Carbon Tax: Moving Towards a Net-Zero Emissions Future

Tanushree Ajmera[1] and Dr. Vivek Nemane[2]

ABSTRACT

In the wake of the 21st century, climate change has emerged as the biggest life-threatening challenge with a potential of evolving into the largest, if not the most complex, economic opportunity since the industrial revolution. While narrowing down its focus to carbon tax as a regulatory fiscal aspect of international economic law, this article explores the potential role of the tax in moulding this economic opportunity in line with the commitments assumed by countries under the 2015 Paris Agreement. The issue is whether imposition of carbon tax or restructuring tax rates can have a significant impact in regulating carbon emissions by rationally pushing consumers, investors, and producers, towards an environmentally sound direction. To answer this, the article investigates three carbon-tax implementation case studies; British Columbia, South Africa, and the revision of European Union Energy Taxation Directive in the context of aviation, with the aim to explore the scope of contributing factors – from adequate tax rate determination to optimum tax revenue use – in successfully curbing carbon-based emissions. Drawing upon the policy-efforts of the countries in the case studies, the challenges and the solutions, the article proposes a suggestive policy model of carbon-tax in the wake of COVID-19 pandemic, as the way forward in ensuring global carbon-neutrality.

Keywords: Carbon Tax; International Economic Law; Paris Climate Agreement; Climate Change; COVID-19; British Columbia; South Africa; European Union Energy Taxation Directive.

* DOI: https://doi.org/10.18601/01236458.n57.07

1 5th year student at Symbiosis Law School, Pune, Symbiosis International University (India); ajmeratanushree@gmail.com

2 Assistant Professor at Symbiosis Law School, Pune, Symbiosis International University. E-mail: (India), PhD, vivek.nemane@symlaw.ac.in

INTRODUCTION

Acknowledging the damaging effects of anthropogenic emissions on climate, the United Nations conducted the Paris Climate Change Conference (PCCC) in 2015 and under its aegis released an agreement to legally and fairly bind countries to contribute towards sustainable future.[3] Adopted on December 12, 2015, the Paris Agreement has 195 signatories and 193 parties, including the major greenhouse gases (GHG) emitters, such as the United States, India, China, European Union, Canada, Russia, and Japan which together account for over 62.75% of the total GHG emissions (Friedrich *et al.*, 2020). The Paris Agreement prescribes economic transformation at the financial and policy level to set a limit on the rise of global temperature well below 2 degrees Celsius at pre-industrial levels, the background target remaining 1.5 degrees Celsius (Burns, 2016). To accommodate the predicted direction of future economic growth of countries, the Agreement inculcates mitigation plans aimed at curbing carbon emissions and industrial pollution with optimum technological, administerial, and financial measures.

This article examines carbon tax as one such measure capable of assisting countries in achieving their emission reduction targets in line with their development goals. This study becomes necessary due to (a) the aggrandizement of the need of investment in low emission economy by the Paris Agreement through its GHG emission reduction targets of net zero by 2050 and 50% by 2030, and (b) the salient role of private investors in fuelling the shift to low emission economy. It builds on the premise that carbon tax is a fiscal policy tool which has the potential to internalise environmental and social costs. Working on the economic principle of externalities, carbon tax sets an exact price on carbon by specifying a tax rate on GHG emissions or on the carbon amount found in fossil fuels.

The article hypothesises that the carbon tax can induce economic behavioural changes in the favour of decarbonization. To this end, it argues that financial cost incurred in emissions reduction efforts does not act as a threat to economic growth. Further, to promote the role of fiscal policy actions in shaping the future of International Economic Law, the article, at the outset, evaluates and compares the existing carbon taxation frameworks by tracing the trajectory of three major case studies.

First, the Canadian province of British Columbia's successful implementation of carbon tax, covering around 70% of provincial GHG emissions. Second, the South Africa's carbon tax focusing on emissions from processes in the industrial, power, building and transport sectors. Third, the alignment of the European Union Energy Taxation Directive (EUETD) that creates the community framework for levying

3 The Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104. https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

taxes on energy products used as aviation fuels, motor fuels and electricity with the EU 2050 carbon-neutral ambitions, so as to rectify the error of imposing unfair challenging burden on other industries in the transportation sector. It does so with the underlying objective to study the various purposes of carbon taxation, including internalisation of social and environmental costs, regulation, and control of GHG emissions, abatement of emissions in the case of commercial aviation, and investment in green innovation.

Upon reaching a tabled efficacy assessment of the three carbon taxation frameworks, the article then incorporates into discussion the possible impact of the current COVID-19 pandemic on the taxation regimes across nations. It advocates that the idea of restructuring tax rates is especially appealing in the ongoing pandemic scenario which has pushed governments to implement unprecedented fiscal policy actions. It is an opportunity for governments to cushion the blow of the pandemic and advance structural reforms towards low-carbon transition. To this end, the article finally proposes a carbon-tax policy parameter model to ensure balanced implementation of the tax in COVID-19 recovering, globalised and digitalized economies, and closes with a conclusion.

RESEARCH METHODOLOGY

This article conducts comparative legal-economic research of carbon taxation regulations, spanning across three jurisdictions. Following the evaluations of the strengths and weaknesses of the said fiscal policy frameworks, it devises a model framework capable of being globally adopted, in a streamlined manner, to assist the Paris Agreement carbon-neutral efforts. To this end, in this conceptual study, the authors scrutinise the existing peer-reviewed literature or credible secondary sources to showcase the positive potential role of carbon tax in reaching GHG emission reduction targets of 2030 *vis-à-vis* 2050. The research aims to contribute to ascertaining an unbiased break-even analyses of the three regulations as the way forward in tackling the global carbon footprint which is set to increase one-fifth by 2050.

LIMITATIONS OF THE RESEARCH

The overall objective of the research is to study carbon tax, as a GHG emissions reductions measure, along with its various purposes. It attempts to offer a fiscal policy action solution on the lines of tax reform to assist the global carbon-neutral efforts, as set in legal terms through the Paris Agreement. To this end, the narrow scope of the research may also be construed as its one possible limitation. As carbon tax is only one of the measures capable of assisting the GHG emissions reduction efforts, the extent of its impact on reaching the net-zero target is restricted due to issues, such as affordability, absence of global consensus and time sensitive implementation.

Nevertheless, in comparison to other policy instruments, carbon pricing continues to create a greater incentive for countries to switch to low-carbon alternatives with the help of climate policy packages. Therefore, for the simplification of the complex possible solutions to the issues highlighted under the Paris Agreement and to explore and evaluate the competence, impact, importance, and potential of fiscal reforms in-depth, the authors deemed it necessary to focus on the solution i.e., carbon tax . Building on the findings of this article, further studies may be conducted to examine other possible measures in consonance with carbon tax. Hence, for countries starting off with a low carbon price, this would assist in projecting an amalgamation of successful measures into a framework capable of reaching the GHG emissions reduction targets of 50% by 2030 and net-zero by 2050.

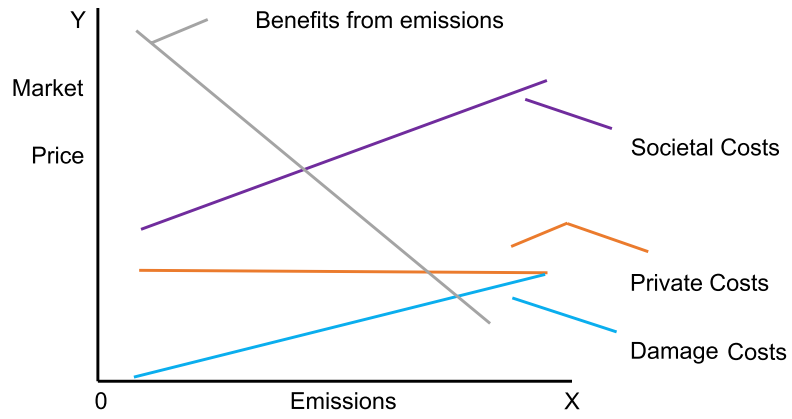
THE CONCEPT OF ENVIRONMENTAL TAXES PRICING *VIS-À-VIS* CARBON TAX

Organisation for Economic Co-operation and Development (OECD) estimates that to meet the 2 degrees Celsius target, emissions must be limited to 24 gigatons of CO_2e in 2050, however, based on the current action, the emissions are predicted to reach 82 gigatons of CO_2e in 2050 (OECD, 2013, p. 8). The aim is to either make such actions undesirably expensive or promote environmentally sound behaviour. Environmental policy instruments can be broadly categorised into market-based and non-market-based. While the former as fiscal tools can be further classified into revenue-based instruments and subsidies, the latter include command and control regulations and awareness initiatives. Taxes, charges and fees which are price-based instruments along with quantity-based instruments form part of the larger head i.e., revenue-based instruments (Schratzenstaller, 2021, p. 2).

Environmental taxes are fiscal tools that measure any action that can have a negative impact on the environment against a monetary charge (Eurostat, 2013, p. 9). It must be noted that environmental taxes have for decades been playing an imperative role in the overall environment-friendly policies. The idea behind the imposition of these taxes is simple, target and hold the individual responsible for environmentally unsound activities accountable for his actions (Metcalf, 2019, p. 410). The tax rate is determined as per the societal damage caused due to such activities, hence, has a direct effect on pattern consumer shift to low-emissions alternatives (Wang *et al.*, 2019).

The indirect result of the green tax can be observed through the quantities of emissions controlled or reduced. The price set on the environmentally damaging activity invariably affects the quantity of carbon released in the atmosphere (European Commission, 2020). The production of a commodity includes, along with private costs, damage costs. For a consumer, based on his purchase power, choosing a particular commodity over another is determined by comparing the benefits with costs. A green tax, however, brings an additional societal damage cost to the private cost (European Environment Agency, 1996, p. 15). In regard to carbon emissions, this tax rate is perceived as the carbon price.

FIGURE 1. THE THEORETICAL UNDERSTANDING OF ENVIRONMENTAL PRICING



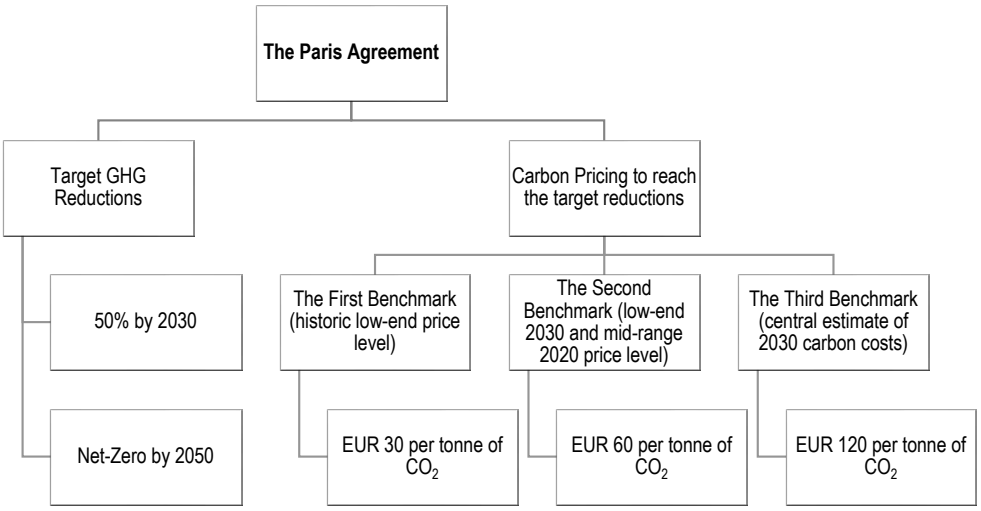
Source: Vollebergh (2012), Environmental taxes and Green Growth, The Hague: PBL Netherlands Environmental assessment Agency.

The societal costs associated with carbon prices are extremely volatile and uncertain. It is the cost imposed upon the consumer because of a transaction for which they have not been compensated or paid. To take the example of automobile industry, within the transportation sector, which heavily contributes to fossil fuel consumption, the private cost of driving a car includes fuel, depreciation, maintenance, and the driving time, whereas the societal cost incorporates the private cost as well as the cost forced on those (other than the operator) exposed to air pollution and other health risks resulting from the use of the car (Federal Reserve bank of San Francisco, 2002).

Overtime the full overview of associated societal costs is becoming clearer. The societal cost does not necessarily curb the effectiveness of carbon taxes, rather highlights the risks and threats of climate change (OECD/IEA/NEA/ITF, 2015, p. 30). A tax that associates and labels a price on these side effects or negative externalities, is much needed in the integration of environmentally efficient policies with economics (Pearce, 1991). In a scenario where societal costs cannot be accurately calculated carbon tax may be, i) roughly estimated on the principle of climate-change-cost internalization (Pindyck, 2013b); or ii) based on an emissions reduction target set in the policy decision (Marron, 2014).

Once the social cost is determined, the goal is then to incorporate this price as a fiscal intervention to increase the price of a certain activity or a certain cross-sector use, for instance, the use of fossil fuel, to reduce carbon emissions (Stern & Stiglitz, 2021). The design of a carbon tax may vary from jurisdiction-to-jurisdiction, depending upon the political motives, public opinions, policy instruments, and climate change awareness.

FIGURE 2. FUTURE PROJECTIONS & IDEAL CARBON PRICING



Source: Self (2022)[4]

THE CASE FOR CARBON TAXATION

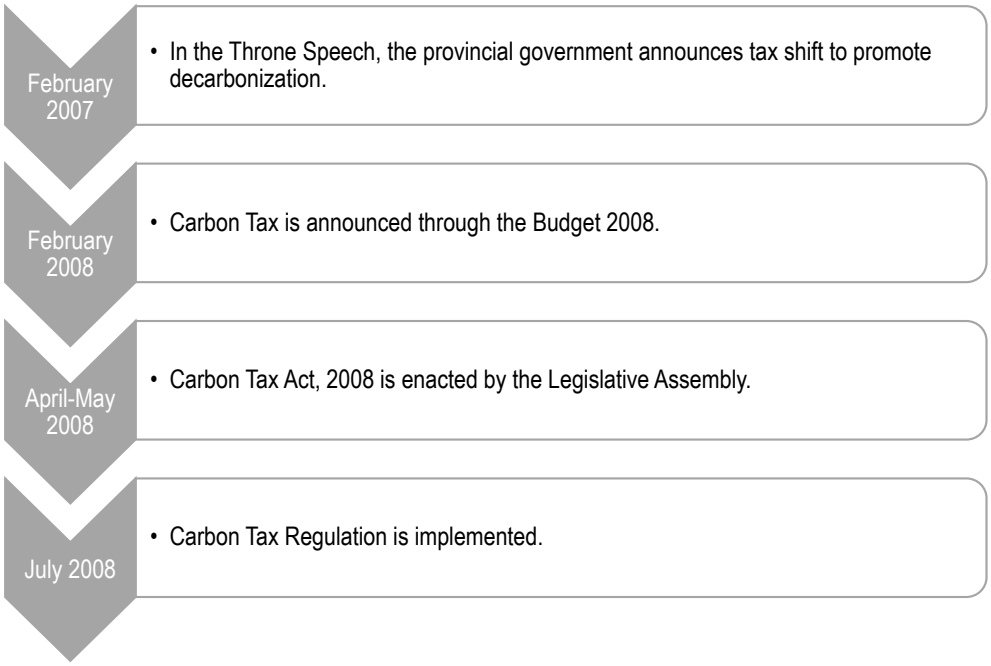
Explicit carbon pricing is a relatively new concept, hence, to further understand the optimum modelling of a carbon tax that coincides with the urgent need of reducing the carbon footprint, this section aims to analyse the policy success and failures of carbon taxation through three case studies. The case study of British Columbia investigates the ingredients responsible for the relative success of carbon taxation policy framework, which has been in place in the region since 2008, whereas the South African case study focuses on the pricing and execution shortcomings of the recently implemented framework of 2019. The former would offer an evidence-based tax policy approach on long-term implementation strategy, such as annual reporting and gradual tax rate increase. The latter shall help understand the consequences of implementing a weak carbon tax policy initiative in the context of a developing country, especially concentrating on the lacunae, risks and solutions therein. Considering the massive carbon footprint of the airline industry, the EUETD case study, while highlighting the debate on fair and unfair tax policy, critically analyses the limited scope of green taxation in fostering the switch to low-carbon aviation fuel alternatives. The authors criticise the shift of the tax burden on the consumer.

4 For figurative depiction of Future Projections and Ideal Carbon Pricing, the authors have relied on the information provided in OECD (2021).

THE BRITISH COLUMBIAN CARBON TAX

British Columbia is a province of Canada, where a rigorous climate-policy effort was enforced in 2008 to reduce GHG emissions by 40% below 2007 levels by 2030, 60% by 2040 and 80% by 2050 ("Climate Change – Province of British Columbia", 2021). As part of a wider set of tax developments, a coordinated broad-based carbon tax, the first of its kind in North America, was enacted to cover almost 70% of the total GHG emissions within British Columbia ("British Columbia's Carbon Tax – Province of British Columbia", 2021).[5] The carbon tax applies to the purchase and use, including non-combustible use, of fuels, such as diesel, gasoline, heating oil, natural gas, propane, and coal (Ministry of Finance Tax Bulletin, 2021). The carbon tax rate starting at $10 Canadian Dollar (CAD) per metric ton of CO_2 and increasing by $5 CAD per year, as of April 1, 2021, rose from $40 CAD to $45 CAD and is scheduled to increase to $50 CAD on April 1, 2022. Further, in order to bring emissions in line with the limit of 2°C in temperature rise, the tax rate shall reach $170 CAD in 2030 ("British Columbia's Carbon Tax – Province of British Columbia", 2021).

FIGURE 3. LEGISLATIVE HISTORY OF THE CARBON TAX



Source: Ministry of Finance (2016).

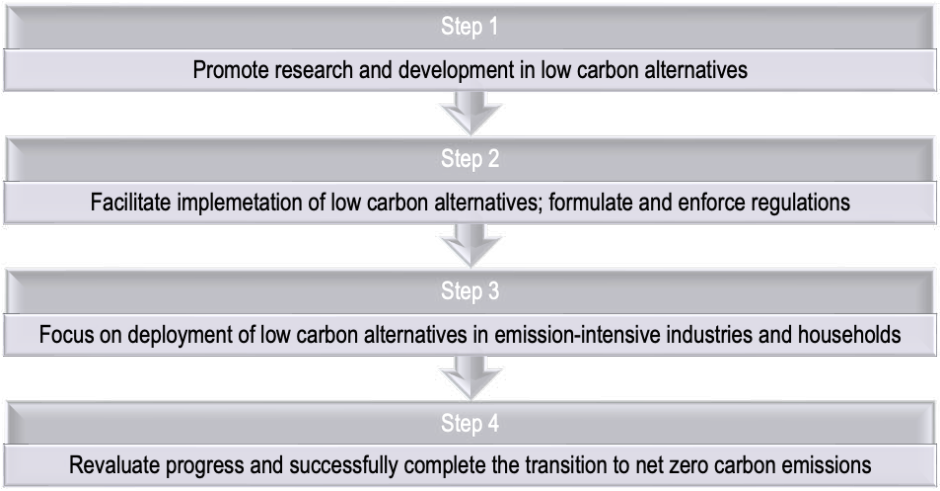
5 Carbon Tax Act 2008 (SBC) Chapter 40 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_08040_01

One of the core features of the carbon tax is to protect affordability to prevent any disproportionate effect on low-income households (World Bank Group & Agence Française De Development, 2019). The Revenue agency of Canada issues a low-income climate-action credit four times a year to offset the financial burden of carbon taxes on low- and middle-income households ("British Columbia's Carbon Tax – Province of British Columbia", 2021). In July 2020, the credit was increased to $174 CAD per adult and $51 CAD per child which reduces taxes by $450 CAD for a low-income family of four ("British Columbia's Carbon Tax – Province of British Columbia", 2021). Additionally, in its first year of implementation, all the residents of British Columbia were offered a one-time climate action dividend of $100 CAD (Metcalf, 2019).

Up until 2017, almost $1 billion CAD annual collection through tax was returned to individuals and businesses *via* tax rate reductions, grants, and other tax cuts to avoid an increase in the budget (Ministry of Finance, 2019). Approximately 60% of carbon tax revenues have contributed towards upliftment of businesses through rate reductions and credits, and the remainder have helped households (Bowen, 2015). Over time this positively improved the perception of the public towards the carbon tax, with approval rates reaching 65% by 2012 (Metcalf, 2015). Moreover, in 2018, the revenue neutrality requirement was eliminated to the extent to allow reallotment of additional revenue towards maintaining industry competitiveness and encouraging green initiatives, in addition to providing tax relief (World Bank Group & agence française de development, 2019, p. 6).

In a move towards placing a national price on carbon pollution, as of April 2019, the local governments of British Columbia are obliged to present a plan to price carbon emissions (Metcalf, 2019, p. 425). If a government fails to do so, the Canadian government shall have the authority to impose a tax at the rate of $20 CAD per metric ton of CO_2 (Thomas & Araral, 2020). It must be noted that so long as carbon tax is operative in the province, the federal tax shall not be imposed. Additionally, in the Clean British Columbia Roadmap to 2030 ("Roadmap to 2030", 2021), the carbon tax rate by 2023 is expected to be refurbished to meet or exceed federal carbon price requirements, albeit in consonance with household affordability ("Roadmap to 2030", 2021). The focus shall be on improving industry programs that facilitate not only innovation and adoption of low carbon alternatives but also needed business competition.

FIGURE 4. STEPS TO DEFINE INDUSTRY-SPECIFIC POLICY GOALS FOR REACHING NET-ZERO CARBON EMISSIONS



Source: Self (2022)[6]

Policy Analysis

The success and feasibility of the said policy can be assessed on mainly three components, *first* economic efficiency, *second* the reduction in GHG emissions, and *third* administrative feasibility. The fact that the carbon tax is not averse to economic growth is attributable to the use of tax shift. The carbon-policy specifically provides an economic incentive to body corporates, individuals, industries, and governments to reduce the fossil-fuel consumption (Lacroix & Richards, 2015).

The fiscal regime was designed to internalize environmental costs and facilitate behavioural changes with the end goal of protecting a resource system that provides climate regulation. The concept of revenue neutrality was inherently imbibed in the policy to prevent any overall increase in taxation, i.e., revenue raised from the carbon tax was used to offset other taxes as well assist disadvantaged households while imposing decarbonization incentives ("British Columbia's Carbon Tax", 2021). While the government collected $1.6 billion CAD in carbon tax revenues in 2020-21, it spent a total of $1.33 billion CAD on climate related initiatives. In fact, the 2021-22 budget forecast predicts the spending to increase to $1.46 billion CAD ("2021 Climate Change Accountability Report", 2021, p. 11). The economic impact of carbon tax has been exceedingly encouraging, in fact, it has been responsible for a major drop in per capita gasoline demand (Elgie, 2014).

6 For figurative depiction of Steps to Define Industry-Specific Policy Goals for Reaching Net-Zero Carbon Emissions, the authors have relied on the information provided in (Victor *et al.*, 2019).

From 2007 to 2019, the provincial economy grew by 30%, while a net increase of 2% was recorded in the GHG emissions, hence, the GHG emissions when considered in the context of a growing economy and increasing population, decreased in intensity by 19% ("2021 Climate Change Accountability Report", 2021, p. 7). The carbon intensity of the economy is calculated by aligning the provincial progress in reaching carbon reduction targets with the net GHG emissions. The GHG emissions per capita is measured by deducting afforestation and deforestation from gross emissions ("2020 Climate Change Accountability Report", 2020, p. 12). An increase in the percentage of GHG intensity decrease, from 16% in 2018 ("2020 Climate Change Accountability Report", 2020, p. 10) to 19% in 2019 ("2021 Climate Change Accountability Report", 2021, p. 7), positively hints towards the progress of the province in reaching decarbonization targets. From 2007 to 2019, the GHG emissions per person have fallen from 15.3 to 13.5 metric ton of CO_2 ("2021 Climate Change Accountability Report", 2021, p. 8), almost 34.5% lower than the Canadian average of 20 metric ton of CO_2 ("2020 Climate Change Accountability Report", 2020, p. 12).

Climate Change Accountability Act[7], 2007, formerly titled Greenhouse Gas Reduction Targets Act[8], prescribes a strict accountability framework with an independent advisory committee and mandatory reporting by the government to the public on the measures taken to forward the decarbonization efforts and manage climate change risks. Under the Act, the provincial government is also given the authority to set emission-cut targets for the provincial public sector organizations ("Climate action legislation – Province of British Columbia", 2021).

The annual accountability report is a transparent lens that provides a detailed window of information, from GHG emissions estimates to expected outcomes of climate actions, to track the progress of the province towards set targets. Additionally, considering the uncertainty surrounding the forecasting of the progress to targets, the report provides a range, as opposed to a fixed number ("2020 Climate Change Accountability Report", 2020, p. 13).

FIGURE 5. EVALUATING EFFECTIVENESS IN TERMS OF FULFILMENT OF THE OBJECTIVES OF THE REGULATION (BRITISH COLUMBIA)

Sr. No.	Objectives	Fulfilment Status
1.	Internalize social and environmental costs	Fulfilled
2.	Maintain Affordability through revenue neutrality	Fulfilled

7 Climate Change Accountability Act 2007 (SBC) Chapter 42 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_07042_01

8 Greenhouse Gas Reduction Targets Act 2007 (SBC) Chapter 42 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/consol31/consol31/00_07042_01

Sr. No.	Objectives	Fulfilment Status
3.	Maintain a co-ordinated tax regime throughout the country	Fulfilled
4.	Reduce GHG emissions in line with the targets prescribed under the Paris Agreement	Fulfilled
5.	Control purchase and use of fossil fuels	Fulfilled
6.	Encourage and ensure industry competitiveness	Fulfilled
7.	Promote efficient reallotment of tax collects – to fund innovation in low-carbon alternatives	Fulfilled
8.	Facilitate successful implementation and enforcement of the carbon tax through a strict accountability framework	Fulfilled

Source: Self (2022)[9].

Reference Re Greenhouse Gas Pollution Pricing Act (2021)

On appeal from the Court of Appeal from Sasketchwan, the Court of Appeal for Ontario, and the Court of Appeal of Alberta, the case of *Reference Re Greenhouse Gas Pollution Pricing Act* (2021)[10], concerning the constitutionality of the federal carbon pricing law, was brought to the Supreme Court of Canada and decided on March 25, 2021. The provinces questioned the impact of Greenhouse Gas Pollution Pricing Act, 2018[11], which prescribes a price on GHG emissions *via* binding minimum national standards, on the legislative jurisdiction of the provincial governments. While asserting their sole control over their natural resources, they further argued that the Act exceeded its jurisdictional ambit, as the provinces already had environmental policies, catering to their provincial targets, in place.

The Court in a 6:3 ratio upheld the constitutionality of the Act and proclaimed that the issue of climate change is not restricted to the provincial boundaries, rather is a matter of national concern under the "peace order and good government" clause of the Constitution of Canada (Joselow, 2021). Interestingly, the Court differentiated between the term 'carbon tax' and the concept of taxation and clarified them to be mutually exclusive in the constitutional context. Hence, endorsed the carbon pricing

9 In Figure 5, the authors have assessed the effectiveness of the Regulation imposed and implemented in British Columbia in fulfillment of the objective parameter. Accordingly, the status of "fulfillment" is stated against each objective.

10 *References Re Greenhouse Gas Pollution Act*, 2021 SCC 11 (Can.). https://decisions.scc-csc.ca/scc-csc/scc-csc/en/item/18781/index.do

11 Greenhouse Gas Pollution Pricing Act 2018 (Can.). https://laws-lois.justice.gc.ca/eng/acts/G-11.55/page-1.html

to mean a regulatory charge as opposed to a tax (*Reference Re Greenhouse Gas Pollution Pricing Act*, 2021).

Additionally, the Court noted that the applicability of the Act is subject to lack of adequate carbon pricing in provinces i.e., the Act is a backup pricing tool that ensures a uniform minimum pricing standard is applied throughout the country. The majority acknowledged the federal legislative jurisdiction of the Act in preventing an irreversible harm that would be felt across Canada, if the GHG emissions were not proactively reduced (Poliwoda, 2021).

Concerning the above, it can be inferred that carbon tax, if priced adequately and supported by policy efforts in consonance with relevant purposes of carbon taxation, especially revenue reallotment for affordability and green investment initiatives, can prove extremely efficient fiscal tool in meeting the Paris agreement targets. Therefore, scientists, economists, and political leaders have all vouched the success of carbon price, as the most cost-effective tool in reducing GHGs (Elgie & McClay, 2013). In fact, the Canadian Prime Minister, Justin Trudeau at COP26 summit in Glasgow urged all nations to adopt carbon pricing as an effective means to rapidly curb the production and consumption of fossil fuels (Tasker, 2021). The fact that the tax can work in harmony with the growth of the economy, goes on the to depict its capability in not only moulding but also restructuring a green economy according to climate change risks and green initiatives.

THE SOUTH AFRICAN CARBON TAX

Announced by the South African Minister of Finance in the 2019 Budget, the Carbon Tax Act No. 15 came into effect on June 1, 2019[12] (IEA, 2020). It is aimed at curbing high carbon emissions emanating from fossil fuel-dependent companies and industries. The Act gives effect to the polluter-pays-principle, whereby both the producer as well as the consumer is indirectly held accountable for the negative adverse costs (externalities) of climate change and his lack of shift to greener technology. The Act prescribed two phases of implementation, *first* from June 1, 2019, until December 31, 2022, and the *second* starting in 2023 and ending in 2030 (IEA, 2020).

The carbon tax rate is 127 South African Rand (ZAR) per metric ton of CO_2 rising to 134 ZAR in 2021, and subject to annual inflationary increase of 2% until 2022 (Planting, 2021). The South African Revenue Services is responsible for administration and collection of the tax ("Carbon Tax", 2021). Additionally, the carbon tax shall apply to those persons or legal entities who are required to report their greenhouse gas emissions to the Department of Environment, Forestry and Fisheries (DEFF) under its National Atmospheric Emissions Inventory System ("Frequently Asked Questions – Carbon Tax", 2021, p. 6).

12 Carbon Tax Act Number 15 of 2019 (CT) Vol. 647 No. 42483 (SA). https://www.gov.za/sites/default/files/gcis_document/201905/4248323-5act15of2019carbontaxact.pdf

The tax is designed to provide tax-free emission allowances starting at 60% and going up to 95%, including a basic 60% allowance for all emissions, a 10% allowance on process and fugitive emissions, a 10% allowance to companies offsetting their carbon use, a 5% carbon emission intensity reduction allowance, a 5% compliance with reporting requirements allowance, and a maximum of 10% allowance to trade sectors (IEA, 2020). These allowances result in reducing the tax rate to anything from 6 ZAR to 48 ZAR per metric ton of CO_2 which allows corporations the time to transition to greener alternatives ("Carbon Tax", 2021). Hence, the intention is to start off low and escalate the rate over time in order to turn the tax into a liability for the emitters ("What the new carbon tax means for SA industry", 2019).

Noting the Lacunae

South Africa ranks 14th in the list of global emitters and releases almost 421.7 million tons of CO_2 annually into the atmosphere ("Green House Gas Emissions by Country 2021", 2021). Due to its heavy dependence on coal, it is also the most carbon intensive economy in the G20. As opposed to the world average of 286 tons of CO_2 per million dollars of gross domestic product, South Africa has a carbon intensity of 599 tons. Moreover, in 2019, while the world recorded a decrease of 2.4% in its carbon intensity, South Africa recorded an increase of 1.3% (Reed, 2021).

Considering such a high emission stance of South Africa against the robust 2050 targets under the Paris Agreement, the carbon tax seems inefficiently low to positively impact the decarbonization efforts. In contrast to the British Columbian carbon tax policy, the South African tax framework limits the tax price to an annual increase rate of 2%, which is especially inadequate in the backdrop of such immense tax allowances. The tax *only* covers Scope 1 emissions, i.e., direct GHG emissions from fuel combustion, industrial processes, and fugitive emissions, and not Scope 2 and Scope 3 emissions, i.e., emissions from production of electricity and induced emissions within the supply chain, respectively. Additionally, unlike its British Columbian counterpart, the carbon tax revenue use in South Africa lacks transparency (PWC, 2020, p. 3). It remains unclear whether the tax collects have been ring-fenced to fund green initiatives or further the cause of net-zero emissions set in the 2015 Paris climate Accord. This casts doubts on its effectiveness to curb emissions.

Although the carbon offset allowance can be claimed by those companies which offset their carbon use by investing in emission reducing projects, even the projects not directly subject to carbon tax may register the reductions in emissions as carbon offsets. These can then be purchased by those liable to pay carbon tax to manipulate and reduce the amount of emissions on which they must pay tax ("What the new carbon tax means for SA industry", 2019). For instance, Sasol Limited, a South African integrated and chemical company, purchased almost 100,000 carbon offsets from Bethlehem Hydro, a South African independent power producer in 2020 to record a false reduction in its GHG emissions. This was especially discouraging because

Bethlehem Hydro not only had the title of being the first independent power producer in South Africa to secure a generation licence in 2005, also was one of the first projects to be registered under the Clean Development Mechanism of the United Nations Framework Convention on Climate Change in 2009 (Planting, 2021).

FIGURE 6. EVALUATING EFFECTIVENESS IN TERMS OF FULFILMENT OF THE OBJECTIVES OF THE REGULATION (SOUTH AFRICA)

Sr. No.	Objectives	Fulfilment Status
1.	Internalize social and environmental costs	Fulfilled
2.	Maintain Affordability through revenue neutrality	Unfulfilled (The allowances have made the tax rate inefficiently low and are outside the ambit of revenue neutrality)
3.	Maintain a co-ordinated tax regime throughout the country	Fulfilled
4.	Reduce GHG emissions in line with the targets prescribed under the Paris Agreement	Unfulfilled (Inefficiently low tax rate)
5.	Control purchase and use of fossil fuels	Unfulfilled (The scope of the tax is limited to direct emissions, i.e., Scope 1 emissions)
6.	Encourage and ensure industry competitiveness	Unfulfilled (Lack of revenue neutrality)
7.	Promote efficient reallotment of tax collects – to fund innovation in low-carbon alternatives	Unfulfilled (Lack of transparency)
8.	Facilitate successful implementation and enforcement of the carbon tax through a strict accountability framework	Unfulfilled (The projects not directly subject to carbon tax may register the reductions in emissions as carbon offsets)

Source: Self (2022)[13].

In conclusion, it is imperative that South Africa cut its emissions by 60-75% by 2050 and invest approximately $700 billion United States Dollars (USD) in environmentally sound technology and initiatives to achieve the target of keeping the temperature from rising beyond 2 degrees Celsius (PWC, 2020, p. 3). As a developing country

13 In Figure 6, the authors have assessed the effectiveness of the Regulation imposed and implemented in South Africa in fulfillment of the objective parameter. Accordingly, the status of "fulfillment" is stated against each objective.

this target may seem rather ambitious. In this regard, the carbon tax may play a crucial role in achieving the same, however, only if such targets are set in policy and a system is developed around the carbon taxing requirements, especially enveloping optimum revenue use.

EUROPEAN UNION ENERGY TAXATION DIRECTIVE AND AVIATION

The European Union Energy Taxation Directive (EUETD) is a policy directive that creates the community framework for levying taxes on energy products used as aviation fuels, motor fuels and electricity (*Restructuring the Community Framework for the Taxation of Energy Products and Electricity*, Directive 2003/96/EC)[14]. Up until 2019, the fact that this directive was alienated from the general EU policy concerning reduction in GHG emissions was largely ignored (Investigative Europe, 2020). For instance, the tax rates imposed on fuels were not influenced by their overall carbon footprint. In fact, the aviation fuel used for international transport purposes was entirely exempt from taxes (*Restructuring the Community Framework for the Taxation of Energy Products and Electricity*, Directive 2003/96/EC)[15]. This posed an unfair challenging burden on other industries in the transportation sector.

Therefore, the EU decided to conduct a revaluation of the EUETD as part of the European Green Deal which, among other policy reforms, would align the EUETD with the EU 2050 carbon-neutral ambitions set as per Paris Climate Accord of 2015 ("EU Green Deal – Revision of the Energy Taxation Directive", 2021). Restructuring tax rates would be crucial in rationally pushing the single European market, with its consumers and producers, towards an environmentally sound direction. Revised EUETD will implement International Civil Aviation Organisation's ("ICAO") Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in the second half of 2021 to monitor carbon-neutral fuel efficiency ("Reducing emissions from aviation", 2021).

Within the EU Green Deal, the environmental taxes are an important mechanism to control emissions ("Green Taxation – in support of a more sustainable future", 2021). Through Environmental Tax Reform (ETR) the burden of these taxes is gradually shifted from the labour to pollution, more specifically to the resource and in turn to the consumer ("the European Green Deal", 2019, para 2.2.2). This tax shift ensures that the revenue generated goes towards balancing other unreasonable taxes (Gore, 2021). Revised EUETD would impose minimum tax rates on aviation fuels, which would gradually increase over a period of decade to reach €10.75 per gigajoule ("EU's

14 Directive 2003/96/EC. *Restructuring the Community Framework for the Taxation of Energy Products and Electricity*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF

15 Directive 2003/96/EC. *Restructuring the Community Framework for the Taxation of Energy Products and Electricity*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF

green deal proposals for aviation", 2021). It is claimed that unlike command control instruments, a tax might indirectly decrease redundant flight trips or encourage environmentally sound behaviour (Keen & Strand, 2006). In an ideal scenario, airlines may perceive this as an incentive to invest in green innovation through low-emission technology choice to avoid green taxes. For instance, technologically, procedurally, and systematically renewing air traffic management or investing in research and development of alternate carbon-neutral fuels (Dichter *et al.*, 2020).

It cannot be denied that aviation due to its high fossil fuel consumption may be affected in the short run due to higher tax burden. Although, the switch to green technology in the long run may help set an edge over the competition, however, it would be difficult for companies to source huge investment costs over and above the tax burden (Dichter *et al.*, 2020). The role of revised EUETD as a policy prerequisite for the emergence of competitive advantage is extremely relevant. It would not have a direct effect on reducing green-house-gas emissions, however, an indirect influence through improved energy efficiency i.e., less fuel per unit of output and switch to fuel with a lower carbon content (Klauber *et al.*, 2020).

Points of Deliberation – Issues with Emissions

It cannot be denied that since the implementation of EUETD in 2005, the fuel emissions per person in aviation dropped by 24% by 2017, however, this drop must not be studied in isolation, rather analysed in the backdrop of tremendous increase, almost 60%, in the number of individuals choosing air travel since 2005 ("Reducing emissions from aviation", 2021). In the year 2017, the aviation carbon footprint was responsible for 3.8% of global carbon dioxide emissions – if it were a country, it would rank in the top 10 global emitters, in fact, it is the second largest source of GHG emissions in the transportation sector ("Reducing emissions from aviation", 2021). A person travelling from London to Madrid *via* train would be responsible for generation of 43kg of CO_2e, as opposed to 118kg of CO_2e while traveling by plane ("Climate Change: Should you fly, drive or take the train", 2019).

To make matters worse, the onset of the COVID-19 pandemic has triggered the aviation emissions to increase threefold by 2050 (Gossling *et al.*, 2021). This, apart from carbon dioxide, would include release into the air of volatile organic compounds, sulphur dioxide, nitrogen oxides, and particulate matter, all of which have significantly devastating effects on the environment (Touri *et al.*, 2013).

In the backdrop of COVID-19, a move towards low-emission production technologies or fuels with low-carbon content fuels, to aviation companies, may seem more expensive than paying the societal damage cost in the form of the green tax ("Taxes on polluting fuels are too low", 2019). Therefore, EU Member States may frame appropriate green taxes and remove fossil fuel subsidies, however, the polluter would still be willing to pay. Here, the recent revision of EUETD undertaken by EU becomes extremely relevant to the discussion.

In 2016, ICAO brought into force CORSIA and EU, in order to support the global measures, decided to limit the scope of EUETD to flights operating within European Economic Area, Iceland, Norway, and Liechtenstein ("Reducing emissions from aviation", 2021). Under CORSIA, airlines operating along international routes would be required to offset any growth in their carbon emission levels beyond 2020 levels. In its ongoing review, EU has decided to reform the implementation of EUETD as per the mandates established in CORSIA ("Reducing emissions from aviation", 2021). However, CORSIA and EUETD are part and parcel of achieving carbon-neutrality. As noted above they have no direct influence on reducing GHG emissions, hence, they must be tied with an investment goal to increase their impact on reducing aviation emissions.

So far, no evidence has concretely proven that imposition of taxes on fuels reduces the carbon footprint of aviation (Aviation Intelligence Unit, 2020). Additionally, COVID-19 has destabilised the demand for international credits, as airlines are speculating their offsetting obligations under CORSIA (World Bank Group, 2020, p. 6). From a benefit-cost perspective, it is the economic output that ultimately guides the demand and in turn carbon emissions. Greater the demand, higher the emissions. Hence, the EU must focus on decarbonisation measures. With a potential to achieve carbon-neutrality by 2050, decarbonization measures must incorporate ICAO's fiscal (tax) measures, low-emission technology, systemic reforms, and adoption of Sustainable Aviation Fuels (SAF) ("Net-Zero Carbon Emissions by 2050", 2021). Although the revised EUETD does not prescribe a set methodical use of tax revenues, however, to further the target of net-zero emissions, any revenue generated through green tax must be used to fund research and investment in initiatives such as Airbus Zero, hydrogen, electric and hybrid aircrafts.

FIGURE 7. EVALUATING EFFECTIVENESS IN TERMS OF FULFILMENT OF THE OBJECTIVES OF THE REGULATION (EUETD)

Sr. No.	Objectives	Fulfilment Status
1.	Internalize social and environmental costs	Fulfilled
2.	Maintain Affordability through revenue neutrality	Unfulfilled (The cost of low-carbon technologies or fuels is higher than the green tax due to lack of revenue neutrality)
3.	Maintain a co-ordinated tax regime throughout the European Union	Fulfilled
4.	Reduce GHG emissions in line with the targets prescribed under the Paris Agreement	Unfulfilled (CORSIA and EUETD have no direct influence on reducing GHG emissions until they are tied with investment initiatives in low-carbon alternatives)

Sr. No.	Objectives	Fulfilment Status
5.	Control purchase and use of fossil fuels	Unfulfilled (The tremendous increase in the demand for air travel confronted by the absence of technological, operational reform, and SAF tied to an investment plan alongside green tax)
6.	Encourage and ensure industry competitiveness	Unfulfilled (The polluter continues to willingly pay the internalized societal and environmental costs)
7.	Promote efficient reallotment of tax collects – to fund innovation in low-carbon alternatives	Unfulfilled (Lack of revenue neutrality)
8.	Facilitate successful implementation and enforcement of the carbon tax through a strict accountability framework	Fulfilled

Source: Self (2022)[16].

Revision Solutions

EU green tax is an important tool in reducing aviation emissions, however, on its own, is not enough to tackle the carbon footprint of aviation and reach the carbon-neutrality ambitions of 2050 ("Taxes on polluting fuels are too low", 2019). As noted above, EUETD through imposing taxation costs on aviation fuels has achieved a level of success in reducing aviation emissions. However, solely relying on the will of the passengers to switch to another mode of transport due to higher cost of tickets, or the ambition of airlines substitute high-emission technology and fuels for low-emission, especially when at times the cost of doing so is higher than paying the green tax, is not enough to achieve climate energy targets.

Therefore, the revision of the EUETD in line with market measure such as CORSIA must be undertaken in the backdrop of decarbonisation measures. It is the demand of long-distance flights by passengers, who tend to weigh the value of time against price of the ticket, that ultimately guides the increase in carbon emissions (Timperley, 2020). While unfair tax exemptions on aviation fuels must be removed, fiscal measures

16 In Figure 7, the authors have assessed the effectiveness of the EUETD in fulfillment of the objective parameter. Accordingly, the status of "fulfillment" is stated against each objective.

must be imposed along with technological, operational reform, and SAF, and tied to investment means. This would significantly increase the impact of green taxation on aviation in terms of mandatorily switching to environmentally friendly alternates with the help of a government-backed policy reform.

FINDINGS IN BRIEF

It can thus be deduced that the issues, challenges, and risks involved in carbon tax implementation so discussed and analysed through the prism the above case studies clarify the positive potential of carbon tax in reducing GHG emissions. It is the successful merger of economic policies and environmental goals that may truly compliment the restructuring tax efforts.

A weak carbon tax model which does not create enough incentive to switch to greener alternatives or does not prescribe a methodical use of tax revenues to fund green initiatives shall *only* be deemed burdensome, as seen in the case of both EUETD and South Africa. Therefore, at this juncture, the authors wish to move forward with their prospective carbon tax parameter model which considers the mounting uncertainty posed by the COVID-19 pandemic.

A SUGGESTIVE MODEL IN LINE WITH THE ECONOMIC EFFECTS OF COVID-19

The COVID-19 pandemic began with an immense burden on health infrastructure which soon escalated into imposition of virus containment measures causing an unprecedented worldwide economic slump. The global GDP declined by 10% in 2020 in the first half of 2020. To withstand the economic and health crisis, the countries constantly engaged in sustained vaccinations drives, businesses bail outs, monetary assistance to households, tax rebates, and so on. Consequently, countries find themselves grippled with a mounting government debt due to shortages in public finances. As government expenditure continues to rise as against decreased revenues from tax, so does the vulnerability of increase in rate of interest on sovereign debt, risk of debt rollover, and decline of economic growth. In effect, this has trapped the governments in a recovery cycle in which they can neither withdraw the fiscal support nor increase taxes to support economic recovery post the crisis.

Hence, as countries fund the renewal of their economic activities, they must do so in a manner that restores public finances. Considering, the amplification of the long-term structural challenges, such as climate change, by the pandemic, such recovery cannot be in isolation of sustainability goals. To this end, a combination of reassessment of tax and spending policies must be adopted as part of recovery packages and reformed fiscal frameworks (OECD Tax Policies, 2021).

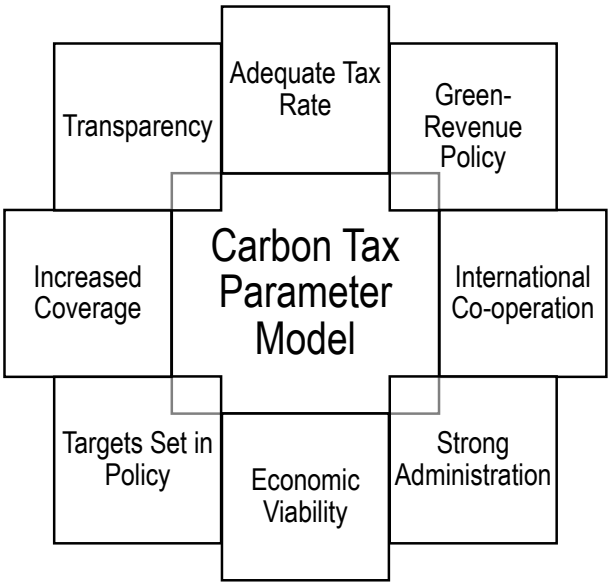
It cannot be denied that contemporary tax systems are anything but simple. From the robust British Columbian tax structure, which received major backlash from the New Democratic Party (Harrison, 2013), to the South African weak carbon-policy initiative, the decision to adopt an appropriate policy framework ultimately depends on the public and political awareness of a country. Nevertheless, the role of carbon tax in facilitating the shift to a decarbonized economy, as one of the instruments in the climate policy package is apparent in all the above discussed case studies. This is especially true in a world recovering from the COVID-19 pandemic where economic recovery packages aimed at restoring businesses would likely be environmentally unsound.

Almost 50% of climate policy packages offered across jurisdictions in the COVID-19 revival period include support for carbon-intensive fossil fuels (Boone, 2020). In such a scenario, a strong strategic framework consisting of a well-designed reformative carbon tax policy can have a profound effect on enabling the shift towards a low-carbon recovery. It can create public support for low-carbon alternative technology or behaviours. For instance, by pricing GHG emissions, government can create an incentive in minds of consumers and producers to move to cost-effective alternatives and in turn lead to cost-effective reduction of carbon emissions. This would mobilise private investment as well as government revenues, further reduce rebound effects (OECD Tax Policies, 2021).

It cannot be denied that increase in taxes tends to have a disproportionate effect on the middle class and the low-income class in developed and developing countries, respectively. Environmental taxes can particularly be perceived regressive as they negatively affect affordability of energy fuels and increase poverty risk. However, as observed in the case of British Columbia carbon tax framework, the importance of revenue neutrality must not be undermined to improve affordability. Revenue from higher taxes can be reallotted to make not only low-carbon alternatives, also carbon tax more affordable. Another option could be to start off low and gradually increase the carbon tax rate. Considering the time-dependent climate sensitivity in the reduction targets for 2030, the rate of gradual increase of carbon tax must be adequate to reach the ideal carbon pricing by 2030 i.e., EUR 120 per tonne of CO_2 (OECD, 2021).

Currently around 65 carbon pricing initiatives have been implemented which envelope 45 national jurisdictions and 34 subnational jurisdictions and cover 11.5 gigatons of CO_2e, representing 21.5% of the annual global GHG emissions (The World Bank, 2021). If the carbon tax coverage is extended domestically in western countries and developing nations adopt it in their policy efforts, the tax may effectively label a price on half of global GHG emissions (Kossoy *et al.*, 2013).

FIGURE 8. PARAMETERS TO BE CONSIDERED WHILE FORMULATING A CARBON-TAX POLICY MODEL



Source: Self (2021).

Figure 8 depicts parameters, analytically devised from the preceding case studies of the carbon taxation policy effectiveness. They may be incorporated in a carbon-tax policy model by any country aiming to align its COVID-19 recovery package with global decarbonization efforts i.e.,

i. incorporating an adequate tax rate competent to influence the decarbonization efforts,
ii. ensuring funding of low-carbon economic efforts through tax collects or revenue,
iii. promoting decarbonization through cross-border co-operation,
iv. expanding the coverage of the tax,
v. encouraging greater transparency to ensure environment probity,
vi. formulating strong administrative framework for accountability,
vii. securing a feasible integration of economic and environment policies,
viii. supporting officiation of emission reduction targets that incorporate societal costs in the policy.

EXPLORING THE PARAMETERS

The International Carbon Pricing Commission in its 2017 report suggested a carbon tax rate range of $50-100 USD per metric ton of CO_2 for 2030 (Stern *et al.*, 2017). However, after considering the ramifications of carbon use in terms of heat waves, flooding, people displacement, threat to life, drought seasons, air quality depletion, etc. across the globe, Nicholas Stern and Joseph Stiglitz *et al.* (2017) recommended that a carbon tax rate of $100 USD is ideal to keep the temperature below 2 degrees Celsius threshold set in the Paris Climate Accord. While this pricing is aimed at influencing private sector decisions, Kaufman *et al.* (2020) recommends a social cost of $125 USD per metric ton of CO_2 based on marginal damages to guide public decisions. Although the two approaches are different, however, the tax rate likely to emerge in either of the cases shall be close to the figure of $100 USD rather than $50 USD (Stern & Stiglitz, 2021), which goes on to show the importance of implementing a higher carbon tax rate to achieve the decarbonization targets. For instance, EU green tax due to its inadequate pricing has proven inefficient in tackling the carbon footprint of aviation.

Marc Hafstead and Williams (2020) suggest a type of environmental integrity mechanism, a tax adjustment mechanism (TAM) to automatically adjust the carbon tax rate in a scenario where actual emissions do not meet the emission reduction targets. Introduced by Metcalf (2009), TAM prescribes different levels of emissions targets over a period of time within the legislation, and automatically adjusts carbon tax price in case the actual emissions stray from the set targets. TAM promotes transparency, limits administrative intervention, and contrasts much of uncertainty surrounding emissions (Hafstead *et al.*, 2020).

Only 5% of the current carbon prices adopted by countries are at levels consistent with ambitions of Paris Climate Accord ("Implementing Effective emissions trading systems: lessons from international experiences", 2020, p. 13). Incremental implementation of the carbon taxes in phases may be considered to increase the tax rate over time. For instance, British Columbian provincial government initially set the carbon tax at $10 CAD per metric ton of CO_2 which rose by $5 CAD per year to its current $45 CAD ("British Columbia's Carbon Tax – Province of British Columbia", 2021). Although the province still has a long way to go in reaching the ideal tax rate of $170 CAD by 2030, nevertheless, such an approach has helped individuals, households, and firms adjust to the said prices. Sweden followed an incremental phase from €24 in 1991 to € 114 in 2021, thereby levying the highest and the most ideal carbon tax rate in the world (IEA, 2021). However, EU green tax due to its inadequate pricing has demonstrated significant ineffectiveness in tackling the carbon footprint of aviation.

Governments can also strive to expand the coverage of the tax to ensure optimum exploitation of the potential of the tax in reducing emissions. The carbon tax implemented in Finland gradually extended from covering *only* heat and electricity production to covering transportation and heating fuels (OECD, 2013). As discussed

above, the South African carbon tax lags in its competence precisely due to its restricted coverage of Scope 1 emissions which is amplified due to lack of transparency in tax revenue use.

A transparent framework depicting the environmental integrity of the policy in correctly employing the carbon-tax revenue towards green initiatives and low-carbon-economy-oriented infrastructure, is crucial in facilitating a positive public opinion that shall ultimately further the cause of net-zero emissions. It is also imperative in securing a sound merger of environment policy with economic policy. As seen in the case of British Columbian carbon tax, funding of decarbonization initiatives through tax revenue, including by providing credits, has helped in offsetting the impact of the tax on producers and consumers.

An environment-economic-policy oriented revenue use shall also assist in facilitating a robust mechanism to prevent manipulative credit swap between companies, through accountability. For instance, a detailed annual information handbook intended for public viewing must be published to clarify everything – from revenue use to future emission reduction targets. This shall further contribute towards establishing an internationally consistent mechanism to encourage cooperation across jurisdictions under Article 6 of the Paris Climate Accord (World Bank Group, 2020). Emission reduction targets as formulated in the Paris Agreement on a cross-border level can then be nationally set in tax legislations to help in calculation of optimum societal costs.

CONCLUSION

This article has approached the concept of carbon tax, through a discussion and analysis of three case studies. The COVID-19 pandemic has although presented unprecedented challenges to the world, it has also provided an opportunity to integrate environment and economic policies. In conclusion, carbon tax as part of a recovery green package offered by the governments in the COVID-19 era shall promote decarbonization efforts in line with the integration objectives. It has the potential to rationally push consumers, investors, and producers, towards an environmentally sound direction.

The studies harness lessons from the implementation experiences of British Columbian carbon tax, South African carbon tax and EU green tax (to curb aviation emissions). While British Columbia successfully implemented a carbon tax that is set in a robust policy framework, the South African carbon tax is riddled with transparency issues with a narrow emission coverage. The EU green tax is inadequate in tackling aviation emissions, especially due to its low tax rate which does not provide enough motivation to airlines to switch to greener alternatives. The case studies, nevertheless, remain unconfrontational, i.e., they do not delve into who is responsible and who is not (Lester, 2021). British Columbian success model too falls short in setting an optimum tax rate, it still needs to increase its tax rate by $125 CAN to ensure attainment of carbon neutrality. Rather, under the international economic law, the study facilitates in moulding the learnings from a strong carbon tax policy framework, along with

issues and lacunae found in weaker frameworks, into a carbon tax parameter model to enable a reasonable carbon policy framework on the principles of environmental integrity and economic efficiency.

It cannot be denied that the current pandemic has forced governments to resort to fiscal measures to combat the repercussions of the economic shutdown. However, the environmental unsoundness of these measures can suitably be replaced with a green carbon tax that can fast-track the structural reforms towards building a low-carbon economy. An optimally formulated and premeditated carbon tax policy-effort can successfully align national environment protection principles with those of international decarbonization goals set in the Paris Agreement. It is capable of providing powerful incentives to investors, producers and consumers for curbing GHG emissions with public support for a well-established revenue use and internationally affiliated emission targets.

It must nevertheless be observed that while the carbon tax parameter model is a route to implementing a robust carbon-policy framework, the actual success of the carbon tax in effectively supporting the switch to low-carbon economy shall depend on the country's own domestic economic, legal, and political constraints. As seen in the case of *References Re Greenhouse Gas Pollution Act* (2021), the support of judiciary in upholding the law that promotes the cause of zero-net emissions is as crucial as the role of the lawmaker who prepares the law. Hence, the focus must be on overcoming the domestic issues and challenges and reaching consensus on an internationally sound policy framework. As more and more countries consider carbon taxation, further research must aim to propound various approaches formulating multiple policy models that can be submitted to nations for their reasonable views and suggestions on the terms of the proposal. This would enable the formulation of sound international carbon tax policy model capable of reaching net-zero emissions target.

REFERENCES

Articles

Aviation Intelligence Unit. (2020). Does taxing aviation really reduce emissions? *EUROCONTROL*, Think Paper Number 7. https://www.eurocontrol.int/sites/default/files/2020-10/eurocontrol-think-paper-taxing-aviation-oct-2020.pdf

Bowen, A. (2015). Carbon Pricing: How Best to Use the Revenue? *Policy Brief, Grantham Research Institute and Global Green Growth Institute*. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/11/Bowen-policy-brief-2015.pdf.

Burns, W. (2016). Loss and Damage and the 21st Conference of the Parties to the United Nations Framework Convention on climate Change. *ILSA Journal of International & Comparative Law*, 22(2), 415-433. https://nsuworks.nova.edu/ilsajournal/vol22/iss2/4

Dussax, D. (2015). Is taxing the right way to regulate environmental damage. *Review of Environmental Economics and Policy*, 11(2), 87-98.

Elgie, S., & McClay, J. (2013). BC's Carbon Tax Sift is Working Well after Four Years ("Attention Ottawa"). *Canadian Public Policy / Analyse de Politiques*, 39, S1-S10. https://www.jstor.org/stable/23594767

European Environment Agency (1996). Environmental taxes: Implementation and environmental effectiveness. *Copenhagen 1996: Environmental Issues Series*, Number 1. https://www.eea.europa.eu/publications/92-9167-000-6/file

Federal Reserve bank of San Francisco (2002, November 1). What is the difference between private and social costs, and how do they relate to pollution and production? https://www.frbsf.org/education/publications/doctor-econ/2002/november/private-social-costs-pollution-production/

Friedrich, J., Ge, M., & Pickens, A. (2020). Changes in the World's Top 10 Emitters. *World Resources Institute*. https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters

Gore, T. (2021). The revision of the energy taxation directive could underpin a fair and green tax reform in Europe. *Heinrich Boll Stiftung Brussels*. https://eu.boell.org/en/2021/09/13/revision-energy-taxation-directive-could-underpin-fair-and-green-tax-reform-europe

Gossling, S., Humpe, A., Fichert, F. & Creutzig, F. (2021). COVID-19 and pathways to low-carbon air transport until 2050. *Environmental Research Letters*, 16, Number 034063. https://iopscience.iop.org/article/10.1088/1748-9326/abe90b/pdf

Hafstead, M., Brooks, S., Keohane, N. & Look, W. (2020). Carbon Tax Adjustments Mechanisms (TAMs): How they work and lessons from modelling. *Environmental Defence Fund and Resources for the Future*, Issue Brief 20-08. https://media.rff.org/documents/IB _20-08_TAM.pdf

Hafstead, M. A. C. & Williams III, R. C. (2020). Designing and Evaluating a U.S. Carbon Tax Adjustment Mechanism to Reduce Emissions Uncertainty. *Review of Environmental Economics and Policy*, 14(1), 95-113. https://doi.org/10.1093/reep/rez018

Harrison K. (2013). The Political Economy of British Columbia's Carbon Tax. *OECD Environment Working Papers*, Number 63. https://doi.org/10.1787/5k3z04gkkhkg-en

IEA. (2020). Implementing Effective Emissions Trading Systems: Lessons from International Experiences. *OECD Publishing, Paris*. https://doi.org/10.1787/b7d0842b-en

Kaufman, N., Barron, A. R., Krawczyk, W., Marsters, P. & McJeon, H. (2020). A near-term to net zero alternative to the social cost of carbon for setting carbon prices. *Nature Climate Change*, 10, 1010-1014. https://doi.org/10.1038/s41558-020-0880-3

Keen, M. & Strand, J. (2006). Indirect Taxes on International Aviation. *International Monetary Fund*, WP/06/124. https://www.imf.org/external/pubs/ft/wp/2006/wp06124.pdf

Kossoy, A., Oppermann, K., Reddy, R. C., Bosi, M., Boukerche, S., Hohne, N., Klein, N., Gilbert, A., Jung, M., Borkent, B., Lam, L., Roser, F., Braun, N., Hansel, G. & Warnecke, C. (2013). Mapping Carbon Pricing Initiatives: Developments and Prospects. *World Bank, Washington, DC*. https://openknowledge.worldbank.org/handle/10986/15771?locale-attribute=en

Lacroix, K. & Richards, G. (2015). An alternative policy evaluation of the British Columbia carbon tax: Broadening the application of Elinor Ostrom's design principles for managing common-pool resources. *Ecology and Society*, 20(2), 38. https://www.jstor.org/stable/26270200

Marron, D. B. & Toder, E. J. (2014). Tax policy issues in designing a carbon tax. *American Economic Review*, 104(5), 563-68. http://dx.doi.org/10.1257/aer.104.5.563

Metcalf, G. E. (2009). Cost Containment in Climate Change Policy: Alternative approaches to mitigating price volatility. *University of Virginia Tax Review*. 29(2), 381-405. https://doi.org/10.3386/w15125

Metcalf, G. E. (2015). A Conceptual Framework for Measuring the Effectiveness of Green Fiscal Reforms. *GGKP Research Committee on Fiscal Instruments*, GGKP Working Paper 07/2015. https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/A_Conceptual_Framework_for_Measuring_the_Effectiveness_of_Green_Fiscal_Reforms_GGKP.pdf

Metcalf, G. E. (2019). On the Economics of a Carbon tax for the United States. *Brookings Papers on Economic Activity*, 405-458. https://www.brookings.edu/wp-content/uploads/2019/03/Metcalf_web.pdf

OECD (2013). Climate and Carbon: Aligning Prices and Policies. *OECD Environment Policy Papers*, Number 1. https://doi.org/10.1787/5k3z11hjg6r7-en

OECD/IEA/NEA/ITF (2015). Aligning Policies for a Low-carbon Economy, *OECD Publishing, Paris*. http://dx.doi.org/10.1787/9789264233294-en

OECD (2019). Taxes on polluting fuels are too low to encourage a shift to low-carbon alternatives. *OECD Publishing, Paris*. https://www.oecd.org/tax/taxes-on-polluting-fuels-are-too-low-to-encourage-a-shift-to-low-carbon-alternatives.htm

OECD (2021). Effective Carbon Rates 2021: Pricing Carbon Emissions through Taxes and Emissions Trading, *OECD Publishing, Paris*. https://doi.org/10.1787/0e8e24f5-en.

OECD (2021), Tax and fiscal policies after the COVID-19 crisis, OECD Policy Responses to Coronavirus (COVID-19), *OECD Publishing, Paris*, https://doi.org/10.1787/5a8f24c3-en.

PWC (2020). Net Zero for South Africa. *PWC Net Zero Economy Index: The Pivotal Decade*. https://www.pwc.co.za/en/assets/pdf/net-zero-for-south-africa.pdf.

Pearce, D. (1991). The role of carbon taxes in adjusting to global warming. *The Economic Journal*, 101(407), 938-948. https://doi.org/10.2307/2233865

Pindyck, R. S. (2013). Climate change policy: what do the models tell us. *Journal of Economic Literature*, 51(3), 860-872. http://dx.doi.org/10.1257/jel.51.3.860

Poliwoda, D. A. (2021, April 7). *References Re Greenhouse Gas Pollution Act* – Supreme Court of Canada Rules Carbon Pricing Constitutional. *Client Alert*. https://www.dickinson-wright.com/-/media/files/news/2021/03/client-alert—greenhouse-gas-pollution-pricing-act.pdf

Schratezenstaller, A. K. M. (2021). Effects of Environment and Carbon Taxation: A literature review. *WIFO Working Papers*, 619/2021. https://www.wifo.ac.at/jart/prj3/wifo/resources/person_dokument/person_dokument.jart?publikationsid=66813&mime_type=application/pdf

Stern, N., Stiglitz, J.E., Duan, M., Edenhofer, O., Giraud, G., Heal, G., Rovere, E. L., Morris, A., Moyer, E., Pangestu, M., Shukla, P. R., Sokona, Y. & Winkler, H. (2017). Report of the High-Level Commission on Carbon Prices. *World Bank Group*. https://www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices

Stern, N. & Stiglitz, J. E. (2021). The Social Cost Of Carbon, Risk, Distribution, Market Failures: An Alternative Approach. *National Bureau Of Economic Research*, Working Paper 28472. http://www.nber.org/papers/w28472

Touri, L., Sari-Minodier, I., Molinari, N. & Chanez, P. (2013). The airport atmospheric environment: respiratory health at work. *European Respiratory Review*, 22(128), 124-130. https://err.ersjournals.com/content/22/128/124

Victor, D. G., Geels, F. G. & Sharpe, S. (2019). Accelerating the Low Carbon Transition: The case for stronger, more targeted, and coordinated international action. *The Brookings Institution*. https://www.brookings.edu/wp-content/uploads/2019/12/Coordinatedactionreport.pdf

Vollebergh, H. R. J. (2012). Environmental taxes and Green Growth: Exploring possibilities within energy and climate policy. *The Hague: PBL Environmental Assessment Agency*. https://www.pbl.nl/sites/default/files/downloads/PBL _2013-Environmental-taxes-and-Green-Growth_1009.pdf

Wang, P., Xiangzheng, D., Huimin, Z. & Yu, S. (2019) Estimates of the social cost of carbon: A review based on meta-analysis. *Journal of Cleaner Production Volume*, 209, 1494-1507. https://doi.org/10.1016/j.jclepro.2018.11.058

World Bank Group & Agence Française De Development. (2019). Using Carbon Revenues, Annex to report: Case studies. *Pratnership for Market Readiness*, Technical Note 16. https://openknowledge.worldbank.org/bitstream/handle/10986/32247/UsingCarbonRevenuesAnnexCaseStudies.pdf?sequence=3&isAllowed=y#:~:text=In%20practice%2C%20British%20Columbia%20went,transfers%20over%20the%20same%20period

World Bank Group. (2020). State and Trends of Carbon Pricing. https://openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf?sequence=4&isAllowed=y

Case Laws

References Re Greenhouse Gas Pollution Act, 2021 SCC 11. https://decisions.scc-csc.ca/scc-csc/scc-csc/en/item/18781/index.do

News Publications

(2019, August 24). Climate Change: Should you fly, drive or take the train. *BBC*. https://www.bbc.com/news/science-environment-49349566

(2021, October 4). Net-Zero Carbon Emissions by 2050. *IATA*, Press Release Number 66, https://www.iata.org/en/pressroom/2021-releases/2021-10-04-03/

Investigative Europe. (2020, September 4). *The EU's Broken Energy Taxation Directive: ripe for revision*. https://www.investigate-europe.eu/en/2020/energy-taxation-directive-explained/

Joselow, M. (2021, March 29). National Carbon Tax Upheld by Canada's Supreme Court. *E&E News: Environment*. https://www.scientificamerican.com/article/national-carbon-tax-upheld-by-canadas-supreme-court/

Planting, S. (2021, April 7). South African companies scramble to comply with the new carbon tax. *Daily Maverick*. https://www.dailymaverick.co.za/article/2021-04-07-south-african-companies-scramble-to-comply-with-the-new-carbon-tax/

Reed, E. (2021, February 5). Carbon tax failing to tackle South African Missions. *Energy Voice*. https://www.energyvoice.com/renewables-energy-transition/ccs/africa-ccs/297013/south-africa-carbon-tax/

Tasker, J. P. (November 2, 2021). Trudeau calls for global carbon tax at COP26 Summit. *CBC*. https://www.cbc.ca/news/politics/trudeau-carbon-tax-global-1.6233936

Thomas, V. & Araral, E. (2020, September 28). The Benefits of Carbon Tax. *The Hindu*. https://www.thehindu.com/opinion/op-ed/the-benefits-of-a-carbon-tax/article32709677.ece

Timperley, J. (2020, February 19). Should we give up flying for the sake of climate? *BBC*. https://www.bbc.com/future/article/20200218-climate-change-how-to-cut-your-carbon-emissions-when-flying

Blogposts

(2021, January 27). British Columbia's Carbon Tax. *Futurepolicy.Org*. https://www.futurepolicy.org/renewable-energies/british-columbias-carbon-tax/

(2019, August 29). What the new carbon tax means for SA industry. *Deloitte South Africa*. https://www2.deloitte.com/za/en/pages/tax/articles/what-the-new-carbon-tax-means-for-SA-industry.html

Boone, L. (2020, September 16). Coronavirus: Living with Uncertainty. *ECOSCOPE: An Economic Lens on Policies for Growth and Wellbeing*. https://oecdecoscope.blog/2020/09/16/coronavirus-living-with-uncertainty/

Dichter, A., Henderson, K. & Riedel, R. (2020, May 13). How airlines can chart a path to zero-carbon flying. *McKinsey & Company*. https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/how-airlines-can-chart-a-path-to-zero-carbon-flying

Elgie, S. (2014, July 9). Just the Facts: What's behind B.C.'s whopping fuel use drop? *Sustainable Prosperity*. www.sustainableprosperity.ca/blogpost97

Klauber, A., Harvey, N. & Wight, K. (2020, October 22). The low-carbon jet fuel market is cleared for take-off. *RMI*. https://rmi.org/the-low-carbon-jet-fuel-market-is-cleared-for-take-off/

Lester, S. (2021, July 17). Krugman on Carbon Tariffs. *International Economic Law and Policy Blog*. https://ielp.worldtradelaw.net/2021/07/krugman-on-carbon-tariffs.html

Timperley, J. (2019, February 4). Corsia: The UN's plan to 'offset' growth in aviation emissions. *Carbon Brief*. https://www.carbonbrief.org/corsia-un-plan-to-offset-growth-in-aviation-emissions-after-2020

Williams, A., Knight, K. (2021, July). The EU's green deal proposals for aviation and the UK Decarbonizing transport plan: initial thoughts. *Norton Rose Fulbright*. https://www.nortonrosefulbright.com/en/knowledge/publications/536e8d65/the-eus-green-deal-proposals-for-aviation-and-the-uk-decarbonising-transport-plan-initial-thoughts

Legislations

Carbon Tax Act 2008 (SBC) Chapter 40 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_08040_01

Carbon Tax Act Number 15 of 2019 (CT) Vol. 647 No. 42483 (SA). https://www.gov.za/sites/default/files/gcis_document/201905/4248323-5act15of2019carbontaxact.pdf

Climate Change Accountability Act 2007 (SBC) Chapter 42 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_07042_01

Directive 2003/96/EC. *Restructuring the Community Framework for the Taxation of Energy Products and Electricity*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF

European Commission. (2019). Communication from the Commission to the European Parliament, the European Council, the European Economic Committee and Social Committee and the Committee of the Regions, The European Green Deal. *EUR-Lex*, COM/2019/640 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

European Commission. (2020). Communication from the Commission to the European Parliament and the Council, an action plan for fair and simple taxation supporting the recovery strategy. *EUR-Lex*, COM/2020/312. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:0312:FIN

Greenhouse Gas Pollution Pricing Act 2018 (Can.). https://laws-lois.justice.gc.ca/eng/acts/G-11.55/page-1.html

Greenhouse Gas Reduction Targets Act 2007 (SBC) Chapter 42 (Can.). https://www.bclaws.gov.bc.ca/civix/document/id/consol31/consol31/00_07042_01

The Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104. https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

Policy Documents

Eurostat (2013). Environmental Taxes: A statistical guide. *Eurostat Manuals and Guidelines*, ISSN 2315-0815. https://ec.europa.eu/eurostat/documents/3859598/5936129/KS-GQ-13-005-EN.PDF

Ministry of Environment and Climate Change Strategy (2020). 2020 Climate Change Accountability Report. *Government of British Columbia*. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2020_climate_change_accountability_report.pdf

Ministry of Environment and Climate Change Strategy (2021). 2021 Climate Change Accountability Report. *Government of British Columbia*. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2021_climate_change_accountability_report.pdf

Ministry of Environment and Climate Change Strategy (2021). Roadmap to 2030. *Government of British Columbia, Clean BC. Our Nature. Our Power. Our Future.* https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_2018-bc-climate-strategy.pdf

Ministry of Finance (2019). Budget and Fiscal Plan 2019/20–2021/22. *Government of British Columbia*. https://www.bcbudget.gov.bc.ca/2019/pdf/2019_budget_and_fiscal_plan.pdf

Ministry of Finance Tax Bulletin (2021). Tax Rates on Fuels, Motor fuels Tax Act and Carbon Tax Act. *Government of British Columbia*, MFT-CT 005. https://www2.gov.bc.ca/assets/gov/taxes/sales-taxes/publications/mft-ct-005-tax-rates-fuels.pdf

South African Revenue Service (2021). Frequently Asked Questions – Carbon Tax. *South African Revenue Services Government of South Africa*. https://www.sars.gov.za/wp-content/uploads/Docs/CarbonTax/Frequently-Asked-Questions-Carbon-Tax_3.0.pdf

Websites

(2021). Green House Gas Emissions by Country 2021. https://worldpopulationreview.com/country-rankings/greenhouse-gas-emissions-by-country

European Commission (2021). EU Green Deal – Revision of the Energy Taxation Directive. *Law*. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12227-EU-Green-Deal-Revision-of-the-Energy-Taxation-Directive_en

European Commission (2021). Reducing emissions from aviation. *Climate Action*. https://ec.europa.eu/clima/eu-action/transport-emissions/reducing-emissions-aviation_en

European Commission (2021). Green Taxation – in support of a more sustainable future. *Taxation and Customs Union*. https://ec.europa.eu/taxation_customs/green-taxation-0_en

IEA (2020). South African Carbon Tax. *IEA/IRENA Renewables Policies Database*. https://www.iea.org/policies/3041-south-african-carbon-tax

IEA (2021). Sweden Carbon Tax. *IEA/IRENA Renewables Policies Database*. https://www.iea.org/policies/12725-sweden-carbon-tax

Ministry of Environment and Climate Change Strategy (2021, January 27). Climate action legislation – Province of British Columbia. *Government of British Columbia*. https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/legislation

Ministry of Environment and Climate Change Strategy (2021, May 27). British Columbia's Carbon Tax – Province of British Columbia. *Government of British Columbia*. https://www2.gov.bc.ca/gov/content/environment/climate-change/clean-economy/carbon-tax

Ministry of Environment and Climate Change Strategy (2021, November 9). Climate Change – Province of British Columbia. *Government of British Columbia*. https://www2.gov.bc.ca/gov/content/environment/climate-change

Ministry of Finance (2016). British Columbia Carbon Tax: Presentation for State of Connecticut. *Government of British Columbia*. https://portal.ct.gov/-/media/DEEP/climatechange/GC3_Webinar_Series/BCCarbonTaxStateofConnecticutApril2016FINALpdf.pdf

South African Revenue Service (2021, July 20). Carbon Tax. *South African Revenue Services Government of South Africa*. https://www.sars.gov.za/customs-and-excise/excise/environmental-levy-products/carbon-tax/

The World Bank (2021). Carbon Pricing Dashboard. https://carbonpricingdashboard.worldbank.org/