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Fairness in Climate Change Mitigation: The Case of Carbon Taxation

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Abstract

Environmental economists have advocated carbon taxation for its efficiency and effectiveness in reducing Greenhouse Gas (GHG) emissions. Yet, whether the policy would be fair in any given context needs to be better realized. While the distributive effects of carbon taxation have been widely discussed, a more comprehensive understanding of tax fairness is lacking. This paper reviews the academic literature through the lens of three justice concepts -recognition, procedure, and distribution—to understand the implications of previous studies for fair carbon tax policy-making. Upon examining the relevant literature, the findings highlight the limited evidence concerning recognition and procedural justice in carbon taxation, particularly in developing country context. This calls for more assessments through these perspectives. It also emphasizes the importance of recognition for vulnerable groups, such as women, with an intersectionality approach; a fair policy process through information provision, inclusive representation, fair level playing field; and proportionate burden sharing through context-specific design elements such as targeted revenue use.

Keywords

Climate Change, Carbon Tax, Recognition Justice, Procedural Justice, Distributive Justice

1. Introduction

Climate change is associated with substantial justice-related issues. It not only affects the least advantaged people disproportionately regionally and globally (Smith et al., 2001), but also climate change mitigation measures can raise justice issues (Zhang & Baranzini, 2004; Büchs et al., 2011; Wang et al., 2016). As Klinsky et al. (2017) mention, the world is characterized by vast disparities in

well-being, making it precarious to analyze climate policies without regard for these different structural positions of humans. Climate change action is fundamentally for the overall well-being of communities. In this context, it is necessary not to overlook the varying impacts of climate change and climate policies on people's well-being (Klinsky et al., 2017). Therefore, climate change mitigation policies should also safeguard other social and environmental aspects of sustainable development. At the same time, the pressing need for limiting the adverse effects of climate change demands ambitious and meaningful mitigation policies.

Among various mitigation policy tools, carbon taxes are designed to affect the target group's behavior by altering their economic incentive structure. A carbon tax reflects the negative environmental impacts of economic activities by assigning a particular cost to them, thereby creating a price signal that incentivizes polluters to reduce their impacts. Therefore, compared to the traditional command-and-control instruments, carbon pricing policies exhibit two key characteristics that render them attractive: cost-effectiveness and a dynamic incentive for innovation (Stavins, 1998). As a crucial instrument for cutting carbon emissions, the adoption of carbon pricing policies has been growing worldwide. In fact, over the past decade, the share of global emissions covered by carbon taxes and Emissions Trading Systems (ETSs) has increased from 7% to 23% (World Bank, 2023). Nonetheless, despite their asserted effectiveness and efficiency, carbon taxes may encounter resistance and low support from the public (Carattini et al., 2018; Bachus et al., 2019). Consequently, to avoid public opposition, politicians might opt for politically more feasible policies (e.g., command-and-control instruments) over those that are more efficient and effective (e.g., carbon taxation). A key reason for public's low support for carbon taxation is concerns about its fairness (Carattini et al., 2018). In this regard, the literature has predominantly focused on the distributive effects of the policy on various income groups. It is mainly believed that carbon taxes are regressive, disproportionately affecting lower-income households (e.g. Kerkhof et al., 2009; Büchs et al., 2011; Grainger & Kolstad, 2010; Williams et al., 2014; Klenert & Mattauch, 2016). Apart from income, some studies have emphasized the issues of horizontal equity and how the tax burden can vary based on factors such as consumption patterns within similar income groups, the allocation of tax revenues, regional differences, socio-demographic factors, race, and ethnicity (e.g. Feng et al., 2010; Rausch et al., 2011; Morris & Munnings, 2013; Wang et al., 2016; Cronin et al., 2019).

In order to deliver efficient climate policies and reap their full benefits, careful policy design is essential. A well-designed carbon price is an indispensable part of an efficient emission reduction trajectory in order to avoid further severe interferences with the climatic systems (Stiglitz et al., 2017). Carbon tax policy analysis is mainly concerned with the effectiveness of the tax in reducing GHG emissions and its cost-efficiency. At the same time, less attention has been paid to justice in taxation. Currently, despite the numerous studies dedicated to dis-

tributive justice, the issue of justice in carbon taxation has remained understudied. Such narrow focus on one aspect of justice (i.e. distribution) would not sufficiently encompass all the fairness-related issues that can emerge during the implementation of carbon taxation. Such an approach might run the risk of designing a policy that would only partially address the concerns of various stakeholders and overlook some of the potential equity impacts of the taxation scheme. Consequently, the tax policy might face limited public support and be deemed as unjust. Therefore, this study aims to contribute to the design of feasible carbon taxes by providing a comprehensive understanding of the breadth and dimensions of fairness, exploring the considerations that should be part of fair carbon tax policy-making. It draws upon three concepts of recognition justice, procedural justice, and distributive justice from environmental and climate justice theories and explores the previous literature in order to discover any relevant insights. As a constructive contribution to the existing literature, it offers a structured overview of the justice-related contents of the previous carbon pricing literature and puts forth an immediately applicable checklist for the formulation of fair carbon taxes. In doing so, it aims to bridge some gaps in the climate justice debate regarding its struggle for delivering justice in climate action. It also underscores the importance of recognition and procedural aspects alongside distributive effects as three distinct yet interlinked justice concepts, supported by the evidence acquired from the review.

The remainder of this article is organized as follows. Section 2 provides the theoretical background regarding justice and its core dimensions. Section 3 details the method and the review process. Section 4 offers a comprehensive overview of the results, and section 5 presents the concluding remarks.

2. Theoretical Framework

Environmental justice studies emerged shortly after the issue of environmental racism raised in 1982, involving hazardous waste dumping in African-American neighborhoods in the United States (Mohai et al., 2009). As the remedy for environmental racism, Bullard defined environmental justice as a principle that grants all people and communities to equal protection under laws and regulations regarding environmental and public health (Bullard, 1996 as cited in Mohai et al., 2009). Later on, the U.S. Environmental Protection Agency (1998, EPA) elaborated on this definition: environmental justice is "the fair treatment and meaningful involvement of all people regardless of race, ethnicity, income, national origin or educational level with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies". Schlosberg (2004) argues that environmental justice must include recognition, participation, and distribution as separate but interlinked elements of justice (Schlosberg, 2004). In a subsequent work, he contends that a group lacking equal respect might face exclusion and marginalization in decision-making processes and, thus, likely to experience distributive disadvantages. Similarly, a group with a distributive disadvantage might lack adequate resources for effective participa-

tion in decision-making and go unrecognized (Schlosberg, 2007).

With the growing concerns for a changing climate, the conceptions of climate justice emerged as a separate concept but closely linked to environmental justice. The primary focus of the concept was to assist those affected by climate change, share the burdens of climate change equitably, mitigate emissions, and facilitate adaptation (Lyster, 2016). Schlosberg and Collins (2014) recognize three broad conceptualizations for climate justice: ideal academic theories, the perspectives of elite NGOs, and the viewpoints of grassroots movements, with the latter being considered the most thorough and authentic. The pluralistic conceptions of environmental justice are replicated and expanded in the formation of climate justice conceptions by grassroots movements. These conceptions encompass concerns about the inequitable impacts of fossil fuel production on already vulnerable groups, issues of procedural justice, and the provision of basic needs in vulnerable communities (Schlosberg & Collins, 2014).

The climate justice debate has faced some criticism. For instance, due to its breadth and lack of content clarity, Jenkins (2018) argues that the climate justice concept is a struggling one which fails to be compatible with meaningful emission reduction and sufficient climate action. This concept falls short in addressing critical questions, such as how to manage untapped oil and gas reserves, define the right to sustainable development, or address the unequal distribution of wealth. These limitations reflect the insufficiency of the climate justice agenda in addressing the challenges posed by climate change (Jenkins, 2018). Moreover, according to Bulkeley et al. (2013), although the engagement of climate justice with environmental justice has integrated concerns about the outcomes and processes of climate policy into the same frame of analysis, still, climate justice mainly revolves around international debates (Bulkeley et al., 2013). However, it is equally important to note that those more vulnerable to climate change might also be more vulnerable to climate policies (Marino & Rebot, 2012, as cited in Bulkeley et al., 2013).

Despite the existing criticism regarding their broad scope and limitations in delivering justice in practice, environmental and climate justice theories provide a substantial framework through their emphasis on issues of recognition, procedure, and distribution. These elements can serve as guiding criteria for further advancements in the field. Therefore, this study employs these three core justice tenets, drawing upon this background, with the aim of shedding light on and enhancing the conceptual clarity of fairness within the realm of climate policies as governed by climate justice. In the following sub-sections, more details regarding each justice dimension are provided. In each section, a brief exploration of the ideas put forth by other authors precedes the definition of each justice dimension, all of which are informed by the underlying theoretical foundation.

2.1. Recognitional Justice

Responsibility, vulnerability, and decision-making power of individuals and

groups in the case of climate change can be related to social structures characterized by gender, socio-economic status, ethnicity, nationality, health, sexual orientation, age and location (Kaijser & Kronsell, 2014). To examine those differences, recognition is vital. A lack of recognition constrains people, is the foundation of distributive injustice, and can decline a person's membership and participation in society (Schlosberg, 2004). In this regard, a crucial concept is intersectionality. Intersectionality is "the interaction between gender, race and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power" (Davis, 2008) and how such intersections drive or exacerbate privilege, discrimination, and oppression (Ahmed, 2017). Intersectionality asserts that focusing on one single marker leads to a false and simplified classification of people that does not capture lived realities (Hankivsky & Cormier, 2011). Mikulewicz et al. (2023) argue that integrating intersectionality into climate justice is essential to understanding and tackling climate inequities. Engaging with intersectionality makes climate justice a critical approach which continuously questions the status quo and acknowledges the intricate social dynamics inherent in climate action (Mikulewicz et al., 2023). Hence, the current research considers recognitional justice as a concept that concerns the acknowledgement of and respect for multiple identities through the pluralistic lens of intersectionality, which will try to recognize individuals and groups based on their various intersecting identities in order to more realistically pinpoint the most vulnerable.

2.2. Procedural Justice

All major socio-technical transitions, such as the transition to a low-carbon society, require open and democratic participation of all actors (e.g. firms, consumers, civil society groups, community groups, city authorities, political parties and ministries) (Bickerstaff et al., 2013, as cited in Sovacool et al., 2019). In general, procedural justice seeks to identify who plans and makes the rules, laws, and decisions and who can have a say in this process (Sovacool et al., 2019; Povitkina et al., 2021). Bubna-litic and Chalifour (2012) delineate two facets of procedural justice: one involves assessing the degree to which the public can genuinely engage in the selection and design of policies, while the other refers to the negotiating power of stakeholders, where usually large corporations and industries have the lobbying power to preserve their interests. Maguire and Lind outline the principles of procedural justice, including full participation in the process, ability to express freely and have a voice, being respected, receiving adequate information, impartial decision-makers, and correctable and responsive decisions in the face of new information (Maguire & Lind, 2003; as cited in Gross, 2007). Drawing on multiple previous research, Yenneti and Day (2015) regard open information exchange, community participation in decision-making, and representation of all sectors in relevant processes as the main aspects of procedural justice. Therefore, a fair policy process guarantees democratic par-

ticipation of all relevant actors in decision-making, gives voice to them and considers their concerns, is transparent and provides information during all stages of the policy process, equalizes power dynamics among interest groups, remains impartial in the face of influential lobbyists, and allows for adjustments in decisions when necessary.

2.3. Distributive Justice

Johansson-Stenman and Konow (2010) assert that the distribution of costs and benefits of environmental policies poses a critical challenge for policy-makers, and the outcomes of these policies can vary significantly in terms of distribution. They argue that distributive justice pertains to moral preferences regarding the allocation of social and economic benefits and burdens among individuals or groups. These distributive preferences can be characterized by rules such as accountability, efficiency, need, or equality. Sovacool et al. (2019) state that distribution has three main aspects: identifying the goods and bads that are to be distributed (e.g. pollution, energy, wealth), identifying the entities among whom those goods or ills are to be distributed (e.g. specific communities or stakeholders), and identifying the appropriate mode of distribution (e.g. need, merit). Granqvist and Grover (2016) mention that it is important to also distinguish between a policy's immediate distributive impacts and its final incident. Similarly, they introduce several principles of distributive justice which are particularly relevant in the climate change context: Polluter Pays (PPP), Ability to Pay (APP), and Beneficiary Pays (BPP). Thus, generally, distributive justice in policy-making is primarily concerned with the equitable allocation of policy benefits and burdens among relevant groups and individuals. It relies on certain principles and criteria to determine and correct (mal)distribution, while considering the realistic estimations of the policies' short-term and long-term distributive impacts.

3. Methods

In order to synthesize and clearly present the existing evidence on fairness in carbon pricing from the previous literature, discover the main limitations and overlooked concepts in the past research, and eventually set the foundation for a fair carbon tax policy-making, this study uses the review approach. Literature reviews summarize the existing literature to find an answer to a review question, set forth context for further research, or discover gaps in the literature. Systematic review approach follows strict steps aimed at minimizing bias, making the literature review rigorous, comprehensive, and transparent (Hempel, 2020). Despite such advantages, systematic reviews are highly time- and resource-intensive, which makes them only feasible in some settings. Therefore, traditional reviews can still provide valuable information. At the same time, in order to increase the reliability, objectivity, and quality of traditional reviews, they can benefit from some aspects of systematic review methods such as systematic searching, screen-

ing, and critical appraisal (Haddaway et al., 2015). Due to time and resource constraints, this study conducts a traditional exploratory review; however, it adopts some principles of systematic reviews following the guidelines from Haddaway et al. (2015) and Hempel (2020) to increase the review's quality and reliability.

3.1. Database Search

The search of the literature was done during May and June 2023. Initially, the search was conducted in Web of Science (WoS) database. Additionally, references from the final selected WoS articles were screened (reference mining) for collecting further relevant material. Moreover, a further search was performed in Google Scholar in order to include other potentially relevant articles that might have been missed in the previous search steps.

In order to search in WoS, Boolean operators were applied. Several search strings using a combination of search terms such as "justice", "fairness", "carbon pricing", "carbon taxation", and "climate change mitigation" were developed. After testing several search strings (Table 1) and pre-screening the relevance of the yielded articles, the following search string was used to retrieve articles from WoS: (justice OR fair* OR equity) AND (recognition* OR distributi* OR procedur*) AND ("carbon pricing" OR "carbon taxation" OR "environmental taxation" OR "climate change mitigation"). Search string for Google Scholar was a more general phrase in order to include more potential articles: "carbon pricing justice fairness equity". The Google Scholar search was limited to articles published between 2013 and 2023 sorted as the most relevant.

Table 1. Tested search strings (the bold strings show the final selected search strings).

Database	Date	Results	Search string
Web of Science	29/5/2023	76	Justice carbon pricing
		139	Justice (carbon pricing OR carbon taxation OR environmental taxation OR climate change mitigation AND recognition)
		211	Justice (carbon pricing OR carbon taxation OR environmental taxation OR climate change mitigation AND distribut*)
		140	Justice (carbon pricing OR carbon taxation OR environmental taxation OR climate change mitigation AND procedur*)
		154	Justice (recognition* OR distribut* OR procedur*) AND (carbon pricing OR carbon taxation OR environmental taxation OR climate change mitigation)
	30/5/2023	143	(justice OR fair* OR equity) AND (recognition* OR distributi* OR procedur*) AND ("carbon pricing" OR "carbon taxation" OR "environmental taxation" OR "climate change mitigation")
	5/6/2023	152	**(justice OR fair* OR equity) AND (recognition* OR distributi* OR procedur*) AND ("carbon pricing" OR "carbon taxation" OR "environmental taxation" OR "climate change mitigation")**
Google Scholar	21/6/2023	16,900	**Carbon pricing justice fairness equity**

*Only the first 100 articles (sorted by relevance) were screened.

3.2. Screening Process, Eligibility Criteria, and Data Extraction

Articles retrieved in the search step were screened for relevance at title, abstract, and full-text levels based on predefined inclusion criteria. After abstract screening, potentially suitable papers were collected in full-text, and the whole paper was assessed to pile up the final set of relevant articles. The inclusion criteria are as follows: English language papers, academic research and review papers, papers including either dimension of justice (i.e. distribution, procedure, recognition) and their implications, and papers concerning relevant energy and climate policies. Papers concerning justice-related climate change issues and papers with a global perspective without implications at a national level were excluded from further analysis. After full-text screening of the selected articles, data from each paper was organized in a coding framework (evidence table). Studies were organized based on author/date, journal, location, policy type, research method, and justice dimension(s).

3.3. Critical Appraisal

Critical appraisal refers to assessing each of the included articles. It is about critically reviewing the quality of the material that has been included. There are numerous ways and standards to assess publications and understand how they help answer the review question (Hempel, 2020). Haile (2022) compiles a list of widely used critical appraisal tools based on the type of the study. Based on Haile's results, this study used Johns Hopkins Research Evidence Appraisal Tool (Newhouse et al., 2005) for quantitative papers and Joanna Briggs Institute Critical Appraisal Tools (JBI) for qualitative research (Lockwood et al., 2015), systematic reviews (Aromataris et al., 2015) and expert opinions (McArthur et al., 2020). In addition, besides the criteria mentioned by these tools, importance was given to studies that were closely relevant to the review question raised in the present research. Following the appraisal, each study was categorised as high, good, or low quality (see **Table 3**). Examples of criteria mentioned by each tool are presented in **Table 2**.

4. Results

4.1. Descriptive Information

The diagram in **Figure 1** illustrates the article screening and selection process. A total of 274 articles were initially retrieved as potentially relevant publications. Eventually, 50 articles were included after screening steps, which provided relevant implications regarding fairness in climate change mitigation policies.

As shown in **Figure 2**, a considerable portion of the studies cover European countries. Even studies with a cross-country scope mainly presented examples from European countries or other developed nations. This is not unexpected, as most carbon pricing policies have been implemented in European and North American countries. Only a limited percentage of the studies covered the African context. Similarly, few studies cover South American and Asian contexts.

Table 2. Critical appraisal tools and examples of their questions.

Appraisal tool	Johns Hopkins Research Evidence	Joanna Briggs Institute
Study type	*Quantitative*	*Systematic review*
Examples of criteria	- Does the researcher identify what is known and not known about the problem? - Was the purpose of the study clearly presented? - Was the literature review current (most sources within the past five years or a seminal study)? - Was the sample size sufficient based on the study design and rationale?	- Is the review question clearly and explicitly stated? - Were the inclusion criteria appropriate for the review question? - Was the search strategy appropriate? - Did the reported data support recommendations?

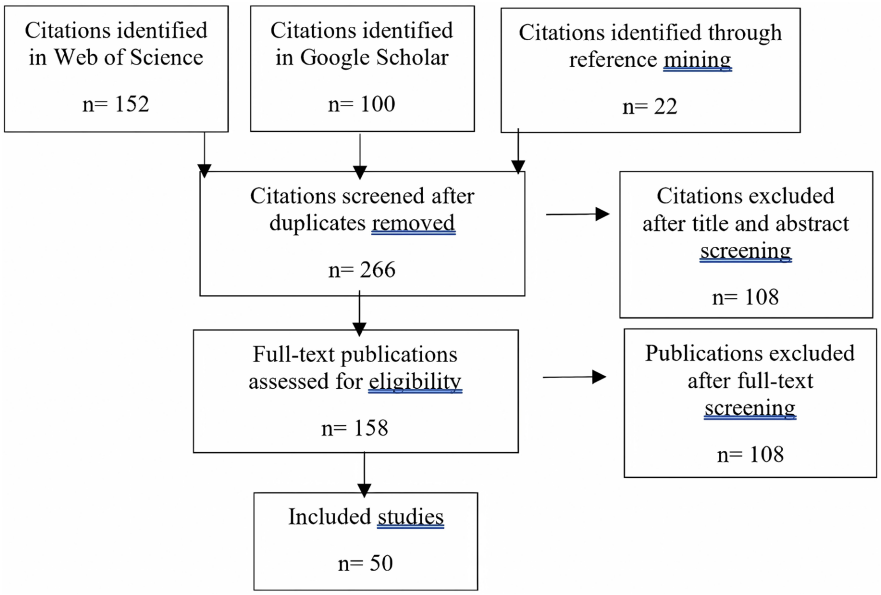

Figure 1. Flowchart of screening and selection process.

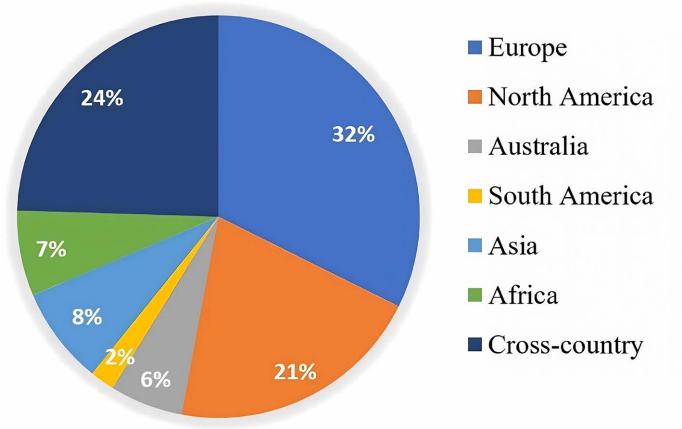

Figure 2. Percentage of studies in different regions.

Although several South American countries have implemented or plan to implement carbon pricing, research on justice issues is minimal, even compared to Asian and African contexts. This explicitly reveals the context gap in the litera-

ture on carbon tax and the substantial need for further ex-ante and ex-post analyses in the developing country context.

Figure 3 shows the number of studies by the type of justice aspect being discussed. As expected, the distribution aspect has been the topic of most studies, followed by procedural and recognitional justice aspects. While 46 studies have mentioned distributional concerns, only 18 and 19 articles have explicitly or implicitly discussed recognitional and procedural issues, respectively. As mentioned earlier in this dissertation, distributional concerns of carbon pricing policies and other low-carbon transition policies overshadow other justice aspects. Still, this chapter has valuable implications regarding less investigated justice aspects.

4.2. Articles' Review Results: Key Themes in Each Justice Dimension

An excerpt of the summary characteristics of the reviewed articles, such as policy type, justice dimension, and research methods, are presented in the evidence Table 3 (for a complete list of articles, refer to **Appendix A**). Due to the purpose of the study and the heterogeneous nature of the included articles, the results in this section will be summarized narratively.

Recognition

26% of the studies recognized that climate change mitigation policies (including energy transition and carbon pricing policies) can have a disproportionate impact considering household characteristics and place of residence. Around 10% of the studies mentioned that ethnic and racial minorities as well as local and indigenous communities are more vulnerable to mitigation policies. Only around 6% of the articles specifically stated women's higher vulnerability and gender implications of mitigation policies. Similarly, only 6% of the articles implied concerns for fossil-fuel-intensive industries upon introducing low-carbon policies.

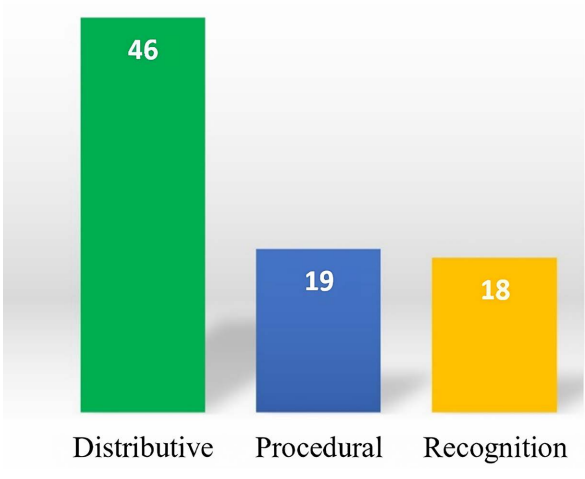

Figure 3. Number of studies (out of a total of 50) covering each dimension of justice (Note that some studies address more than one dimension).

Table 3. An excerpt of characteristics of the reviewed articles.

						Justice aspect(s) implied		
Author/date	Journal	Quality	Context	Policy type	Study type	Recognition	Procedure	distribution
Abrell et al., 2018	Environmental economics and management IF: 4.6	High	USA	Carbon tax	Quantitative analysis through theoretical and numerical general equilibrium analysis			✓
Agostini & Jimenez, 2015	Energy economics IF: 12.8	High	Chile	Gasoline tax	Statistical analysis through Suites Index on household budget survey data			✓
Bailey, 2017	Annals of the American association of geographers IF: 4.557	Good	Australia	Carbon pricing	Document analysis, semi-structured interviews	✓		✓
Baranzini et al., 2017	WIREs Climate change IF: 9.2	High	-	Carbon pricing	Review		✓	✓

Several climate mitigation policies worldwide have failed due to insufficient recognition of vulnerable people and the right to self-determination (Robinson & Shine, 2018). Recognition understands differences and protects equal rights for all. It supports the idea of fair representation for vulnerable groups without distortion or fear of reprisal (Sovacool et al., 2019). Climate policies such as carbon taxation can have gender implications. Socially constructed gender roles impact individual livelihoods, and therefore, distributive effects of climate mitigation are likely to be gendered (Bendlin, 2014). Policies which solely address distributional effects on low-income households do not consider the disparities between men, women, their socio-economic status, and any other socially marginalized groups. Nevertheless, policies such as carbon pricing tend to focus only on distributional effects on low-income households and fail to consider such disparities. An important link exists between distributional impacts and women since, generally, more women live in poverty than men. It is safe to say that men have contributed to GHG emissions more than women due to their higher income and use of transportation fuels, for instance (Chalifour, 2010). Chalifour (2010) believes that three main questions should be addressed to understand whether women benefit from or are hurt by a carbon tax: What are the gender implications of the tax (including income and non-income impacts)? What are the gender implications of the whole carbon tax policy package? And what are the gender implications of the outcomes of the tax?

Other marginalized groups might also be at risk following climate policy introduction. It is necessary to understand whether there are pre-existing inequalities regarding other marginalized groups, such as ethnic minorities and their

capability to deal with increased fuel and energy prices. Bubna-Litic and Chalifour (2012) state that carbon pricing policies in Australia and Canada put indigenous people at risk. They say that one concern regarding carbon taxation is that it is usually implemented in the context of existing institutional and administrative structures; thus, there is less opportunity for adjustments and enhancing fairness by including various perspectives.

Household-specific needs and characteristics can also make some people more vulnerable than others: living in extreme weather, living in rural areas, long commuting distances and car dependency, female-headed households, households with older person reference and with children can be more vulnerable to carbon pricing policy depending on its design. Decarbonization policies raise concerns about communities that their livelihoods depend on fossil fuel extraction and production (Bennear, 2022). In the USA, a study on decarbonization policies finds that after controlling for income, distributional effects are higher for black, indigenous, and people of color (Bennear, 2022). In Australia, many people opposed carbon pricing on alternative justice grounds, competing with the claims of climate justice. Significant debates and concerns about fair treatment for resource-dependent states and the fear of losing jobs, loss of competitiveness for fossil fuel industries, effects of carbon pricing on households with higher car dependency, longer travel distances and extreme climates were some of the major arguments that the opponents of the carbon pricing raised (Bailey, 2017). An important matter in recognizing vulnerable groups is taking an intersectionality perspective. A gender and social equity intersectional perspective highlights the issues of overlapping inequities, such as when gender inequality interacts with inequalities related to ethnicity, race, class, and age (Johnson et al., 2020).

Procedure

Around 26% of the studies emphasized the necessity of participation and representation for all, especially the more vulnerable. About 8% of the articles also highlighted the importance of access to information about the policy process for all and transparency in policy-making. Also, around 12% of the reviewed studies underscored the impacts of decision-making and lobbying power on the policy's outcomes.

Procedural justice demands that a just transition to a low-carbon future requires the involvement of unions and communities in the decision-making process (Hansford & McKerchar, 2010; Goddard & Farrelly, 2018). Different groups can have different representation in the course of policy-making. For example, gender and social norms limit women's ability to participate in decision-making processes (Chalifour, 2010; Johnson et al., 2020). Women are usually underrepresented in decision-making, a considerable problem when mitigation policies have widespread gender risks and opportunities. While representation in government, public administration and international organizations, elections, policy formulations and implementation, and NGOs are essential,

women's equitable participation in climate governance also involves access to equal health, education, and employment opportunities in climate-related sectors (Bendlin, 2014). Evidence from the study of multiple carbon markets in African and Asian countries suggests that local communities lack the opportunity to participate in national-level decision-making. Some actions can be taken to elevate the local communities from a disadvantaged position: capacity building, attention to power relations, prioritizing sustainable development goals, and bridging the local communities to higher levels through non-state actors (Mathur et al., 2013). Driscoll (2021) conducts in-depth interviews with Yellow-vest movement activists and draws several main themes about how they frame carbon pricing and climate change. One central theme was how they believe they have little voice in the policy-making process and politicians do not care about their concerns. They generally suggest that the policy-makers include the voices of people more with direct democracy.

Transparency and information provision are substantial for procedural justice. In the case of carbon or energy taxation, for instance, the benefits and burdens of the tax system and its revenue recycling scheme should be transparently communicated to the public (Dorband et al., 2019, Gago et al., 2021). O'Beirne et al. (2020) mention that in the case of the Greenhouse Gas Removal (GGR) in the U.K., procedural justice has received little attention despite its importance. Access to information about GGR is not guaranteed while maintaining a public register is necessary. Also, although there are some provisions for public participation, they are vague, and it is unclear who is represented and whose voice is recognized. Local stakeholders are not meaningfully participating due to the limited availability of accessible, non-technical information, and distrust in the available information. There is a lack of understanding of how the public should be engaged in participation and the proper means for that (O'Beirne et al., 2020). An assessment of Clean Development Projects (CDM) by Wilson (2011) reveals that CDM projects do not specify how or whether appropriate means of communication are required to ensure all stakeholders and local communities without internet access will be sufficiently informed of the project's development and implementation. Asking for stakeholder comments at early stages during the preparation and design of a project creates better chances for considering the public's concerns than after the project has been designed. The stage of public consultation and the how and means of consultation should be clearly identified (Wilson, 2011). Walker and Dey (2012) state that procedural injustice in the U.K. regarding the issue of fuel poverty that might be a consequence of decarbonization is about inadequate access to information on the problem of fuel poverty, fuel prices, and solutions; lack of participation in energy policy, housing policy, climate policy, and fiscal policy; and limited access to legal rights and the ability to challenge these.

Also, decision-making power can be significantly different among different actors; thus, some groups' needs and wishes might be overlooked, and excep-

tions can create an unequal playing field (Finley-Brook & Holloman, 2016). For example, energy-intensive industries might have strong lobbying power, which can cancel the implementation of a policy or change it in their favor (Baranzini et al., 2017). Thus, it is necessary to pay attention to the institutions that underpin the bargaining power of the poorest and the most vulnerable groups (Karlsson et al., 2018). Bubna-Litic and Chalifour (2012) state that in the case of carbon pricing in Canada and Australia, indigenous people have less representation in policy, and large and powerful industries and businesses lobby for favorable treatment. From a feminist perspective, Chalifour (2010) believes that gender-mainstreaming and gender budgeting should be consistently applied to all policies to ensure that the gender implications of the policies are understood and that women have fair representation in policy-making. In the case of carbon markets and the possibility for their linkage, Guldbrandsen et al. (2019) state that policy diffusion processes are influenced by local political interests and institutions and design characteristics such as the sectors and covered gases are at least partly determined by the political power of the affected industries. They highlight the power of political coalitions in the favor of status-quo and the necessity for further political economy research on designing carbon pricing schemes.

Distribution

86% of the studies have mentioned the regressivity or progressivity of mitigation policies, especially carbon pricing policies, and the design elements that make the tax scheme regressive or progressive. One crucial topic in this regard is the use of tax revenues, which usually favor progressivity or economic efficiency. Around 60% of the articles emphasize the importance of revenue use in the outcomes of the carbon tax scheme. 20% of the studies refer to tax exemption, reduction, or abatement for cushioning the regressive effects and loss of competitiveness. The importance of complementary policies for equitable carbon pricing and mitigation policies has also been highlighted in about 14% of the studies reviewed. In addition, 10% of the articles state that carbon taxation is generally progressive in developing countries.

Many studies realize that low-carbon transitions and carbon pricing policies have distributional effects on poor households as they spend a bigger proportion of their income on critical services such as energy (e.g. Boyce, 2018; Bennear, 2022). In the case of a carbon tax, this is especially true if the behavioral change and tax rebates are not considered (Berry, 2019). Research suggests that depending on the sector covered by the tax, it can be regressive or even progressive (Wang et al., 2016). For example, generally speaking, consumption taxes and taxes on home energy can be more regressive than taxes on transport fuels in some contexts (Datta, 2010; Büchs et al., 2011; Büchs et al.; 2021, Eisner et al., 2021). Previous research has also discovered that the regressivity of the taxed fuel can considerably depend on socio-economic factors such as income, employment situation, being headed by a woman, dwelling characteristics, house-

hold composition, space-heating technology, and location (Büchs & Schnepf, 2013; Farrell, 2017). The choice between expanding the tax base size or increasing the tax rate can also lead to regressive or progressive taxes (e.g. Renner, 2018). It is also important to note that regressive effects should be well estimated, for example, by considering life-time income and wealth and behavioral change, in order not to underestimate or overestimate the tax regressivity (Büchs et al., 2011; Agostini & Jimenez, 2015; Teixidó & Verde, 2017).

One design element that can affect distributive effects is whether tax differentiation, abatements, or exemptions should exist across sectors. For example, energy-intensive industries can experience regressive effects from carbon taxation; thus, many countries have considered tax reductions or exemptions in those sectors. However, distributive effects across industries should be estimated regarding their regional location, production scale, and long-term benefits (Wang et al., 2016). A study in the U.S. by Abrell et al. (2018) suggests that where an optimal rebate scheme is possible, tax differentiation across sectors is not necessary; however, with per-capita rebates, it is optimal to differentiate carbon taxes across sectors in order to address the policy-induced inequities. Hänsel et al. (2022) suggest that, in Germany, in the optimal case of information availability, governments should apply a uniform carbon tax combined with household-specific lump-sum payments to address both vertical and horizontal equity issues.

The use of revenues has the most critical implications for the distributive impacts of carbon pricing policies. General fairness principles, including equality, equity, and merit, can justify different revenue distributions in environmental taxation. For example, equity calls for targeted transfers to the poorest households (vertical equity) or the most pollution-intensive households (horizontal equity) (Sommer et al., 2022; Pitkanen et al., 2022). Many studies suggest that revenues should be specifically targeted at vulnerable groups such as low-income households, female-headed households, households with elderly and children, people living in rural or distant areas, and households in regions with higher cooling and heating needs (Büchs et al., 2011; Büchs & Schnepf, 2013; Boyce, 2018; Berry, 2019, Eisner et al., 2021; Frondel & Schubert, 2021). Across various research, it is widely acknowledged that there is a trade-off between the tax scheme's progressivity (i.e. equity) and its efficiency (Wang et al., 2016). For example, in the U.S., uniform lump-sum transfers of tax revenues to households are the most progressive but the least efficient. Thus, an alternative revenue recycling scheme that compromises efficiency and equity is desirable (Caron et al., 2018; Jorgenson et al., 2018). However, uniform lump-sum transfers may ensure broad public acceptability due to their transparency, progressivity, and policy stability (Klenert et al., 2018; Köppl & Schratzenstaller, 2022). Ravigne et al. (2022) state that recycling schemes favoring the poorest households effectively reduce short-term carbon tax regressivity. However, policies supporting technology penetration in households will reduce tax payments at farther horizons

(Ravigne et al., 2022). Pereira and Pereira (2019) suggest that using tax revenues to finance feed-in tariffs for electricity generation from renewable energy is superior to a simple carbon tax. Although such a scheme might cause macroeconomic and distributional disadvantages, it still leads to better environmental outcomes at lower economic and social costs than a tax in isolation.

Several studies point to the need for complementary policies. Green and Gambhir (2020) express that low-carbon transitions should be complemented by Transitional Assistance Policies (TAP) for a just and equitable transition. They say five main groups might be affected by mitigation policies: consumers, workers, corporations, specially-affected communities, and states. There are four main TAP strategies: compensation, exemption, structural adjustment assistance, and comprehensive adaptive support. However, the success of these strategies depends on the government's capacity to steer complex, and long-term transitions (Green & Gambhir, 2020). Some examples of complementary policies in the literature include: higher subsidies or energy efficiency rebate programs for lower-income families, retraining and labor transitions for affected regions and industries (Barrington-Leigh et al., 2015), providing green vouchers for equal access to basic levels of low-carbon consumption (Büchs et al., 2021), providing access to affordable and clean energy for the poor in low- and middle-income countries (Dorband et al., 2019), subsidies on energy and food for poor households (Zhao et al., 2022), improving energy efficiency in poor households, enhancing public transportation, and redistributing part of revenues from energy subsidy removal in the form of energy dividend (Bourban, 2021), and weatherization measures to protect the buildings' interior and to improve their energy efficiency in marginalized households besides monetary help (Lewis et al., 2020).

Finally, some studies assert that carbon taxation is progressive in low-income countries; however, this claim needs further research across a broader range of countries (Wang et al., 2016). For example, Datta (2010) finds that fuel tax is progressive in India. Yusuf and Resosudarmo (2015) conclude that a carbon tax in Indonesia is strongly progressive in rural areas and either neutral or slightly progressive in urban areas. Agostini and Jimenez (2015) discover that in the Chilean case, the gasoline tax is slightly progressive considering household income and moderately progressive considering household expenditure. Dorband et al. (2019) find that carbon pricing is likely to be progressive in countries with annual per capita income below US$ 15000. However, in newly industrializing countries highly dependent on fossil fuel energy, there might be more resistance to carbon pricing. The summary of the discussion is presented in **Table 4**.

4.3. Considerations for a Fair Carbon Taxation

Based on the review results, the following checklist is proposed. The checklist reveals the main themes in each justice dimension and provides a series of guiding questions to consider and address to make a carbon tax scheme fairer. While

Table 4. Summary of the main themes drawn from the literature.

Recognition		
Theme	*Number of papers referring to it*	*Comment*
Household characteristics and place of residence	13	Socio-demographic heterogeneities make some households more vulnerable to the tax.
Carbon intensive industries	3	These industries can be at risk of losing competitiveness.
Ethnic and racial minorities and indigenous communities	5	Being institutionally marginalized, they can be over-burdened by carbon pricing; thus, the needs of these groups must be recognized and respected.
Women	3	Unequal socio-economic position of women can make them more vulnerable to carbon taxation and calls for gender mainstreaming.
Procedure		
Theme	*Number of papers referring to it*	*Comment*
Representation and participation	14	Different social groups can have different representation, and thus, capacities for inclusive policy processes should improve.
Transparency and information provision	7	Information at all stages of policy-making should be transparently provided through accessible means.
Decision-making power	6	Strong lobbies can affect policies in their favor, and therefore, institutions underpinning such inequalities should be corrected.
Distribution		
Theme	*Number of papers referring to it*	*Comment*
Regressive effects	43	Regressivity depends on design elements such as covered sectors and gases, and household characteristics.
Tax differentiation and exemption	10	One method to alleviate regressive effects mainly for energy-intensive industries.
Use of revenues	30	It is the main tool for dealing with distributive effects, which can take various forms based on the priorities for the equity-efficiency trade-off.
Complementary policies	7	Various kinds of policies can complement carbon pricing in order to facilitate the transition.
Carbon tax effects in developing countries	5	Some evidence shows that carbon taxation is progressive in developing countries.

some considerations are more general and not restricted to carbon taxation only, others are more specific to the case of carbon tax:

Recognition

- Are vulnerable groups, including low-income households, women, people living in remote areas, ethnic and religious minorities, people with disabilities, people living in extreme weather, and people working in carbon-intensive industries recognized and their needs considered? Are there pre-existing inequalities regarding these groups that might affect their response to increased fuel and energy prices?

- Are the people at the intersection of vulnerable social identities recognized in order to identify the most vulnerable groups (e.g. women belonging to ethnic minorities)?
- Are there underlying institutions and structures that have led to the marginalization of certain groups recognized?
- Is there an understanding of how carbon tax policy might affect the needs and well-being of any of these groups?
- Is there a need for capacity-building to elevate the position of the disadvantaged?

Procedure

- Is the public provided with sufficient information about climate change effects?
- Is the public, especially the vulnerable, provided with sufficient information about the benefits of carbon taxation in reducing the risks of a changing climate and its potential burdens, such as the issue of regressivity?
- Is this information easily accessible and non-technical to be understood by a wide range of stakeholders?
- What are the most appropriate means and mediums for information sharing to avoid leaving any of the actors behind?
- Is there transparency regarding design characteristics and the use of tax revenues?
- Do all layers of society and stakeholders have sufficient representation for policy-making? Are they represented and consulted in different phases of the process? Are their feedbacks taken into account?
- Is there a balance in the lobbying power of carbon-intensive industries and incumbents, NGOs, unions, communities, and the public?
- Are there any plans for updating and evaluating the carbon tax policy?
- Is gender mainstreaming applied to carbon tax policy and, on a broader scale, to all public policies?

Distribution

- Are there estimations of potential regressive effects of the carbon tax, for example considering life-time income, wealth, and behavioral change, to avoid understating and overstating the regressivity?
- What fuels/sectors (i.e. home, transport, electricity) should be covered by the tax? What are the potential regressive/progressive effects of taxing certain sectors and fuels? Should there be tax differentiation across sectors?
- Should there be tax abatement, reduction, exemptions or tax thresholds for vulnerable industries and households?
- What are the trade-offs between environmental, economic, and social justice outcomes of the tax and rebate system? Are there any priorities favoring such outcomes (e.g. is tax progressivity a priority)?
- How should the revenues be used? Should the tax revenues be entirely or partially redistributed (e.g. revenues being directed to general budget, used

for environmental purposes, paid back to households, used to cut other distortionary taxes, or a hybrid system)?

- What is the principle for revenue redistribution (e.g. equity, equality, merit, need)? Should the revenues be specifically targeted at vulnerable households?
- Should the use of revenues be updated or changed over different planning time horizons (i.e. regarding short-term effects of tax versus long-term effects)?
- Should there be complementary policies to reduce possible adverse disproportionate effects of the tax (e.g. energy efficiency improvements for poor and vulnerable households, retraining and assistance for labor transition, enhancing the extent and affordability of public transport)? Are these policies funded by tax revenues or other financial resources?

5. Conclusion

This study explores the relevant literature using some principles of systematic review methods in order to discern the essential components of fair carbon tax policy-making. It borrows three key concepts of justice—recognition, procedure, and distribution—as the main criteria for extracting pertinent information from the literature. Following the analysis of academic papers, it presents a checklist of questions that should be considered and addressed to fulfill fairness requirements. In addition, the review yields the following insights.

The study underscores the significance of recognitional and procedural justice dimensions, which represent a notably smaller portion of studies focusing on fairness in carbon taxation. While roughly 90% of the included articles address distributive effects, recognition and/or procedural justice concerns are evident in fewer than half of the studies. This gap in the literature highlights the need for more inclusive assessments of justice in climate change mitigation in general and with a specific focus on carbon taxation. In addition, the majority of studies have analyzed developed countries, while sufficient evidence from developing country context is lacking. This highlights the urgency of conducting more research in the Global South.

Overall, recognition justice has received minimal attention in the context of carbon taxation. While certain studies have acknowledged household heterogeneities and their potential to impose disproportionate burdens on specific households, other aspects of recognition are barely investigated. For instance, little evidence exists regarding gender-based assessments of how carbon taxation impacts different genders and its potential to alleviate or exacerbate the existing gender disparities. It is also unknown whether such effects vary between the Global North and South. Similarly, impacts on other vulnerable groups, such as ethnic minorities and indigenous communities, are not sufficiently analyzed. An important consideration is adopting an intersectionality perspective to identify the most vulnerable groups more realistically. Thus, recognizing vulnerable groups like women and indigenous people through an intersectionality lens,

along with assessments of how a carbon tax may impact these groups, carries substantial policy implications on the distributive front. This may include targeting revenues towards specific groups or implementing complementary policies to address disproportionate tax burdens. This again highlights the interconnectedness of the justice dimensions.

In a similar vein, only a limited number of studies are concerned with procedural justice in carbon taxation. In general, a few studies have emphasized the importance of representation, information provision, and decision-making power in the realm of mitigation policies, principles that can be equally relevant to carbon taxation. Nevertheless, additional studies are needed to examine how the public has been or should be engaged in the policy-making process, what methods of communication and information exchange are suitable, and what institutional factors influence the establishment of a fair and equitable policy environment across various countries and contexts. This holds significance because affording various groups a voice and pursuing a transparent policy process have the potential to enhance public trust and support, contributing to the success of the policy.

Research on distributive effects is comparatively abundant. The main design elements of the carbon tax scheme, such as covered sectors and GHGs, exemptions and tax reductions, and the use of revenues, primarily determine its distributional impacts. In this regard, the literature has predominantly emphasized revenue utilization. Revenue use can take various forms, depending on priorities within different countries and jurisdictions. Whether the revenues are allocated as a cushioning tool for regressive effects, used for further attempts for emission reduction, directed to the general budget, employed to reduce other distortionary taxes, or used for multiple purposes hinges on the desired trade-off between equity and efficiency in every context. Therefore, there is no universally preferred approach to revenue use. Thus, it is essential to understand what principle (e.g. need, equality, equity) of revenue sharing suits the respective context.

The proposed checklist provides an overview of considerations within each justice dimension, serving as a guide for just carbon tax policy-making. It reveals the core themes without striving for exhaustiveness and can be extended through further research in the field. It emphasizes the importance of recognition for household heterogeneities and vulnerable groups such as women, minorities, and local communities, while having an intersectionality approach; a fair policy process through the provision of information, representation of all relevant stakeholders and power balance; and proportionate burden sharing through measures such as tax exemption/reduction, targeted revenue allocation, and complementary policies counteracting the potential negative impacts of the carbon tax system on specific groups.

The current review has some limitations. First, a complete systematic review was not feasible due to time and resource constraints. As a result, this study solely concentrated on peer-reviewed academic papers and did not incorporate

gray literature, which could potentially add valuable insights to the review. However, as Johnson et al. (2020) mention, this can be an important starting point where we could understand how such concerns as fairness in mitigation policies are reflected in academic studies. Second, due to the scarcity of studies on recognition and procedural justice, during the critical appraisal stage, the review had to frequently rely on the limited number of articles dedicated to these dimensions. For example, in several instances, the review makes reference to Chalifour (2010), a relatively dated paper. However, this paper is one of the few articles explicitly concerned with fairness in carbon taxation from a feminist perspective, a perspective which still has not been sufficiently developed over a decade later. Therefore, such studies still provide valuable insights for future research and can be further developed through additional investigations into the assessment of recognition and procedural justice within mitigation policies. Third, due to the limited literature on carbon pricing and taxation, the study also delved into research on low-carbon transition. Still, these studies can offer significant implications for carbon pricing, given their common goal of emission reduction. Finally, although this review tested several search strings for their relevance, the use of fixed search strings can run the risk of missing some of the potentially important studies. Therefore, future research can further refine or test possible search strategies in order to retrieve other significant pieces of information.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix A. Full List of Included Papers

						Justice aspect(s) implied		
Author/date	Journal	Quality	Context	Policy type	Study type	Recognition	Procedure	distribution
Abrell et al., 2018	Environmental economics and management IF: 4.6	High	USA	Carbon tax	Quantitative analysis through theoretical and numerical general equilibrium analysis			✓
Agostini and Jimenez, 2015	Energy economics IF: 12.8	High	Chile	Gasoline tax	Statistical analysis through Suites Index on household budget survey data			✓
Bailey, 2017	Annals of the American association of geographers IF: 4.557	Good	Australia	Carbon pricing	Document analysis, semi-structured interviews	✓		✓
Baranzini et al., 2017	WIREs Climate change IF: 9.2	High	-	Carbon pricing	Review		✓	✓
Barrington-Leigh et al., 2015	Canadian Public Policy/Analyse de Politiques IF: 3.235	Good	Quebec, Canada	Cap-and-Trade	Quantitative analysis through integrated assessment model	✓		✓
Bendlin, 2014	Cambridge review of international affairs IF: 2.492	High	-	Mitigation policies	Opinion through the lens of women's right perspective	✓	✓	✓
Bennear, 2022	Annual review of resource economics IF: 5.8	Good	USA	Decarboniza-tion and energy transformation policies	Literature review	✓		✓
Berry, 2019	Energy policy IF: 9	High	France	Carbon tax	Tax simulation through microsimulation model			✓
Boyce, 2018	Ecological economics IF: 7	High	-	Carbon pricing	Review			✓
Bubna-Litic and Chalifour, 2012	Dalhousie law journal IF: -	High	Canada and Australia	Carbon taxation and emissions trading	Case study review through a fairness framework	✓	✓	✓
Büchs et al., 2011	Critical social policy IF: 2.3	Good	-	Economic instruments including carbon pricing	Literature review	✓		✓

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Büchs et al., 2021	Environmental research letters IF: 6.7	Good	27 European countries	Carbon taxation	Microsimulation using input-output data			✓
Büchs and Schnepf, 2013	Ecological economics IF: 7	High	U.K.	Mitigation policies including carbon taxation	Bivariate analysis and multivariate OLS regression using expenditure survey data	✓		✓
Caron et al., 2018	Climate change economics IF: 2.3	Good	USA	CO_2 tax	General equilibrium model			✓
Chalifour, 2010	Canadian journal women and the law IF: -	High	Canada	Carbon taxation	Case study review from a feminist perspective	✓	✓	✓
Datta, 2010	Energy economics IF: 12.8	High	India	Fuel tax	Input-output analysis of household survey data			✓
Dorband et al., 2019	World development IF: 6.9	High	87 lower- and middle-income countries	carbon pricing	Microsimulation using household expenditure data		✓	✓
Driscoll, 2021	Social problems IF: 3.2	High	France	Carbon taxation	In-depth interviews, document analysis		✓	
Eisner et al., 2021	Energy policy IF: 9	High	Austria	Carbon tax	EASI (Exact Affine Stone Index) demand system model	✓		✓
Farrell, 2017	Ecological economics IF: 7	High	Ireland	Carbon taxation	Concentration index methodology, multivariate decomposition			✓
Finley-Brook and Holloman, 2016	International journal of environmental research and public health IF: 4.614	Good	USA	Carbon taxation	Literature review		✓	✓
Frondel and Schubert, 2021	Energy policy IF: 9	High	Germany	Emissions trading	Partial equilibrium model			✓
Gago et al., 2021	Hacienda publica Espanola-Review of public economics IF: 0.7	Good	Spain	Energy-environmental tax	Tax effects simulations	✓	✓	✓

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Goddard and Farrelly, 2018	Applied energy IF: 11.2	High	Australia	Transitioning power sector into renewable energy	Document analysis		✓	✓
Green and Gambhir, 2020	Climate policy IF: 6.056	High	-	Low-carbon transition	Literature review			✓
Gulbrandsen et al., 2019	Climate policy IF: 6.056	High	-	Carbon markets	Literature review		✓	
Hänsel et al., 2022	Environmental economics and management IF: 4.6	Good	Germany	Carbon taxation	Welfare-theoretic model of optimal taxation and redistribution			✓
Hansford and McKerchar, 2010	eJournal of tax research IF: -	Good	-	Environmental taxation	"is-ought" philosophical framework		✓	✓
Johnson et al., 2020	Energy research and social science IF: 6.7	Good	Multiple countries including developed and de-veloping	Low-carbon energy	Systematic literature review	✓	✓	✓
Jorgenson et al., 2018	Climate change economics IF: 2.3	Good	USA	Carbon taxation	Inter temporal general equilibrium model			✓
Karlsson et al., 2018	Peasant studies IF: 5.333	High	-	Climate-smart agriculture	Document analysis	✓	✓	✓
Klenert et al., 2018	Nature climate change IF: 28.862	High	-	Carbon pricing	Perspective			✓
Köppl and Schratzenstaller, 2022	Economic surveys IF: 2.299	Good	-	Carbon taxation	Literature review			✓
Lewis et al., 2020	Energy efficiency IF: 3.1	Good	USA	Energy efficiency	Literature review	✓		✓
Mathur et al., 2013	Climate policy IF: 6.056	High	African and Asian countries	Carbon market	Literature review	✓	✓	✓
O'Beirne et al., 2020	Environmental science and policy IF: 6	High	UK	Greenhouse gas removal (GGR)	Document analysis and interviews		✓	
Pereira and Pereira, 2019	Green finance IF: 8.6	Good	Portugal	Carbon tax	Dynamic multi-sector general equilibrium model			✓

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Pitkanen et al., 2022	Ecological economics IF: 7	High	Finland	Personal carbon trading in mobility	Factor analysis and regression Analysis of questionnaire survey data			✓
Ravigne et al., 2022	Ecological economics IF: 7	High	France	Low carbon strategy	Combined microsimulation and macroeconomic modelling	✓		✓
Renner, 2018	Energy policy IF: 9	High	Mexico	Carbon tax	Input-output analysis of household survey data			✓
Robinson and Shine, 2018	Nature climate change IF: 28.862	High	-	-	Expert opinion	✓	✓	✓
Sommer et al., 2022	Ecological economics IF: 7	High	Germany	Environmental taxation	Stated choice experiment			✓
Sovacool et al., 2019	Climatic change IF: 4.8	High	Four E.U. countries	Low carbon transitions	Mixed methods: interviews, focus groups, forum data	✓	✓	✓
Tank, 2020	Applied philosophy IF: 1.104	Good	-	Carbon pricing	Opinion through Moral argument of "Unfair Burdens"			✓
Teixidó and Verde, 2017	Ecological economics IF: 7	High	USA	Gasoline tax	Statistical matching using household-level data			✓
Walker and Day, 2012	Energy policy IF: 9	High	U.K.	Fuel poverty policy	Literature review	✓	✓	✓
Wang et al., 2016	Applied energy IF: 11.2	High	-	Carbon taxation	Literature review			✓
Wilson, 2011	Ecological law quarterly IF: -	High	-	Clean Development Mechanism (CDM)	Empirical critique		✓	
Yusuf and Resosudarmo, 2015	Environmental economics and policy studies IF: 1.7	Good	Indonesia	Carbon tax	Computational general equilibrium modelling			✓
Zhao et al., 2022	Sustainability science IF: 6	High	China	Carbon tax	Integrated assessment model			✓