benefits from the energy sector are fairly distributed, avoiding disproportionate impacts on affected communities. Environmental burdens and negative consequences resulting from the transition should not be shifted to vulnerable communities, promoting a fair and equitable energy transition.

Lastly, the criteria consider the rights of future generations by working to avoid the displacement of negative impacts from the coal phase-out and energy transition to future generations. This forward-looking approach is further elaborated by Gibson et al. (2005) in their sustainability assessment criteria, also discussed by Bond al. (2012) and others aligning strategic assessment and next-generation assessment

features (see sections 3.3.1, 3.3.1.1, 3.4). It ensures that the decisions made today do not compromise the well-being and opportunities of those who will inherit the world we shape.

In summary, the criteria in this category are focused on securing livelihoods, ensuring fairness, and preserving opportunities for individuals and communities impacted by the coal phase-out. By prioritizing social justice, workers' well-being, and environmental sustainability, the criterion aims for an inclusive and equitable transition away from coal.

4.2.3 Social dialogue, participatory decision-making, and democratic governance

Criteria in category 3 are focused on promoting social dialogue, participatory decision-making, and democratic governance in the context of coal phase-out policy, as discussed previously in sections 3.3.1.1 (sustainability assessment criteria and frameworks), 3.3.2, 3.4 (strategic assessment and next-generation assessment features), and 3.7 (just transition and framework by Harrahill and Douglas (2019). The criteria in this category aim to ensure that all relevant stakeholders, especially workers and their representatives, have a meaningful say in the transition process. It emphasizes the need for open and ongoing participation in decision-making, which fosters social acceptance and promotes public support for the transition. To achieve this, it advocates for well-informed consultations that build strong social consensus and enhance political effectiveness.

These criteria also emphasize the recognition of rights for different groups in society, particularly prioritizing the rights of Indigenous communities and future generations (aligned with recognition justice issues, see Heffron and McCauley (2018) framework in section 3.7.1). This aspect highlights the commitment to fairness and equity, ensuring that the transition process benefits all segments of society, and recognizing the importance of diverse perspectives in influencing inclusive and equitable policies and decision-making.

In addition, as addressed in section 3.3.2.1 by Nwanekezie et al. (2021) on transitions-based strategic assessment, and by Sinclair et al. (2022) as a key element for next generation assessment (section 3.4), an essential criterion in this third category is the promotion of partnerships and cooperation among stakeholders. Collaborative efforts are seen as vital to diversify and sustainably transition the region's economy, promoting a more inclusive and resilient economic development.

This category also emphasizes the active involvement of affected parties throughout the entire process, as previously discussed in sections 2.4.4, 3.3.1.1, 3.4, 3.6 and 3.7.1. This issue intersects many of the frameworks explored in this research: sustainability-based assessment (from Gibson et al. (2005)), just transition framework for coal jurisdictions by Harrahill and Douglas (2019), essential criteria for next-generation assessment by Sinclair et al., 2022. The engagement of stakeholders in this category is also a requirement from the initial design to long-term monitoring and addressing cumulative effects (a crucial

element brought by Finkelman et al., 2021, as seen in section 2.3.2 on coal use concerns). This approach ensures that the voices of those impacted by the coal phase-out are heard, respected, and integrated into the decision-making process.

4.2.4. Adaptability, precaution, and monitoring for long-term sustainability

This criterion focuses on ensuring the continuous assessment of energy justice, equity, and the livability of communities impacted by the transition processes, looking beyond immediate effects and considering intergenerational timescales (as discussed in section 3.3.1.1 regarding sustainability-based criteria by Gibson et al. (2005) and Bond et al. (2012)). By taking this long-term perspective, policymakers can better understand and address the lasting impacts of the phase-out on affected communities, striving for sustainable outcomes that stand the test of time.

To achieve long-term sustainability, clear targets and pathways towards decarbonization must be established and rigorously monitored. This issue is present both in Sinclair et al. (2022) next generation-assessment criteria and in the sustainability-based criteria by Gibson et al. (2005), as well as in Bond et al. (2012) (sections 3.3.1, 3.3.1.1, 3.4) and in Patterson et al. (2017), along with other discussions on transformative pathways in section 3.5. Regular reporting to affected authorities and stakeholders ensures transparency and accountability in the progress towards meeting these targets. Additionally, implementing long-term focused planning and accountability systems becomes imperative to identify gaps and make necessary adjustments without compromising the integrity of socio-ecological systems, as discussed in section 3.4 on next-generation assessment essential aspects. This approach enables adaptive management, allowing for flexibility and responsiveness in addressing unforeseen challenges that may arise during the transition process.

Furthermore, the criteria in this category emphasize the application of the precautionary principle (as highlighted in the sustainability-based criteria assessment by Gibson et al. (2005) in section 3.3.1.1) to ensure restorative justice - previously discussed in sections 3.6 and 3.7 by Tschersich and Kok (2022), Hazrati and Heffron (2021) and incorporated in the just framework from Heffron & McCauley (2018). Properly restoring and repurposing energy production sites for community use contributes to healing the environmental and social impacts of the phase-out, making it a just and equitable process for affected communities. Additionally, to avoid path dependency on fossil fuels, the criteria advise against capital-intensive and massive long-term projects with limited capacity for modifications, as previously explored in chapter 2 (sections 2.2.1, 2.4.1) regarding past experiences and challenges for coal phase-out. Such projects could potentially extend reliance on fossil fuels, delaying the transition to cleaner energy sources. The issue with securing pathways to decarbonization was also previously elaborated by Keeney and McDaniels (2001) in their framework to analyze climate change policies and more recently in the research by Climate

Transparency (2019).

4.2.5 Governance accountability, inter-jurisdictional collaboration, and government support for the just transition

Criteria in category 5 is focused on establishing governance bodies with clearly defined mandates and responsibilities, ensuring accountability and fostering collaboration throughout the transition process. These bodies play a crucial role in overseeing the implementation of policies and initiatives, ensuring that all stakeholders are held responsible for their actions, and promoting transparency and efficiency in decision-making. These issues were previously emphasized in the key elements for next generation assessment by Sinclair et al. (2022) (see section 3.4) and in strategies to manage the transition as analyzed by Diluiso et al. (2021) (section 2.4.3). They anticipate challenges experienced by countries going through the coal phase-out such as the Canadian case further elaborated in chapters 6 and 7.

Furthermore, successful coal phase-out policies require alignment of objectives across various levels of governance – from local to regional, national, and even global scales. Such alignment fosters an integrated approach to transition planning, enabling coherent implementation and effective cooperation among different government sectors (aspects emphasized by Weller (2019) and Sinclair et al. (2022) in section 3.4). This approach may enhance the overall effectiveness and efficiency of the transition process.

In addition to governance and collaboration, supportive policies are paramount in ensuring a smooth and sustainable shift away from coal (as previously discussed in section 2.4.3 and in 3.7.1 as part of the framework by Harrahill and Douglas (2019)). These supportive policies (e.g., worker transition programs, community investment, environmental restoration programs) are instrumental in maintaining the viability and reliability of the transition, allowing for a balanced and equitable distribution of benefits and minimizing potential negative impacts on communities and the environment.

Lastly, the criteria in this category include prioritization of impacted communities in clean energy procurement programs (Brown and Jeyakumar, 2022). By actively including affected communities in the development and distribution of clean energy projects, decision-makers can ensure that these communities directly benefit from the transition, focusing on community and Indigenous project ownership (Brown and Jeyakumar, 2022). Such prioritization serves as a key component of the just transition, providing opportunities for meaningful participation, equitable access to resources, and fostering social inclusivity (see also sections 2.3.3 and 2.4.3 regarding opportunities and strategies for coal phase-out).

4.3 Summary of requirements in the sustainability-based assessment criteria specified to coal phase-out policy

It is clear these dimensions are very much interrelated and should be interpreted as a broad set of

principles and requirements deeply integrated, leading to mutually reinforcing gains – although likely implicating relevant trade-offs. An opposing view would be a balance between these dimensions.

The table below summarizes the key requirements in the preliminary criteria specified for coal phase-out policy.

Table 11 - Preliminary sustainability-based assessment criteria specified for coal phase-out policy

Core categories	Sustainability-based assessment criteria for coal phase-out policy
C1 - Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives	C1.1. Ensure transition processes enable the achievement of fundamental climate change mitigation objectives by 2030 and 2050 (e.g., Paris Agreement commitments, IPCC recommendations). \ C1.2. Ensure the transition process prepares communities to better address and adapt to climate change in the long-term. C1.3. Ensure the precautionary approach is applied through transitioning to energy sources that promote pathways to halt climate change impacts and promote a healthy environment to the communities. C1.4. Ensure energy security and reliability while contributing to decarbonization, air quality respecting planetary boundaries and ecological systems integrity. C1.5. Ensure restorative justice through proper decommissioning, waste management and returning energy production sites to former use. C1.6. Assess environmental impacts and ensure protection of viable ecological and socio-ecological systems and restoration and regeneration of impaired ones.
C2 - Livelihood sufficiency, affordability, equity and opportunity	C2.1. Ensure a just transition through securing new employment that delivers the same or a better quality of life to those displaced due to the de-intensification of the coal industry. C2.2. Guarantee assistance to workers and communities in adapting to life after coal, e.g., through re-training programs to those dependent on coal thus avoiding an additional burden to those affected. C2.3. Proactively assist workers to re-enter employment in industries that do not degrade the environment. C2.4. Respect, promote and realize fundamental principles and rights at work. C2.5. Ensure communities affected by coal phase-out maintain and enhance their reputation as livable communities. C2.6. Ensure distributive justice through the fair distribution of benefits from the energy sector and also avoid the negatives impacts of additional burden from environmental impacts to affected communities. C2.7. Ensure distributive justice through avoiding the displacement of negative impacts from coal phase-out and energy transitions to future generations.
C3 - Social dialogue, participatory decision-making and democratic governance	C3.1. Ensure there is social dialogue while enhancing the potential for workers or workers' representatives to influence the transition process. C3.2. Secure social acceptance and public support of transition processes through open participation in decision-making, adequately informed and ongoing consultation, building strong social consensus and enhancing political effectiveness. C3.3. Ensure gender equality in consultation processes and enable gender-equal participation in decision making. C3.4. Secure equity in the recognition of rights for different groups in

	society and in particular the rights of Indigenous communities and future generations. C3.5. Foster partnerships and cooperation through collaborative work among stakeholders to diversify and sustainably transition the region's economy. C3.6. Ensure affected and interested parties participate and have decision-making power to contribute to the transition process throughout its design, application and monitoring long-term and cumulative effects. C3.7. Secure equity in the recognition of rights for different groups in society and in particular the rights of Indigenous communities and future generations. C3.8. Involve affected stakeholder groups early in transition negotiations.
C4 - Adaptability, precaution and monitoring for long-term sustainability	C4.1. Ensure energy justice, equity, livability of communities affected by the transition processes are assessed continuously in the long term through intergenerational timescales. C4.2. Establish and monitor progress towards clear targets and pathways toward decarbonization and periodically report progress to affected authorities and stakeholders. C4.3. Implement long-term focused planning and accountability systems to track progress and identify gaps, avoiding disturbance to the integrity of socio-ecological systems in the long-term C4.4. Ensure restorative justice through proper application of the precautionary principle to allow restoration and repurposing of energy production sites for community use. C4.5. Avoid planning and decision-making that increase path dependency (e.g., capital intensive, massive long-term projects with low capacity for modifications over time, and infrastructure that strengthens fossil fuel lock-in)
C5 – Governance accountability, inter-jurisdictional collaboration, and government support for the just transition	C5.1. Ensure there are governance bodies with clear mandates and responsibilities to ensure accountability and collaboration while implementing the transition process. C5.2. Align objectives across levels (local, regional, national and global) and sectors of government to promote an integrated approach and ensure coherent implementation of the transition process. C5.3. Ensure supporting policies related to economic, social and environmental dimensions and their interactions are put in place to maintain the viability and reliability of an effective and sustainable transition away from coal. C5.4. Prioritize impacted communities in clean energy procurement programs.

Applications of the specified framework should also consider process features emphasized in the next-generation assessment framework (section 3.4) by Sinclair et al. (2022) (comparative evaluation of alternatives including the null option, integrated, tiered assessments, assessment streams, cooperative project and regional/strategic assessments, co-governance with indigenous nations/ communities, meaningful public participation, transparency and accountability, independent follow-up , independent and impartial administration and assessment review).

4.4 Trade-off rules

As discussed earlier in this chapter, sustainability-based assessments demand a careful examination of trade-offs arising from contextual factors. In this thesis, the evaluation of trade-offs will be further specified for the Canadian case. However, it remains fundamental to consider them even during the initial stages of framework development. In this sense, the initial framework elaborated for coal phase out policy must align with the overarching sustainability goal of minimizing or eliminating trade-offs (Gibson et al., 2005). To achieve this objective, Gibson et al.'s general trade-off rules will be adopted as a valuable tool for further refinement and application of the framework (see Table 10 below). These trade-off rules align with the reasoning presented earlier in this chapter and will guide the efforts in specifying the framework for sustainability-based assessment of coal phase-out policy.

Table 12 - Gibson et al.'s generic trade-off rules

Maximum net gains	Any acceptable trade-off or set of trade-offs must deliver net progress towards meeting the requirements for sustainability; it must seek mutually reinforcing, cumulative and lasting contributions, and must favour achievement of the most positive feasible overall result, while avoiding significant adverse effects.
Burden of argument on trade-off proponent	Trade-off compromises that involve acceptance of adverse effects in sustainability-related areas are undesirable unless proven (or reasonably established) otherwise; the burden of justification falls on the proponent of the trade-off.
Avoidance of significant adverse effects	No trade-off that involves a significant adverse effect on any sustainability requirement area (for example, any effect that might undermine the integrity of a viable socio-ecological system) can be justified unless the alternative is acceptance of an even more significant adverse effect. Generally, then, no compromise or trade-off is acceptable if it entails further decline or risk of decline in a major area of existing concern (for example, as set out in official international, national or other sustainability strategies or accords, or as identified in open public processes at the local level), or if it endangers prospects for resolving problems properly identified as global, national and/or local priorities. Similarly, no trade-off is acceptable if it deepens problems in any requirement area (integrity, equity, etc.) where further decline in the existing situation may imperil the long-term viability of the whole, even if compensations of other kinds, or in other places are offered (for example, if inequities are already deep, there may be no ecological rehabilitation or efficiency compensation for introduction of significantly greater inequities). No enhancement can be permitted as an acceptable trade-off against incomplete mitigation of significant adverse effects if stronger mitigation efforts are feasible.
Protection of the future	No displacement of a significant adverse effect from the present to the future can be justified unless the alternative is displacement of an even more significant negative effect from the present to the future.

Adapted from Gibson et al. (2005)

As discussed by Gibson et al. (2005), trade-off rules play a crucial role in acknowledging and resolving moral and ethical dilemmas in decision-making processes. The authors also point out that it is not realistic to expect options that only have positive impacts on all aspects of sustainability. In light of these challenges, sustainability-based assessments aim to avoid or minimize trade-offs whenever possible (Winfield et al., 2010). To help with this, the trade-off rules presented above are useful for identifying, evaluating, and finding ways to reduce or eliminate proposed trade-offs.

Trade-off rules in sustainability-based assessment are crucial in ensuring a comprehensive and informed decision-making process. As indicated by the trade-off rules above, policy developers (proponents) should bear the responsibility for identifying trade-offs, for formulating policy options that minimize such trade-offs and for justifying their conclusions in light of the rules set out above. Justifying trade-off related decisions by federal and provincial jurisdictions requires examination of arguments, carefully considering the implications across multiple jurisdictions and the long- as well as short-term impacts. These trade-off rules are broadly applicable in the context of sustainability. Specific examples can be provided to address sustainability and social justice questions, enabling a more inclusive and holistic evaluation of policy options (see specific trade-off considerations for the Canadian case in chapter 8).

The process of addressing trade-offs involves intricate negotiations, legal considerations, and interactions between stakeholders such as unions and corporate leaders. Negotiability varies based on factors like middle ground existence. Often, stakeholders struggle to reach consensus or gain constituency authorization, leading to indecision. Identifying and avoiding trade-offs are the most crucial rules although further research could explore contextual nuances influencing these principles. While appointing specific alternatives are beyond the scope of this thesis, understanding how to approach trade-offs with transparency and avoidance is vital.

4.5 Specification and integration

The sustainability-based assessment criteria for coal phase-out require further specification for application in specific contexts. To gain deeper insights into this matter, a comprehensive examination of the Canadian case through literature review and document research is essential. Such research will unveil various regional realities, including economic, political, and social factors that significantly influence decision-making in Canada concerning coal phase-out.

Moreover, adopting an integrative approach allows for the identification and resolution of trade-offs that may arise during decision-making. The guidance provided by Gibson et al.'s rules (2005) is of great value in the decision-making process for the coal phase-out, playing a role in mitigating or avoiding trade-offs. However, a deeper investigation of trade-offs considering the complexities and interdependencies of various factors, specified to the Canadian context, is required for comprehensive

application of this framework. This investigation is mentioned in the concluding chapter's discussion of areas for further research.

4.6 Summary of relevant insights and conclusions

In conclusion, this chapter emphasized the significance of an integrated approach toward a sustainability-based framework for coal phase-out policy. The sustainability-based assessment criteria provided in Table 9 offer a comprehensive framework for guiding decision-making. The interconnected dimensions of socio-ecological system integrity, compliance with fundamental climate change mitigation objectives, livelihood sufficiency, social dialogue, adaptability, precaution and monitoring along with governance accountability must be treated as a interconnected set of principles to achieve mutually reinforcing gains and ensuring a just transition that prioritizes impacted communities and future generations.

Gibson et al.'s trade-off rules are valuable in navigating complexities, promoting net gains, and avoiding significant adverse effects. Context-specific specification and integration of sustainability criteria are essential for effective policy development, taking into account regional realities and challenges. An integrative approach is crucial to address trade-offs effectively and resolve moral dilemmas. By adopting this approach, decision-makers can create comprehensive and sustainable coal phase-out strategies.

The chapter has established requirements and categories for a robust and holistic framework of sustainability-based assessment criteria for coal phase-out policy. Building on discussions on sustainable development, assessment approaches, and coal phase-out processes, the specified criteria aim to ensure alignment with long-term sustainable development objectives. By incorporating insights from the analysis in previous chapters and utilizing the approach based on Gaudreau's steps, five key sustainability-based assessment criteria categories have been identified. They are informed by the iterative nature of the approach and anticipate potential issues discussed in the Canadian case, providing a comprehensive and contextually relevant framework for evaluating coal phase-out policies and informing future decision-making. Such efforts may contribute to policymaking aiming at a just and sustainable energy transition for the benefit of current and future generations.

CHAPTER 5. Case study research design and methods

5.1 Introduction

This chapter presents the rationale for using a case study as a major component of the research approach and its application in developing a specified sustainability-based assessment framework for coal phase-out policy in the Canadian context. It is important to note that the case study here is not limited to a single policy or program package but encompasses several sub-cases, reflecting the analysis of federal and provincial policies. The following sections outline the research design, including case study selection, data collection, and analysis techniques, used to specify the framework for its application in the Canadian case and context.

5.2 Rationale for use of a case study

Merriam and Tisdell (2015) define case study as a thorough description and analysis of a specific and bounded system, also adding that the key characteristic of case study research is the focus on a specific object of study, known as the bounded system or case. The aim is to provide a detailed and insightful description of the investigation's findings (Merriam and Tisdell, 2015).

According to Harrison et al. (2017), case studies are a commonly used research approach in various fields, particularly in evaluation. The approach involves conducting an extensive analysis of a specific case, which could be a program, event, activity, process, or even a set of individuals (Harrison et al., 2017). The cases are defined by their temporal and activity boundaries, and researchers gather comprehensive information by employing diverse data collection methods over an extended duration (Creswell, 2014).

In the context of the Canadian coal phase-out policy, the case study approach is instrumental in gaining a deeper understanding of the key issues derived from the Canadian coal phase-out, enabling a comprehensive examination of its potential sustainability and just transition outcomes.

By exploring the details, context, and features of the policies, initiatives and programs, the case study approach facilitates the development of a set of specified sustainability-based criteria to ensure coal phase-out policy in the Canadian context delivers a positive contribution to sustainability and enables a just transition away from coal. This in-depth exploration is crucial for uncovering the unique characteristics and complexities of the Canadian coal phase-out policy, aiming at guiding policy decision-making and advancing sustainable development outcomes.

The findings of this research will contribute to the development of a specified framework that may support climate change policy decision-making and just transition outcomes. While the focus is on Canadian coal phase-out policy, the case study methodology is applied to illustrate and test the framework's applicability in this specific context, rather than aiming for generalization. The insights gained from this

study will have implications for theory and practice, providing a foundation for further development of the framework and its potential application in similar contexts while unavoidably requiring specification for application in other contexts and jurisdictions. Overall, this chapter aims to demonstrate how the case study approach, leading to a context-specific framework, contributes to the understanding and assessment of the Canadian coal phase-out policy.

5.3 Case study approach

This section will cover the reasons for selection of Canada as a case study and methods to analyze this case. To gain a comprehensive understanding, the case study methods incorporate an extensive literature review to explore existing knowledge and insights on the case, coupled with research of official documents related to Canada's policies and initiatives regarding coal phase-out. This combined approach will illuminate the details of Canada's energy transition away from coal and can contribute to a broader understanding of similar efforts worldwide, besides contributing as a valued opportunity to test and apply the sustainability-based assessment framework for coal phase-out policy developed in this thesis.

5.3.1 Rationale for selection of Canada as the case to study

The selection of the case study for this research was based on consideration of the focused on a sustainability-based assessment framework for evaluating coal phase-out policies in Canada and informing future policymaking, involved careful consideration of several factors. Overall, the country's coal phase-out policies and their implications for sustainability aligned closely with the objectives of this study, and the criteria of relevance, availability of data and scope and scale were assessed for the case study’s selection.

As nations strive for sustainable development and decarbonization, transitioning away from fossil fuels becomes imperative. In this setting, the Canadian government has set ambitious goals to address climate change by approving GHG emissions reductions regulations, eliminating coal-fired power plants and establishing a sustainable jobs plan focused on delivering a just energy transition.

The selection of Canada as the case study nation was primarily driven by the fact that I am based here, providing convenient access to data and resources for the research. Moreover, Canada presents an intriguing and reasonable test case for applying a sustainability-based assessment framework to evaluate coal phase-out policies. The country's federal and provincial levels offer a rich and well-documented record of initiatives dealing with coal phase-out issues, encompassing a diverse range of challenges. However, it is essential to clarify that this choice does not imply Canada is the only test case suitable or available globally. Other nations may present equally valuable insights and unique contexts for studying sustainable energy transitions.

The choice of Canada as the case study was also motivated by its unique energy landscape. Canada has phase-out policy at both the federal level and in several provinces. That combination, and the differences involved, provide particularly rich opportunities for comparison of approaches with a single case Also, while Canada's overall energy mix is not heavily dependent on coal compared to some other countries, several important regions of Canada have or have had relatively higher reliance on coal-fired power generation.

Canada's commitment to transitioning away from coal-fired power and its efforts to reduce greenhouse gas emissions and align with the Paris Agreement's commitments were key considerations in selecting it as the case study. The research aims to examine the effectiveness of federal-level and provincial-level policies and initiatives in promoting the phase-out of coal-fired power plants (and associated thermal coal mine closures and impacts) as it relates to sustainable outcomes and a just transition away from fossil fuels.

In selecting Canada as the case study, the relevance of the country's overall coal phase-out policy and the provincial responses to the research topic was paramount. Additionally, the availability of data was a crucial factor, and Canada offers a wealth of information and resources related to its coal-fired power sector, including studies, reports, policy briefs, regulations and government documents.

The scope and scale of the case study were also taken into account. Canada's geography and regional characteristics, and varying approaches to coal phase-out in each of the provinces provide a comprehensive context for studying the sustainability implications of the coal phase-out policy, also implicating multiple jurisdictions at the same time. Different provinces have distinct degrees of reliance on coal-fired power, providing a rich opportunity to study the complexities of coal phase-out policies across different jurisdictions. This regional variation allows for analyzing the policy approaches' implications in diverse socio-economic and environmental contexts of the energy transition.

Overall, Canada emerges as a compelling case study due to its specific characteristics, the significance of its coal phase-out policy within its energy mix in particular jurisdictions, and the potential to contribute valuable insights for coal power phase-out policy and governance.

5.3.2 Case study methods

In order to understand the complex issues surrounding the coal phase-out federal policy in Canada, case study methods were employed to provide in the analysis. This section focuses on two specific methods: literature review and complementary document research. These methods were used to gather and analyze existing information, policies, and other relevant documents to gain insights into the background, context, and impacts of the coal phase-out policy in Canada.

Given the scope of the research, the focus was on policies and programs directly relevant to coal phase-out and potential for just transition that have been implemented in Canada, with coverage from the

initial approval of regulations to phase out thermal coal electricity generation. This timeline extends from the federal approval in 2018 of regulations to phase-out coal fired power (or the equivalent dates in the provinces, e.g., the provincial approval in Alberta in 2015), up to the completion of my thesis research in July 2023. Within this timeframe, these policies were reviewed based on their relevance to the generic criteria in the framework presented in chapter 4. The scope of the analysis was limited by the time dedicated to the research and the availability of documents from publicly accessible sources.

The primary focus of the specified framework and case study has been to examine particular government policies and initiatives, at both the national and local levels, that are directly relevant to coal phase-out for climate change mitigation (e.g., policy commitments to phase-out coal fired power in the federal and provincial jurisdictions) and just transition in coal phase-out (e.g., programs for re-skilling workers, funding for affected coal workers and local economic development in coal communities, governance structures to tackle the transition away from coal). However, it is clear that the range of policies that may affect just transition and climate change in the context of coal phase-out is likely to be much wider. In this setting, while recognizing that the research cannot cover all potentially influential policies and programs due to time and other limitations, the thesis intends to serve as an initial exploration, drawing important insights from the limited range of directly relevant policies it has analyzed and developing a basic framework for policy evaluation. This foundational work could then pave the way for more extensive and ambitious research in the future.

5.3.2.1 Literature review

The literature review conducted for this case study aimed to comprehensively examine the existing scholarly literature (including but not limited to peer-reviewed articles, theses, and books), and the official documents discussed in the following section. Grey literature (including but not limited to reports, policy briefs, working papers) and newspaper articles were also a significant source of information for this review, particularly for the chapters focused on the case study (chapters 6 and 7).

To ensure a thorough exploration of coal phase-out policy and just transition initiatives in Canada, federal and within provincial jurisdictions, a set of keyword combinations was applied during the search process. The following search terms were considered for the literature review on coal phase-out policy and just transition in Canada:

1. Coal phase-out policy AND just transition Canada
2. Sustainability assessment AND coal phase-out policy Canada
3. Energy transition AND just transition AND Canada
4. Coal phase-out policy AND renewable energy transition Canada
5. Just transition AND social justice AND energy policy Canada

6. Environmental policy AND coal phase-out AND sustainable development Canada
7. Energy security AND coal phase-out policy AND economic impacts Canada
8. Carbon emissions AND coal phase-out AND energy transition Canada
9. Coal production AND Electricity generation AND Canada
10. Energy justice AND just transition AND fossil fuels Canada
11. Stakeholder engagement AND coal phase-out policy AND energy governance Canada

The selected search terms aimed to cover a wide range of relevant topics related to Canada's energy transition and coal phase-out. The search terms were initially used in accessible databases such as Scopus, Google Scholar, OMNI (as available through the University of Waterloo Library). By employing these search terms, the literature review sought to gather a comprehensive collection of studies, reports, policy briefs, articles, and other relevant sources to provide a robust foundation for the case study. These search terms served as a starting point and were refined iteratively based on the identified sources and their relevance to the research objectives. The provinces affected by the coal phase-out in Canada were eventually included in the search terms (e.g., Alberta AND coal phase-out, nova scotia AND coal phase-out, New Brunswick AND coal phase-out, Saskatchewan AND coal phase-out). Furthermore, aiming to capture and analyse relevant stakeholders' current reactions and interpretations of the coal phase-out policy measures and just transition efforts, the research was broadened to include media articles and reports found through the Google search tool.

The literature review examined various aspects related to coal production, mining, deposits, exports, and use, shedding light on the characteristics of the coal industry in Canada. Additionally, it provides a brief contextual overview of coal power generation and its associated greenhouse gas (GHG) emissions in Canada. The review also explored the historical context, focusing on relevant structural reforms in coal power generation, particularly the Ontario case, and identifies key factors for a successful phase-out of coal-fired power in that region. Furthermore, it explores the political context for decarbonization and coal phase-out in Canada, and the political context within specific provinces, such as Alberta, Saskatchewan, Nova Scotia, and New Brunswick, highlighting the unique challenges and developments in each region.

Overall, the literature review method adopted for this case study ensured a comprehensive examination of the existing knowledge and research related to coal phase-out policy and just transition initiatives in Canada. The combination of specific search terms allowed for a focused exploration of key aspects within the broader context of energy transition and sustainability.

5.3.2.2. Official document research

In addition to the literature review employed for the Canadian case study, document research served as a complementary approach. This method involved the examination of official documents, including policy statements, regulations, amendments, plans, and programs that were publicly accessible on official Canadian authorities' websites and the websites of provincial governments.

The primary objective of the document research was to conduct an evidence-based analysis of official decisions pertaining to the coal phase-out in Canada, as documented and released by federal or provincial government sources. Analysing these authoritative documents, along with the academic literature, facilitated development of a comprehensive understanding of the policy landscape and its evolution in relation to the coal phase-out

The document research contributed to the overall research methodology by providing a reliable and up-to-date source of information that directly informed the analysis and findings of this research. It ensured that the examination of the Canadian case was grounded in the official records and decisions made by relevant governmental bodies.

The combination of official documents and literature review including grey literature sources strengthened the credibility and robustness of the research findings, enabling a comprehensive analysis of the coal phase-out in Canada from multiple perspectives.

5.4 Specification of the framework

The generic set of sustainability objectives, as proposed by Gibson et al. (2005), served as the foundation for the framework. These objectives encompassed the core requirements for progress towards sustainability: socio-ecological system integrity, livelihood sufficiency, inter- and intra-generational equity, resource efficiency, democratic governance, precaution, and integration. It formed the basis for identifying characteristics that represent crucial contributions to sustainability.

To specify the framework for application to coal phase out policy, the specification steps identified by Gaudreau (2013) were used (see section 4.1). As discussed in Chapter 4, the specification of the sustainability assessment criteria starts by defining the purpose (informing the assessment of existing national coal phase-out policy or guiding the development of new ones). The criteria aim to assess the coal phase-out policy’s positive contribution to sustainability, considering socioeconomic impacts, just transition, and climate change mitigation. The framework focuses on thermal coal's use in electric power generation and associated mining impacts. The specified criteria help identify and compare alternative pathways for coal phase-out, guiding policy options and implementation approaches.

Based on Gibson et al.'s (2005) sustainability criteria, the initial set of criteria was adapted to align with coal phase-out, just transition, sustainability, and transformation, as discussed in chapters 2 and 3.

Anticipating issues disclosed through the analysis of the Canadian case, iterative adjustments were applied to address essential elements illuminated by the case study.

The preliminary set of criteria concerned the following five core categories:

Steps 3, 4, 5 and 6 by Gaudreau (2013) were developed along with the case study analysis throughout chapters 6, 7 and 8. In step 3, the case and context were developed using methods of literature review and document research (as described in the previous sections in this chapter), guided by thew preliminary sustainability criteria (Gaudreau, 2013). Step 4 involved organizing the gathered information into key issues, as seen in sections 6.1.4.1, 6.5, 7.5, 7.6, 8.6). Step 5 and 6 from Gaudreau (2013) represented re-specifying and finalizing the criteria after analyzing the case. The final criteria resulted from gathering the main issues from the case study and going through iterations based on emerging themes integrated from the case study (e.g., the inter-jurisdictional approach and governance issues were more emphasized in the criteria after careful analysis of the Canadian case). This led to a refined sustainability criteria set. A results table reflecting the criteria was developed in section 8.6. Through repeated iteration, the criteria were thoroughly grounded in the case and context. In this case, a formal analysis of potential alternatives regarding the coal phase-out transition was not conducted. Instead, the emphasis of this work was on clearly defining the criteria and making initial observations that highlight themes for further research or discussion.

The case study supported the specification of the framework, considering the contextual reality within Canada, especially the contexts of the particular provincial jurisdictions affected by the coal phase-out in the country. To cover the key issues for criteria specification in the context of coal phase-out federal policy in Canada, three fundamental categories of considerations based on Gibson (2016) were addressed: the starting conditions and existing dynamics (existing problems, possibilities, fears, needs and desires, capacities and deficiencies, etc.); the potential effects of what is being assessed (including effects of associated options); and the future results that are desired or feared (Gibson, 2016).

According to these considerations, the three major groups of influences for the framework specification to the case of the Canadian coal phase-out policy were identified as follows:

1. Starting Conditions and Existing Dynamics:
    a. Identifying the existing conditions related to coal production, mining, deposits, exports, and use in Canada.
    b. Considering the possibilities and opportunities for transitioning away from coal, such as renewable energy alternatives.
    c. Considering the fears, needs, and desires of various stakeholders, including workers in the coal industry, affected communities, and environmental advocates.
    d. Identifying the key aspects in recent history of energy transition in Canada.
2. Potential Effects of the Coal Phase-Out:

a. Evaluating the environmental impacts of coal power generation, including greenhouse gas emissions and air pollution, and discussing the potential benefits of transitioning to cleaner energy sources.
b. Examining the economic consequences of the coal phase-out, including the impact on coal mining jobs, energy prices, and economic diversification in affected regions.
c. Considering the social implications, such as community well-being, health outcomes, and social equity, and discussing how the phase-out may affect different groups of people.
d. Discussing the feasibility and reliability of alternative energy sources and energy security issues to ensure a smooth transition and uninterrupted electricity supply.

3. Desired or Feared Future Results:
    a. Identifying the desired outcomes of the coal phase-out, such as reduced greenhouse gas emissions, improved air quality, and a transition to a more sustainable and low-carbon energy system.
    b. Considering the potential benefits of a just transition for affected workers, communities, and Indigenous groups, including job creation, retraining opportunities, and economic diversification.
    c. Addressing any feared consequences of the coal phase-out, such as job losses, economic decline in coal-dependent regions, and social unrest.
    d. Addressing goals and targets for the transition process, including timelines for phasing out coal-fired power plants and achieving specific emission reduction targets.

By considering these key influences and incorporating them into the criteria specification process, the initial framework was specified to address needs for a comprehensive and well-informed approach to coal phase-out federal policy in Canada aiming for appositive contribution towards sustainability. The specified framework resulted in fifth core category, “Governance accountability, inter-jurisdictional collaboration, and government support for the just transition”, as it represented crucial issues needed for the coal phase-out transition that were specifically covered by the initial criteria.

The framework specified to the Canadian case facilitated the identification of barriers and opportunities for pursuing sustainability goals in the context of coal phase-out while applying a set of rules for trade-off avoidance. The integrative assessment approach aimed to disclose both the challenges and potential pathways towards sustainability. The specified framework and associated discussion can be found in Chapter 7.

5.5 Methodological limitations

The scope and depth of this master's thesis research project were constrained by the timeline, particularly in terms of the case study selected (one case study with multiple jurisdictions). The literature review was limited to the databases used in this research and the available sources within those databases.

While the case study approach facilitates a reasonably comprehensive analysis of the coal phase-out implementation within its specific context, the characteristics observed in each case cannot be generalized to other instances of coal phase-out. Use of the proposed sustainability assessment framework relies on generic criteria that need to be tailored and specified for each unique case and context. The primary goal of this research is not to prove the effectiveness of a specific intervention, but rather to understand the experiences and identify desirable sustainability requirements associated with coal phase-out policies. Therefore, conducting an exploratory literature and official documents review and applying the framework to context-specific case studies is appropriate. It is important to acknowledge that the case study serves as a means to understand how the framework could be applied in specific contexts of coal phase-out policy. Both the generic criteria and the specifications are subjective and open to debate.

Finally, it must be recognized that being a foreigner in the Canadian jurisdiction may limit my ability to fully grasp and interpret the cultural subtleties that are relevant to the findings of this study.

In conclusion, this methods section has explored the foundation for the following chapters, which will dive into a comprehensive analysis of the Canadian case study on coal phase-out. The upcoming discussions will focus on understanding the context and characteristics surrounding the coal phase-out in Canada. By following the steps outlined in this section, a sustainability-based framework will be developed specifically for the Canadian case. This framework will create a set of criteria that address crucial issues to ensure both sustainable outcomes and social justice in the transition away from coal.

CHAPTER 6. Coal phase-out federal policy – the Canadian case

This chapter focuses on the Canadian case study of the federal coal phase-out policy, analyzing its objectives, implementation, and outcomes. The decision to phase out coal-fired power generation in Canada aimed to reduce greenhouse gas emissions and transition to cleaner energy sources. The following discussion explores the policy's historical context, formulation factors, and implementation timeline. It also examines key components, including regulatory measures, policy statements, federal and provincial programs, financial incentives, and support for affected communities and workers.

The chapter focuses on coal's importance for the Canadian energy and GHG emissions context and it provides the historical background and context for the decision-making process focused on phasing out coal fired power in the country.

By studying the Canadian case, it will be possible to provide a comprehensive understanding of an example of a federal coal phase-out policy and its implications for sustainability and just transition goals. The case study highlights the challenges faced by coal-dependent workers and communities during this transition, and it assesses the role of various stakeholders, such as government, industry, labour unions, and community groups. Through this analysis, the case study aims to present gaps and strengths identified in the Canadian context along with the most important challenges or contributions for sustainable outcomes and an effective implementation of a just energy transition.

6.1. Background and context for coal phase-out in Canada

This chapter section provides essential background and context information regarding the coal phase-out in Canada. This section explores the historical trajectory that led to the formulation and implementation of coal phase-out policies in Canada and examines the significance of coal as an energy source in Canada, including its contributions to energy production, GHG emissions and employment. By establishing the background and context, this section sets the foundation for a comprehensive analysis of the coal phase-out policies and their implications for the Canadian energy transition context.

6.1.1 Characteristics of coal production, mining, deposits, exports, and use

Coal is mined in Canada for domestic use and for export. Within Canada, coal is mainly used for electricity generation, heating, and industrial purposes (e.g., for iron and steel production). According to Natural Resources Canada, in 2019, electricity generation and heating had the largest share of domestic coal use (67%), followed by steel and iron's industrial use (12%). In 2019, Canada produced 57 Mt of coal, of which 53% was metallurgical coal used by the steel industry, and 47% was thermal coal used for electricity (Natural Resources Canada, 2019). According to the Canada Energy Regulator (2019), Canada's

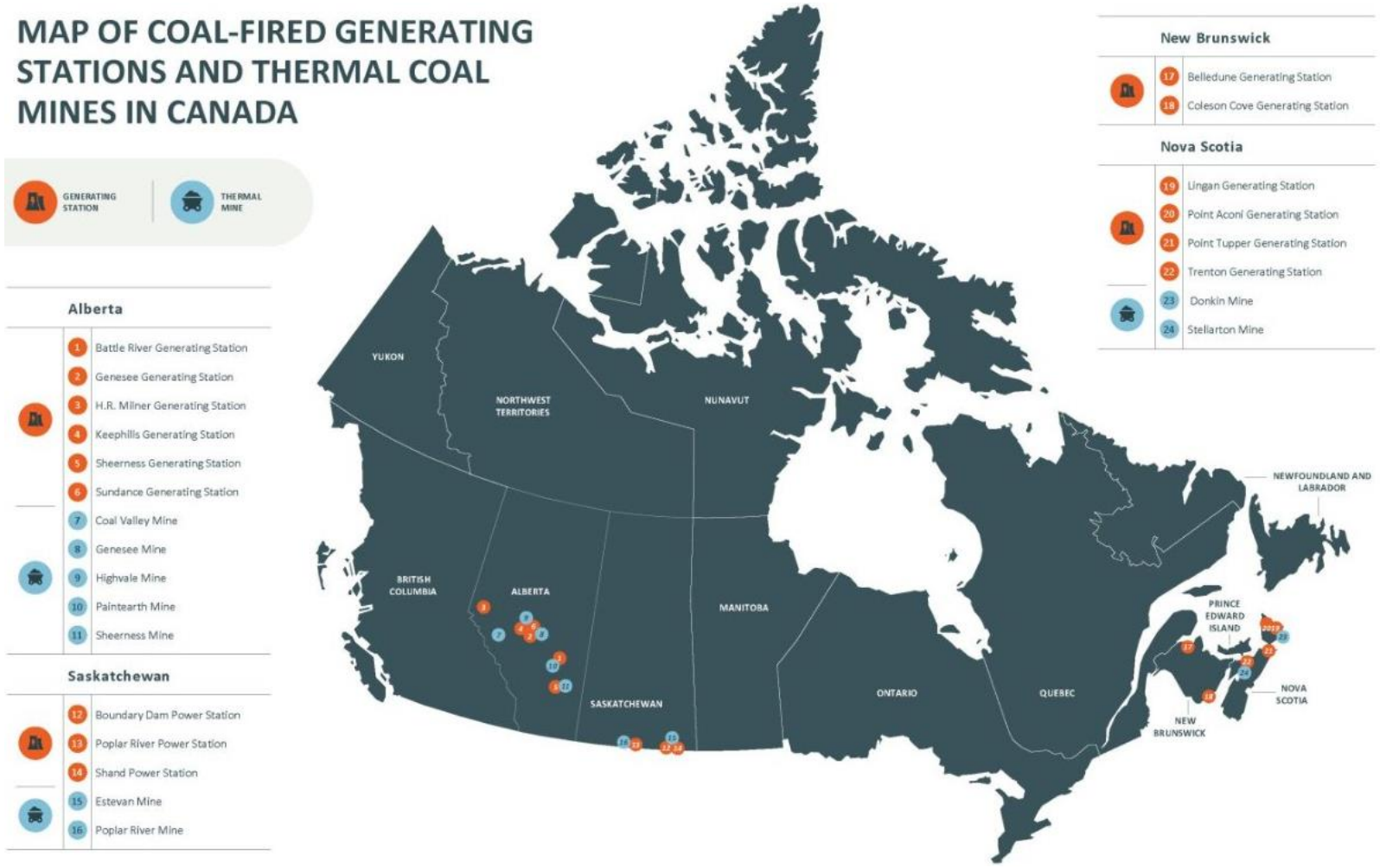
coal reserves would last approximately 170 years if the consumption rate of coal in Canada remained the same as in 2019.

In terms of coal's relevance for the Canadian economy, in 2019, Canada came as the 13th largest coal producer and seventh coal exporter in the world, exporting approximately half of its production – of which most goes to Asian countries. The most relevant importers of coal coming from Canada were South Korea (25%), Japan (23%), India (14%), and China (13%), and 95% of the coal exported by the country in 2019 was metallurgical coal. Also, Canada imports coal although the imports have been decreasing for the last decade. In 2021, Canada's coal production was 48 million tonnes while the imports represented around 6 million tonnes – the lowest number of imports in the last decade (Natural Resources Canada, 2017). Most coal imports (72%) come from the United States, and nearly half of it is used for steel manufacturing, while the other half is used for electricity generation (Natural Resources Canada, 2017). In this setting, thermal coal – used for electricity generation, plays a relevant role in domestic consumption but is not as crucial for exports.

The coal-producing provinces in 2021 were British Columbia (62%), Alberta (21%), Saskatchewan (17%), and Nova Scotia (0.4%) (N. R. Canada, 2017). Use for thermal coal combustion is distributed differently. The provinces with the largest share of coal consumed for electric power generation in Canada in 2021 were Alberta (44%), Saskatchewan (43%), followed by Nova Scotia (10%), and New Brunswick (3%) (N. R. Canada, 2017).

Most coal resources in the country are in the Western Canada Sedimentary Basin, from the Canadian Shield to the Rocky Mountains through Manitoba, Saskatchewan, Alberta, and northeastern British Columbia (Treasury Board of Canada Secretariat, 2023). In Alberta, 45% of deposits are sub-bituminous coal; in Saskatchewan, 14% are lignite. All the remaining deposits (41%) are bituminous and semi-anthracite (Treasury Board of Canada Secretariat, 2023). The anthracite class is primarily a resource for the steel industry rather than for power generation in the utility industry. Therefore, thermal coal mines are more concentrated in Alberta and Saskatchewan. The coal-fired power stations and thermal coal mines that were operating in 2018 – before a coal phase-out policy was put in place are presented in the map below (Environment and Climate Change Canada, 2019).

Figure 5 - Map of Coal-fired Generating stations and thermal coal mines in Canada

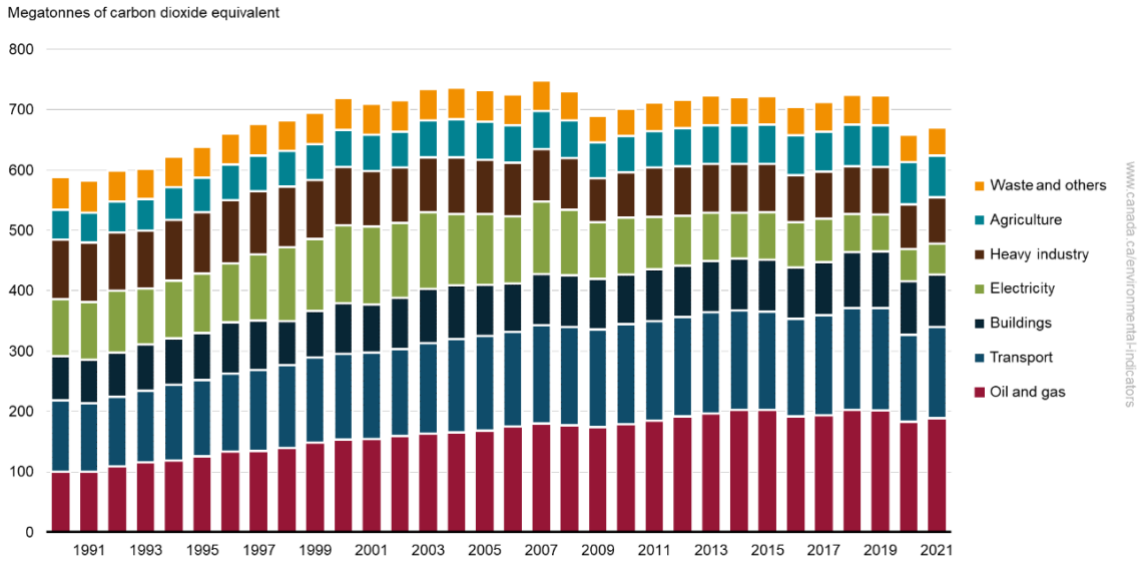


From Environment and Climate Change Canada (2019). Final Report by the Task Force on Just Transition for Canadian Coal Power Workers and Communities: Complete text. https://www.canada.ca/en/environment-climate-change/services/climate-change/task-force-just-transition/final-report-complete.html

6.1.2 Brief contextual information on coal power generation and GHG emissions in Canada

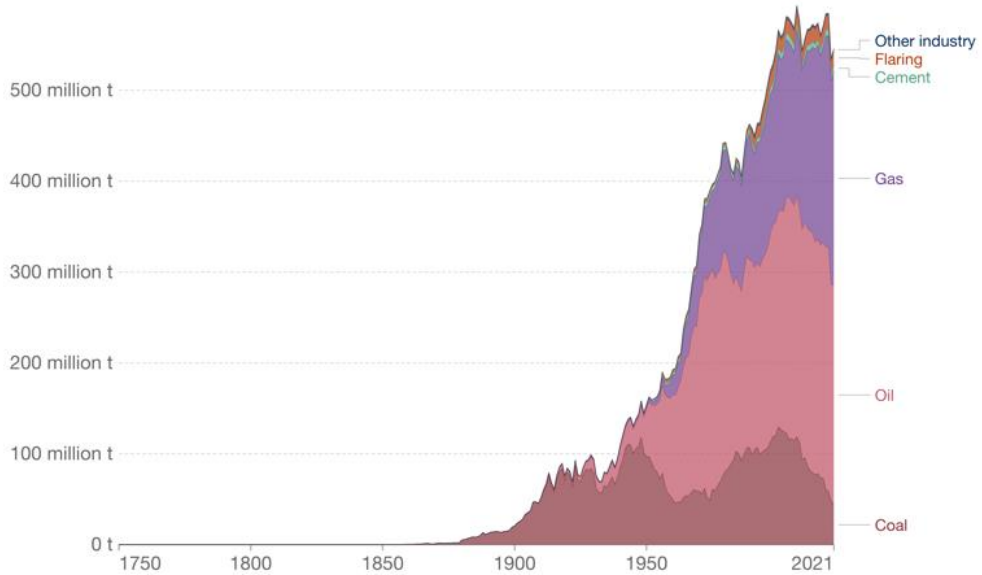
Globally, Canada ranks 11th in total GHG emissions and 15th in GHG emissions per capita (Ritchie et al., 2020), The most critical GHG emitting economic sectors are oil and gas, followed by transportation (Environment and Climate Change Canada, 2023). However, in terms of most emitting fuel sources in Canada, coal is in third place, after oil and gas, as seen in the figures below (Ritchie et al., 2020).

Figure 6 - Greenhouse gas emissions by economic sector, Canada, 1990 to 2021



From: Environment and Climate Change Canada (2023) Canadian Environmental Sustainability Indicators: Greenhouse gas emissions. Consulted on May 15, 2023. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gasemissions.html.

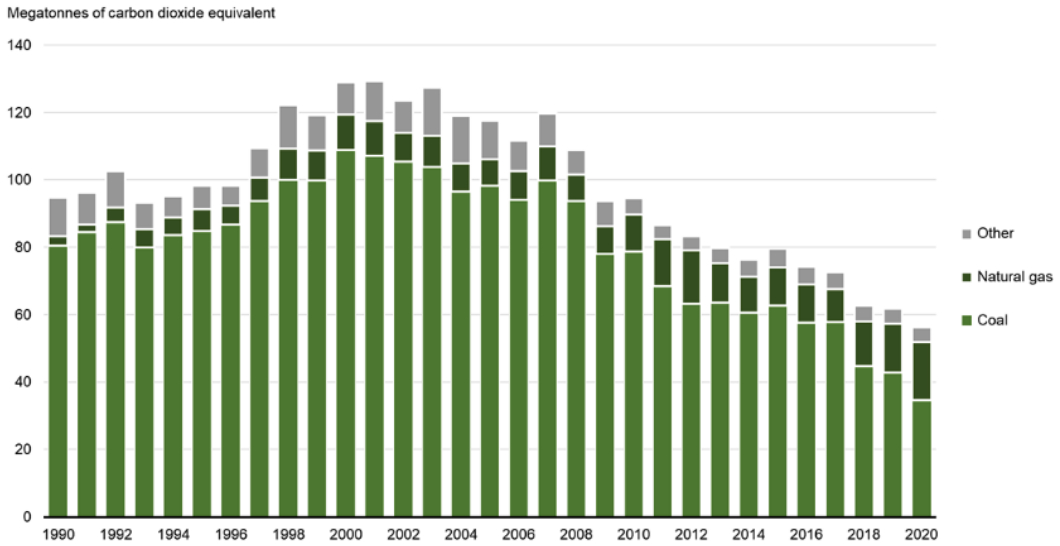
Figure 7 - CO_2 emissions by fuel or industry type, Canada



From Ritchie, H., Roser, M., & Rosado, P (2020). CO_2 and Greenhouse Gas Emissions. Our World in Data. Consulted on April 15, 2023. Available at: https://ourworldindata.org/co2/country/canada

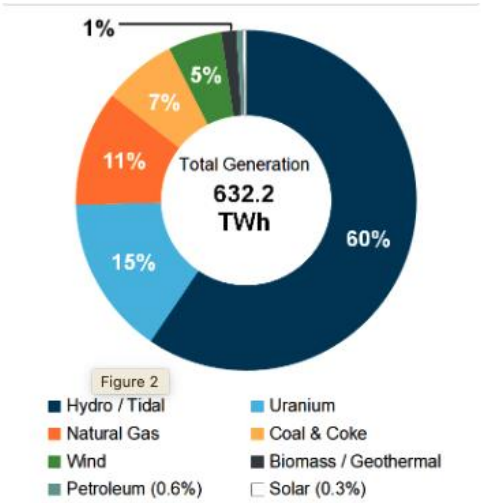
The electricity sector accounts for only 8.33% of national GHG emissions, due to mostly to more than half of electricity being generated from hydro sources (Government of Canada, 2023). Still, the Government of Canada reports that coal was responsible for 61% of CO_2 emissions in the electricity sector, even though it accounted for only 7% of the utility electricity generated in Canada in 2019 (see figures below) (Government of Canada, 2023a; Environment and Climate Change Canada, 2023).

Figure 8 - Electricity sector greenhouse gas emissions, Canada, 1990 to 2021



From Environment and Climate Change Canada (2023) Canadian Environmental Sustainability Indicators: Greenhouse gas emissions. Consulted on April 15, 2023. Available at: (Government of Canada, 2023).

Figure 9 - Electricity Production in Canada per fuel per source, 2019

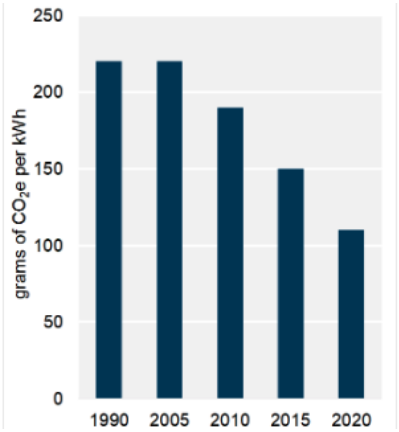


From Government of Canada, C. E. R (2023a, March 3). CER – Provincial and Territorial Energy Profiles – Canada. Available at: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html

According to Canada's Task Force on Just Transition (Environment and Climate Change Canada, 2019), compared to coal, the industries of pulp and paper, iron and steel, cement, lime and gypsum, and chemicals and fertilizers industries collectively emitted fewer GHG emissions than the coal power sector in Canada (Environment and Climate Change Canada, 2019),

Canada's National Inventory of GHGs emissions covering the period of 1990 to 2020 showed that the most considerable reduction in emissions from public electricity and heat production between 2005 and 2020 was caused by the decrease in power generation from oil (decrease of 86%) and coal (62% reduction) – see figure below (Canada. 2021 National Inventory Report (NIR) | UNFCCC, n.d.). Ontario's phase-out of coal power generation by 2014 was a significant contributor – delivering a 52% reduction of GHG emissions from electricity production between 2005 and 2020.

Figure 10 - Emissions intensity of electricity generation in Canada



From Government of Canada, C. E. R (2023a, March 3). CER – Provincial and Territorial Energy Profiles – Canada. Available at: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html

The 2018 coal phase-out plan by the federal government of Canada is directed at coal-fired electricity generation and does not target coal use for metallurgical processes (E. and C. C. Canada, 2019). Nonetheless, the 2018 federal policy is expected to impact thermal coal mining as well as coal-fired electricity generation, with the decrease of thermal coal mines in the country, for example with three thermal coal mine closures in Alberta in 2021 (Secretariat, T. B. of C., n.d.). This shift can also be evidenced by the fall of coal production in the past decade, from 68,152 kt in 2010 to 40,792 kt in 2020 (The Mining Association of Canada, 2021).

Moreover, even though Canada relies mainly on hydro and other non-coal electricity generation sources, some provinces and regions still rely on coal-fired power. In 2018, coal was the source of 55.8% of the electricity generation in Nova Scotia, 42.1% in Alberta, and 43.5% in Saskatchewan (Government of Canada, 2023a). Thermal coal production and mining are also relevant economic activities in some provinces (e.g., Alberta), and they will be (and already are) directly affected by the federal coal phase-out policy.

6.1.3 Characteristics of the coal-fired power industry in Canada

Under Canada's Constitution, electricity generation is mostly a matter of provincial jurisdiction and authority. Within each province, electricity transmission, distribution, market structure, and resource management are also controlled by the provincial government – chiefly through regulatory agencies and provincial Crown utilities (Natural Resources Canada, 2020).

Concurrently, within the electricity sector, the federal government is responsible for resource management on frontier lands, nuclear safety, inter-provincial and international trade, environmental and other impacts across provincial boundaries or where federal lands or control apply, and standards related to conservation and demand (Electricity Canada, 2022) The federal government is also responsible for research and development investments and for supporting commercialization of new technologies (Natural Resources Canada, 2017).

Overall, the entities primarily involved in the electricity sector in Canada are the Canada Energy Regulator (formerly known as the National Energy Board), provincial and private sector utility companies, industry associations such as Electricity Canada, other societies and associations in the provinces (e.g., The Alberta Electrical Alliance, Maritimes Energy Association) and other associations representing a specific source of power generation (e.g., Coal Association of Canada, Canadian Renewable Energy Association).

The Canada Energy Regulator has jurisdiction over the movement of energy throughout Canada. They are in charge of keeping watch over the companies that operate pipelines and electrical powerlines that cross a national, provincial, or territorial border (Government of Canada, 2020).

At the same time, provinces have jurisdiction over the generation, transmission and distribution of electricity in Canada, mainly through provincial Crown utilities and regulatory agencies. Traditionally, vertically integrated electric utilities (frequently provincial Crown corporations with monopoly rights) have provided electricity in the country (Natural Resources Canada, 2009).

Nova Scotia has a single publicly traded utility, while Saskatchewan and New Brunswick's electricity management is carried out through crown corporations (Environment and Climate Change Canada, 2019). Alberta and Ontario have competitive generation and at least somewhat open electricity markets. Alberta's largest power generation companies include TransAlta, Heartland Generation, Suncor, ENMAX, and Capital Power (Government of Canada, 2023). Ontario has both private sector and public utility generators.

While some Canadian coal power generation companies own coal mines or coal production operations, others purchase coal for power generation (Natural Resources Canada, 2019). In 2018, there were fourteen active coal-powered generating stations in Canada – in Alberta, Saskatchewan, Nova Scotia and New Brunswick (Carbon Brief, 2020) – see table below.

Table 13 - Coal power generating stations in Canada, location, owners, and commissioning year

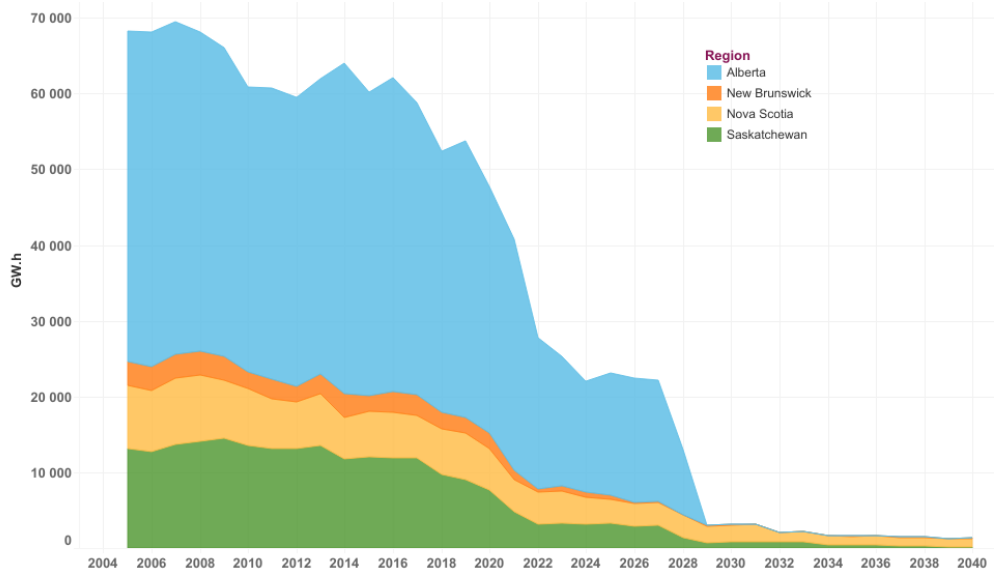
	Generating Station	Owner	Commissioning year
AB	H.R. Milner	Maxim Power	Unit 1- 1972
	Battle River	ATCO Power	Unit 1- 1969 Unit 2 - 1975 Unit 3 – 1981
	Sundance	TransAlta Corporation	Unit 1- 1976 Unit 2 - 1977 Unit 3 – 1978 Unit 4 - 1980
	Keephills	TransAlta Corporation	Unit 1- 1983 Unit 2 - 1984 Unit 3 – 2011
	Genesee	TransAlta Corporation	Unit 1- 1989 Unit 2 - 1994 Unit 3 – 2005
	Sheerness	TransAlta Corporation	Unit 1 - 1986 Unit 2 - 1990
SK	Boundary Dam	SaskPower	Unit 1- 1969 (CCS) Unit 2 - 1970 Unit 3 - 1973 Unit 4 – 1978
	Poplar River	SaskPower	Unit 1 - 1981 Unit 2 - 1983
	Shand	SaskPower	Unit 1 - 1992
NS	Lingan	NSPI	Unit 1 - 1979 Unit 2 - 1980 Unit 3 - 1983 Unit 4 – 1984
	Point Aconi	NSPI	Unit 1 – 1995
	Point Tupper	NSPI	Unit 1 – 1973
	Trenton	NSPI	Unit 1 - 1969 Unit 2 - 1991
NB	Belledune	NB Power	Unit 1 - 1993

Adapted from Environment and Climate Change Canada, 2019

Also, coal plant types in Canada differ according to their emission intensity. Traditional or "sub-critical" plants are the most common in Canada, and they are the most polluting ones. There are two other units of the more efficient type ("super-critical") in Alberta (Keephills 3 and Genesee 3) and one unit with carbon capture technology (Boundary Dam 3 in Saskatchewan) (Thibault et al., 2021).

Alberta has the largest proportion of coal-fired generating capacity at 65%, followed by Saskatchewan (17%) and Nova Scotia (12%) – see figure below (Canada Energy Regulator, 2022).

Figure 11 - Coal-fired generating capacity in Canada



From Canada's Energy Future 2019, Canada Energy Regulator, 2022

Of Canada's thermal coal mines, nine were active in 2018 (see table below). The Stellarton mine in Nova Scotia was scheduled to close in 2019, according to the Task Force on Just Transition for Canadian Coal Power Workers and Communities report (Environment and Climate Change Canada, 2019). However, Burns (2022) reported in 2022 that despite discussions about closing the mine in 2019, the provincial Department of Natural Resources and Renewables had not received any notification of the mine's closure as of July 2022. Concerns have arisen over land reclamation and safety as the mine approaches its end, but the town is proposing ideas for the reclaimed land such as a lookoff area and mountain bike trails (Burns, 2022). The provincial government holds a remediation security deposit, and residents have reported positive interactions with Pioneer Coal (Burns, 2022). The town aims to improve communication with the company and hopes the land will be left in a usable state after mining operations conclude (Burns, 2022).

Table 14 - Thermal coal mines in Canada, location, and owners

	Generating Station	Owner	Associated Generating Stations
AB	Highvale Mine	TransAlta	Keephills/Sundance
	Genesee Mine	Westmoreland Coal Company	Genesee
	Sheerness Mine	Westmoreland Coal Company	Sheerness
	Paintearth Mine	Westmoreland Coal Company	Battle River
	Coal Valley Mine[1]	Westmoreland Coal Company	Domestic/export
SK	Estevan Mine	Westmoreland Coal Company	Boundary Dam/Shand
	Poplar River Mine	Westmoreland Coal Company	Poplar River
NS	Stellarton Mine[2]	Pioneer Coal Limited	Trenton
	Donkin Mine[3]	Kameron Coal	Lingan/export

[1] Thermal coal produced at the Coal Valley Mine is mainly exported.
[2] The Stellarton Mine sells coal for use at the Trenton Generating Station and is slated to close in 2019.
[3] The Donkin Mine exports coal internationally and resumed supplying thermal coal within Nova Scotia in 2018.

From Environment and Climate Change Canada, 2019

In March 2020, Kameron Coal announced a shutdown due to geological conditions in the Donkin mine on Cape Breton Island, Nova Scotia, which has been troubled by roof collapses for more than a year (Pottie, 2019). However, the Nova Scotia government later renewed an industrial licence for Donkin in December 2022, allowing it to continue operating for another seven years (Pottie, 2019). The mine was also cited for safety violations since reopening with concerns raised about hazardous conditions, lack of safety equipment, and residents calling for stronger government action to address concerns (Pottie, 2019).

There are significantly different circumstances in the coal power-generating provinces, which impact not only the technical and other practical aspects implementing the coal phase-out policy, but also the interests of and relationships between workers, unions, communities, governments and other affects stakeholders and authorities (Environment and Climate Change Canada, 2019).

Over the past decade, the provinces have reduced the amounts of coal mined and used in their power plants. Economic factors have played a significant role in this reduction since, according to a report by the Carbon Tracker, more than 60% of coal plants had higher operating costs than costs of electricity from new renewables in 2020. By 2030, new renewables are expected to be even cheaper (Carbon Tracker, 2020) However, environmental and health concerns, environmental targets, and regulations were also relevant motives for the coal phase-out, as further explained in coming sections in this chapter.

6.1.4 Brief history of relevant structural reforms in coal power generation in Canada – the Ontario case

In Canada, the most significant policy and structural reform regarding coal power generation in the past decade has been the phase-out of coal-fired power generation in Ontario. Although climate change was not a strong motive for this process, understanding the essential influences, important players and the resulting impacts should be relevant to other cases where coal phase-out is happening – especially in Canada. This section will briefly go through the history of Ontario's coal phase-out.

The phase-out of coal-fired power generation in Ontario happened between 2003 and 2014. Although 2007 was initially planned as the last year for coal power stations in the province, the goal was deemed too ambitious and delayed to 2014 (Harris et al., 2016). In 2003, the province relied on coal for 25% of its electricity generation, with five coal-fired power stations having 19 units and employing 1,400 people (Environment and Climate Change Canada, 2019).

In Ontario, the main driver for phasing out coal-fired power was not related to climate change but primarily due to health concerns. According to Environment and Climate Change Canada (2019), there had been a record number of smog advisories in the province – for example, 15 smog advisories were reported in Ontario in 2005, covering 53 days. After the phase-out of coal-fired power generation, the number of smog advisories reported in the province came down to zero – and remained there (Environment and Climate Change Canada, 2019; Flanagan & Gass, 2017). However, Ontario Hydro

owned the five coal plants and was regarded as one of the biggest utilities in the world with no intention of ending coal fired power (Cundiff, 2015). Likewise, the union representing the coal workers in these plants did not support the coal power phase-out in the province and neither did the Association of Major Power Consumers of Ontario (Cundiff, 2015). Also, with the province's attitude toward aligning the use of cheap coal fired power with economic success and prosperity while making great efforts to maintain artificially low power prices, both politicians and bureaucrats strongly opposed any rise in rates and consequently the coal phase-out as well (Cundiff, 2015)

Representatives of health concerns and entities were essential players in the engagement with the population in support of the phase-out of coal-fired power generation (Harris et al., 2015). At the early stage of the phase-out, a campaign was carried out by a coalition of environmentalists (Ontario Clean Air Alliance), doctors (Ontario Medical Association), and other entities for the collective goal of phasing out coal power (Harris et al., 2015). This campaign mainly targeted the adverse health effects of coal. It brought the issue to the spotlight in the provincial election in 2003 – persuading representatives of the three main parties (Progressive Conservative, Liberal, and New Democratic) to recognize the health concerns related to coal (Harris et al., 2015). The engagement of major political parties played a fundamental role in building consensus – regardless of the winning party at the elections – and it was crucial for the approval of the coal phase-out policy in the province (Harris et al., 2015). In response to health-focused narratives that portrayed coal as a significant contributor to air pollution, advocates of coal argued that Ontario's coal plants were responsible for only six percent of the province's pollution (Rosenbloom, 2018). Some proponents of coal advocated for the use of clean coal solutions, such as scrubbers and carbon capture and sequestration, as a means of extending the use of this power source (Rosenbloom, 2018).

The negative impacts of the coal phase-out in Ontario were not a priority in the campaign and direct job losses were not part of it (Cundiff, 2015) Though there was concern about job losses, the direct employment issue received little attention although the Power Workers' Union defended coal by advertising non-existent clean coal technology and scrubbers (Cundiff, 2015). At the same time, the Ontario Clean Air Alliance stated that a partial privatization of the electricity system may have overshadowed the issue, or the broader public may not have believed that these jobs were sustainable given the health impacts of coal (Cundiff, 2015). As cited by Rosenbloom (2018), the Liberal party had originally intended to cease all coal power production by 2007. However, due to unforeseen challenges and external pressure from various organizations such as think tanks, unions, and industries, they had to delay the deadline twice (Rosenbloom, 2018). The postponement of the coal phase-out deadline was due to concerns over job losses, although the Ontario Clean Air Alliance believed that Ontario Power Generation was equipped to ensure a just transition for coal plant workers given their large workforce and robust spending habits (Cundiff, 2015).

The coal phase-out process was part of a more extensive set of policies changes by the provincial government, targeting reform of the Ontario electricity sector and promoting renewable energy sources

(Harris et al., 2015). For example, the 2009 Green Energy and Green Economy Act aimed at opportunities for renewable energy projects and promoting a green economy (Green Energy and Green Economy Act, 2009).

Apart from the health and environmental concerns, the context of the coal power stations and coal power generation in the province was also fundamental to this decision. The coal-fired power plants in Ontario were considered relatively old at the time, and coal was imported rather than locally produced in the province (Harris et al., 2015). Also, the provincial government owned the coal plants, and the costs related to closing the plants were covered by the government (Harris et al., 2015).

In Ontario the end of coal generation was accommodated by an electricity transition mainly to non-GHG-emitting power sources (e.g., nuclear, wind, and solar – see table below) (Government of Ontario, n.d.). Some gas-fired generation plants were built to replace coal, especially to meet peak demand needs, and they had to demonstrate reliability before the coal-fired plants were closed entirely (Government of Ontario, n.d.).The transition to non-emitting sources, along with measures for energy efficiency and conservation, ensured a significant decline in emissions (Thibault et al., 2021) making it the single largest greenhouse gas reduction measure in North America (Harris et al., 2015). However, Winfield and Saherwala (2022) state that the coal phase-out in Ontario had far-reaching consequences, involving significant environmental, economic, and political trade-offs that continue to be the subject of debate. While energy conservation and renewable energy played key roles in the phase-out, the process also necessitated a substantial recommitment to nuclear energy and an expansion of natural gas-fired generation, both of which carry their own adverse environmental impacts (Winfield and Saherwala, 2022). At the same time, the economic costs of the phase-out, including the extensive reconstruction of the province's electricity system and the effects on electricity prices, have been a contentious issue in Ontario politics, influencing and shaping policy decisions and fueling ongoing discussions on the benefits and drawbacks of Ontario's approach to the phase-out (Winfield and Saherwala, 2022).

Table 15 - Percentage share of total electricity generation in 2003 and 2014 in Ontario

Energy supply	Percentage of total generation in 2003	Percentage of total generation in 2014
Nuclear	42%	60%
Gas	11%	9%
Hydro	23%	24%
Coal	25%	0%
Non-hydro renewables	0%	7%

Adapted from *(Government of Ontario, n.d.)*

Lastly, the closure of coal power plants in Ontario involved a phased approach, helping to maintain the electricity system's reliability. Lakeview GS (2,400 MW) closed operations in 2005,

followed by Atikokan GS (211 MW) in 2012, Lambton GS (1,980 MW) and Nanticoke GS (3,940 MW) in 2013, and Thunder Bay GS (306 MW) in 2014 (Government of Ontario, n.d.).

6.1.4.1 Key factors for a successful phase-out of coal-fired power in Ontario

In conclusion, attention to strategic issues is crucial to help understand why Ontario's coal phase-out was considered successful. Building a campaign with critical stakeholders (e.g., Ontario Medical Association) supporting the cause since the early stages of phase-out planning and targeting the buy-in of all major political parties were significant factors for a successful approach (Harris et al., 2015). The principal representatives in the phase-out campaign ensured broad consultation with various stakeholders (e.g., civil society, the industry, and municipalities) throughout the process (Harris et al., 2015).

Furthermore, the Government of Ontario acknowledges that a diverse supply mix to substitute coal-fired power capacity was crucial to secure reliability (Government of Ontario, n.d.). Also, the provincial government highlighted the importance of the phased approach along with a long-term plan, the diverse group of major players involved in the implementation (e.g., Ministry of Energy, Ontario Power Generation, the Independent Electricity System Operator), transparent and efficient communication with stakeholders and the engagement of labour unions throughout the decommissioning process (Government of Ontario, n.d.).

Although complementary policies were not a particularly relevant concern in Ontario's coal phase-out, policy changes and other initiatives in reforming the electricity system were a significant aspect in the context of the coal phase-out. in Ontario (see table below).

Table 16 - Synthesis of recent electricity sector reforms in Ontario

Summary of recent electricity sector reforms in Ontario
Over the years, the electricity system in Ontario has changed to address problems and promote sustainability. In 1998, a law called the Electricity Act was passed to open up the electricity market to competition. However, this led to higher electricity bills and a shortage of power. In 2003, a new law called the Electricity Restructuring Act was introduced to balance competition and long-term planning. Other legislation including the Green Energy, Green Economy Act in 2009 promoted renewable energy and conservation. But in 2018, a new government canceled renewable energy projects and focused more on nuclear and natural gas energy, which can harm the environment. These alternatives would go against the national commitment to address climate change. Overall, the changes in Ontario's electricity system have been influenced by politics, market forces, and sustainability concerns.

Adapted from: Aguilar Vargas, 2023

Finally, the focus of an early-stage campaign on a more local, evidence-based concern, such as air quality and related health impacts, can count as a success factor in this case. Air pollution and illness can be engaging issues for many people, enabling stakeholders and political representatives with distinct opinions to form a consensus and to support the cause – which is more challenging for a global issue like climate change which involves protecting the global commons (Harris et al., 2015). According to Winfield and Saherwala (2022), without the efforts of the Ontario Clean Air Alliance and the coalition of health professionals, municipal governments, unions, and other NGOs they brought together, it is uncertain whether the Ontario phase-out, and the subsequent national phase-outs, would have taken place.

6.1.5 Political context for decarbonization and coal phase out

Campaigns for phasing out coal-fired power started to gain momentum after 2015 when the Paris Agreement was established. The document was a historical victory for climate change since it was signed by 194 parties of the UNFCCC and established the commitment to halt the "increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels." (Paris Agreement, 2015, pg.3). However, signing the agreement was the first step to a long-term journey since effective action is needed. According to the IPCC SR1.5, coal power generation should peak by 2020 and decline rapidly, phasing out by 2040 while OECD countries should phase-out before 2031 (Climate Analytics, 2019; Environment and Climate Change Canada, 2019)

Before the federal government's commitment to phase out coal-fired power in the country, Ontario had already been through this process and Alberta had established its climate plan to tackle coal phase-out by 2030 (Vriens, 2018).

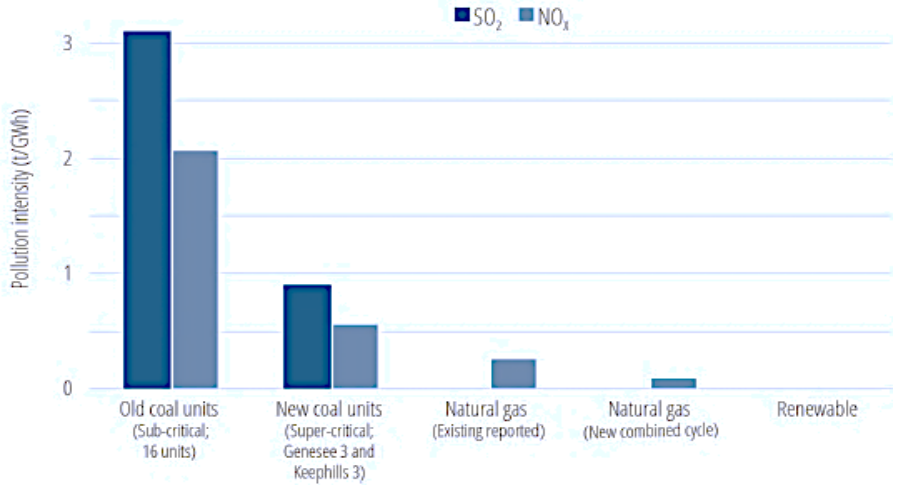
Climate change was gradually recognized to be a pressing issue and a particularly relevant concern for the phase-out of coal-fired power in the country, as opposed to the phase-out process in Ontario. However, besides climate change, public health also factored in as a motive for decarbonization and coal power phase-out in Canada beyond Ontario.

At the time of the first regulations in 2012 to retire coal units, these regulatory changes would have an impact of 900 fewer premature deaths in Canada between 2015 and 2035, 120,000 fewer asthma episodes, and over $4.2 billion related to avoided negative health impacts ("Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations," 2012; Thibault et al., 2021). Furthermore, the first report from Canada's Task Force on Just Transition (Environment and Climate Change Canada, 2019) also cited the effect of 260 prevented premature deaths, reduced occurrence of 40,000 asthma episodes, and alleviated 190,000 days of respiratory distress and limited physical activity in Canada by 2055 - due to the acceleration of the coal phase-out with the federal regulations in 2018 (Environment and Climate Change Canada, 2019)

Although coal defenders have campaigned for "clean coal" (a broad term generally related to coal plants with carbon capture and storage technology or other measures to reduce pollutants) (IEA,

2008), it is not a desirable solution. The most advanced coal plant produces approximately fifty percent more GHGs than natural gas (EIA, 2021). In Canada, the most efficient coal facilities (Genesee3 and Keephills 3 in Alberta) with advanced emission control measures emit more Nitrogen oxides than any other electricity generation source, and coal is the source of most of the Sulfur dioxide emissions by the electricity sector – as seen in figure below (Thibault et al., 2021).

Figure 12 - SO2 and NOx pollution intensity by generation source in Alberta



From Thibault et al., 2021

In terms of mercury emissions, Alberta has applied mitigation efforts in coal plants, while in Saskatchewan, coal-fired electricity remained responsible for approximately 75% of the overall provincial mercury emissions through the 2010s (Pembina, 2021)

At the same time, it is indispensable to acknowledge that coal's competitiveness as a fuel source has been steadily declining – an IRENA report showed that two-thirds of new renewable power in 2021 had lower costs than the world's cheapest coal-fired alternative in the G20 (IRENA, 2022).

In Canada, the price of natural gas fell by over 60% between 2014 and 2018, making it increasingly more competitive than coal (Environment and Climate Change Canada, 2019). In addition, mining, processing, and associated services from thermal and metallurgical coal contributed to approximately 0.2% of Canada's GDP in 2016 (Environment and Climate Change Canada, 2019) – half of it being related to metallurgical coal. On the other hand, renewables contributed 1.3% of Canada's GDP (Environment and Climate Change Canada, 2019) Ultimately, Bauer et al (2018) stated that coal is much more sensitive than oil to carbon pricing, with a carbon price of 20 dollars per ton doubling the cost of coal consumption – as opposed to oil, which is less sensitive to carbon pricing and approximately five times the price of coal (UNFCCC, 2018; Bauer et al., 2018) Therefore, the economic factor and the declining competitiveness of coal also provide fundamental reasons for phasing out coal-fired power in Canada.

In summary, the factors contributing to the phase-out of coal in Canada relate to climate change and the Paris Agreement's targets. CO_2 emissions from coal combustion need to decline by fifty percent over the next decade to keep warming "well-below 2ºC" at the lowest cost (Jeyakumar et al., 2016). The

low price of natural gas and the declining price of wind and solar technologies affecting coal's competitiveness are equally contributing factors (Pembina Institute, 2016) Moreover, with increasingly strict climate policies and regulatory requirements for air pollutants, it became necessary to transition from coal as a source of electricity (Pembina Institute, 2016)

6.2 Policies already in place to phase out coal and how they were developed

The Canadian federal government has taken two major law-based steps related to the coal phase-out. The first is the amendment to the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations enacted in 2018, and the second is Canada's "Net Zero Accountability Act" which came into effect in 2021 (*Government Bill (House of Commons) C-12 (43-2) - Royal Assent - Canadian Net-Zero Emissions Accountability Act - Parliament of Canada*, 2021).

The 2018 regulatory amendment strengthened the first federal regulations to implement coal phase-out in Canada issued 2012. The 2012 regulations (SOR/2012-167) established a regime to reduce CO_2 emissions from coal-fired power generation *(Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations*, 2012). According to a report by the Pembina Institute (2021), the federal government was looking for readily achievable goals to accomplish GHG emissions reductions and targeted coal-fired power generation units (Thibault et al., 2021). The regulations in 2012 set new standards for GHG emissions by old coal-fired power plants, limiting GHG emissions to 420 tonnes of CO2e per gigawatt-hour of electricity generated (t/GWh). In practice, only coal power units with carbon capture would achieve this standard (Environment and Climate Change Canada, 2018) since the most efficient coal plants in Canada would still emit double that rate (Thibault et al., 2021) However, the 2012 regulations applied only to units at the end of their operating life (approximately 45 years after the commissioning date). This meant that ten of the then active units would still operate without any mandatory GHG emissions reduction until at least the 2030s – most of them into the 2040s. For two plants in Alberta, the regulations would apply only in 2055 and 2061 (Thibault et al., 2021)

In the context of the Paris Agreement targets and growing global pressures for a rapid coal phase-out, the federal government passed amendments to these regulations in 2018 to phase out coal-fired power by 2030. The changes supported the 2016 Pan-Canadian Framework on Clean Growth and Climate Change developed by the federal government with the provinces and territories, which centred on t pricing carbon pollution, complementary climate actions, adapting and building resilience, and actions related to innovation, clean technology, and job creation (Government of Canada, 2018). The regulatory amendments required all coal-fired units to meet the 2012 performance standard set by December 31, 2029. These new regulations impacted operations in fourteen of Canada's coal-fired electricity units – five in Alberta, one in Saskatchewan, one in New Brunswick, and seven in Nova Scotia (Environment and Climate Change Canada, 2018). These units would have to be replaced with cleaner sources of power generation (e.g., renewable sources or natural gas) or close at or before their

end of life – by 2029 at the latest. Another option for the owners of these units would be to comply with the amended regulations by installing carbon capture and storage technology in the existing units (Environment and Climate Change Canada, 2018).

However, equivalency agreements were signed between the federal government and the provincial governments of Nova Scotia in 2018 and Saskatchewan in 2020 (Environment and Climate Change Canada, 2018). The Canadian Environmental Protection Act (CEPA) allows provinces to have their regulations prevail over the federal ones if provincial regulations achieve equivalent or better environmental outcomes (Péloffy et al., 2019). Under these equivalency agreements, the application of end-of-life regulations by the federal government is removed if provincial regulations can attain equivalent overall emissions reductions in the electricity sector, although allowing for higher coal emissions (Thibault et al., 2021). The equivalency agreements allow for a more extended retirement period for coal-fired power units in these provinces (Thibault et al., 2021). In this setting, ensuring accountability and transparency within the equivalency agreements is crucial to the effectiveness of federal and provincial regulations implementation (Péloffy et al., 2019). Critics have concern about the willingness of the federal government to take action to safeguard the environment when the provinces are ineffective in doing so (Péloffy et al., 2019).

In Alberta, the coal-fired power phase-out movement first started in 2015, when the provincial government committed to phasing out coal as a source of electricity generation by 2030 – before the federal government amendments in 2018 (Government of Alberta, 2022; Thibault et al., 2021). However, the phase-out has been accelerating for the past few years. In 2022, the Alberta government announced its intention to complete the transition from coal-based electricity generation by the end of 2023. The government stated this move aligned with both the industry and government's dedication to achieving excellence in environmental, social, and governance outcomes, influential factors in investment choices and decisions (Government of Alberta, 2022).

Furthermore, thermal and metallurgical coal prices have significantly dropped in recent years as the world shifts away from coal (Wilt, 2017). Factors such as the increased viability of renewables, economic slowdown, and the drop in natural gas prices have all contributed to the decline of coal use – preceding Alberta's announcement to phase out of coal fired power (Wilt, 2017; Clark, 2022).

The result, as emphasized by a Pembina Institute's electricity program representative, Alberta's climate plan could support the transition from coal to renewables while allowing for planning and support for workers during the transition (Wilt, 2017)

The alternative of not developing a plan and waiting until federal regulations would apply could mean that coal plants would be shutting down purely for economic reasons while giving workers and the province less time to plan for compensation and transitioning to the new economy (Wilt, 2017). The province would have to shut down around 65% of its coal power units by 2030 to be in accordance with the 2012 federal regulations, unless they reduced emissions to 420 tonnes of CO2 per gWh through carbon capture and storage (CCS) (Wilt, 2017). However, CCS requires a high carbon price or

government investment, and Alberta's plan has not considered CCS, since it would entail significant higher bills (Wilt, 2017). Instead, the Alberta government's plan focused on converting coal-fired plants to natural gas, where feasible (Wilt, 2017). However, as stated by Binnu Jeyakumar, program director of the Pembina Institute's electricity program in an article by Wilt (2017) cheaper and better alternatives to coal include renewables (2 to 3 times cheaper) and energy efficiency (up to 6 times cheaper) (Wilt, 2017). In any case, despite the benefits of a planned phase-out, the decline of coal towns remains a difficult reality. More details on the outcomes of this policy and supporting actions by the government will be presented in the following chapter.

In 2017, two years after the launch of Alberta's climate plan and a year after the federal government announced the national phase-out of coal-fired power, Canada and the United Kingdom co-founded a new international partnership called "Powering Past Coal Alliance." The alliance brought global leaders to the forefront of phasing out coal power, including 27 national, provincial, state, and city governments as first members (Powering Past Coal Alliance, 2022). The alliance showed the world how Canada positioned its climate actions toward phasing out coal power.

As previously mentioned, another law-based milestone that influenced the phase-out of coal-fired power was Canada's "Net Zero Accountability Act" (Bill C-12), which received royal assent in 2021 (Parliament of Canada, 2021). According to the Emissions Gap Report 2022 (UNEP, 2022), 79 percent of global GHG emissions are covered by 88 parties with net-zero targets, either as part of the legislation, policy documents, or other announcement and strategies. In this sense, Canada is aligned with the global movement of committing to Net-Zero targets, responding to the growing temperature rise concern in the Paris Agreement.

The "Net Zero Accountability Act" strengthens the country's commitment to achieving net-zero emissions by 2050, improving transparency and accountability by the government (Parliament of Canada, 2021) The act established a legally binding process to achieve net-zero emissions by 2050, setting five-year emissions-reduction targets and requiring plans to achieve these targets and report on progress (Parliament of Canada, 2021). Other measures within the act include requirements for public participation and establishing an advisory body accountable to the Minister of the Environment (Parliament of Canada, 2021). In this setting, phasing out coal becomes unavoidable to ensure the Canadian economy has either zero emissions or completely offsets all GHG emissions by 2050.

While "Net Zero Accountability Act" was praised by some organizations like Ecojustice, stating that more frequent reporting is a major improvement, other experts have showed discontent (Woodside, 2021). According to Ecojustice's climate program director to Alan Andrews, breaking the 2030 and 2050 emission targets down into five-year chunks ensures more near-term certainty, accountability, and action from the government in a time horizon that lines up with politics and business (Woodside, 2021). The National Observer article also stated that the Canadian government's new climate accountability legislation is a major step forward (Woodside, 2021).

However, the Act has been criticized for falling short of world-class standards set by countries like the United Kingdom (Woodside, 2021). The legislation lacks important elements such as the use of carbon budgets to effectively reduce emissions and address the issue of responsibility, particularly when provinces fail to meet national targets (Woodside, 2021). Andrew Gage, a staff lawyer at West Coast Environmental Law, highlighted the need for improvements in the legislation, recommending the establishment of provincial carbon budgets and a clear clarification of the federal government's role in addressing non-compliance (Woodside, 2021).

The social and environmental organization Council of Canadians also criticized the act, stating that it lacks meaningful targets, that reporting only every five years is ineffective, and that no penalties or consequences were set for missing targets (Council of Canadians, 2020). Lastly, a report by the federal Office of the Auditor General suggests that coordination across all levels of government is necessary for effective climate action and that policies within various jurisdictions must be complementary rather than contradictory. Additionally, the government needs to ensure that lead departments on climate change are given the resources and authority they need to provide leadership to other departments and agencies (OAG, 2022).

6.3 The political context in the provinces

This chapter subsection presents the political context surrounding the coal phase-out process in the Canadian provinces. The section examines the political dynamics within each province, including the government priorities, essential contributing factors and public opinion on coal phase-out. It also explores the interaction between federal and provincial governments, highlighting occasions of cooperation and potential areas of conflict. By analyzing the political context, this section aims to provide insights into the factors influencing policy development and implementation, as well as the varying approaches taken by different Canadian provinces for the coal phase-out.

6.3.1 Alberta

In Alberta, a coal phase-out policy was already in place before the federal government amended regulations in 2018 – although the 2012 federal regulations on emissions regarding coal plants were approved beforehand. According to the Government of Alberta, in 2015, the province contributed 38 percent of Canada’s greenhouse gas (GHG) emissions, although it accounted for 11 percent of the population in the country (WRI, 2021). Coal-fired power phase-out in Alberta involves retiring approximately 40 percent of Alberta’s 2016 installed capacity and the the gradual discontinuation of local thermal coal mining in practice (Vriens, 2018).

The provincial government in Alberta was central to the phase-out of coal – particularly after the coming of the New Democratic Party (NDP) to power, which facilitated the shift of decarbonization to the centre stage in Alberta. The NDP won the provincial elections in 2015 and, in the same year,

committed to phasing out coal-fired power by 2030 while also implementing carbon pricing (Vriens, 2018) The coal power phase-out was part of the Climate Leadership Plan – launched by the Government of Alberta in 2015, which also set commitments to increase its power generation mix to 70% natural gas and 30% renewables by 2030 (Environment and Climate Change Canada, 2019). This move was ambitious since Alberta accounted for 55% of Canada's total coal power generation in 2015 (Littlecott, 2015). Furthermore, the coal plants had private owners; the energy sector was heavily supported by the local population, and smog was not a significant issue (Vriens, 2018). In this setting, the coal phase-out policy posed relevant challenges to be overcome in the province (Vriens, 2018).

Multiple factors paved the way for the move away from coal in Alberta. The election of the NDP was a major contributor that also allowed for a diversity of stakeholders to exercise influence, including environmental NGOs, labour unions, academics, and public health groups (Vriens, 2018). These stakeholders, who were distant from the political decisions before, became significant players supporting the Climate Leadership Plan and political messages related to climate change and health impacts (Vriens, 2018). However, according to Harrahill & Douglas (2019), local communities needed to be more effectively included in the negotiation process leading to the coal phase-out, along with workers, who were actually represented (Harrahill & Douglas, 2019). These authors also stated that labour unions had a critical role in securing compensation for displaced workers. However, the same level of dialogue and engagement did not happen with local communities, causing some distrust toward decarbonization processes (Harrahill & Douglas, 2019). The lack of social dialogue within affected communities may spur negative reactions toward climate mitigation policies. This was the case in Alberta where conservative political interests responded by advocating for “clean coal” and dropping the carbon tax (Vriens, 2018).

Nonetheless, unions supported the Climate Leadership Plan and were engaged in visiting communities and providing information to workers when communication directly from the government was deficient. The unions also fundamentally influenced design of the just transition program in Alberta (Vriens, 2018).

The main reason for the accelerated phase-out in the province can also be related to the decline in coal’s competitive positioning compared to lower-emissions alternatives, carbon prices, and climate risks to corporate interests (Thibault et al., 2021) Lower natural gas prices and competitive wind and solar options also played a role in the phase-out (Clark, 2022).

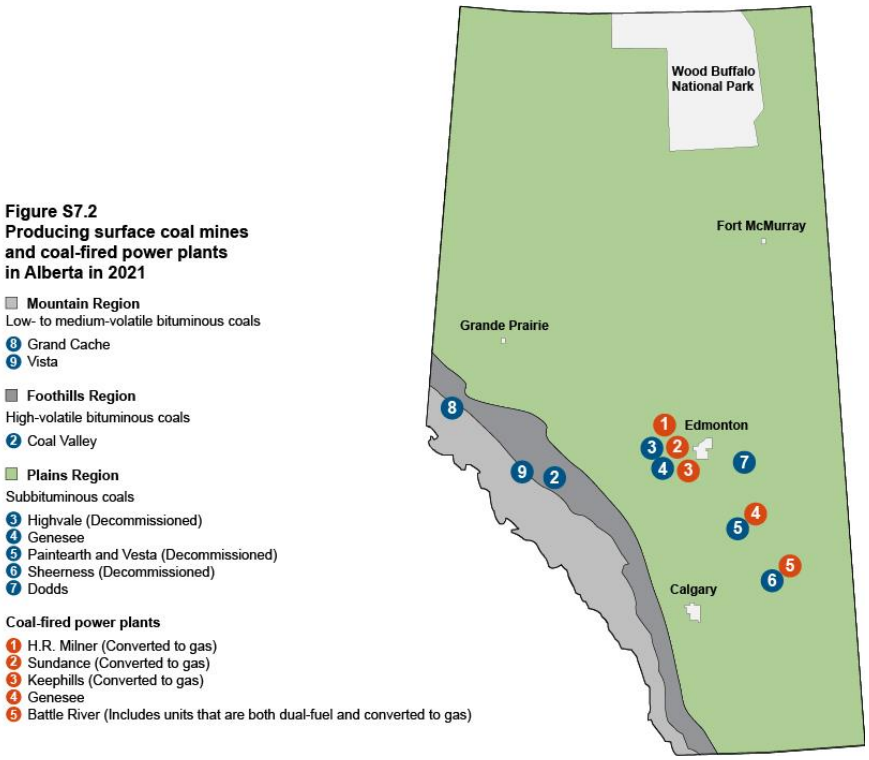
Carbon taxes in the province were destined for a payout to the coal power companies– resulting in a $1.1 billion compensation agreement with the major coal power utilities in Alberta and for programs directed at affected workers and communities (Environment and Climate Change Canada, 2019) This action helped to earn support from coal power companies (Vriens, 2018). Other factors facilitating approval of the climate plan and coal phase-out in Alberta included the substantial supply of Alberta natural gas as an alternative fuel for power generation. Additionally, a cap on consumers’ electricity prices was also influential to “mitigate the political influence of the power companies”, since the market

in Alberta is driven by supply and demand (Vriens, 2018). The cap on electricity prices in Alberta helped counter power companies' influence, ensuring consumers weren't burdened by high costs. While not directly tied to the coal phase-out, the cap contributed to political support for the climate plan along with natural gas availability and compensation agreements.

In summary, the process of phasing out coal power in Alberta mainly depended on the initiatives implemented by the provincial government and relied on the province's financial resources (Harrahill & Douglas, 2019). The political context in the province after the 2015 elections, the increased political participation from new stakeholders, and the economic issues - such as the natural gas availability turning coal into an uncompetitive option, influencing the coal power companies and the energy sector in the province, all helped to win approval for a coal exit (Vriens, 2018). In the Alberta case, local the provincial government has had a critical role in building political support for decisions related to decarbonization.

As cited in an article by Kevin Clark in *Power Engineering*, by January 2022, TransAlta had retired 3,794 MW of coal-fired generation and converted another 1,659 MW of capacity to natural gas (Clark, 2022). Capital Power's Genesee coal-fired units are the last remaining units and will be repowered as natural gas-fired combined cycle units (Clark, 2022), The phase-out is nearly complete, and a changing provincial government that brought environmental, labour, and other groups together helped speed up the process (Power Engineering, 2022) According to Evan Pivnick of Clean Energy Canada, in contrast to Ontario's coal phaseout, Alberta's phaseout is primarily focused on ensuring a healthy market that provides competitive prices and stability for investors (Clark, 2022), Genesse is the only remaining coal-fired generation plant in Alberta (Government of Canada, 2023). See figure 29 below with producing coal mines and coal-fired plants in Alberta in 2021.

Figure 13 - Producing coal mines and coal-fired plants in Alberta in 2021



From Alberta Energy Regulator, 2022

6.3.2 Saskatchewan

Most of the electricity in Saskatchewan is generated by the crown corporation SaskPower and approximately 18% is generated by independent power producers. Fossil fuels account for 81% of electricity generation in the province – 40% relies on natural gas, and 41% on coal. The remaining 19% is produced from renewables, primarily hydroelectricity (Canada Energy Regulator, 2023).

Relying on its own provincial climate plan, the government of Saskatchewan signed an equivalency agreement with the federal government regarding the 2018 emissions reduction regulations, which included phasing out coal power by 2030 (Environment and Climate Change Canada, 2019). Under this equivalency agreement, the provincial government committed to having at least 40% of the province's electricity generation capacity from non-emitting energy sources by 2030 (Government of Canada, 2019) and Boundary Dam 5 would operate until the end of 2024 (CBC News, 2019) The agreement outlines Saskatchewan's commitment to increase the share of non-emitting energy sources in its electricity generation capacity by 2030. To progress towards the 40% goal, the province has set specific targets for each milestone year aiming to reach a range of 26 to 30 percent of non-emitting energy sources by 2021, 30 to 34 percent by 2024, followed by a range of 34 to 40 percent by 2027 (CBC News, 2019). Finally, by 2030, the province aims to achieve a range of 40 to 50 percent of non-emitting energy sources. In 2019, the province was at approximately 25 percent of electricity generation capacity from non-emitting energy sources (CBC News, 2019).

Saskatchewan has the only Carbon, Capture, and Storage (CCS) system in Canada. As of 2022, it sequesters 65% of GHGs from the Boundary Dam Unit 3 coal-fired power plant near Estevan (Schlissel, 2021). However, as reported in an article by James Wilt in the Narwhal in 2017, the addition of CCS technology to SaskPower's Boundary Dam coal-fired power plant serves as an illustration of the significant expense involved (Wilt, 2017). The retrofitting project incurred a cost of $1.47 billion, which effectively resulted in a doubling of power cost from $0.06 per kilowatt hour (kWh) to $0.12 per kWh generated by the facility (Wilt, 2017). Furthermore, Boundary Dam has encountered numerous problems since its establishment, such as frequent shutdowns, a significant storage tank leak, cost overruns, and equipment failures – with the compressor failure in resulting in only 44% of the targeted volume capture, which fell short of the monthly objective of 65% (Achondo, 2022). An article by Karin Rives on S&P Global's website also cited SaskPower's monthly reports revealing frequent outages in the unit caused by technical issues, including power plant shutdowns (Rives, 2022). According to the piece, the facility has failed to achieve the promised emissions reductions and has experienced persistent breakdowns since its inception (Rives, 2022). A geography and environmental studies professor at the University of Regina stated that the technology is not considered effective since the facility has been capturing less than 65% of carbon emissions from the coal plant since its launch in 2014 (Rives, 2022).

6.3.3 Nova Scotia

Similarly, the government of Nova Scotia adopted a climate change strategy in 2009, focusing on mitigating and reducing overall emissions in its energy sector (Environment and Climate Change Canada, 2019). With its climate policy, regulations to cap GHG emissions in the electricity sector, and a Renewable Electricity Plan with targets for increasing renewable sources, the province also established an equivalency agreement with the federal government in 2015 (Environment and Climate Change Canada, 2019).

Gretchen Fitzgerald, the national program director of Sierra Club Canada-Atlantic, expressed concerns that the federal-provincial agreement that would allow Nova Scotia to continue to burn coal instead of developing a plan to shut down coal plants (Doucette, 2016). Two environmental groups (Margaree Environmental Association and the Sierra Club Canada-Atlantic) quoted by Keith Doucette in a CBC News article suggested that 80% of the coal burning capacity could be replaced by wind and solar power projects, power from the Muskrat Falls project, and power from Quebec (Doucette, 2016). The province has projected that coal would continue to play a part in energy production until 2042.

In 2017, Erin Flanagan from the Pembina Institute stated that Canada would still have a long way to go to achieve its net-zero target and Nova Scotia was seeking an exemption from this target, allowing the province to continue using coal-fired plants beyond 2030 (MacDonald, 2017). Although the province had surpassed the 2020 target of 10% below 1990 levels (Government of Nova Scotia, 2014), Flanagan expressed concern that other provinces might follow suit, resulting in setbacks for Canada's progress towards its climate goals (MacDonald, 2017). The province set an ambitious goal to

generate 40% of its energy from renewable sources by 2020, although it previously projected using coal until 2042 (MacDonald, 2017).

The first equivalency agreement Nova Scotia established with the federal government was renewed in 2015 and was set to terminate on December 31, 2019. The current Equivalency Agreement came into force on January 1, 2020 and compares the total amount of CO_2e emissions allowed by the federal Coal-fired Electricity Regulations to Nova Scotia's Greenhouse Gas Emissions Regulations until December 31, 2029 (East Coast Environmental Law For Ecology Action Centre, 2020). The current agreement requires more GHG emissions reductions than the previous one. While the Equivalency Agreement does not prevent Nova Scotia from phasing out coal-fired electricity generation, it could be a disincentive to do so (East Coast Environmental Law, 2020).

More recently, in 2021, the provincial government committed to a coal phase-out by 2030 (Nova Scotia Power, 2022). The commitment is supported by new regulations under the province's 2021 Environmental Goals and Climate Change Reduction Act, which sets targets such as 80 percent of Nova Scotia's energy to be supplied by renewable sources by 2030 (Government of Nova Scotia, 2021).

6.3.4 New Brunswick

New Brunswick relies heavily on nuclear and fossil fuels for electricity generation, with nuclear contributing 38% and fossil fuels accounting for 30% of the province's total generation in 2019 (Government of Canada, 2023). NB Power, the main electricity generator in the province, operates various stations, including hydro, coal, oil, diesel-powered plants, and the Point Lepreau Nuclear Generating Station (Government of Canada, 2023). Wind power has grown, contributing to 7% of electricity generation in 2019 compared to 0% in 2005, and biomass accounted for 4% of electricity generation in the same year (Government of Canada, 2023).

The province's Belledune coal-fired power plant is the heaviest emitter of greenhouse gases in Atlantic Canada in 2019 (Woodside, 2021). It is also the second-largest emitter in the province and has emissions higher than the Irving Oil refinery (Poitras, 2021). The coal plant is facing a strict deadline since the Canadian government, committed to phasing out coal-fired power across the country, has denied any extension beyond 2030 for the plant – although the province had tried to secure an equivalency agreement (Thibault et al., 2021; Woodside, 2021) The federal decision gave the province and NB Power only eight years to find an alternative fuel source or prepare to close the plant.

The federal government's decision refusal to sign an equivalency agreement allowing the Belledune plant to continue burning coal past 2030 aligns with the Atlantic Loop initiative (Woodside, 2021). This initiative aims to connect power grids in Atlantic Canada, facilitating the flow of hydropower from Quebec and Labrador to counterbalance coal-fired power plants. Although New Brunswick expresses a desire to keep the Belledune plant operational beyond 2030, the federal government remains committed to phasing out traditional coal-fired electricity generation by that year (Thibault et al., 2021). A statement by Binnu Jeyakumar, director of clean energy at the Pembina

Institute, commended the federal government's decision while also mentioning the importance of supporting New Brunswick in achieving a net-zero grid and providing assistance to workers and communities affected by the closure of the plant (Thibault et al., 2021).

According to Poitras (2021), Liberal Members of the Legislative Assembly (MLAs) in the Belledune area voiced their support for the decision made but emphasized the need for the provincial government to swiftly identify an alternative fuel source for the Belledune plant and suggested that N.B. Power should show the same commitment as it did with the Bayside natural gas plant in Saint John in 2019 (Poitras, 2021)

At the same time, the provincial environmental organization Conservation Council of New Brunswick praised the federal decision and highlighted that 70% of New Brunswickers desire the replacement of Belledune's electricity with renewable sources such as wind, solar, or hydropower generated within the province (MacNeill, 2021).

6.3.5 Recent developments and status in the provinces

Since the end of 2021, when Nova Scotia's government committed to a coal phase-out by 2030, almost all utilities in the affected provinces have been on track for the phase-out by 2030, in compliance with the 2018 federal regulations (Thibault et al., 2021). However, Nova Scotia Power still has to update its power system plan to align with the 2030 coal power phase-out commitment, and New Brunswick's proposal for an equivalency agreement with the federal government (allowing New Brunswick Power to operate the Belledune Generating Station past 2030) was rejected in November 2021 (Thibault et al., 2021). The province has yet to identify an alternative to the coal fired Belledune Generating Station after 2030 (Thibault et al., 2021). Eventually, the New Brunswick and Nova Scotia utilities are expected replace coal power with nuclear, renewable energy power purchase agreements (long-term contracts under which a business agrees to purchase electricity directly from a renewable energy generator), and/or imported hydropower (Thibault et al., 2021).

Most of Alberta's coal units have been or will be converted to natural gas plants, at least as an interim measure. However, the Canadian government also established greenhouse gas performance standards for natural gas-fired electricity under federal legislation passed in 2018 (Environment and Climate Change Canada, 2018). Under federal regulations, coal units converted to gas will be allowed to operate normally for a fixed period (Environment and Climate Change Canada, 2018). The application of the performance standard will be centered on the result of a performance test conducted in the first year of operation. Afterward, they will have to meet the performance standard (420 t/GWh maximum) that applies to new natural gas units (Environment and Climate Change Canada, 2018).

The upgrades at coal-to-gas converted units are expected to extend the economic life of existing plants by 5 to 10 years (Environment and Climate Change Canada, 2018) Still, the province of Alberta anticipates having 30% of its electricity generated from renewable sources and new natural gas-fired electricity generation units by 2030 (Environment and Climate Change Canada, 2018). However, several

problems have been identified. The tolerance for natural gas units to keep operating (as is the case of the previously coal-fired Genesee Generating Station 3, converted to a supercritical-combustion gas plant) may be a deterrent instead of an incentive for future investment in non-emitting technologies (Thibault et al., 2021). Provinces may risk losing approximately half of their emissions reductions achieved through coal power phase-out if they switch to low-abatement natural gas-fired electricity (Thibault et al., 2021). Continued investments in natural gas infrastructure can pose a challenge to more ambitious climate change targets and potentially lead to inertia and lock-in of dependence on fossil fuels (Kemfert et al., 2022; Brauers, 2022). Finally, Brauers (2022) adds that legitimizing natural gas as a bridge fuel source may cause policymakers to underestimate the negative impacts of natural gas' carbon intensity.

Overall, while most utilities with coal-fired units are committed to the net-zero goal by 2050, these commitments would still fail to deliver on the current Canadian target for the electricity sector - achieving net-zero emissions by 2035.

In Saskatchewan, the the gas-fueled Great Plains Power Station will be completed by 2024, along with other natural gas power plants in Saskatchewan (e.g., Aspen Power Station to be ready by 2027, and two other expansion projects) (*Aspen Power Station*, n.d.). The utility company SaskPower aims to reduce GHG emissions from the electricity sector by 50% by 2030 (SaskPower, 2023), through shutting down coal plants and expanding the natural gas fleet with the Great Plains Power Station, and the other facilities (Maenz, 2023). However, the province has reached around 34% of renewables in its electric power mix as of March 2023, from 25% in 2018 (SaskPower, 2023; Green, 2021) SaskPower's long-term goal is to transition to a Net Zero electricity system by 2050, while potentially replacing natural gas plants with renewables and low-emission options like small modular nuclear power plants (Government of Saskatchewan, 2023).

6.4 Impacts of the coal power phase-out on coal mining

Until 2021, the federal government's coal phase-out focused solely on coal-fired power. The main impacts on coal mining resulted from coal power plant closures when (thermal) coal mines were strictly supplying these plants. Even with the coal power phase-out, existing coal mines would keep working to operate power plants and supply coal exports. Much criticism was raised by environmental NGOs on this issue. There were petitions and campaigns against coal exports and mining from several organizations (e.g., Council of Canadians, Stand. Earth, Environmental Defence, Green Party of Canada)

However, in December 2019, the Minister of the Environment and Climate Change, in partnership with Natural Resources Minister, announced a strategic assessment to provide guidance on assessments of future new thermal coal mine projects under the Impact Assessment Act (Impact Assessment Agency of Canada, 2021) According to the statement by the federal government, the strategic assessment's primary emphasis would be placed on examining the environmental and health

consequences of thermal coal mining, conducting a market analysis to forecast thermal coal demand, assessing its economic implications and effects on employment in Canada, as well as scrutinizing the utilization of thermal coal mining and how it influences Canada's international obligations and efforts (Environment and Climate Change Canada, 2019) The terms of reference drafted were published on July 30, 2020, and they were open for a month to receive public comments (Impact Assessment Agency of Canada, 2021),

The drafted Terms of Reference for the Strategic Assessment on Thermal Coal mining received praise and suggestions for improvement from environmental groups and NGOs. Environmental Defence, for example, commended the federal government on the initiative though suggesting improvements (Hayes, 2021). Comments from the organization address issues such as the inclusion of lifecycle effects (e.g., "greenhouse gas emissions, of the mining, export, and end use of thermal coal, including emissions resulting from burning coal in importing countries"); inclusion of expansions of existing thermal coal mines as part of the strategic assessment, assessment of coal demand in compliance with Paris Agreement parameters; and reliance on independent panels of credible experts and Indigenous representatives, with meaningful engagement throughout the assessment process (Hayes, 2021).

Later, in a meeting of the G7 in 2021, Canada positioned itself beside other G7 countries stressing the importance of ending investments in coal-fired power and signaling a move towards ending thermal coal exports (G7 Research Group, 2022; Powering Past Coal Alliance, 2021). Concurrently, a policy statement by the federal government acknowledged that the G7 countries (including Canada) would be committed to implementing actions for ending international investments in unabated coal by the end of 2021 (Natural Resources Canada, 2021) .Aligned with this stance, the policy statement on future thermal coal mining projects recognized that new thermal coal mining projects and expansions were prone to result in undesirable environmental impacts within the scope of federal jurisdiction and do not conform to Canada's domestic and global climate change obligations (Environment and Climate Change Canada, 2021). The policy statement aimed to discourage proposals for new coal mines or expansions that would be subject to assessment under the federal Impact Assessment Act. Assessments under the Act inform decisions by the Minister, or in some cases the Governor-in-Council (Cabinet). Those decisions that must be based consideration of whether the effects that would be caused by the proposed project are in the public interest of Canadians (Environment and Climate Change Canada, 2021). According to Jonathan Wilkinson, the Minister of Environment and Climate Change, the development of new thermal coal mining projects or their expansions does not align with the climate ambition desired by Canadians or with Canada's domestic and international climate obligations. He emphasizes that phasing out coal-fired power and transitioning to cleaner energy sources is a crucial element of moving towards a low-carbon economy. Consequently, the construction of new thermal coal mines for energy generation is deemed unsustainable (Environment and Climate Change Canada, 2021). Because the policy statement had addressed the primary purpose of the Strategic Assessment of Thermal Coal Mining (to "guide decision-makers on how new thermal coal mine projects will be considered

under the Impact Assessment Act") (Impact Assessment Agency of Canada, 2021), the strategic assessment was no longer necessary and was canceled (Impact Assessment Agency of Canada, 2021).

In this context, a proposed expansion of a thermal coal mine in Alberta (the Vista Coal Mine near the town of Hinton) by Coalspur Mines Ltd. was reconsidered for federal review after 47 Canadian groups (e.g., Climate Action Network Canada, the David Suzuki Foundation, Ecojustice, Keepers of the Athabasca, Keepers of the Water, the West Athabasca Bioregional Society), signed a letter requesting a federal impact assessment for the mine expansion since not doing so would be opposing the country's commitment to phase out coal by 2030 (Environmental Justice Atlas, 2022). According to Daniel Cheater, a lawyer from Ecojustice, expanding the Vista coal mine would harm the critical habitat of the endangered Athabasca Rainbow Trout (Ecojustice, 2023). Ecojustice also cited Jesse Cardinal, Executive Director of Keepers of the Water, who stated that a federal impact assessment would be necessary to protect watersheds, uphold Treaty rights, and align with Canada's commitment to eliminating coal (Ecojustice, 2023). Furthermore, Art Jackson, President of the West Athabasca Watershed Bioregional Society, expressed concerns about the long-term damage to water, land, air, and wildlife, supporting the decision to assess the Vista coal mine expansion (Ecojustice, 2023). Following a court order in 2021, Minister Jonathan Wilkinson recommended the project for a federal assessment review (Impact Assessment Agency of Canada, 2021; Weber, 2021).

The policy statement on thermal coal mining was regarded as a bold and positive move toward decarbonization (Hayes, 2021; Andrews 2021), providing more certainty for investors and the mining sector while also addressing UN Sustainable Development Goals such as SDG#3- Good Health and Well-Being, SDG#6 – Clean water and sanitation, SDG#11 - Sustainability Cities and Communities, SDG#12 - Responsible Consumption and Production, SDG#13 – Climate action, SDG#14 - Life Below Water, SDG#15 - Life on Land (Environment and Climate Change Canada, 2021). Nonetheless, social and environmental groups still criticized the initiative for leaving coal exports out of the policy statement. The environmental organization Ecojustice, for example, stated that mining was only a part of the thermal coal issue in Canada since the country still exports millions of tons of Canadian and American thermal coal every year (Andrews, 2021; Thomson, 2022).

Coal sector associations opposed the federal position. The Coal Association of Canada released a statement in 2021 supporting measures to achieve climate change goals but claiming the federal government's policy statement on thermal coal did not consider the progress and positive results of the Carbon Capture and Storage technology in Canada (Coal Association of Canada, 2021). The association stated that a ban on new thermal coal mining projects and plans to expand existing mines on environmental damage grounds would allow for inferior-quality coal from other regions to fill the market gap – since Canadian thermal coal is considered of high quality and has a low sulfur content relative to world standards (Coal Association of Canada, 2021; Lazenby, 2021).

Nonetheless, at the end of 2021, the Prime Minister released a mandate letter to the Minister of Environment and Climate Change continuing the coal power phase-out while also advising the Minister

to ban thermal coal exports from and through Canada by 2030 (Prime Minister of Canada, 2021). Although the decision by the Canadian government received pushback from coal miners (Kuykendall, 2021), the Institute for Energy Economics and Financial Analysis (IEEFA) estimated the climate impact of the decision would be equivalent to taking between one million and three million cars off the road (IEEFA, 2021). In context, the movement toward pushing for a ban on thermal coal exports gained momentum. In 2022 a coalition of environmental, health, and social justice organizations (including the Canadian Association of Physicians for the Environment, Council of Canadians, Ecojustice, Environmental Defence, Keepers of the Water, and Stand. Earth) released a statement on Earth Day calling on the federal government to implement a prohibition on the export of thermal coal through Canadian ports by 2023 and unveil a plan outlining the steps for this ban (Ecojustice, 2022; Council of Canadians, 2022; Ross, 2022). Also, environmental and health groups such as Ecojustice, Environmental Defence, and the Canadian Association of Physicians for the Environment (CAPE) engaged in campaigns and petitions for an early ban of coal exports (e.g., by 2023) (Thomson, 2022; CAPE, 2022; Levin, 2022). In sum, the federal policy to phase out coal-fired power in Canada spurred various reactions from affected stakeholders, including environmental NGOs and coal industry NGOs and eventually representing the first step towards gradually phasing out thermal coal mining and exports – that is, going beyond the phase-out of coal power generation.

Finally, as a result of phasing out coal-fired power, coal mines have also been decommissioned. Three mines in Alberta are already in the decommissioning process or preparing to be decommissioned due to the coal power phase-out since they supply coal for local power stations while the Coal Valley Mine is the only one exporting to global markets (Environment and Climate Change Canada, 2019b). Detailed information on the communities' opinions associated with the decommission of these mines couldn't be identified for this research. However, an example of transition project in communities surrounding coal mines can be found in Hanna, Alberta, where the decommissioning of Hanna's Sheerness coal mine will take place (Government of Alberta, 2022; Irwin, 2021) A 162-million-dollar solar project proposed in Hanna aims to generate green, renewable energy and may support the region with job opportunities and economic activity (Gold-Irwin, 2019). However, it is unclear whether the project will be indeed a solution for job losses. According to an article in CBS, the mayor of Hanna stated that more than 200 well-paying jobs would be lost, accounting for roughly 8 percent of the town's population (CBC News, 2017).

Regarding the Highvale coal mine in Alberta, a decommissioning plan has already been published by TransAlta corporation, inviting stakeholders to a public open house to collect stakeholders' opinions and support community involvement in the regulatory process for the combined Decommissioning Plan and Final Reclamation Plan (TransAlta, 2022). The Highvale Mine has been in full-time reclamation since January 2022, with plans to be fully reclaimed by 2046 (TransAlta, 2022) At the same time, the company has reported its early talks with regulatory bodies to explore the

possibility of constructing a solar plant on land previously used for mining activities within the confines of the Highvale Mine permit zone (TransAlta, 2022)

As for Westmoreland Coal Company's Paintearth Mine in Forestburg, Alberta, the organization Emission Reduction Alberta (ERA) has reported that a program called BIOSALIX will be implemented to address the accelerated closure of prairie coal mines and an increased demand for organic residual management (ERA, 2022). Municipal biosolids and other organic residuals will be used to establish fast-growing willow wood biomass crops on the reclaimed mine land, which can be used as a feedstock in clean energy, reclamation, or bioproduct development (ERA, 2022) Project partners include Alberta Innovates and Natural Resources Canada's Canadian Forest Service. As reported by Emission Reduction Alberta, the program aims to meet carbon strategy policy targets, offer sustainable biosolids management, and support the transition of coal mining communities to a clean technology industry (ERA, 2022) Also, according to an article on CBC news (Snowdon, 2019). John Lavery, the principal scientist with Sylvis Environmental Services, the environmental consulting firm leading the project, stated that the company is conducting significant technology and skills transfer at the mine site to ensure that the current workforce becomes the long-term workforce for the biomass system (Snowdon, 2019). The mine supplied coal to the power plant until 2022 (Snowdon, 2019).

6.5 Conclusions

This chapter focused on the Canadian case of the federal coal phase-out policy and provided an analysis of the Canadian background as it relates to climate change mitigation policy, coal phase-out motivations and decisions taken by the federal and provincial governments. The chapter aimed to examine the historical background, formulation factors, and implementation timeline of the federal coal phase-out policy instruments in Canada. It analyzed various components such as regulatory measures, policy statements, federal and provincial programs, financial incentives, and support for affected communities and workers. The significance of coal as an energy source in Canada, including its contributions to energy production, GHG emissions, and employment, was also discussed.

Regarding recent developments of the coal phase-out in the provinces, Nova Scotia's government committed to a coal phase-out by 2030, and most utilities in the affected provinces are on track to meet the phase-out deadline. However, challenges remain, such as the need for Nova Scotia Power to update its power system plan, and for New Brunswick to identify alternative sources after 2030 for the coal fired Belledune Generating Station. Alberta's coal units are being converted to natural gas plants as an interim measure, but this approach poses challenges to achieving more ambitious climate change targets.

The chapter also discussed the impacts of the coal power phase-out on coal mining. While the federal government's policy statement on thermal coal mining received praise for its decarbonization efforts, it faced criticism for not addressing coal exports. Environmental and health groups called for a ban on thermal coal exports, and in response, the Prime Minister advised the Minister of Environment

and Climate Change to ban thermal coal exports from and through Canada by 2030. This decision received pushback from coal miners but was estimated to have a positive climate impact. The phase-out of coal-fired power also led to the decommissioning of coal mines. Some mines in Alberta are already in the decommissioning process, as they supplied coal for local power stations that are being phased out. The Coal Valley Mine continued to export to global markets. Transition projects in communities affected by the decommissioning of coal mines, such as in Hanna, Alberta, are also being discussed.

Overall, this first chapter on the Canadian case study sets the foundation for a comprehensive analysis of the coal phase-out policies and their implications for the Canadian energy transition context. As a follow-up, the next chapter will discuss the just transition initiatives undertaken in the context of federal Canadian coal phase-out policies. It will explore the measures implemented so far to address the social and economic impacts of the coal phase-out and ensure fairness for affected communities and workers, proposed amendments, and challenges faced by coal-dependent stakeholders. It aims to assess gaps, strengths, challenges, and sustainable outcomes for an effective just energy transition during coal phase-out.

CHAPTER 7. Coal phase-out and related just transition initiatives undertaken in Canada

This chapter provides an overview of the just transition initiatives undertaken in conjunction with the introduction of Canadian coal phase-out policies, including the s whole set of programs and support systems established to mitigate or avoid adverse impacts of the transition away from coal. The just transition initiatives aim to address the social and economic impacts of the coal phase-out and ensure fairness for affected communities and workers.

This chapter examines the initiatives and implementation strategies, the critiques they faced as well as their positive aspects. By exploring the details of the just transition efforts, the aim is to provide an understanding of the effectiveness and challenges of Canadian coal phase-out policies while also highlighting any existing gaps in the just transition efforts – focusing not only on federal initiatives but also on provincial support programs.

7.1 Just transition and federal government initiatives to phase out coal-fired generation of electricity

This section examines just transition measures initiated by the Canadian federal government in the context of coal phase-out, focusing on policies and programs to mitigate negative socioeconomic impacts on affected coal communities.

The implementation of the federal government's decision to phase out coal power began in 2018, with proposed amendments to the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations (Government of Canada, 2018). The proposed amendments required compliance from all coal-fired power units with an emissions performance standard of 420 tonnes of carbon dioxide per gigawatt hour of electricity produced (t of CO2/GWh) by 2030 (Government of Canada, 2018). The application of the amendments would pose risks to the wellbeing of coal miners, power station employees, their families, communities, employers, contractors, and other stakeholders (Environment and Climate Change Canada, 2019). Just transition was one of the priorities affirmed by the Paris Agreement, which included the clause, "taking into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs by nationally defined development priorities" (Paris Agreement, 2015, pg.2). Consequently, the federal government concluded that ensuring a just transition and planning to implement it in Canada was necessary.

Concerns about the anticipated effects of the coal power phase-out on workers and communities dependent on coal led the federal government to launch the Task Force on Just Transition for Canadian Coal Power Workers and Communities (the Task Force). This initiative was tasked with supplying information, alternatives, and counsel to the Minister of the Environment and Climate Change regarding

the execution of a fair transition for laborers and communities directly affected by the swift discontinuation of coal-fired power generation in Canada (Environment and Climate Change Canada, 2018). The Canadian Task Force for Just Transition's mandate focused on something other than coal power phase-out rules or establishing pathways for emissions reductions to meet Paris Agreement commitments. These aspects of the energy transition were left to federal regulations (and provincial regulations in some cases). Conversely, the main focus of the Task Force was to identify potential solutions to facilitate an equitable and fair transition for Canadian coal power workers and communities (Environment and Climate Change Canada, 2019).

The Task Force's nine-month mandate included engaging with affected stakeholders and providing insights on possible solutions to ensure a just transition for Canadian coal power workers and communities. Their work had to be delivered in two reports for the Minister of the Environment during the mandated period.

Appointed in 2018, the 12 members of the Task Force represented a diversity of distinct groups, including union leaders, labour congress representatives, NGOs, experts in sustainability, and coal power utilities representatives (Environment and Climate Change Canada, 2018). At least five of the members of the Task Force were based in one of the coal provinces. One was a municipal government and Indigenous community representative from a coal region (Gurtler et al., 2021). Gurtler et al. (2021) analyzed the Task Force's work through a just transition perspective and relied on interviews with the Canadian Task Force's members. The authors concluded that such representation in the Task Force increased the group's legitimacy and ability to support affected communities (Gurtler et al., 2021).

The provincial governments were not represented among the Task Force's members since provinces' interpretations of the coal phase-out vary significantly (Gurtler et al., 2021). In contrast, the Canadian Labour Congress was an important regional stakeholder represented on the Task Force. The organization had been largely responsible for setting up the agenda and was a pivotal stakeholder in lobbying for the Canadian Task Force to be established (Gurtler et al., 2021). In various ways, most Task Force members represented the labour movement. However, this situation did not specifically help to build a strong labour movement bias – although members of the Task Force eventually mentioned that communities and labour representatives should be equally represented within the Task Force (Gurtler et al., 2021).

The Task Force visited affected 15 affected communities in the provinces that still relied on coal power in 2018 (Alberta, Saskatchewan, Nova Scotia, New Brunswick), toured seven facilities, hosting public sessions, met with 80 stakeholder groups, and received input from over two dozen individual and groups through online submissions. (Environment and Climate Change Canada, 2019). As a result, the Task Force published two reports with findings and recommendations (Environment and Climate Change Canada, 2019). The main findings included assessments of the status and preparedness of the

provinces to deal with the transition away from coal and the most common concerns of communities and workers in each affected region.

The key concerns identified and reported by the Task Force related to early retirement to ensure full pensions for coal workers; ensuring reliable and affordable electricity for all following the phase-out; financial security due to layoffs, relocations, salary reductions, tax revenue reductions; and securing liveability for the communities through funding opportunities, regional planning, partnerships, and economic diversification (Environment and Climate Change Canada, 2019). Lastly, the Task Force report highlighted the concern with open communication and collaboration throughout the transition (ensuring an open and transparent process with the collaboration of affected parties and fair treatment) (Environment and Climate Change Canada, 2019).

The work by the Task Force resulted in two major reports, leading to identifying the status of the communities in 2019 and their main concerns and contributions, as synthesized above. The first report also addressed seven principles for a just transition in Canada and a set of ten recommendations to guarantee that the coal phase-out is delivered through a just transition approach. The principles and the summary of recommendations identified by the task force are described in the tables below.

Table 17 - Seven principles for a just transition by the Task Force on Just Transition for Canadian Coal Power Workers and Communities

Seven principles for a just transition
1. Respect for workers, unions, communities, and families;
2. Worker participation at every stage of transition;
3. Transitioning to good jobs;
4. Sustainable and healthy communities;
5. Planning for the future, grounded in today's reality;
6. Nationally coherent, regionally driven, locally delivered actions; and,
7. Immediate yet durable support.

Adapted from: Environment and Climate Change Canada, 2019

Table 18 - Ten recommendations for a positive contribution to a fair and just transition for affected workers and communities by the Task Force on Just Transition for Canadian Coal Power Workers and Communities

Embed just transition principles in planning, legislative, regulatory, and advisory processes to ensure ongoing and concrete actions throughout the coal phase-out transition.
1. Develop, communicate, implement, monitor, evaluate, and publicly report on a just transition plan for the coal phase-out, championed by a lead minister to oversee and report on progress.
2. Include provisions for just transition in federal environmental and labour legislation and regulations, as well as relevant intergovernmental agreements.
3. Establish a targeted, long-term research fund for studying the impact of the coal phase-out and the transition to a low-carbon economy.

Ensure locally available supports. 4. Fund the establishment and operation of locally-driven transition centres in affected coal communities
Provide workers a pathway to retirement. 5. Create a pension bridging program for workers who will retire earlier than planned due to the coal phase out.
Transition workers to sustainable employment. 6. Create a detailed and publicly available inventory with labour market information pertaining to coal workers, such as skills profiles, demographics, locations, and current and potential employers. 7. Create a comprehensive funding program for workers staying in the labour market to address their needs across the stages of securing a new job, including income support, education and skills building, re-employment, and mobility.
Invest in community infrastructure. 8. Identify, prioritize, and fund local infrastructure projects in affected communities.
Fund community planning, collaboration, diversification, and stabilization. 9. Establish a dedicated, comprehensive, inclusive, and flexible just transition funding program for affected communities. 10. Meet directly with affected communities to learn about their local priorities, and to connect them with federal programs that could support their goals.

Adapted from: Environment and Climate Change Canada, 2019

The principles address issues closely associated to a positive contribution to sustainability since they include, beyond issues related to job opportunities and respect for workers and communities, attention to the well-being and health of communities in the long term and affected stakeholders' participation in decision-making. The ten recommendations are more specific and relate to the social and economic impacts of the coal phase-out, tackling issues that are particularly relevant for coal workers such as bridging pension programs for workers, ensuring funding and structural support for workers regarding job market information, skills building, re-employment, and relocation (Environment and Climate Change Canada, 2019).

Although the recommendations also touch on community infrastructure for economic diversification and local priorities, and include the development ofa long-term research fund, the issue of lasting well-being for communities is less emphasized.

The Task Force's first report was released in 2019. The report acknowledged that approximately 2,000 people were working at coal-fired power stations and between 1,200 and 1,500 workers in thermal coal mines at the time. These workers were considered highly skilled, earning above-average wages in provinces like Alberta and Nova Scotia. Positions included engineers, mechanics, electricians, heavy equipment operators, and maintenance staff (Environment and Climate Change Canada, 2019).

The report also stated that 50 communities in the four coal-power generating provinces would be affected by the coal power phase-out – although most affected workers were in Alberta and

Saskatchewan. Common traits among these communities were the small size (small cities, towns, and villages from 650 to 34,000 residents) and their cultural connection to and dependency on the coal industry (Environment and Climate Change Canada, 2019). Also, unemployment was a common characteristic within the affected coal communities in all four provinces. The median age of the coal workers at the time was over 50 years – above the national average – which poses challenges involving healthcare and retirement security (Environment and Climate Change Canada, 2019).

Acknowledging the impacts of coal phase-out on workers and communities and the need for a just transition program in Canada, the federal government also established the Canada Coal Transition Initiative (CCTI) in 2018 (Natural Resources Canada, 2021). This federal program is focused on ensuring investment and funding for affected communities. The first significant outcome of the initiative was building transition centers in seven communities in the Battle River Region of Alberta (Environment and Natural Resources Canada, 2021). Transition centers have been used as local hubs to support communities when there are changes in the labour market – especially in North America (Environment and Natural Resources Canada, 2019). These local centers have been regarded as essential spaces, staffed by people in the industry and community with a diversity of resources for providing information specific services, and one-on-one assistance in communities affected by labour disruptions. Meant to remain open until residual negative transition effects have been minimized, they represent reliable model for delivering adaptable services and information, including re-employment opportunities, skills recognition, education, finances, and healthcare, tailored to specific contexts (Environment and Climate Change Canada, 2019).

Centers in Alberta and Saskatchewan have been locally run with funding support from the federal government. For example, the SaskCoal Transition Centre is run through a partnership between the United Mine Workers of America Local 7606 and the International Brotherhood of Electrical Workers (IBEW) to provide affected workers in Estevan and Coronach with career, training, business, retirement, and mental health support services. It has been open since early 2021 and has funding support from the federal Canada Coal Transition Initiative (The Estevan Coal Transition Centre, n.d.). As of 2021, three transition centers were operational in the affected provinces.

The first announcement of federal government funding to support the transition for workers and communities was in the 2018 federal Budget, which directed $35 million over a five-year period to facilitate skill enhancement and promote economic diversification initiatives, aimed at assisting workers and communities in the western and Atlantic regions in adjusting to Canada's shift toward a low-carbon economy (Environment and Climate Change Canada, 2019). However, the Task Force stated this would be only the first step and the investment would need to expand to hundreds of millions of dollars, considering a timeline beyond 2030 (Environment and Climate Change Canada, 2019).

In the 2019 Budget, the federal government also committed $150 million to the Canada Coal Transition Initiative-Infrastructure Fund (CCTI-IF), which was initiated in 2020 to support infrastructure investments and economic diversification in the communities affected by the coal power

phase-out (Environment and Natural Resources Canada, 2021). Projects to be funded need approval from the Minister of Economic Development and Official Languages (Infrastructure Canada, 2021). Also, there is coal phase out program collaboration within the federal government, linking Infrastructure Canada, Western Economic Diversification (WD), and the Atlantic Canada Opportunities Agency (ACOA) to provide guidance on new projects (Infrastructure Canada, 2021).

In light of these initiatives and the funding available, the support for a just transition in the Canadian coal power phase-out could be successful. However, criticism of the application of funds has arisen among editorial journalists. An article in Politico stated that a $86 million program funded by the federal government for the coal phase-out transition did not have a system to track results (Lum, 2022). The statement was based on a report from the Office of the Auditor General and House of Commons documents (OAG, 2022) signaling that most of the funded programs were not precisely directed at the just transition of coal communities. The amount was mainly approved for municipalities, applying to projects such as road paving, sewer, and water system upgrades (Lum, 2022; OAG, 2022).

In 2021, the federal government announced an additional investment through the Canada Coal Transition Initiative (CCTI) and Canada Coal Transition Initiative-Infrastructure Fund, stating that more than $5.6 million would be invested in support of eight projects across Alberta (Government of Canada, 2022). As publicly stated by Prairies Economic Development Canada, the funded projects included a strategic analysis and economic diversification study to inform future investment and business opportunities, a Tri-Municipal Sub-Regional Plan aligning land use, services, and infrastructure services, additional funding for the Community Futures Network of Alberta (CFNA) to support workers and businesses in communities affected by the coal transition, additional funding to the United Steelworkers to hire a transition coordinator to help laid-off coal industry workers, among others (Government of Canada, 2022).

Furthermore, with the new strengthened national climate plan launched in Canada (named Healthy Environment Healthy Economy Plan), the impacts of climate actions in the country could go well beyond those affecting the coal industry (including, for example, the oil and gas sector) (Environment and Climate Change Canada, 2020).

In this context, the federal government released a Just Transition discussion paper in 2021 (“People-Centred Just Transition: a discussion paper”), seeking feedback on proposed just transition legislation (Government of Canada, 2021). The key points to be covered by the just transition legislation would include principles centered around prioritizing people, specifically workers and communities, in the government's policy and decision-making regarding actions to address climate change and an external Just Transition Advisory Body to provide recommendations to the federal government regarding strategies for just transitions at regional and sectoral levels promoting the well-being of workers and communities (Government of Canada, 2021). A report by Hulse (2023) from Ecojustice on the Just Transition Act advocates for the legal framework since it can support planning and implementation for a structured, equitable, and just transition to a low-carbon economy in the country (Hulse, 2023).

Additionally, in July of 2021 the federal government engaged in consultations with a diverse range of stakeholders to gather input on federal legislation for “sustainable jobs” that would help ensure Canadian workers are prepared for the transition to net-zero emissions by 2050 (Natural Resources Canada, 2023). Although the term "sustainable jobs" may refer to jobs that are compatible with Canada's low-carbon, climate-resilient future, the federal government stated that a clear definition for this term would also be an output of the consultation process (Natural Resources Canada, 2023). The consultations involved over 30,000 written submissions, 17 virtual roundtable discussions, and meetings with provinces, territories, and Indigenous representatives and many stakeholder groups including workers and labour organizations, industry, academia, non-governmental organizations, youth, and experts in skills, training, and diversity and inclusion (Natural Resources Canada, 2022). This consultation process ended in April 2022 and the feedback gathered informed the federal sustainable jobs report on findings - part of the Natural Resources Canada departmental plan for 2023-2024 (N. R. Canada, 2023a)

Also, the federal government's 2022 climate plan, "Healthy Environment and a Healthy Economy," includes commitments such as investing $1.5 billion in a Clean Fuels Fund and providing $319 million for carbon capture, utilization, and storage (CCUS) technologies. Funding for skills development and job creation for economic diversification was also announced. However, the announcements did not include establishment of specific monitoring processes and indicators to measure the success and effectiveness of the just transition and sustainability performance during the coal phase-out.

Lastly, as result of the 2021 consultations, a “Sustainable Jobs Plan” was released by the federal government in early 2023 with the goal of “detailing concrete federal actions to advance economic prosperity and sustainable jobs in every region of the country” (Government of Canada, 2023, pg.1). The federal government’s Sustainable Jobs Plan for 2023-2025 sets a framework for future Sustainable Jobs Action Plans (Government of Canada, 2023). The plan sets out federal measures across ten key areas, including establishing a Sustainable Jobs Secretariat, promoting Indigenous-led solutions, improving labour market data, and collaborating globally (Government of Canada, 2023). The Canadian government's definition of sustainable jobs means “any job that is compatible with Canada’s path to a net-zero emissions and climate-resilient future” and involves fair income, job security, social protection, and social dialogue (Government of Canada, 2023, pg.8). Ongoing collaboration, expert advice, and regular updates are crucial components of the plan, with legislation to be introduced in 2023 to ensure alignment with a sustainable economy.

A significant highlight in the federal Sustainable Jobs plan relates to the creation of a Sustainable Jobs Secretariat based on best practices from other jurisdictions and recommendations from public consultations (Government of Canada, 2023). This secretariat aims to be a central governance structure to provide leadership, facilitate a comprehensive approach across the government, coordinate federal policies and programs, and oversee the implementation of future Sustainable Jobs Action Plans (Government of Canada, 2023). The federal government will provide 250-million dollars in funding

over five years to Employment and Social Development Canada to be used for the Sustainable Jobs Secretariat, introduce a sustainable jobs stream under the Union Training and Innovation Program, and create a Sustainable Jobs Training Centre.

As also stated in the Sustainable Jobs Plan, Canada is committed to approve legislation focused on just transition which would potentially include governance structures to collect external input and oversee programs and policies for a net-zero economy and sustainable job creation (Government of Canada, 2023). In June of 2023, Bill-50, also called The Canadian Sustainable Jobs Act (described as "an Act respecting accountability, transparency and engagement to support the creation of sustainable jobs for workers and economic growth in a net-zero economy") was tabled and is currently under review in the House of Commons (N. R. Canada, 2023b; *Government Bill (House of Commons) C-50 (44-1) - First Reading - Canadian Sustainable Jobs Act - Parliament of Canada*, n.d.). A crucial component in the Act is the establishment of a Sustainable Jobs Partnership Council, aiming to provide the government with independent advice through continuous social dialogue and engagement for determining effective measures to create sustainable jobs and to support workers and communities in building a resilient economy (N. R. Canada, 2023b). The act also includes establishing the Sustainable Jobs Secretariat, proposed to enhance policy and program coherence among federal entities regarding the government's sustainable jobs approach. This Secretariat would work in conjunction with the Partnership Council, providing support and coordination for their activities (N. R. Canada, 2023b). Furthermore, the legislation includes reporting requirements to ensure transparency and accountability, such as the publication of a Sustainable Jobs Action Plan every five years, beginning in 2025, regarding measures for the net-zero emissions economy and skills of the future (N. R. Canada, 2023b). These elements are subject to discussion and debate in Parliament, as reported by the federal government (Government of Canada, 2023).

The Act was welcomed by a series of organizations but still received criticism. IISD emphasized the importance of establishing governance bodies, such as the Sustainable Jobs Secretariat and Partnership Council, in legislation to ensure effective coordination across government (IISD, 2023). However, IISD stated that amendments are necessary to address gaps in the legislation, specifically focusing on mechanisms to support Indigenous Peoples as equal partners at all levels of planning and decision making, referencing Canada's climate commitments and the Net-Zero Emissions Accountability Act, assisting regional just transition planning, and support programs for workers facing job loss or transition (IISD, 2023). The environmental group Environmental Defence also supports the legislation, regarding it as a credible commitment by the federal government to involve affected workers and communities in the energy transition. However, they express concerns that the legislation does not adequately address the urgency of the climate crisis and urge a focus on sustainable jobs in energy efficiency, renewable energy, clean transportation, and low-carbon industries. The organization also highlighted the importance of a tailored approach to the transition, including a nation-to-nation

mechanism for Indigenous communities' economic diversification and federal support for local plans aligned with a nationwide strategy (Rougeot, 2023).

Labour representatives such as the Canadian Labour Congress have commended the federal government on the act (Bruske, 2023). A crucial aspect of the proposed Partnership Council lies in the composition of 15 members including co-chairs, required to reflect Canada's diversity and underrepresented groups, with a balance of labor, Indigenous, and industry representation (N. R. Canada, 2023b). Also, council members must possess knowledge in key sectors, worker issues, union representation, Indigenous knowledge, climate change, economics, skills development, and advisory board governance (N. R. Canada, 2023b).

In this context, there is an improvement in federal measures regarding governance bodies and mechanisms to oversee the impacts of the energy transition on workers and communities. Also, the federal government has advanced on measures to report on the Sustainable Jobs plan, establishing them in legislation as well. It remains to be seen if the legislation will be approved as it is while potentially reinforcing support for sustainable jobs away from the fossil-fuel industry.

7.2 Just transition efforts to phase out coal-fired generation in Alberta

At the provincial level, the phase-out of coal power started in 2015, with the provincial government's commitment to the elimination of emissions from coal power generation by 2030. The shift away from coal in the province was mostly due to the declining competitive edge of coal with the rise of cleaner energy options, sector-wide carbon pricing, and corporate initiatives to tackle climate risk and carbon liability (Thibault et al., 2021). In this setting, besides a new provincial climate plan released in 2023 (including the phase-out of coal power), the province also implemented strategic steps to try and promote a just transition for workers and communities and a favorable investment environment avoiding potential economic impacts (World Resources Intitute, 2021). However, according to a report on just transition released in 2022 by the Canadian Labour Education Centre and the Adapting Canadian Work and Workplaces (ACW) initiative, Alberta's provincial government's motivation to close early and compensate for stranded assets may have been to demonstrate to their electorate they were taking emission reductions seriously without tackling the much larger emissions produced by the tar sands (Labour Education Centre and ACW, 2022). The report states that compensation was paid out without any obligations to their workers or communities. Yet, public opinion and union pressure put in place a strong program for displaced workers and some community support (Labour Education Centre and ACW, 2022).

The carbon tax revenues were directed to payouts to coal power companies under off-coal agreements and just transition programs (over 1 billion and 45 million, respectively) (Vriens, 2018). According to Vriens (2018) with these complementary policies, Alberta may ensure earlier retirement and conversion of coal plants to gas conversions, besides gaining support from labour organizations,

power companies, public health advocates, environmental non-governmental organizations, and the federal government (Vriens, 2018).

At the same time, the Labour Education Centre and ACW's report regards the phase-out of coal-fired power in Alberta (and also in Ontario) as an election platform, prompted in part by air quality concerns and by the election of an NDP (social democratic) government with an understanding of the need to reduce emissions efficiently and rapidly (Labour Education Centre and ACW, 2022). With a prolonged period before effective closure of the plants, the Labour Education Centre and ACW stated that the phase-out resulted in affected workers facing long periods of concern and anxiety in light of the reality of job losses and displacement, and the loss of local revenue (Labour Education Centre and ACW, 2022). Furthermore, the provincial government did not have a transition plan ready, or even in preparation when the closures were announced (Labour Education Centre and ACW, 2022). However, a good plan was put in place in Alberta before the layoffs started to happen though after the government had already compensated the utility companies (Labour Education Centre and ACW, 2022).

The Alberta Federation of Labour and its president played a key role in convincing the Alberta government to rectify its initial oversight of not having a transition program for workers and communities (Labour Education Centre and ACW, 2022). They led the efforts in organizing community consultations and released a report with suggestions on how to establish a Just Transition program. Government sources have recognized that the workers and their union representatives should have been consulted earlier in the process of phase-out (Labour Education Centre and ACW, 2022).

In 2018, some relevant actions were already in motion for the transition in Alberta. The existing measures (beyond those of the provincial government) in the province included establishment of the Coal Transition Coalition (created by the Alberta Federation of Labour and unions "to ensure that communities and workers have a voice"), the Battle River Economic Opportunities Committee (with seven local communities to establish a transition plan for the region), the Alliance of the towns of Calmar, Thorsby, Warburg, Breton (to work on municipal priorities through a collaborative partnership) among other actions for collaboration, partnerships and economic diversification and infrastructure (E. and C. C. Canada, 2019).

Alberta has also engaged in re-training programs for the affected workers in the provinces (Harrahill and Douglas, 2019). An example is The Coal and Electricity Transition Tuition Voucher program, providing workers with up to twelve thousand dollars to engage in higher education to prepare for new professional opportunities (Government of Alberta, 2018a; Harrahill & Douglas, 2019). The provincial government also established a Coal Workforce Transition Fund to provide income assistance to workers for retirement or transitioning to other jobs. However, it also supported them with relocation costs when changing jobs, career counseling, tuition, and retraining assistance (Vriens, 2018) According to Vriens (2018), the income allowance provided workers with up to 75% of their previous weekly earnings until their eligibility for pension. While compensatory measures might have a limited effect in the long term, Harrahill and Douglas (2019) stated that such initiatives improved the conditions for a

just transition in the province of Alberta since they also supported workers with job transition and reduced workers' dependence on industries with environmentally harmful practices for employment (Harrahill & Douglas, 2019). At the same time, Harrahill and Douglas (2019) stated there was less investment in infrastructure in Alberta and more initiatives related to individual compensation measures for workers. Furthermore, fossil fuels remained present, and the coal transition triggered potentially greater dependence on natural gas (Harrahill and Douglas, 2019).

According to World Resources Institute (2021), Alberta's transition away from coal has shown strengths and gaps. The social dialogue and stakeholder engagement promoted with key stakeholders can be considered a positive aspect of this process. The engagement process included unions, employers, government, coal workers, communities, and business leaders, among other groups, and it informed the creation of financial support programs for communities and workers (WRI, 2021). Another important aspect in Alberta highlighted by WRI was the Off-Coal Agreement, which offered compensation for major coal companies to convert to natural gas, facilitating the transition away from coal (WRI, 2021). – although it may create lock-in with another type of fossil fuel.

Regarding the funding for a just transition away from coal, the Parkland Institute reported in 2019 that both the Alberta and Canadian governments have allocated funds for local economic planning in coal communities (Hussey & Jackson, 2019). The provincial Coal Community Transition Fund saw significant participation, with 17 out of the 20 affected municipalities and First Nations taking advantage of the available resources (Hussey & Jackson, 2019). Yet, the funding issue in Alberta is considered as a challenge by WRI Canada. Although the Coal Community Transition Fund provided crucial resources to coal-dependent communities, it was a one-off payout in March 2018, and there is uncertainty about availability of funding in the future (WRI, 2021). WRI also stated that the future of the Coal Workforce Transition Programs is uncertain, which can undermine just transition efforts (WRI, 2021). Additionally, economic diversification is an important element of Alberta's transition, but if proper precautions are not taken, the risk of investing in projects that establish other unsustainable and emission-intensive industries remains a concern (WRI, 2021). The delay between the announcement of Alberta's coal phase-out and consultative processes with affected communities and workers was also highlighted as a negative aspect in phase-out process, since it created unease and discontent that could have been avoided with earlier stakeholder engagement (WRI, 2021).

While Alberta's Climate Leadership Plan in 2018 stated that 30% of its electricity grid would be supplied by renewables, according to Alberta's "Emissions reduction and energy development plan" released in 2023, natural gas is expected to play a crucial role in Alberta beyond 2035, as it provides stable and on-demand generation, while renewable energy sources, such as wind and solar, are not regarded as reliable to provide power alone for the electricity grid (Alberta Government, 2018; Alberta Government, 2023). The provincial plan also mentioned that energy storage and clean hydrogen technology will likely complement natural gas in the future. Currently, natural gas-fired generation

serves as the main support of Alberta's electrical grid, while the province aims to be off coal by the end of 2023 (Alberta Government, 2023).

Additionally, Alberta is planning to expand its use of low-emitting technologies, such as carbon capture and storage, hydrogen, and Small Modular Reactors (SMRs) (Alberta Government, 2023). The use of carbon capture and storage is anticipated to capture over 90% of carbon dioxide emissions from power plants (Alberta Government, 2023). To facilitate the pursuit of SMRs by the private sector, Alberta is working with other provinces to establish an appropriate regulatory framework (Alberta Government, 2023). The province also identifies hydrogen-fired gas turbines and combined-cycle gas turbines as key technologies in reducing emissions in the electricity sector (Alberta Government, 2023). The Alberta government claims the province already achieved a 44% reduction in greenhouse gas emissions in the electricity sector between 2005 and 2020 (Alberta Government, 2023).

In light of the sustained dependence on natural gas (a fossil fuel though with less emissions than coal), with this energy transition Alberta may be supporting an energy transition strategy focused on preserving fossil fuels – including oil and gas, even if continuing subsidies would be needed (Samson, 2023). According to Samson's article in Policy Options, this strategy opposes the transition strategy of pursuing clean energy, technology, and minerals (Samson, 2023). Declining markets (such as oil and gas) provide short-term gains, but they cannot sustain long-term growth and subsidies for emission reductions in fossil fuels may lead to financial instability (Samson, 2023). Additionally, an effective strategy is one that generates long-term value for Canadians, including diversifying exports, attracting investments, expanding value-added activities, and achieving better outcomes for the environment, workers, and Indigenous Peoples (Samson, 2023).

Finally, there is still disagreement between the federal and provincial government in Alberta around a just transition bill aiming at supporting workers in a lower-carbon future that has not yet been approved. According to an article published by CTV News in February 2023, Alberta's Environment Minister, Sonya Savage, criticized the term just transition and its implications (e.g., phasing out fossil fuels), while the federal Minister of Natural Resources, Jonathan Wilkinson, defended the bill as a sustainable energy work plan (Lachacz et al., 2023). According to the federal minister, the proposed legislation is principle-based, summarizing existing supports and future programs developed with provinces and territories (Lachacz et al., 2023). Seemingly, both sides agree on the importance of energy transition, with oil and gas still playing a role, but a representative from the non-governmental organization Iron and Earth (focused on representing people who work in the fossil fuels industry) Louisa Da Silva emphasized the need to support workers during the transition without phasing out the oil sands and providing communities with autonomy, equity, and support for diversification (Lachacz et al., 2023).

Also, according to an article by Energy News Network, following the provincial and federal government's decision to phase out coal, from January to June of 2020, 4,500 coal jobs have been lost in Canada, and it is unclear where these workers will go (Energywire, 2020). A case study report by

Parkland Institute stated also that in Alberta, Parkland County has already experienced a significant loss of coal plant and mine jobs, with several hundred positions already eliminated (Hussey & Jackson, 2019). In 2018, Highvale Mine, which served as one of the county's major employers, employed 650 workers. However, by March 2019, the mine's workforce had decreased to just over 300, highlighting a significant decline in employment opportunities (Hussey & Jackson, 2019). Although the sources previously addressed indicated job losses as a negative impact of the coal phase-out in Alberta and in Canada, a clear indicator or progress report has not been found to account for the job losses and the transition's adverse impacts in general or indicators associated with the effects of just transition efforts.

Transitioning away from coal in Canada, and specifically in Alberta, has been recognized as a "state-managed effort", demonstrating leadership from both the federal and provincial governments (Krawchenko & Foster, 2021). However, while labour advocacy has played a significant role in the just transition initiatives to support coal workers and communities, the initiatives implemented have been regarded as primarily reactive, failing to address the structural inequalities within affected communities (Krawchenko & Foster, 2021). While converting coal-fired plants to natural gas may offer short-term job preservation, outcomes in the long-term are still unclear (Krawchenko & Foster, 2021). Communities reliant on single industries are looking for sustainable alternatives to avoid repetitive economic cycles (Krawchenko & Foster, 2021). Therefore, just transition measures must consider the specific context and livelihoods of impacted communities for long-term resilience and sustainability (Krawchenko & Foster, 2021).

7.3 Just transition efforts to phase out coal-fired generation in Saskatchewan

Saskatchewan has a coal power station equipped with poorly functioning CCS technology (Boundary Dam Generating Station Unit 3 in Estevan) the province has already concluded an equivalency agreement with the federal government, with the primary utility company SaskPower establishing targets to achieve 50% of generating capacity from renewable energy sources by 2030 (E. and C. C. Canada, 2019). However, the Task Force reported there is still much concern from the workers and communities and a general support basis for coal power to continue in the province, including opinions opposing Canada's international image to the detriment of Canadian communities (E. and C. C. Canada, 2019). As coal has become entrenched in the local culture and history of communities in the coal regions, there are strong opinions concerning the transition, involving the effects on children, households, and the long-term prospects of their neighborhoods (E. and C. C. Canada, 2019).

Two-thirds of the residents in one of the regions (City of Estevan, Town of Bienfait, Rural Municipality of Estevan No. 5, Rural Municipality of Coalfields No. 4) are indirectly or directly supported by the coal industry, and there are no other major industries that support the economy in Coronach (E. and C. C. Canada, 2019). Coronach and the surrounding area have a small and dispersed population, with residents traveling far to receive essential services such as healthcare, commuting to

work or school, and an economic development organization or chamber of commerce is absent (E. and C. C. Canada, 2019).

A recent meeting (in February 2023) was held by a member of the Legislative Assembly in Saskatchewan, Lori Carr, in Estevan with town residents, concerning new possibilities for the town in the energy sector, such as the installation of small modular reactors and conversion of coal to gas plants. On the occasion, support for coal mining in the region was transparent, according to the local news channel (Kowal, 2023). The transition center in the region (SaskCoal) is also supportive of coal continuity and CCS in the province, as shown in recent articles they have published online (The Estevan Coal Transition Centre, n.d.).

Saskatchewan has received support from the federal government through a new agency in western Canada: Prairies Economic Development Canada (PrairiesCan). It is one of the two new agencies established by the federal government to deliver coal transition programs, supporting affected parties in Saskatchewan and Alberta (OAG, 2022). PrairiesCan's primary objective is to build on the legacy of the former agency Western Economic Diversification Canada to achieve better economic outcomes for regional economies – covering Manitoba besides the two coal provinces (Canada, P.E.D., 2021). According to PrairiesCan's Departmental Plan 2022-2023, the agency is also committed to supporting Canada in addressing the United Nation's 2030 Agenda and the Sustainable Development Goals (SDGs) – for example, through investment in clean technology and supporting communities transitioning away from coal-fired electricity generation (Canada, P.E.D., 2022b).

Saskatchewan was also a beneficiary of federal support under the Canada Coal Transition Initiative (CCTI) and Canada Coal Transition Initiative – Infrastructure Fund (CCTI-IF), announced in 2022 by the Minister of Northern Affairs, Daniel Vandal. The funding, delivered through PrairiesCan in collaboration with Infrastructure Canada, enabled a series of projects Saskatchewan (Canada, P.E.D., 2022a). Part of the funding was allocated for an ongoing effort to back the transition initiatives related to coal in the Coronach region. Extra funding was directed towards an established project tasked with conducting an economic assessment concerning tourism, agri-food, and energy advancements in Coronach, as reported by Canada's Public Economic Development department in 2022 (Canada, P.E.D., 2022a). Additionally, the funds were utilized to facilitate the development of a conceptual design plan for the downtown area and to support public engagement activities in Estevan (Canada, P.E.D., 2022a).

In addition, an article by the Bykhovskaia et al. (2023) at Western Investor reported that the Southeast College in Estevan is taking steps towards a low-carbon future in the province's coalfields (Bykhovskaia et al., 2023). The college has received a grant of up to $200,000 from the Municipal Coal Transition Funding Committee to support the start-up costs of its Centre of Sustainable Innovation, focused on applied research, just-in-time learning, and entrepreneurship to promote sustainability and innovation in various industries (Bykhovskaia et al., 2023). The center may play a role in attracting investment, advancing economic development, and finding sustainable energy solutions applicable to the region, and the collaboration between the college and the University of Regina also aims to expand

alternative and sustainable energy education in rural communities, aiding in the reskilling of individuals affected by the transition away from coal-powered energy (Bykhovskaia et al., 2023).

Nonetheless, other sources reported that in the most affected regions in Saskatchewan (in the town of Estevan, for example), there was still strong support for coal power (The Estevan Coal Transition Centre, n.d.) and reliance on carbon capture and storage technology (Hürlbert et al., 2020). Also, Hurlbert (2022) conducted a focus group study in three Saskatchewan communities on power production and climate change and results of this research showed Estevan, which has the world's first post-combustion coal CCS plant, supported coal power production even after expert panelists discussed decarbonizing electricity. The participants in Estevan only supported informing people, not involving them, in decision-making, and focused on the economic costs of the energy transition, including job losses (Hurlbert, 2022). Regina and Saskatoon opposed coal power pre and post the focus groups discussions, and expressed trust in universities and research, with less trust in government. Participants in both locations supported transparency, clear criteria, and education as part of the transition process while they also stressed the inter-generational and entire life cycle costs in tackling climate change (Hurlbert, 2022). In this sense, coal communities in the province like Estevan and Coronach have not showed support for the transition away from coal.

A report by the Canadian Rural Revitalization Foundation released in 2021 government stated that Coronach faced an identity crisis when it learned in 2014 that its coal industry would end by 2030 since the town was heavily reliant on fossil fuels (Leader et al., 2021). In 2021, the town was going through a period of grief while reviving its agricultural roots and building regional relationships to mitigate the effects of the coal industry closure (Leader et al., 2021). Furthermore, Coronach is addressing the lack of regional collaboration by establishing the South Saskatchewan Regional Economic Partnership (SSREP)- formalized in early 2020. Activities conducted so far include conducting branding exercises to understand the region's cultural context and opportunities (Leader et al., 2021). This partnership can support Coronach and nearby municipalities affected by the closure of the coal industry while allowing them to advocate more effectively at the provincial and federal levels and collaborate to create new opportunities and diversify their economies in the long-term (Leader et al., 2021).

In conclusion, Saskatchewan's transition away from coal faces mixed sentiments from affected communities. While there has been progress with CCS technology and equivalency agreements with the federal government, strong support for coal power remains and the attachment to coal in communities like Estevan and Coronach poses challenges. However, initiatives from PrairiesCan and the Canada Coal Transition Initiative show efforts for economic diversification and community development. Continued engagement and transparency are crucial in the province, considering the persistent support for coal power and carbon capture and storage technology.

7.4 Just transition efforts to phase out coal-fired generation in the Atlantic provinces

As previously discussed, in New Brunswick, the provincial government has recently (September 2022) disclosed its Climate Change Action Plan, designed to address climate change and reduce greenhouse gas emissions between 2022 and 2027. The plan includes the creation of a Sustainable Economic Development Plan that supports workforce and skills readiness in the province and demonstrates the government's commitment to tackling climate change and reducing greenhouse gas emissions. However, particular initiatives to tackle the transition away from coal and its adverse impacts to the workers and community were not clearly stated in the climate plan.

An article by the organization Atlantica Energy Canada in 2022 stated that the mandate for New Brunswick and Nova Scotia utilities to phase out coal from electricity generation by 2030 is a major concern as a feasible and affordable solution is yet to be identified (Atlantica Energy Canada, 2022). Although new technology such as Small Modular Reactors and hydrogen hold potential to assist in achieving climate objectives, Atlantica Energy Canada claims that strong government leadership is required to develop policies and regulations that establish a clear and predictable investment environment. Furthermore, the absence of comprehensive, region-specific data and a strategic direction is a significant challenge (Atlantica Energy Canada, 2022). Thorough research on the forecast for electricity supply, demand, and cost to reach net-zero revealed a lack of information within governments and the public to make informed decisions (Atlantica Energy Canada, 2022). Additionally, Atlantica Energy Canada states there is lack of alignment among the provinces and the federal government, as it is still unclear who will bear the associated costs of the coal phase-out in the region. Affordability and energy security remain critical for the energy transition away from coal. While clean energy solutions show promise, Kucharski & Exner-Pirot (2022) state they require substantial time and financial investment to become scaled up to displace most fossil fuels (Kucharski & Exner-Pirot, 2022). A responsible transition must recognize the need to pursue multiple goals simultaneously, potentially facing trade-offs (Kucharski & Exner-Pirot, 2022). To ensure sustainable outcomes from the transition away for coal-fired power, multiple societal goals must be pursued beyond climate change mitigation, such as economic sustainability, consumer affordability, and energy security (Kucharski & Exner-Pirot, 2022).

Lastly, public buy-in is crucial for the success of the energy transition, and the government must ensure that the public is well-informed and engaged in the process (Atlantica Energy Canada, 2022). Without public support, it will be challenging to develop new sources of energy, create jobs, integrate new technologies, and ultimately reduce emissions (Atlantica Energy Canada, 2022). In summary, the transition away from coal involves overcoming challenges, acknowledging the time and investment required for clean technologies, and recognizing the need to pursue multiple societal goals (Kucharski & Exner-Pirot, 2022).

7.5 Relevant strengths and gaps in the implementation process in Canada

This section examines the obstacles and deficiencies that have been observed during the implementation of the coal phase-out in Canada so far, along with notable strengths demonstrated by the federal government and other governing bodies in executing policies and initiatives.

7.5.1 The Task Force's work

According to Brauers et al. (2022), the critical objective of coal commissions (like the Task Force in Canada) would be to achieve consensual recommendations on how the coal phase-out process (including the just transition) should be carried out. However, political commitment was also involved. As the World Resources Institute in Canada noted, the strength of the federal coal power phase-out policy reflected a resolute commitment demonstrated by the prime minister and the minister of the environment to guarantee observance of the Paris Agreement targets while adopting a just transition perspective (WRI Canada, 2021). The Task Force had strong support and clear guidelines from the federal government, translating into more effectiveness.

Brauers et al. (2022) also highlight the clear mandate established for the Task Force, which focused on "providing knowledge, options, and recommendations on just transition pathways for workers and communities" (Brauers et al., 2022, pg.3). While climate change is one of the main reasons behind coal phase-out processes, it was not the main focus of the Task Force's work (Brauers et al., 2022). Since the coal phase-out by 2030 was already approved as part of federal regulations, the Task Force mainly targeted stakeholder engagement and focused on regional needs rather than national issues (Brauers et al., 2022). The Task Force's members had to clarify for communities that the commission did not represent the federal government (Gurtler et al., 2021). Rather, they were "advocates for local concerns," focusing on coal phase-out practicalities rather than the legitimacy of coal phase-out at the national level (Gurtler et al., 2021, pg.7).

Brauers et al. (2022) emphasized the alignment of the coal phase-out process in Canada with Paris Agreement targets but also noted the Task Force's engagement with communities – relying on numerous visits, town hall meetings, and expert hearings to get direct input from affected stakeholders – and efforts made to achieve a gender balance as well as ensuring First Nations involvement (Brauers et al., 2022). Furthermore, the Task Force was the primary vehicle for stakeholder groups such as unions, coal workers, communities, and employers to engage and discuss the issues and potential solutions aiming to inform the government on just transition initiatives (WRI Canada, 2021).

Gurtler et al. (2021) stated that the work of the Task Force in Canada was the first opportunity for affected coal workers and communities to express their concerns since the federal government's decision to phase out coal power did not include direct consultation or interaction with affected communities (Gurtler et al., 2021). Communities were well prepared for the meetings, and hundreds of participants, including coal workers and their families, attended the gatherings (Gurtler et al., 2021).

Some meetings with the communities were tense, and, on some occasions, participants showed discontent and anger (Gurtler et al., 2021). A common issue in the meetings with the affected communities was the conflict between local, national, and international interests. As stated by an interviewee in Gurtler et al.'s research: "I think it is a hard pill to swallow that you are the town that's going to get nuked on behalf of international climate policy." (Gurtler et al., 2021, pg.7). However, other participants stated that meetings had good facilitation and chairing while being informative and well-organized (Gurtler et al., 2021). In brief, the Task Force was considered inclusive and open to hearing the various concerns at the local and regional levels (Gurtler et al., 2021).

Although multi-stakeholder commissions like the Canadian Task Force are a valuable tool to establish social dialogue and create policy implementation recommendations, they also face criticism when they tackle controversial topics (Brauers et al., 2022). The criticisms are often related to reaching lowest common denominator compromises, maintaining power imbalances, and legitimizing government decisions facing opposition (Brauers et al., 2022). Since unequal power relations generally shape the political context of the coal phase-out, Task Force members' different levels of political experience and access to resources may significantly impact negotiation processes (Brauers et al., 2022). At the same time, in the Canadian case, the commission members were responsible for establishing a dialogue with affected communities, listening to their concerns, and providing recommendations. Therefore, although the Task Force's mandate in a matter of controversy affected their work and results, the Task Force was not mainly tasked with the decision-making within the coal phase-out and its following implementation steps. On this matter, Brauers et al. (2022) argue that commissions can be used by governments to to delegate challenging decisions and delegate accountability for decisions and legislation that would have been enacted regardless. Moreover, if multistakeholder commissions are used inadequately to delegate political responsibility or delay climate action, the legitimacy and stability of the outcome might be compromised (Brauers et al., 2022).

The Task Force engaged with a diverse group of stakeholders and was focused on promoting social dialogue so that their recommendations would support affected workers and communities in a just transition away from coal. However, Gurtler (2021) argues that the Task Force only provided general recommendations and guiding principles for the subsequent policy development process (Gurtler, 2021). Moreover, the Task Force and its recommendations were only a starting point for subsequent follow-up deliberations and implementation processes (Gurtler, 2021). Mertins-Kirkwood and Duncalfe (2021) state that Canada's Just Transition Task Force was a step in the right direction, though it worked for a limited period without significant resources. After the Task Force's work concluded, Canada did not set up a dedicated body to administer the just transition agenda (Mertins-Kirkwood and Duncalfe, 2021), despite reminders that a just transition will not occur autonomously. (Clarke & Lipsig-Mummé, 2020). As in other efforts to meet climate and environmental targets and mitigating damage, planning and policies are needed to ensure opportunities for a more equal and

resilient society for workers and communities – rather than reducing the social dimension to decent jobs and human rights (Clarke and Lipsig-Mummé, 2020).

7.5.2 Funding for just transition initiatives

Though efforts were made to provide financial support to provinces affected by the phase-out, a report by the World Resources Institute claimed hundreds of millions of dollars would still be required to fund the transition away from coal. The effort would need to be maintained for at least a decade, since the coal power phase-out is to be completed in 2030 (WRI Canada, 2021). Also, although funding is provided by the federal level for each affected province and region, the application of these resources relies mainly on the provinces and local government. Effective application of funds for the just transition away from coal and contribution to sustainability would require long-term planning and clear targets to be developed and pursued by the affected regions.

Prairies Economic Development Canada funded three coal-transition centers in affected communities In Alberta and Saskatchewan (OAG, 2022). The federal Office of the Auditor General found that the funding allocated for just transition initiatives was adequate. Funding was established in October 2018 and August 2020 to support affected communities transitioning from coal-fired power (OAG, 2022). The regional development agencies funded 67 projects through the Canada Coal Transition Initiative and the Infrastructure Fund in 26 communities across Alberta, Saskatchewan, Nova Scotia, and New Brunswick, focusing especially on opportunities for skills development and economic diversification (OAG, 2022).

7.5.3 Governance, planning and monitoring systems for the transition

Even though the phase-out of coal is a federal policy, tackling the challenges and implementation of initiatives occurs mainly in the local and provincial spheres. The relationships and responsibilities shared among the different jurisdictions (e.g., municipal, provincial, federal) are a central aspect of the coal phaseout in Canada. A lack of collaboration between these jurisdictions might create a disproportional burden on local governments and communities (Harrahill and Douglas, 2019).

To determine whether Natural Resources Canada, Employment and Social Development Canada, the Atlantic Canada Opportunities Agency, and Prairies Economic Development Canada had adequately supported a just transition for workers and communities affected by the coal power phase-out, the Office of the Auditor General of Canada (OAG) initiated inquiries addressed in a report released in 2022. The report identified gaps in the federal government's programs to support a just transition away from coal (OAG, 2022). The OAG report focused on three main gaps: lack of a formal governance structure to coordinate the just transition, lack of a federal implementation plan for the Task Force's recommendations; and the absence of a measuring and monitoring system to track progress on the just transition (OAG, 2022).

Firstly, the OAG concluded that to lead a coordinated approach involving various jurisdictions, stakeholders, and organizations, the federal government would need an established and continuing

governance structure, roles, or responsibilities to guide federal departments in organizing and cooperating with the various other jurisdictions, stakeholders, and organizations involved (OAG, 2022). After the Task Force reported, there was no follow-up initiative to establish a governance body or specific roles to implement the Task Force's recommendations. Instead, Employment and Social Development Canada, the Atlantic Canada Opportunities Agency, and Prairies Economic Development Canada relied on existing program mechanisms not designed to support affected coal workers and communities in a just transition away from coal (OAG, 2022). Natural Resources Canada did have discussions about just transition and future skills with departments such as Employment and Social Development Canada through an informal working group; however, the group did not have terms of reference-setting roles and responsibilities, a clear mandate, or a meeting schedule (OAG, 2022).

The OAG also held that a federal implementation plan, reflecting early and long-term planning was needed to ensure affected communities and workers do not face hardship, economic disruption, or carry the burden of the coal transition (OAG, 2022).

Finally, the OAG noted the absence of a system to measure and monitor the coal phase-out initiatives and effects on workers and communities and to understand to apply the lessons learned in the future (OAG, 2022). The federal government had not implemented a framework to measure, monitor or report on its actions (OAG, 2022) although a progress report on the implementation of the Pan-Canadian Framework on Clean Growth and Climate Change was released in 2021, presenting efforts undertaken by the Government of Canada since 2016 (Government of Canada, 2021). In terms of the coal phase-out, the report briefly addresses the coal phase-out, including the finalization of equivalency agreements with Saskatchewan and Nova Scotia, as well as the allocation of funding in response to Task Force recommendations.(Government of Canada, 2021). However, it remains unclear whether the federal government has planned subsequent progress reports to assess just transition measures and monitoring systems for evaluating the outcomes of implemented initiatives.

Prairies Economic Development Canada and the Atlantic Canada Opportunities Agency established indicators of the number of jobs created and projects funded. However, they did not specifically target the impacts of the programs to transition away from coal (e.g., the diversification of the economy and the availability of other occupations in coal communities) (OAG, 2022). Similarly, neither Natural Resources Canada nor the agencies mentioned before had yet reported on the results of the Canada Coal Transition Initiative and the Infrastructure Fund – although specific results may only be measurable at a later date (OAG, 2022). Still, on the monitoring issue, Natural Resources Canada engaged in research on current skill sets in Canada and developed a mapping tool to help identify communities vulnerable to the effects of the transition (OAG, 2022). However, efforts were not coordinated with other departments to ensure a monitoring system was implemented to report on the progress of the coal transition (OAG, 2022). At the same time, the OAG recognized that the absence of follow-up actions may have been due in part to the COVID-19 pandemic that slowed down and redirected efforts by the federal government.

The OAG's overall conclusion was that the pace of planning for a just transition is falling short of the requirements to be addressed in the transition to a low-carbon economy (OAG, 2022). The report recommended that collaborative approach between Natural Resources Canada, Employment and Social Development Canada, and relevant agencies should be urgently put in place to establish the needed data related to skills, occupations, and diversity in coal communities and workers, determine the tools to monitor the impacts on affected workers and communities and establish a process for public reporting on progress toward a just transition for workers and communities to a low-carbon economy (OAG, 2022).

Lastly, although the Task Force had a mandate to establish a dialogue with affected communities and workers, hear their concerns, and develop specific recommendations to support the federal government with the implementation of a just transition away from coal, the OAG reported that only four Task Force recommendations had been implemented. Neglected or rejected recommendations were related to a report on progress for just-transition activities for coal workers and communities; just-transition legislation and labour market transfer agreements; a long-term research fund to study the impact of the coal phase-out, meeting the commitment to protect the pension funds of affected workers; a public inventory with labour market information about coal workers, and insufficient Employment Insurance benefits (OAG, 2022).

7.6 Conclusions

In conclusion, the challenges highlighted in this section address critical aspects that need to be addressed for a successful transition away from coal in Canada. Insufficient coordination among jurisdictions and stakeholders may adversely impact the support for a just transition from coal, potentially burdening local governments, and communities disproportionately. Additionally, the absence of a formal governance structure and comprehensive federal implementation plan dedicated to the coal communities and affected stakeholders undermines the efforts leading to a just transition, leading to hardships and economic disruptions for affected communities and workers. Furthermore, inadequate monitoring and reporting may further delay progress evaluation and informed decision-making while the slow pace of the transition highlight the urgent need for collaborative actions, comprehensive planning, and improved monitoring systems. Canada can prioritize these measures to achieve a successful shift to a low-carbon economy, ensuring fairness, resilience, and sustainable outcomes. Although the recent Sustainable Jobs Plan released in 2023 showed some progress related to governance structure and planned progress reports and has been included in the Sustainable Jobs Act for approval, it is a framework for future action and the final version and approval of the bill and its implementation are still to be seen.

Chapters 6 and 7 have highlighted the strengths and gaps of the Canadian coal phase-out case. The next chapter will focus on a sustainability-based framework specifically tailored to the characteristics of the Canadian case. This framework aims to analyze essential criteria to assess and

guide coal phase-out policy in Canada, leading to a positive contribution for sustainability and just energy transition. The objective is to provide valuable insights for policymakers and guide sustainable energy transitions in the future.

CHAPTER 8. Sustainability-based assessment framework for coal phase-out policy specified for the Canadian case

This chapter presents a sustainability-based assessment framework for Canada's coal phase-out policy. This framework offers a structure for future sustainability-based assessments targeting coal phase-out policy with consideration of sustainability and just transition components.

Sustainability and just transition issues have been entrenched in Canada's coal power phase-out movement. With the federal regulations to phase out coal-fired electricity generation by 2030, concerns about effects on the communities and workers affected by the federal policy have been continuously discussed by government entities, non-governmental organizations, unions, and many other stakeholder groups. While meeting targets for greenhouse gas emission reductions has been the crucial factor for the federal coal power phase-out (in contrast to the Ontario phase out that was driven mostly by health concerns), considerable emphasis has been placed on ensuring affected communities will not bear the burden of the transition.

An example of concern with the communities is the Task Force on Just Transition (discussed in more detail in Chapter 6), which was established with a mandate by the federal government to listen to stakeholders' concerns and suggestions, and to recommend ways of ensuring a just transition for coal workers and communities. However, the Task Force had a limited period of operation. After its two reports were released, it was dissolved. During its lifetime, the Task Force was the only specific government entity responsible for overall review of federal initiatives in the transition away from coal power in Canada. Natural Resources Canada, Employment and Social Development Canada, and regional agencies like Prairies Economic Development Canada and Atlantic Canada Opportunities remain as the separate existing federal structures that have been supporting the transition through funding and programs for the affected communities. Local governments and new transition centers have also played important roles as bodies in closer contact with communities and workers.

Coal mining in Canada has been deeply affected by the coal power phase-out. The federal government has specifically addressed thermal coal mining through a strategic assessment process and a policy statement expressing that new thermal coal mining projects and expansions are not aligned with Canada's domestic and international climate change commitments. This response from the government followed pressure from environmental NGO groups and meetings with the G7 resulting in stricter decisions related to thermal coal (Environment and Climate Change Canada, 2021; *G7 Chair's Summary: Joining Forces to Accelerate Clean and Just Transition towards Climate Neutrality*, 2022; *New PPCA Members Tip the Scales towards 'Consigning Coal to History' at COP26*, 2021; Ross, 2022)

Considering the factors discussed above, the framework for sustainability assessment specified for the coal power phase-out policy is used in this section to consider the Canadian case and identify its most relevant issues. The analysis is based on the literature review and document research conducted for the Canadian case study, along with insights from the previous literature review process conducted

for the framework development. The following discussion uses the sustainability assessment framework that in chapter 4 was specified broadly for application to coal phase-out policy. The discussion serves as a basis for future sustainability-based assessment of the Canadian case. However, the main objective of this chapter is to identify the key contextual elements to be addressed in further specification of the framework for more advanced future assessments of Canada's coal power phase-out policies and their application. The chapter ends with the context-specified framework and a discussion of its potential application with particular attention to how associated trade-offs should be considered.

8.1 Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives (Category 1, criteria C1.1, C1.2, C1.3)

Ensuring the coal phase-out contributes to sustainability in Canada, including meeting Canada's climate change mitigation commitments, involves moving to new energy sources aligned with necessary climate change mitigation goals. Meeting Paris Agreement targets and Canada's international agreements, such as the Powering Past Coal Alliance agreement, means contributing to keeping the global temperature increase to not more than 1.5°C or at least well below 2°C. Failing to do so sets up scenarios in which social and ecological systems will be disturbed beyond a turning point – when effects will be severe and irreversible.

In the Canadian context, moving away from coal is crucial for progress toward the Paris Agreement targets. However, with some provinces switching from coal to gas (either converting to gas or building new gas plants), the climate change impacts resulting from the coal phase-out coal could be jeopardized. Alberta's case is particularly relevant since the current provincial government's climate plan relies on 70% of electricity generated by gas and 30% from renewables. Although natural gas can be considered a less-emitting energy source than coal (Gould & McGlade, 2017) studies have shown that the fuel's emissions impacts may be severe, especially due to fugitive methane emissions (Kemfert et al., 2022). A study by Kemfert et al. (2022) reveals higher methane emissions from natural gas production and transport than previously estimated. The exact methane leakage rates vary depending on technical characteristics and process factors, but methane emissions were underestimated by 50-60% according to regional studies in Canada and the United States (Kemfert et al., 2022). If around 3.2% to 3.4% of produced gas escapes before combustion, the greenhouse gas advantage of natural gas compared to coal would be marginal (Kemfert et al., 2022), turning natural gas into an unsuitable option as a "bridge fuel".

Another issue with switching from coal to gas in Canada is locking in the infrastructure and local economy to fossil fuels, entrenching dependencies and making it more expensive and challenging to invest in renewable sources eventually (Volcovici et al., 2020). Stranded assets may also be a problem tied to coal-to-gas conversions since it is likely that more regulations and carbon taxes will impact profitability for natural gas (and other fossil fuels) infrastructure in the future (Caldecott et al., 2021).

According to the IPCC, limiting global warming to 2°C could result in fossil infrastructure worth US$4 trillion becoming stranded assets by 2050. The amount could be even higher if the warming limit is set at 1.5°C (Rozansky & Langenbrunner, 2022; IPCC, 2022). Kemfert et al. (2022) state that the financial sector, academics, governments, and NGOs have warned of the carbon bubble and stranded assets as key climate-related financial risks. These risks stem from both the physical impacts of climate change (physical risks) and the policy changes accompanying the transition to a net-zero economy (transition risk) (Kemfert et al., 2022).

Additionally, restoring and regenerating affected ecosystems is crucial with the coal phase-out and the associated closure of plants and mines. Proper decommissioning of the coal infrastructure in the affected areas with effective waste management and restoration of biodiversity is a sustainability requirement to ensure that coal phase-out delivers a positive contribution to ecological systems' integrity. The clean-up process dedicated to the affected coal areas could also benefit or disadvantage the local population especially Indigenous communities living next to coal areas with a direct and close relationship with the land. Remediation activities carry risks in handling toxic materials and efforts to address abandoned mines and toxic sites can reignite historical conflicts and a sense of injustice (Sandlos & Keeling, 2016). However, it is also possible for Indigenous communities to use the cleanup process to address past inequalities in how the negative effects and benefits of the original mines were distributed (Sandlos & Keeling, 2016). It is crucial that the coal phase-out safeguards or re-establishes equal access to ecological system resources by local communities. Also, land plays a vital role by providing space for societal activities and resource production, and restoration of mine land and soil is necessary to secure future natural resource provision and services on a local and regional scale (Pavloudakis et al., 2023). Reclaimed waste areas can be used for investment projects that support economic development, job creation, and landscape changes while maintaining environmental care (Pavloudakis et al., 2023). The effective and sustainable reclamation of mining land is essential for positive outcomes of the coal phase-out.

Also, aligned with requirements in category 4, the environmental impacts resulting from the coal phase-out and associated coal-fired plants and mine closures in Canada must be monitored and managed throughout the decommissioning and clean-up process and afterward to ensure effective rehabilitation and long-term environmental stewardship. As mentioned in chapter 6, mines in the process of closure or already decommissioned include Coal Valley mine, Paintearth Mine and Highvale Mine, all in Alberta (Environment and Climate Change Canada, 2019b; Government of Alberta, 2022; Irwin, 2021; TransAlta, 2022).

Furthermore, poorly managed mine closures can harm local economies, reputations, community social and cultural wellbeing and traditional Indigenous harvesting activities, and while affected stakeholders expect proactive management of the socio-economic and cultural as well as environmental closure impacts, the mining industry lacks the necessary social performance capabilities to consistently address social risks and minimize negative effects (Bainton & Holcombe, 2018).

Lastly, the criteria in this category require avoidance of further disturbance of ecological and social systems, for example, through stopping new coal mine projects or expansions. The current federal government in Canada has already signaled that new thermal coal mine projects and developments are "likely to cause unacceptable environmental effects within federal jurisdiction", going against Canada's climate commitments, and are therefore unlikely to be approved (Impact Assessment Agency of Canada, 2021).

8.2 Livelihood sufficiency, affordability, equity, and opportunity (Category 2, criteria C2.1, C2.2, C2.3)

As previously reported in this chapter, the coal power phase-out in Canada affects 50 communities in four provinces, with most affected workers residing in Alberta and Saskatchewan. These communities are small and culturally connected to coal, with high unemployment rates and older workers. In this context, efforts to address the impact of the coal phase-out in Canada must include funding and coordinating comprehensive re-training and re-skilling programs for workers and communities affected by the transition. Such initiatives may enable them to acquire new skills aligned with emerging industries and sustain their livelihoods in the changing job market. An example implemented in Alberta is the retraining programs, including the Coal and Electricity Transition Tuition Voucher program, providing workers with up to $12,000 for post-secondary education, and the Coal Workforce Transition Fund, which provides income assistance, relocation support, and career counseling.

In addition to re-training, securing new employment opportunities for workers displaced by the coal phase-out is crucial. Options include supporting the creation of employment aligned with climate change targets and sustainability goals, such as in renewable energy, energy efficiency, and other green industries. This would both provide economic stability for affected workers and contribute to the transition toward a more sustainable and low-carbon economy. Financial assistance for workers and communities throughout the transition period is also essential, particularly for those nearing retirement and relying on pensions. Such assistance can help to alleviate financial challenges and ensure that workers are supported during this period of change. A program that the federal government has implemented and already cited in this chapter is the Canada Coal Transition Initiative (CCTI), established in 2018 to provide funding and investment for affected communities, including the creation of transition centers in Alberta. These centers provide local support and assistance during labor market disruptions.

Related initiatives include investing in coal regions' futures by supporting economic diversification, entrepreneurship and creating a supportive environment for new industries is crucial. For example, clean energy infrastructure projects, especially if near to the affected communities, would

significantly impact transitioning regions by creating job opportunities, local procurement, and community participation in renewable energy projects, ensuring a just and inclusive transition.

Lastly, energy security and affordability are also critical considerations for communities impacted by the coal transition since accessible and affordable energy for these communities will help to mitigate any potential negative impacts and ensure that they can continue to meet their energy needs during and after the transition. A report by the IISD released in 2022 stated that the energy system in Canada is vulnerable to global politics and market uncertainties while relying heavily on oil, gas, and coal (Christensen & Dusyk, 2022). However, the cost of renewable energy has dropped significantly, and in many places, it is now cheaper than fossil fuel-based electricity, with the advantage of renewable energy prices also not fluctuating with global fuel markets and reduced risk of price spikes for renewable energy (Christensen & Dusyk, 2022). Fossil fuel-reliant areas like Saskatchewan pay 60% more for electricity than Quebec and 45% more than Manitoba (Zacharias, 2022). In this sense, replacing coal and gas with solar and wind has been considered ideal also due to a decrease in renewable energy prices (including battery tech costs) (Christensen & Dusyk, 2022).

8.3 Social Dialogue, participatory decision-making, and democratic governance (Category 3, criteria C3.1, C3.2)

A lack of early and meaningful engagement with affected stakeholders and their active participation in the implementation process of the coal phase-out can undermine the delivery of a just transition away from coal in the affected communities.

The federal government's Task Force initiative has been considered an appropriate approach to establishing communication and forums of social dialogue with affected stakeholders in the coal communities (Brauers et al., 2022). However, the decision-making process concerning the coal power phase-out was centralized in the federal government. In some cases, the provincial government anticipated and implemented it (e.g., the coal power phase-out in Alberta). Also, with the Task Force's recommendations (resulting from the consultation process) not being fully implemented, listening to the communities' concerns may represent an effort to legitimize the federal government's decision on the coal phase-out rather than a sufficiently comprehensive and effective contribution to support workers and communities in the transition process (Brauers et al., 2022). With some stakeholders being consulted and informed about the phase-out by the Task Force for the first time, it is not surprising that some meetings in the coal communities had angry or discontented participants (Gurtler et al., 2021).

There is a complex tension between pursuing global climate commitments through federal regulations and other initiatives, while most of the consequences occur locally in coal-dependent municipalities and villages. The way decisions are made for the coal transition, especially the extent to which they foster equitable, informed, and democratic participation, and avoid power imbalances in governance structures, is fundamental to securing social and environmental justice. Respecting

Indigenous rights and considering the interests of future generations require special attention, involving fostering reconciliation with Indigenous communities and making decisions that prioritize long-term sustainability for the well-being of future generations who cannot be present to advocate for themselves. Furthermore, without an adaptable long-term plan and monitoring system to track progress (related to criteria in category 4) with the effective participation of the affected workers and communities, it is unclear how just transition measures will effectively address the key issues and stakeholders overcoming the energy transition impacts.

8.4 Adaptability, precaution, and monitoring for long-term sustainability (Category 4, criteria C4.1, C4.2, C4.3, C4.4, C4.5)

To effectively address the impacts of the coal phase-out in affected regions of Canada, it is essential to implement robust and collaborative long-term planning processes that adapt continuously to the evolving needs of communities. This includes engaging stakeholders in decision-making (also related to criteria in category 3), identifying and addressing potential challenges and risks, and developing strategies that prioritize the well-being of affected populations while taking particular care to protect the most vulnerable.

Also, implementing adaptive and flexible monitoring systems is crucial to continuously assess and respond to the impacts of the coal power phase-out on communities. This allows for the timely identification of challenges and opportunities and enables adjustments to be made to support programs as needed. As mentioned in this chapter, people and communities in Canadian provinces affected by the coal phase-out require significant funding for a decade-long energy transition. Effective application of these funds demands long-term planning and clear targets by affected regions. As also stated by the federal OAG's report, a federal implementation plan and early planning are required to prevent hardship for affected communities and workers. Although Natural Resources Canada developed a mapping tool to identify vulnerable communities, this initiative was not accompanied by coordinated work with other departments to implement a monitoring system (which also touches on the issues in category 5). At the time of writing (June, 2023) the federal government had not yet implemented a system to monitor and evaluate the coal phase-out initiatives' impact on workers and communities – even though a report on progress for just-transition activities was part of the Task Force's recommendations report released in 2019 – as discussed in Chapter 6. However, with the recent Sustainable Jobs Act under discussion in the House of Commons, progress on dedicated governance structures and reporting measures for job creation and support for workers and communities impacted by the energy transition could be coming in Canada.

Regular monitoring and evaluation of the effectiveness of assistance programs are critical to ensure that they are meeting their intended goals and effectively supporting affected workers and communities. Establishing accountability systems and indicators is vital to track and report progress on

the programs dedicated to assisting coal workers and communities. This includes setting clear targets, measuring outcomes, and reporting on the results to ensure transparency and accountability. In addition, regular reporting and evaluation of progress can help identify areas that may require additional attention or improvement and facilitate informed decision-making and resource allocation.

Empowering, supporting, and funding transition centers can play a crucial role in coordinating, monitoring, and reporting on assistance programs for coal communities. These centers can serve as hubs for information dissemination, resource coordination, and community engagement. They can also facilitate collaboration among various stakeholders, including government agencies, industry representatives, labor organizations, and community members, to ensure a coordinated and comprehensive approach to addressing the impacts of the coal phase-out.

Additionally, it is essential to avoid replacing coal with other fossil fuel lock-ins, such as natural gas units, which could perpetuate dependence on fossil fuels and hinder the transition to cleaner energy sources. Instead, a proactive approach should be taken to explore and invest in sustainable and renewable energy options that align with climate change targets and sustainability goals.

8.5 Governance accountability, inter-jurisdictional collaboration, and government support for the just transition (Category 5, criteria C5.1, C5.2, C5.3, C5.4)

Designating specific governance bodies to oversee the implementation of just transition and sustainability principles is crucial to ensure coordinated efforts and effective policy implementation, including responses to unexpected problems and opportunities. These bodies can facilitate collaboration among different levels of government, stakeholders, and communities and ensure that the transition process is well-coordinated and inclusive. One of the structures implemented by the federal government through funding from the Canada Coal Transition Initiatives was the set of transition centers to support local hubs when there are labor market changes. These centers provide essential services such as re-employment opportunities, skill recognition, educational and financial services, and healthcare. The centers are locally run with funding support from the federal government. A structural shift such as the coal phase-out requires collaboration between the different jurisdictions involved to ensure the coherent application of funds and effectiveness to deliver just transition outcomes.

Several funding programs (or commitments to funding) and other initiatives have been announced by the federal government to support just transition for the communities affected by the coal phase-out (e.g., $1.5 billion in a Clean Fuels Fund and $319 million in R&D for CCUS technologies; $5.6 million for projects in Alberta in 2021 through the Canada Coal Transition Initiative and Canada Coal Transition Initiative-Infrastructure Fund, $150 million committed in Budget 2019 to the Canada Coal Transition Initiative-Infrastructure Fund to support infrastructure investments and economic diversification, etc.). However, more monitoring systems and governance structures are needed to track the application of these funds and the impact of such funding programs in terms of sustainable and just

transition outcomes in the affected communities. As stated by the OAG in their report on the just transition in Canada (Government of Canada, OAG, 2022), Prairies Economic Development Canada and the Atlantic Canada Opportunities Agency lacked appropriate indicators to assess outcomes of coal-transition programs. They measured job creation and project funding, but not economic diversification or changes in available occupations. As a result, they couldn't demonstrate how funded projects supported the objective of transitioning affected workers and communities to a low-carbon economy(Government of Canada, 2022). Under the new Sustainable Jobs Act under discussion in the Canadian Parliament, a Partnership Council would prepare an annual report with their advice and activities made public within 30 days of submission. Also, the Minister would need to respond to the report within 120 days and make the response public. The Council would also research and report on specific matters as requested by the Minister while providing progress reports. While it is still legislation under discussion in the House of Commons, these measures, if approved, would increase accountability and governance capacity to deal with the impacts of the energy transition on workers and communities.

Better multi-level governance and collaboration among stakeholders could help to ensure that funding policies are tailored to the unique needs of local communities, promoting a just and equitable transition. Furthermore, long-term research programs focused on studying the impacts of the coal transition are essential to inform evidence-based decision-making and policy implementation. Sharing results and best practices across jurisdictions and stakeholder groups can contribute to a more informed and effective approach to the coal phase-out process.

Alongside governance structures, accountability mechanisms are crucial for ensuring justice in policy determinations (Krawchenko & Gordon, 2021) and clear allocation of responsibilities is essential, even in complex governance systems, to overcome the problem of shared and blurred accountability (Pao-Yu et al., 2019). Governance accountability and aligning roles and responsibilities across different government levels can prevent overburdening of local municipalities and local government entities (Harrahill & Douglas, 2019) and is essential to enhance support for the local initiatives for economic diversification and mitigation of adverse impacts in the coal communities (Government of Canada, OAG, 2022). Hence, the integration of governance structures, accountability mechanisms, and clear allocation of responsibilities plays a critical role in ensuring justice, overcoming the responsibility issues, preventing overburdening of local entities, and supporting local initiatives for economic diversification and mitigating adverse impacts in coal communities. By establishing clear guidelines and mandates, the responsibilities of each level of government can be clarified, leading to more effective and efficient coordination and cooperation in the coal phase-out process.

In summary, coordinated governance efforts and informed decision-making are essential in coal phase-out efforts. These can be achieved by establishing designated governance bodies, aligning roles and responsibilities, designing targeted funding policies, and supporting research programs.

8.6 Summary of issues in the sustainability-based assessment framework specified to the Canadian coal phase-out federal policy context

The transition away from coal in the particular context of Canada presents a unique set of challenges and opportunities. To ensure a sustainable and just approach to the coal phase-out, a comprehensive framework that considers environmental, social, and economic factors and their interactions is essential. This chapter section summarizes the key issues that should be covered by the sustainability-based framework specified for the coal phase-out policy in Canada. This framework aims to provide a holistic approach that considers the needs of affected communities, workers, and the environment while aligning with climate change targets and sustainability goals. The framework has been elaborated in consideration of the essential aspects of Canada's coal phase-out policy and context and has been refined with the incorporation of the findings presented previously in this chapter and in the literature review. The specified criteria were obtained from the application of the initial generic framework to evaluate the coal phase-out policy in the context of the Canadian case. The framework is designed to serve as a tool to evaluate the existing policy instruments for phasing out coal and for future assessments of related efforts, such as federal plans, projects, and initiatives aiming at phasing out coal. For more narrowly focused future applications, including in individual provinces, the framework should be tailored to the specific context of the region under consideration, acknowledging particular characteristics, priorities, and needs of each jurisdiction.

This context-specific elaboration of the framework contributes to answering the main research question concerning specific criteria for ensuring that a coal phase-out policy is aligned with contributions to sustainability, with particular attention to climate change mitigation, and just transition. At the same time, it aims to guide development of well-designed coal phase-out policies in Canada that align with sustainability pathways, promoting their improvement and contributing to sustainable energy transitions.

The table below presents the sustainability-based assessment framework further specified for evaluations of Canadian coal phase-out federal policy.

Table 19 - Proposed sustainability-based assessment framework specified for application to the Canadian coal phase-out federal policy

Core categories	**Sustainability assessment criteria specified for the Canadian case of coal phase-out**
C1 - Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives	**C1.1** Implement the transition away from coal in ways aligned with Paris Agreement targets and Canada's international climate commitments. C1.1.1 Avoid new lock-ins with lower-emitting fossil fuels C1.1.2 Transition away from coal power to renewable energy sources C1.1.3 Guarantee safe and healthy air quality for Canadian communities **C1.2** Ensure restorative justice for affected communities throughout the coal transition C1.2.1 Anticipate and assess the environmental impacts of coal phase-out related to the closures of electricity generation units and coal mines

	C1.2.3 Implement proper decommissioning of mines and plants, with attention to waste management, restoration, and regeneration of affected ecosystems C1.2.4 Secure equitable access to ecological system resources (safeguarding the local and Indigenous communities' relationships with the land) **C1.3** Avoid further disturbance of ecological systems throughout the transition away from coal (regarding e.g., new thermal coal mining projects or expansions)
C2 - Livelihood sufficiency, affordability, equity and opportunity	**C2.1** Implement a just transition that avoids hardships and disruptions for coal workers and affected communities. C2.1.1 Fund and coordinate efforts to re-train and re-skill workers and communities affected by the coal phase-out C2.1.2 Secure new employment for workers displaced by the transition away from coal C2.1.3 Support and create jobs aligned with climate change targets and sustainability goals C2.1.4 Support workers and communities with financial assistance throughout the transition period, especially workers close to getting pensions. C2.1.5 Fund and create new opportunities for future generations in the coal regions **C2.2** Implement programs for economic diversification in the affected communities. o Ensure that new clean energy infrastructure projects benefit the regions transitioning from coal through new opportunities. **C2.3** Ensure energy security and affordability for communities impacted by the coal transition
C3 - Social dialogue, participatory decision-making and democratic governance	**C3.1** Implement early and meaningful engagement with affected stakeholders throughout the coal phase-out process. C3.1.1 Establish engagement and participatory governance mechanisms in the affected communities in partnership and collaboration with other government entities (e.g., municipalities, provincial and Indigenous governments, and federal agencies.) C3.1.2 Engage with all affected stakeholders (including community leaders, labour groups and representatives for future generations) to design, implement and monitor programs to support communities throughout the coal transition. C3.1.3 Recognize the rights of all affected stakeholders and secure gender equality in decision-making processes related to the transition away from coal[6]. C3.1.4 Assess social, economic, and environmental impacts of the coal transition on affected communities through participatory processes with affected stakeholders. **C3.2** Respect Indigenous rights and the interests of future generations, fostering dialogue with Indigenous governments and reconciliation with Indigenous communities

[6] Attention to gender equity is also mandatory under federal assessment law (IAA, 2019, 22(1)(s))

C4 Adaptability, precaution and monitoring for long-term sustainability	**C4.1** Implement collaborative and adaptive long-term planning processes continuously responding to the impacts, needs and opportunities identified in the affected coal regions **C4.2** Implement adaptive and flexible monitoring systems to continuously assess the impacts of the coal power phase-out for affected communities C4.2.1 Establish accountability systems and indicators to track and report progress on the programs dedicated to assist coal workers and communities affected by the coal phase-out. **C4.3** Empower, support and fund transition centers to coordinate, monitor and report on assistance programs for coal communities. **C4.4** Avoid phasing-out of coal in ways that establish new electricity infrastructure, such as natural gas units, bound to other fossil fuel lock-ins. **C4.5** Favour system options, including energy conservation and demand management as well as renewable energy and storage components that are modular, diverse, and easy to adjust or replace.
C5 – Governance accountability, inter-jurisdictional collaboration, and government support for the just transition	**C5.1** Designate specific accountable governance bodies to coordinate and oversee the implementation of just transition and sustainability principles and programs throughout the transition away from coal C5.1.1 Establish guidelines, mandates and responsibilities for all governance entities representing the government as coordinators and facilitators of the coal phase-out **C5.2** Align roles and responsibilities across different government levels to work effectively in collaboration and ensure the transition does not overburden municipalities and local government entities. **C5.3** Design targeted long-term funding policies to assist affected local communities and workers (e.g., funding early retirement, re-skilling, training, job replacement, economic diversification programs, infrastructure) relying on multi-level governance and collaboration for a just and equitable transition. **C5.4** Support funding for long-term research programs focused on studying the impacts of the coal transition, sharing results and best practices across jurisdictions and stakeholder groups.

As previously stated for the preliminary framework criteria, future applications of the specified framework should also consider process features stated in the next-generation assessment framework (section 3.4) presented by Sinclair et al. (2022) (comparative evaluation of alternatives including the null option, integrated, tiered assessments, assessment streams, cooperative project and regional/strategic assessments, co-governance with indigenous nations/ communities, meaningful public participation, transparency and accountability, independent follow-up , independent and impartial administration and assessment review).

8.7. Trade-off considerations

Developing coal phase-out policies in Canada involves tackling a series of interactive issues and trade-offs in decision-making processes. The sustainability assessment criteria must be applied as an integrated package of multiple principles and conditions to be met without neglecting any essential issues. However, in the context of several jurisdictions and stakeholders with different backgrounds and

potentially opposing interests, conflicts, and dilemmas are likely to arise in discussions and decision-making on the complexity of factors surrounding the coal phase-out. In this setting, as previously discussed in chapter 3, it is crucial to recognize that trade-offs must be recognized and accepted only as a last resort, although unavoidable trade-offs need to be anticipated. This section identifies the key aspects to be considered for potential trade-offs.

These considerations were informed by Gibson et al.'s (2005) and Gibson and Fonseca (2022) trade-off rules and by the core insights gathered from the literature review and document research, and the application process. The trade-off considerations are as follows:

- **Avoid sacrificing social and ecological well-being for future generations in efforts to gain short-term economic benefits:** Moving away from coal and switching to other fossil fuel options, such as natural gas, may offer short-term economic benefits associated with a less expensive energy source and infrastructure. However, it can lead to long-term path dependency on a new type of fossil fuel. Once investments are made in fossil fuel infrastructure, switching to and investing in renewable energy sources becomes challenging and expensive. These lock-ins lead to continued fossil fuel dependence and hamper the achievement of necessary climate mitigation targets. Therefore, phasing out coal while relying on other fossil fuels poses long-term sustainability risks and displaces the burden of the transition to future generations. In this context, avoiding the trade-off between short-term economic benefits and long-term sustainability is crucial. Investing in renewable energy, implementing low-carbon technology policies, and limiting natural gas infrastructure expansion are essential aspects to consider within this trade-off.
- **Ensure that initiatives to meet climate mitigation targets do not entail immediate adverse social and economic effects, especially on vulnerable individuals and communities**: Phasing out of coal implies coal mine and power plant closures in coal communities, leading to significant economic and social consequences, such as unemployment, loss of economic activity, and a potential exodus of population. While transitioning to cleaner sources of energy is crucial to reduce greenhouse gas emissions and improve public health, it can result in a domino effect leading to a decrease in the local population, local economic activity, and future opportunities, including for new generations. To minimize negative impacts, avoid this trade-off, and ensure a net gain toward sustainability, governments can implement policies and programs, such as investing in new industries and infrastructure, creating new job opportunities in renewable energy projects, offering retraining programs, and involving local communities in decision-making processes to transition away from coal.
- **Ensure that initiatives to meet climate mitigation targets avoid adverse effects on energy security and affordability:** Closing coal plants and mines can pose a trade-off between environmental benefits and energy security and affordability. While transitioning to renewable energy can help reduce greenhouse gas emissions, it could lead to energy insecurity and

increased energy costs. The reliability and affordability of renewable energy are crucial considerations in ensuring energy security across Canada. For example, where there are valuable infrastructure options for renewable energy, such as wind and solar, it is essential to ensure that they are sufficient to meet the country's energy demands. Investing in energy storage technologies and smart grid infrastructure can help ensure the stability of the grid and address concerns about energy security while transitioning away from coal and switching to renewable energy. At the same time, careful and independent assessment of the economic viability of energy alternatives is crucial when transitioning away from coal.

- **Avoid displacing the burden of the energy transition away from coal to other regions and countries:** Fighting climate change and mitigating the effects of greenhouse gas emissions within the parameters of the Paris Agreement targets means there is a globally shared responsibility across countries. Avoiding the adverse climate, environmental and health impacts associated with coal-fired power, coal mining, and exports needs to be achieved without displacing these impacts to other regions and countries. While phasing out the use of coal power and mining can help reduce carbon emissions and mitigate adverse environmental impacts, importing or buying energy from other countries sourced from fossil fuels associated with climate change impacts, emissions, or pollution can lead to carbon leakage. In 2021, 72% of Canadian coal imports came from the United States and over half of the imports were used for electricity generation. Canada has also been a long-term coal exporter. The coal power phase-out in Canada needs to be completed ensuring the thermal coal imports and exports effectively cease. At the same time, provinces affected by the coal phase-out must guarantee energy security through replacing coal power with non-emitting energy sources, avoiding additional GHG emissions from other fossil fuel energy generation (e.g., oil and gas) in these provinces or imported from elsewhere. The displacement of carbon emissions to other regions and countries may undermine the positive impacts of Canada’s climate actions. Thus, Canada needs to work collaboratively across provinces and with other countries to ensure that the transition to cleaner energy sources is not shifting environmental, health and GHG emissions burdens to other regions. Promoting renewable energy and developing supporting policies to encourage a global and shared effort to reduce carbon emissions is a fundamental step.
- **Avoid negative social and ecological impacts from new energy sources:** The closure of coal plants and mines yields benefits such as cleaner air and water, lower greenhouse gas emissions, and improved public health. However, constructing new replacement energy infrastructure such as wind farms and solar power plants can cause harm through habitat loss, community displacement, and environmental injustice to affected groups, including Indigenous communities. Careful collaborative deliberations and recognition of the rights of affected communities, including Indigenous peoples, need to be at the core of the decision-making process for new energy substitutes. Further, investing in sustainable energy solutions with

community ownership and equitable benefit sharing can mitigate negative effects and enable a shift towards a low-carbon future.

- **Ensure democratic and participatory governance while developing timely responses to climate mitigation needs:** Engaging with affected stakeholders early in planning the transition away from coal is crucial to give communities an active and effective voice in deliberations and decision-making about future steps for the affected regions. Involving communities, workers, and businesses in identifying the challenges and opportunities of transitioning to alternative energy sources and in developing strategies to support them during the transition is fundamental to phasing out coal while also ensuring a just transition. Because this process can be time-consuming and face political pressure for quick responses, ensuring participatory and democratic governance in the energy transition needs to be well-adjusted to the ongoing demand for timely carbon emissions reductions and remaining within the 1.5°C temperature increase.

8.8 Conclusions

In conclusion, this chapter has presented a sustainability-based assessment framework for the coal phase-out policy in Canada aligned with just transition considerations. The country's coal power phase-out movement has been rooted in climate change mitigation concerns, with a federal regulation aimed at eliminating coal-fired electricity generation by 2030 although also taking into account just transition efforts. Throughout the coal phase-out policy development, the focus has been on achieving greenhouse gas emission reduction targets while aiming to mitigate adverse impacts for affected communities and workers. Efforts to address just transition issues were exemplified by the Task Force on Just Transition, which was established to listen to stakeholders' concerns and provide recommendations but has since been dissolved, and various entities, and regional agencies have been involved in supporting the transition through funding and programs for affected communities. However clear governance mandates and accountability was not part of the coal phase-out development until a recent “Sustainability Jobs Act” was approved by the Federal government in 2023 (not focused on coal phase-out impacts in particular but in a broader context of energy transition). Additionally, the government has taken steps to address thermal coal mining and align it with climate change commitments.

The chapter explored a sustainability-based assessment framework specified to the Canadian case, identifying key contextual elements and potential trade-offs that need further consideration. Ultimately, this framework provides a foundation for more advanced future assessments of Canada's coal power phase-out policies and their application, keeping in mind the paramount importance of sustainability and a just transition for all stakeholders involved.

CHAPTER 9. Conclusions

9.1 Summary of the thesis

This research aimed to create and apply a framework to assess how policies for phasing out coal can be developed to positively contribute to sustainability. The main objective was to identify essential sustainability-based assessment criteria to facilitate better decision-making, leading to favorable long-term outcomes and lasting well-being for communities in harmonious relationship with the environment.

To achieve this goal, I apply Gibson et al.'s (2005) framework for sustainability assessment. Gibson's framework is well recognized for its integrated approach to sustainability-based decision-making and has been successfully applied to different projects and research work related to the energy sector in the past (e.g., Gaudreau, 2013; Winfield et al., 2010; Aguilar Vargas, 2023).

The primary theoretical contributions of this thesis revolved around building on Gibson et al.'s framework, to develop a framework specifically tailored to coal phase-out policies. This sustainability-based framework was built on fundamental issues explored in the literature review throughout chapters 2 and 3, including next-generation assessment (particularly the framework by Sinclair et al. (2022) discussed in section 3.4), strategic assessment (especially considerations in section 3.3.2), transformations and sustainability transitions (e.g., regarding work by Patterson et al. (2017) and Patterson et al. (2018) in section 3.5), and climate change mitigation with specific attention to coal phase-out strategies and cases (discussed in sections 2.2.1, 2.3.2, 2.3.3, 2.4).

The framework for coal phase-out also aims at the following sub-objectives, which are connected to the main criteria as follows:

(1) Developing a sustainability-based assessment approach for coal phase-out policy suitable for a world marked by uncertainty, dilemmas, and trade-offs (e.g., ensuring climate change mitigation objectives align with socio-ecological system integrity and social justice during coal phase-out).

(2) Formulating guidelines to define the characteristics of an appropriate and constructive decision-making process for coal phase-out (e.g., promoting transparency, accountability, long-term monitoring mechanisms, social dialogue, democratic governance throughout the transition).

(3) Combining the outcomes of the research and framework development into a distinct, integrated and comprehensive set of sustainability criteria specified for coal phase-out policies and initiatives.

The framework was specified and tested through the application to the Canadian case study (federal and provincial coal phase-out policy and associated just transition initiatives). The case study not only provides valuable insights on its own but also helps to refine sustainability-based assessment criteria particularly focusing on sustainable and just transition outcomes for coal phase-out processes.

The primary focus of the specified framework and case study has been to examine particular government policies and initiatives, at both the national and local levels, that are directly relevant to

coal phase-out for climate change mitigation (e.g., policy commitments to phase-out coal fired power in the federal and provincial jurisdictions) and just transition in coal phase-out (e.g., programs for re-skilling workers, funding for affected coal workers and local economic development in coal communities, governance structures to tackle the transition away from coal). However, it is clear that the range of policies that may affect just transition and climate change in the context of coal phase-out is likely to be much wider. In this setting, while recognizing that the research cannot cover all potentially influential policies and programs due to time and other limitations, the thesis intends to serve as an initial exploration, drawing important insights from the limited range of directly relevant policies it has analyzed and developing a basic framework for policy evaluation. This foundational work could then pave the way for more extensive and ambitious research in the future.

9.1.1 Answering the research questions

This thesis work has collected and integrated key insights from the literature to address the three research questions formulated in Chapter 1, with a specific focus on sustainable outcomes deriving from coal phase-out policy. These research questions were developed in response to growing socioecological concerns (e.g., unemployment, lower income in coal dependent communities, lack of opportunities) arising from closure of coal-fired power plants and coal mines, which can be considered instrumental for climate change mitigation although setting out significant challenges for equity and social justice outcomes.

As discussed in chapter 1, this thesis draws on the following foundational areas of knowledge: climate change mitigation, sustainability assessment, transformations towards sustainability and just transition. This section aims to present how the main findings from this thesis have contributed to answering the three research questions established in Chapter 1.

Three central questions guided this research and are explained below:

1. What specific requirements are needed to ensure a coal phase-out policy is aligned with contributions to sustainability, with particular attention to climate change mitigation and just transition?

This question was answered following a series of steps. Firstly, a comprehensive literature review was conducted to extract insights from existing research on climate change mitigation with particular focus on coal phase-out policies and past and current experiences from different jurisdictions; sustainable development and sustainability-based assessment requirements, and just transition. Key issues were then identified, encompassing areas such as climate targets, socioeconomic considerations and social equity, job creation, community development and engagement, among others. Social equity and just transition strategies were particularly relevant to develop requirements focused on mitigating negative impacts and promoting positive contributions for affected communities and workers through training, financial and infrastructure (including government) support, economic diversification, and alternative employment opportunities. Also, stakeholder engagement and governance requirements emphasized community involvement in policy development and decision-making, monitoring for

progress tracking, and interjurisdictional collaboration. The Canadian case was also instrumental to test the application and specification of the framework, offering insights from real-world experience. Lastly, the synthesis and conclusion emphasized interconnectedness of the requirements for a sustainable approach to coal phase-out, highlighting climate change mitigation and just transition objectives, thoroughly exploring the research question.

2. *What can be learned from coal phase-out experiences already implemented globally in terms of strategies and tools applied, challenges, barriers and drivers for coal phase-out?*

The research question seeks to learn from global experiences of coal phase-out, focusing on strategies, tools, challenges, barriers, and drivers involved. To answer this question, multiple case studies from various regions or countries where coal phase-out has already been implemented were analyzed (sections 2.4 and 2.4.1) and summarized in section 2.4.3. This analysis examined strategies and tools employed, as well as the challenges faced by these jurisdictions, along with and the driving factors behind the decision to phase out coal (section 2.4.4). During coal phase-out, addressing environmental impacts, transitioning to cleaner energy, economic challenges for coal-dependent regions, social equity through just transition, and ensuring energy security were key sustainability issues identified in Chapter 2. Insights from academic literature and real-world experiences also emphasized strategies such as supporting policies for economic transition, retraining coal workers, energy security and promoting diversified, sustainable energy sources. The considerations discussed particularly in Chapter 2 can provide valuable insights for policymakers and stakeholders planning or considering coal phase-out initiatives, pointing out identify common concerns and lessons learned with potential implications for future research and policymaking in this area.

3. *How can the characteristics of the Canadian design and implementation of coal phase-out policy inform the construction and application of a sustainability-based framework for planning, assessing, and implementing national coal phase-out policies?*

By examining the Canadian experience as a case study and applying the framework within this context, strategies, challenges, and outcomes associated with coal phase-out. Through a comprehensive analysis of the Canadian coal phase-out policy instruments addressed in this thesis (in chapters 6 and 7), this research aimed to extract key lessons and considerations that can inform the development of a robust sustainability-based framework. The Canadian coal phase-out experience emphasizes the need to pursue long-term sustainability by prioritizing renewables over other fossil fuels while avoiding short-term economic disruptions. Effective policies should mitigate immediate socioeconomic impacts and ensure energy security and affordability during the transition. Careful consideration is required to prevent shifting burdens to other regions such as through imports or exports of energy from fossil fuels. Also, collaborative decision-making within jurisdictions, recognizing Indigenous rights, and community-owned solutions, as well as early stakeholder engagement and participatory governance are crucial for a just transition that aligns with climate goals while maintaining democratic processes. These characteristics were the basis for the specified criteria, resulting in a comprehensive sustainability-based framework for planning, assessing, and implementing coal phase-out policy within the Canadian

context. It is essential to recognize that governance issues such as interjurisdictional collaboration, clear mandates and accountability for governance bodies were issues included in the preliminary core categories and criteria through iterations between each research step, being illuminated by the analysis of the Canadian case.

Furthermore, the application of the sustainability-based framework in the Canadian context provides an opportunity to assess its applicability, effectiveness, and adaptability. By evaluating how the framework interacts with the unique socio-economic, environmental, and political dynamics of Canada, this research contributes to the development of a tool for future coal-phase-out initiatives in the country and to guide other jurisdictions in coal phase-out policies prioritizing sustainability outcomes, provided that the framework is specified for the case and context of the jurisdiction in question.

In conclusion, this thesis has synthesized valuable insights from the literature review and official documents research to address the research questions within the context of coal phase-out. The findings highlight the importance of a holistic and collaborative approach to effectively transition away from coal towards sustainable alternatives, while considering the social and ecological dimensions to ensure a viable and promising future with lasting well-being.

9.2 Summary of the sustainability-based assessment framework for coal phase-out policy

The sustainability-based assessment framework for coal phase-out policy is a comprehensive and structured approach aimed at guiding decision-making towards a sustainable transition away from coal. This framework encompasses five key categories, each with specific sub-components (criteria):

- **Socio-ecological system integrity and compliance with fundamental climate change mitigation objectives (C1):** focuses on ensuring the transition aligns with fundamental climate change mitigation goals. It emphasizes achieving climate targets, preparing communities for long-term climate resilience, and adopting energy sources that promote a healthy environment. Additionally, it stresses the importance of energy security, ecological system preservation, and restorative justice through responsible decommissioning and site restoration.
- **Livelihood sufficiency, affordability, equity and opportunity (C2):** addressing the social dimension, this category emphasizes the equitable distribution of benefits and opportunities. It highlights providing displaced workers with comparable or improved livelihoods, facilitating their transition to environmentally friendly industries, and respecting workers' rights. Furthermore, it highlights the importance of maintaining community well-being, avoiding negative impacts on affected populations, and ensuring future generations' rights.
- **Social dialogue, participatory decision-making, and democratic governance (C3):** focuses on inclusive decision-making processes that involve stakeholders, particularly workers and marginalized groups. It emphasizes open consultations, gender equality, indigenous community rights, and the establishment of partnerships for a sustainable regional economy. The framework emphasizes

long-term participation and consensus-building, ensuring diverse perspectives contribute to the transition process.

- **Adaptability, precaution and monitoring for long-term sustainability (C4):** focuses on long-term planning, continuous monitoring, and adaptability. It stresses assessing energy justice, long-term focused planning and accountability systems for progress tracking. The application of the precautionary principle is emphasized, along with avoiding decisions that could lead to fossil fuel dependence or path dependency and carbon lock-in.
- **Governance accountability, inter-jurisdictional collaboration, and government support for the just transition (C5):** This criterion highlights the importance of effective governance and collaboration across different levels of government. It stresses clear mandates, integrated objectives, and supportive policies implementing supporting policies to maintain the viability and reliability of the transition process. It also emphasises prioritizing impacted communities in clean energy programs and maintaining a coordinated governance approach to ensure a just and successful transition.

Overall, the framework offers a robust and comprehensive set of criteria to guide decision-making and ensure that the coal phase-out policy contributes positively to sustainability and a just transition away from coal.

9.3 Summary of findings from the case applying the framework

In this section, we provide a summary of the findings derived from the application of the framework within the context of the Canadian case study. The case study not only validated and expanded upon the preliminary framework criteria established through the literature review but also shed light on unique considerations and dynamics specific to the Canadian coal phase-out context.

Interjurisdictional approach and collaborative governance

The analysis of the relationship between provincial and federal jurisdictions in the Canadian case confirmed the significance of a multi-level governance and collaborative approach in navigating the coal phase-out. While this approach was recognized in previous cases explored in chapter 2 (e.g., , the Canadian case highlighted its exceptional importance. The relationship between provincial and federal authorities served as a focal point for defining and refining the core principles and criteria of the framework (especially category C5). The consolidation of multi-level governance as a requirement within the framework with specific criteria highlights the need for synchronized efforts, transparent communication, and shared responsibilities among different levels of governance to ensure a cohesive and effective coal phase-out strategy.

Engagement of affected communities and stakeholders

The relevance of engaging affected communities and stakeholders, a key consideration highlighted in the preliminary framework criteria based on the literature review, gained dimension and emphasis within the Canadian context. Beyond the general importance of involving communities in decision-making and assessment processes, the Canadian case illuminated the significance of respecting

and recognizing indigenous rights and sharing governance responsibilities. The case study revealed that meaningful engagement must extend beyond consultation, requiring a commitment to genuine collaboration and partnership-building, particularly with indigenous communities, for a just and inclusive transition.

Path dependency and transition fuels

The Canadian case study offered valuable insights into the varying responses of different jurisdictions to coal phase-out. It highlighted the potential challenges posed by the heavy reliance on natural gas as a bridge fuel, potentially leading to new dependencies on fossil fuels and carbon lock-in. This aspect further accentuated the need to not only understand coal's contribution to climate change but also to recognize and plan for the specific transition trajectories that jurisdictions may undertake. The contextual variations in energy landscapes, as exemplified by the European energy crisis after the Russian war discussed in chapter 2, highlight the need for tailored and context-specific strategies that account for vulnerabilities and potential energy supply disruptions.

Vulnerability of coal communities and sustainable transition

The Canadian case reaffirmed the vulnerability of coal mining and coal power communities, emphasizing their deep cultural ties to coal and limited economic diversification. The necessity to address this vulnerability was consolidated as a crucial criterion within the framework. The case study highlighted the significance of comprehensive support measures beyond job creation, including community infrastructure support, economic diversification and planning, and restoration efforts in response to mine closures. The framework emphasizes the importance of safeguarding the well-being and resilience of these communities as an integral component of the coal phase-out strategy.

Establishment of specific governance bodies and accountability

A recent development in the Canadian case was the introduction of the Sustainable Jobs Act, which represented a notable step forward in establishing specific governance bodies to oversee the transition and monitor progress. Although still facing some criticism, this development highlighted the dynamic nature of policy evolution and the potential for institutional arrangements to strengthen the implementation of coal phase-out transition strategies. The case study emphasized that establishing dedicated governance bodies with clear mandates can enhance coordination, accountability, and the effective execution of transition initiatives.

In conclusion, the application of the framework to the Canadian case study not only validated and expanded upon the preliminary criteria (based on Gibson et al. (2005) sustainability-based assessment framework and insights for the literature review covered in chapters 2 and 3) but also introduced context-specific considerations that enrich the framework's applicability (e.g., through application and testing in the Canadian case). The case study highlights the need of collaborative multi-level governance, proactive and inclusive engagement, effective climate transition pathways, community support, and responsive governance structures in formulating coal phase-out policies. These

findings collectively contribute to the strength of the framework and provide guidance for developing strategic approaches to climate change mitigation, particularly to coal phase-out.

9.4 Implications for developing strategic approaches to climate change mitigation, particularly for coal phase-out policy

The insights gained from this thesis have significant implications for the development of strategic approaches to climate change mitigation, particularly in the context of coal phase-out policies. As the global community struggles with the urgent need to restrict greenhouse gas emissions and address the impacts of climate change, the findings of this research provide valuable guidance for producing applicable and comprehensive strategies.

One of the central implications lies in the formulation of coal phase-out policies that go beyond GHG emissions reduction targets. The multidimensional approach illuminated by this research emphasizes the importance of integrating various dimensions of sustainability, encompassing not only environmental aspects but also social and economic considerations, with particular attention to equity and just transitions. By recognizing the interconnectedness of these components, policymakers can design and implement coal phase-out policies that prioritize the well-being of communities, workers, and ecosystems directly affected by the transition. The inclusive approach developed in this research ensures a just transition for all stakeholders and aims to minimize potential socio-economic disruptions while reducing trade-offs.

Moreover, the research addresses the critical role of diversification in energy solutions and innovation in achieving a successful coal phase-out. The insights from this thesis highlight the significance of advancing renewable energy technologies and energy storage solutions. By investing in research and development, policymakers can accelerate the development of cleaner alternatives and facilitate an effective transition away from coal avoiding new carbon lock-ins.

Furthermore, this research emphasizes the need for collaboration and engagement among diverse stakeholders in shaping and implementing coal phase-out strategies. By fostering partnerships between governments, industries, civil society organizations, and local communities, a collective effort can be used to manage the transition. This collaborative approach not only enhances the feasibility of policy implementation but also encourages a sense of ownership and shared responsibility, therefore increasing the likelihood of successful outcomes.

Future applications of this framework in strategic assessment would require consideration of alternative options for phase-out initiatives (packages of plans, policies and programs, etc.) and application of process features stated in the next-generation assessment framework (section 3.4) by Sinclair et al. (2022).

9.5 Implications for developing a set of guidelines for coal phase-out policy development

The sustainability-based assessment framework for coal phase-out policy presents valuable implications for policy development, monitoring and improvement in the transition away from coal. Policymakers can use this framework to develop comprehensive guidelines that address the complexities of the phase-out process.

Firstly, the framework highlights the importance of aligning the transition with climate change mitigation objectives (C1), encouraging policymakers to prioritize climate targets, ecological preservation, and responsible decommissioning of coal mines and coal-fired power units. Secondly, it emphasizes the need for equitable distribution of benefits and opportunities (C2), urging policymakers to focus on supporting affected communities and workers during the transition to sustainable livelihoods. Thirdly, the framework emphasizes the significance of inclusive decision-making and social dialogue (C3), advocating for stakeholders' involvement and consensus-building to ensure diverse perspectives contribute to the policy and program development process. Moreover, it emphasizes long-term planning and adaptability (C4), which should guide policymakers to continuously monitor and assess the transition's progress, while avoiding any decisions that could lead to fossil fuel dependence. Finally, the framework stresses effective governance and inter-jurisdictional collaboration (C5), encouraging policymakers to establish clear mandates and supportive policies across different levels of government. By implementing guidelines based on this framework, policymakers can pave the way for a just, sustainable, and successful phase-out of coal.

The sustainability-based assessment framework for coal phase-out policy is a comprehensive and structured approach designed to facilitate a sustainable transition away from coal. The framework encompasses five key categories: (1) Socio-ecological system integrity and climate change mitigation objectives, (2) Livelihood sufficiency, affordability, equity, and opportunity; (3) Social dialogue, participatory decision-making, and democratic governance; (4) Adaptability, precaution, and monitoring for long-term sustainability; and (5) Governance accountability, inter-jurisdictional collaboration, and government support. This framework may serve as a valuable tool for policymakers, offering a set of comprehensive criteria to guide policy development and ensuring that the coal phase-out policy, programs and initiatives lead to a just and sustainable transition away from coal.

9.6 Implications for the usefulness of the framework and its specification

The implications for the usefulness and specification of the framework are significant, as they demonstrate both its applicability and its limits in guiding a sustainable coal phase-out.

The case study employed to illustrate the framework specification serves a crucial role, not as a means of establishing generalization, but as a method of testing and demonstrating its value within the context. Through the application of a case study, the framework is illustrated and tested, confirming its practical value in guiding the transition away from coal in this particular case. It is essential to note that

while the framework proves to be useful here, its generalization to all cases should be approached with caution. The case study methodology is employed solely for illustration and testing purposes, not to establish universal principles, ensuring the framework's usefulness and relevance remain within this specific context. This careful approach avoids overgeneralization.

While its direct application might be best suited for the current case, the underlying principles and categories could potentially serve as a template for others aiming to address diverse sustainability challenges. This approach emphasizes that while the framework is indeed a valuable and illuminating tool for its intended purpose, the applicability of the framework in different contexts requires thoughtful consideration, specification, and adaptation.

9.7 Areas for further research

To enhance the comprehension and application of the sustainability-based framework for coal phase-out, several research opportunities can be explored. One potential path involves extending the framework's applicability to different jurisdictions, such as other countries or regions, to assessment its adaptability and problem-solving capabilities in diverse contexts. It could also provide a comparative approach in the application to different jurisdictions.

Additionally, conducting direct interviews and discussions with individuals and communities impacted by coal phase-out could provide valuable insights. By engaging in conversations and requesting input, researchers can gain a deeper understanding of real-world experiences, concerns, and suggestions, ensuring that the framework accounts for practical needs and scenarios.

Further development of the framework could encompass examination of a broader range of policies and other strategic level initiatives that are likely to have important through indirect effects on coal phase-out and just transitions. Also useful would be integration of specific measurement indicators to assess its effectiveness and progress. This approach would allow for continuous evaluation and adjustment, providing a clearer picture of the framework's impact and the potential need for modifications.

Moreover, exploring the application of the framework to different types of coal phase-out, such as metallurgical coal (going beyond the application of this research focused on thermal coal power and mining), presents another opportunity for investigation. By studying how the framework aligns with the unique characteristics of this coal type, researchers can expand its applicability and relevance.

Finally, further investigation of specific trade-offs in the Canadian context of coal phase-out could provide more insights for application in sustainability-based assessment initiatives.

Research findings in these areas may enhance the framework's usefulness, advancing a more comprehensive understanding of coal phase-out dynamics and their implications.

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