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**Committee of Experts on International Cooperation in Tax Matters**
**Twenty-second session**
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Item 3(h) of the provisional agenda
**Environmental tax issues**

# Coordinator's report

**Handbook on Carbon Taxation for Developing Countries**

## Note by the Secretariat

This report is presented to the Committee FOR INFORMATION at its 22nd Session.

The main purposes of this report are to:

(i) Provide the Committee with a summary of the work the Subcommittee on Environmental Taxation has carried out since the 21st session of the Committee.

(ii) Provide an overview of the structure and content of the complete Handbook on Carbon Taxation for Developing Countries.

(iii) Provide a guide to navigate chapters of the Handbook presented for approval at the 22nd Session.

The complete text of the Handbook (as of 9 April 2021) is included as an annex. This version is unedited and not for citation. Chapters that were submitted to the Committee for approval in the current Session reflect (in "clean" format) the most updated edits, as will be proposed during the session.

1. At the 22nd Session of the Committee, agenda item 3(h): Environmental Tax Issues will include the following Conference Room Papers (CRPs) FOR APPROVAL, all related to the Handbook on Carbon Taxation for Developing Countries:

| **CRP number** | **Corresponding Chapter/Section of the Handbook** |
|---|---|
| E/C.18/2021/CRP4 | Chapter 1: Introduction |
| E/C.18/2021/CRP5 | Chapter 3 [Former Chapter XX]: How to generate public acceptability for carbon taxes |
| E/C.18/2021/CRP6 | Chapter 4A [Former Chapter 3A], Section 5.5.2: International Maritime Transport |
| E/C.18/2021/CRP7 | Chapter 6 [Former Chapter 5]: Revenue Use |
| E/C.18/2021/CRP8 | Chapter 7 [Former Chapter 6]: Carbon Taxation: Interaction with other instruments |

2. The Handbook, in its final version, will be comprised of seven chapters, as outlined below. The most updated version of the Handbook (as of 9 April 2021) can be found as an Annex to this note. It includes all the approved Chapters, as well as the Chapters submitted for approval at the 22nd Session of the Committee, in "clean" format.

**Chapter 1:** Introduction to the Handbook on Carbon Taxation for Developing Countries

⇒ Submitted FOR APPROVAL at 22nd Session of the Committee.

**Chapter 2:** An Introduction for Policymakers

⇒ APPROVED at 21st Session of the Committee.

**Chapter 3** [former Chapter XX]: Public Acceptability of carbon taxes. Conceptual model and policy implications

⇒ Submitted FOR APPROVAL at 22nd Session of the Committee.

**Chapter 4** [former Chapter 3]: Designing a Carbon Tax

⇒ APPROVED at 20th Session of the Committee; however, its section 4A, 5.5.2 on International Maritime Transport is submitted FOR APPROVAL at 22nd Session of the Committee, following

edits to reflect the most updated work of the United Nations International Maritime Organization (IMO).

**Chapter 5** [former Chapter 4]: From Design to Administration: Practical Application of a Carbon Tax

⇒ APPROVED at 21st Session of the Committee.

**Chapter 6** [former Chapter 5]: Revenue Use

⇒ Submitted FOR APPROVAL at 22nd Session of the Committee.

**Chapter 7** [former Chapter 6]: Carbon Taxation: Interaction with other instruments

⇒ Submitted FOR APPROVAL at 22nd Session of the Committee.

**Annex 1:** Carbon Taxation in the Context of the United Nations

⇒ APPROVED at 21st Session of the Committee.

3. The Handbook will also include a Foreword by the Director of the Financing for Sustainable Development Office (FSDO), that will outline how the Handbook was developed, recognize the contribution of the Subcommittee and of the Secretariat, and briefly provide considerations on how COVID-19 might impact the adoption of carbon taxation, and of climate change policy in general, around the world.

4. The structure of the Handbook on Carbon Taxation for Developing Countries was updated to place former Chapter XX (on Public Acceptability of carbon taxes) in the flow of the text, as Chapter 3. The Subcommittee proposes this placement to highlight that considerations on public acceptability should be made as soon as possible when considering the introduction of a carbon tax, and before designing specific elements of the tax. This placement also creates a coherent package for policymakers, as Chapter 3 immediately follows the high-level introduction to carbon taxation provided in Chapter 2. These two chapters deal with some of the most crucial high-level considerations, before the Handbook delves into more specific and technical aspects of the tax design and administration.

5. The Coordinator of the Subcommittee on Environmental Taxation Issues wishes to acknowledge the work of the Subcommittee's members, and the guidance received by the Committee during its current mandate, in drafting the comprehensive and well-structured Handbook on Carbon Taxation for Developing Countries, which provides options to introduce carbon taxation taking into account a broad variety of perspectives. This approach will be instrumental for countries at all levels of development, in particular developing countries, to tailor the guidance provided in the Handbook, and adapt it to their specific situation.

**ANNEX TO COORDINATOR'S REPORT – 22nd SESSION OF UN TAX COMMITTEE**

**HANDBOOK ON CARBON TAXATION FOR DEVELOPING COUNTRIES**

**UNEDITED VERSION (NOT FOR CITATION)**

**AS OF 9 APRIL 2021**

# Table of Contents

# Chapter 1: Introduction to the Handbook on Carbon Taxation for Developing Countries

[For approval at 22nd Session of the Committee]

1. The United Nations Handbook on Carbon Taxation for Developing Countries is a response to the need, often expressed by developing countries, for clear and holistic guidance on the application of carbon taxes, as a policy option that is geared towards (i) curbing carbon-based emissions that are responsible for climate change; and (ii) living up to the commitments assumed by countries under the Paris Agreement. This Handbook outlines some of the common reasons why countries might want to introduce a carbon tax, and provides options for policy design and administration that might cater to the different needs and priorities of countries. It is meant as a practical guide, and it contains many real-world examples and practical tools, including checklists to guide on the design and administration of the tax.

2. This introduction is meant to provide an overview of the topics covered in each chapter of the Handbook.

3. The primary intention of **Chapter 2: An Introduction to Policymakers** is to give policymakers all the elements to make an informed decision when considering whether to introduce a carbon tax, and when weighting the benefits of a carbon tax over other carbon pricing instruments. It seeks to provide an introductory overview of key concepts and policy options further developed throughout the Handbook, as well as to discuss high-level concepts such as the goals of carbon taxation. Although Chapter 2 is intended primarily to address policymakers, it was drafted having in mind the wide range of potential users of the Handbook, from politicians to practitioners Chapter 2 starts by putting carbon taxation within the context of climate change, and discussing how countries might benefit from carbon mitigating policies; it then delves deeper into the features of carbon taxation, as opposed to other carbon pricing instruments; and finally, it discusses the goals and policy features to consider when introducing a carbon tax. Chapter 2 also briefly touches on the international framework that provides the backdrop for the introduction of carbon taxes; a more detailed discussion can be found in **Annex 1: Carbon Taxation in the Context of the United Nations**.

4. **Chapter 3: Public Acceptability of carbon taxes – conceptual model and policy implications** makes the argument that, when introducing a carbon tax, policymakers should take into account how to achieve public acceptability, and not just how to achieve the best technical design. Chapter 3 starts by developing a conceptual model of which factors potentially affect individual behaviours and preferences towards environmental instruments, including carbon tax. Based on these considerations, the chapter then analyses what elements of a carbon tax can increase public acceptability, for example increasing transparency, addressing distributional concerns, and clearly

communicating the intended use of revenues (e.g. to adapt to the effect of climate change, or to increase welfare). Finally, the chapter provides some examples of how public concerns can be addressed, both from a policy design and from a timing perspective.

5. **Chapter 4** deals with **Designing a Carbon Tax**; for readers' convenience, it is divided into three Subchapters. In addition, in the spirit of providing a practical tool for policymakers and tax officials working in the design of a carbon tax, each Subchapter starts with a checklist of the aspects that should be taken into account when dealing with the different features of a carbon tax.

6. **Section 4A- Basic elements in designing a carbon tax** outlines different possible approaches in designing the key elements of a carbon tax, including the tax base, the point of regulation and the identification of the taxpayer. The two main approaches discussed in this section, which will constitute the framework for the following chapters, are the *Fuel Approach* (based on a tax by volume or weight units of the fuels giving rise to emissions when combusted, where the tax rate is based on standardized amounts of carbon content in those fuels), and the *Direct Emissions Approach* (which measures the emissions directly as they occur from the burning of such fuels). The Fuel Approach is discussed based mainly on the example of Sweden, while the Direct Emissions Approach is outlined making frequent reference to the case of Chile.

7. **Section 4B – How to set the carbon tax rate** discusses why setting the tax rate can be an important design element, and discusses several practical approaches and their theoretical framework; however, an important conclusion of this section is that it is more important to get started, and potentially set a sub-optimal tax rate, than delay the introduction of a carbon tax while trying to get to the perfect rate.

8. Finally, **Section 4C – Addressing undesired effects for households and industries** outlines the design features to keep in mind to counter potential undesired effects of the carbon tax. Potential adverse effects include negative impacts on households (some concerns include distributional impacts and equity implications); negative impacts on firms (for example, reduced competitiveness due to higher costs incurred as a result of the carbon tax); and carbon leakage (when the introduction of carbon pricing in one jurisdiction results in increased emissions in another jurisdiction, as producers decide to shift their activities to another country or area; or as investors shift away from domestic production). The Section also takes the reader through some methods to assess the actual risk of such negative effects, and finally policy options to counter them, including tax-reducing measures, support measures and trade-related measures; some of this discussion is theoretical, as some of these instruments (for example, border carbon adjustments to address carbon leakage) have never been implemented in the real world.

9. **Chapter 5: From Design to Administration: Practical Application of a Carbon Tax** describes different procedures and steps necessary to implement a carbon tax, following its design. The

chapter is framed around fundamental design features covered in previous chapters, primarily 4A, and details specific actions to each approach (Fuel vs Direct Emissions). It focuses on real-world execution and critical administrative considerations once the basic design selections concerning a carbon tax have been made. Chapter 5 strives to address how to execute the basic design choices during the regulatory process, considering initial implementation on-going daily administration and need for follow-ups and adjustments of the tax along the way of its application. The focus is on the "administrative" facet of design issues. The chapter addresses implementation issues, meaning regulatory choices that determine how the tax will function (facilitating the stakeholders' involvement), as well as the administrators' role in executing. Administrative aspects are reviewed in detail: who needs to do what, or how to make the system operate smoothly.

10. **Chapter 6: Revenue Use** discusses the complexities related to the use of revenues from carbon taxation, and what are issues to be further investigated in their specific national framework. The chapter starts by outlining how revenues from a carbon tax can fund the overall State budget, or finance specific items, and what are some of the mechanisms that countries can use to commit revenues from carbon taxation to a specific purpose (including earmarking and political commitments). Revenue raising is put into perspective with an overview of the current amounts raised by carbon taxes around the world, and their potential in different scenarios. Finally, the chapter discusses some of the main areas of uses that countries may allocate carbon tax revenues to, either by direct earmarking or by enforcing such destinations through the general state budget. Such areas could include compensation for affected households or industries, environmental spending and tax shifts; and some policy considerations that policymakers may want to take into account when designing policy packages, including the role that revenues can play in the acceptability of a carbon tax.

11. **Chapter 7: Carbon Taxation: Interaction with other instrument** aims to address the interaction between a carbon tax and a range of other instruments that (implicitly or explicitly) put a price on carbon, or conversely that reduce the cost of products that contain carbon, including (i) other carbon pricing instruments (both explicit, such as emission trading schemes, and implicit, such as emissions standards); (ii) other taxes, in particular energy taxes (excises and consumption taxes); and (iii) instruments that reduce the price of carbon, such as subsidies. The Chapter assesses those interactions by using a goal-oriented approach, i.e. for each instrument, the chapter discusses whether introducing a new carbon tax would reinforce or weaken the intended policy goals that the tax intends to achieve. For example, considering that a carbon tax aims to reduce carbon emissions, policymakers should think about how this goal would be affected if they introduce a carbon tax within an existing framework of fossil fuel subsidies.

# Chapter 2: An Introduction for Policymakers

[Approved at 21st Session of the Committee]

## 1. The Environmental Problem: Carbon emissions[1]

1. Carbon dioxide (CO2) is a naturally-occurring gas in Earth's atmosphere, and it serves the very important function of trapping some of the Sun's heat and keeping the planet at a temperature sufficient for life to exist. Without CO2, the Earth would freeze. Gases that trap heat in the atmosphere are called greenhouse gases (GHG); currently, CO2 makes up the majority of GHG in the atmosphere.

2. Through natural processes, the Earth keeps a balance of CO2 in the atmosphere, through a complex carbon cycle. Just to give an example, part of the natural emissions of carbon dioxide are generated by the respiration of humans and animals, and by decomposition; and part of the emissions are captured by plants, during photosynthesis, and absorbed by the ocean.

3. Besides natural processes, CO2 can also be produced by human activities, most notably the burning of fossil fuels;[2] these emissions are called "anthropogenic". Human activities since the industrial revolution have caused a spike in CO2 in the atmosphere,[3] and disrupted Earth's natural balances. This phenomenon is causing the Earth to warm faster than normal in interglacial periods.

4. The Earth has already experienced an increase in temperature of around 1 degree Celsius since the industrial revolution. Earth's temperature cannot be controlled like a thermostat; even if we stopped

[1] This section is intended as a general overview on the link between carbon emissions and climate change. For a more detailed discussion, there is a wide range of scientific publications that can be consulted, mostly for free. For example, the NASA website offers a comprehensive (but easily consultable) description of the causes and effects of climate change, as well as a discussion of why there is scientific consensus on global warming being caused by human activities. You can navigate the website from this tab: https://climate.nasa.gov/evidence/. The IPCC reports (https://www.ipcc.ch/reports/) offer a deeper assessment of climate change causes and impacts, based on the most advanced scientific knowledge available and drafted drawing on the expertise of a wide range of scientists and organizations.

Academic texts used in college-level degrees in environmental science (or similar) provide exhaustive, rigorous discussions of the mechanisms behind climate change; the best approach might be to contact your local university and inquire about what text they are using to tech introductory courses on climate change or climatology; or alternatively, to check out the websites of major universities, which often include the syllabus for courses they offer, and the text of reference (although these textbooks might be harder to find locally). Finally, for a "journalistic" approach, two very good, simple and informative sources are the BBC's "very simple guide" to climate change: https://www.bbc.com/news/science-environment-24021772 and the National Geographic Global Warming Overview: https://www.nationalgeographic.com/environment/global-warming/global-warming-overview/

[2] For simplicity, we refer to fossil fuels as the main source of anthropogenic carbon emissions. However, it should be noted that CO2 emissions are also generated by biofuels, by cement production, and by a range of other activities. Other GHG emissions too can be generated both by fossil fuel production, and by other sources: for example, methane can leak from oil wells but is also a by-product of farming and of garbage disposal in landfills.

[3] Concentration of CO2 in the atmosphere rose from 280 parts per million (ppm) before to the Industrial revolutions, to almost 415 ppm in February 2020. Source: Lindsey, Rebecca (Feb 20, 2020). *Climate Change: Atmospheric Carbon Dioxide.* National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide

all emissions today, it would take up to 200 years for the last artificially-emitted CO2 particle to leave the atmosphere.

5. As the planet warms, a series of reactions ("positive feedbacks") kick in and amplify the warming effects, that cause climate change. For example, as the planet warms, ice melts at the Poles; this results in a loss of white surface, which is crucial to reflect part of the Sun rays. With lower reflective surface, more rays are absorbed; this causes the Earth to warm.

6. In a recent report of the Intergovernmental Panel on Climate Change (IPCC, 2018), scientists estimate that a total increase of 1.5 degrees with respect to pre-industrial levels (0.5 more than today) would cause the climate to change, with severe consequences to natural and human systems. With an increase of 2 degrees, the Earth might reach a tipping point, where it is no longer possible to reverse global warming.

7. The effects of climate change are already visible and felt by many communities around the world, in particular the most vulnerable. These effects are extremely dire, and they include sea level rise (flooding, loss of coastal land, loss of islands); heat waves (human health, droughts); increased precipitation (flooding); more extreme weather events (hurricanes). They also cause the loss of biodiversity and migration of species (e.g. decline of marine fisheries).

8. Global warming will likely have severe impacts on agriculture, and it could cause famines at the global level. The situation would be made worse by the fact that around 60% of people will live in cities by 2030, without direct access to food sources.

### 1.1. Carbon emissions: a global policy problem

9. Carbon emissions generated by humans are mainly a consequence of the combustion of fossil fuels. They are generated in connection to a range of human activities, including the production of consumer goods, transportation and electricity generation. High emissions are also generated by intensive, unsustainable agriculture and farming.

10. Whenever fossil fuels are burnt, carbon emissions cannot be completely eliminated. Unlike other pollutants, CO2 cannot be "filtered" before being emitted into the atmosphere – at least not with current technologies.[4] Currently, the only way to generate zero emissions in energy production is by using non-fossil fuel sources, for example by employing renewable sources (wind, solar, etc.).

11. Emissions can also be reduced by using more efficient technologies, that require lower amounts of fuel to generate the same amount of energy. By technological abatement we mean the capacity to introduce a new technology or practice that can reduce emissions without changing the fuel

[4] Some technologies, such as carbon capture and storage, can intercept the carbon emissions before they are released in the atmosphere, and safely store them in geological formations. However, such technologies do not prevent fossil fuels from being utilized; moreover, they are not yet commercially scalable.

source; for example, a car with a more efficient engine that will do more mileage per liter or gallon of gasoline. More efficient technologies also have important co-benefits in reducing local pollution, for example smog in cities.

12. Carbon emissions are a global problem, meaning that emissions in any part of the world contribute to warming the whole planet, and not just the location where they were generated. This is another characteristic that sets carbon dioxide apart from other pollutants, and it poses challenges but also offers opportunities.

13. An obvious opportunity is that, if carbon emissions are reduced anywhere in the world, this will have impacts on a global scale. As mentioned above, artificial carbon-capture technology is not yet scalable to the needs of the whole planet; however, emissions can be "absorbed" by supporting natural processes, for example by increasing the amount of forests. Because of the global nature of carbon, a power plant in the city generating emissions and a forest outside the city absorbing emissions could balance (or "offset") each other, and result in zero net emissions. The forest could even be located in another country, or another part of the world.

14. Some countries, and even corporations, already use the concept of carbon offsets to counter their carbon emissions. For example, an airline can pay for planting a certain number of trees, or sponsor renewable energy technology in a different part of the world, to balance the emissions generated by the gasoline burnt in their planes. However, this approach is not without controversies: some experts point out that carbon offsets are an insufficient incentive (and sometimes, a perverse incentive or disincentive) for companies and individuals to lower their carbon footprint; some also question the effectiveness of some forms of offsetting (for example, planting trees) in removing carbon dioxide from the atmosphere in the long-term. Another wide-spread criticism relates to the efficiency and effectiveness of programs implementation, as these can be hard to monitor and can be more expensive than alternative approaches.

15. The global nature of carbon also poses significant challenges, most notably from the policy point of view: all countries have to act together to reduce carbon emissions and fight against climate change. The next section will discuss the steps undertaken by the international community in this respect.

### 1.2. Countries' commitments to lower greenhouse gas emissions[5]

16. In 2015, Member States of the United Nations committed to three ground-breaking international agreements: the 2030 Agenda for Sustainable Development (2030 Agenda); the Addis Ababa Action Agenda (which contains the foundation for financing the 2030 Agenda); and the Paris Agreement.

[5] For more details about carbon taxation in the context of the United Nations, see Annex 2.

17. The 2030 Agenda contains 17 Sustainable Development Goals (SDGs) and 169 targets to advance the three dimensions of sustainable development: economic, social and environmental.[6] Nine of the 17 goals contain pledges related to environmental protection, based on the consideration that environmental protection is inextricably linked to sustainable and equitable development, and that countries should aim to decouple economic growth from environmental degradation (SDG 8.4).

18. The 2030 Agenda does not contain specific commitments related to the reduction of carbon emissions, but acknowledges that the United Nations Framework Convention on Climate Change (UNFCCC) is the primary platform to address global actions to fight climate change.

19. The UNFCCC, signed in 1992, was the first international agreement on climate change. It is an umbrella convention that provides a framework for both market and non-market approaches to address climate change.

20. As follow-up agreements to the UNFCCC, the Kyoto Protocol (signed in 1997, entered into force in 2005) and the Paris Agreement emphasized different climate protection instruments, each at its own time. The Kyoto Protocol introduced a market-based approach for the reduction and control of greenhouse gases. The 2015 Paris Agreement greatly broadened the set of tools to address carbon emissions and climate change, to include green financing and trading in green bonds, as well as regulatory and fiscal instruments.

21. The Paris Agreement also broadened the scope of the fight against climate change, as it requires countries at all levels of development to use their best efforts through nationally determined contributions (NDCs)[7] to curb greenhouse gas emissions and to commit to the GHG reduction goals assigned under Article 2 of the agreement.

## 2. Carbon pricing

22. Economic actors, such as firms and households, don't usually have an incentive to adopt technologies that would lower GHG emissions deriving from their polluting activities; it is often cheaper to just continue emitting, regardless of the effect this would have on the environment. It is therefore fairly straightforward that policy intervention is needed to fight climate change and achieve the NDCs pledges under the Paris Agreement.

23. In general, governments can take two policy approaches to reduce carbon emissions. First, regulatory approaches that rely on the introduction of specific standards to changes in practices and improvements in the quality of the environment (e.g. regulations, reporting requirements, emission

[6] United Nations (2015b). *Transforming our world: the 2030 Agenda for Sustainable Development*. ECOSOC Resolution A/RES/70/1, Resolution adopted by the General Assembly on 25 September 2015. Retrieved from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

[7] Nationally determined contributions are the successors of binding targets for greenhouse gas emissions.

licensing, etc.); these are often known as "command-and-control" instruments. Second, there are market-based instruments (MBIs, also known as "economic instruments"). Both types of instruments are effective at reducing pollution. However, there is strong evidence that MBIs do so at a lower social cost (Baumol and Oates, 1988).

24. MBIs are policy instruments that use markets, prices and/or other economic variables to provide incentives for economic agents to reduce or eliminate environmental externalities. The theoretical and empirical justification for these policy instruments is well established (Pigou, 1920, Coase, 1960, Baumol 1971) and, today, they are considered fundamental to support environmental policy, in general, and climate mitigation, in particular (OECD, 1991; CPLC, 2017).

25. Examples of MBIs include taxes, subsidies, deposit-refund-schemes, and emission trading schemes (ETS, or cap-and-trade). In the context of climate mitigation, both taxes and ETS have been implemented, and since both instruments imply a price on carbon emissions, they are commonly referred to as carbon pricing instruments (CPLC, 2017).

26. Carbon pricing can be used by countries to lower their carbon emissions and meet their NDC pledges under the Paris Agreement. In fact, two-thirds of all submitted NDCs (around 100 countries) consider the use of carbon pricing to achieving their emission reduction targets. Carbon pricing is also a low-cost option to achieve emissions reduction and meet the targets set in NDCs, it could alone reduce the cost of climate change mitigation by 32% by 2030, and achieve full potential when coupled with coherent energy and environmental policies (World Bank, 2016).

27. As of June 2019, 57 carbon pricing initiatives had been implemented or scheduled for implementation; of these, 29 are carbon taxes, primarily applied on a national level. Although these instruments represent around 20% of global GHG emissions, less than 5% of emissions are priced at levels consistent with the Paris Agreement goals (World Bank, 2019).

28. Private investors are starting to take carbon pricing into account when making financial decisions even in jurisdictions where instruments haven't been introduced yet.

29. In the case of a carbon tax, the government sets the price of carbon, and lets the market determine the total emissions. On the other hand, with an ETS the government sets a maximum limit on emissions and lets the market determine the price of carbon emissions and the allocation of emissions abatement efforts (i.e. which economic actors will innovate, and how). In effect, taxation and ETS consist of different instruments with the same objective, namely pricing environmental externalities, and, in the case of climate change specifically carbon emissions, so that economic agents fully or partially internalize the social costs of their actions.

30. There are also hybrid systems that have design elements of both of these 'pure' instruments - for example, tax regimes that accept emission reduction units to reduce the tax burden, or ETS with

floor and ceiling prices, but all these instruments with different specific design features are based on the same principle: to internalize environmental damage through carbon pricing pricing so as to provide an incentive to reduce emissions.[8]

31. It is also important to note that there are a number of other instruments which a country may introduce or already have in place, which in practice set a price on carbon; for example, taxes on energy. The interaction between carbon taxes and those instruments will be investigated in more detail in chapter 7 (interaction between carbon tax and other instruments).

32. A summary of the main advantages and disadvantages of carbon tax and other instruments currently used to lower emissions, can be found in table 2.1 below.

| | Advantages | Disadvantages |
|---|---|---|
| **Carbon tax** | • Generation of revenues<br>• Certainty in costs for economic actors<br>• Depending on the format, can require more or less administration<br>• Cost-effective | • A-priori uncertainty in quantity of emissions reduction (however, the tax rate can be adjusted over time to meet emission reduction goals; see Chapter 4B.4 for more information on how to dynamically set the tax rate). |
| **Command & Control** | • Often requires less administration<br>• Easier to enforce | • Regulation is usually insufficient to achieve carbon reduction goals<br>• Does not generate revenues<br>• Costly (as in, not cost-effective) |
| **ETS** | • Generation of revenues<br>• Provides certainty in emission reduction goals<br>• Cost-effective | • Uncertainty in costs doesn't necessarily incentivize investment in low-carbon technology<br>• Can be administratively more complicated than other measures, e.g. carbon tax, due to the need to set up a carbon market, auctions etc. |
| **Offsets** | • Offsets can be more cost-effective.<br>• Provide incentives to reduce emissions beyond the tax base | • Market not well developed and subject to manipulation<br>• Risk of low additionality (due to manipulation and/or other uncertainties) |

Table 2.1: Summary of the advantages and disadvantages of policy measures to reduce carbon emissions.

[8] For a detailed discussion of how carbon pricing can be used to internalize environmental damage, see the following references (in bibliography): Goulder et al., 2013, Aldy and Stevens, 2012, Edenhofer et al 2015, Metcalf and Weisbach 2009, Schmalensee and Stavins 2015.

### 2.1. Carbon Tax

33. For the purpose of this Handbook, we will intend carbon taxation as "a tax capable of conferring a reduction in corresponding carbon-based (equivalent) emissions in the atmosphere." It is thus regarded to have environmental purpose and effect.

34. In this sense, carbon taxes can be seen as a specific type of environmental taxes, as per the OECD definition of "[taxes] whose tax base is a physical unit (or a proxy of it) that ha[ve] a proven specific negative impact on the environment",[9] for example CO2.

35. Environmental taxes, in turn, can be seen as a subset of environmentally related taxes, defined as "any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance."[10] (OECD, 2004).[11]

**Box 1: What is there to a name?**

The aim of a carbon tax is to price a negative externality, namely, carbon emissions; and to factor that cost into the final price of the fossil fuels traded domestically.

In doing so, the object of taxation, or tax base, tends to be generally described as "carbon intensive fossil fuels," meaning gasoline, coal, gas, diesel and their by-products. Many countries have already introduced carbon taxes at a domestic level; among developing countries, Chile, Colombia, Argentina, Mexico and South Africa. However, other countries have introduced taxes which may be called "carbon tax" but should not be considered carbon taxes from a technical perspective.

For example, some countries have taxes in place that are commonly referred to as a carbon tax, but in reality, are ad-valorem taxes on fuels; or taxes on motor vehicles.

The distinction is relevant because those instruments, in practice, do not act like a carbon tax. They may be appropriate for raising revenue, but will likely fail to produce the carbon-reducing effects that are usually associated with a true carbon tax (although they might reduce local pollution or bring other environmental benefits). For example, an ad-valorem tax on gasoline might reduce car use, but not have any effect on the use of fuels for home heating, which also generate carbon emissions. Another example is that a carbon tax allows to price differently a traditional diesel and "cleaner" diesel (i.e. lower fossil content, achieved by blending with biofuels), while this would be more difficult with an ad-valorem tax.

Since currently there is no single definition of what a carbon tax is, policy makers should be aware of possible methodologies to design carbon taxes. A comprehensive overview is provided in Chapter 4.

36. In theory a carbon tax, as any other environmental tax, should be set at the marginal social cost of the damage generated (in this case, the social cost of carbon). In the case of climate change, the marginal social cost is global and the reduction costs local; as a result, the optimum tax set at the global level may be considerably higher than what a specific jurisdiction can effectively sustain economically. Therefore, governments will have other considerations to determine the tax rate, such as emissions

[9] https://stats.oecd.org/glossary/detail.asp?ID=6437

[10] OECD, Environmental Fiscal Reform, Progress, Prospects and Pitfalls, Report for the G7 Environment Ministers June 2017, pg. 6, available at: https://www.oecd.org/tax/tax-policy/environmental-fiscal-reform-G7-environment-ministerial-meeting-june-2017.pdf.

[11] There is still a lot of debate around the definition of carbon tax, environmental tax and environmentally-related tax, and those terms may have different meanings in different contexts. The definitions proposed here should be intended as working definitions, for the purposes of this Handbook.

objectives or commitments (e.g. the NDCs), competitiveness, the distributive impact, coherence with other policy instruments and, above all, political viability. Therefore, in practice, carbon taxes are not set in terms of the socially optimum level but the specific objectives of the jurisdictions that implement them. As a result, taxes vary considerably across jurisdictions (see chapter 4A for a discussion and for examples).

### 2.2. Carbon pricing and cost efficiency

37. As discussed in Table 2.1, there are many obvious advantages of implementing a carbon tax instead of an ETS. It is simple, it does not require a complex monitoring, reporting and verification (MRV) system and it can be implemented through the current tax administration system. All issues that will be discussed in this Handbook.

38. Despite these advantages of the carbon tax, ETS is often perceived as a market instrument that reduces emissions more cost-efficiently than a tax, because they create an emission trading market; as we will discuss below, however, a properly designed tax (combined with an offset market) can replicate in essence the carbon market feature of an ETS, but with potentially lower administrative cost. This can be an especially attractive feature for developing countries.

39. In their most basic form, ETS establish a maximum cap for total emissions within a specific jurisdiction and assign permits to emissions sources.[12] Emitters can choose to use their permits, or to sell them to other emitters that have fallen short; emitters are usually allowed to trade directly among themselves, sometimes across sectors and even jurisdictions. This way, polluters for whom it is easier or cheaper to lower their emissions can do so, and sell their permits to companies that are having a harder time in reducing their emissions. As we will discuss in section 2.3.3, this feature allows to establish markets that go beyond the sectoral or national level, thus recognizing the fact that climate change is a global problem. Emissions from carbon are hard to abate from a technological perspective (i.e. the only way to truly achieve zero emissions would be not to use fossil fuels); and when emissions can be abated, it might be costly to do so, especially in some sectors. For these reasons, allowing emitters who can abate cheaply to "sell their abatement" to other actors, allows for higher cost-efficiency.

40. If the market works, and there is no incentive to accumulate permits or speculate due to uncertainty, ETS can take advantage of the different marginal costs of reduction across emitters, in different sectors and even across multiple jurisdictions (as described above); i.e. a specific emitter will find it more convenient to just buy extra permits from another firm, to avoid exceeding their allocation; while for the other firm it is cheaper to install technology that lowers their emissions, or to source their energy from renewable sources. However, the key design consideration for an ETS is allowing trade

[12] Permits can be assigned to emitters through a range of mechanisms, including auctions, free allowances or an allocation of the two. For more details about how ETS work in practice, see PMR/ICAP 2016.

across firms and sectors. If this is not permitted, then an ETS is in practice is the same as a tax in its basic formulation. ); We should also keep in mind that, in reality, the permit exchange in ETS does not occur at the global level, but only among a few (geographically separated) groups of jurisdictions

41. It should be noted that, when implemented at the national level, a carbon tax and an ETS achieve (theoretically) the same cost-efficiency. The situation is different when we look at the international level; and when we consider the different potential for emissions abatement in different economic sectors. Establishing the carbon markets that characterise ETS is complex to administer, especially if polluters are allowed to trade across sectors and internationally; but this mechanism can (theoretically) achieve emission reduction at a lower overall cost for society at the global level.

42. Carbon taxes, in their pure form, are introduced locally (at country or sub-national level), and they do not establish a market for exchanging "permits to pollute"; as a result, the price of carbon is specific to each jurisdiction, and depends on the established tax rate. The lack of a carbon market means that carbon taxes do not allow different actors to reduce their abatement costs by trading permits; in practice, companies can choose between paying the tax on a unit of emissions, or reducing that unit of emissions. This limitation of the carbon tax (i.e. the lack of a carbon market that allows to buy permits, which can be cheaper than reducing emissions) can be partially overcome by using mechanisms such as offsets, i.e. allowing economic actors to pay for an equivalent amount of emissions to be reduced or "absorbed" elsewhere, instead of paying the tax. An example could be that a power plant in Canada pays a farmer in Zambia to plant a quantity of trees sufficient to offset the power plant emissions. This might be cheaper than paying the tax, and it can have substantial co-benefits (for example, on the livelihoods of people in developing countries). On the other hand, offsets have some limitations too, as described in para. 14 above.

43. In this sense, a carbon tax can replicate the market feature of an ETS by establishing emission limits or incorporating offsets as a complementary mechanism to reduce costs, thus implicitly facilitating emissions trading across sectors or jurisdictions. In fact, a carbon tax joined with an offset market is essentially equivalent to an ETS that allows for trading of permits across different sectors (and/or jurisdictions. The decision on the specific design features of a tax will ultimately depend on institutional and political context of the jurisdictions implementing the instrument. What is relevant for our purposes, is that a tax can have additional complementary features that allow for more cost efficiency, making it therefore comparable to the advantages of an ETS in terms of cost efficiency, but with potentially lower administrative costs. For this reason, carbon taxes with offset mechanisms can be easier to implement, especially in developing countries, while providing much of the same benefits as an ETS that allows for a secondary cross-sector market. For a summary of the basic design features of a carbon tax, and how they compare to an ETS, please refer to table 2.1.

### 2.3. Social cost of carbon emissions and the role of markets

44. Climate change is a global problem with multiple impacts. The social cost of carbon can be defined as the monetary value of the damage generated by the emission of an additional (marginal) unit of carbon. Significantly, since the problem is global, the social cost of carbon should (in theory) be the same anywhere; a carbon tax should therefore be set at the same level everywhere. However, as we will discuss in Chapters 3 and 4, establishing a tax rate is often a political decision that takes into account a large number of factors, including political acceptance.

45. There is a lot of debate with respect to what the global social cost of carbon is. It depends on estimating the impact of climate change and determining the economic valuation of the damage which, in turn, depends on a series of technical, scientific and public policy issues. There are many estimates, according to the 'Report of the High-Level Commission on Carbon Prices' (CPLC, 2017), that conducted a complete review of the literature, a price consistent with the objectives laid out in the Paris Agreement varies between US$ 40-80 per tonne of $CO_2$ for 2020 and between USD 50-100 for 2030 (CPLC, 2017).

46. While the social cost of carbon should, in theory, be the same everywhere, the costs of CO2 mitigation may vary considerably across different jurisdictions. For example, the cost of labor or installing a new technology might be different depending on the country. The economic implication is that reducing emissions is more cost-efficient in jurisdictions where the cost of reduction is lower. For example, if the global social cost of $CO_2$ emissions is US$50, but it costs US$10 to reduce emissions in Chile and US$40 to reduce in Europe, it is socially optimal to reduce carbon emissions in Chile rather than Europe. As mentioned above, this is the logic behind integrating global markets, in short: to reduce the costs of climate change mitigation, some form of carbon market exchange is necessary. In the case of carbon taxes, this can be achieved by introducing measures such as offsets and compensations schemes across sectors and jurisdictions, and/or by introducing a sufficient level of coordination among States so that the real value of carbon pricing is similar in different jurisdiction.

47. According to recent estimates, global mitigation costs can be reduced by implementing integrated markets, and by reducing emissions wherever it is cheapest to do so, to almost 56% in the unconditional NDC scenario and by 44% in the conditional NDC scenario (Hof, et al. 2017). Similarly, Fujimori (2016) found that global market could reduce welfare losses up to 75%.[13]

48. However, as emission reduction targets globally become more ambitious, all countries will have to contribute to the best of their abilities; in the scenario above, if all of Europe turned to Chile to offset emissions, at some point the marginal cost of emission reduction in Chile would start to grow and

[13] In the UNFCCC and Paris Agreement nomenclature, National Determined Contributions are the Parties (country) explicit commitments for climate mitigations. Conditional NDC refer to those commitments that depend on additional financial support.

level with that of Europe (for example, cheaper technologies reach capacity and economic actors have to start employing more and more expensive technologies; or the capacity for reforestation starts declining; etc.).

**Box 2. The performance of carbon taxes to lower GHG emissions**

The environmental performance of carbon taxes to lower GHG emissions is a highly debated topic; empirical evidence is available for a sufficient period of time only in a limited number of countries. Additionally, drawing univocal conclusions can be difficult: carbon taxes are usually implemented in the context of wider green policy reform, therefore it can be hard to isolate the specific effect of this measure on GHG emissions reduction.

One way to assess whether carbon taxes are effective is to measure the amount of GHG emissions covered by the tax over time; if the emissions decrease, it can mean that the tax has played a role in reducing them. A recent study[14] concludes that the introduction of carbon taxes has coincided with the reduction of covered emissions over time, in the majority of jurisdictions analysed; however, when that was not the case, the reason might actually be that the tax rate is too low, or that there is some uncertainty related to the carbon tax (for example its effective date, covered emissions or tax rate). Another very recent study even quantifies the monetary correlation between carbon pricing and emissions levels, claiming that, at the global level, an additional 1Euro/tonne of carbon price would reduce emissions by 0.3% per year;[15] however, it must be noted that the effects of an increase in carbon pricing would change dramatically across jurisdictions[16].

Chapter 4 will further elaborate on the factors to take into account when designing relevant features of a carbon tax, including tax rates, and how to make sure tax rates are high enough to fulfil the environmental purpose of the tax.

## 3. Motives for the introduction of a carbon tax

49. Usually, the primary purpose of policy instruments such as a carbon tax is the protection of the environment, and more specifically the reduction of carbon emissions. However, governments may also seek additional (and potentially as important) goals while implementing these policies; for example, they may wish to also generate public revenues. Different policies provide different

[14] Haites, Erik and Maosheng, Duan and Gallagher, Kelly Sims and Mascher, Sharon and Narassimhan, Easwaran and Richards, Kenneth R. and Wakabayashi, Masayo, Experience with Carbon Taxes and Greenhouse Gas Emissions Trading Systems (January 2018). Available at SSRN: https://ssrn.com/abstract=3119241 or http://dx.doi.org/10.2139/ssrn.3119241

[15] Best, R., Burke, P.J. & Jotzo, F. Carbon Pricing Efficacy: Cross-Country Evidence. Environ Resource Econ 77, 69–94 (2020). https://doi.org/10.1007/s10640-020-00436-x

[16] For a specific study that shows the positive correlation between carbon pricing and the reduction of emissions, see Andersson, Julius J. 2019. "Carbon Taxes and CO2 Emissions: Sweden as a Case Study." American Economic Journal: Economic Policy, 11 (4): 1-30. DOI: 10.1257/pol.20170144

advantages and disadvantages; depending on their priorities, Governments may therefore prefer to implement one type over the other, or to combine elements of two or more policy categories.

50. A major challenge for developing countries is to develop their growing industrialization while reducing emissions. In order to reduce CO2 emissions, many countries are shifting towards renewable energy over traditional sources. In the EU, for example, renewables are expected to reach at least 27 % by 2030. Similarly, some oil producer and import countries have developed plans in the medium and long-term to reduce their dependence on oil and diversify their respective economies (e.g. Vision 2030 plan or China´s National Climate Change Programme). However, other countries are still strongly reliant on fossil fuels to develop their economy.

51. How to balance economic growth and reduction of emissions poses a crucial policy approach to both developing countries and those countries already industrialized which are introducing public policies oriented to a decarbonization of their economy.

52. We will provide below a discussion of some potential goals that governments may seek to address in their policies for emissions reduction; for each goal, we will discuss whether carbon taxes are the best-suited instrument, in light of the advantages and disadvantages of this measure.

53. Although the primary focus of this Handbook is on carbon taxes, we will also provide some elements of comparison with other policy options to reduce carbon emissions. The purpose of this comparison is to support policymakers in understanding whether carbon taxes are the best policy instrument for their country, depending on their desired policy objectives and institutional constraints.

### 3.1. Fighting climate change by reducing carbon emissions (the "green" dividend)

54. MBIs are considered a cost-effective way to incentivise the reduction of greenhouse gas emissions by encouraging lower-carbon behaviour, including the abatement of emissions through investment in technology. The reduction of carbon emissions is the primary tool to fight against climate change and fulfil Sustainable Development Goal 13 (Climate Action).

55. By putting a direct price on carbon emissions through a tax, or an indirect price by setting a limit to emissions through an ETS, emitters are confronted with the environmental cost of their actions and forced to manage their carbon output. Carbon prices create incentives that spread up and down supply chains, delivering emissions reductions where they make sense while at the same time providing disincentives for new investments in carbon intensive technologies. In addition, the reduction of emissions has other side benefits to consider as, for example, lowering health-related costs by protecting citizen´s health from, amongst others, environmental degradation and pollution.

56. However, contrary to an ETS, the carbon tax does not offer the same degree of certainty on what will be the total amount of emissions reduction in the economy (and therefore the amount of

emissions that will accumulate in the atmosphere, in the long run). The uncertainty derives from the fact that a carbon tax sets a price on emissions, and it is up to economic actors to decide how much to emit (based on the total amount they are willing to spend). Therefore, there can be no assurance that any given tax level will result in the desired reduction in greenhouse gas emissions.

57. However, such disadvantage can be somewhat reduced by the introduction of adjusting elements in the design of the carbon tax that may apply if the initial emissions reductions are considered to not meet the objectives; more insight on this issue will be provided in Chapter 4 (designing a carbon tax).

58. On the other hand, an ETS provides certainty about the amount of emissions generated in the economy in a certain period of time, as this limit is set by the regulator; therefore, it allows greater control over which degree of environmental protection to target in a specific time frame

59. As mentioned above, while command-and-control instruments can also be useful to reduce carbon emissions, they are not the most cost-effective instrument for this purpose, as they do not provide appropriate incentives to reduce emissions beyond the threshold set by regulation.

### 3.2. Generation of budgetary sources

60. Carbon taxes generate revenues, even though their primary objective is not revenue-oriented, but to decarbonize a country´s economy through the price signals it sends to the market.

61. Therefore, in addition to the “green dividend”, carbon taxes usually increase public revenue, which may help the budget of developing countries. In this respect, an efficient redistribution of MBIs revenues may foster sustainable growth, creating new business and employment opportunities (the “green growth”); it can also offset some of the regressive effects of the instrument.

62. As far as carbon tax revenues are concerned, the design of the tax could include provisions to ensure that revenues offset some of the distributional concerns, as discussed in Chapter 6 (Use of revenues).

### 3.3. Promotion of investment in new technology

63. Putting a price on emissions is the most cost-effective way to reduce them because it encourages producers and consumers to seek out the lowest-cost options to reduce their emissions. Price certainty is potentially important for mobilizing investment into clean technologies or other alternative technologies.

64. In this respect, carbon taxes provide a continual incentive to invest in emissions abatement and, therefore, encourages alternative energy by making it cost-competitive with respect to fossil fuels. Ideally, over time continued investment in technologies for emissions reduction would result in technological progress and reduce the cost of clean energy, therefore providing an accelerating mechanism for the reduction of carbon emissions. Where the tax rate is kept stable, a reduction in

emissions would shrink the tax base and affect revenue stability over time. In order to provide a growing incentive for emissions reduction, and to keep revenues stable, the tax rate should be revised periodically, and potentially increased over time.

65. A secondary effect is that technical innovations may create new jobs while offering a competitive edge to industries.

## 4. Policy considerations in the introduction of a carbon tax

66. When introducing a carbon tax, as mentioned, policymakers will take into consideration what their goals are; and why a carbon tax provides advantages over other instruments, given the specific policy goals. They also apply the four environmental principles behind carbon taxation (outlined in box 3 below).

67. In addition to doing this, policymakers also need to make additional policy considerations, to facilitate smoother introduction and implementation of the tax, and to ensure that other overarching policy goals are not negatively impacted by the introduction of the tax. The sections below discuss some of the elements that policymakers might want to take into account when designing this instrument, including the certainty and predictability of the carbon tax; its administrative burden; the prevention of distributional impacts; and the safeguarding of competitiveness. All of these questions will also be explored in more detail in subsequent chapters of this handbook.

**Box 3. Core principles of carbon taxation**

When introducing carbon taxation, policymakers are (implicitly or explicitly) applying the four core environmental principles which characterize this instrument. Even though these principles might not be stated in national legislation, they have a solid underpinning in international agreements (see Annex 1 for more details).

(i) The **polluter pays principle** promotes the internalisation of environmental costs through the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, rather than shift the cost of pollution to the community as a whole.

⇒ A carbon tax is capable of internalizing the environmental cost of pollution by making the polluter pay a tax that is directly proportionate to the polluting content of the product consumed, produced or extracted.

(ii) The **principle of prevention** provides that States have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States.

⇒ A carbon tax does not impede economic activity per se, although countries with high carbon tax rates (e.g. above USD40) may render carbon intensive investments less appealing. In essence, countries employing carbon taxes continue making use of their sovereign right to exploit their own resources pursuant to their own environmental and developmental policies.

However, by attaching a price to one's right to pollute (i.e. by costing the environmental damage), countries employing carbon taxes at a high enough rate not only prevent the widespread use of carbon intensive fuels and technologies, they also employ the required duty of care to make sure that the activities within the control of their jurisdiction do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

(iii) The **precautionary principle** is based on the concept that preventative measures should be put in place when there is a risk of future long-term harm to the environment, that cannot be fully assessed at the time of the decision-making process.

⇒ By conceding to employ a tax instrument of environmental control, countries automatically acknowledge that there is a risk of future long-term harm to the environment if their emissions are not reduced or eliminated. Therefore, the introduction of a carbon tax is also the indirect embodiment and endorsement of the precautionary principle.

(ii) The **principle of common but differentiated responsibilities** assumes that all countries are to share the responsibility for avoiding environmental degradation, but with differentiated levels of engagement depending on their social and economic development.

⇒ The principle is implicitly included in every national carbon tax legislation in the form of the tax rate adopted by the country. Low- and middle-income countries employing carbon taxes are more prone to apply lower tax rates (particularly on first introduction) whereas high income countries are more likely to employ higher taxes, as further demonstrated in chapter 4.

### 4.1. Certainty and predictability of the price of carbon

68. A carbon tax ensures cost certainty as the cost is the amount of the tax, and whatever the incidence of the tax (i.e., whether it can be passed on to consumers or not), the cost cannot rise above the tax rate. An ETS, on the other hand, suffers from inherent cost uncertainty. While allowances may be initially distributed for free, businesses will eventually have to pay for them, and the cap may be reduced; the key question for businesses that need to acquire allowances to address a reduction in the cap is what would be the future price of allowances.

69. A carbon tax offers stable and predictable carbon prices: economic actors are aware that they will have to pay a certain price when the triggering event occurs, i.e. when they emit above a certain level. This enables businesses to plan ahead their investments on low-carbon technologies based on reliable decision-making elements. Therefore, a carbon tax provides certainty about the cost that the polluter will take into account when making decisions on the activity (whether or not to carry on the activity, how it is done, or its extent). In addition, in situations of emissions reductions (e.g. economic downturn), the tax will continue to provide a price signal.

70. In order to ensure the continued reduction of emissions, policymakers should review periodically the tax rate and check whether the rate is still suitable to achieve the desired emission targets. However, revision of the tax rate might provide uncertainty; a way to lower uncertainty is to be explicit in the law, and inform businesses that the tax rate might be increased up to a certain percentage every so many years.

### 4.2. Administration of the carbon tax

71. A carbon tax is often simple, easy and quick to implement as well as easy to administer and collect at low costs. Generally, monitoring, reporting and verification of emissions is not simple, something that is normally required for carbon trading systems. However, carbon tax systems tend to work with a proxy (i.e. an assumed amount of carbon released when burning certain types of fossil fuels). The proxy price generally avoids the complexities of carbon trading systems.

72. However, this easiness may change where exemptions, subsidies or refund mechanisms are applied in order to support or compensate certain industries affected by the tax (e.g. agriculture, fisheries, etc.). For this reason, it is important to take into account the existing overall fiscal framework when introducing a carbon tax, and carefully consider administrative interactions.

73. Additional details on the administration of carbon taxes, and on which elements may simplify or complicate their implementation, will be found in Chapter 5 on the administration of a carbon tax.

### 4.3. Potential distributional implications and need for corrective measures

74. Introducing a carbon tax may have distributional effects that raise concerns, in particular where such effects are regressive in the sense that they impact more on low-income household and consumers, with low capability to pay, and relatively less on the wealthy part of the population (see chapter 4C for more details).

75. As previously mentioned, in order to mitigate the overall negative economic distributive effects of certain taxes and levies, governments may need to consider other changes to the tax system to alleviate the tax burden of low-income citizens; a more detailed discussion of how to design a carbon tax with this purpose will be provided in Chapter 6 (Use of revenues).

### 4.4. Safeguarding the competitiveness of domestic industries

76. In the absence of a global agreement, some countries or regions have unilaterally adopted a carbon price. A carbon price, whether in the form of a carbon tax or another instruments, forces domestic producers to partially internalize the cost of environmental damage, and therefore can raise their cost of production.

77. When the carbon tax is not imposed on producers outside that country or region, this can reduce the competitiveness of domestic producers as compared to foreign companies. The result may be that a polluting activity is reduced in geographical areas where environmental standards are higher,

but increased or taken over by competitors in places with laxer regulatory regimes ("carbon leakage").[17] Determining the extent and nature of competitive disadvantage and potential carbon leakage is important for government to gain industry acceptance of climate policy, including carbon pricing (see chapter 4C for more details).

## 5. Conclusions

78. Carbon emissions are the main driver of climate change, which will have extremely negative consequences for humans and for the environment. Even a warming of 1.5 degrees will impact ecosystems and societies much more severely than previously thought; considering that the Earth temperature has already increased by 1-degree post-industrial revolution, it is imperative to act quickly.

79. Carbon taxation is one of the instruments available to countries to reduce carbon emissions; this measure can be used in conjunction with other environmental taxes, as well as other forms of regulation, to promote environmental protection and fight against climate change.

80. This chapter provided an overview of what are some of the Market-Based Instruments (MBIs) that Governments can choose to lower GHG emissions, and to achieve a range of other policy goals, such as to raise revenue. The chapter outlined the advantages and disadvantages of such instruments as opposed to carbon tax, to allow policymakers to identify which are their most pressing concerns, and whether carbon tax is the right instrument.

81. To be effective, however, carbon tax needs sufficient public acceptability, and it has to be well designed. In the next chapters, we will go into more detail on how to improve public acceptance, and how to design a carbon tax from the practical point of view, to ensure this instrument is effective at achieving the goals set by policymakers.



[17] Ex-post studies have found little evidence confirming the existence of carbon leakage. See for example Partnership for Market Readiness. 'Carbon Leakage: Theory, Evidence and Policy Design.' *Partnership for Market Readiness Technical Papers.* World Bank, 2015. https://openknowledge.worldbank.org/handle/10986/22785

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# Chapter 3: How to generate public acceptability for carbon taxes

[For approval at 22nd Session of the Committee]

## 1. Introduction

1. In order to reach the global climate mitigation goal adopted at the Paris Climate Conference (Conference of the Parties (COP) 21), growing pressure is placed on governments worldwide to achieve greater reductions in the emissions of greenhouse gases through the introduction of more stringent domestic policies.

2. This requires that policy-makers carefully consider the opportunities and pitfalls of implementing policy measures that hold the potential to achieve the mandated emission cuts – here called "feasible policy measures". With a specific focus on carbon taxes as a policy measure addressing climate change mitigation, this chapter discusses the significance of *acceptability* for policy feasibility, which factors that determine acceptability, and in particular we present what policy-makers need to consider (and how) in order to increase the possibilities for successful policy implementation.

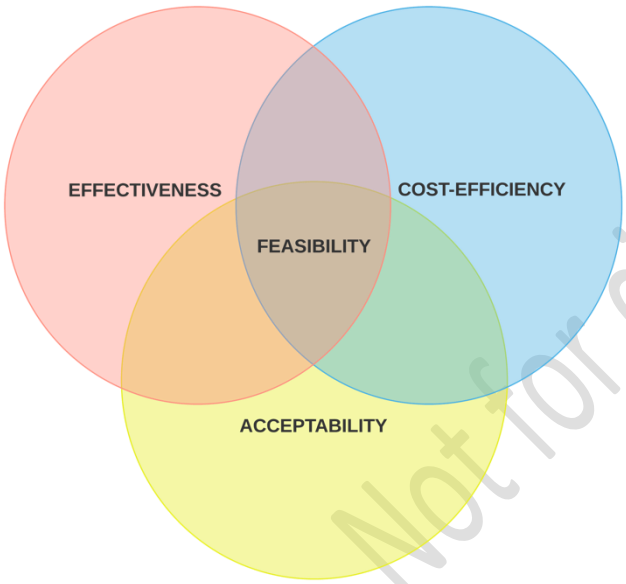
3. The chapter is organized in the following way. First, we briefly discuss the concept of feasible carbon taxes, and the necessity of acceptability in achieving this. Thereafter we account for the main factors affecting people's attitudes towards carbon taxes. Finally, we discuss how these factors can be avoided or mitigated, either through more direct interventions or mixes of policies.

## 2. Designing a feasible carbon tax

4. Evaluating the merits of different climate policy designs is a complex task, which needs to be based on several criteria. In particular, direct and indirect positive effects on the climate (i.e. effectiveness) must be considered in combination with the cost of implementing and enforcing the policy and, in addition, the possible side-effects of implementation (i.e. cost-efficiency).

5. In regard to both effectiveness and cost-efficiency, pricing externalities through a carbon tax have, according to economic theory, apparent advantages compared to other types of price-based, rights-based or regulatory measures (cf. Sterner & Coria 2012). However, the extent to which a policy measure successfully addresses climate change is not solely dependent on technical or political-administrative factors. The effectiveness and cost-efficiency of a carbon tax are also clearly interconnected to another component: *acceptability*, i.e. the extent to which the policy, once implemented, has the potential to be accepted by the general public. Only when these three components coincide can the policy measure be defined as feasible (see figure 1 below). Although the focus of this chapter is placed specifically on public acceptability of carbon taxation, the last part of the chapter to some degree also discuss how policy-mixes, simultaneously addressing all three components in figure 1, may increase the probability for a feasible policy implementation.

**Figure 1: Feasibility as a function of Effectiveness, Cost-Efficiency, and Acceptability**






### 2.1. The importance of acceptability

6. Even though carbon taxes are both effective and cost-efficient tools for mitigating climate change, they are at present only implemented in a small number of jurisdictions around the world . This cross-national difference in policy-choice can in part be attributed to contextual factors such as system of government and policy-making, path-dependency, economic conditions and dependencies, quality of government, and political culture (cf. Harring et al. 2019). However, previous research also points towards the highly politicized nature of climate policy measures in general and carbon taxes in particular, making them exceedingly sensitive to public opinion for their successful implementation (Feldman and Hart 2017). More specifically, the marginal prevalence of carbon taxes in a global perspective is considered reflecting a lack of public acceptability[1] for such policy measures, thereby making them unfeasible.

7. In political practice, several attempts to implement carbon taxes has failed as a result of low acceptability, for example in Washington State, where a ballot initiative for a carbon tax was rejected in both 2016 and 2018, as well as in France, where the *gilets jaunes* (yellow vests) protests during the

[1] In many studies of policy attitudes, the concepts of acceptability, acceptance and support are used interchangeably, without considering neither the timing or strength of the attitude in question. Here, we focus on *acceptability* as denoting an ex-ante attitude towards a proposed, but not yet implemented, policy measure. *Acceptance*, on the other hand, signals the ex-post evaluation of an already implemented policy, which commonly is not the case for carbon taxes as they are non-existent in most countries of the world. *Support* is, as opposed to the passive evaluation of acceptability/acceptance, an attitude signalling a readiness also to act as to realise the policy and its goals (cf. Kyselá et al. 2019). For policy-makers aiming to avoid public protests and discontent as a reaction to policy implementation, reaching a state of (passive) acceptability will probably be sufficient.

winter of 2018-19 led to the Macron-government's suspension of its proposing to escalate the existing carbon tax (Maestre-Andrés et al. 2019). Several other empirical examples of how low public acceptability restrict policy making and implementation also exist (cf. Drews & van den Bergh, 2016).

8. The public's attitudes towards the tax is also crucial once the policy has been implemented. Thus, public *acceptance* (i.e. attitudes formed once the policy is in place) is crucial to sustain over time too (also see the below section "Consider trial periods"). Research on the implementation of other similar policy instruments, e.g., congestion charges and taxes in some major European cities (e.g., London and Stockholm) show that the level of acceptability was typically relatively low among the general public before the implementation, but the level of acceptance among the public has gradually increased when the policy has been in place for a while (Schuitema et al. 2010). A reason for this development has been that people's acceptance is linked to their experience that the policy has intended effects (Jagers, Matti & Nilsson 2017).

9. To sum up, it is crucial for governments to recognize the importance of policy acceptability, as well as to design carbon taxes in a way that minimize public resistance and subsequent political and economic costs. In order to do so, knowledge on the factors that both help and prevent acceptability is imperative. However, and as will be further asserted throughout this chapter, although some factors are known to generate positive environmental policy attitudes in general, how these function as drivers for attitudes towards carbon taxes in a particular country more exactly, is still largely an empirical question. Thus, it is also a question that has yet to be answered for countries aspiring to implement carbon taxes in the future.

## 3. Explaining attitudes towards carbon taxes

10. Throughout research, a number of factors have consistently been shown to drive environmental policy attitudes in general. Although not all of these have been systematically studied in relation to acceptability of carbon taxes specifically, there are good reasons to believe that they constitute important drivers also for carbon taxation acceptability. In the following overview we therefore draw on a broad variety of studies on policy attitudes, whilst at the same time acknowledging results from studies focusing on attitudes towards carbon taxes in particular.

11. It should also be emphasized that the majority of research on policy attitudes is limited in terms of geographical scope, with very little systematic research on carbon taxation acceptability conducted in the Global South. This fact obviously (and negatively) impacts the possibilities to draw any more direct conclusions for developing countries, and emphasizes the importance of conducting empirical pre-studies before designing and implementing novel policies. This current situation is further explored in the final section of the chapter.

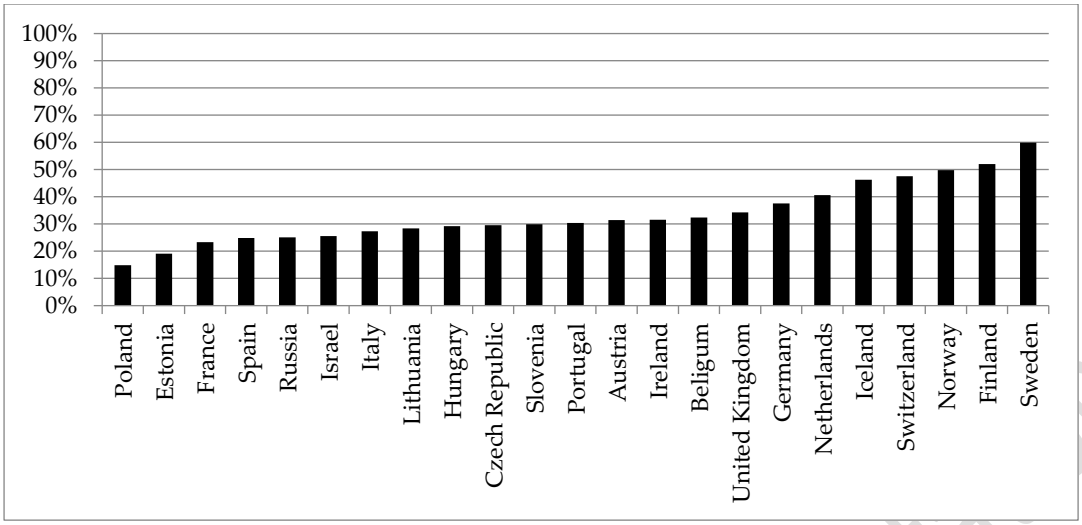
12. A major strand of research attempting to explain public attitudes to carbon taxes focuses on *individual-level factors*. In particular, a person's core values, beliefs (e.g., about the seriousness of climate change and general risk perceptions) and personal norms (i.e., a feeling of moral obligation to act in a specific way) are relevant for his or her attitudes towards carbon taxation. In addition, people who are more aware of or knowledgeable about climate change, tend to be more willing to accept climate policy measures. Lastly, a person's ideological orientation also constitutes a powerful explanatory factor for tax attitudes, where a consistent finding over time is that conservatives typically are less accepting towards vigorous governmental intervention than the liberals left. It should, however, be recognized that few studies have focused the particular relationship between ideology and climate policy attitudes *outside* the Global North.

13. A set of *inter-relational factors* also determine policy attitudes. Most notably, trust in other people's voluntarily compliance with policy initiatives (i.e. interpersonal trust) and trust in the political-administrative system responsible for implementing and enforcing policies (i.e., institutional trust) affect policy acceptability. Whereas interpersonal trust influence both the perceived necessity and potential effectiveness of a carbon tax, institutional trust targets the perceived ambition and ability of political institutions to monitor and enforce compliance; to create incentives for behavioural change; and to present viable alternatives to the public.

14. There are significant variations in acceptability across different types of policy measures and between different policy designs. This suggest that the perceived characteristics and consequences of the proposed policy, or *policy-specific beliefs*, should be added to the catalogue of factors determining policy attitudes.

15. Four – interrelated - policy-specific beliefs have been suggested to affect policy attitudes: personal outcome expectancy (i.e. perceptions of how oneself will be positively or negatively affected by implementing a carbon tax), perceived distributional effects (i.e. the extent to which the consequences of a carbon tax are perceived as being fair), perceived impact on freedom of choice (i.e. whether implementing a carbon tax necessitates a change in behaviour, and whether behavioural substitutes are readily available), and perceptions of policy *effectiveness* (i.e. the extent to which the proposed carbon tax is expected to achieve its aims). It is worth noting that these policy-specific beliefs, naturally, are the result of both individual-level factors and policy design.

**Figure 2. Attitudes to climate taxes across 23 countries.**




Note: The figure is previously published in Davidovic & Harring 2020 using the survey question 'To what extent are you in favour or against the following policies in [country] to reduce climate change?' and five response categories ranging from 'strongly in favour' (1) to 'strongly against' (5). The figure shows the proportion of respondents in percentages who are "somewhat in favour" or "strongly in favour" of climate taxes ("increasing taxes on fossil fuels, such as oil, gas and coal"), in 23 countries. Source: European Social Survey 2016.

16. Differences in policy acceptability is not only evident between individuals. As Figure 1 illustrates, there is also substantial cross-national variation in carbon tax attitudes. Thus, it is important to consider how *contextual factors* might interact with the factors mentioned above to determine policy attitudes. Cross-national variations have been attributed to various contextual features such as system of government and policy-making, path-dependency, economic dependencies, political culture, wealth and affluence and social capital. Recent studies also suggest that differences in political and institutional quality, or *Quality of Government* (QoG) can explain why policy attitudes differ significantly across countries. In particular that higher levels of corruption correlate negatively with the acceptability of economic policy tools, such as taxes and subsidies, but positively with acceptability of command-and-control regulations.

## 4. How to generate public acceptability

17. As already said, for any carbon tax to be successfully designed, decided upon and eventually implemented, i.e., to become feasible, effectiveness and cost efficiency should be considered in combination with public acceptability. Most likely, however, any attempt to balance these three components will entail certain costs. Accounting also for the acceptability of carbon taxes can imply refraining from full optimality in terms of the tax's cost-efficiency, or setting the tax-level at a slightly lower level than would be perfectly effective. On the other hand, even if combining all three targets only results in the implementation of a second-best policy measure in terms of effectiveness and cost-efficiency, one should keep in mind that this will nevertheless be significantly better than the risk of a

completely failed implementation due to public protests. In addition to the high indirect societal costs of attempting to forcefully implement an unpopular (yet optimal) tax, introducing policy measures that do not enjoy acceptability among broad layers of the public should also be questioned from a perspective of democratic legitimacy. As such, striving for feasible approaches should be seen as a worthwhile route for most decision-makers.

18. Below we first highlight a number of factors that policy-makers aiming to introduce a carbon tax should consider in order to increase its public acceptability. Thereafter we provide some examples of how policy-mixes can be developed in order to overcome or negotiate negative public attitudes due to the perceived consequences of the policy measure.

### 4.1. The role of political and institutional trust

19. Since government is the key actor when deciding on and implementing policy measures, the characteristics and quality of government, and consequently it's trustworthiness, is crucial for whether or not a proposed carbon tax will be considered acceptable among affected actors or not. This is obviously a challenge for most governments, but will be particularly problematic in countries where overall trust in both government and the governmental administration is low (Davidovic & Harring, 2020). Institutional trust is important since it is linked to people's general beliefs about the legitimacy of the political system, i.e. a belief that the existing political institutions and processes are the most appropriate. Without political legitimacy, most governmentally initiated policies are difficult to implement and uphold.

20. Unfortunately, there are no known quick fixes or short cuts when it comes to generating or renewing institutional trust. However, trust might be generated more readily concerning a specific issue, for example for a proposed carbon tax. One key component in doing so is to ensure transparency in all steps of the decision-making process and, furthermore, to open up for stakeholder dialogue early on in the process. A large body of social science research suggest that deliberative practices are crucial for generating acceptability for authoritative decisions, in particular when they conflict with stakeholders' short-term self-interests.

21. Furthermore, openly displaying the use of tax revenues can be a successful way to develop higher levels of acceptability for a carbon tax, also among groups with low levels of political and institutional trust. Since attempts to clearly and transparently connect tax revenues with offsets easily can be associated with, or even become, a case of ear-marking, which is typically not allowed in many countries, such approaches should be further investigated especially from a legal point of view. Finally, it is important to note that many of the countries that have introduced carbon taxes are rather non-corrupt countries. In a situation where countries and governments suffer from low political trust and rampant corruption, it is important that the introduction of carbon taxes does not add to these problems (Klenert et al. 2018).

### 4.2. Focus on the revenues

22. As further discussed elsewhere in this handbook, compared to other sources of income for a government a carbon tax is often a more reliable in terms of guaranteed revenues. This fact can be utilized and contribute to increased levels of acceptability, especially if it can be convincingly demonstrated that welfare improvements will be targeted with the prospective revenues from the carbon tax (e.g. Jagers & Hammar 2009).

23. Furthermore, the costs for climate change adaptation are likely to increase in most countries around the world over time. Linking mitigation policies such as carbon taxation to the funding of various adaptation projects might therefore be a way to increase acceptability for the former. In essence, using revenues for adaptation is a way to emphasize local or national returns from the tax, instead of a one-sided focus on mitigation for global benefits, and a way to build political alliances with domestic groups that benefit from adaptation. Furthermore, policies where the benefits accrue to broader groups in society might run less risk of withdrawal when there are parliamentary changes (see further Klenert et al. 2018).

### 4.3. The importance of perceived fairness

24. Previous research has emphasized the importance of perceived fairness for policy acceptance (Maestre-Andrés et al 2019, Drews & van den Bergh, 2019). Although this is discussed more in detail in the forthcoming example section, it is worth some special attention already here. Expectations that some groups will benefit more, or suffer less, than other groups is a hotbed for perceptions of unfairness, which has a strong tendency to result in negative opinions about a carbon tax (and not necessarily only among those who expect to be personally worse off than others, but also among e.g., morally righteous "winners").

25. One implication of this is that with an increasing number of exceptions built into the tax-instrument (e.g., tax reliefs for certain industries), the likeliness that the tax will be perceived as unfair, and therefore unacceptable, increases among the general public. At the same time, however, people tend to have different perceptions on what fairness entails. This might instead imply that allowing for exceptions among certain groups, e.g., those who are proportionally more negatively affected or who are particularly essential for society, could simultaneously be a way to reach increased acceptability. In conclusion, this points to the necessity of carefully analysing how (and what type of) fairness is associated with tax attitudes.

### 4.4. Searching for windows of opportunity

26. Previous experience of carbon tax implementation (e.g., in Sweden, Chile, Colombia and Mexico) suggest that timing can be an important factor for increasing acceptability. Introducing carbon taxation as an isolated policy response will inevitably increase the amount of attention, both positive

and negative, that will be paid to the novel policy, compared to if the carbon tax is implemented as part of a broader tax-reform. This will also provide an opportunity for governments to more clearly signal the interlinkages between carbon taxation, other sources of governmental revenues and potential plans for revenue-use.

### 4.5. Consider trial periods

27. Research on the acceptance of other economic policy measures, for example congestion taxes and charges, find that there is typically a larger resistance against the policy before implementation than after. This indicate the importance of policy-specific beliefs, in particular that expected outcomes are a key driver for pre-implementation acceptability. Once implemented, experiences tend to differ from expectations as people get familiar with the policy, see its effects first-hand and even experience the consequences as less negative than what was initially expected.

28. Utilizing trial-periods, where groups who initially expect the policy to have significant negative consequences, will have the opportunity to evaluate whether or not these expectations were realized after the trial, is another way to benefit from the possibility of gradual positive changes in the opinion. However, although this has been shown to matter for policies where the local benefits are evident (e.g. improved air quality and less congestion), there are less empirical evidence for policies where the positive outcomes are primarily global. A related strategy more relevant for carbon taxes is therefore to introduce a relatively low tax in order to gradually (and transparently) increases the tax rate along the way.

### 4.6. Examples of potential policy-mixes/packages

29. For some of the factors that the research has identified as drivers behind acceptance or non-acceptance for carbon taxes, there are no simple solutions. For example, the fact that people's core values affect their propensity to accept a carbon tax does not take policy-makers far in terms of policy design since (a) core values are very difficult to change and (b) it is difficult to design a tax that is sensitive to, or regard the great variation in core values that people can have, and apparently do have. In that respect, a factor such as a *personal norm* is probably less challenging. Not because the tax can be designed to match with these norms but rather because such norms *can* be changed. Two important channels for such norm changes are education and media. Thus, through the national curricula for education, a longer set target can be to educate students that environmental policies in general are relevant for sustainable development (and potentially also the rationale behind Pigouvian taxes). However, we do not aim at discussing such grander political endeavours here, and will instead concentrate on the factors more directly affecting public acceptance, namely policy-specific beliefs.

30. As was established in the previous section, there are mainly four policy-specific beliefs that have been identified as major drivers of (non)acceptance: (a) Personal outcome expectancy, (b)

perceived consequences for personal freedom, (c) perceived fairness consequences of the policy and (d) perceived effectiveness.[2] Proceeding from these findings, it is worth asking if it is possible to reduce or increase the impact of the various policy-specific beliefs on acceptance for a carbon tax. Be believe it is. By combining the tax with additional policy measures. It should be said, upfront, that although there is an incipient stream of research, the current, empirically founded literature on policy mixing is still rather scant. Thus, the following exercise should primarily be seen as *food for thought* for policy makers when designing policy packages aimed at overcoming challenges constituted by the various policy-specific beliefs.

#### *4.6.1. (Un)fairness in outcome*

31. If conducted pre-studies[3] demonstrate that perceived unfairness in outcome is a crucial reason why actors express disapproval with an intended carbon tax, reducing the potential resistance by combining the tax with compensatory measures should be considered. This can obviously be done in various ways. For example, already a flat dividend will compensate for perceived "wallet"/income effects, especially among lower-income groups. If this compensation is connected to an annual income tax return, then a flat dividend can even have a certain re-distributional effect, since many citizens with lower incomes may not have access to a car at all, but will – in this example - still benefit from the dividend. An alternative compensation scheme would be to connect the tax revenues to other policy goals, e.g., to materialize the compensation by improving healthcare, education or other policies aimed at increasing the general welfare.[4] Finally, based on previous research, avoiding exceptions is another approach that can lower resistance, since the tax will then "hit" more equally among society.

#### *4.6.2. Freedom*

32. Introducing a carbon tax is often associated with reduced freedom (e.g., of movement). When the price increases, some people can only afford public transportations or vehicles without combustion engines. For example, one often pronounced argument against the intended increase of the French carbon tax was that it would mainly affect people living in suburbs or in rural areas and since the public transportations are (relatively speaking) poorly developed, such a tax increase would hit disproportionally hard on those who have no alternatives but to drive their car. To avoid such reactions, it would be possible to combine the carbon tax with policies increasing the availability of public transportations, e.g., by broadening the public transportation system altogether, or at least by improving

[2] It is true that all four aspects in a sense can be seen as different expressions of fairness, but here we disregard this and stick to the terminology in the literature.

[3] See further below under "*Measuring acceptability in due time"*

[4] Such connections should not be conflated with "ear-marking", which is typically not compatible with many countries' constitutions.

the public's access to the existing system (for example through the provision of parking space nearby train- or bus stations) or by subsidizing the private consumption of electric vehicles.

#### *4.6.3. Effectiveness*

33. As we have seen, a common reason for questioning a carbon tax among the public is to dispute the degree to which it is necessary at all and/or whether it will have intended effect. It is obviously difficult to overcome such arguments only by complementing the tax with some kind of compensation scheme. This challenge has more to do with overcoming people's scepticism: i.e., lack of knowledge, conviction and eventually with experience. For the former two factors, one should not underestimate the importance of both a good rhetoric/pedagogics, as well as to make use of easily accessible scenarios and prognoses in order to explain to the public the benefits and the most likely outcomes of the implemented tax. The pedagogical path can be built upon various lines of reasoning, e.g., either by applying pure cost-efficiency arguments, or more ethical motivations, such as to convincingly argue that it is more *reasonable* that only the actual polluters are paying, rather than society as a whole. The latter will for example most likely be the consequence if a country chose to subsidize biofuels (and where that funding could be spent on general welfare investments instead) or the government decides to invest in public transportations while sustaining unpriced carbon emissions by avoiding the implementation of a carbon tax. As for experience, the use of trial periods might be a way to milder potential resistance (see above). A typical tendency for other policy measures is that there is often a larger resistance against the policy *before* implementation. However, once the policy has been in place for a while, the level of acceptance tends to increase. By adopting a trial period, it is possible to decrease the initial concerns while at the same time gather and reenforce the amount of public support gradually being generated after the initial implementation.

#### 4.6.4. *Personal Outcome Expectancy*

34. This factor very much resemblances unfairness in outcomes but is specifically directed towards the consequences for the individual consumer or citizen. Yet, pretty much the same logic can be applied for both, i.e., the tax can either be complemented with a purer form of compensation, such as a dividend or a deduction in the income tax return and/or in investments in more general welfare policies such as improved public transportations, educational programs or improvements in the health sector.

### 4.7. Measuring acceptability in due time

35. Throughout this chapter, it has been emphasized that trying to prognosticate if a prospective carbon tax *will be* considered acceptable or not, is both difficult and - perhaps first and foremostly - an empirical task. The reviewed literature clearly signals that the acceptability of carbon taxes is determined by numerous factors (though some are considerably more important than others) and also that one can expect variation from one country to another. Thus, there is hardly any panacea or a

universal "one-fit-all-solution" to consult or to hope for. For these reasons, it is important to survey the opinion in order to understand and establish which are the main objections against such a tax in each particular case and furthermore to do this in order to come up with complementary policies that can help overcome these objections. The previous examples of how to develop policy mixes can hopefully give some inspiration. Furthermore, it is important to do this already at an early stage of the decision-making process.

36. At least three approaches are conceivable. First, and also discussed above; policy-makers should open up for dialogue – consultation procedures – which can primarily provide important qualitative input into the designing of the tax. Second, through the use of survey instruments, also important quantitative aspects of potential objections of the tax can be discovered (e.g., which factors matter most). Thirdly, various types of (survey-)experimental approaches can be used in order to determine if a certain policy package will/would be more friendly received compared to other policy mixes. The latter approach become more and more common in the research literature and methodological guidance and can be collected from there (e.g. Fesenfelt et al. 2020; Hainmueller et al. 2014).

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# Chapter 4: Designing a Carbon Tax

[Approved at 20th Session of the Committee]

# Chapter 4A: Basic elements in designing a carbon tax

1. Motives for introducing carbon dioxide taxation, commonly referred to as a carbon tax, have been discussed in chapter 2. Once a decision has been made to consider such a tax, the policymaker is faced with a number of choices. In this chapter we will primarily deal with issues regarding the taxing power and tax base, while tax rates and ways to address undesired distributional effects for households and firms will be addressed in chapter 4B and 4C. As the choice of taxpayer and time of tax payment also are aspects of importance when designing the tax, these aspects are given some attention in this chapter although administrative issues primarily are handled in chapter 5.

2. To sum up, key aspects for policymakers to consider for the basic design of a carbon tax are listed in a short check list in the following section. These aspects will all be further elaborated in the following.

## 1. Check list for basic design of a carbon tax

3. Important choices when designing a carbon tax, which will be highlighted in this chapter are summarized below.

- Consider **possible taxing power boundaries** – national or subnational tax? Cooperation essential among different national ministries and other relevant public bodies.
- **Scope of the tax** – the decision of whether to measure and tax direct emissions or use a method of taxing fuels using average carbon content of fuels for tax rate calculation.
- **When is the tax to be paid** – at which point in the distributional chain, or point of regulation, of fuels or occurrence of emissions are legal entities to be made responsible for paying the tax?
- **Taxpayer** – connected to the point of regulation is the matter of which legal entity who will be responsible for paying the tax to the authorities.
- **Sectors, activities and kind of fuels to be covered by the tax** – the discussion of different approaches and their consequences (see also chapter 4C on Addressing undesired effects for households and industry).

4. After deciding on the approach based on the issues singled out above, a potential tax base can be defined. It is strongly recommended to thoroughly analyse the size and characteristics of the tax base prior to the tax implementation, to ensure the achievement of the desired effects.

## 2. Indirect taxation vs direct taxation

**Box 1: Special characteristics of an indirect tax compared to a direct tax**

Direct taxes are normally paid directly by an individual or business relating to, for example ownership of real estate, or income gained by the individual or business. An indirect tax is levied on particular goods or services and is normally collected by a producer or retailer, not the final consumer. The cost of an indirect tax is in most cases passed on to the consumer as part of the purchase price of the goods or services.

| **Taxes** | |
|---|---|
| Direct taxes | Indirect Taxes |
| ➢ Income Tax<br>➢ Corporate Tax<br>➢ Property Tax<br>➢ Inheritance Tax<br>➢ Wealth Tax | ➢ Excise Duties, e.g. alcohol, tobacco, fuels, emissions<br>➢ Sales Tax<br>➢ Value Added Tax |

**Table 1: Direct vs Indirect taxes**

5. Before discussing the actual design choices that faces the policymaker, it is necessary to identify some on the differences between indirect taxes and direct taxes, in order to set the scene for our continued discussions.

6. Taxes are generally divided into direct taxes and indirect taxes. Direct taxes are imposed on a person or property and are normally paid directly by that person or property owner to a local or national tax authority. Examples are personal and corporate income taxes and property taxes. An indirect tax, on the other hand, is levied on specific goods or the provision of services and is collected and paid to the tax authority by an entity in the supply chain (usually a producer or an intermediary such as a retailer). However, the basic concept of an indirect tax means that the producer or seller who pays the levy to the tax authority is passing the cost of the tax on to the consumer as part of the purchase price of the goods or services. This is normally the case in most situations when goods or services are provided for payment. There are basically two kinds of indirect taxes, sales taxes or value added taxes and excise taxes on specific goods or services which are typically imposed in addition to a sales tax or value added tax.

7. This means that a carbon tax, levied on fuels by weight or volume or on actual emissions would be referred to as an indirect tax and more precisely an excise tax (or in some jurisdictions labelled

an excise duty). An excise tax is typically[1] a per unit tax, costing a specific amount for a volume or unit of the item, whereas a sales tax or value added tax is an ad valorem tax and proportional to the price of the goods. Another difference is that an excise tax typically applies to a narrow range of products (such as alcohol or tobacco products or petroleum products) while a sales tax or value added tax is more generally applicable to all sales occurring in a jurisdiction.

8. Compared with a direct taxation system, there are some issues that warrant special consideration when assessing how a carbon tax system may be set up in a country with little or no experience in levying excise taxes. Aspects relating to when in the supply chain a carbon tax can be levied and who faces the cost of the tax are of special interest and will be further discussed below.

## 3. Who faces the cost of a carbon tax?

**Box 2: Difference between who pays a carbon tax and who bears the cost of such a tax**

In carbon tax legislation rules are laid down as to which legal entity will be responsible for paying the tax to the Government (taxpayer). A carbon tax is aimed at giving consumers an incentive to change their behaviour and consume less amounts of fossil fuels. Whether this effect is achieved depends on whether the taxpayer can pass the cost of the carbon tax on to the consumers or not.

9. There is a difference between who is targeted by the tax and legally responsible for paying it, and who in the end bears the burden of the tax. In economics, the tax burden or tax incidence is the effect of a specific tax amount on the distribution of economic welfare in society. The introduction of a tax drives a wedge between the price consumers pay and the price producers receive for a product, which typically imposes an economic burden on both producers and consumers. Tax incidence is said to "fall" upon those who ultimately bear the burden of the tax. The key concept is that the tax incidence or tax burden does not depend on where the revenue is collected (so called statutory incidence), but on the relative own-price elasticities of demand and supply which, in turn, determines the extent to which the taxpayer can pass the cost of the tax on to the consumers.



[1] There are although also examples of ad valorem excise taxes, such as the carbon tax in Costa Rica which is calculated as a percentage of the price of certain fuels.

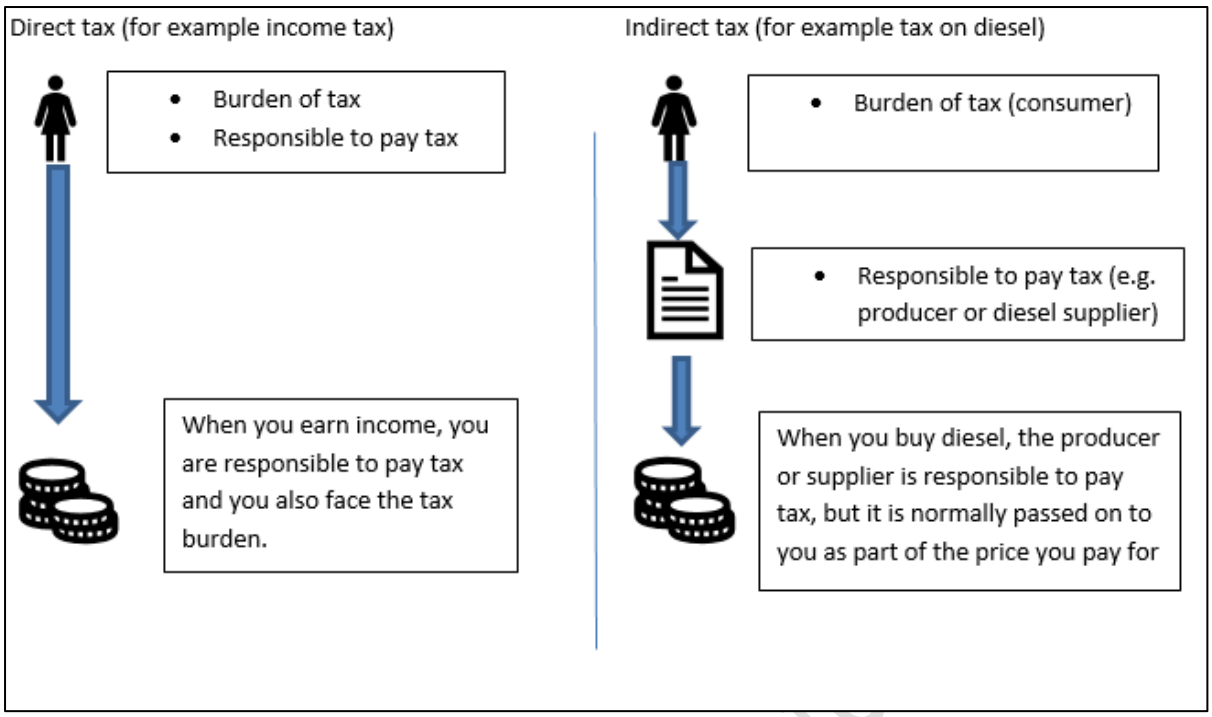


**Figure 1: Direct vs indirect tax – who pays the tax and who faces the tax burden**

10. In the case of a carbon tax, the tax incidence depends on whether the entities obliged to pay the carbon tax to the authorities (taxpayers) can pass it on to the consumers or not. If the entities can raise the product price to compensate for the full amount of the tax, the whole tax incidence falls on the fuel consumers. In this discussion, it is important to emphasize that a change in consumer behaviour is needed for the tax to fulfil the purpose of reducing emissions. If the product price is not raised, the producer will bear the full incidence of the tax. The consumption will remain unaffected and the emissions of carbon dioxide will not be reduced.

11. There are several important issues to consider in this discussion. For instance, if a governmental price regulation exists, it may not be possible to increase the price and pass on the burden of the tax. In this case the tax burden falls on the taxpayer entities, reducing their profits. A carbon tax under these circumstances will not reduce emissions in the short term, but solely work as a revenue raiser. However, most entities act in markets where they will have possibilities to pass on at least part of the increased cost of the tax to consumers. That means, in most scenarios the incidence of the carbon tax will be split between the taxpayer entities and the consumers. There are, however, circumstances where the taxpayers are unable to transfer increasing costs to consumers, for instance when facing an international competition. In these cases, it might be plausible to discuss the need for exemptions and/or lower tax rates for certain sectors of the economy. Another option might be for jurisdictions to engage in regional cooperation on carbon taxation. These issues will be further discussed in chapter 4C.

# 4. Taxing power

## 4.1. Consider taxing power boundaries early in policy design

12. The statutory power to levy taxes, or in other words the authority to levy taxes, varies between jurisdictions. The same goes for the definition of how this power is to be exercised. These rules can take the form of constitutional requirements, general public law requirements, supra-national principles or arrangements. When designing a carbon tax, it is important to understand the boundaries of these rules. These boundaries may influence certain design choices as well as identify potential gaps in regulation. Some countries, such as for example Indonesia, has adopted a fiscal decentralisation policy, giving provincial and local governments the authority to levy certain taxes and also decide on the use of the revenues from such taxes.

13. In addition, considering the taxing power early in the process of evaluating design choices will help provide a clearer view on who should be involved in the design and the implementation of a carbon tax and what resources the carbon tax policy makers can have at their disposal to effectively implement and apply a carbon tax.

14. Besides constitutional and regulatory requirements that may influence whether a carbon tax is introduced at municipal, state/province or federal level, the potential impact on cross jurisdictional value chains should also be considered. The lower the subnational level of introduction, the higher the complexity and the potential for double or multiple taxation for producers, retailers and customers. The level of introduction will also influence the need for adjustments to the system to deal with potential impacts on carbon leakage and competitiveness.

## 4.2. The institutional framework in general for setting and collecting taxes

15. The purpose of taxation has traditionally been to raise funds to meet the expenditure plans of the government. Thus, an institutional framework is in most countries already in place, determining the taxing power for taxes with that objective. Often, taxes are designed by national Ministries of Finance and the tax collection is carried out by Tax Agencies or Customs Authorities. A mandate and governance structure for setting and collecting regular taxes tends to be in place.

## 4.3. Will the same institutional rules and framework apply for a carbon tax?

16. As has been discussed in the previous section, a carbon tax has some distinct features that makes it different from other kinds of taxes. This relates in particular to the fact that the primary purpose of a carbon tax is not to raise revenue but to change the behaviour of households and firms. An effective carbon tax will incentivise the reduction of carbon emissions.

17. Other parts of government may have an interest in setting carbon reduction policies, which will have an impact on the features and effects of the carbon pricing policy and in certain cases in how

the tax is collected[2] as well. Given the policies and potentially different objectives of various government Ministries, coordination among various parts of government is beneficial when considering and introducing a carbon tax. Understanding the goals and actions that other Ministries are setting to deal with reduction of carbon dioxide emissions, climate change and energy transition, will increase the pool of expertise on the subject as well as the opportunities for alignment and coordinated buy in.

18. When designing a carbon tax based on a Direct Emissions Approach (see further discussions later in this chapter) the technical expertise of environmental and energy related matters may be crucial for the effective design and administration of such a tax and this expertise is usually found outside the national Ministries of Finance and authorities normally already assigned to the collection of taxes in general. Cooperation between relevant government Ministries and bodies is thus an essential part of the evaluation process leading up to implementing a carbon tax.

19. On the other hand, as will also be highlighted in subsequent discussions in this chapter, a carbon tax may also be designed in a way that makes use of already existing excise tax administration systems (the Fuel Approach, see further below). The need for cooperation between different Governmental bodies could in this case relate more to the overall design of carbon reduction policy strategies, while the administration of the carbon tax will be handled by regular tax collection authorities in a way that do not differ much from that of other taxes.

### 4.4. Are there particular rules in the constitution regarding taxing power?

20. National constitutions or similar documents often allocate taxing power and how taxing power needs to be exercised. The constitutional requirements to introduce taxing powers or legislate tax rules may be more stringent than the constitutional requirements and checks to legislation in general. This means that policymakers may need to consider constitutional requirements and the confines of the fiscal system in general, as it may influence the choice to introduce a carbon tax as well as its design.

21. One example of a jurisdiction that has more stringent constitutional requirements for taxes is the US State of California. Its constitution requires a two-thirds supermajority vote for tax measures, which heightens attention to what is a "tax". After the State of California created a cap-and-trade programme that auctioned emissions allowances, a court determined the auction system did not impose a "tax" that should have been approved by a supermajority requirement.

22. Carbon tax proposals can generally be adjusted in design to accommodate such restrictions but understanding constitutional requirements and boundaries upfront improves the effectiveness of introduction.

[2] E.g. Singapore recently introduced a carbon tax that will not be collected through the Tax Authorities. The tax works through emission certificates. Although there is no carbon emission certificates market, the tax will be collected through the issuance of certificates, which will be done outside the Tax Authorities.

23. Some jurisdictions ensure that the constitutionality of a tax law proposal is reviewed by an independent legal body before being put in force. This is for example the case in France, where an original proposal of introducing a carbon tax in 2009 was blocked by the country's Constitutional Council. The Council expressed concerns that the tax included too many exemptions, among them certain industries, trucking and agriculture, which would have made the tax unequal and inefficient. The carbon tax which was finally introduced in France in 2014 had addressed those concerns by broadening the scope of the tax and thus tightening certain loopholes in the prior proposal.

24. While many jurisdictions do not earmark tax revenues for specific purposes, it is common for jurisdictions to indicate in advance how revenues from environmental taxes, such as a carbon tax, will be used and to what extent these revenues will be spent to increase environmental protection. Earmarking of all or a portion of the tax revenues can be a tool for a Government to gain popular support for the introduction of a carbon tax, as it may ring-fence funds for specific environmental causes. This will be further discussed in chapter 6 on Revenue Use. Some constitutional rules even prohibit this kind of informal earmarking, e.g. by defining in a limited way the specific taxes that can be introduced without mentioning a carbon tax. Exceptionally, this could mean that introducing a carbon tax could not be possible without constitutional changes. If this would apply, efforts can be made to change the constitution, although that may be a long and difficult political process to undertake for the sake of a single tax.

25. However, even if policy makers need to address specific constitutional issues in their national jurisdictions, it is rare to find situations where constitutional requirements would significantly hinder the very introduction of a carbon tax[3].

### 4.5. Special considerations for jurisdictions with subnational levels

26. In case a state has subnational levels, a country's constitution or public law arrangements will likely contain rules as to which levels of the state have taxing powers, e.g. municipal level, provincial level and/or federal level. These levels may vary depending on types of taxes.

27. For a carbon tax, the constitutional mandate for regulating environmental issues should be considered as well as the mandate for taxation in general as these mandates may be differently allocated.

[3] In case exceptional constitutional limitations exist for taxing power, they are often not applicable to other instruments. This means that other instruments could be considered that price or regulate carbon dioxide emissions. E.g. the European Union initially explored the possibility to introduce a carbon tax framework for the Union. However, according to the EU Treaty rules, tax rules need to be approved by unanimity whereas an emission trading system could be introduced by qualified majority. The EU Emissions Trading Scheme (EU ETS) ended up being easier to introduce than an EU wide carbon tax, mandatory in all the Member States, in large part for that reason. Discussions within the EU have continued to extend the current tax framework for energy products to cover also a mandatory carbon tax, as a complement to the EU ETS for sectors which are not covered by the EU ETS. This far it has, however, not proved possible to reach unanimous agreement on such a tax system. As the current EU legislation allows EU Member States to introduce a carbon tax unilaterally as part of their general excise duty regime, seven countries have chosen to do so up to date.

Ensuring the support of the various levels of a state upfront may be an alternative to having to change the constitution to align.

28. In Canada, provinces and territories are required, by 2019, to have a carbon pricing instrument of some sort that meets a level of stringency determined by the federal government. In the case of provinces and territories that do not have a sufficiently stringent system, or at their request, a federal backstop applies. The federal system is composed of a regulatory charge on fossil fuels (called the fuel charge) and an output-based pricing system for large industrial facilities and applies either fully or partially depending on the circumstances in a given province or territory. Some provinces have instituted legal proceedings challenging the constitutionality of the federal backstop legislation on the ground that it exceeds federal jurisdiction.

29. Even if there is no conflict between various subnational entities on mandate, it is very helpful to stipulate which taxes take precedence. A subnational entity may be inclined to introduce a carbon tax before action is agreed at national level. For example, currently, in the USA, it is very challenging to introduce a federal carbon tax. However, individual US states may consider state carbon taxes and some proposals have been up for discussion over the past years.

30. Including clarity on the interaction between a tax at various levels of government could garner more support for introducing the tax at a subnational level, while calling for introduction of the same or a similar tax at a higher state level. The federal tax could become creditable against the state tax once it is introduced. It could also be argued that the subnational tax should cease to apply once a federal tax has entered into force.

31. In Spain, Autonomous Communities have the constitutional power to create new taxes, subject to the condition that they do not overlap with taxes at the national level. Following the Constitution, several Autonomous Communities have created a wide array of regional environmental taxes (e.g. on carbon dioxide emissions, thermonuclear electricity production, electricity, waste, etc.). The situation has given rise to compliance costs on firms operating or with facilities subject to taxation in more than one Autonomous Community, in some instances it has led to Constitutional Court cases as well.

32. Besides ensuring clarity on how the various taxes interact, e.g. whether they can be credited one against the other, concerns of double taxation could also be dealt with by considering taxation at a higher national or even supra national level. For example, the mandate for introducing a carbon tax could be exercised at national or even supra national level to outline the framework and main design features for a carbon tax rather than introducing different taxes at a lower level. As mentioned earlier, the EU Commission proposed a carbon tax framework to be introduced in EU Member States. Such a mandatory EU wide framework has, however, not yet been decided within the EU.

33. In general, it is important to consider at what level the taxing power would be most appropriate. As climate issues are global, introducing an explicit pricing mechanism on carbon dioxide emissions, like a carbon tax, is economically most efficient and effective when introduced as broadly as possible. Certain aspects are easier to retrofit and adjust once the tax is in place whilst others are considerably more problematic to adjust once the tax is implemented. Canada, for example, has introduced a federal system for carbon taxation where a minimum price of carbon is set. However, it did not require other design features to be aligned, such as what exactly is the scope and how should the definition of carbon be determined. The latter aspects are as crucial for achieving good environmental results.

## 5. Scope of the carbon tax and defining the tax base[4]

### 5.1. What are we going to tax?

34. The simple answer, to the question of what we are going to tax, is carbon. Carbon is the primary element that may give rise to the release of carbon dioxide, if submitted to a combustion process. If kept in the nature, carbon will not on its own lead to emissions of greenhouse gases (GHG). Carbon dioxide amounts to roughly 80 percent of the total greenhouse gas emissions emitted globally and already this fact speaks highly in favour of starting out by focusing taxation on these greenhouse gas emissions. In this handbook, we will thus focus our discussion on the use of carbon within the context of its conversion into carbon dioxide when being combusted as a fuel.

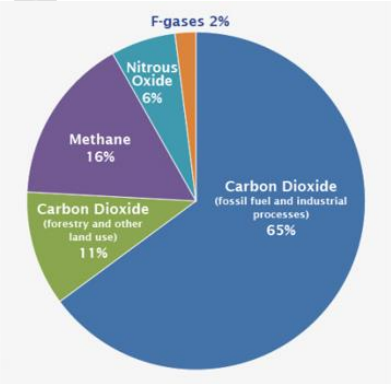


**Figure 2: Global Greenhouse Gas Emissions by Gas**

35. Carbon dioxide enters the atmosphere mainly through burning of fossil fuels (such as coal, natural gas, and oil), solid waste, trees and wood products. Carbon dioxide is removed from the atmosphere when it is absorbed by plants or in ocean waters as part of the biological carbon cycle or

[4] Unless otherwise stated, the source for facts on the Chilean carbon tax is Rodrigo Pizzaro, Universidad de Santiago de Chile (expert in the Subcommittee) and for facts on the Swedish carbon tax Karl-Anders Stigzelius and Susanne Åkerfeldt, both Swedish Ministry of Finance (experts in the Subcommittee).

artificially in a framework of carbon capture and storage. Taking these facts into account, there are two basic approaches when considering what to tax. One is focusing on a tax by volume or weight units of the fuels giving rise to emissions when combusted ("the Fuel Approach"), where the tax rate is based on standardized amounts of carbon content in those fuels. The other includes measuring the emissions directly as they occur from the burning of such fuels ("the Direct Emissions Approach"). There are pros and cons with both approaches and the design choice depends on the national prerequisites in a specific jurisdiction and both can in principle result in well-designed carbon taxes. A discussion will follow below, where also examples will be given from tax systems currently in force in different jurisdictions[5].

36. Many jurisdictions across the globe – such as for example most countries in the European Union, Sri Lanka, South Africa and Zimbabwe – have introduced an element into their taxation of the acquisition of ownership of passenger cars which accounts for emissions of carbon dioxide from the propulsion of the vehicle. However, these kinds of taxes are not within the scope of this handbook.

37. While carbon dioxide by far accounts for the vast part of greenhouse gases emitted from combustion of fuels and thus merits the focus of this handbook, also smaller amounts of nitrous oxide and methane are emitted during the combustion, depending on the type of fuel and method of combustion[6]. Emissions of other greenhouse gases than carbon dioxide can be converted into carbon dioxide equivalents ($CO_2e$) to enable a comparison between the emissions and some jurisdictions using the Direct Emissions Approach in their carbon tax design are applying this method to also include other greenhouse gases in their tax scheme.

38. There are also examples of jurisdictions, which have introduced taxation of fluorinated greenhouse gases, so-called f-gases, the most common ones being hydrofluorocarbons (HFC) and perfluorocarbons (PFC)[7]. However, f-gases are generally used for refrigeration systems. This means that such taxation would not relate to the burning of fuels and the tax design would need to be found outside of a system of taxing fuel products or actual emissions from the combustion of the fuels and therefore merit different considerations that are beyond the scope of this document.

[5] Most carbon taxes currently in existence follow either the Fuel Approach or the Direct Emissions Approach. However, in literature, consumption-based carbon taxes are also discussed as an alternative approach to existing carbon taxes. Consumption-based carbon taxes which prices carbon further to the point of final consumption. In theory, pricing carbon consumption, rather than just production can help to avoid the risk of carbon leakage. However, consumption-based carbon taxes only really exist in theory as they are very complex to administer and will not be covered in this handbook. See for further reading: https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/5ad8d232758d46c25386e589/1524159026153/27916-CPLC-ExecBrief-CarbonPricing-v7.pdf.

[6] There are seven greenhouse gases covered by the United Nation's Framework Convention on Climate Change (UNFCC), including apart from carbon dioxide six others, namely methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.

[7] Denmark and Norway for instance, tax emissions of carbon dioxide as well as f-gases, while Spain is an example of a jurisdiction with a tax solely on f-gases at national level.

39. Another aspect of carbon tax coverage is what sectors the tax will cover, or in other words what are the sectors, subsectors or certain economic activities to be targeted. This is a broader question than what types of fuel or emissions from what kind of installations to be covered. In jurisdictions without any carbon pricing system in place, a broader carbon tax will typically provide more opportunities and thus more efficient emission reductions. Circumstances will differ between jurisdictions and the most suitable coverage of the carbon tax will depend on a range of factors, including, for example, the emissions profile of the jurisdiction; other relevant tax policies; the structure of key sectors; and government capacities for administering the tax. To attain emission reductions, it is important to analyse what reductions are possible to achieve in the targeted sectors, and to what costs. As a result, governments can also see a need to address potential adverse impacts (on e.g. firm competitiveness and distributional effects) from the tax. This is further discussed in chapter 4C.

## 5.2. The Fuel Approach

### 5.2.1. Basic concept

40. Currently the predominant method of carbon taxation in jurisdictions worldwide is to levy a carbon tax on specific fossil fuels, primarily oil, gas and coal, and their derivative products. The tax would, in principle, be levied at a point close to the extraction of the fuel (in a mine or crude oil extraction site) or at importation into the jurisdiction. However, most tax schemes to some extent allow the tax due upon extraction or importation to be suspended during part of the distributional chain, if the fuels are handled by approved bodies. This means that the tax in these cases is levied when the fuels are leaving such an established tax suspension arrangement. An example of a tax suspension arrangement is the one applicable for excise taxes (including carbon taxes) within the EU. Member States have a certain choice of who to register as taxpayers within the regime, but the basic principle is the same for all countries, see the illustration of the Swedish scheme in figure below. The time when a tax will be due to be collected is briefly discussed later in this chapter, but administrative issues will be discussed in more detail in chapter 5.

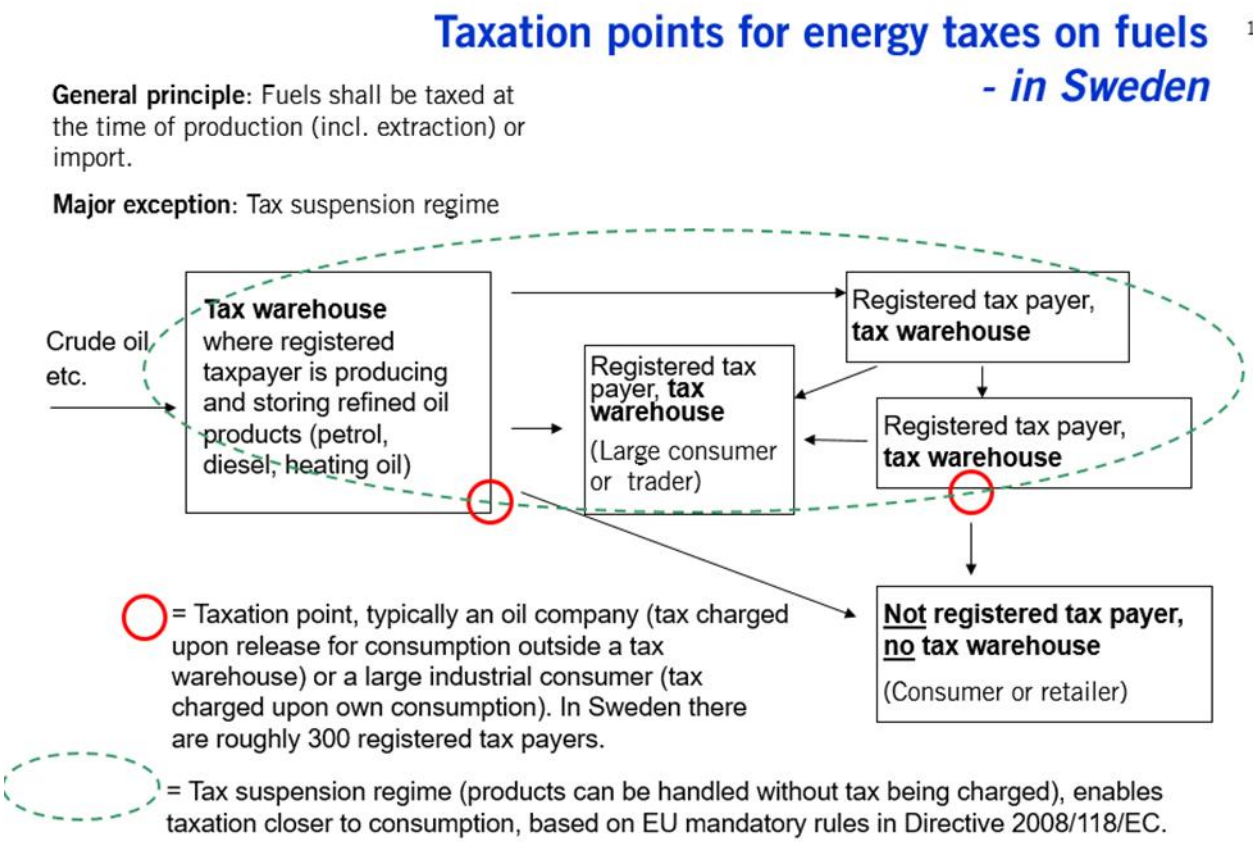


**Figure 3: Example Taxation points for the carbon tax in Sweden**

41. In the case of fuel combustion there is a close relation between carbon content and carbon dioxide emissions. Therefore, when drafting the law, pre-calculated general tax rates can be used. These tax rates are based on the average fossil carbon content of the fuels, not on the actual emissions occurring from the consumption nor considering any emissions occurring during the production of the fuel. Calculations made by Government officials, based on the average carbon content of the fuels, will determine the tax rates laid down in the tax legislation. No measurements of actual emissions are necessary. A jurisdiction introducing a carbon tax could thus choose to express their carbon tax rates by volume or weight units (such as litre of petrol or tonne of coal) based on calculations of the average carbon content of the relevant fuel. Volume or weight units are standard trade units and such an approach makes it easier for tax administration, as such tax rates are easy to apply for operators as well as for the authorities. The calculation of the tax rates will be further outlined in more detail below. This is something that would be done by the responsible Ministry or other body drafting the relevant carbon tax legislation and is not something to be left to the bodies given the task to administer the tax and transfer the collected tax amounts to the relevant Government authority.

42. The table below shows examples of emission factors and heating values for a few common types of fuels from the IPCC Emission Factor Database and the IEA Energy Statistics Manual. The carbon content and the emission factor, as well as the heating values, vary for all fuels depending on

the composition of the fuel. Hence, specific values should be used where available to reflect national or facility-specific circumstances. Also see box 4 below.

**Table 2: Examples of emission factors and heating values for common fossil fuels**

| | Emission factor* (kg $CO_2$ per GJ) | Heating value** | Emissions from combustion*** |
|---|---|---|---|
| **Petrol** | 73 | 33 GJ per $m^3$ | 2409 kg per $m^3$ |
| **Diesel oil** | 74 | 37 GJ per $m^3$ | 2738 kg per $m^3$ |
| **Liquified petroleum gas (LPG)** | 63 | 24 GJ per $m^3$ | 1512 kg per $m^3$ |
| **Fuel oil** | 77 | 40 GJ per $m^3$ | 3080 kg per $m^3$ |
| **Coal (anthracite)** | 98 | 30 GJ per tonne | 2940 kg per tonne |
| **Natural gas** | 56 | 38 MJ per $m^3$ | 2128 kg per 1000 $m^3$ |

* IPCC default values: https://www.ipcc-nggip.iges.or.jp/EFDB
** Estimates based on typical net calorific values and densities (for liquid fuels): https://www.iea.org/publications/freepublications/publication/statistics_manual.pdf
*** Emission factor multiplied by heating value

43. For any given specific fuel type, when completely combusted in dry air the relation between the carbon content and carbon dioxide emissions is exact. Most jurisdictions, for administrative reasons, have chosen to group similar fuels in fuel categories with the same tax rate per litre. This is for example normally the case with diesel fuels of different qualities, which the IPCC emission factor for that fuel in the table above indicates. While this means that a certain approximation is done, the relation to carbon content is still deemed sufficiently close for the carbon tax to be effective and provide an incentive to reduce carbon dioxide emissions.

44. It may be noted that fuel qualities may change over time due to technical developments, the Swedish example is a case in point. When the Swedish carbon tax was introduced in 1991, an average emission factor for diesel as well as light and heavy fuel oils for heating purposes was used to calculate a single tax rate per litre for all these fuels. At the time, the quality of these liquid fuels was reasonably close and applying the same carbon tax rate for all these fuels was a major simplification that lowered administrative costs for business and tax authorities[8]. However, recently Sweden updated the emission factor used for diesel to better reflect diesel qualities common on the Swedish market of today[9]. As coal

[8] Emission factor for light heating fuel and diesel was 2.74 kg $CO_2$/litre, for heavy fuel oil 2.97 kg $CO_2$ /litre, which gave an average emission factor used of 2.86 kg $CO_2$/litre.

[9] This meant that from 1 July 2018, the carbon tax rate for the fossil part of diesel is calculated on the emission factor of 2.54 $CO_2$/litre.

is not a fuel commonly used for taxable purposes in Sweden, since 1991 an average emission factor for different coal types (such as hard coal, lignite and coke) has been used to lay down a single tax rates for all coal types. A country with a major coal consumption may very well chose to use specific emission factors for each coal fuel type to achieve a balanced tax rate based on the specific emission factor of a particular type of coal. The important thing to consider, however, is that the carbon content of each single consignment of a fuel is never measured for carbon content but rather relies on pre-calculations based on average emissions. And as discussed above, such a design will still create a sufficiently effective carbon tax.

45. In general, jurisdictions are taxing the fuels only when they are used as motor fuels or for heating purposes, not when the fuel product is used for non-combustion purposes – such as coal or natural gas used as a component in certain industrial reduction processes or in purification filters. However, the calculation method as such does not prevent taxing the fuel products when used for such purposes.

*[Possible to add a picture of fossil fuels, such as oil, natural gas and coal]*

### 5.2.2. Coverage of fuels by the Fuel Approach

**Box 3: Examples of fuels subject to a Fuel Approach carbon tax in different jurisdictions**

Seven states in the European Union have introduced national carbon taxes covering all motor fuels, coal and the bulk of commercially available liquid and gaseous fuels used for heating purposes. In those jurisdictions, the carbon tax has been added to an already existing general excise duty scheme, either as part of the general excise duty or as a separate tax.

For various reasons, countries may choose to only tax certain fuels. Iceland only taxes petrol, diesel and heating gas oil. India and the Philippines only tax coal, while Mexico taxes coal and petroleum products (not natural gas) and Costa Rica levies tax on all fossil hydrocarbons. On the other hand, natural gas as motor fuel and coal are exempted from the carbon tax coverage in Colombia. The carbon tax in Argentina covers all major fossil fuels used in motor fuels or for heating purposes with the exemption of natural gas and liquified petroleum gas used for heating purposes.

46. Basing carbon taxation on fuels has the administrative advantage of allowing a policymaker to make use of a general system of fuel taxation. Such systems already exist in some form in many jurisdictions. The naming of this instrument may vary across jurisdictions – tax, excise duty, levy being the most common names.

47. For the Member States of the European Union, there is a harmonized tax framework for taxation of fuels[10],which the EU Member States need to follow in their national tax implementation. This framework does not oblige the Member States to levy a carbon tax, but if a Member State decides

[10] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, see https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF. The products to be taxed are listed in Article 2 of the directive. For more info on carbon tax rates in the EU Member States, see the European Commission's on-line information tool Taxes in Europe Database (TEDB) at https://ec.europa.eu/taxation_customs/economic-analysis-taxation/taxes-europe-database-tedb_en.

to introduce such as tax it is considered a duty covered by the harmonized EU tax framework[11]. This means that the seven EU Member States which have chosen to introduce a specific carbon tax are using the fuel tax base of this EU directive. It consists of all motor fuels, coal and the bulk part of all commercially available liquid and gaseous fuels used for heating purposes.

48. The EU Member States that have introduced a carbon tax have generally added it to an already existing general excise tax, either as part of the general excise duty (e.g. in France) or as a separate tax (e.g. in Denmark, Finland, Norway and Sweden [12]). In some cases, the introduction of a carbon tax was combined with a reduction in the pre-existing excise tax covering the same fuels. Excise taxes reduce energy use and hence carbon emissions. However, they do not usually do so in a cost-effective way, because they are not aligned with the carbon content or the broader pollution profile of the taxed fuels. If an excise tax, on the other hand, is designed in proportion to carbon content it steers towards a low-carbon energy mix. This means that a carbon tax in this respect tends to outperform an excise tax where the tax rates are laid down without no specific logic and rather based solely on political deliberations.

49. The same way of introducing a carbon tax can be used in non-EU jurisdictions, as taxing energy has become a common source of revenue raising across the world. There are different approaches of how to treat the interaction between these two different taxes. Sweden, for instance, has over the years chosen to significantly increase its carbon tax share of the total tax on energy products. Most other EU countries have, however, added a smaller – but in most cases increasing – carbon tax on top of their already existing taxation of energy products. The same goes for Lichtenstein, Norway and Switzerland, which are European countries outside the EU. The carbon taxes in Lichtenstein and Switzerland are, however, not levied on road fuels, which are only subject to an excise duty not specifically based on the carbon content of fuels.

50. The carbon tax base in Iceland consists of petrol, diesel and heating gas oil, as these are the only fossil fuels available on the market in that country. Outside Europe, some countries, for instance India, Mexico, the Philippines and Zimbabwe, have chosen to tax only a few fuels. In the case of India and the Philippines only coal is being taxed, while Mexico taxes coal and petroleum products. The Colombian carbon tax base consists of natural gas and other petroleum products. Although not specifically designed as a carbon tax, an example of a country having introduced a tax only on certain fuels is Zimbabwe, where only petrol and diesel are taxed. The carbon tax in Argentina covers all major fossil fuels used as motor fuels or for heating purposes with the exemption of natural gas and liquified petroleum gas used for heating purposes.

[11] See Article 4.2 of Directive 2003/96/EC.

[12] The legal provisions for the separate taxes are in some Nordic countries laid down in the same legal act and in others in separate legal acts.

51. Costa Rica is the Latin American pioneer in carbon taxation, as the country has had such a tax since 1997. The Costa Rican tax base is fossil hydrocarbons, which means an application of the Fuel Approach. However, the carbon tax rate is not related to the fossil carbon content of the hydrocarbons nor based on the measurement of emissions, but rather by a percentage (currently 3.5) of the market price of the hydrocarbons.

52. The reasons behind these different approaches are often found in the national contexts, such as existing administration systems, the fact that the chosen fuels amount to the bulk part of carbon emissions or due to public policy concerns. In Latin America many of the countries currently applying a carbon tax, exempt natural gas from the carbon tax base.

53. In Mexico and Argentina, natural gas is considered as a transitional fossil fuel. The policy in those countries aims to substitute carbon intensive fossil fuels such as coal, diesel and petrol, for natural gas, which is less carbon intensive.

54. Competitive concerns for certain business sectors, social concerns for households or for specific geographical areas can also play a role, as measures to meet such concerns could ease the introduction of a carbon tax. Such measures can later be phased out during continued policy design (see further chapter 4C).

### 5.2.3. Methodology to calculate a carbon tax by the Fuel Approach

55. If policymakers use the Fuel Approach to design a carbon tax, the essential element in the design phase is to pre-calculate tax rates to be proposed in the tax legislation based on average fossil carbon content for specific fuel types. The basic thinking behind such a design has been outlined above and there are significant administrative advantages with this approach, such as low administrative costs since it is possible, in most cases, to build on existing tax administration structures. To facilitate the understanding of this approach, an example from Sweden is given in the box below of how to calculate a carbon tax rate per litre of petrol.

**Box 4: How to calculate the actual carbon tax rate for a fuel with the Fuel Approach**

With the Fuel Approach, the rationale is that the carbon tax is applied to fuels and the tax rate presented in the tax legislation is calculated based on the amount of $CO_2$ emitted when the fuel is combusted, expressed in volume or weight units of the fuel in question. The amount of $CO_2$-emissions from combustion can be calculated from specific emission factors and heating values for different fuels (see examples in Table 2 above) and the tax rate is then obtained by simply multiplying the emissions with the general carbon tax level.

Emission of $CO_2$ [kg $CO_2$/unit] * General carbon tax level [currency/kg $CO_2$] = Carbon tax rate [currency/unit]

Example, calculation of carbon tax rate on petrol in Sweden 2018.

Heating value of fossil petrol: 31.39 GJ/$m^3$

Emission factor: 74 kg $CO_2$/GJ

Emissions of fossil $CO_2$: 31.39 GJ/$m^3$ * 74 kg $CO_2$/GJ = 2323 kg $CO_2$/$m^3$

The general carbon tax rate: 1.15 SEK/kg fossil $CO_2$

2.323 kg/litre * 1.15 SEK kg/fossil $CO_2$ = 2.67 SEK/litre

### 5.2.4. The tax rates are presented in the tax law in weight or volume units

56. There is no need to express the method of calculation in the legal carbon tax provisions. However, to increase transparency the amount of tax per kg of fossil carbon, which is the basis of the tax calculation, can be mentioned in the tax law or in other official regulations. For example, the Swedish legislative tradition is to keep statutes as short and simple as possible and provide additional explanations in the preparatory works (Government Bills). When the carbon tax was first introduced in Sweden in 1991, the relevant Government Bill, containing the proposal presented to Parliament for decision on the carbon tax law, contained a detailed description of the method and emission values used by the Government when calculating the actual tax rates. The description included a list of emission values used for the different fossil fuels. However, the actual legal text proposed to Parliament only consisted of the carbon tax rates expressed in weight or volume units, which has since been the transparent and established method in Sweden. The units used for the Swedish carbon tax are litre for petrol, $m^3$ (1 000 litres) for gas oil, kerosene and heavy fuel oil, 1 000 kg for liquefied petroleum gas (LPG), 1 000 $m^3$ for natural gas and 1 000 kg for coal and coke.

### 5.2.5. It is possible to differentiate based on fuel quality

57. Different coal qualities have, as was mentioned above, significant differences in carbon content. If such fuels are major energy sources in a country, it could make sense to set different tax rates based on the carbon content for the various coal qualities. The same design approach as have been laid down above can be used.

58. Further, the increased use in some jurisdictions of motor fuels consisting of mixtures of fossil and biomass components can be a further challenge to an administratively simple and easily controllable system, if the fossil carbon content of the fuel is the base of the tax. Whether the components made up from biomass sources add complexity to a tax system depends on the choice of the taxable event. If a finished product is not established until it leaves a fuel depot and is due to be taxed, regular bookkeeping will enable the taxpayer to pay the correct tax. Such a system has been applied in Sweden for many years.

### 5.2.6. Some aspects relating to carbon content in fuels of biomass origin

**Box 5: Fuels of biomass origin**

The focus in most jurisdictions that have introduced carbon taxation based on the Fuel Approach has been on fossil fuels. Fuels of biomass origin have not been covered by the tax. However, low blends of ethanol and biodiesel into petrol and diesel are often subject to the same carbon tax rate as their fossil equivalents, due to

administrative reasons and, in some cases, legal constraints when combining a tax exemption with another policy measure. Some jurisdictions, however, take account of the biomass part when calculating the tax rate for the petrol and diesel mixture.

*[Maybe include illustration of liquid biofuels]*

59. Another decision facing a policymaker is whether the tax base should relate to the fossil carbon content of fuels, or to carbon content in general, which also would include biomass-based fuels, as for instance ethanol and biodiesel. Most jurisdictions that have introduced carbon taxation have primarily sought to deal with emissions from fossil fuels, since these fuels are predominant on the global fuel market and contribute by far to most of the changes in atmospheric temperature[13]. However, the global debate is increasingly focusing on indirect emissions in land use changes which may be triggered by biomass for fuel production.

60. Some jurisdictions consider a switch to biomass-based fuels fulfilling laid down sustainability criteria as part of the solution towards a low-carbon economy, while other jurisdictions are more inclined to be alarmed by problems with the increased use of such fuels and would rather focus solely on a transition to other renewable energy sources such as wind and solar. Motives for the latter approach can, for instance, be found in OECD reports concluding that policy support for biofuels contributes little to reduced greenhouse-gas emissions and other policy objectives, while it can be one of several factors contributing to raise international food prices. However, an in-depth discussion about this issue is outside the scope of this handbook.

61. Sweden is an example of a country rich in forest resources, where sustainable forestry management is a key component of the country's agricultural and forestry policy. The general principle of not subjecting fuels of biomass origin to a carbon tax has prevailed since the introduction of such a tax in 1991. A restriction to applying this principle only to biofuels fulfilling certain established sustainability criteria has since been introduced, following mandatory EU legislation. An increased use of non-fossil fuels has played a key role for Sweden's road towards a low-carbon economy. The reasoning behind the Swedish approach is that combustion of sustainable biofuels would not result in a net increase of carbon in the atmosphere and therefore those fuels should not be subject to carbon taxation.

### 5.2.7. Low blends of ethanol and biodiesel into petrol and diesel

62. Even if the prevailing principle in jurisdictions that have introduced a carbon tax is to tax only fossil fuels, some simplifications have often been made for administrative reasons. This relates, for example, to taxation of petrol and diesel. When using the Fuel Approach method, many countries tax

[13] The IPCC has stated that 75 percent of the changes in the temperature in the atmosphere during the past 25 years relates to the combustion of fossil fuels (add source). The remaining 25 percent is due to changes in land use, primarily deforestation.

low blends of ethanol into petrol and Fame (biodiesel) into fossil diesel by the same rate per litre fuel, as if the fuel mixture would have been of 100 percent fossil origin. This is particularly true if countries have introduced another economic instrument, such as a quota obligation scheme, to ensure certain amounts of biofuels on the market. Almost all EU countries have now introduced national quota systems for biofuel blending into petrol and diesel and this has normally meant that the tax rates for petrol and diesel are the same, regardless of the content of biomass fuels in those motor fuels. EU state aid provisions put legal constraints on EU Member States' possibilities to combine a quota obligation scheme with tax exemptions.

63. Depending on where in the distribution chain a carbon tax is to be levied, jurisdictions may also encounter administrative problems if aiming to enable a tax exemption for low blended ethanol. However, this is a tax design problem and there are solutions to be found, such as extensive bookkeeping and verifications or legal definitions of the level of a low blend to be eligible for a tax refund.

### 5.2.8. Take account of the biomass part of petrol and diesel when calculating the carbon tax rate

64. In some countries using the Fuel Approach design, such in Sweden and France, the carbon tax per litre of petrol and diesel have been calculated to take account of the blend of biomass fuels following a quota obligation.[14] However, the use of pure or high blended liquid fuels of biomass origin, which yet amounts to low volumes in most countries, are often exempted from applicable carbon taxes. Another example is British Columbia, Canada where the carbon tax applies to ethanol at the same rate as petrol and to biodiesel and renewable diesel at the same rate as diesel or light fuel oil.

65. When British Columbia introduced its renewable fuel standard in 2010, which requires an average annual blend of five and four percent renewable content for petrol and light fuel, respectively, carbon tax rates on these fuels were reduced by five per sent to reflect the resulting emission reductions.

### 5.2.9. Finland – an example of a jurisdiction with an innovative view of future carbon taxation

66. Finland was the first country in the world to introduce a carbon tax in the early 1990's and like the other Nordic countries, the carbon tax in Finland is a key component in the country's pathway to a low-carbon and eventually carbon neutral society. The Fuel Approach method is used. Since 2011

[14] Prior to the introduction of the quota obligation in Sweden the carbon tax rate for petrol and diesel only applied to fossil fuels whereas now the tax rate is calculated for the fuel blend. Compared to the example in Box 4 above, calculating the Swedish carbon tax rate for petrol for 2020 the heating value of fossil petrol was 32.76 GJ/$m^3$ and the emission factor 72 kg $CO_2$/GJ (both values revised to better reflect current quality of fossil petrol in Sweden). Furthermore, assuming zero fossil emissions from sustainable biofuels and with a quota resulting in a 7.7 % share of biofuels in petrol, the emissions of fossil $CO_2$ from blended petrol amounted to 32.76 GJ/$m^3$ * 72 kg $CO_2$/GJ * (1-0.077) = 2177 kg $CO_2$/$m^3$, or 2.177 kg $CO_2$/litre. Multiplying this with the 2020 general carbon tax level of 1.19 SEK/kg fossil $CO_2$ the carbon tax rate for petrol is obtained at 2.57 SEK/litre.

the energy taxation of motor fuels and heating fuels has been based on energy content, carbon dioxide emission component and local emissions of fuels.

67. The carbon component is based on the carbon dioxide emissions of each fuel in a life cycle perspective. Biofuels are subject to a carbon tax rate that is reduced from 50 to 100 percent according to the performance, giving a full carbon tax exemption for the environmentally best biofuels – sometimes referred to as second generation or advanced biofuels – and applying different levels of carbon taxation for other biofuels based on parameters laid down in EU legislation[15].

68. The key parameter in the Finnish system is still taxing fossil carbon. However, when classifying biofuels in three levels of the carbon tax, the legislator has based these levels on life cycle values[16] providing how much life cycle carbon dioxide emissions reduction is achieved relative to equivalent fossil fuels. Biofuels that fail to meet set sustainability criteria are subject to the same carbon tax per energy content as the equivalent fossil fuel, as there is deemed to be no savings in fossil carbon dioxide emissions. Biofuels that meet the sustainability criteria (e.g. agriculture origin/first generation biofuels) and where emission savings exceed 50 percent, are subject to a carbon tax rate corresponding to 50 percent of the carbon tax applicable to the equivalent fossil fuel. Finally, no carbon tax is levied in Finland on second generation biofuels made of waste, residues, lignocellulose, etc., as these fuels in average are calculated to have carbon dioxide emissions savings of over 80 percent. Comparing the current Finnish carbon tax design with, for example the Swedish carbon tax, the emission factors used are different as Finland looks at life cycle emissions and not at emissions at the combustion. This affects the value of the emission factors used, but not the general method for calculating the tax rate and the how the carbon tax is still expressed in volume or weight units in the tax law.

69. In conclusion, even in this form of a Fuel Approach the need for environmental knowledge for the tax authority is small, or even non-existent. What the tax administration basically needs is how to calculate and audit the number of litres fuel sold by the taxpayer. This is a task which tax authorities normally are well familiar with.

## 5.3. The Direct Emissions Approach

### 5.3.1. Basic concept

*[Maybe an illustration showing emissions from a stationary installation, such as large industrial plant?]*

[15] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0028.

[16] A life-cycle analysis (LCA) of the production of fuels is a technique to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling. There have been studies made in recent years comparing energy and carbon balances for production and use of different fuels.

70. An alternative to a tax based on the carbon content of the fuel is to measure the actual emissions. With this approach, which we call the Direct Emissions Approach, the carbon tax targets carbon dioxide emissions regardless of the type of fuel being used in the group of stationary installations chosen.

71. This approach has attracted increased attention in recent years, it relies on direct reporting of emissions from certain types of stationary installations/facilities, such as large factories, power plants and oil refineries. This is the case in Chile and most recently in Singapore and South Africa. Those facilities may often already be subject to requirements to measure emissions by IPCC regulations or even more stringent national environmental codes. This might seem to be a more accurate approach, but the number of emission sources is often large and measurement systems are not precise, which implies high administration costs. Moreover, in the case of taxes based on actual emissions rather than on the carbon content of fuels, jurisdictions may need to establish new systems for monitoring, reporting and verification. While such requirements already exist regarding large industrial and power installations in the UNFCCC national reporting guidelines, this is not the case for emissions from either smaller plants or vehicles.

72. A variation is to focus on certain processes and types of emissions. This approach allows for coverage of activities beyond fossil fuel combustion and, therefore, also of GHGs other than carbon dioxide as well as of other sources of pollution from certain installations. In this way, jurisdictions may be able to ensure broader coverage, especially where a large part of their emissions are not fuel-based. This kind of an approach would work best in a context where a jurisdiction's policy approach is primarily addressing emissions from certain types of stationary installations. It is thus not a system well suited to cater for incentives to reduce emissions from small plants, due to the major administrative costs likely to occur. For the same reason it is not a foreseeable alternative for emissions from the propulsion of vehicles.

73. A policymaker considering the Direct Emissions Approach is likely to need more assistance of technical expertise on environmental and energy related matters in the tax design than the Fuel Approach. As will be further outlined in chapter 5, a carbon tax based on a Direct Emissions Approach will also be administered in a way which differs from the tasks authorities normally assigned to the collection of taxes are familiar with. On the other hand, a Direct Emissions Approach of a carbon tax design can strengthen already existing environmental schemes on reporting emissions and co-benefits can thus be found in this respect.

### 5.3.2. Coverage of emissions by the Direct Emissions Approach

**Box 6: Examples of fuels subject to a Direct Emissions Approach carbon tax in different jurisdictions**

Chile introduced a green tax reform in 2017, which included a carbon tax, targeting emissions from facilities with stationary sources comprised of boilers or turbines with a combined thermal power of 50 MW. It covers

around 40 percent of Chile's emissions affecting 94 facilities in different parts of the country from a range of sectors. The Chilean carbon tax can be viewed as a Direct Emissions Approach carbon tax.

In the San Francisco Bay Area, USA and Singapore, the carbon tax is calculated from measured emissions from certain large stationary installations. Several different greenhouse gases are measured and converted into carbon dioxide equivalents. A similar approach is chosen in South Africa.

74. Although not as common as taxation of fuels, there are jurisdictions that have chosen to tax direct emissions of carbon dioxide. A clear example of such a carbon tax approach is Chile, which introduced a green tax reform in 2017. The reform included the introduction of two new green taxes, namely a carbon tax and a local pollution tax. Both taxes target emissions from facilities with stationary sources comprised of boilers or turbines, which individually or together have a thermal power of at least 50 MW. Even with this fairly high threshold, over 40 percent of the national carbon dioxide emissions is covered by the carbon tax. While the carbon tax covers emissions of carbon dioxide, the local pollution tax covers other local pollutants, namely PM (particulate matters, such as e.g. dust or smoke), $NO_X$ (oxides of nitrogen) and $SO_2$ (sulphur dioxide).

75. The Chilean carbon tax exempts stationary sources which use renewable, non-conventional means in which the primary energy source is biomass. In other words, also by using a Direct Emissions Approach, it is possible to let it cover only fossil carbon emissions.

76. Other examples include the San Francisco Bay Area, USA which is the first local urban carbon tax in the USA (in force since 2008) and the recently (1 January 2019) introduced carbon tax in Singapore. Both these jurisdictions calculate the tax on measured emissions arising from combustion of fuels in certain large stationary installations. By converting emissions from other greenhouse into carbon dioxide equivalents ($CO_2e$) such other greenhouse gases are included in the taxation scheme as well.

77. The San Francisco Bay Area Tax is charged on emissions from installations which are subject to local environmental regulations (permits), while the Singapore carbon tax requires any industrial facility that emits direct emissions equal to or above 25,000 $tCO_2e$ annually to register as a taxable facility and pay the carbon tax.

78. A similar approach is to focus on emissions from certain processes is done in South Africa, where a carbon tax came into force on June 1, 2019. The South African carbon tax[17] targets $CO_2e$ emissions above a certain level from fuel combustion, electricity generation and industrial processes as well as estimated fugitive emissions[18]. While in principle using a Direct Emissions Approach, the

[17] For further information about the South-African carbon tax, see Republic of South Africa Carbon Tax Bill B-46-2018, http://www.treasury.gov.za/comm_media/press/2018/2018112101%20Carbon%20Tax%20Bill%202018-B46-2018.pdf.

[18] Fugitive emissions are emissions of gases or vapours from pressurized equipment due to leaks and other unintended or irregular releases of gases, mostly from industrial activities.

emissions taxed are calculated based on emissions factors pre-determined according to a methodology approved by the relevant authority. The tax law also lays downs standard values in case such a methodology does not exist for a specific activity.

79. The installations targeted by a Direct Emissions Approach carbon tax are, in many cases, already obliged to measure their emissions and report them according to the IPCC framework. There may also be national requirements in place, following environmental regulation schemes. To implement the Direct Emissions Approach a measurement, reporting and verification system is necessary (so-called MRV). This requires cooperation between the national tax administration and agencies with environmental and technical knowledge to be able to control and monitor the measurement of the emissions to ensure tax control. All parties to the Paris Agreement will be required from 2024 to report their emissions using the guidelines of the Paris Rulebook. Although developing countries with limited capacity may initially report with flexibilities, parties will, over time, increase the accuracy of the inventory of national emissions, thereby also increasing the possibility to implement a well-designed carbon tax. One of the principal advantages of the Direct Emissions Approach would therefore be, while more difficult to implement, that it will strengthen the countries' MRV capabilities which is required for a range of international commitments and local policies.

80. Further, while the Direct Emissions Approach places the tax on actual emissions, it is not necessary to have direct measurement of emissions at all sources. In effect, countries use a range of mechanisms to measure emissions that include continuous emissions measurement systems (CEMS), direct measurement, or estimations based on fuel use. In effect, the only requirement to monitor emissions is to ensure reporting at the facility level. It is this feature of the approach which is relevant to develop more sophisticated policy instruments or introduce other complementary environmental policies such as local pollution controls.

### 5.3.3. Methodology to calculate a carbon tax by the Direct Emissions Approach

81. There are examples when a jurisdiction has chosen to let its carbon tax only cover emissions from certain kinds of stationary facilities, where the consumption of fuels take place. This could be the case of large power plants. Here a tax on actual emissions could serve as a feasible option. Chile and Singapore are jurisdictions which have opted for this approach. In many cases such installations would, due to regulations following the UNFCCC national reporting guidelines or additional national environmental requirements, be obliged to measure their emissions. Thus, determining the tax on these values would be appropriate. Adding the use of such measured emissions also in a carbon tax could give more incentives to strengthen the reporting system. This could be true in a jurisdiction, which has no prior taxation of fossil fuels and thus has no tax administration system already in place. However, when such a jurisdiction decides to broaden the scope of the tax say to propellants, the measurement of actual emissions arising from the combustion at the point of consumption would no longer be feasible.

82. The Direct Emissions Approach raises different issues and problems to the Fuel Approach. In the following we will discuss some of the more complex issues, primarily related to the definition of a facility and the tax liability. Depending on how the tax is designed, the definition of a facility, or what are the boundaries of the tax liability, is an issue to consider in the design. This, in turn, is associated with the established criteria of who pays the tax.

83. Jurisdictions may identify the affected facility depending on an emission threshold, say 10,000 or 25,000 tons of carbon dioxide emissions emitted during a calendar year. This has two problems, first, how to define the specific boundaries that define a facility. Is it a spatially contained area, or broader processes that span a larger area? Is it one chimney stack or many? A second issue is that the threshold approach requires the development or existence of an MRV system before identifying who is liable to pay the tax. Therefore, countries who do not have a sophisticated emissions reporting system will need to develop one before implementing this tax approach.

84. Another approach is the one taken by Chile, where the liable facility was determined by a technological condition, namely the existence of boilers and turbines with 50 MW potential capacity, and the tax was based on the annual emissions, regardless of a specific emissions threshold. The advantage of this approach is that it facilitates the identification of the liable facility by the regulator, without recourse to an MRV system, and places the burden on the facility to develop its MRV system in order to report its emissions, thus determining the tax liability.

85. However, this approach requires a strict definition of the liable facility. As a facility may have more than one structure or chimney, the law or regulatory statute requires a precise definition of facility. In the case of Chile, it was defined as "*the set of structures and installation where one or more boilers or turbines are located, which are close to each other and that for technical reasons are under a single or coordinated operational control*." Consequently, the definition of a liable facility depends on the specific technology available, basically boilers and turbines, and only if they have a thermal capacity of 50 MW or more. For this reason, the tax is directed to facilities in different economic sectors, such as food processing, refining and electricity generation.

### 5.3.4. Measuring, Reporting and Verification Systems (MRV)

86. Both the Fuel Approach and the Direct Emissions Approach will require a system of measurement, reporting and verification. However, in the case of the Fuel Approach, the MRV system is, in effect, the current tax institutional system. The Direct Emissions Approach will, on the other hand, require a new MRV system.

87. The general structure of the MRV system is composed of, at least, four components, namely

- the registry of the facility and sources subject to the tax
- the measurement (M) or quantification of emissions

- the reporting (R) mechanisms of emissions at the facility level, and
- the verification (V) of those emissions.

We will now look at these components in turn.

***a) Registry***

88. A key component of the MRV system is the system for registering emitting facilities. In general, the whole population of potential facilities liable to the tax should be registered to determine who complies with a predetermined threshold to be subject to the tax and is therefore liable. Most countries will already have some form of registrar of polluting firms who are already reporting emissions or are subject to some form of control. In the case of Chile, for example, the Pollution Release Transfer Registry (PRTR) was used. However, if no such registry exists one must be developed.

***b) Measurement of Emissions***

89. In the case of the Direct Emissions Approach, it may seem like the focus should be on the emissions measurement issue. But this not the main problem. In fact, it is not necessary for facilities to actually measure emissions. It is sufficient for them to control the use of fuels and estimate emissions based on the carbon content. What is required, however, is to report emissions at the facility level. This is the main advantage of using emissions as the tax base since it forces facilities to make explicit, transparent and certifiable declarations of emissions. It is the basis of the development of an institutional infrastructure to support systems for monitoring, reporting and verification (MRV) at the facility level. More accurate reporting systems will be essential for international reporting and expanding carbon pricing policies across jurisdictions and sectors.

90. Facilities subject to the tax apply different methodologies or techniques for quantifying emissions for the purposes of paying the tax. These will vary across sectors and institutional capacities. In short, there are four possible measurement approaches.

i. Direct measurement:

   It consists of the direct quantification of the output concentrations emitted, through a measuring device installed on site. Quantification can be carried out by continuous sampling or measurement systems.

ii. Point or sampling:

   Collection of a sample with specialized equipment for subsequent laboratory analysis or on-site measurement. Deliver the output concentration and the representative flow of the moment of measurement.

iii. Continuous:

   Real-time collection and analysis of emissions, through a continuous emission measurement system (CEMS). It can determine average emission schedules, generally during an annual period.

iv. Estimate:

This method consists of the indirect quantification of emissions, through emission factors (associated with the specific production process), and the annual activity level (hours of operation, fuel consumption, among others). For local pollutants, the emission factors provided by the United States Environmental Protection Agency (EPA) can be used, while for carbon the factors proposed by the Intergovernmental Panel on Climate Change (IPCC, 2006) can be considered.

***c) Reporting***

91. After the measurement, the facility must report its emissions to the Environmental Authority. These must be verified (see below) and consolidated to report to the authority in charge of the tax administration (Tax Authority). The emission reporting process should be based on specific guidelines that establishes the conditions and standards that must be met both to register the affected facilities and to report the taxable emissions. This will be further outlined in chapter 5.

***d) Verification***

92. Verification systems refer to the institutional structures to validate, confirm or verify the emissions reported. Since this is a tax, the amount to be paid will be based on the reported emissions which need to be verified by the environmental authorities. However, if the objective is for the tax to evolve to other more sophisticated systems, such as offsets or compensation schemes, some form of independent verification system could be conceptualized from the beginning and then later developed.

93. The figure below presents the different issues raised by the MRV system.


**Figure 4: Different issues raised by an MRV system**

### 5.3.5 Point of regulation

94. As was discussed above, one of the issues of tax implementation is the point of regulation. A carbon tax based on the Fuel Approach can, depending on the tax design, use either an upstream or a

more downstream point of regulation. A carbon tax on emissions must, however, be regulated downstream, as that is the moment when the emissions occur. While this is technically more difficult and requires the construction of an MRV system, it can be consistent with the development of other more sophisticated policy instruments, such as offsets, compensations schemes or transnational emissions trading.

95. A carbon tax based on the Direct Emissions Approach is a downstream tax calculated based on actual emissions released by facilities subject to taxation. As have been outlined earlier in this handbook, many jurisdictions around the world have introduced carbon taxation with somewhat different designs. However, Chile is the only Latin American country to have opted for a downstream tax, while Colombia and Mexico have chosen to institute upstream taxation based on carbon content of fuels.

**Box 7: Chile's carbon tax and measurement, reporting and verification systems (MRV)**

Chile decided to use a downstream taxation mechanism so as to enhance the coherence between its mitigation policies for both global and local pollution. The national distribution of emissions was also considered, as most are released by a small number of facilities –mainly power plants – that feature more advanced direct emissions measurement systems, thus facilitating management and adaptation to the new tax.

Furthermore, it was observed that an emissions standard already existed for thermoelectric power plants (for units rated for over 50 MW), serving as a forerunner for the new MRV system. Implementation of downstream environmental taxes has required the consolidation of institutional infrastructure that hinges on coordinated efforts by a number of ministries and public agencies, both to build develop methodologies and to implement the MRV system, besides drawing on a range of information provided by different state bodies agencies.

### 5.3.6. Institutions involved

96. The Fuel Approach basically requires technical or institutional support from the environmental agencies when defining the methodology for calculating the carbon tax rate. In the case of a carbon tax on emissions the role of technical and environmental agencies is permanently essential and are the key institutions that determine both the tax base and consolidate the emissions for the final tax. Thus, one of the problems or advantages of the Direct Emissions Approach is that it strengthens the coordination between environmental line ministries and the Ministry of Finances and the Tax Authority.

97. A central aspect in the implementation of a carbon tax is the coordination of the relationship among various ministries and Government departments for the construction of reliable methodologies and information systems on emissions, issuers, technologies, tax payments and fines.

98. In general terms, the Ministry of Environment or an equivalent Agency would be responsible for coordinating the process through the regulation of emission measurement, reporting and verification systems, which constitutes the information base for the calculation of the tax.

99. After each facility declares its final emissions the Environmental Agency should verify and consolidate the emissions, then the Tax Authority will calculate the tax burden of the specific facility.

### 5.4. Summing up of pros and cons of different carbon tax approaches

100. In the table below, a summing up is made of the major pros and cons of the two tax design approaches previously discussed, which are the Fuel Approach and the Direct Emissions Approach.

**Table 3: Some pros and cons of different carbon tax approaches**

| | **Pros** | **Cons** |
|---|---|---|
| **Fuel Approach** | Incentive is clear – Polluter Pays (as tax is normally included in fuel price)<br>Administratively simple, can be added to an existing excise tax system<br>Scope can include large part of $CO_2$ emissions, in small as well as big stationary facilities as well as transport | If incentive to choose higher quality fuels within the same tax group is desirable, system may be more complicated as more tax rates are needed<br>Other types of $CO_2e$ emissions are outside scope<br>Does not develop measurement, reporting and verification systems (MRV) |
| **Direct Emissions Approach** | Incentive is clear – Polluter Pays<br>Making use of existing MRV and incentive to further develop MRV<br>Possibility of developing other more complex instruments and of eventually converting to an emissions trading scheme<br>Possible to include non-fuel combustion emission in scopes | Costly to measure<br>Cannot be applied to small facilities<br>Cannot be applied to transport fuels<br>Administratively complex |

101. However, while the table above compares and contrasts the different approaches, this is probably not the best way of assessing these approaches. A better way of evaluating them is to consider them as complementary, since they have different advantages and disadvantages and achieve different goals in different sectors. In effect, jurisdictions may decide to implement a combination of both approaches.

### 5.5. Some aspects relating to the taxation of fuels in air transport and maritime

102. When developing and determining the appropriate scope of a carbon tax, geography is an important consideration for policy makers. In this respect, extending the scope of a carbon tax beyond the borders of a particular jurisdiction has the potential to lead to, amongst other aspects,

double/multiple taxation depending on how the tax is structured. In this context, the existing international treaties and agreements that a country has enacted/ratified must also be considered, where it is important to note that under customary international law, a State may not use the provisions in its domestic law as a rationale for failing to adhere to the provisions of a treaty (Article 27 of the Vienna Convention).

103. This handbook aims to give an overview of how a general carbon tax, levied on fuels consumed within the borders of a certain jurisdiction, can be implemented. Taxing fuels used in commercial air transport and maritime (including fishing) present certain challenges, which will not be specifically dealt with in this handbook but may offer interesting approaches worth further, future considerations. Below are thus included some brief texts about the impact of international agreements and regulations as well as discussions that presently are starting in different fora on economic instruments to be used to curb fossil carbon dioxide emissions from commercial air transport and maritime.

### 5.5.1. Commercial air transport

104. There has been a widespread perception that it is not possible to tax fuel used in international aviation. This perception is based on the view that the Chicago Convention prohibits such taxation.

#### *a) The Chicago Convention*

105. The Chicago Convention from 1944 forms the basis for the International Civil Aviation Organization, ICAO, a specialized agency of the UN, and the rules regarding international civil aviation. The contracting states have, through the convention, agreed to not tax fuel on board an aircraft of a contracting state, on arrival in the territory of another contracting state and retained on board on leaving the territory of that state. This only applies to fuel on board an aircraft when arriving in another state. Furthermore, the provisions of the Chicago Convention only apply to international flights. Therefore, the Convention imposes no limitation on a state's right to tax fuel taken on board and consumed during a domestic flight.

106. ICAOs Policies in the Field of International Air Transport only have standing as non-binding soft law. They contain ICAO Council Resolutions, in which the Council resolves that when an aircraft registered in one State departs from an international airport of another State either for another customs territory of that latter State or for the territory of any other State, the fuel taken on board for consumption during the flight shall be furnished exempt from all customs and other duties. Several States have, in an appendix to the policies, stated that they don't agree with the resolutions. Further specific agreements, known as Air Services Agreements (ASAs), permit contracting States to designate their national airline(s) the right to operate flights between the counterparty State(s), as well as specify requirements around for example safety, security, capacity, and ground handling services. ASAs, which are akin to

an international treaty, can provide for the exemption from customs duties, excise taxes and other duties and charges on aircraft, fuel, lubricating oils, technical supplies and spare parts used by an airline of the counterparty State in the provision of international air transport services.

107. Consequently, it is advisable that the scope of any local, regional, or national carbon tax regime examine and consider any existing international agreements prior to implementation.

***b) Carbon Offsetting and Reduction Scheme (CORSIA)***

108. It can further be noted that in 2016, ICAO adopted the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Political agreement for CORSIA at ICAO was achieved on the condition that CORSIA would be the market-based measure applied to carbon dioxide emissions from international flights and on the basis, that emissions should not be accounted for more than once. The resolution means that carbon dioxide emissions from international aviation should be stabilized on year 2020 levels. Any carbon dioxide emissions above this needs to be compensated for. The new system will start by a voluntary phase and will be compulsory from 2027.

***c) Ongoing discussions on Carbon Pricing and Aviation Taxes***

109. In early 2019, several EU Member States argued in different fora that Member States, without effective global instruments being in place, should consider carbon pricing at the EU level. This could include the EU Emissions Trading Scheme, a tax on kerosene, an air passenger tax or a tax per flight. Following these discussions, the Netherlands held in June 2019 a conference on the topic, gathering politicians, civil servants and scientists from EU countries as well as other countries. *[This section may be updated pending further discussions prior to the publication of this handbook.]*

110. During the conference, it was a common understanding that taxing fuel for international aviation is legally possible. For example, countries may agree, on a bilateral basis, to tax fuel on flights between themselves and such taxation would be in compliance with international law[19]. There may be issues to consider, for example if there is an ASA prohibiting tax on fuel or how to handle flights from third countries.

111. At the time of the publication of this handbook, discussions are still ongoing on this topic.

**5.5.2. International Maritime Transport**

112. Unlike the case of commercial air transport, there are no restrictions in international or tax law prohibiting or limiting a State's right to tax fuels used on cross-border maritime transport of goods and in high-sea fishing exploration.

[19] https://ministeriefinancienconference-cms.lwprod.nl/uploads/1560873188_PacheTaxationHagueTextI.pdf

113. There is, as of yet, no international agreement establishing a country's entitlement to tax carbon emissions (or fuel consumption) deriving from international maritime transport. Absent such international agreement, two different sets of international regulations may come into play: (i) the regulations issued by the International Maritime Organization ("IMO"), and (ii) the UN Convention on the Law of the Seas ("UNCLOS"). None of them specifically deal with economic instruments relating to carbon emissions, but there is nothing that prevents them from implementing economic policies such as carbon taxes to reduce carbon emissions.

***a) The Role of the IMO Convention***

114. The IMO was created in 1948[20] as a specialized UN agency, with the purpose of developing, administrating, and legally implementing international regulations and practices to be followed with the cooperation of Governments, in order to achieve the highest standards in matters concerning maritime safety, efficiency of navigation, and prevention and control of marine pollution from ships. The Marine Environmental Protection Committee was created to address environmental issues under IMO's remit.

115. The IMO has issued Mandatory energy efficiency standards for new ships (the Energy Efficiency Design Index (EEDI)) and mandatory operational measures to reduce emissions from all ships which have entered into force in 2013, as amendments to MARPOL Annex VI. By 2025, based on the EEDI phased approach, all new ships are expected, based on that legislation, to be 30% more energy efficient than those built before 2014.

116. In 2018, IMO adopted the Initial IMO Strategy on Reduction of GHG Emissions from Ships (Resolution MEPC.304(72)), aiming at reducing total GHG emissions from international shipping at least by 50% by 2050. To that purpose, the Strategy lists a number of candidate measures to reduce GHG emissions from international shipping. They do not, however, include carbon taxation.

117. As mentioned, IMO's policies so far have only addressed mitigation techniques and efficiency improvements, rather than carbon taxation or market-based initiatives (such as emissions trading). Besides, the EEDI only applies to new ships, and since a ship's operational life ranges between twenty and twenty-five years on average, it is unlikely that energy efficiency standards would be sufficient to reduce $CO_2$ in the short- and medium-run. Even in the long-run, Smith et al. (2016) indicate that with the current designed EEDI, shipping's cumulative $CO_2$ emissions will be reduced by only 3% between 2010 and 2050. EIA (2017); and Smith et al. (2015, 2016), in a study commissioned by IMO, predict that the EEDI regulation alone will not change the increasing trends of $CO_2$ and GHG emissions.

***b) The role of the UNCLOS***

118. The 1982 UNCLOS is responsible for codifying the rules applicable to activities on the high seas, by: 1) establishing an international legal order for the economic and scientific exploration of seas

[20] Initially named Inter-Governmental Maritime Consultative Organization (IMCO), in 1982 it changed its name to IMO.

and oceans; (2) facilitating international communication; and (3) promoting the peaceful uses of the seas and oceans, equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment. Furthermore, the UNCLOS regulates every state's rights and obligations when lending a vessel the national flag to navigate through the high seas or to promote an economic activity in international waters.

119. UNCLOS, which was ratified by 166 parties (including the European Union, but not the United States), is a general convention and, as such, is compatible and may be subject to the provisions of other more specific conventions regulating, for example, environmental obligations, and defining international taxing rights, provided that the *lex specialis* in question does not contravene the basic principles embodied in the Convention. The UNCLOS may thus interact with the Paris Agreement and the Kyoto Protocol, for example, when it comes to setting specific and higher standards for environmental protection for shipping operations.

***c) Conclusion***

120. The international maritime transport sector is not currently subject to the payment of any carbon tax or environmental charge. This has at least three adverse consequences. The *first* is a higher than optimal activity in international shipping (types of vessels, the routes they take, and the types of goods they transport), as it does not face the true global costs of international trade. The *second* is too high fuel consumption (and too polluting fuels) and consequently too high carbon emissions[21] (see Smith et al. (2015)). The *third* is the lost opportunity of raising fiscal revenues raised from international shipping transport for countries participating in international trade, which are so critical for many low-income countries with low tax revenues.

121. Absent an international environmental agreement to source and tax carbon emissions from international shipping, taxation of those emissions becomes a topic of exclusive competence of national States.

122. The attribution of indirect taxing rights over activities occurring on the high seas is not a topic covered under international tax treaties or the UNCLOS. Regulatory environmental standards are within the competence of the flag state, but as tax is a specialized topic within the general field of environmental law, *lex specialis derogat lex generali*, and therefore it would be up to policy makers to define how taxing rights derived from global emissions could be allocated between states.

123. Taxing carbon emissions would be consistent with the principle, consolidated in the UNCLOS, that the responsibility for the emissions released on the high seas should be shared by the larger international community, and with the IMO's guiding principle of non-discriminatory treatment

[21] Bunker fuel consists primarily of residual and distillate fuel oil (see EIA (2015)). Starting January 1, 2020, IMO requires that all fuels used in ships contain no more than 0.5 percent sulfur. The cap is a significant reduction from the existing sulfur limit of 3.5 percent.

of all ships regardless of the flag state. Extensive cooperation between all countries on this matter would represent a recognition of such responsibility and would be the first step allowing countries to reach an agreement on a global carbon tax scheme for the international shipping sector. The international community (including IMO) acknowledges that low-income countries (LICs) and small island developing states could be affected. To address any possible negative effects of implementing a carbon tax in the maritime sector may for example require to design a compensation scheme to the countries that are most affected.

## 6. When the tax is to be paid and by whom

*(Some illustration/graph including money/revenues might be included)*

**Box 8: Key factors to consider when determining who will pay the tax and when**

The carbon tax legislation needs to lay down provisions about who will be held liable to pay the tax to the authorities (taxpayer). The choice of taxpayer will depend on national conditions, such as already existing taxation of fuel, available tax control capacity, the organization of fuel distribution or the types of fuels targeted by the tax. Degrees of complexity of tax administration vs the need to be able to carry out tax controls are key issues to consider.

For a Fuel Approach design, there are examples globally of countries having chosen taxpayers in different stages of the distributional chain.

For countries choosing a Direct Emissions Approach a close link to existing environmental performance legislation has often been desirable.

### 6.1. Basics to consider when deciding on the taxpayer

124. The choice of what entity to give the legal responsibility for paying the tax to the authorities may seem like a purely administrative issue. However, emissions typically involve a range of actors operating at different points in the fuel distribution chain. In addition to determining which sectors or activities will be subject to the tax, jurisdictions also need to carefully consider the choice of taxpayer. Some more technical aspects involving the taxpayer and actual payment of the tax will be handled in chapter 5. The basics for jurisdictions to bear in mind are, however, highlighted in below as they are important features to ensure that the tax functions well to achieve the policy goals set out for it.

125. The actual payment of the tax – when and by whom – is a matter to be regulated in the carbon tax legislation. These issues are of interest to authorities set to administer the carbon tax and in consequence also to legislators considering how to design their tax legislation. This is essential and not much attention has been given to these issues in the vast literature already dealing with carbon taxation. The key focus of literature seems to have been the issue of economic incentives for people and businesses to promote ecologically sustainable activities. The latter discussion depends e.g. on the possibilities for the taxpayer to transfer the cost of the tax down the fuel supply chain. This issue has been touched upon earlier in this chapter (see section 3).

126. There is no simple answer to which entity is best suited to be held responsible to pay a carbon tax to the authorities and when that event is to occur. It obviously primarily depends on the tax design

approach chosen, but also to a large extent on already existing administrative structures in the jurisdiction and to what extent the jurisdiction would like to build on such existing administration. The environmental objective laid down for the tax is also a feature to be considered as well as the entity in the fuel distribution chain that is most likely to respond to the price signal of the tax. It should also be highlighted that many developing countries are adopting digital tax declarations systems, which can significantly facilitate the tax administration while labour resources can be concentrated on ex-post tax control in the forms of tax audits and spot-checks (see also chapter 5 on administration).

127. Jurisdictions choosing to design a carbon tax levied on fuels (the Fuel Approach) are likely to explore existing excise duties on the relevant fuels and who is responsible for the collection of such taxes. Choosing the same taxpayer for the new carbon tax will mean low additional administrative costs for both the taxpayers and the tax authorities.

128. If a Direct Emissions Approach is chosen for the design of a new carbon tax it would be natural to choose as the taxpayer, the entity that generates the emissions. Administrative advantages can be seen in coordinating the tax collection and payment with already existing obligations to report emissions based on environmental regulations. Still, such a tax system would most likely require new administrative practices for the tax authorities, including necessary cooperation with – and the technical expertise of – environmental authorities to be able to carry out tax control.

129. In determining the point of regulation, it is crucial to analyse which actors will bear the burden of the tax and if they are responsive to the price signal. To ensure efficiency and environmental effectiveness households and firms should respond by changing their behaviour. Whether the price signal will be passed on to the final consumer, by being part of the retail price of the fuel, is, however, a consequence of trade agreements between sellers and buyers of the fuel. It is nothing to be regulated in a tax act.

130. Another important aspect is the challenge associated with administering the tax, including difficulties in monitoring, reporting and verification, often referred to as MRV. Due to administrative complexities and the number of taxpayers, it would not make sense to let each individual consumer, for example private persons consuming petrol in their car, be responsible for paying the tax to the Government or some other public body.

### 6.2. When will the tax be due – point of regulation

131. A distinction between upstream, midstream or downstream points of regulation is sometimes used in economic literature to identify the point at which the tax is controlled or collected. However, we are refraining from using this terminology as it risks adding to confusion, especially as these terms may have different meanings when used in different contexts.

### 6.2.1. The Fuel Approach

***a) General principles***

132. A general principle in a carbon tax based on a Fuel Approach, that is a tax system levying a certain tax amount on fuels by weight or volume unit, is that the fuels shall be taxed at the time the fuels enters the economy. This normally coincides with extraction or importation. A strict application of such a system is illustrated in figure 6 below and it may be a good starting point for a country which already administers some other kind of excise duty on the taxable fuels or has no prior experience of administering excise duties.

133. Administrative simplicity along with good possibilities for tax control are key issues to consider. Keeping the number of taxpayers to a minimum is another aspect to keep administrative costs low, which often is desirable to the authorities as well as to the taxpayers. One option would be to establish a tax collection point very early in the fuel distribution chain, that is the point of extraction (such as coal mine, oil drill, natural gas pipeline) or importation. Choosing a taxation point at importation would also have administrative advantages, as the tax collection can be combined with the collection of applicable customs duties to be paid upon importation. Further, a resource-rich country can choose to let the tax, at least from the start, be levied at the point of extraction, while a resource-poor country may feel it appropriate to start with only taxing fuels at the point of importation.

134. However, while choosing a tax point as illustrated in figure xx below could offer administrative advantages in terms of relatively few taxpayers and better opportunities to conduct an effective tax control, there are also some other aspects to consider. Crude oil and natural gas largely dominate the imports of fuels to most countries and choosing a taxation point at importation can make it difficult to differentiate the carbon tax between different qualities of refined petroleum products (such as petrol, diesel, heavy fuel oil etc.). However, in this regard Colombia offers an interesting example.

135. Colombia introduced a carbon tax in 2017[22]. The tax base consists of different refined petroleum products, namely natural gas (for certain industrial processes), liquified petroleum gas, petrol, kerosene, diesel and fuel oil and the importer or producer of such products is the body responsible for paying the carbon tax to the Government. In certain cases, the tax law gives the final consumer the right to ask for a tax reimbursement.

[22] For more information on Colombia's carbon tax please refer to the carbon tax legislation (Law 1819 of 2016 and the Decree 926 of 2017( Congreso de la República, 2016; Ministerio de Hacienda y Crédito Público, 2017) http://es.presidencia.gov.co/normativa/normativa/DECRETO%20926%20DEL%2001%20DE%20JUNIO%20DE%202017.pdf and Gutierrez Torres, Daniela (2017): Interaction between the carbon tax and renewable energy support schemes in Colombia- Complementary or overlapping?, The International Institute for Industrial Environmental Economics, http://lup.lub.lu.se/student-papers/record/8927410.

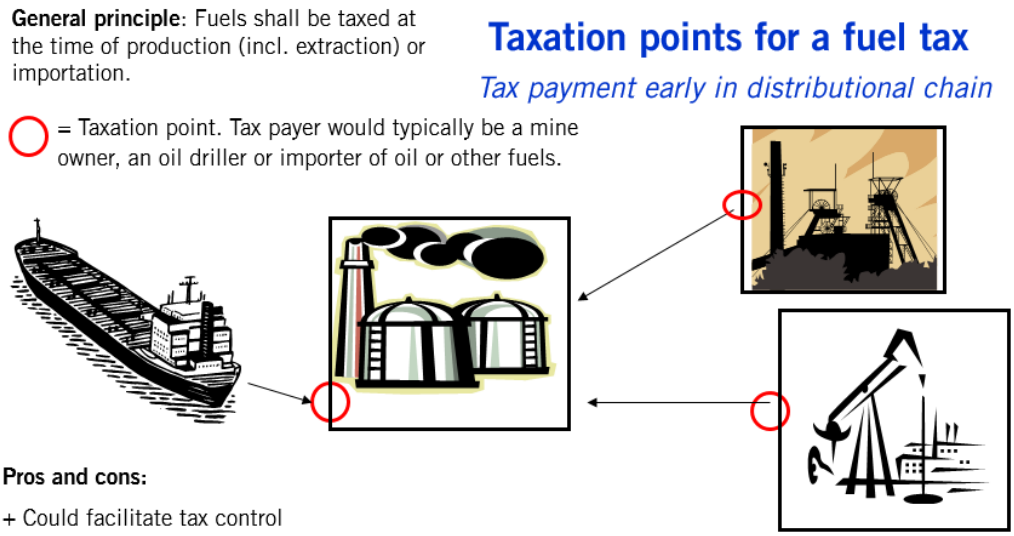


**Figure 5: Example of a fuel tax design – tax payment early in the distributional chain**

Note. Not applicable within the EU, as the major part of taxable events occur within a tax suspension regime system with authorized traders under Directive 2008/118/EC, see further figure 2.

*[The figure above may be replaced by a new graph incorporating the possible taxation points in both major systems, the Fuel Approach and the Direct Emissions Approach]*

### *b) Possible to coordinate tax collection with import duties*

136. Coordinating tax collection with other taxes or duties could facilitate tax administration. For a country choosing to collect a carbon tax upon importation, it could be an alternative to coordinate the carbon tax collection with the collection of import duties due on the taxable fuels. Although not being an explicit carbon tax, Zimbabwe can be mentioned as a country which coordinates its collection of a tax on certain energy products, a Petroleum Importers Levy on petrol and diesel, with import duties[23]. Firms or individuals holding a procurement license to import petroleum products in bulk into Zimbabwe are liable to pay this levy, which amounts to USD 0.03 per litre.

### *c) Carbon tax due later in the distributional chain*

137. Choosing the same taxpayer for the carbon tax as an already existing excise duty on fuels will mean low additional administrative costs. The carbon tax can be implemented as a new, separate tax or be incorporated as part of an already existing excise duty levied on fuels. A separate tax can be administrated in the same way as the existing excise duty and would not give rise to much additional administration, e.g. in the form of human resources employed. As we have seen from the previous

[23] https://www.zimra.co.zw/index.php?option=com_content&view=article&id=1201&Itemid=139.

sections, a carbon tax designed by the Fuel Approach means that the tax is levied by weight or volume units, that is the same as other excise duties are normally levied. Introducing a separate carbon tax will also make it possible for a Government to more clearly advocate to the public that the tax is a climate tax.

138. Even if the general principle still is to levy a tax close to production or importation, many jurisdictions have deviated from this principle. There may be several reasons for this. One is the desire to be able to differentiate the tax rates depending on final use of a fuel, such as between different sectors of the economy[24]. Another, which may be especially interesting in a country with high tax rates, may be to facilitate trading of the fuels between approved operators before reaching the final consumer. Negative liquidity effects on business may be avoided by such a construction, as the tax will not need to be paid before the fuel has been sold to the final consumer.

139. The discussion of when in the distributional chain to let the tax be due, is a matter primarily occurring then assessing the Fuel Approach. If choosing the Direct Emissions Approach, the issue does not really occur, as the tax administratively normally will coincide with the measurement of the emissions.

*Example Norway's Carbon Tax [May be put in a box]*

140. Norway is an example, where the liability to pay the carbon tax normally arises when the goods are imported or produced. However, this is not always the case in practice. First, production of taxable products in Norway must take place in and by an entity which has been approved by the tax authorities, known as an approved tax warehouse. Liability to pay tax does not occur until the goods leave the tax warehouse. An importer may choose to register in the same way. This means that the registered taxpayers can store the fuels without having to pay the tax. The Norwegian tax system includes certain cases of exemptions and reduced rates. These are either implemented as direct exemptions, which means that the registered importer or producer sells the product without paying tax or at a lower tax rate. In other cases, a situation like the abovementioned Colombian case, it is accounted for as an end-user can ask for reimbursement of the tax.

*Example Carbon Taxes within the EU Energy Taxation Framework*

141. The bulk part of all commercially available fuels is subject to excise duty in the EU Member States. Following the choice of the Member State, the excise duty may include a specific carbon tax, currently seven Member States have chosen this approach. Such carbon taxes are in principle chargeable at the time of:

- Production, including, where applicable, their extraction, of taxable goods within the territory of the EU

[24] For example, Sweden applied for several years (1991-2017) different carbon tax rates for heating fuels used by industry compared to households and service sector firms, see further chapter 4C.

- Importation of taxable goods into the territory of the EU.

142. However, a carbon tax in an EU country does not become chargeable until it is released for consumption the Member State. This means:

- The departure of taxable goods, including irregular departure, from a tax suspension arrangement.
- The holding of taxable goods outside a tax suspension arrangement where carbon tax has not been levied pursuant to the applicable provisions of EU law and national legislation.
- The production of taxable goods, including irregular production, outside a tax suspension arrangement.
- The importation of taxable goods, including irregular importation, unless the goods are placed, immediately upon importation, under a tax suspension arrangement.

143. This model is very similar to the one used in Norway. However, within the EU each Member State has discretion as to where in the distribution chain the tax is liable, that is there is flexibility in determining the extent of the tax suspension regime.

144. Some EU countries are applying rules which result in a relatively few taxpayers. Such taxpayers are normally to be found early in the distributional chain and operators further down the distributional chain will not be involved in the tax collection. Tax rebates are in those cases normally administered by the end users asking for a tax reimbursement. Another way could be to introduce approval procedures for businesses, which under tax control may receive the fuels tax exempted.

145. While some EU countries, for example of Sweden (see further in chapter 5), allow large business consumers to be taxpayers, the EU legislation does not allow private individuals to register as taxpayers. This means, for example, that petrol stations selling motor fuels to households are not taxpayers but buy the fuels already taxed in a previous leg of the distributional chain.

*Example – British Columbia's Carbon Tax*

146. British Columbia, Canada[25] is an example of a jurisdiction that has moved the event when the tax becomes liable for payment and consequently also the taxpayer down in the distributional chain, by enlisting the fuel distributors as tax collectors. First-time manufacturers or importers of a fuel must be appointed as a collector for each fuel type they sell. They generally remit security to the provincial government and are reimbursed as fuel is sold through the supply chain until the tax is borne by end purchasers. The British Columbia scheme allows for fuel sales between refiner collectors and natural gas sales to be exempt from security.

[25] For more information about the carbon tax in British Columbia, please refer to https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/carbon-tax.

### 6.2.2. The Direct Emissions Approach

147. A carbon tax based on a Direct Emissions Approach requires the measurement or estimation of actual emissions at the source. Therefore, the taxpayers are likely to be those who control the production process that generates the emission, this can either the owner/renter of the installation where the emissions occur or the business carrying out the activity requiring the process from the installation giving rise to the emissions.

148. Measuring emissions at source does not necessarily involve actual measurement – although it is better to do so – emissions can still be estimated, based on fuel inputs and carbon content emission factors, but it does require the development of a measurement, reporting, and verification (MRV) systems for emissions at source. This will inevitably require close cooperation between Tax and Environmental Authorities, which may many times be difficult. There are pros and cons of such an approach. The most obvious is that the tax on emissions is explicit, which can facilitate the introduction of a carbon tax in a country where new taxes are not easy to implement. On the other hand, it can lead to increased institutional complexity and conflict in the shared responsibility for tax administration and tax control between Tax and Environmental Authorities. Other advantages include that the MRV system developed will be useful for purposes over and above those necessary for green taxes, such as developing inventories, enhancing domestic and international comparability, facilitating management within companies, and even generating conditions to move towards more sophisticated policy instruments such as compensation mechanisms, offsets, and/or an emissions trading system.

## 7. References

[more to be added]

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# Chapter 4B: How to set the carbon tax rate

## 1. Check list for setting the carbon tax rate

- At an initial stage, the most important thing is to **introduce a system for carbon taxation**.
- Implementing a carbon tax rate is a learning by doing task, as new information becomes available, carbon tax rates should be subject to an **ongoing evaluation process.**
- Carbon tax rates should, ideally, be consistent with the targets of the Paris Agreement. Policymakers may rely on economic data to set the rate. However, in practice, **a dynamic tax rate trajectory** may be feasible as there is a lack of clarity about the exact social costs of carbon. Thereby, the tax rate could be adjusted if specific policy emission reduction targets are not met.
- However, in the end, **setting the tax rate is a political decision**. From an environmental point of view, instead of waiting to find the most appropriate tax rate, which is enormously challenging in practice, a rate should be agreed upon. In practice, this rate should subsequently be evaluated and adjusted accordingly, if necessary.

## 2. Basic considerations for setting the tax rate

1. Setting the rate of a carbon tax is an essential element in the policy design of a carbon tax. The level of the tax rate has direct consequences on the effectiveness of the environmental objective envisaged via the tax and on the economy as a whole, since it is influencing fossil fuel market prices. Therefore, setting the tax rate merits careful consideration. This chapter will point out key aspects for policymakers to consider when making this decision.

2. Implementing a carbon tax is a learning by doing process because the impacts of the tax can be difficult to predict in advance. Hence, it is advisable for jurisdictions to start applying a carbon tax, irrespective of the starting rate[1]. From a policy perspective, and in meeting the objectives of the Paris Agreement, jurisdictions should strive to enter the carbon taxation ladder as soon as possible and gradually increase the rate over time and hence achieve a more significant carbon tax rate as soon as possible. To the extent the desired policy goal is not reached after a certain period (to be analysed according to the jurisdiction's specific economic and social circumstances), a tax adjustment should follow. A dynamic tax rate trajectory could help to increase the accuracy of the tax. There are also economic theories and approaches that could be used in setting the tax rate[2].

3. The range of carbon tax rates currently in force in jurisdictions across the globe varies from less than one US $ / tCO2e to over one hundred dollars[3]. It is worth noting that the highest taxing

[1] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

[2] Kettner-Marx, C., Kletzan-Slamanig, D., 2018, *Carbon Taxes from an Economic Perspective*, WIFO Working Paper 554/2018.

[3] For an overview, see World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO.

jurisdictions did not start their carbon tax programs by immediately applying a very high tax rate. Most jurisdictions (such as for example Sweden) initiated their carbon tax program with relatively low tax rates, increasing them over extended periods of time[4]. Despite that, most initiatives levy relatively low carbon tax rates below US $ 30 / tCO2e [5].

4. However, to reach the 1.5°C temperature target agreed upon by the Paris Agreement, the High-Level Commission on Carbon Prices proposed a carbon price ranging from US$ 40 to US$ 80 / tCO2 by 2020 and US $ 50 – 100 / tCO2 by 2030[6]. A brief comparison with the current state of the art of carbon taxation will show that these are quite high prices to achieve in a relative short time period, which is an argument to start as early as possible. However, even low initial tax rates can serve as a starting signal, since the tax rate can be adjusted to a level, which is in line with environmental targets after its implementation. Therefore, even getting the system started with a low initial carbon tax rate could create the basis for a – from an environmental perspective – successful carbon tax. Ideally, the introduction of a certain tax rate should include a political commitment that the rate will increase over time to reach a specific emission reduction target. The implementation of hard commitments to raise carbon price trajectories is difficult, even impossible, however, certain design features may help. Examples include political commitments to higher rates when carbon prices rise in neighbouring countries or with trading partners, ensuring that changes to the tax rate do not require changing primary legislation, ensuring that its revenue generation and use is integrated within the fiscal policy[7].

5. If jurisdictions apply one uniform carbon tax rate, which applies to all emission sources, such a price signal can help to reach carbon reduction goals in an economical efficient way[8]. The goal of this chapter is to provide suggestions of policy instruments, which may help to set a proper carbon tax rate. Some jurisdictions have chosen in practice to apply different carbon tax rates[9]. Following this idea, carbon tax rates can be distinguished according to the utilization of fuels (e.g. heating, transport) or according to various sectors (e.g. households, industries). Differentiation might be a practical necessity

[4] Hammar & Åkerfeldt, *$CO_2$ Taxation in Sweden – 20 Years of Experience and Looking Ahead*, 2011, https://www.globalutmaning.se/wp-content/uploads/sites/8/2011/10/Swedish_Carbon_Tax_Akerfedlt-Hammar.pdf.

[5] OECD, 2018. *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading*, p. 8.

[6] *IPCC, Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development in Special Report: Global Warming of 1.5 ºC above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* IPCC (2018), p. 153.

[7] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

[8] Kettner-Marx, C., Kletzan-Slamanig, D., 2018, *Carbon Taxes from an Economic Perspective*, WIFO Working Paper 554/2018, p. 2.

[9] See for an overview Carbon Pricing Dashboard, The World Bank available at https://carbonpricingdashboard.worldbank.org/map_data.

to get acceptance for introducing a tax at all. However, considerations regarding the application of several carbon tax rates are not covered in this chapter, as they are discussed in chapter 4C.

6. In this chapter, we will look into different practical approaches, which have been discussed in literature to set a tax rate, complemented by country examples[10]. Those approaches are standard and price approach, revenue target approach and the benchmarking approach. The methods are not to be considered independently of each other since ideas of all methodologies could be integrated into the decision-making process. This is because input from various methodologies can help to find a tax rate, which is in line with a desired climate policy objective.

## 3. Setting the Rates

### 3.1. Pigouvian taxation – internalising external costs

7. The use of a carbon tax is encouraged through the economic considerations of the Pigouvian taxation[11].[12]. The theory behind the Pigouvian taxation involves reducing $CO_2$ emissions through the full internalization of external costs of environmental damages through taxes. It is based on the consideration that emitters of $CO_2$ impose costs and disservices on others, without paying for the resulting damage that occurs. Thus, market failure may occur, as the private and social cost and interests do not coincide. It is possible to internalize external costs by setting a tax rate which exactly represents the external costs of an action. Thereby, the tax equalizes the costs of an economic actor (private costs) to the costs of society (social costs). As a result, the polluters bear all costs occurring as a result of economic actions[13]. Although the Pigouvian tax faces practical limitations, as it requires a high quantity of economic data, it represents an interesting theory, which can help to set a proper carbon tax rate.

*[Consider adding a picture of chimneys]*

8. According to economic theory, the tax rate of a Pigouvian Tax should be set equal to the marginal social cost of the pollution[14]. In consequence, the price for the activity causing the pollution which is responsible for the external effects will rise. This results in a situation where the demand for the underlying activity decreases because of higher prices.

**Box 9: Technical Note: Pigouvian Taxation**

[10] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 89.

[11] See chapter 2.

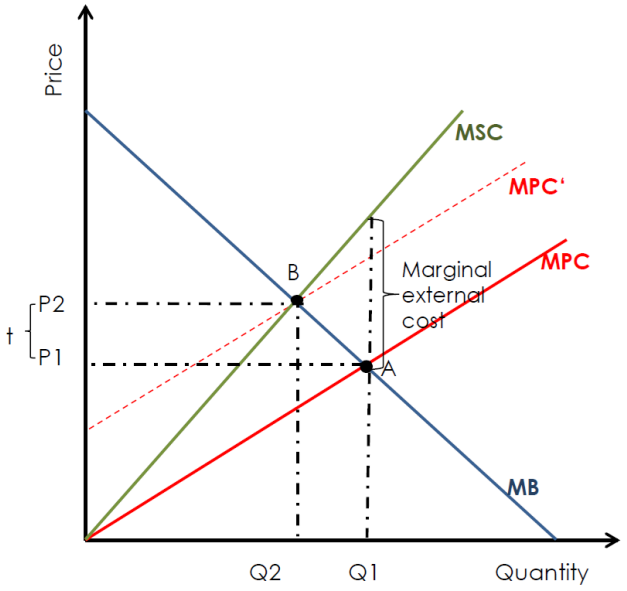
[12] Pigou, A. C, 1920. *The Economics of Welfare*.

[13] Pearce, D., 2003. *The social cost of carbon and its policy implications*. Oxf. Rev. Econ. Policy 19 (3), 362-384;

Pigou, A. C, 1920. *The Economics of Welfare*; Kettner-Marx, C., Kletzan-Slamanig, D., 2018, *Carbon Taxes from an Economic Perspective*, WIFO Working Paper 554/2018.

[14] See chapter 2.

**Figure 1. Pigouvian Taxation**




Source: Kettner-Marx/Kletzan-Slamanig 2018

The graph illustrates the working of a Pigouvian Tax. The horizontal axes represent the amount of output produced by the polluting factor. The vertical axis represents the market price. The marginal benefit curve (MB) measures the marginal benefit (benefit from the production of each additional unit) which arises for society for each level of production. The marginal private cost (MPC) represents the marginal costs (costs of each additional unit) which can be attributed to the producer. Finally, the marginal social costs (MSC) measures the marginal costs (costs of each additional unit) for the society. The MSC are composed of the MPC and the costs of the externality. Point A represents the market equilibrium with the quantity Q1 and the price P1 which arises without any market intervention. However, point A is not optimal for society as its costs are not covered completely at the level of the producer. As a result, the costs exceed the social benefit. In order to correct market failure, a tax (t) at the level of the marginal external cost could be introduced. Thereby, the MPC will be shifted to the MSC at point B, which represents the social optimum. At this level, production is reduced to Q2 at the new price P2. At point B, the MSC equals the value of the MB[15].

9. Although the Pigouvian tax makes sense from an economic perspective, the implementation of pure Pigouvian tax face limitations in reality. Ideally, the tax rate of a Pigouvian Tax exactly represents the external cost. However, it is important to mention that carbon tax rates do not necessarily have to correspond to the external costs in order to trigger an ecological steering effect. But the valuation of the externalities is a difficult task. This is because complex economic models are necessary to determine the social cost of carbon[16]. One difficulty in calculating the exact social costs of carbon is the

[15] Kettner-Marx, C., Kletzan-Slamanig, D., 2018, *Carbon Taxes from an Economic Perspective*, WIFO Working Paper 554/2018, p. 2.

[16] Hope, C.W., 2006. *The marginal impact of CO2 from PAGE2002: an integrated assessment model incorporating the IPCC's five reasons for concern. Integr. Assess*. J. 6 (1), 19-56; Nordhaus, W., Boyer, J., 2000. *Warming the World: Economic Models of Global Warming*. MIT press, Cambridge, MA; Nordhaus, W., Yang, Z., 1996. *A regional dynamic general-equilibrium model of alternative climate-change strategies*. Am. Econ. Rev. 86, 741-765; Isacs, L., Finnveden, G., Dahllöf, L., Håkansson, C., Petersson, L., Steen, B., Swanström, L., Wikström A., 2016. *Choosing a Monetary Value of Greenhouse Gases in Assessment Tools: A Comprehensive Review*. Journal of Cleaner Production 127: 37–48.

necessity to combine the work of climate scientist and economists. Various assumptions and forecasts must be made to calculate the costs of climate change. These might include damages, which are directly related to climate change, as well as other costs, such as adaption and mitigation costs resulting from it. Moreover, assumptions regarding adaption and technological change and the choice of the discount rate[17] also, have a significant impact on the calculation. Thus, even the most complex model is not capable to fully reflect reality and is subject to uncertainty.

10. Although the practical implementation of the Pigouvian tax seems hardly achievable, the theory can play a crucial role when developing a practical solution, which may help to internalise the external costs. The core statement of the Pigouvian tax is that emitters of CO2 should contribute to cover the cost of the damage resulting from their action. The internalization of the costs of climate change is undoubtedly a promising measure for climate change mitigation. Accordingly, the ideas of the Pigouvian taxation can help policymakers to set an environmental effective carbon tax rate.

**Box 10: Carbon Taxes and the Nobel Prize**

William D. Nordhaus was one of the first economists who combined economic and climate-related models. Thereby, he created an Integrated Assessment Model, which describes the interplay between the economy and climate. Nordhaus supports the idea of implementing carbon taxes. His research has shown that carbon pricing via emission trading schemes or carbon taxes is an efficient way of lowering $CO_2$ emissions. In 2018, Nordhaus received the Nobel Prize in Economics. The Nobel committee recognized with the award the economics of climate change, which underlines the relevance of a carbon tax[18].

Nordhaus' model is often used to simulate how the economy responds to climate change. Moreover, his Integrated Assessment Model can also be used to calculate the cost of climate change. This data can help to define the tax rate of a carbon tax. In addition, the model provides a methodological framework to examine the consequences of various climate change policies, like carbon taxes. The practical relevance of the model was demonstrated through the application by the IPCC, who referred to the work of Nordhaus when calculating the costs of climate change[19].

### 3.2. Standards and Price Approach – to reach a specific carbon reduction target

11. In practice, several practical approaches can be used to set a carbon tax rate. Thereby, it is possible to set the tax rate without an underlying economic theory. A more practical approach would be to set the tax rate corresponding to a specific carbon reduction target through the Standards and Price

[17] The discount rate refers to the rate that future costs and benefits are discounted relative to current costs.

[18] For further reading on the contribution of William Nordhaus, see http://www.nobelprize.org/uploads/2018/10/advanced-economicsciencesprize2018.pdf.

[19] *IPCC, Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development in Special Report: Global Warming of 1.5 ºC above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* IPCC (2018), p. 150.

Approach (also known in literature as *Baumol/Oates* approach)[20]. Therefore, the focus of the Standard and Price Approach is not the determination of the correct social cost of CO2. The primary objective is rather the determination of a carbon tax rate, which helps to reach a specific emission reduction target. Using the Standards and Price Approach, inaccuracies in the economic determination of the carbon tax rate can be overcome. The basic idea is to set the carbon tax rate at a level that is expected to be necessary, in order to reach a specific emission reduction target.

12. In the first step an emission reduction target (Standard) is set. After this target is set, a tax (Price) will be implemented in order to reach the goal. The tax rate will then be adjusted according to a "trial and error" policy in order to reach the set standard. Following the iterative approach of the Standard and Price Approach helps to reach specific emission reduction targets since the price signal is getting more and more accurate. Thereby, the initial carbon tax rate could be set by any economic model or on a technology-based approach (e.g. Marginal Abatement Costs Curves (MACC))[21]. The main advantage of this method, compared to the Pigouvian Taxation, is that it is not necessary to find the economic optimal tax rate, as the emission reduction goal will be reached following a dynamic tax rate trajectory. However, the disadvantage of the Standard and Price Approach is that there needs to be a strong political commitment to follow this strategy over several years, because regular tax rate adjustments are crucial for the Standard and Price Approach. Those adjustments must be solely based on environmental, rather than on political considerations.

13. This approach is especially feasible if the primary purpose of a carbon tax is to meet a specific emission reduction target. Emission targets could be set in national law or as a political commitment. Moreover, an emission reduction target can be based on the nationally determined contributions under the Paris Agreement and the United Nations Framework Convention on Climate Change.

**Box 11: Standards and Price Approach in practice**

A Standard and Price Tax on waste helped Denmark to achieve a solid waste reduction of 26 % between 1987 and 1998. The tax was levied per ton of solid waste, which was produced, for example, from the industry or construction activities. The purpose of the tax was merely to affect the behaviour. The tax was introduced to support a national plan to increase the recycling rate to 54 % in 1996. The Danish authorities did not attempt to evaluate the externalities associated with waste treatment. This means that no economic model served as a basis for the tax rate. Tax rate adjustments helped to reach the targeted standard. The tax rate gradually increased from DKr 40 / ton to DKr 375 / ton in 2000. Therefore, the tax can be seen as a tax that followed the principles of the Standards and Price Approach[22].

[20] Baumol, W.J., Oates, W.E., 1971, *The use of Standards and Prices for Protection of the Environment*, The Scandinavian Journal of Economics 31, 42-54; Walker, M., Storey, D.J., 1977, *The "Standards and Price" Approach to Pollution Control: Problems of Interaction*, The Scandinavian Journal of Economics 37, 99-109.

[21] Vogt-Schilb, A., Hallegatte, S., 2014 *Marginal abatement cost curves and the optimal timing of mitigation measures*, Energy Policy 66, 645-653.

[22] Andersen, M. & Dengsøe, N., 2002, *A Baumol–Oates approach to solid waste taxation*, Journal of Material Cycles and Waste Management 4: 23.

### 3.3. Revenue Target Approach

14. Different policy objectives may encourage jurisdictions to implement carbon taxes. Besides environmental considerations, one of the main motives for some jurisdictions to implement carbon taxes is to generate considerable tax revenues[23]. In 2018, the total value of all carbon taxes and emission trading schemes which are in force in jurisdictions worldwide was US $ 44 billion, which is an increase of nearly US $ 11 billion[24]. Therefore, carbon taxes contribute to the budget in general or to reduce unwanted distributional effects of the carbon tax itself (see chapter 6 on revenue use).

**Box 12: Tax revenue - a driver for the implementation of a carbon tax**

Although Chile has no earmarking of tax revenues, the possibility of using revenues to desirable purposes was of interest when implementing the carbon tax within the framework of a broader fiscal reform in Chile. The fiscal reform modified the income tax system considerably and implemented a carbon tax. The fiscal reform was estimated to collect US $ 8.3 billion in total. The government experts calculated in advance that the carbon tax will generate a tax revenue of US $ 168 million. However, the government did not define a specific revenue target in advance, which had to be met with the carbon tax[25].

15. Moreover, it is possible that jurisdictions set the tax rate in a way that maximises their tax revenue or that generates a specific level of revenue. Therefore, jurisdictions could try to adjust the tax rate of a carbon tax to reach a targeted tax revenue. For example, a jurisdiction may decide in advance to reach a specific tax revenue with the carbon tax. This decision has a strong impact on the tax, because the choice of the tax rate has a direct impact on the tax revenue. Thereby, the tax rate can be set within the dedicated market forces (supply and demand). In order to actively shape and influence the tax revenue, the revenue target approach also requires a lot of economic data to be available in order to reach a specific revenue target (see Box 13, Price Elasticities)[26]. This is because the level of tax revenue generated from a specific tax rate depends on the demand and supply curve of carbon-intense products.

**Box 13: Price Elasticities**

To follow the revenue target approach, it is crucial for policymakers to know the price elasticity for products that are subject to the carbon tax. In economics, the own-price elasticity measures the responsiveness of the demand for a good or service after a change in its price. Studies have shown that the price elasticity of fuels is relatively inelastic in the short-term. This means that the demand responds disproportionately low to changes in the price. This is partly due to the fact that emitters

[23] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 93.

[24] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO, p. 6.

[25] 4echile.cl, 1 Strategy – Chile´s Green Tax, available unter: https://www.4echile.cl/4echile/wp-content/uploads/2018/05/1.-Strategy.-Chile´s-Green-Tax.pdf

[26] Abenezer Zeleke, A., 2016., G*asoline and diesel demand elasticities: A consistent estimate across the EU-28*, Swedish University of Agricultural Sciences, Working Paper 11/2016.

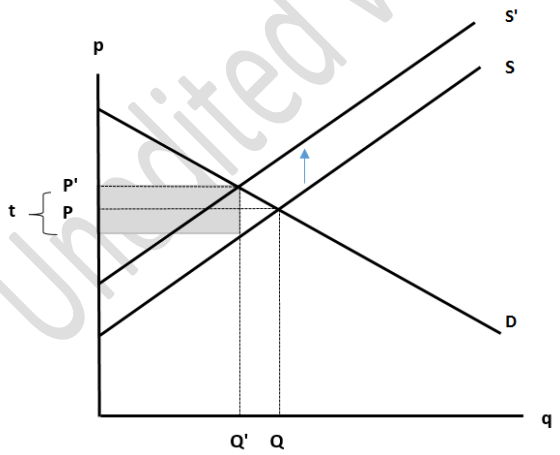
can hardly change their habits in the short term. However, in the long-term, studies have shown that the elasticity is higher, which means that the demand responds to price changes[27].

16. Economists need this data to calculate and estimate a tax rate, which generates a targeted level of revenue. Carbon taxes can be a stable source of revenue over the usual planning horizons of fiscal policy[28]. Although carbon taxes are primarily intended for climate reasons, carbon taxes can generate a considerable amount of tax revenue. However, once the CO2 emissions decreases the tax base of a carbon tax may be eroding. Therefore, a targeted tax revenue cannot be maintained over time. Moreover, the revenue target approach could be seen in a critical light from an environmental point of view. According to economic theory, the primary aim of carbon taxes is to internalise external costs and not to raise the tax revenue for the government. Hence, the generation of specific revenue targets through carbon taxes could thus contradict environmental objectives in the long term.

**Box 14: Revenue target approach**

The revenue target approach is based on microeconomic theory. The graph below illustrates the supply (S) and demand (D) curves. In the initial scenario, market equilibrium emerges at the intersection of both curves. At this point, the market produces the quantity Q at a price of P. However, the market equilibrium changes after the implementation of a tax (t). The supply curve is shifting because of the increasing cost of production. As a result, a new equilibrium will be reached at the intersection of S' and Q'. The tax revenue is calculated by multiplying the new quantity Q' by the tax rate t. In practice, setting the carbon tax rate through the revenue target approach is a tricky task, as the tax revenue depends on many factors which need to be considered. Examples are price elasticity, market power and economic situation.

**Figure 2 Price Elasticities**




Source: Partnership for Market Readiness. 2017. Carbon Tax Guide

[27] Abenezer Zeleke, A., 2016., G*asoline and diesel demand elasticities: A consistent estimate across the EU-28*, Swedish University of Agricultural Sciences, Working Paper 11/2016.

[28] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 120.

## 3.4. Benchmarking Approach

### 3.4.1. Benchmarking comparison with carbon tax rates

17. Overall, around 30 jurisdictions around the globe impose taxes on carbon in 2019[29]. Jurisdictions which have already implemented a carbon tax could to some extent serve as examples for policy makers to study when setting a tax rate for carbon. The OECD and the World Bank publish carbon tax rates and trends of carbon pricing from several jurisdictions on a regular basis[30].

18. The table below illustrates a selection of current carbon tax rates, ranging from US $ 2.65/ t $CO_2e$ (Japan) to around US $ 121.29 / t$CO_2e$ (Sweden). The wide spectrum of tax rates is an indicator that different policy strategies are followed by carbon taxes[31].

| Jurisdiction Covered | Nominal tax rate in November 2019 US $ / t$CO_2$ |
|---|---|
| **Argentina** | 6.24 (most liquid fuels) |
| **British Columbia** | 30.26 |
| **Chile** | 5 |
| **Colombia** | 4.99 |
| **Denmark** | 25.91 (fossil fuel) |
| **Finland** | 68.43 (transport fuel) |
| **France** | 49.23 |
| **Japan** | 2.65 |
| **Mexico** | 3 (Upper) |
| **Norway** | 57.14 (Upper) |
| **Singapore** | 3.63 |
| **South Africa** | 8.29 |
| **Sweden** | 121.29 |
| **Switzerland** | 96.57 |

**Table 5: Selection of nominal carbon tax rates in November 2019**

[29] See chapter 2.

[30] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO; OECD, 2018. *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading*.

[31] See chapter 2.

Source: Data based on Carbon Pricing Dashboard, The World Bank available at https://carbonpricingdashboard.worldbank.org/map_data.

19. The benchmarking approach relies on an analysis of the tax rates as well as the tax design of other jurisdictions. It is important to mention that the implemented taxes differ from each other. For example, they are levied on different levels of the production chain, some of them include exemptions for certain industries, while others have not implemented any exemptions. Furthermore, carbon taxes differ regarding the scope of the taxes as some carbon taxes might have a limited coverage while other taxes have a broad coverage. In addition to that, some carbon taxes are levied on certain transactions while others are directly related to emissions. Moreover, as jurisdictions have different framework conditions, policymakers should consider which jurisdictions are in a comparable situation when designing their tax rates. Regarding the selection of comparable jurisdictions, the following factors may be taken into account[32]:

- policy objective
- similar economies/politics
- demographic factors
- energy production
- geographic distribution
- potential for coordination
- tax system

20. The list only shows some examples and ideas, which factors may be relevant in order to identify jurisdictions that are appropriate for benchmarking. It is also important to consider current trends and international developments of carbon taxes in a benchmarking analysis. This could help policymakers to connect international developments with discussion on a national level.

21. Another important factor to consider is the carbon tax level of key trading partners and competing jurisdictions. Policymakers may be concerned about introducing carbon taxes, which are high compared to taxes applied in those jurisdictions, where the key trading partners operate. The benchmark approach also takes into account the tax rate level of competing jurisdictions in order to reduce the risk of carbon leakage. Political concerns regarding carbon leakage and competitiveness are in practice key factors for setting the tax rate.

22. While it can be useful for policymakers to be informed about existing carbon tax rates in other jurisdictions, it should at the same time be noted that current carbon tax rates in most cases are

[32] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

significantly lower than the tax rates required to achieve the Paris temperature target. For instance, the High-Level-Commission on Carbon Prices, as mentioned earlier, proposed on the basis of policy experience, and relevant literature, a carbon price level of US $ 40–80 / $tCO_2$ by 2020 and US $ 50–100 / $tCO_2$ by 2030[33]. Currently, only the tax rates in six countries (Finland, France, Liechtenstein, Norway, Sweden and Switzerland) are higher than US $ 40 / $tCO_2$. In other words, most jurisdictions which have implemented a carbon tax are facing a gap in order to reach the Paris goals. From an environmental perspective, it is therefore questionable if the current carbon tax rates are appropriate for a benchmarking analysis.

23. At the same time, studies from the OECD have shown that taxes on fossil fuel products have been rising over the past years in many jurisdictions. For example, Alberta, British Columbia, in Canada, Finland, France, Iceland and Switzerland have increased – some of them significantly – their carbon tax rates in 2018. This recent development could encourage the implementation of a more ambitious carbon tax rate.

**Box 15: Examples of carbon tax rate changes made in 2018 and 2019:**

- British Columbia's carbon tax increased from CAN$ 30 / $tCO_2$ (US $ 23 /tCO2) to CAN$ 35 / $tCO_2$ (US $ 26 /tCO2) in 2018. The government in British Colombia announced that it will continue to increase the tax rate annually by CAN $ 5 / tCO2e until the rate is CAN § 50 / tCO2 (US $ 38 /tCO2) in 2021;
- Iceland carbon tax increased by 10 percent to approximately ISK 3850 / tCO2 (US$ 36 /tCO2) on January 1, 2019;
- The Portugal carbon tax rate almost doubled from € 6.85 /tCO2 (US $ 8 /tCO2) to € 12.74 / tCO2e (US $ 14 /tCO2) on January 1, 2019.
- Switzerland's carbon tax increased from CHF 84 / tCO2 (US $ 85 /tCO2)to CHF 96 / tCO2 (US$ 97 /tCO2);

Source: The World Bank, 2018. State and Trends of Carbon Pricing 2018 and The World Bank, 2019. State and Trends of Carbon Pricing 2019.

### 3.4.2. Benchmarking comparison with other market-based instruments

24. The benchmarking analysis does not have to be limited to the comparison of carbon tax rates exclusively. Including other market-instruments in the analysis can provide important context considering that such instruments indeed also can contribute to the aggregated price signal on carbon in a given jurisdiction. In this respect specific taxes on fuel (excises tax) can also be relevant to consider in a benchmarking analysis, as well as prices observed in emissions trading systems[34].

[33] High-Level Commission on Carbon Prices. 2017. *Report of the High-Level Commission on Carbon Prices. Washington, DC: World Bank.*

[34] OECD, 2018. *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading.*

25. Although they do not explicitly price carbon, special taxes on fuels can in many ways show close resemblance to carbon taxes. Adding specific taxes on fuels to the benchmark analysis requires some precision however as tax rates on various fuels as well as for various users may differ strongly within a given jurisdiction. Consequently, it is not always clear which concrete tax rate should be used for benchmarking, e.g. the tax rate for diesel, petrol, coal? This is especially difficult when doing benchmarking analyses for carbon taxes as the basic idea of carbon taxes is to apply a uniform tax rate for carbon, which does not depend on fuel types. Another additional context for benchmarking analyses may also be provided from carbon prices which are observed in emission trading schemes. For example, Portugal and Iceland use the allowance prices within the EU Emission Trading Scheme as one factor, which is used to set the carbon tax rate[35].

26. It is also possible to use a measure of the aggregate effective carbon price signal in the benchmark analysis. So called *effective carbon rates* – consisting of carbon taxes, excise taxes on fuels and prices of tradable emission permits – are calculated by the OECD for a large number of countries[36].

**Box 16: OECD Effective Carbon Rates**

The OECD publishes the effective carbon rates for 42 OECD and G20 countries, on a regular basis[37]. In its report, the OECD measures the carbon pricing gap, which represents the difference between actual effective carbon rates and a benchmark rate. Today, the benchmark is EUR 30 and it is estimated to increase to a midpoint of EUR 60 in 2020. EUR 60 also serves as a low-end estimation for 2030. The carbon pricing gap indicates to which extent the benchmark is not reached. A small gap is an indicator that the effective carbon tax rate is close to the benchmark.

According to the OECD, carbon prices are too low to slow climate change to the degree countries have pledged. In 2018 the effective carbon tax rates in all 42 jurisdictions are priced 76.5 % below even the lowest benchmark of EUR 30. Therefore, most jurisdictions do not reach even the lowest estimated costs of society. However, the carbon pricing gap has improved from 83 % in 2012. But 46 % of the emissions are still not taxed at all. The OECD concluded, that more needs to be done to steer economies along a decarbonized growth path. It is important to notice that in the OECD report, also emissions from biomass are included when effective carbon rates are calculated. For countries with large shares of energy from biomass, the effective carbon rates for fossil energy may be higher than the OECD estimates indicate.

## 4. Temporal Development of the Tax Rate

[35] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

[36] OECD, 2018. *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading.*

[37] OECD, 2018. *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading.*

### 4.1. The role of politics

27. We have in this chapter discussed various approaches for setting a carbon tax rate. Those approaches can help jurisdictions to create a policy strategy. Thereby, this will include the involvement of political compromise. However, economic theories and various approaches will play an important role in the political process. Even more important is the strategy that was agreed upon. Thereby, the broadest political consensus should be found in order to avoid that the tax rate does not become subject of short-term political considerations.

28. A long-term implementation is crucial for the effectiveness of a carbon tax, since only with a long-term strategy planning security for investors can be ensured. This is because investors and actors must rely on the political commitment to support the green development for the next 10 to 50 years.

### 4.2. Tax Rate trajectory

29. It is important for policymakers to consider the temporal dynamics of the tax rate during the introduction phase of a carbon tax[38]. There are different policy strategies behind imposing a carbon tax rate and its modification in the first periods: One strategy is to introduce an initial tax rate, which remains on the same level for the next periods ("static carbon tax rate"). Another strategy is to adjust the tax rate over time to soften the impacts of the sudden implication of a carbon tax. This is the strategy that has been most often applied by the jurisdictions leading the application of carbon taxes worldwide. To do so, policymakers may decide to apply a lower tax rate in its initial year ("ramp up introduction")[39]. If a jurisdiction has decided to apply a slow ramp up strategy the tax rate would be gradually increased until the tax rate has reached the desired level. Under the ramp up strategy, it is easier to adjust and anticipate carbon taxes. The economy would have more time to invest in alternative and environmentally friendly technologies and would not face major economic shocks.

30. For example, British Columbia, Canada followed a ramp up strategy. British Columbia introduced a carbon tax at a rate of CAD $ 10 / tCO2 in July 2008. The province then gradually increased the tax rate within the next four years per CAD $ 5 each year, reaching its target level at CAD $ 30 in 2012. Further, the British Columbia carbon tax increased to CAD $ 35/tCO2 on April 1, 2018 and increases by $ 5/tCO2 on every April 1 until hitting CAD $ 50/tCO2 on April 1, 2021[40]. A similar approach was taken by France, which introduced a carbon tax in 2015. The legislator set the rising tax rate for each year up to 2021 when it is planned to reach € 56 / t CO2. The French legislator also laid down the goal for the tax rate to reach € 100 in 2030 without defining the actual tax rates between 2021

[38] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

[39] Institute for European Environmental Policy (IEEP). 2013. *Evaluation of Environmental Tax Reforms: International Experiences*, p. 58.

[40] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO, p. 32.

and 2029 from the outset. However, in response to major national protests the trajectory was temporarily stopped in 2018, to give the authorities time to further consider the coordination between the carbon tax policy and other measures. Singapore has also implemented a carbon tax with an initial tax rate of S $ 5 /tCO2 in 2019. The intention of Singapore is to increase the tax rate gradually to S $ 10 to 15 / tCO2 in 2030[41].

31. It is not necessary to define the exact trajectory to a specific tax level. However, it is from an environmental point of view important to define the future targeted tax level when introducing a carbon tax. Only then, emitters will respond to the future carbon price from the beginning of the implementation of the carbon tax. A gradual increase of the carbon tax rate seems politically desirable, as it is easier to gain political support for a gradual implementation. Moreover, it also gives investors and business operators time to phase-out carbon intense facilities. Nevertheless, the ramp up strategy has also notable risks. First, the environmental effect is limited in its initial phase, due to relatively low tax rates. Second, low initial tax rates may stick due to political considerations.

32. The alternative would be to follow a strategy with a static carbon tax rate, which means that the carbon tax rate stays the same after its introduction. Such an approach has the advantages of giving the market a stable and predictable price signal. However, in order to be effective from an environmental point of view, the tax rate would need to be set at a sufficiently high level, which can trigger sudden increases in prices after the implementation of a carbon tax. The consequence could be an economic shock in carbon-intense industries. Emitters would also have less time to adjust their behaviour to avoid negative consequences. Also, a static carbon tax rate at a high level is likely to face more political opposition than a ramp up strategy by those who are affected by the tax. If a static approach with a high tax rate is chosen upon implementation it would need be to be part of a comprehensive reform package including certain compensatory measures for vulnerable groups of society[42].

### 4.3. Regular adjustments of the Tax Rate

33. Setting the rate of a carbon tax is not a one-time task in the initial phase. It is an ongoing process which requires constant adjustments. This is because setting a carbon tax rate is always subject to uncertainties, since the exact impact of the tax is not predictable in advance. Therefore, it is crucial to change and evaluate carbon tax rates over time. Thus, tax rate adjustments in consequence of a dynamic tax rate trajectory policy are crucial for policymakers. Moreover, new available scientific data and information could help to re-shape the tax rate in order to reach a specific goal with a carbon tax. For example, the underlying assumptions or economic models, which have served as a basis for modelling the carbon tax could be outdated because of new scientific results. From an environmental

[41] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO, p. 41.

[42] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 95.

point of view, it is essential to adjust the tax rates over time. Economic developments (e.g. inflation[43]) or recent international developments on carbon taxes may change basic assumptions, which were made in the past (see Box 17). Furthermore, changes in a jurisdiction's climate mitigation target or a change in public support may occur[44].

**Box 17: Tax Rate and Inflation**

Even if the tax rates remain constant, jurisdictions may decide to index the carbon tax rate to inflation to ensure a stable environmental effect. This is because of inflation, which could lead to the situation that a constant tax rate weakens over time. Therefore, for example, the Chile, Colombia, Denmark, Mexico, Netherlands and Sweden, have indexed their carbon and energy taxes to inflation in order to maintain the price signal of their tax rates.

The effect of not indexing the tax rate according to inflation can be verified under the Argentine example. As previously denoted, Argentina currently applies a carbon tax that is valued at US $ 6.25 t/$CO_2$e. Worthy to note is the fact that the Argentine carbon tax was originally priced at US $10 t/$CO_2$e in 2018. However, due to a massive currency devaluation of the Argentinian peso against the American dollar through the fiscal year of 2018, the effective carbon price was reduced to US $ 6.25 t/CO2e. It is still the highest price for the region, but it has the potential to be devalued even further considering the law does not foresee annual carbon price adjustments according to inflation[45].

34. Therefore, policymakers may decide to implement predetermined adjustments formulas within the law[46]. The law could include specific criteria or scenarios which could trigger changes in the tax rate. One example could be that the tax rate automatically increases if specific reduction targets are not meet. Moreover, economic factors like GDP growth or exchange rates developments could be used as triggering factors. Switzerland has implemented reduction targets in its national carbon tax. The tax rate is raised by a predetermined formula in advance[47]. The exact predomination of the adjustment formula is crucial to avoid another legislative procedure by the parliament. In the case of Portugal, the national carbon tax has incorporated an annual adjustment, which is dependent on economic criteria. However, predetermined adjustment formulas may raise constitutional and political concerns in some jurisdictions.

35. Furthermore, policymakers may decide to periodically review the carbon tax rate for example via a special committee. Thereby, experts may report the impacts of the carbon tax within the past periods on an annual basis. Past experiences and available information about future developments allow those expert committees to draft concrete proposals for tax rate changes. The composition of the panels may differ in each jurisdiction. Those committees may only be composed of experts or of various

[43] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO, p. 21.

[44] See para 66 in chapter 2.

[45] World Bank Group. 2019. *State and Trends of Carbon Pricing 2019*. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/31755 License: CC BY 3.0 IGO, p. 29.

[46] See para 66 in chapter 2.

[47] See Article 10 *Verordnung über die Reduktion der CO2-Emissionen (CO2-Verordnung)* vom 30.12.2012 (Stand 19.02.2019), AS 2012 7005.

stakeholders, which are involved. Reviewing the carbon tax rate can also be part of the general political considerations normally taking place within Government Offices. For example, Norway is reviewing its carbon tax rate on a yearly basis, as the Norwegian tax law constitutionally is presented as part of the annual national budget. During this process, the Norwegian carbon tax rate has been increased over the last years[48]. Also, Ireland reviews the status of their national carbon tax rate on a yearly basis. Thereby, Ireland reviews the performance of the tax and may consider international trends of carbon pricing[49]. One advantage of reviewing processes is that it provides for more flexibility compared to a strict adjustment formula. However, any review of tax rates involves a political decision-making process and the amount of input from external experts and stakeholders in that process no doubt varies greatly between jurisdictions.

### 4.4. Setting Tax Rates under challenging circumstances

36. Special consideration may occur when setting a carbon tax rate for a specific country because it may not be in a comparable situation with other countries that have implemented a carbon tax. For example, some countries may face the challenges of a weak economic performance and a low Human Development Index, which are factors that merit special considerations when designing a carbon tax. Choosing a tax design which is easy to administer would thus often be a key issue for countries in such circumstances. Economic growth and development are essential to fight widespread poverty. Therefore, concerns might exist that high carbon taxes could slow down future economic development which might hamper access to basic services and infrastructure. However, it can also be argued that tax increases, help countries to strengthen their social and educational systems, which could help to reach a higher growth path. Additionally, resource-rich countries may feel dependent on carbon-intense industries like, coal, oil, cement, steel and aluminium. Therefore, they might be concerned that climate protection counters their economic growth and development. In practice, all countries have special economic and demographic characteristics, which need to be considered when setting a tax carbon tax rate.

37. However, carbon taxes may be essential not only for protecting the environment but also for enhancing development[50]: The revenues from a carbon tax mobilizes domestic revenues, which can support poverty reduction to develop infrastructure in an environmentally friendly way[51]. Carbon taxes can also stimulate development of the energy sector and innovation, which could create economic

[48] Partnership for Market Readiness. 2017. *Carbon Tax Guide: A Handbook for Policy Makers*, World Bank, p. 97.

[49] Report of the Joint Committee on Climate Action. 2019. *Climate Change: A Cross-Party Consensus for Action.*

[50] See chapter 2.

[51] High-Level Commission on Carbon Prices. 2017. *Report of the High-Level Commission on Carbon Prices*. Washington, DC: World Bank, p. 18.

opportunities for countries with a variety of different backgrounds. For example, Singapore mentioned the stimulation of low-carbon innovation as an additional objective of its carbon tax.

38. Another example can be given from the Colombian context. The Colombian government implemented a carbon tax on all liquid and gaseous fossil fuels used for combustion as part of a broad tax reform package in 2017. The carbon tax can help Colombia to steer its economy towards a lower-carbon development path. Colombia also uses the tax revenue of the carbon tax to finance for example investments in low carbon projects, adaptation and technological innovation. The initial tax rate of the Colombian carbon tax was determined with US $ 5. The tax is set to increase annually by 1 point plus inflation until the tax rate reaches US $ 10. In its initial year, the Colombian carbon tax generated tax revenue of nearly US $ 250 million, which was more than initially expected. Analyses by the Colombian government has shown that the carbon tax is not regressive in Colombia, which means that households with higher income are more affected by the tax.

39. Trade-offs between economic development and emission reduction may exist in some countries. Examples would be countries, which are strongly dependent on carbon-based energy resources and on energy imports[52]. In such cases, the imperative of development and poverty reduction may justify lower carbon tax rates in the short time. Lower tax rates could help to support a smooth transition from a carbon-based economy to a low carbon economy. Moreover, lower carbon tax rates may also be justified in countries with lower purchasing power. A lower purchasing power would lead to the situation that a given tax rate, which is derived from the tax rate of a rich country would be more burdensome for least developed countries. Therefore, carbon tax rates, which are applied in countries with strong economic performance, may not be suitable or overshooting for countries with challenging economic performance. Moreover, empirical studies have shown that the price elasticity of fuel products in poor countries is higher than in rich countries, which means that the demand for fuel products reacts stronger on price changes. Therefore, lower carbon tax rates may be justified by the specific economic situation in countries where the impact of a price change in fuel prices is higher.

40. Summing up, various factors support the idea of lower carbon tax rates under some circumstances and in some countries. However, this conclusion does not mean that some countries should not implement carbon taxes. Well-designed carbon taxes can play a major role in a sustainable development in all countries. Carbon taxes are promising tools in achieving the UN Sustainable Developments goals by 2030.

[52] High-Level Commission on Carbon Prices. 2017. *Report of the High-Level Commission on Carbon Prices*. Washington, DC: World Bank, p. 19.

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# Chapter 4C: Addressing undesired effects for households and firms

## 1. Check-list for addressing undesired effects for households and firms

- Policy makers should first carefully assess the risks of competitive effects and carbon leakage as well as undesired distributional effects in the particular jurisdiction.
    - Energy-intensive and trade-exposed firms are more likely to suffer from adverse competitiveness effects than others.
    - Energy intensive and trade-exposed firms in general also face the largest risk of carbon leakage.
    - Distributional effects often depend on household income, but there can be considerable heterogeneity within income groups which also may need to be considered.
- Next, appropriate measures to mitigate impacts can be chosen, for instance:
    - Measures that reduce carbon tax payments (exemptions, reduced rates, tiered systems, thresholds etc.).
    - Support measures to alleviate negative effects (support programs, flat payments, reductions of other taxes than the carbon tax, wider economic policy reforms etc).
    - International coordination and cooperation.
- While designing measures to address undesired effects of a carbon tax, policy makers should seek to:
    - Avoid undue administrative complexity.
    - Preserve the environmental integrity of the tax.
    - Be attentive to the perception of fairness of the tax among both different social groups as well as sectors.
- Regularly assess implemented measures to ensure that they remain relevant and appropriate

## 2. Introduction

1. The economic purpose of a carbon tax is based on the conception that emitters of carbon dioxide impose costs on others, without paying for the resulting damage that occurs. A carbon tax provides a price signal that gives incentives to emission reductions. However, concerns over undesired effects on firm competitiveness and carbon leakage, together with fear of unwanted distributional impacts, can constitute significant political obstacles for the implementation of a carbon tax and therefore such concerns need to be considered in the process of designing the tax.

2. Like any policy intervention, carbon taxation can give rise to undesired side effects. While introducing a price on carbon dioxide that is emitted into the atmosphere, carbon taxes may also lead to price increases for goods and services which in turn can have negative impacts on households as well as on

firms. Policy makers may – for a wide range of reasons – want to avoid, or at least mitigate, as much of these negative impacts as possible. Addressing concerns over e.g. distributional effects, social equity and fairness, employment and firm competitiveness is also important for getting public acceptance for a carbon tax and can make implementing the tax easier. In addition, paying attention to possible adverse side effects can help safeguard the environmental integrity of the carbon tax as some of the measures available for policy makers to protect domestic firm competitiveness may serve as a means to avoid carbon leakage.

3. In this chapter we will discuss some of the issues jurisdictions may want to consider when trying to mitigate possible negative side effects of a carbon tax. An account is given for the concerns generally raised, including brief accounts of the current knowledge of the actual occurrence and size of negative effects on households and firms. Next, the chapter presents an overview of possible measures different jurisdictions have undertaken to address undesired impacts of a carbon tax. Finally, examples of how jurisdictions have introduced a carbon tax using two-level tax system and thresholds are given.

## 3. Possible adverse effects from carbon taxation

### 3.1. Concerns over negative impacts on households

4. Introducing a carbon tax will most likely have implications, both direct and indirect, for households in the jurisdiction. The impact of the tax on households is also often at the center of the public debate when carbon taxes are on the agenda. Such discussions are important and can provide valuable input to the design of the tax or give insights to the need for policies complementing the tax and the possible design of such measures.

5. Moreover, fear of negative effects for households and individuals can take the form of public protests. The French nation-wide demonstrations organized by the “Gillets Jaunes” movement expressed dissatisfaction over a range of economic policies was indeed sparked in late 2018, among other things, by concerns for the effect of increasing carbon taxation on fuel prices and how this would affect households that are dependent on their cars in daily life.

6. It is clear that concerns over e.g. distributional impacts, social justice and equity implications of a carbon tax in many cases are not only legitimate and important to address as such, but also require the attention of policy makers in order to secure the success of the tax. It is also important to take into consideration the wider policy context of those affected or the public may find it difficult to accept the carbon tax. It is for instance advisable to evaluate other economic policies in conjunction with implementing or making changes to the tax.

7. The most common way to measure distributional effects is to study the impact on different income groups. The empirical literature has predominately investigated distributional effects from general excise duties on energy sources, rather than from carbon taxation specifically. However, the impacts on households from general excise duty taxation and carbon taxation are likely to be very similar, which means that the conclusions drawn from studies on distributional impact from the former are all in essence transferrable to the latter.

8. Conventional wisdom regarding the distributional effects of taxation of energy sources has been that it is regressive, i.e. that such taxes affect households with lower income more than those with higher income. As the knowledge-base has grown this has changed and today a somewhat different picture has emerged. The evidence now shows that taxes on energy no longer can be viewed as universally regressive, but instead that the tax incidence, or the ultimate distribution of the burdens of the taxation, depends on a variety of factors. These factors include, among other things, the type of energy commodity being taxed, the social, physical and climatic characteristics of the jurisdiction, and how household income is measured[99].

9. For instance, taxation of vehicle fuels has been found to be neutral or even progressive in several middle and lower-income countries, which can be explained by the fact that motor vehicle ownership is less likely in poorer households in these countries and hence these households will to a lesser extent be directly affected by a tax on diesel or petrol. However, households may be affected by a carbon tax not only through having to pay for their own emissions (e.g. from the burning of fuels for transport or heating). In addition, they may also face increased overall costs for their consumption as taxation of emissions that arise in the production of goods and services gets passed through to consumer prices. These indirect costs to households are sometimes less tangible and hence more difficult to measure. Nevertheless, when looking at the social effects of a carbon tax, it is important to take into account both the direct and indirect effects.

10. In addition to the distributional effects and the possible regressive or progressive nature of a carbon tax in a given jurisdiction, other dimensions of the social impacts of the tax include the perception of fairness, equity social and justice in the design and implementation of the tax.

### 3.2. Concerns over adverse effects on firms

11. As shown above, a carbon tax can cause, both directly and indirectly, increased costs. For a firm operating in a jurisdiction with a carbon tax, the increased direct cost is partly due to the actual tax

[99] See e.g. Flues, F., & Thomas, A. (2015). The distributional effects of energy taxes (p. 0_1,2-3,6-74). Paris, France: Organisation for Economic Cooperation and Development (OECD)., or William A Pizer & Steven Sexton, 2019. "The Distributional Impacts of Energy Taxes," Review of Environmental Economics and Policy, vol 13(1), pages 104-123., and references therein.

expenditure that a firm has to pay as a result of its emissions, but the cost increase can also arise from the fact that a firm's other inputs become more expensive as the cost of emissions is getting passed on to the price of goods and services needed for the firm to operate.

12. Apart from the increased direct cost of emissions, goods and services, the firm may also face increased costs from its own emissions reduction measures. In the short run, measures to decrease emissions can entail e.g. fuel switching or energy efficiency improvements. There is also the possibility that some firms may choose to avoid the tax by simply reducing production. In the short run, it is likely that the range of possible mitigation options firms can choose from is somewhat limited due to capital constraints, current technologies and production processes etc.

13. In the medium to long run on the other hand, other type of mitigation efforts can be expected as firms will have had more time to raise capital, invest in R&D and adopt new technologies. More long-term investments by firms can be focused on reducing emissions within the existing production technologies and processes, or be aimed at changing entire production processes. Either way, the more profound mitigation measures a firm undertakes, the more resources are likely to have been invested and hence the larger the direct cost for the firm.

14. In addition to the direct investment cost in mitigation measures, firms may also face an indirect cost, measured as the loss in profits that follows from the fact that investment in mitigation activities crowds out productive investments in capital and innovation that the firm would otherwise have undertaken. While the opportunity cost of capital does not increase expenditure for firms like the direct costs discussed above, it can have a more long-term negative effect on e.g. future competitiveness.

15. Firms that produce a homogeneous product for an international market normally compete through the price of their goods (rather than quality) and will consequently find it difficult to pass on costs from increased taxation to its customers. Under these circumstances, an increase in production costs therefore risks leading to reduced market shares for the domestic firms. The competitiveness of such firms is, in theory, likely to be more negatively affected by a carbon tax than firms with a lower energy intensity and trade exposure. In jurisdictions where exporting firms constitute an important part of the economy, there may also be concerns over impacts on aggregated economic indicators such as total factor productivity, investments, employment and output.

16. Firms that have the ability to transfer a significant portion of its costs through their product prices without losing market shares are in general more likely to be less exposed to adverse competitiveness effects. Knowing ex-ante which firms and sectors that are most vulnerable in this respect requires a careful assessment as it depends on the particular circumstances in each specific jurisdiction. There is no

straightforward way to determine the vulnerability of a given firm or sector, but various measures of trade exposure and emission intensity are often used to identify which are likely to be negatively affected.

17. It could be noted here that having to invest in less polluting technologies sometimes is considered to have a positive effect on e.g. firm productivity, profits and competitiveness as investments will lead to enhanced resource efficiency, spur innovation and open new markets. Although there is a considerable amount of research on the topic the empirical evidence to support the existence of the so-called Porter hypothesis, according to which environmental regulation enhances innovation and competitiveness, is not conclusive. While regulation indeed seems to spur innovation, it is less clear to what extent stricter regulation also enhances business performance.[100]

18. There is an extensive economic literature trying to shed light specifically on the interaction between environmental taxes (such as carbon taxes), energy prices and trade and how these factors affect competitiveness.[101] Ex-ante studies indicate the effects can be rather large, depending on which sectors are being investigated and what method is used for the analysis. Although, when it comes to establishing theses effects ex-post, there is less evidence to support significant adverse effects from environmental taxes on firm competitiveness in general. As expected, ex-post studies do confirm that negative impacts are more likely to occur in energy intensive trade exposed sectors than others. The observed impacts have been found to be relatively small and short-term.

19. This is not to say that carbon taxes cannot have negative impacts on firm competitiveness, nor that concerns over such impacts do not need to be considered when designing and implementing the tax. But to date the evidence suggests that any such negative impacts have been limited. There are several possible explanations for this, e.g. the fact that carbon taxation only is one out of a multitude of factors that affect the choices made by firms. Careful policy design may also have prevented or mitigated possible negative impacts.

### 3.3. Concerns over carbon leakage

20. Closely related to the question of adverse competitive impacts is the notion of carbon leakage. Carbon leakage can be said to occur when the introduction of carbon pricing, through e.g. a carbon tax, in one jurisdiction results in increased emissions in another jurisdiction. While the effects of carbon taxes discussed above are manifested as increased costs for economic agents, carbon leakage is instead related to

[100] Se e.g. Ambec et al (2011) *The Porter Hypotheis at 20. Can Environmental Regulation Enhance Innovation and Competitiveness?* Review of Environmental Economics and Policy, Volume 7, Issue 1, Winter 2013, Pages 2-22

[101] See e.g. discussion in Coste et al in Pigato (ed) (2019) *Fiscal policies for development and Climat Action*. International development in focus. Washington, DC. World Bank, and references therein. Again, the literature referred to here is on environmental taxation in general rather than on carbon taxes, but as noted earlier the conclusions are in essence valid for carbon taxes as well.

the effectiveness of the tax as an instrument to reduce global carbon emissions. There are several channels through which such leakage can arise, but here the so-called competitiveness channel is the most relevant to consider.

21. As a carbon tax will increase the cost of domestic production in a given jurisdiction, foreign goods gain a competitive advantage and as a result consumption may switch towards imported goods. As production and emissions decrease domestically they are likely to increase abroad. Since the effect on climate change from carbon dioxide emitted into the atmosphere is the same regardless of where the emissions occur, the overall climate effect cannot solely be measured by the domestic emission reductions. If the domestic production is less polluting than the foreign production, the reduction in domestic emissions will be more than offset by increased emissions abroad. The opposite can of course also be true, i.e. that foreign production is in fact cleaner and hence that only some of the domestic emission reduction is offset, but this is less likely to happen as it is reasonable to assume that production will move to jurisdictions with less stringent climate policy.

22. Carbon leakage can occur in the short run as an effect of firms choosing to reduce current production volumes in existing plants. In the longer run it can also arise as investments, in anticipation of reduced profits or lower rates of return, shift away from the domestic industry and thereby also affecting future production capacity. In both cases there is a risk the overall emissions will increase. Hence, addressing concerns over potential adverse effects of a carbon tax on competitiveness may also at the same time strengthen the environmental integrity of the carbon tax.

23. The empirical literature on carbon leakage – and especially through the competitiveness channel – coincides to a large extent with the literature on trade, competitive effects and environmental taxation. The evidence for carbon leakage to date is rather weak.[102] While ex-ante studies show leakage rates varying from negligible to close to 100 per cent (depending on analytical framework and sectors studied), there is less support to be found for significant carbon leakage in ex-post evaluations. As noted above, the reasons for this may be many. One explanation can be found in the fact general excise duty taxation on energy or carbon taxation is but one out of a long list of factors that influence the decisions of firms and investors. Design features, in existing carbon taxes and other pricing mechanisms, that aim at protecting firm competitiveness and carbon leakage may certainly contribute as well. Furthermore, carbon leakage has likely also been limited by the fact that carbon taxes to date have been set at rather modest rates.

[102] References to empirical studies can be found e.g. in Coste et al in Pigato (ed) (2019).

## 4. Assessing the risk of negative effects

24. Before deciding on what measures to implement, however, the extent of possible carbon leakage, adverse competitive effects and distributional risks need to be properly assessed. Such an assessment should try to answer where in the economy (e.g. sectors or groups of actors) the risks are more pronounced, and why. Understanding the unique challenges and specific context where the carbon tax is to be introduced will enable policy makers to design appropriate measures to avoid or counter unwanted negative effects. It will also help to ensure that actors are not given unnecessary compensations. Properly assessing and communicating how the proposed carbon tax may affect different actors can also be helpful in gaining public acceptance for the tax.

25. There are many ways by which the effects of a carbon tax can be analyzed. Assessments by experts and broad public consultations can for instance be valuable sources of input to the design of the tax and help policymakers in identifying the need for complementary measures (see further chapter 7). However, economic and/or energy system models are often crucial to the analysis as modelling tools offer the possibility to explore the effects of alternative tax designs and complementary measures in more detail. There are a wide range of different modelling approaches. What kind of models to use depend to a large extent on the questions that need to be answered. Economic partial equilibrium models, for example, can help explain how a carbon tax would affect a specific industry or sector while a computable general equilibrium model can be particularly useful for estimating economy-wide effects such as the level and distribution of costs. On the other hand, the overall techno-economic potential and possible paths to reach given emission targets can be explored using energy system modelling. There are also other modelling approaches.[103]

26. As different analytical tools will provide insights from different perspectives, adopting a set of multiple approaches can be valuable. At the same time, modelling can be rather resource demanding and the lack of funding, availability of data and limited personnel skills may narrow down the number of alternatives. Regardless of the means available for the assessment, careful planning using available resources as wisely as possible will likely provide policy makers with more useful information for the

[103] For a general overview of different modelling approaches, their strengths and weaknesses see e.g. Miria A. Pigato, Editor. 2019. Fiscal Policies for Development and Climate Action. International Development in Focus. Washington, DC: World Bank and Partnership for Market Readiness (PMR) 2017. *Carbon Tax Guide: A Handbook for Policy Makers*. World Bank, Washington, DC.

design of complementary measures. To some extent international organizations may also provide some assistance in the analysis of domestic mitigation policies.[104]

## 5. Policy options to address concerns over unwanted adverse effects

27. Economic theory suggests a uniform carbon tax with a wide base in terms of its coverage to be the most efficient design. At the same time, stakeholders commonly raise concerns that additional tax burden would lead to adverse effects on the competitiveness of domestic firms – especially in energy-intensive and trade-exposed sectors – causing carbon taxes introduced in practice to deviate from a theoretically ideal carbon tax. Many jurisdictions have strived for a balance between fulfilling environmental objectives on the one hand and accounting for the risks of carbon leakage and securing the competitiveness of certain sectors being subject to international competition on the other hand. Despite that the risk of undesired effects from carbon taxes on firm competitiveness and carbon leakage in many cases are limited, such risks can constitute significant political obstacles for the implementation of a carbon tax and therefore need to be considered in the process of designing the tax. The impact of a carbon tax in different income groups and geographical regions, and how such impacts are alleviated, are other factors determining the acceptability of the tax. Consequently, each carbon tax system needs to have its unique design to address such concerns. The box below shows examples of how different jurisdictions in recent years have designed their carbon taxes with regards to coverage and various mechanisms to minimize adverse impacts[105].

**Box 18: Country examples of carbon tax designs with various degrees of exemptions**

The carbon tax in *Argentina* was adopted in 2017 as part of a comprehensive tax reform and entered into force in 2019. The tax partially replaced an already existing fuel tax. The carbon tax applies to carbon dioxide emissions from all sectors and covers almost all liquid fuels and coal, in total 20 per cent of all the Argentinean greenhouse gas emissions. The use of fossil fuels in certain sectors and/or for certain purposes is partially exempt from the carbon tax, including international aviation and international shipping, export of the fuels covered, the share of biofuels in mineral oils and raw materials in petro-chemical processes. To offset the fuel price increase by the carbon tax, the existing tax on liquid fossil fuels were adjusted at the introduction. For mineral coal, petroleum, and fuel oil, the tax rate started in 2019 at 10 per cent of the full tax rate, increasing annually by 10 per cent to reach 100 per cent in 2028.

The *Colombian* carbon tax was adopted as part of a structural tax reform and was launched in 2017. The tax applies to greenhouse gas emissions from all sectors with some minor exemptions. It covers all liquid and gaseous fossil fuels used for combustion, accounting for 24 per cent of all greenhouse

[104] E.g. the IMF has developed a spreadsheet tool to help countries evaluate progress towards their Paris mitigation pledges. See IMF (2019), "Fiscal Policies for Paris Climate Strategies - from Principle to Practice", *IMF Policy Paper*, No. 19/010, International Monetary Fund, Washington D.C.

[105] More information about these, and other, carbon tax schemes around the world can be found at the World Bank Carbon Pricing Dashboard (https://carbonpricingdashboard.worldbank.org/).

gas emissions in Colombia. Tax exemptions apply to natural gas consumers that are not in the petrochemical and refinery sectors, and fossil fuel consumers that are certified to be carbon neutral.

In *Mexico* the carbon tax is an excise tax under the special tax on production and services. It is not a tax on the full carbon content of fuels, but on the additional carbon dioxide emission content compared to natural gas. 46 per cent of all greenhouse gas emissions in Mexico are covered. The tax is capped at 3 per cent of the fuel sales price. Since 2017, companies liable to pay the carbon tax may choose to pay with credits from CDM projects developed in Mexico, equivalent to the market value of the credits at the time of paying the tax.

The *South African* carbon tax came into force in 2019 and applies to greenhouse gas emissions from the industry, power, buildings and transport sectors irrespective of the fossil fuel used. 80 per cent of the South African greenhouse gas emissions are covered. For many sectors tax exemptions starting from 60 per cent up to 95 per cent will apply. The level of tax exemption depends on the presence of fugitive emissions, level of trade exposure, emission performance, offset use and participation in the carbon budget program. Also, residential transport is exempt from the carbon tax. Companies may be eligible for either a 5 or 10 per cent offset allowance to reduce their carbon tax liability.

28. There are several policy options available that seek to address concerns related to possible adverse effects of a carbon tax, and the measures can be targeted towards both firms as well as households. The most popular set of policies in jurisdictions that have implemented a carbon tax focus on different types of *tax-reducing measures* lowering the effective carbon tax via exemptions, thresholds or reduced rates. Another set of policies in use include different *support measures* to affected households, firms or sectors: output-based rebates or targeted support for resource efficiency and cleaner consumption and production. Also, reductions from other taxes than the carbon tax (such as labour or income taxes) can be included in this group of measures. A third category of policies consists of *trade-related measures*, such as border carbon adjustments, consumption-based taxation and international cooperation.

29. Many of the different measures have the potential to contribute to the implementation of a carbon tax by increasing its public acceptance. The political economy aspects of carbon taxation are indeed important to acknowledge and the question of how to gain public acceptance for a carbon tax is further investigated in chapter 2. A carbon tax will undoubtedly raise tax revenues, at the same time measures to counter or mitigate unwanted effects from the tax often require public funding. Considerations regarding how and to what extent carbon tax revenues can be used to finance various other policy measures is further discussed in more detail in chapter 6.

### 5.1 Tax-reducing measures

30. Most jurisdictions that have already implemented a carbon tax have chosen to lower the carbon tax rate for some fuels and/or sectors, or exempt them altogether. Measures that reduce the carbon tax, such as exemptions, thresholds, reduced rates or tax payment refunds, can be temporary or phased out step-wise, or they can be part of a long-term policy design. These kinds of measures can in many cases be relatively

straight forward to implement and can be directly targeted at specific sectors or groups in society. In addition, they are easy to communicate and popular with groups benefitting from the measure. Some examples of how exemptions have been applied in various jurisdictions are found in [Box 19].

31. An immediate result of reduced carbon tax rates and exemptions is the loss in public revenues which, of course depending on the magnitude of the implemented measures, can be rather substantial. Another important disadvantage with introducing reduced tax rates or exemptions is the fact that the price signal of the tax, and consequently the Polluter Pays Principle, is compromised. As the price signal differs between sectors abatement will be more costly in those sectors not benefitting from the reduced rates and thereby the overall economic cost of reaching the jurisdiction's abatement targets are likely to increase. If sustained, such measures may also prove counter-productive as sectors benefitting in the short-term face the risk of being less adapted to compete in a low-carbon economy in the longer term.

32. As it may be difficult for policy makers to determine the appropriate scope, level and duration for the reduced rates careful ex-ante analysis can provide valuable input to the decision process. Measures to reduce the carbon tax payment nevertheless risk to be questioned by those excluded from the tax reductions which, in turn, may contribute to negative perceptions in society regarding the fairness of the tax. Excessive tax exemptions can also lead to domestic legal challenges. For instance, the first attempt of a carbon tax in France was rejected by the National Constitutional Council in 2009, since it deemed that multiple tax exemptions and thus differences of treatment were not consistent with the legislator's intentions.

33. It is crucial for policymakers to consider alternatives to exemptions and to balance the negative effects with the need to protect certain sectors of special importance to the economy. If exemptions are part of the tax design, policymakers may want to attempt to minimize their environmental and economic costs. This can be achieved by making exemptions targeted and, if possible, timebound with regular reviews.

34. In some carbon taxing schemes offset allowances enable liable entities to reduce their tax payments by investing in carbon mitigating activities outside the scope of the tax. This can also to some extent be viewed as a broadening of the tax base. Examples of this can be found in Chile as well as in Colombia.

**Box 19: What sectors to exempt – some examples**

To be able to properly address any potential adverse effects of a carbon tax, it is important to thoroughly analyse how and to what extent such effects are likely to occur. Each jurisdiction faces different circumstances that need to be considered.

A common distinction is to exempt installations in sectors included in an emission trading scheme, as consumption of fuels in such installations are already covered by another economic instrument aimed to incentivize less emissions of carbon dioxide. This line of action has been chosen by for example

Denmark, France, Ireland and Portugal regarding emissions covered by the European Emission Trading Scheme.

In other jurisdictions fuels or sectors considered to be of certain importance to the economy have been exempted from the carbon tax. One example is Switzerland, where only fuels used for heating purposes (not propellants) are taxed. The UK Climate Change Levy (CCL), which can be considered as a climate tax although it is calculated on the energy content of fuels rather than the content of carbon, has chosen a somewhat different approach by only levying the CCL on business consumption, thus exempting households from the levy altogether.

### 5.2 Support measures

35. In addition to tax exemptions and rebates, various types of support measures can be used to reduce the overall financial burden of entities subject to the carbon tax. Such measures can be targeted to specific sectors or have an even broader coverage. For example, it might be possible to reduce other taxes, lower employer contributions to labour costs, or implement governmental grants or programs in order to maintain the competitiveness of particularly vulnerable sectors. Examples of the latter can be public support for clean technology investments. Reallocating carbon tax revenues collected from a sector to the firms within the same sector based on their share of domestic production – so called output-based rebates – is another way to protect firms while still providing incentives for emission reductions.

36. The durability of measures can differ, depending on their purpose. There may, for instance, be a need to combine short-term relief for firms and long-term incentives for them to adapt by adopting cleaner and more efficient technologies. As support schemes most often are easier to implement than to withdraw, policy makers may want to announce up front for how long or under what circumstances a particular measure will be in force.

37. Support measures can also be targeted to households in terms of e.g. (non-carbon) tax reductions or flat payments. In certain jurisdictions in Canada for instance, revenues from the Federal Carbon Pollution Pricing System is being redistributed to households and individuals via their income tax and benefits return. The British Columbian Climate Action Tax Credit is another example of a support measure that seeks to offset the impact of the carbon taxes paid by low-income individuals and families. The amounts received depend on family size and adjusted family net income. Yet another scheme for allocating carbon tax revenues to households can be found in Switzerland where part of the revenue from the Swiss $CO_2$ levy is redistributed uniformly to all residents through an annual discount in the compulsory health insurance premium.

38. Other support schemes for households can involve direct or indirect subsidies to reduce emissions by e.g. support for improved energy efficiency in housing or subsidies for public transport. Properly designed, such measures will contribute to incentivize households to shift towards less polluting

consumption patterns, and thereby also help them lower their carbon tax expenditure. At the same time care should to be taken to ensure that support is given where it is needed the most; subsiding high-end electric vehicles will likely benefit households in higher income groups and may prove both cost-ineffective and counter-productive from a public acceptance perspective.

39. Similar to the tax-reducing measures discussed above, support measures imply a direct cost to the public budget. Yet targeted support to a certain group (e.g. low-income households or disproportionately affected workers, or communities such as coal-mining areas) may not necessarily be very costly in relation to the overall carbon tax revenue. Again, it is important that measures are designed with care, preferably supported by ex-ante analysis of the need for and effects of possible support policies.

40. Jurisdictions may choose to implement a carbon tax as part of a wider tax reform. For instance, the Swedish carbon tax was introduced in the early 1990s in a major reform including reductions of already existing taxes on energy as well as taxes on labour, capital and income. Subsequent changes (increases) to the Swedish carbon tax rate have also often taken place in the context of broader tax reforms which has helped package the implementation of the new rates. Other countries that more recently have taken the opportunity to introduce carbon taxes whilst undergoing a larger tax reform are Argentina and Colombia.

41. Introducing or increasing a carbon tax as a part of a more general tax reform not only gives policy makers the chance to present the carbon tax in a wider context but it also provides an opportunity to implement complementary measures to address distributional (income and/or geographical) concerns related to the impact of the carbon tax. Similarly, reductions in broad-based non-carbon taxes can also be designed to benefit firms or specific sectors. Revenues from the carbon tax can of course also be used to address distributional concerns or reduce inefficiencies in other parts of the tax system as well, the latter possibly resulting in a so called double dividend (society gaining from the carbon tax through both its impact on the climate as well as from the improved functioning of the tax system and the economy).

### 5.3 Trade-related measures

42. Trade-related measures that address carbon leakage and competitiveness concerns arising from carbon taxation are rare in practice. In the EU Emission Trading System, the risk of carbon leakage has been addressed by allocating free emission permits to installations in the most exposed sectors. A measure that has been discussed for long in the academic literature, as well as among policy makers, as a promising tool specifically for addressing the risks of carbon leakage is Carbon Border Adjustments (CBA). CBA aim at putting domestic firms facing a carbon price on an even footing with importers operating under a lower carbon price, or no carbon price at. Charging a levy on imports corresponding to the difference in carbon price between the jurisdictions would be an example of such a measure.

43. If and how CBA can be used in practice as a tool against carbon leakage is still an open question. No countries to date have tried to implement such measures at their borders and hence there is no international experience. Administrative burden, technical feasibility, the availability of data, the risk of retaliation from other countries, and perhaps most importantly, the compatibility with the World Trade Organization legal framework, are but a few of the challenges often mentioned in relation to CBA.[106] The instrument has gained renewed attention in 2019 as the European Commission announced that it will draft a proposal for a CBA mechanism covering the import of certain products to the EU in order to reduce the risk of carbon leakage, to be presented in 2021[107].

44. Consumption-based taxation (CBT) means that a carbon tax would be levied on the domestic consumers, rather than on the producers, and products would be taxed on their carbon intensity regardless where they are produced. While common in e.g. tobacco and alcohol taxation, CBT with an application to climate is yet to be introduced. As for CBA there are many uncertainties surrounding the practical feasibility of consumption-based carbon taxation.

45. Climate change is a global challenge that requires international cooperation. Economist repeatedly claim that a global price on carbon, e.g. through a global carbon tax, is the most cost-effective policy instrument to reduce carbon emissions in line with the Paris agreement. Still the international community has so far fallen short to coordinate any kind of global carbon pricing. Coordinated action in a smaller international context, through bilateral or multilateral agreements, is therefore more likely to succeed. This could e.g. be in the form of common minimum carbon tax levels agreed upon between jurisdictions (such as the Federal Carbon Pollution Pricing System in Canada) or within a larger group of trade partners.

46. A summary of the three main categories of policy instruments that can be used to address unwanted adverse effects of carbon taxes can be found in [Table X] below.

Table 1: Overview of measures to address unwanted adverse effects of carbon taxes

| **Measure** | **Advantages** | **Drawbacks** |
|---|---|---|
| **Tax-reducing measures** | | |

[106] For an overview of the economic and legal challenges see e.g. Cosbey et al (2019) *Developing Guidance for Implementing Border Carbon Adjustments: Lessons, Cautions, and Research Needs from the Literature.* Review of Environmental Economics and Policy, volume 13, issue 1, Winter 2019, pp. 3–22

[107] Communication of the European Green Deal, EU Commission Document presented on 11 December 2019, see https://ec.europa.eu/info/publications/communication-european-green-deal_en.

| | | |
|---|---|---|
| Exemptions<br><br>Reduced rates<br><br>Tax payment refund | Target and effectively protect vulnerable industries (at least in the short term)<br><br>Relatively simple to implement (but only for downstream tax)<br><br>Popular with industry groups; easy to communicate | Undermine tax price signals and environmental effectiveness<br><br>Difficult to determine appropriate level and extent ex-ante<br><br>Risk of rent-seeking and challenge from/extension to nonexempted industries<br><br>Increase abatement costs for other sectors<br><br>Costly option in terms of tax revenue<br><br>Risk of long-term competitiveness loss |
| Offsets | Incentive for emission reductions in uncovered sectors<br><br>Incentive for private investment in emission reductions | Undermine price signals for the taxed industry<br><br>Administratively complex to ensure environmental effectiveness<br><br>Reduced tax revenues<br><br>Effectiveness at improving competitiveness depends on offset prices |
| **Support measures** | | |
| Support for resource efficiency and cleaner production | Retain price signal and additional abatement incentives<br><br>Promote green innovation<br><br>Popular with industry groups<br><br>Possibility to leverage commercial finance<br><br>Flexible in design | Scope for gains varies depending on country, sector, firm type, etc.<br><br>May not provide immediate or full relief to industries<br><br>Depending on scheme, widely varying cost and can be difficult to scale up at industry level |
| Output-based rebates | Retain tax price signals and abatement incentives for producers<br><br>Strong leakage protection<br><br>Divides industry opposition: Up to half of industry enjoys net gain (if sufficient revenue used to finance rebates) | High cost to public budget (although less than exemptions)<br><br>Reduce incentives for producers to adopt cleaner inputs and for consumers to shift to cleaner products relative to BCA and CBT (but better than for exemptions) |

| | | |
|---|---|---|
| Flat payments | Retain price signal<br><br>Simple for citizens to claim<br><br>Popular with general public<br><br>Potential for net positive social and<br><br>economic benefits | Cost to public budget |
| Reducing broad-based (non-carbon) taxes | Reduce distortions from the tax system, for example, by reducing corporate income taxes or electricity taxes<br><br>Potential "double dividend" (creating net gains to output/welfare/employment) | Tax revenue reduced by using environmental tax to finance reductions in other taxes<br><br>Benefitting the economy rather than individual sectors with industry-specific competitiveness problems |
| **Trade-related measures** | | |
| Carbon border adjustment (CBA) | Effectively prevent competitiveness losses and leakage while maintaining tax price signal<br><br>Prevent free riding by non-taxing jurisdictions<br><br>Do not put pressure on public budgets | Administratively challenging<br><br>Uncertainty regarding WTO compatibility (though well-designed measures could likely be defended)<br><br>Risk retaliations by partners and damaging trade/climate negotiations<br><br>Limited experience to date |
| Consumption-based taxation (CBT) | Effectively address competitiveness and leakage risks<br><br>Extends pricing to non-domestic emissions<br><br>Lower legal/political risks than BCA | Limited experience to date with application to climate (although standard for taxation of other “bads” like tobacco and alcohol)<br><br>Administratively complex for design options with best environmental effectiveness |
| International cooperation | Retain price signal and protect against leakage<br><br>Leverages domestic tax to encourage equivalent effort in partner jurisdictions<br><br>No administrative cost or legal risk | Not controlled by domestic policy makers only<br><br>Difficult to negotiate across many countries and in sectors with many competitors<br><br>Only regional examples to date, no global ones. |

Adapted from Miria A. Pigato, Editor. 2019. *Fiscal Policies for Development and Climate Action*. International Development in Focus. Washington, DC: World Bank and Partnership for Market Readiness (PMR) 2017. *Carbon Tax Guide: A Handbook for Policy Makers*. World Bank, Washington, DC.

## 6. Administrative simplicity, environmental integrity and fairness

47. Fear for adverse impacts from a carbon tax may justify measures that seek to avoid or alleviate these negative effects. At the same time, however, the measures often come with unwanted side effects of their own.

48. Whereas concerns of losses in firm competitiveness and distributional effects often must be addressed, the indiscriminate concession of exemptions and tax reductions can lead to increased complexity in the carbon tax legislation, and inefficiency in the administration and collection of the tax. Countries without experience in excise duties on energy may therefore want to strive to grant the least exemptions/price differentiations possible to avoid complexity and thereby reduce implementation costs. A key to the administration of a simple system, is to consult widely with the different actors within society and get their input prior to introducing the tax, to avoid a web of exemptions.

49. The economic purpose of carbon taxes is based on the notion that emitters of carbon dioxide impose costs on others, without paying for the resulting damage that occurs. Carbon taxes aim to equalize private costs with social costs. Exemptions undermine this aim, thereby limiting the efficiency and effectiveness of the tax. If emissions are taxed at different rates or exempt, policymakers should be aware of unintended, environmentally harmful behavioral responses, like fuel switching, which could in fact defeat the purpose of the tax in the first place and increase the country's carbon footprint.

50. In spite of that, governments will at times see the need to resort to tax exemptions and rebates in order to gain popular support, particularly while discussing the introduction and implementation of the tax. As carbon taxes become more popular and widely used, so does the tax fairness and equity debate[108]. In fact, the notion of fairness is greatly perceived through the intended use of revenues from the carbon tax (see further chapter 6). Stakeholders are more prone to support carbon taxation when they understand that the revenues derived therefrom are spent in projects that are high in the public agenda, are returned to the general public according to ability to pay through targeted exemptions, rebates or corresponding reduction of other taxes, or are employed towards projects that will derive a positive environmental result and are consistent with the sustainable development goals[109]. What is considered high on the agenda of a given society depends on their level of understanding of climate change, civic engagement, level of inequality, and of economic development. Therefore these issues are to be tailored depending on the country context. The question of how to gain public acceptance for a carbon tax is discussed in more detail in chapter 2.

[108] Tatiana Falcao and Jacqueline Cottrell *A Climate for Fairness: Environmental Taxation and Tax Justice in Developing Countries*, Vienna Institute for International Dialogue and Cooperation (VIDC), November 2018.

[109] A. Baranzini, M. Caliskan and S. Carattini *Economic Prescriptions and Public Responses to Climate Policy*, Haute École de Gestion de Gèneve, 2014.

## 7. Examples of carbon tax introduction: Two-level tax systems and thresholds

51. To date a carbon tax has been implemented in around 30 national or subnational jurisdictions, all with different tax approaches to protect competitiveness and address distributional risks. A two-level tax system, and/or the adoption of thresholds are two examples of exemptions that can be found in some of these jurisdictions.

52. In a *two-level carbon tax system* different carbon tax rates apply to different parts of the economy, and such a system is easier to administer than lowering the tax rates for individual sectors and companies in the economy. A two-level tax system can be a feasible design leading to over-all better environmental results, as the politically acceptable alternative could be a general carbon tax for all operators set at low level to protect the domestic industry, which is subject to international competition.

**Box 20: Country example of a two-level carbon tax**

When designing the Swedish carbon taxation system, in order to avoid negative effects to the domestic industry and carbon leakage, two carbon tax levels were introduced. The lower carbon tax level was applied to fuels used for heating purposes by the industry. The lower tax level has, since the introduction of the tax in 1991, been phased out in Sweden and was fully abolished in 2018. Such a lower tax level has been the prerequisite for a high tax level for other sectors and one important cause of the emission reductions achieved in the high taxed sectors[110].

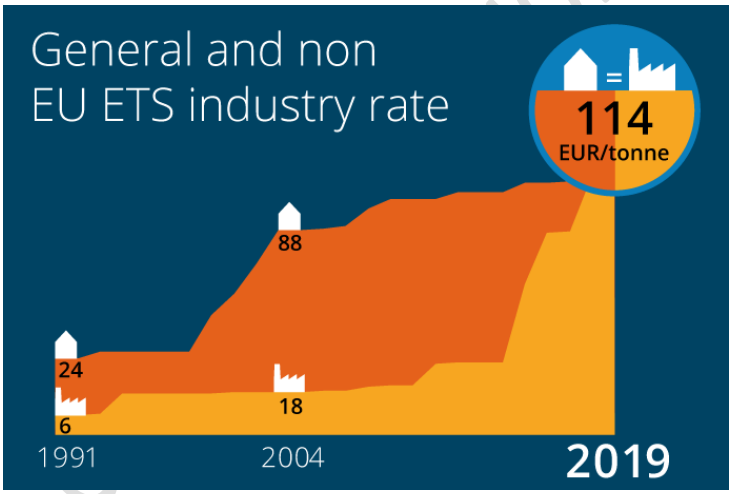


**Figure** Development of the Swedish Carbon Tax. General level and industry level. Industry level outside the EU Emissions Trading Scheme (EU ETS) since 2008. (Source: Government Offices of Sweden)

[110] Hammar & Åkerfeldt, *$CO_2$ Taxation in Sweden – 20 Years of Experience and Looking Ahead*, 2011, https://www.globalutmaning.se/wp-content/uploads/sites/8/2011/10/Swedish_Carbon_Tax_Akerfedlt-Hammar.pdf.

53. A *threshold* is a minimum level of activity that will trigger responsibility for paying the tax, that is, a minimum level of emissions per entity for the taxation to apply. The purpose of a threshold is often to reduce the costs of reporting and administration.

54. To examine the potential need of a threshold several characteristics can be analysed. One of them is the proportion of emissions derived from small emitters. If there are many small sources of emissions in sectors covered by the carbon tax, a relatively low threshold may be needed to ensure that a significant proportion of emissions is covered by the tax. The cost of reporting in relation to the tax amount, the capabilities among firms to administer a carbon tax, and the risk for intersectoral leakage are other important aspects to consider. A threshold could also result in small firms deciding not to grow to avoid the tax and counteract the establishment of large-scale operators.

55. In the case of carbon taxes, thresholds applied directly to emissions are rather common. By contrast, jurisdictions that apply their carbon tax to fuels at the level of distribution typically do not apply thresholds. Applying a tax to fuels normally does not require direct measurement of emissions and is often built upon existing excise taxes, thereby making thresholds less necessary. Applying thresholds in these cases could also create market distortions by encouraging consumers to purchase from smaller wholesalers.

**Box 21: Country examples of thresholds**

An example of thresholds is the later abolished Australian Carbon Pricing Scheme, where emissions were taxed at the point where they were released into the atmosphere. The threshold was decided to 25,000 $tCO_2e$ in order not to burden smaller facilities with reporting obligations.

Another example is Chile, where the carbon tax was initially only applied to fuels used in industrial and power generation plants of a certain capacity (above 50 MW). Such a technical condition is easily observable, whereas an emissions threshold require that a level of reporting is already in place.

# Chapter 5: From Design to Administration: Practical Application of a Carbon Tax

[Approved at 21st Session of the Committee]

## 1. Check list for carbon tax administration

1.

- Identify the necessary organizations (e.g. ministries, agencies, private sector, and civil society representatives) to consider in the administration of a carbon tax scheme. Determine which relations (e.g. inter-administrative cooperation or public consultations) are beneficial.
- Define the core elements for good administration considering the legislative previous delimitation of taxable event, the taxpayers, the tax base and rate, the filing obligations, etc. (e.g. adapted to a fuel or direct emissions approach).
- Assess the extent of detailed administrative regulations.
- Try to facilitate ex-post evaluation.

## 2. Introduction

*Summary:* Main Topics To Address

| |
|---|
| ALLOCATION OF TASKS → WHO SHOULD CARE? |
| NEW CHALLENGES → WHAT APPROACH? |
| OPERATIONAL ASPECTS → HOW TO OFFER GUIDANCE? |
| CONTINUOUS IMPROVEMENT → WHICH TOOLS? |

### 2.1. Viewpoint and structure

2. This chapter is focused on real-world execution and critical administrative considerations once the basic design selections concerning a carbon tax have been made[111]. It discusses the regulatory choices

[111] Fundamental design features are covered in previous chapters, primarily 4A. For the sake of clarity, due to the possible readers' different backgrounds, the chapter avoids technical wording. This chapter strives aims to address how to execute the basic design choices during the regulatory process, considering implementation (in a narrow sense: put the carbon tax into practice) and on-going administration. There is an "administrative" facet to design issues distinct from fundamental choices, and here this focus is highlighted. Implementation, in its widest sense,

that make the determinations about how the tax will function (facilitating the stakeholders' involvement), as well as the administrators' role in executing them (in concert with orientating taxpayers' behaviour).

3. The administrative aspects are reviewed here in detail: who needs to do what, or how to make the system operate smoothly. In fact, while some core design features need to be part of the initial tax design, other decisions regarding the design of administrative provisions are likely to be made later once the carbon tax scheme in operation (from its introduction to its evaluation) and may involve diverse institutional levels.

4. Basically these are the essential questions:

(1) How does the institutional or procedural allocation of tasks affect the administrative design process?

(2) What specific administrative challenges are associated with the main approaches to carbon taxation (on fuel or direct emissions)? How can these be managed?

(3) What needs to be done to convert the tax from the foundational governing legislation into an operational instrument? In what ways do the steps with regard to carbon taxes differ from those occurring when handling other kinds of taxes that jurisdictions may be more familiar with (such as, already applicable fuel levies)?

(4) How is the carbon tax monitored over the course of time to allow *ex post* evaluation[112]?

5. The next sections in this Chapter have been structured to provide answers to these questions.

### 2.2. Main issues in tax administration

6. Establishing a functional administration of a carbon tax is a key issue for policymakers, as it is necessary to ensure that the carbon tax legislation is effective and serves as an operational instrument to reach its goals[113].

7. It is worth stressing that the fundamental approach to the administration of a carbon tax –like any other kind of tax– is to guarantee that the tax revenue is collected in line with the provisions laid down in the applicable legislation. From the revenue perspective, it is imperative to ensure that the systems put in place to collect this tax are well-functioning, thus helping in parallel to adequately meet its environmental



would cover the organizations involved and their interactions to better apply the carbon tax, the concrete design of administrative matters through more detailed regulations, and finally the application and control of this tax to promote justice, efficacy and efficiency.

[112] While ex-post evaluations of a carbon tax's effectiveness are not exclusively linked to pure administrative issues, we will consider them due to its significance in a more general policy perspective.

[113] The choices of taxpayer and time of tax payment are aspects we have already dealt with in Chapter 4A.

objective. This task is usually given to **tax authorities**, which means that they need to be aware of the specific challenges and expectations when administering a carbon tax.

8. The administration of a carbon tax is mainly affected by this choice: to tax direct **emissions** by measuring them, or to tax **fuels** by using its average carbon content. The differences between both approaches will be highlighted in the following pages[114].

9. The major elements of how to administer a carbon tax should be laid down by legislation (i.e. most jurisdictions use an act –law or statute– passed by a national parliament or similar body). However, the decision-making levels competent to regulate more detailed matters for its administration may vary among jurisdictions. **Secondary legal acts** –regulations– are often used to facilitate day-to-day management, once the legislation establishing a carbon tax has been enacted. When setting these rules, attention should be paid to the provision of a basis to obtain the necessary information for continuous improvement of the carbon tax design.

10. To overcome challenges in the administration of a carbon tax, it is important to think of how to use **existing tools** to ensure low administrative costs and generate possible co-benefits. The priorities in the administrative cycle can be reviewed to **recalibrate** or improve them in light of the problems found and the responses given during the implementation phase.

11. In summary, whether a carbon tax is effective in terms of the environmental objectives depends on the legal design of the tax and its administrative application as well. Its effectiveness can be evaluated by ex-post analysis, if the proper data have been captured along the process.

# 3. Topics to address in the administration of a carbon tax

## 3.1. Institutions and their responsibilities

### 3.3.1. Involvement of the administrative agents

*Summary:* Exploit Your (Combined) Administrative Potential

[114] Rodrigo Pizarro has provided the information about the Chilean carbon tax. Susanne Åkerfeldt and Karl-Anders Stigzelius (Swedish Ministry of Finance) have provided the information about the Swedish carbon tax. Further, the administration of a carbon tax was the theme for one of the sessions during a workshop on carbon taxation, arranged in Stockholm in October 2019 within the framework of the Coalition of Finance Ministers for Climate Action. A summary note as well as presentations given by different speakers are found at https://www.financeministersforclimate.org/events/workshop-carbon-taxation-stockholm-sweden. These include for example presentations on the Swedish and Chilean carbon taxes.

To what extent can you use the existing tax or environmental structures (e.g. to collect fuel taxes or report emissions) to minimize the administrative costs of a carbon tax? What type of cooperation between them could be beneficial?

12. Policymakers should, at an early stage, decide which public agency will administer the carbon tax and subsequently allocate public funds to it in order to cover the administrative costs (e.g. enough human resources or adequate technologies). This choice will often depend on the way the tax is designed and how tax administration in general is handled within the jurisdiction. The tax authorities administering the carbon tax and may seek the interested parties' involvement when they are affected by the tax (e.g. tax accountant's association) to ensure the well-functioning of the administrative provisions, both during the administrative design process and once the tax is in place.

In Singapore, for example, the carbon tax is collected by the National Environment Agency (NEA), not the Inland Revenue Authority of Singapore, and is paid into Singapore's Consolidated Fund. Under the Carbon Pricing Act 2018, registered persons with operational control of taxable facilities in Singapore would need to purchase fixed-price carbon credits and surrender them at the end of each reporting period in payment of their assessed carbon tax. The carbon tax is levied on the direct emissions of six types of greenhouse gases. The Carbon Pricing Act 2018 also imposes annual reporting obligations with regard to these six types of greenhouse gases (under the United Nations Framework Convention on Climate Change, Singapore itself must report these data in its greenhouse gas inventory). The Carbon Pricing Act 2018 distinguishes between facilities that are reportable or taxable, depending on their emissions levels. Different measurement, reporting and verification requirements apply to reportable and taxable facilities. Verification of emission reports is done by NEA-accredited independent third parties.[115]



[115] See www.sso.agc.gov.sg As shown in this example, different jurisdictions may allocate different tasks related to the administration of a carbon tax to different authorities. In this sense, any authority could be appointed to collect the tax (e.g. the standard tax authorities or other specific agencies not attached to the Ministry of Finance). In such a situation, in certain countries, the environmental agency might be also broadly considered as a tax authority, because it in fact administers the tax. Here, authority in this context does not only include the typical tax administration. Regardless of what agency manages, handles and collects the tax, this chapter describes some important administrative decisions to be made.

Key factors to consider when determining the tax payer has been outlined in Chapter 4A, section 6. The Dutch Government has recently proposed a national $CO_2$ tax to be introduced in 2021 for industrial production and waste incineration. This tax is to be introduced alongside the existing system for the pricing of $CO_2$ at EU level (EU ETS) and is planned to be administered by the Dutch Emissions Authority (NEA), and not the Tax and Customs Administration. If approved in the coming months, it will enter into force on the 1st of January 2021.

In Australia collection through other parties in the value chain was considered, but this tax did not enter into force.

13. A carbon tax based on the **Fuel Approach** can be implemented through the existing administrative structure of taxes on fuels. This approach is relatively simple, and there are few new purely administrative issues. The main difference lies in the way the tax rate is calculated before it is included in the tax legislation. Since each fuel has a different carbon content, to estimate emissions correctly, the legislator would need to ensure that the relevant emission factors are available and taken into account when laying down the tax rate in the tax law for each fuel[116]. This is likely to involve cooperation with other relevant Government agencies or authorities.

14. Though tax administration may be organised in a distinct manner in different jurisdictions (tax authorities may be an independent body or part of the Ministry of Finance), the most common strategy for a carbon tax, under the Fuel Approach, is to assign the administration to the tax authorities (either local tax offices or one central tax authority). Another quite common way of administration is to have taxes administered by the Customs Offices. This choice may be of particular interest if a country's fuel mix consists principally of imported fuels.

15. If the carbon tax follows the **Direct Emissions Approach** the best choice for an administrative body is still likely to be the tax authority[117]. However, it will need to rely on emission data submitted by the facilities with some form of verification performed by a technical agency, since it does not have the expertise to monitor or assess pollution data. In many cases the environmental authorities are already in charge of gathering relevant data and have developed reporting and monitoring systems. These data can be used for the calculation of the carbon tax, for example, a Pollution Release and Transfer Registry (PRTR). For example, in Chile the environmental agency used the PRTR system to register facilities and monitor emissions related data.

16. As with the tax authority, the technical agency may be independent or part of another Government office (such as the Ministry of the Environment). On the one hand, this agency must ensure that the measurement of the emissions level is accurate, secure, and verified. Trustworthiness is vital because emissions are tax liable under this scheme. On the other hand, making use in the tax design of information initially collected for the purpose of environmental reporting in accordance with the Intergovernmental



[116] See description in Chapter 4A.

[117] The administrative issues may differ from the drafting. Depending on national conditions, a jurisdiction may leave the Ministry of Finance in charge of drafting the carbon tax law and its officials would thus need to seek environmental technical assistance. Alternatively, a jurisdiction can ask the Ministry of the Environment to take the lead in the drafting, as the environmental knowledge is fundamental for the design of the carbon tax, and its officials should seek technical assistance in tax matters.

Panel on Climate Change (IPCC) regulations could also result eventually in strengthening the mechanisms nationally introduced to fulfil these international obligations.

17. Therefore, devising a sound administrative strategy may require **cooperation** among different agencies and ministries within Government offices and at other lower levels of jurisdiction. This includes gathering the necessary information for making decisions on how to better administer the tax. A basic aspect to keep always in mind, regardless of the design approach chosen (i.e. emissions or fuel), is to what extent existing organizational structures can be used, as this can be a way of keeping administration costs low.

### 3.3.2. Administration in a regional context

*Summary:* Consider The Situation Within And Across Borders

| |
|---|
| In the context of fiscal federalism multi-level decisions on the design and the administration of a carbon tax may influence its efficacy. The administrative channels for fluent communication should be carefully established. The risks of (un) coordinated action in regional groupings or with neighbouring countries need to be assessed. |

18. The regional context is also a factor to account for when devising administration of the carbon tax to work smoothly[118]. On the one hand, administering a carbon tax may present specific challenges in jurisdictions with fiscal federalism, as in case of Spain and Canada where carbon taxes are applied at the sub-national levels; on the other hand, another type of administrative challenges may occur when national carbon taxes are applied in the context of a broader regional area, for instance in the European Union within the EU wide framework of taxation of energy products.

19. Each jurisdiction implementing a carbon tax must respect its own constitutional law, though the policymaker may be inspired by other carbon taxes introduced in adjoining geographical areas (sub-national jurisdictions or neighbouring countries). This makes it easier for operators engaged in activities in more than one area to establish the necessary administrative routines. Special attention should be paid to **enhanced administrative cooperation** in case of cross-border situations (e.g. a big installation located in two jurisdictions, or the risk of double taxation when one jurisdiction takes fuels into account in different time and location conditions).

20. In a **sub-national** jurisdiction, policymakers may need to pay some attention to special situations. Several Spanish Autonomous Communities have adopted taxes on polluting emissions and they can set different administrative details (e.g. amount and period of partial payments), which may complicate

[118] The regional context (different provinces or other sub-national levels within one country, or even neighbouring countries) may influence decisions on the level of the carbon tax rate or measures to alleviate undesired distributional or competitive effects. These aspects have been dealt with in Chapter 4C.

compliance[119] (particularly burdensome when the same company may operate more than one plant in different regions within the same country). Having several carbon taxes levied in the same country with too many divergent ways when designing and applying them, may cause inefficiencies and an undesirable burden for the taxpayers. Some sort of administrative channel should be implemented to ensure fluent communication among different tax authorities and avoid problems in implementation.

21. At an international level, a **regional association or group** of countries may agree on legally binding rules to establish a common framework to administer certain taxes. One example are the countries within the EU. As mentioned in chapter 4A, proposals introducing a mandatory carbon tax in the EU have – yet unsuccessfully – been discussed among the EU countries, lastly during 2011-2015[120]. This means that the EU countries introducing national carbon taxes have done so within the framework of the existing Energy Taxation Directive (Council Directive 2003/96/EC[121]). Although no specific provisions in this Directive refer to carbon taxes, it covers all indirect taxes (except value added tax) calculated directly or indirectly on the quantity of energy fuel products. The EU law lays down provisions for the administration of those indirect taxes and allows production, storage and movements of energy products under a tax suspension regime between tax warehouses within the EU, see Council Directive 2008/118/EC[122]. Energy

[119] Galicia, Andalucía, Aragón, Castilla-La Mancha, Comunidad Valenciana and Cataluña. The Committee of Experts for the Regional Finance proposed the establishment of a permanent normative Commission where previous communication may take place between tax administrations in cases of new projects regarding environmental taxes to be introduced in the system (ADAME MARTÍNEZ, F.: "Los tributos ambientales en España" (Environmental taxes in Spain), Chapter 23, in Cubero Truyo, A. ; Masbernat, P. (dirs.): Protección del medio ambiente. Fiscalidad y otras medidas del derecho al desarrollo, Thomson Reuters Aranzadi, Cizur Menor, 2019, pp. 322- 327, 354-355). In the future, by reaching an agreement, a State framework Law could harmonize the core elements including the tax base and leave the Autonomous Communities the choice of the tax rate and tax reductions. The report presented in 2017 by this Committee can be found here (see proposal in p.59) https://www.hacienda.gob.es/CDI/sist%20financiacion%20y%20deuda/informaciónccaa/informe_final_comisión_reforma_sfa.pdf For Andalusia's Act 18/2003, 29 of December. Aragon's Act 13/2005, 30 of December (Legislative Decree 1/2007, 18 September). Castile's Act 16/2005, 29 of December, Catalonia's Act 12/2014, 10 of October. *See* Secretaría General de Financiación Autonómica y Local Subdirección General de Relaciones Tributarias con las Comunidades Autónomas: Tributación Autonómica. Medidas 2020 Capítulo III Impuestos propios, Updated 2317 Julyne 2020. Available at https://www.hacienda.gob.es/Documentacion/Publico/PortalVarios/FinanciacionTerritorial/Autonomica/2%20Cap%C3%ADtulo%20III%20Tributación%20Autonómica%202020.pdfhttp://www.hacienda.gob.es/Documentacion/Publico/PortalVarios/FinanciacionTerritorial/Autonomica/Cap%C3%ADtulo%20III%20Tributación%20Autonómica%202019.pdf

[120] https://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/excise-duties-energy/excise-duties-energy-tax-proposal_en.

[121] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003L0096.

[122] Council Directive 2008/118/EC of 16 December 2008 concerning the general arrangements for excise duty and repealing Directive 92/12/EEC, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008L0118. A recast has been decided of Directive 2008/118/EC, see Council Directive (EU) 2020/262 of 19 December 2019 laying down the general arrangements for excise duty, https://eur-lex.europa.eu/legal-

products subject to excise duties can be produced and stored without requiring the tax payment (suspension regime) in authorised tax warehouses by an authorised warehouse keeper. The tax warehouses and warehouse keepers are authorised by national authorities according to conditions meant to prevent any possible tax evasion or tax abuse. Once these goods are released for consumption, i.e. removed from the tax suspension regime, the excise duties must be paid. An authorised warehouse keeper can move excise products – under tax suspension – from a tax warehouse (or the place of importation into the EU) to another tax warehouse without the liability to pay excise duty occurring. All movements of excise goods under tax suspension between Member States are entered into a computerised system, Excise Movement Control System, and must be accompanied by a reference to the relevant entry into the system to enable a proper tax control[123]. Any national carbon tax applied in an EU Member State is thus subject to the constraints of these administrative procedures[124]. However, a regional approach could lead to a scaling problem where the system was not well designed or implemented, because it would adversely affect a whole region, and not just one country. This could relate to the interaction between carbon tax and emission trading schemes[125]. So greater attention should be paid to it.

22. **Legislative coordination** among competent jurisdictions to enact a carbon tax is desirable, when regulating its administration issues in a regional context (within or outside the national State borders). It allows a subsequent coherent and easier application of any carbon taxes that would affect the taxpayers. If a tax is levied on fuels, a cooperative administrative system needs to be established to avoid certain risks: fuels could be taxed twice if one jurisdiction lays down the taxable event upon production, and another jurisdiction upon consumption of the same fuel. Technically this may not be considered double taxation legally, but the economic effects might be unfair. Cooperation between tax administrations is needed to check the actual application of the tax and avoid fraud. This situation could not solely occur between different regions in one country, but could also arise between neighbouring countries. Moreover, a



content/EN/TXT/PDF/?uri=uriserv:OJ.L_.2020.058.01.0004.01.ENG. The amendments will apply from 13 February 2023.

[123] For further information, see information on the EU Commission website https://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/general-overview/common-provisions_en.

[124] This system has also been briefly mentioned in section 5.2.1 of Chapter 4A, where a figure illustrating the taxable points within the tax suspension regime is included.

[125] The functioning of any other market-based instrument regarded when introducing the carbon tax should be monitored to adjust its administration accordingly. This could happen with an emissions trading scheme. For example, Friends of the Earth (Europe) pointed out in 2010 that failure of the EU ETS was leaving Europe failing to meet its share of the climate challenge. By 2010, twenty-one member states were seeking 2012 emission caps higher than 2005 emissions when the EU ETS was launched. It has also been pointed out that the EU ETS has been characterized by policy uncertainty. Friends of the Earth Europe, 'The EU Emissions Trading System: Failing to Deliver' (October 2010). Andrei Marcu and others, '2018 State of the EU ETS Report' (2018).

jurisdiction could introduce rules stating that a carbon tax on fuels paid in country X will not be reimbursed if the fuel is exported to country Y, as a carbon tax is supposed to incentivize a change of behaviour of consumers in country X and that is not achieved if the fuel in question is exported to another country. However, where the taxpayer is the owner or operator of stationary facilities emitting the taxed pollutant substance, it seems unlikely that specific regulations are needed in neighbouring jurisdictions to avoid this particular problem.

23. Finally, special administrative design challenges may appear with the attempt to give **local** governments an increased revenue stream, and to facilitate public acceptance by a higher visibility of the revenue use for local projects. Such discussions are currently emerging in African countries. In Indonesia, local district and province governments are playing a greater role in administering their areas, but no carbon tax has yet to be introduced, either at national or sub-national level.

### 3.3.3. Stakeholders and public engagement: administration issues

*Summary:*

Public Consultations Are Desirable

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| Consultations with stakeholders, in their different available modalities, may serve to obtain useful information for an efficient administration, and also to gain social acceptance through the broad involvement of stakeholders. |

Transparency

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| Information campaigns help administrative accountability and taxpayers' adaptation avoiding uncertainty. In addition, coherence of public policies should be shown through adequate management of the accompanying support measures. |

Offer A Reasonable Time Frame

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| The announcement of a carbon tax, the steps to be taken and the length of the transition period should be enough to allow administrations' and taxpayer's adjustments, bearing in mind the national circumstances. |

24. 24. To achieve expected benefits through carbon taxation, **expanded cooperation** with the private sector may also be beneficial, seeking for public-private collaboration in line with Sustainable Development Goal 17 in different moments. This section contemplates how the administration can manage the integration of the stakeholders' views (so relevant for public acceptance); and simultaneously stresses the importance of making their participation focus on the

administrative issues that might be otherwise underestimated by them (although are key to better achieve carbon taxation objectives).

#### *3.1.3.1. Administering consultations prior to enactment*

25. As a starting point, the organizational structure already in use for consultations (e.g. by the tax revenue service or other bodies of the Government) may allow to work more efficiently with stakeholders and to promote positive behavioural changes. The issue of whether stakeholders are involved in the process of drafting a tax varies across jurisdictions.

26. A **consultation** process prior to introducing a new tax or major changes of an existing tax may not be only a way for the policymakers to obtain relevant information to facilitate its future administration, but also a way of getting a wider public acceptance for the new measures. Such an approach is also in line with the principle of openness in providing public information, which prevails in many jurisdictions. Public acceptance is important, and lack of it could lead to failure of the tax.

> In France, for example, the inability to communicate the social benefits of the tax led to a loss of public support over time, contributing to the downfall of the tax. Efforts to increase the tax were shelved after protests over rising fuel prices[126]. In Australia, the tax received backlash from the public and the opposition, and in 2014, the Liberal-National coalition 'axed the tax'[127]. Recently in Malawi, citizens have reacted negatively to the introduction of carbon tax, accusing the Government of taxing the same products twice[128].

27. When conducting a public consultation on the introduction of a carbon tax, it would be advisable for policymakers to engage a broader group of **stakeholders** as compared to other kinds of taxes, where the aim is solely to raise revenues. The stakeholders consulted could be a wide range of bodies, such as potential agencies given the task of administering this tax, the tax authorities and other relevant agencies, business organizations, trade and consumer organizations representing their members who are likely to face the burden of the tax, as well as environmental and technical experts, and national researchers. They could be

[126] Alexis Rocamora, 'The Rise of Carbon Taxation in France: From Environmental Protection to Low-Carbon Transition' (May 2017) <https://www.iges.or.jp/en/publication_documents/pub/workingpaper/en/5983/The_Rise_of_Carbon_Taxation_in_France_Rocamora_May_2017.pdf>.

[127] 'Repealing the Carbon Tax' (Australian Government, Department of Agricuture, Water and the Environment) <https://www.environment.gov.au/climate-change/government/repealing-carbon-tax> accessed 20 February 2020; Padraig Collins, 'How Not to Introduce a Carbon Tax: The Australian Experience' (2019) <https://www.irishtimes.com/news/environment/how-not-to-introduce-a-carbon-tax-the-australian-experience-1.3746214> accessed 20 February 2020.

[128] Yohane Symon, 'MRA Justifies Carbon Tax' (The Times Group, 2 December 2019) <https://times.mw/mra-justifies-carbon-tax/> accessed 6 February 2020.

consulted to supply data relevant for the tax design and tax administration. The necessary information to design the legislation and adopt regulations properly can also be gathered by direct contacts with stakeholders.

28. For example, Sweden and France are countries where the introduction of a carbon tax was the result of proposals from committees of inquiry, which included various experts and business representatives. The tax proposals were sent out for public consultation, enabling more stakeholders to express their views[129]. In many jurisdictions, it is customary to make the draft proposals available for public consultation. Prior to the carbon tax introduction, the South African Ministry of Finance revised its proposal, after a first round of consultations, and sent it out for a second review by stakeholders. This process proved to be instrumental for social acceptance of the tax after several years of deliberations.

29. Comments obtained through a public consultation may relate to the undesired distributional effects which may make policymakers consider certain compensatory measures[130]. However, the comments may also very well relate to more direct administrative issues, such as the length of declaration periods, how tax exemptions should be administered, how the tax collection should be designed to prevent tax fraud, how to lower compliance costs, etc. This sort of bidirectional communication is fruitful in order to support an efficient administration and additionally entails greater legitimation.

#### *3.1.3.2. Information campaigns and post-enactment administration*

30. To pave the way for posterior compliance with administrative requirements and get public acceptance the public consultation could be combined with different **information campaigns** carried out by the relevant authorities, explaining to the public the reasons for the adoption of a carbon tax (e.g. health reasons and reduce risks of mortality), who will be affected, the basics of how the system will work, what the new obligations will be, what outcome is expected (e.g. environmental benefits and revenue use). This transparency effort is needed to pave the way for the normative reform and later to show political accountability and good administrative performance, avoiding risks of corruption.



[129] Sometimes, a public consultation may not be particularly useful. In France the proposal to implement carbon tax received strong public support in 2007 and a negative public reaction in 2009, the Government shelved its plans to introduce a carbon emissions tax in 2010. Declan Butler, 'France Unveils Carbon Tax' (Nature, 11 September 2009) <https://www.nature.com/news/2009/090911/full/news.2009.905.html> accessed 20 February 2020; Rocamora (n 13).

[130] See Chapter 4C. To seek public acceptance, depending on national conditions, compensatory measures may take various forms. They are likely to be directed at consumers who would be affected by the distributional effects of the tax in a way that would not be politically desirable. The public acceptance of a carbon tax is an important matter for policymakers to consider and it is discussed in more detail in Chapter 2.

31. A carbon tax aims to give households and firms incentives to change their behaviour into more low-carbon activities, in the steady process of progressively decarbonising the economy. The effectiveness of a carbon tax is likely to increase if the ultimate aim of the tax is **coherently promoted with public policies**. Campaigns are, however, normally not the task of the tax authority but other public bodies. The Government may implement a carbon tax as part of a package with other measures making it easier for households and firms to make green choices. Making affordable alternatives to fossil fuel use available may often be a key factor to an effective carbon tax. Such measures can include time-limited grants for households to invest in non-fossil heating or cooling equipment, more frequent local public transport options encouraging citizens to leave their car at home when commuting to work, governmental aid to Research, Development and Innovation (R&D+i) for development of more environmentally friendly technical equipment, etc.

#### *3.1.3.3. Transition considerations*

32. For the public acceptance of carbon taxation, it could be advisable to **announce** the introduction of the measure well in advance to give time for adjustments. The rationale for using a market-based policy instrument, such as a carbon tax, is that the price signal created by the tax allows for use of alternatives to avoid the tax and thus help reach the objective of the tax, that is the reduction of carbon dioxide emissions. The cost effectiveness lies, hence, in that the society does not 'pick a winner' (e.g. a particular technology or a particular fuel) but rather allows households and firms to choose the appropriate source of energy as they see fit (which typically coincide with less expensive)[131].

33. A **step-by-step approach** could also ease the transition. Some jurisdictions have laid down a clear trajectory of the trend for the tax rate during a specific time period, and it has been well politically communicated[132]. An early announcement will also give business the incentive to kick-start measures that will reduce the use of carbon dioxide emissions, in line with the existing technologies and their associated costs.

> Sweden provides an example: a tax on the sulphur content in fuels came into effect in 1993, but was approved by Parliament already in 1990. By 1993 the fuel producers had already lowered the sulphur content below the taxable level in most of the volumes of fuels sold.

[131] Such measures, for example, can range from household members putting on an additional sweater to enable a lower temperature indoors to firms investing in a new technology with low or zero carbon dioxide emissions.

[132] This was discussed in Chapter 4B regarding the tax rate and its possible annual increases by the budgetary law.

34. In any case, policymakers should allow a **reasonable time period** between the enactment of a new carbon tax and the date when the legislation will come into force (for example, Chile chose three years). The public authority in charge of the tax collection will need time to register taxpayers and establish relevant forms for filing returns or declarations; the taxpayers will need time to develop proper business routines in their book-keeping, internal systems and procedures to ensure the declarations are accurately completed and payments of the tax amounts are made on time. Taxpayers may also need to consider the effects of the tax on the price of their sales in order to pass the cost of the tax on to the consumers.

35. The length of this transition time will depend on the national conditions in the jurisdiction and the way taxes in general are administered, as well as on the complexity of the tax scheme introduced[133]. Even a relatively simple scheme will, however, need some time to become fully operational. The sole official announcement of a planned implementation of a carbon tax may make authorities and taxpayers start to prepare for the tax, but the final administrative adjustments will not be made until the concrete tax Act is passed by the national parliament or similar regional body.

36. Finally, the time lapse between the decision of a carbon tax law and its actual implementation may also need to be longer if many administrative issues are still left to be decided by lower jurisdiction levels. If a Fuel Approach is chosen there should not be many time constraints as the carbon tax declaration and payment can be closely linked to the already existing fuel taxation. In a Direct Emissions Approach, they also can be closely linked to reporting already taking place in a jurisdiction, but the tax authorities would need some time to seek cooperation with environmental authorities relying on controls made by them.

37. Furthermore, a longer period can be necessary if a broad public consultation was not conducted before the passing of the national carbon tax law. Even with enough advanced notification in relation to the implementation of a new carbon tax, taxpayers may still face significant challenges related to their compliance capacity. Depending on the circumstances, with regard to implementation of a new tax, it can be appropriate for the tax authority to have a defined transition period, under which taxpayers that demonstrate 'best efforts' in complying with the new carbon tax are not assessed fines and penalties associated with non-compliance.



### 3.3.4. Coordination with overlapping economic instruments

*Summary:* Avoid Overlapping

[133] The choice between the fuel or the emissions approach does not necessarily imply a longer transition period, as the direct measurement in the latter is not always required and estimation methods can be used. The decisions on the reporting level and the contents of the report may have an influence in timing.

The administration of a carbon tax should consider the interactions with Emissions Trading Schemes, energy contracts or other duties.

38. An issue to consider is how to deal with other economic instruments that may already be **in place or planned** to be introduced addressing fully or partially the same objective as the carbon tax (e.g. energy contracts)[134].

39. The most common issue of concern with respect to overlapping economic instruments relates to carbon taxation and emission trading schemes (e.g. the UK floor price may be a useful example)[135]. Particularly, the fuels used in installations (that is, facilities or establishments) covered by an emission trading scheme could be totally or partially exempted from the carbon tax, and consequently provisions on how to **administer the tax exemption** would have to be laid down.

40. Consider the example of the EU Emissions Trading Scheme (EU ETS), which in addition to all EU countries, is also linked to similar schemes in Iceland, Liechtenstein, Norway, and Switzerland. The States which have introduced national carbon taxes on fuels have taken different approaches on how to deal with the overlapping regimes. Denmark, France, Ireland, Norway, Portugal, and Switzerland grant an exemption from their national carbon taxes to fuels used in installations covered by the EU ETS. Sweden, on the other hand, has in recent years reintroduced parts of the carbon tax on fuels used in some of the Swedish installations that participate in the EU ETS. Coordination must exist between **the tax administration and the registry** of installations covered by the EU ETS. Exactly how this is handled varies across countries. For example, following requirements in the Swedish Act of Excise Duties on Energy, it is sufficient for being granted the tax reduction to carry out activities according to the EU ETS in an installation under that scheme and use the fuel in such an installation. It is not a task for the tax authority to check whether the EU ETS obligations are fulfilled. Such controls are part of the regulations governing the EU ETS system.

41. Some jurisdictions have addressed overlaps when granting fiscal benefits to the taxpayers regarding **other already existing taxes and schemes**. For example, in South Africa, the 2019 Budget recognised that emission reduction credits could be used to reduce a taxpayer's carbon tax liabilities. Consequently, the tax exemption for income generated from the sale of certified emission reduction credits

[134] See Chapter 4A on fuel taxes and Chapter 7 on overlapping.

[135] How jurisdictions have dealt with potential overlap of related economic instruments, such as carbon taxation in relation to emission trading schemes is dealt in Chapter 7.

was repealed. This was to prevent a situation whereby a taxpayer benefits from that exemption and has a reduced carbon tax liability[136]. In other cases, when introducing a carbon tax under the fuel or the emissions approaches, the possible connections previously established between related taxes should be clarified.

### 3.2. Core elements for good administration. Specific issues in the application of a Fuel or Emissions approach

42. The following are the core features of a carbon tax –to be appraised in the tax law or in secondary regulations depending on the legal sources of each jurisdiction:

- Taxable event (occurrence of what chargeable events should make the tax due? E.g. extraction, sale or consumption of fuel volumes or actual emissions[137]).
- Taxpayer (who should pay the tax to the public authorities?)[138]
- Tax base and tax rate(s) (what is to be taxed and by which amount?)
- Public body to administer the tax or oversee its administration.
- Tax declaration period (time frame to provide data or file the return).
- Information to be given in the tax declaration (concerning the taxpayer or other third parties).
- Administration of possible tax exemptions or other reductions (fiscal benefits) that the taxpayer may apply in his/her carbon tax declaration. Checks need to be made if the requirements are duly met (e.g. possibility to deduct certain amounts from the tax to be paid because of the use of clean technologies, or ask for reimbursements).
- Administration of reducing the facility's tax-burden if other market features such as crediting or emission offsetting schemes are applied. Such features reduce the facility´s tax-burden by reducing emissions in third party facilities. Typically, these schemes are based on some form of

[136] KPMG, 'Carbon Tax: A Burning Issue' (February 2019) <https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/tnf-south-africa-feb25-2019.pdf>.

[137] The point of regulation, that is when the tax will be due, has been discussed in section 6.2 of Chapter 4A. As further outlined there, in particular the Fuel Approach gives the policymaker different choices – based on national preferences and conditions – as to when in the production and distribution chain of fuels the taxable event should be established in the tax law.

[138] Additionally, some legislators may indicate other person liable as a warrant for the tax debt, and administrative procedures should be applied accordingly (jointly and severally, or in a subsidiary manner). E.g. if the designated taxpayer is who emits the taxed pollutant substance and does not pay the tax due; then the owner of the facilities or activities that are sources of emissions could be also declared liable (as a sort of personal guarantee) to be able to recover the carbon tax.

compensation or payment to both tax and/or non-tax liable entities and require some emissions' reduction verification system by the authority[139].

- Control mechanisms and tax enforcement regime (penalties in carbon taxation do not present any speciality and usually can be referred to the general applicable regime).

43. Some of these features need to be dealt with in the initial phase of the tax design, as they relate to the very essence of the tax and determine how well it will meet its declared objectives. This is the case with taxpayer and the taxable event, the tax base and tax rate[140], or the interactions with other instruments[141]. However, there are many design elements that will, inevitably, be resolved at a later stage during the implementation phase. These elements are further discussed below.

44. Different jurisdictions have adopted different practical solutions when addressing these core elements. Chile and Sweden are taken here into consideration as examples, because they have, respectively, opted for the Direct Emissions Approach and the Fuel Approach. Irrespective of the approach chosen, administrative issues are always **key to the success** of a carbon tax, as their particular case studies show.

45. In the table below a comparison is made of the main design features of the carbon taxes with implications on the administration in Sweden (the Fuel Approach) and in Chile (the Direct Emissions Approach).

**Table - Comparison of approaches to administration of carbon taxes: Sweden and Chile**

| | **Sweden – Fuel Approach** | **Chile – Direct Emissions Approach** |
|---|---|---|
| **Taxable event** | When fuel leaves tax warehouse, operated by an authorised warehouse keeper (either consumed by the warehouse keeper in his own business or sold to someone who is not an authorised warehouse keeper) | The emissions at the facility level |
| **Taxpayer** | Authorised warehouse keepers* (fuel distributors or undertakings consuming large amounts of fuel) | Operator of facility with boiler and turbine with an energy potential of 50MW or more ** |

[139] In the administration oft the offset, for instance, when the mechanism may be triggered by the reinvestments in clean energy processes, they have to be verified. If they were implemented badly, the tax base would be eroded and no environmental benefit would be produced. This type of experiences can be found in Colombia and Costa Rica.

[140] All of them have already been discussed in Chapter 4A.

[141] More details on the possible interactions can be found in Chapter 7 (i.e Emissions Trading Schemes, subsidies, etc.).

| | | |
|---|---|---|
| **Tax base** | Fossil fuels | $CO_2$ emissions |
| **Tax rate** | In volume or weight units (litres, tons), calculated based on average $CO_2$ emissions from each fuel type | US$5 /$CO_2$ tons |
| **Public body in charge of administration** | Tax authority | Tax authority and Ministry of the Environment |
| **Declaration period** | Monthly | Facilities are required to report their respective emissions quarterly to the environmental authority, but submit a tax declaration annually, based on the reported emissions. |
| **Information given in tax declaration** | Amount of fuels (litres, tons) that left the tax warehouse during the declaration period or was consumed by the warehouse keeper himself | Emissions, provided by the Environmental Authority. The emissions report to the environmental authority requires additional information to verify that it is accurate |
| **Administration of tax exemptions (e.g. for a special activity, special sector)** | Deductions in declaration, if relating to warehouse keeper's own consumption; reimbursement application to tax authority in other situations (fuels are bought taxed) | No exemptions, however, power energy facilities who are regulated under formal contracts in the electric energy system have rebates associated with their electric generation tariff law |
| **Additional market mechanisms or other forms of crediting through offsetting mechanisms** | | None exist at present, however a recent tax reform (Tax Law 21.210, February 2020), contemplates crediting through an offsetting mechanism by third party emitters. The Ministry of the Environment has yet to publish the secondary legislation to make this innovation operational. It is important to point out that these schemes require an additional administrative burden since the Technical Agency must verify emission reductions. Moreover, if non-tax liable entities are recognized, in practice the tax base is broadened and the average tax-rate reduced. |

| | | |
|---|---|---|
| **Control mechanisms** | Check volumes declared by taxpayer (and related transactions) according to general tax auditing procedures. | Both the environmental agency and the tax authority can inspect emissions, but at present there is no independent verification system |

* While normally the taxpayer is an authorized warehouse keeper the system also, more rarely, allows for other operators to pay tax on a single consignment of fuels.

** As of February 2020 the tax Law 21.210 reformed the taxpayer based on an emissions threshold. However, the new system will be implemented once secondary legislation is adopted (probably in 2021-2022).

## 3.3. Considerations regarding detailed administrative regulations to manage the carbon tax

*Summary:*

Administrative Regulations

These are important aspects related to administrative regulations: consider their nature, timing, proportionality, accurate content and its communication. Do not forget to provide criteria for registration, declaration and book-keeping.

Additional Hints For Carbon Tax Administration

- Explore and make alternative use of data already available and to the extent legally permissible[142], though collected for other purposes.
- Maximize the use of existing administrative systems, allowing wise flows of information and providing place and time for foreseeable beneficial interactions.
- Incorporate carbon tax onto existing legislation to adjust the interplay with the provisions dealing with administrative issues.
- Reinforce cooperation with environmental bodies when using a Direct Emissions Approach, safeguarding data protection. It will also contribute to an increased effectiveness in reporting and monitoring emissions for other than tax purposes and would thus give co-benefits to society.

46. Once the basic carbon tax legislation is in place, in most cases, additional detailed administrative regulations are required. The power to decide such regulations is often based on delegating provisions in

[142] Data protection issues should be taken into account and assessed. If necessary, a change in the legislation in force could make it permissible.

the tax law (delegated acts) or may follow directly from the national constitution[143]. Their **nature** will depend on the body that enacts them and their effects will vary depending on whether they are published or not.

47. From a **timing** perspective, these administrative regulations or information circulars should be drafted and finalized as close to the finalization of the underlying legislation as possible, in order to provide the additional administrative clarity and **certainty** necessary for taxpayers.

48. This implies considering the time spent and the management effort demanded to administer any tax, both seen from the public and business perspective. Making proportionate requirements for the administration of a carbon tax will lead to its better acceptability by the taxpayers, and it also will help the tax administration to render a better service. It is important to avoid unnecessary workloads for taxpayers as well as for tax officials (by taking advantage of digitalisation when possible).

49. In order to ensure that the administration of a new carbon tax will work smoothly, taxpayers need **accurate information on their responsibilities with respect to** the carbon tax legislation and how to perform those tasks in detail. While there are variations across jurisdictions in the way this information is passed on and by whom, it is fair to say the prevailing way would be for the tax authority to give this information.

50. Information can be shared with taxpayers through direct contacts, which may be feasible if the taxpayers are a small number of companies or already are well defined, e.g. registered facilities to be covered by a Direct Emissions Tax or if a Fuel Approach carbon tax is introduced to the same group of taxpayers that already are responsible for handling another excise duty of the same fuels covered by a carbon tax. A more common approach would, however, be to **communicate** general information via web sites and other public communication tools, which may be complemented by individual company-by-company basis at later stages of tax collection and auditing.

51. The administrative regulations can include the following **issues** (most of them are not different as compared to other kinds of taxes):

- Criteria for registering taxpayers and the associated timeframe for registration.
- Various forms, such as tax declarations and applications for tax reimbursement (if applicable).

[143] This kind of secondary legislation often relates to measures the tax authorities normally are very familiar with when dealing with other kinds of taxes. The way these more detailed provisions are decided varies between jurisdictions. Lower levels of Government usually decide these more detailed provisions. Examples include Government regulations, decisions or decrees or provisions laid down by the relevant body in charge of the tax administration. Often a combination of them is found.

- Information that taxpayers need to include in each declaration.
- Period to file the tax return (e.g. regular dates for its presentation, and determination in case the activity starts later or finish earlier). Possible payment plan (e.g. by instalments fractioning the amount to pay in a given period) and acceptable payment methods. Deadlines may vary depending on the traditions in the jurisdiction (declarations may be required after a month, a quarter of a year, or even yearly).
- Specific book-keeping obligations and records that need to be maintained and the length of time they need to be maintained by the taxpayer (commensurate with the statute of limitations) in order to make them available if a more in-depth audit takes place[144].

### 3.3.1. Administrative issues in a Fuel Approach and the Swedish example

*Summary:* Relevant Details in A Fuel Approach In Accordance With The Swedish Experience

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|---|
| Consider thresholds for taxpayers' registration. Try to combine time and forms in declarations to lower costs when taxes may have the same tax base. Count on environmental expertise occasionally (e.g. when granting exemptions) and allow tax authority to focus on volumes. Explain if guarantees are required and book-keeping obligations. |

52. Some administrative issues mainly of interest in the Fuel Approach, are dealt in the following subsections while analysing the Swedish example.

#### *3.3.1.1. Warehouse keepers and registration*

53. The tax suspension arrangement following EU law and thus applicable in Sweden has been described above (see section 3.1.2 in this chapter). A key part of that system is the authorisation of companies handling energy products as taxpayers (so called warehouse keepers). In order to reduce the administrative burden on the tax authority, it is possible to introduce **thresholds** regarding procedural aspects either in the emissions approach or the fuel approach (e.g.

[144] Fiscal control is an essential part of any tax system. The way control mechanisms are administered differs between jurisdictions. However, it is more likely that the variation in control is linked to fiscal traditions in the jurisdictions rather than to any special characteristics of a carbon tax. Also, some jurisdictions tend to rely to a large extent on book-keeping checks, while the fiscal control in other jurisdictions more generally includes checks of the premises where the tax liability occurs. The degree of digitalization of tax reporting also varies across jurisdictions. Many developing countries are adopting digital tax declarations systems, which can significantly facilitate the tax administration if extended to cover also a carbon tax. Labour resources can thus be concentrated on tax control in the forms of tax audits and spot-checks.

for registration or reimbursement). In fact, this can relate to companies, which may apply to be registered as taxpayers (especially if large consumers can register as taxpayers and can receive and store goods under tax suspension regimes). Or eventually it could be decided that only the tax paid above a certain amount would be reimbursed (even if the fuel is used in an exempted area). There is need to strike a balance between the administrative burden and fairness, or treating small and big operators in a similar way. In terms of administrative control, it would be preferable if the tax collection system could be designed in a way that limits the number of taxpayers.

54. Out of 900.000 registered business companies in Sweden, only around 300 companies are **registered taxpayers** for the carbon tax (so called warehouse keepers working under EU harmonized rules), mainly fuel distributors selling taxed fuel to end-consumers. The warehouse keepers are obliged to store fuels in specific premises which need to be approved as storing facilities (tax warehouse) by the tax administration. The tax authorities decide if a company may be granted a **warehouse keeper status**, depending on several criteria, the principal of which is economic situation, and being able to put forward a sound and reliable business idea. The possibility to register as taxpayers in Sweden has also been extended to large consumers, normally engaged in industrial activities. They can store fuels under the tax suspension regime and declare the tax once the actual consumption has occurred, thus avoiding negative liquidity effects.

#### *3.3.1.2. Declaration and book-keeping*

55. 55. The Swedish carbon tax base covers the **same fuel as the general excise duty** on fuels (named as energy tax in Sweden). The two taxes are handled in the **same tax declaration forms** by the same taxpayers under basically the same administrative rules. This strategic option greatly facilitates the tax administration and makes administrative costs low. The administration costs for the Swedish Tax Agency amount to 0.1 per cent of the total revenues from energy and carbon taxes[145].

56. 56. There are certain exemptions from the carbon tax, which mean that a zero tax or a lower tax than the general tax level will apply. Such full or partial exemptions currently apply to non-fuel use of energy products as well as in parts of the manufacturing, agricultural and railway

[145] Hammar, H.; Åkerfeldt, S.: *$CO_2$ Taxation in Sweden – 20 Years of Experience and Looking Ahead*, 2011. Available at the link: https: //www.globalutmaning.se/wp-content/uploads/sites/8/2011/10/Swedish_Carbon_Tax_Akerfedlt-Hammar.pdf. [accessed 3 April 2020].

sectors and have in the past also covered other areas, such as the mining industry. There are different ways to administer these exemptions. A taxpayer can make a deduction in his tax declaration if the fuels have been consumed by him for a purpose that is tax exempted. This system ensures that the taxpayer will not face liquidity constraints which would be the case if he had to pay the tax and later ask for a reimbursement. If a company operating within a tax exempted sector is not an approved taxpayer, he must in most cases buy the fuel with tax included in the price and later ask for a tax reimbursement from the tax authority. In some specific cases, where the risk of fraud is deemed to be minor, it is although possible for a taxpayer to deliver non-taxed fuels to a company not being an approved taxpayer[146]. Such a delivery requires that the recipient holds a special approval by the tax authority.

57. 57. A gross declaration is made, which means that deductions are made for deliveries or own use for certain tax-exempted areas. As mentioned above, such deliveries need to be to a recipient who has received a special approval by the tax authority) to be able to receive the fuels without tax being charged. If the end-consumer buys the fuels fully taxed, he needs to ask for a tax reimbursement at a later stage from the tax authority, upon showing that the fuels have been consumed for a tax-exempted area.

58. 58. The Swedish energy tax and carbon tax declaration is filed once a month and the warehouse keeper supplies lump-sum information of the amount of fuels that left the tax suspension regime (by own consumption or deliveries to a company or individual who is not a taxpayer), for which tax has become chargeable during that month. The required data are typically found in the taxpayer's ordinary **book-keeping**, but the Swedish legislation also lays down specific requirements for stock records to be kept by the warehouse keeper. The Tax Agency issues regulations on how these requirements are to be followed in more detail. Taxpayers are further required to keep proper records of all individual transactions, enabling the Tax Agency to do more in-depth checks of the book-keeping at a later stage.



[146] The fuels are in this situation delivered outside the tax suspension regime. The handling of fuels within a tax suspension has been further described in Chapter 4A as well as above in this chapter.

#### *3.3.1.3. Tax calculation and tax benefits*

59. 59. How to **administer** possible areas of **tax reductions or exemptions**? Should a reimbursement scheme be introduced? What data must the applicant provide in order to be granted a reimbursement? Could a taxpayer by law be entitled to make deductions in his/her carbon tax declaration also for fuels to be used by others for specific purposes (based on some kind of prior authorization, such as use for industry or agriculture)? Should specific considerations be made with respect to certain types of fuels (e.g. biofuels)?

60. 60. In the Fuel Approach, as previously pointed out, the tax authority does not require specific emissions data reported from a facility. The tax administration only needs to calculate and audit the **taxpayer's amounts of fuel used or sold**. This is a task which tax authorities are normally familiar with. The need for further expertise may, however, be more significant if a jurisdiction chooses to implement exemptions or reimbursement schemes, e.g. for businesses performing a certain environmentally-friendly activity, carbon capture and storage, etcetera. The policymaker must acquire relevant data (such as average emission factors, type of fuels and, in some cases, production processes) to **determine carbon content**, set the formula for calculating the tax and transform it into the weight or volume units used to lay down the tax rates in the legal text. Once that is made, it is straightforward to apply the carbon tax and calculate future tax rates changes[147].

#### *3.3.1.4. Securing the payment of the tax due*

61. 61. A balance is sought between promoting flexibility in the commercial movements and, at the same time, assuring compliance when it comes to the payment of the tax due. In Sweden, the registered taxpayers (authorised warehouse keepers) are obliged to **provide a guarantee**, following mandatory EU regulations. This provides a secure and tested system for ensuring that tax obligations are met. The fuels must be stored in the specially approved tax warehouses and the warehouse keeper must leave security to cover potential losses in storage or transport between tax warehouses. A financial guarantee (e.g. a bank guarantee to ensure proper tax collection) for movement of fuels as well as for 10 per cent of the fuels stored on average for one year is required

[147] See Chapter 4A, where the calculation of the tax rates is described in detail.

in Sweden. The purpose of the guarantee is to enable the tax authority to claim it in case of non-payment of a tax debt.

#### *3.3.1.5. Compliance control and audits*

62. In order to avoid fraud, some penalties may reinforce the violations under the different approaches. In a Fuel Approach, the **volumes** must be checked. Here, anti-fraud and control measures might also need the legislation to allow for checks with others than taxpayers (such as the companies who have bought goods including tax from a taxpayer). This is not different from other kinds of taxes such as VAT, with which controls could be coordinated.

63. Sweden is an example of a country where the tax administration relies on book-keeping checks, which has enabled low administrative costs for both the tax authority and the taxpayers while maintaining fiscal control. This also happens with the carbon tax following the Fuel Approach. The taxpayers provide lump sum data in their monthly declarations, and individual transactions need to be recorded in the taxpayer's books to be available if in-depth auditing is eventually performed. The tax authority performs basic computer-based **control** of the tax declarations and further audits are handled on a risk analysis-based selection. Basic audits include e.g. comprehensive checks of tax declaration data and annual financial reports. In-depth audits may include visits to the taxpayer's premises and include checks of book-keeping, including individual transaction checks with customers, checks of anti-fraud systems at warehouses. Often such in-depth audits include checking other taxes, such as corporate tax and value added tax. Computer support is used as much as possible in the Swedish fiscal controls.

### 3.3.2. Administrative issues in a Direct Emissions Approach and the Chilean example

*Summary:* Relevant Details In An Emissions Approach In Accordance With The Chilean Experience

| |
|---|
| Define liable entities in terms of an environmental or technological criterion monitoring, pay attention to reporting and verification systems. Clarify the roles of the competent public authorities. |

64. In a Direct Emissions Approach, secondary legislation is likely to cover a wider area of measures. The key issue in the design and implementation of the Direct Emissions Approach is putting in place the institutional infrastructure to implement a monitoring, reporting and verification system to capture relevant facility level emissions data[148]. While the Fuel Approach can usually take advantage of the existent tax

[148] In the Chilean experience, the MRV is a subsystem of the institutional infrastructure and refers exclusively to the system that captures and verifies emissions data. The institutional infrastructure refers to the comprehensive institutional structure that regulates the responsibilities, procedures, protocols and practices to administer the carbon

revenue institutional infrastructure, the Direct Emissions Approach must develop a new one, albeit in the context of the existing institutional infrastructure of the jurisdiction where the tax is implemented.

65. Despite its name, the Direct Emissions Approach does not necessarily require emissions measurement at the facility level (emissions results can be measured, but also be based on calculations based on average carbon content from fuel volumes). What is necessary is **facility level reporting**. Facilities can monitor their emissions through various measurement strategies, monitoring emissions through end of pipe technology, such as Continuous Emissions Monitoring Systems (CEMS), or estimating emissions through emission factors and using energy inputs. Therefore the Direct Emissions Approach may seem more difficult to implement because it may be assumed that direct measurement is required, but this is not necessarily the case if monitoring is carried out through alternative means. Although this initially will be more costly, since a new Agency or, at least, a new reporting system is necessary, environmental emissions reporting at the facility level will serve multiple policy objectives.

66. Thus, a **monitoring, reporting and verification system** (MRV) will need to be developed at a facility level before implementing the carbon tax. The complexity and costs will depend on the infrastructure already in place in the jurisdiction following national or international emissions reporting obligations. More accurate reporting systems will be essential when a system used for international reporting is to be expanded to fill the needs of a well-functioning carbon tax administration.

67. The process of introducing a carbon tax may also entail expanding and **strengthening the administrative capacity**, particularly of environmental agencies, establishing protocols for determining procedural responsibilities, creating more robust information systems, and improving inter-ministerial coordination. In this regard, the Chilean experience provides a clear example that an emissions-based taxation strategy can be implemented in way that is coherent, administratively feasible and at low cost.

68. Let's explain the Chilean case, where the MRV system is a key component of the institutional infrastructure for implementing the carbon tax, as previously mentioned. It is made up of at least four components: the registry of liable entities/taxpayers, which necessarily requires a broader survey of facilities that may be subject to the tax; the measurement (M), regulated under Government guidelines for emissions monitoring and quantification; reporting (R), which stipulates guidelines for emissions reporting; and verification (V), covered under regulatory verification guidelines in the case of third party verification or enforcement in the case of government verification.

tax. This is constructed through a series of laws, regulations and directives as well as the relations across several public and private agencies.

#### *3.3.2.1. Liable Entities, registration, and declaration*

69. Under the Direct Emissions Approach, many jurisdictions establish emission thresholds to determine from what emissions' level a facility is liable to pay tax on its emissions. Typical thresholds are 10 or 25 thousand tons of $CO_2$ a year. The problem with this approach is that the Government has to set up the reporting system before making facilities liable; only after facilities start reporting will it be possible to determine if they have passed the legal threshold and, therefore, are liable for paying the emission tax. This may take considerable time.

70. Another approach is the one taken by Chile. It established **technological criteria** to determine which facilities were liable, rather than a threshold of liable emissions. In the Chilean example liable facilities are defined as those that have boilers and turbines with 50 or above MW potential capacity. This identifies only the large installations, which have the expected greatest emissions. Once the liable facilities have been identified and are formally registered, they are liable for all their emissions regardless of the amount. The advantage of this approach is that the liable facilities can be clearly identified without recourse to emissions monitoring. Furthermore, the burden of the reporting is placed on the facilities that are liable. They are interested in developing the most accurate reporting system in order to reduce their tax burden. Finally, the tax can be operational immediately without waiting for a long period of establishing a reporting system.

71. Depending on which entities or facilities are required to pay the tax, the authorities will require a system to register them. The **registry** of liable facilities is a key element in the foundations of the MRV system. It identifies the facilities that may be subject to the tax. The law establishes the criteria that all the individuals and legal bodies meet to be liable.

72. Liable entities will be defined in terms of an **environmental or technological criterion**, either the emissions threshold (e.g. referred to yearly emissions) or a specific characteristic associated with the facilities affected (e.g. use of a certain technology). The tax legislation must give authority to a specific agency to identify and register the liable facilities. This can be the Ministry of the Environment, but it will probably depend on the role of different Agencies in the specific jurisdiction implementing the carbon tax.

73. Detailed regulations will include the specific **steps** or system necessary to ensure that liable facilities register, as well as the **sanctions** for not registering or giving false or insufficient information. The relevant information should include data on the facility, owner or operator, but above all the technology and processes in order to verify that the emissions data is consistent with the fuel consumption or load capacity, among others.

74. Once the entity has registered, the Agency must decide whether the entity is liable. This may involve checking whether it uses certain technologies, as in Chile, or whether its annual emissions surpass the previously determined liability threshold. However, this is only for enforcement purposes; facilities are ultimately responsible for determining whether or not they are subject to the tax, thus, as with other taxes, placing the burden of **tax declaration** on the liable facility.

#### *3.3.2.2. Emissions monitoring and available quantification methodologies*

75. Once liable entities/taxpayers have been registered, an MRV system must be put in place in order to capture the emissions data. Each facility has to report emissions. The authority must establish different **reporting and measurement protocols** for the liable entities. This will **depend on the sector, capacity, and type of technology**. It should be consistent with other existing regulations. For example, large energy installations may already have other legal requirements to put continuous emissions monitoring system (CEMS) in place. These monitoring devices can capture $CO_2$ data and they can report through the same system. However, these systems are expensive and, if not adequately managed, may be imprecise. Other facilities may prefer to report fuel data and estimate emissions through emission factors. In any of these ways, facilities are making a legally binding declaration of their emissions, which has a direct impact on their tax lability. For example, in the case of Chile initially 11 methodologies for emissions quantification were proposed for the facilities to choose how to report their emissions.

76. The liable facilities must implement the emissions quantification methodologies determined by the protocols of the regulating agencies. These may be difficult and capacity building may be necessary. In general, there are three types of measurement approaches that may vary in different sectors or technologies. These are:

(a) *Sampling and measurement*:

77. This comprises the direct quantification of emissions concentrations, using measurement equipment installed at the facility. Both sampling and continuous measurement are among quantification options, including CEMS. CEMS provides hour-by-hour emissions averages over the course of the tax period (e.g. a year).

(b) *Discrete sampling*:

78. Monitoring equipment is used to take a sample, which is then analysed in a laboratory or on site. This method is used to determine output concentration and representative flow rate at the time when the measurement is taken.

(c) *Estimation*:

79. This method comprises the indirect quantification of emissions using emission-factors (for the specific production process in question) and annual activity records (such as operating hours and fuel consumption).

#### *3.3.2.3. Emissions reporting and the roles of the public authorities*

80. Once the facility has chosen the methodology to calculate its emissions, it must report them **periodically**. The emissions reporting process should be based on pre-established guidelines that fix the conditions and **standards** to be met. The tax-liable facility must therefore submit an emissions monitoring or estimation report, in accordance with those general guidelines stipulated by the relevant authority (what, when, where and how to report, etc.). The authority must decide when to require this reporting (which may be every year, or other time periods). The moment will depend on, in turn, when the tax is liable. Reporting can be carried out through various platforms (from paper reporting to digital reporting) and **security** is important, since emissions are directly related to the liable entities tax burden.

81. A jurisdiction choosing a Direct Emissions Approach will still in most cases leave the administration of the carbon tax to the **tax authority** in charge of administering other kinds of taxes in its territory. However, the environmental agency will oversee the actual monitoring and verification of emissions from the facility and report this information to the tax authority. This establishes a different institutional relationship between agencies. It requires agencies such as the tax authority, Ministry of Finance and Ministry of the Environment among others to establish a **permanent dialogue**[149]. Although this may be initially difficult and many conflicts may arise, particularly in the initial phase, ultimately it will benefit all institutions since there will be a better understanding of the objectives and of the carbon tax design. Furthermore, the different Agencies will understand the restrictions and commitments of the other institutions involved.

82. The tax law can be designed in a way that the taxpayer pays the tax based on the amount of emissions given by a certificate of emissions issued by the competent supervising environmental authority. This would mean that the tax authority does not need to enter an area where their officials have no technical competence. The policymaker could also choose to focus all the administration relating to the liable facilities to the **environmental body**, making it in charge of administering the tax as well as all the monitoring, reporting and verification. And, quite obviously, there are a variety of alternatives in how to **distribute the responsibilities to different agencies** in a way that the policymaker decides is most

[149] It is most likely to be the general tax authority that administers the tax, but nothing would prevent a jurisdiction from actually deciding that the environmental agency also be in charge of the tax collection. In such a situation, someone, as a matter of terminology, could probably call the environmental body a tax authority too.

appropriate in the relevant jurisdiction. Anyway, information flows through clear channels amongst them are important. Even as their roles are being set out, there is need to ensure that the mandates of all the agencies are clearly defined to avoid a situation whereby there are overlapping functions as these could give rise to confusion and conflicts.

#### *3.3.2.4. Emissions registry and verification*

83. In the Direct Emissions Approach with facility level reporting, **verification** is necessary, and this requires setting up the institutional framework to both register liable facilities or installations and establish a periodic reporting system. This may be carried out by Government Agencies through usual enforcement and compliance practices, or by third-party verification. These verification or **certification** agencies must be registered with the competent authorities and must follow the appropriate guidelines and protocols (established by the Government). Once emissions are reported the environmental or technical agencies in charge of overseeing the emissions verify and consolidate this information. After verification or certification, they are sent to the tax authority. Likewise, the tax authority places the responsibility for determining emissions on the liable entities, and their verification on the Environmental Agency.

#### *3.3.2.5. Tax calculation*

84. The tax authority uses the information provided by the environmental authority to calculate the taxes payable.

## 3.4. Ex-post evaluation of a carbon tax

*Summary:* FACILITATE THE EX-POST EVALUATION

| |
|---|
| To improve the carbon tax design and administration set bodies, methods and measures to consider possible changes upon feedback received from different stakeholders and strongly enhance the cooperation in the international field |

85. While the pure administrative design is a pre-condition to be able to implement a carbon tax, it is also advisable to identify early the criteria to evaluate how well the carbon tax is performing, considering the need for further development and the opportunity to make necessary **changes to improve** its design. It is an on-going process to ensure a well-functioning carbon tax scheme is efficiently administrated and fit-for-purpose. If the carbon tax introduction has not been preceded by a comprehensive public consultation, the need for ex-post evaluations may be even more necessary, to avoid criticism on the goals and risk of institutional mistrust by the civil society.

86. For example, the Swedish carbon tax has been in force for close to 30 years and legal changes – minor or major– have been made more or less every year since its introduction. Such changes have included a wide range of **different measures**: the tax rate, the areas covered, the full or partial exemptions and the administrative procedures (e.g. conditions for approval to act as a taxpayer or level of thresholds for tax reimbursements). Guaranteeing that tax is properly collected with no major tax evasion, making sure that the legislation is followed, is obviously a core aspect to take into account when doing ex-post evaluations of the effectiveness of a carbon tax. This ensures a well-functioning tax ready to meet its revenue objectives and consequently the environmental goals. Similarly, after three years of implementation Chile introduced important reforms to its tax, including making precisions with respect to definitions and other procedural aspects.

87. The **evaluation method**, from different points of view (environmental, revenues, administrative effectiveness and simplicity, anti-fraud design, etc.), is a matter for each jurisdiction to decide, based on the traditions in its legal order and the constitutional constraints. Certain permanent **bodies** may be assigned the task to evaluate a tax regularly at predefined times or upon a special mandate from the Government. A special commission for evaluation may also be appointed. In some jurisdictions this may be a task for the tax authorities, while in other it is considered vital that such evaluations are performed by external, independent bodies. For example, where it exists, the Court of Auditors may help with the control of efficiency of the administrative actions when reviewing the tax incentives granted for environmental purposes. In Spain, the Court of Auditors has published periodical special reports on the control carried out by the tax administration with respect to environmental deductions in the national corporate income tax.

88. The reasons for decisions in favour of changes in a carbon tax design and administration may depend on the **feedback** received from different stakeholders. Amongst them, the desire to increase the environmental impact of the tax, the lobbies arguing for special treatment for specific sectors, the necessary coordination with other measures to foster a transition to a low-carbon economy, as well as the changes the tax authority has found to be advisable during the course of their daily tax administrative work and public consultation initiatives.

89. A frequent dialogue with the relevant stakeholders may be beneficial to understand the needs and the improvements required in each sector. Ultimately, it can result in a modification of the administrative practices or the rules to make them more suitable in accordance with business life.

90. Aiming at applying similar tax provisions in jurisdictions closely connected due to geographical reasons or a major business interaction would be also desirable, as it would not only facilitate the administration for business but also limit the **risk** of carbon leakage[150].

91. In addition, the existing **international mutual assistance** framework for administrative cooperation (either at bilateral or multilateral level) could quite easily cover carbon taxes (just by expanding its scope). This would allow the State parties to these agreements to realise how these environmental regulations are applied in practice by other jurisdictions (by making use of the possibilities to exchange of information relevant to determining the tax debts or collecting them).

92. Further, the discussions carried out to assess carbon taxes in different **global forum** (such as the UN, the World Bank, or the IMF) in line with their joint efforts towards the achievement of the Sustainable Development Goals, would be very useful.

## 4. Final remarks

93. In the implementation of a carbon tax, the role of the involved competent authorities should be clearly stated. In addition, attention should be paid to inter-administrative cooperation relations (particularly in cases of fiscal federalism or regional groupings). Awareness should be also raised, as public consultations and information campaigns may be beneficial to improve administration. The administrative regulations should provide details of the core elements for good administration and promote compliance (i.e. with greater certainty in the measurement of the tax base, how to deal with filing and reporting obligations, etc.). The administrative requirements should facilitate ex-post evaluation either in a fuel or emissions approach.

| Topics to be addressed | Steps in the implementation |
|---|---|
| Organization of management tasks and relations between different institutions and stakeholders | Identify all the institutions and stakeholders and ensure necessary cooperation and communication |
| Specific issues in the application of a fuel or emissions approach | Assess the administrative resources needed with each approach |
| Administrative regulations | Develop legislation adequately to address the needs, while aiming at administrative simplicity |
| Continuous improvement | Set mechanisms (e.g. proportionate reporting requirements and adequate channels) to receive feedback on relevant features of the existing carbon tax design and administration |

[150] See Chapter 4C, and Chapter 2 about the need to use carbon taxation as widely possible.

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# Chapter 6: Revenue Use

[For approval at 22nd Session of the Committee]

## 1. Introduction

1. In general, proceeds from taxes become part of general government revenue and are used to fund the public expenditures as stipulated in the budget. Considering the potentially significant amount of revenues that could be generated from carbon taxes, governments, particularly in developing countries with typically low tax-to-GDP ratios in comparison with developed countries,[151] may want to consider the potential of carbon taxes as a source for domestic resource mobilization in combination with their principal role as an instrument for environmental protection.

2. There are several potential ways of using the revenue from carbon taxes productively. Given the specific political economy of carbon taxes, there are strong arguments for combining their introduction with some form of compensation targeted at vulnerable industries and households that face strong cost increases as a result of the tax. Also, reflecting the particular nature of carbon taxes as both tax and environmental policy instrument, governments may choose to use part of the revenues for environmental spending, either for the reduction of carbon emissions, or (more rarely) for other environmental purpose altogether. Finally, some countries, particularly in the OECD, have used revenues from carbon and energy excise taxes to finance changes in overall tax policy, lowering other taxes simultaneously (these are referred to as green tax shifts or environmental fiscal reforms), or for 'carbon dividends' (broad transfers).

3. Practically, allocating the revenue from carbon taxes to specific, pre-determined uses may come in the form of earmarking or political commitments.

4. Earmarking revenues entails legal prescriptions assigning revenues to specific spending purposes; these provisions can be included in primary or secondary legislation, depending on the country. While earmarking is standard practice in some jurisdictions, it is constitutionally prohibited in others.[152] Where earmarking is prohibited, the creation of special destination funds – environmental or other – may be an option for ring-fencing revenues to specific purposes, in cases where this is considered important for political reasons(see box 1).

5. Political commitments to specific forms of revenue use can come in forms of public statements on how certain amounts of tax revenues will be used, (e.g. as part of policy packages) but do not involve legal

[151] World Bank data, Tax Revenue (% GDP) https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS

[152] For example, in Chile earmarking revenues from any tax is prohibited by the Constitution, while British Columbia earmarked some revenues from their carbon tax to lower the energy costs of low-income households; and Denmark partially earmarked revenues for green spending, specifically for energy efficiency.

prescriptions. Politically committing revenue to specific spending purposes as part of policy packages can have much the same effect as earmarking, but with more flexibility and the possibility to change the allocation of funds as environmental or social priorities change. Political commitments can therefore be useful both in jurisdictions that allow earmarking, and in those that do not. However, such flexibility might also result lower political thresholds in shifting of revenue use as a result of changing political priorities of different governments, and therefore in increased uncertainty for the industry or for citizens.[153]

6. The rationale for specific forms of revenue use, as opposed to contributing to general revenue raising, often lies in the quest for public support for a carbon tax. Where strong constraints on revenue use are needed to strengthen public support for carbon taxes, e.g. because of low trust in government, earmarking becomes more appealing. More generally, there is evidence that clear choices and communication on revenue use that are well adapted to local circumstances have the potential to garner public support.

**Box 1. The potential role of specific purpose trust funds (environmental or other) in linking revenue sources to spending items**

When earmarking revenues is not an option, and depending on the country's legal framework, an environmental fund other specific purpose trust fund can still help to ensure that some funding is set aside for specific purposes (environmental or other) in the case that this should be a policy objective. Independent government agencies could play a similar role.

In general, environmental funds are investment vehicles to help mobilizing, blending, and overseeing the collection and allocation of financial resources for environmental purposes. The money allocated to the fund is usually earmarked to the specified purposes of its mission and kept separate from other funding sources such as a country's general budget. This can help to ring-fence the allocation of resources from the possible influence of political cycles, but also limits the flexibility of the budgetary process.

Revenues from carbon taxes and other environmental taxes can provide a source of funding to environmental funds, while allowing these independent structures to be long-lasting, to the extent they receive a steady incoming flow of revenue resources. This feature may be constrained by legal impediments within a country's budgetary law and may require legislative oversight to operate independently.

Many environmental funds (e.g. the National Fund for Environment and Climate Change (FONERWA) in Rwanda and the Environmental Investment Fund in Namibia) have their own internal governance structures that regulate how they operate and how the funds get to be employed. An internal governance structure can be an important step in keeping the revenues or general resources attributed to the fund separate from a country's general budget, and even allowing contributions from private sources in addition to the revenues from environmental taxes. The more transparent the fund, the more likely that it will be successful in harnessing private investors and international attention to sponsor promoted activities.

[153] For example, in the case where revenues from carbon tax are politically committed to supporting renewable energy power plants, a change in political priorities that reallocates such revenues to lowering energy costs for low-income households would create uncertainty for power producers; they might therefore have less of an incentive to invest in the first place.

**Examples of successful environmental funds**

As shown by these country examples, environmental funds can allow the employment of carbon tax revenues for environmental purposes.

- **Colombia:** 30% of the revenues accumulated via the carbon tax are geared towards a national environmental fund for coastal preservation (activities include protecting the erosion of coastal areas, fighting deforestation, monitoring forested areas, preserving water sources as well as other strategic ecosystems and fighting climate change).
- **Costa Rica**: the main source of funding for the Forestry environmental services program (FESP), is the revenue accumulated via a dedicated tax on the sale of fossil fuels. Over one third of the revenues accumulated via the tax, i.e. 5% of fuel sales, is earmarked to invest into forest reforestation, sustainable management of forests, and forest preservation (Chomitz, Brenes, & Constantino 1999).[154]

For more information about environmental funds, see UNDP (2017). Environmental Trust Funds. http://www.undp.org/content/sdfinance/en/home/solutions/environmental-trust-funds.html

## 2. Carbon tax revenue in perspective

7. While the first objective of carbon taxes is to provide incentives for cutting emissions, discussions on its timing and design may also be informed by the revenue that it could raise. This section discusses actual and potential revenue from carbon taxes, and compares to the revenue from excise taxes on energy use and from emissions trading systems.

### 2.1. Current carbon tax revenue

8. The World Bank's annual State and Trends of Carbon Pricing Reports track the adoption and continued application of carbon taxes and emissions trading systems across the world. In addition to key statistics on the price level and the base covered, the reports provide estimates of the total annual revenue and the total annual value of carbon pricing.

9. Table 6.1 collects revenue and value estimates from recent State and Trends reports.[155]



[154] Kenneth M. Chomitz, Esteban Brenes, Luis Constantino (1999) "Financing environmental services: the Costa Rican experience and its implications", The Science of the Total Environment 240, Elsevier, 1999. https://www.researchgate.net/publication/222497679_Financing_Environmental_Services_The_Costa_Rican_Experience_and_its_Implications.

[155] The table reports the revenues collected through carbon taxes and value of emission trading schemes (ETS), worldwide. While calculations for carbon tax revenue is straightforward (see chapter 4 for further guidance), the value of an emissions trading system is estimated by multiplying the number of allowances by the allowance price, whereas the value of carbon pricing is obtained from government budget documents. The value of an emissions trading is at least as large as the revenue that it generates, with the difference attributable to the allocation of free allowances and of permits below the auction price.

**Table 6.1 Revenue from and value of carbon pricing through carbon taxes and emissions trading systems, billion USD[156]**

| | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Revenue (carbon tax and ETS)** | 26 | 22 | 33 | 44 | 45 |
| **Value (carbon tax and ETS)** | 48 | 49 | 52 | 82 | 98[157] |

10. The table shows that *revenue* from carbon pricing – including both carbon taxes and emissions trading systems (ETS) – is considerably higher in 2019 than in 2015. The increase in 2017 and 2018 is mostly attributable to rising allowance prices in the European Union's ETS, but rising carbon taxes, notably in France and in Alberta, also contribute to the increase. The total revenue of 45 billion USD in 2019 is only slightly higher than in 2018 as EU ETS allowance prices stabilised in that year.[158]

11. The *value* of carbon pricing differs from revenues in that it measures the economic size of pricing systems, which is larger than revenues in case not all pricing policies result in public revenues. In practice, the main reason why value exceeds revenue lies in the free allocation of tradable emission permits. These permits have economic value but do not generate public revenue. As can be seen in Table 1, the value of carbon pricing is around twice as large as the revenue that it generates.

12. In 2019, 53% of *revenues* come from carbon taxes and 47% from ETSs. The share of ETS revenues is higher than in earlier years because of higher prices in the EU ETS, and its large weight in the overall ETS landscape.[159]

13. The 2015 State and Trends of Carbon Pricing report[160] breaks down the 2015 *value* of carbon pricing, estimating that it consists of 14 billion USD from carbon taxes (29%) and 34 billion USD from emissions trading systems (71%).



[156] World Bank State and Trends of Carbon Pricing Reports 2015 – 2019; https://www.worldbank.org/content/dam/Worldbank/document/Climate/State-and-Trend-Report-2015.pdf; https://openknowledge.worldbank.org/bitstream/handle/10986/25160/9781464810015.pdf?sequence=7&isAllowed=y; http://documents.worldbank.org/curated/en/468881509601753549/pdf/State-and-trends-of-carbon-pricing-2017.pdf; https://openknowledge.worldbank.org/bitstream/handle/10986/29687/9781464812927.pdf?sequence=5&isAllowed=y; https://openknowledge.worldbank.org/handle/10986/31755.

[157] This number is calculated from the downloadable Carbon Pricing Dashboard data - https://carbonpricingdashboard.worldbank.org/.

[158] World Bank. 2020. State and Trends of Carbon Pricing 2020. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/33809 License: CC BY 3.0 IGO

[159] Postic S, and M. Fetet, 2020, Global carbon accounts 2020, I4CE – Institute for Climate Economics, https://www.i4ce.org/wp-core/wp-content/uploads/2020/05/TarificationCarbone2020-VA.pdf.

[160] World Bank State and Trends of Carbon Pricing report 2015, footnote 15.

14. The high share of emissions trading systems in the value of carbon pricing indicates that these systems currently dominate the global explicit carbon pricing landscape in as far as incentives for cutting emissions (at the margin) are concerned. Carbon taxes raise relatively more revenue because of the common practice of free allocation of permits.[161]

15. To put the revenues from carbon taxes and emissions trading in perspective, Marten and Van Dender (2019)[162] also calculate the revenues from excise taxes on energy use. This comparison is meaningful because excise taxes on energy use implicitly price carbon, given the strict proportionality between emissions and fuel combustion for any given type of fuel. Even if the excise taxes were introduced for reasons unrelated to climate change, and even if the rates do not translate into uniform carbon prices or into prices that are aligned with climate damages or abatement objectives, these taxes are economically similar to a price on carbon. This is because they incentivize the reduction of fuel use and hence emissions (see OECD, 2018, and World Bank, 2019, for an elaborate discussion)[163]. Across the 40 OECD and G20 countries analysed, the revenue from excise taxes on energy use amounts to an estimated 420 billion EUR in 2016 – this is twenty times larger than the revenue from carbon taxes and emissions trading systems combined. Otherwise said, if the sum of excise taxes, carbon taxes, and emission permit prices is taken to be an effective price on carbon (an "effective carbon rate" in OECD terminology), then the revenue from effective carbon rates consists for 95.2% of excise tax revenue, 3.2% of carbon tax revenue, and 1.6% of revenues from emission allowances.[164, 165]



[161] Considering 40 OECD and G20 countries, Marten and Van Dender (2019: Marten, M. and K. van Dender (2019), "The use of revenues from carbon pricing", OECD Taxation Working Papers, No. 43, OECD Publishing, Paris, https://doi.org/10.1787/3cb265e4-en) estimate the combined revenue from carbon taxes and emissions trading systems at 21 billion EUR in 2016, consisting of 14 billion EUR of carbon tax revenue (33.3%) and 7 billion revenue of auction revenue (66.7%). These revenue proportions are opposite the value proportions, indicating the widespread practice in emissions trading systems of allocating allowances for free. " (Flues and Van Dender, 2017: Flues, F. and K. van Dender (2017), "Permit allocation rules and investment incentives in emissions trading systems", OECD Taxation Working Papers, No. 33, OECD Publishing, Paris, https://doi.org/10.1787/c3acf05e-en.)

[162] Marten, M. and K. van Dender (2019), "The use of revenues from carbon pricing", OECD Taxation Working Papers, No. 43, OECD Publishing, Paris, https://doi.org/10.1787/3cb265e4-en.

[163] OECD, Effective Carbon Rates 2018: http://www.oecd.org/tax/tax-policy/effective-carbon-rates-2018-brochure.pdf and WB State and Trends 2019 (chapter 5): https://openknowledge.worldbank.org/handle/10986/31755

[164] This also means that revenues from carbon taxes are twice as high as those from emissions trading, compared to the near equal split estimated in the Global Carbon Accounts 2020 in the OECD estimate for 2016. As noted, the share of carbon tax revenues is lower in 2019 than in earlier years because of rising emission permit prices in the EU ETS. Differences in country coverage may also matter. According to the Carbon Pricing Dashboard data, the revenue from emissions trading systems is one quarter of revenues from taxes and trading systems combined in 2016.

[165] See World Bank Carbon Pricing Dashboard for country data: https://carbonpricingdashboard.worldbank.org/

### 2.2. Potential carbon tax revenue

16. Carbon pricing presently raises less revenue than it would if the instrument were deployed more in line with its climate policy potential. Low revenues from carbon taxes are mainly attributable to low tax rates and narrow bases; several studies have tried to estimate what is the potential increase in revenue collection, should rates be set higher and bases broadened.[166]

17. Marten and Van Dender (2019) take into account the potential increase in revenues from carbon taxes in 40 OECD and G20 economies. Their estimate is short-run, meaning that they consider an increase in tax rates, but not the reduction in tax base caused by behavioural responses (i.e. they do not take into account that polluters reduce emissions to the extent that it is more convenient than paying the tax, even in the short run). According to their study, implementing a minimum carbon price of EUR 30/tCO2 (where pre-existing excise taxes, carbon taxes and emission permit prices are taken into account to calculate the required tax increase) would raise additional revenue worth 1.32% of GDP across the 40 OECD and G20 countries analyzed (0.72% for OECD only).

**Box 2: Price elasticity of demand**

The size of the change in energy consumption following a change in energy prices (whether induced by a carbon tax or other causes) is described by the price elasticity of demand. The own price elasticity measures the percentage change in the demand for a good or service following a percentage change in its price. A high (absolute) value indicates that the behavioral response to a given price change will be large, a small value indicates that it will be small. For example, an own price elasticity of the demand for gasoline of -0.2 means that at 10% increase in the price of gasoline triggers a reduction of the demand for gasoline of 2%.

Price elasticities are determined by various factors, including the untapped potential for using fuels more efficiently and the cost of tapping it, the availability and price of substitutes, and consumer knowledge. Hence, the price elasticity of demand can vary over time and geography, as well as by income level or even with the price of the good itself. For example, in chapter 4B, para 39, we discussed empirical studies that show that price elasticity of fuel products is higher in poor countries than in rich countries, meaning that demand reacts more strongly to price changes.

The price elasticity of demand of the fuels covered by a carbon tax partly determines the environmental effectiveness of the tax and the amount of tax revenue that it raises. By way of example, suppose that a household's demand for gasoline is 100 liter per month at a price of USD 1 per litre, and that its price elasticity of demand in the short run (e.g. a year) is -0.2. If a carbon tax were introduced which leads to a 10% increase in the gasoline price, i.e. the price is now USD 1.1 per litre. The demand for gasoline drops by 2% to 98 litre per month. The carbon tax revenue is 10 cent per litre, i.e. USD 9.8.

Demand is usually more price elastic in the long run than in the short run, because more options for changing behaviour become available. Suppose, in the previous example, that the long price elasticity is -0.4. In that

[166] The studies quoted below take into account the potential increase in revenues based on an increase in tax rate that would also result in a smaller tax base as polluters reduce emissions to the extent that it is more convenient than paying the tax.

case, over the long run, the 10% price increase leads to a 4% drop in demand, to 96 litres, and tax revenues are USD 9.6. Hence, over the long run, the abatement impact of a tax rises, whereas the revenue generated declines (even if it is still greater than in the situation where there was no carbon tax).

Consequently, to the extent that the price incentive created by the tax leads to stronger behavioral responses of households and firms over time, consumption of the taxed fuels will be reduced and along with it the tax revenue unless the tax rate is simultaneously increased. In practice, if carbon taxes were to be introduced and gradually increased, it can be expected that revenues would first increase and then start to decline over the span of one or two decades.

18. The 2019 IMF Fiscal Monitor[167], in contrast to the OECD study mentioned, takes into account behavioral responses (sector-elasticities) to carbon price increases. Table 6.2 summarizes the estimated impact on revenues of introducing a carbon tax of USD 25, 50 or 75/tCO2 for a selection of countries and across the G20. The tax increase is over and above existing taxes on energy use. The IMF estimates that a carbon tax of USD 75/tCO2 would reduce emissions by 35% in 2030 compared to 1990, which is sufficient to be on track for the Paris Agreement targets of limiting global average temperature increases to 2 degrees Celsius at most. For the G20, this tax would raise revenues worth 0.4% of GDP. Countries where current taxes are lower would collect proportionally more revenue.

**Table 6.2 Estimated revenue from carbon taxes, % of GDP, 2030[168]**

| | Revenue from carbon tax of $25/tCO2 | Extra-revenue from carbon tax of $50/tCO2 | Extra-revenue from carbon tax of $75/tCO2 |
|---|---|---|---|
| G20 weighted average | 0.7 | 0.5 | 0.4 |
| Russia (largest increase) | 1.7 | 1.4 | 1.3 |
| France, UK (smallest increase) | 0.3 | 0.2 | 0.2 |
| India | 1.1 | 0.7 | 0.6 |
| Indonesia | 0.7 | 0.6 | 0.5 |

19. The IMF and the OECD studies suggest that there is potential for considerable revenue increase over the next decades, particularly where carbon prices and energy taxes are currently low, and the base is narrow. However, they also indicate that higher carbon tax rates would likely not result in a deep structural impact on the composition of overall tax revenues of countries. Also, ultimately revenues should decline as the usage of carbon-based fuels declines. However, in the near to medium run, this should not prevent

[167] IMF Fiscal Monitor October 2019 https://www.imf.org/en/Publications/FM/Issues/2019/09/12/fiscal-monitor-october-2019

[168] Source: IMF Fiscal Monitor October 2019, Figure 1.3

countries from integrating carbon tax revenue considerations into their broader tax, climate and spending policy frameworks.

20. Recent OECD estimates of the carbon pricing revenue potential for a selection of developing countries show strong variation.[169] For Egypt, the combined effect of removing fossil fuel subsidies and raising carbon taxes to a minimum rate of EUR 30/tCO2 could generate extra revenue worth 4.5% of GDP. In Ecuador, the potential is around 3.7%, in Morocco close to 2%, and in Nigeria, Sri Lanka and the Philippines around 1%. Jamaica, Côte d'Ivoire, Guatemala, Dominican Republic and Ghana could raise around 0.5% of GDP from a carbon tax of EUR 30/tCO2. Uruguay and Kenya might raise around 0.25% of GDP. In Uganda and Costa Rica, the revenue potential is very limited and almost negligible.

21. The revenue potential differs among countries for two main reasons. First, there are substantial differences in pre-existing carbon prices. In Uganda, for example, where most fossil fuel use occurs in the road sector, prevailing tax rates are already above the low-end carbon benchmark. Second, the carbon intensity of energy use varies across countries. In countries that do not use coal at present, tax and subsidy reform, or even a simple ban[170] will provide incentives for skipping the coal phase in electricity generation and industry. According to the OECD analysis, candidate countries include Costa Rica and to a lesser extent Uruguay and Kenya. These estimates suggest that while rising carbon taxes can help some countries mobilize some revenue, the revenue potential is modest if compared to the total budget of most countries, and it is unlikely that countries will be able to adopt fundamentally different domestic revenue mobilization strategies following the introduction of a carbon tax.

## 3. Destinations of revenue use and considerations for designing policy packages

### 3.1. Options for revenue use

22. The use of the revenues from carbon taxes co-determines their net economic benefits (beyond the direct environmental benefit), affects their distributional impact, and can strengthen support for their introduction or increase. Given the often challenging political economy of carbon taxes, there are strong arguments for reserving and using parts of the revenue from the introduction of a carbon tax to provide compensation targeted at vulnerable industries and households that face strong cost increases as a result of the tax. Governments may also choose to use part of the revenues for environmental spending. Alternatively, some countries, particularly in the OECD, have used revenues from carbon and energy excise

[169] See OECD, 2021 (forthcoming), Taxing Energy Use for Sustainable Development. These estimates account for the estimated demand reduction following the price increase.

[170] Collier, P. and A. Venables (2014), "Closing coal: economic and moral incentives", Oxford Review of Economic Policy, Vol. 30/3, pp. 492-512, http://dx.doi.org/10.1093/oxrep/gru024.

taxes to finance tax shifts, e.g. changes in overall tax policy that combine higher carbon taxes with lower taxes on personal or corporate income (green tax shifts or environmental fiscal reform). A further option is to redistribute the revenue through transfers ('carbon dividends') that may be general or targeted to specific household types. Finally, carbon tax revenue can contribute to higher spending in general or to cutting debt.

### 3.2. Compensation for vulnerable industries

23. Carbon pricing increases costs, particularly in energy-intensive industries, and this can trigger carbon leakage (production moving to places with lower carbon prices) and reduce the ability of firms to compete internationally. These effects may need to dampened, and this can be done by using part of the revenue to compensate trade-exposed industries after the introduction of a carbon tax or other carbon pricing instrument (industry competitiveness concerns are discussed in chapter 3, section 4.4).

24. Different mechanisms are possible to address competitiveness concerns:

- Revenue-recycling measures: direct financial transfers to companies based on output or financial support for efficiency improvements;
- Measures that imply some loss of revenue and of environmental effectiveness: reduced tax rates and tax exemptions.

25. In order not to compromise the environmental objective of the carbon tax, two principles of designing mechanisms to address competitiveness concerns should be followed:

- Compensations should only benefit companies (or industrial installations) which are highly exposed to international trade and that face significant cost increases as a result of the carbon tax. Compensations should be designed in a way that maintains the incentive to reduce carbon emissions.

26. To satisfy the second principle, having companies pay the full tax rate and recycling part of the revenues to those companies based on their output or for supporting efficiency improvements are better options in comparison with reductions of the carbon tax rate or exemptions. If revenue recycling is not feasible, tax reductions or exemptions can be an alternative but this should be limited in time and phased out. Additionally, these measures should be granted only in combination with a conditionality for companies to achieve efficiency improvements.

27. When designing compensation schemes for affected industries, governments will inevitably be confronted with significant industry lobbying for expanding the circle of companies or installations and for more generous compensation. While it is important in principle to limit the circle of benefiting companies or installations to those exposed to international trade and to maintain the incentive for reducing emissions,

it may in practice also be necessary to strike a balance between these principles and the political feasibility of the carbon tax in light of industry pushback.

28. Instead of using tax exemptions or transfers, governments could also address the competitiveness concerns of industries through measures such as tariffs on imports of highly traded emission-intensive commodities.

### 3.3. Compensation for households

29. Carbon taxes, particularly if they include transport or heating fuels or fuels for electricity generation, result in a different relative burdens on households depending on their income.[171] A disproportionate burden on low-income households, or a reduction in energy affordability (irrespective of how the burden differs by income), may be unacceptable from a social perspective and reduce public acceptability of the tax.

30. To mitigate unwanted negative effects of carbon taxes on households, governments may choose to use parts of the revenue for compensating some (usually low-income) households for the price increase. Country experience with compensation mechanisms in the context of a carbon tax is scarce, but there is ample experience in the context of reforming energy subsidies and energy taxes, which can be built upon.[172]

31. Similar to compensations for vulnerable industries, mechanisms for compensating households should be limited to the households that actually need compensation and they should ideally deliver compensation without compromising the incentive of the tax to change consumption. Also similarly, households can be shielded from rising energy prices either through targeted transfers (revenue recycling) or through reduced rates or exemptions (forgone revenue).

32. In comparison with compensating vulnerable industries, it can be more difficult to design compensation mechanisms which actually reach the targeted households. This is due to two factors: the first one is, simply, that it might be difficult to understand which households are most affected by higher energy prices. Secondly, typical compensation measures such as tax deductions or tax credits might not be appropriate for low-income households, as they might not be obliged to pay tax in the first place. This problem is exacerbated where there is a large informal economy.

33. To avoid the second problem above, governments can choose to implement targeted transfers as redistributive mechanisms. Targeted transfers can take the form of cash transfers or near-cash transfers.[173]

[171] Potential distributive implications of carbon taxes are discussed in chapter 2, section 4.3

[172] Coady et al. 2015: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Unequal-Benefits-of-Fuel-Subsidies-Revisited-Evidence-for-Developing-Countries-43422

[173] An example is the National Fuel Allowance Scheme, a weekly cash payment to low- and fixed-income households which recycles carbon tax revenues in Ireland.

If a system to give direct cash transfers already exists and beneficiaries are already known and coincide with households that should receive compensation for increased energy prices, transfers from carbon tax revenues can be distributed by piggybacking on these systems. Targeted transfers can also be handed out conditional on specific behavior of the household (e.g. children going to school), pursuing other policy objectives in addition to redistribution. In the case of carbon tax revenues, conditionality can be kept or removed; and existing beneficiaries can be reduced or kept the same size.

34. Cash transfers or near cash transfers can be used to compensate households for the increased burden created by higher fuel prices, without reducing the incentive for increasing fuel efficiency or switching to low carbon fuels that is created by the carbon price. Near cash transfers or in-kind transfers directed at encouraging fuel efficiency or fuel switching would be even more effective in encouraging low-carbon behavior. Cash transfers are more effective from a social perspective when provided at regular intervals, for example as monthly dividends, to truly offset impacts on household income.

35. Sometimes, broad or universal cash transfers are used to compensate households after the introduction of a carbon tax (e.g. Switzerland, British Columbia) or the removal of fuel subsidies (e.g. Iran in 2010[174]). In the case of a carbon tax, this mechanism is also referred to as a carbon dividend. The benefit of such a compensation mechanism is the salience and the inclusivity of the compensation, which is usually seen to help the acceptability of the tax among broad parts of the society significantly. This is particularly the case if the dividend is disbursed first, before the tax is introduced. The downside of using carbon tax revenue for universal cash transfers is that this mechanism does nothing to improve the effects of the overall reform package on income distribution.

36. An alternative to cash-transfers can be the expansion of existing programs targeting low-income households (e.g. school meals, public works, reductions in education and health user fees, subsidized mass urban transport, subsidies for water and electricity connection costs) [175]. If transfers are not possible, alternative policy choices can be the granting of life-line tariffs, reduced rates for low-income households, or to provide vouchers.

[174] In 2013 and 2015, the government of India introduced a reform to LPG subsidies, whereby LPG was sold at market price and a consumption-linked subsidy is directed to the bank accounts of LPG consumers in scheme. The scheme aimed to reduce leakages by achieving a common market price for LPG and by channelling the consumption-linked subsidy directly to the bank accounts of LPG consumers (MoPNG 2013). Under the scheme, households buy LPG at the market price (instead of the subsidised price) and receive the subsidy directly into their bank accounts (following the purchase, for a maximum of 12 cylinders of 14.2 kilograms each per household per year).

This scheme was first launched on 1 June 2013 and subsequently expanded to 291 districts in six phases covering 17 million people (Nag 2014).

[175] For example, British Columbia uses part of the carbon tax revenue to grant non-energy related tax credits to low-income households, including a “children's fitness and arts” tax credit

37. Finally, pro-poor reinvestment of additional revenue can be an alternative, albeit not very targeted way of compensating low-income households.

### 3.4. Environmental spending

38. Carbon taxes are a revenue-raising instrument and an environmental policy instrument at the same time. While the environmental objective of the carbon tax is achieved primarily through changing the relative price of carbon fuel consumption, governments may choose to use parts of the revenues to further additional environmental objectives. This can strengthen support where the demand for more ambitious environment policy is high, and can be justified if spending needs for environmental policy priorities are not currently met.

39. In practice, there are examples of governments using revenue to finance environmentally related programs and projects, including promoting or subsidizing the use of renewable energies and low-carbon technologies, the conservation and protection of biodiversity, waste and water management, and other green programmes. Carbon tax revenues can also be used to fund energy efficiency and savings measures.[176]

40. Directing part of revenues towards promotion of low-carbon technologies and R&D can help address the issue of hard-to-eliminate emissions.

41. To reduce emissions, countries should aim at "filling-the-gap" policies, i.e. use revenues to address emissions that the tax would miss, while avoiding to reinforce behaviours that are incentivized by the tax anyway. For example, carbon tax revenues are often used to incentivize businesses to install solar panels; since many of those businesses would have likely installed the panels as a result of the tax anyway, it would not have been necessary to spend additional revenues to encourage them. The incentive would therefore be redundant, as the desired change of behaviour (for many businesses) would have already been stimulated by the tax; using carbon tax revenues to provide an additional incentive would be wasteful. "Filling-the-gap" policies, on the other hand, aim at targeting only those entities for which the tax would not be a sufficient incentive to change behaviour. With this approach, more revenues would potentially be available to spend to reduce emissions that would otherwise have been missed, in our example small businesses that might not have the necessary capital to install solar panels.

42. For developing countries, investing in R&D might not be a priority in general; to further environmental protection, they might opt for measures that directly impact citizens instead, such as expanding low-carbon public transport infrastructure; or expand the public electric grid with renewable

[176] Some examples include the carbon dioxide tax in Denmark, which uses part of revenues to fund business energy efficiency subsidies; the Slovenia emissions tax, where 1/3 of revenues are used for emissions mitigation;

energy. These direct measures would also contribute to increasing political acceptance of the carbon tax, as citizens would be able to appreciate the visible results of the policy.

### 3.5. Tax shifts

43. Revenues from carbon taxes can be used also to finance changes in the overall tax policy, e.g. by lowering other taxes simultaneously with the introduction or increase of carbon taxes. Typical examples include the simultaneous reduction in taxes on personal or corporate income (including social security contributions) or capital. In principle, also reductions on other taxes can be financed. The use of revenue from carbon or other environmental taxes to reduce other taxes is often referred to as a green tax shift or an environmental fiscal reform.[177]

44. The rationale for such tax shifts can be to improve the overall efficiency of the tax system. A more efficient tax system is one that raises the same amount of revenue at lower economic cost (i.e. with smaller economic distortions). While some taxes distort behavior, because the activity that is taxed becomes relatively less desirable (e.g. taxes on labor), others do not (e.g. lump-sum taxes). Pigouvian taxes like carbon taxes can reduce distortions in that they move the actual price of a consumed good (as a fuel in the case of a carbon tax) closer to the social cost of its consumption. Hence, in a country context where personal or corporate income taxes are high and where carbon emissions are priced at a level below the social cost, using revenue from carbon taxes to lower income taxes can move the tax system closer to overall efficiency of the tax system. While such tax shifts may be an adequate choice in high income countries where levels of income taxation are comparatively high, they may be less relevant – and less recommendable – for developing countries with comparatively low overall tax-to-GDP ratios and low levels of income taxation.

### 3.6. Communication of revenue use

45. When carbon taxes are introduced as part of a policy package and parts of the revenue are used to compensate vulnerable industries or households or for environmental purposes, the perception of the fairness and effectiveness of revenue use becomes an important factor for the political acceptability of the carbon tax. While the effects of the tax on the price of fuel products is usually felt directly by businesses and consumers as a more or less painful price increase, the (positive) effects of compensating measures addressing businesses or households or of environmental measures is often indirect and less salient. In this situation, deliberate efforts by governments to communicate and explain the design and purpose of the policy package including the use of revenue becomes an important factor for political acceptance of the tax.

[177] The Swedish carbon tax is a notable example of this mechanism. Due to relatively high revenues from carbon taxes, the country has been able to lower other taxes, including personal income taxes, labor taxes and social security contributions, operating a green tax shift.

Revenue recycling mechanisms may not be self-evident. Governments should communicate clearly, what purpose revenues are used for and how these purposes are meant to address negative competitiveness or fairness concerns or further environmental objectives.

46. Trust in government is a relevant context variable for choosing and communicating revenue use. The lower the trust in government, the more important the salience of compensation measures becomes, when the policy objective of using revenues for compensating affected households is to increase public acceptability. In countries with high distrust, very salient options for revenue use like uniform lump-sum or other cash transfers are the use of revenues that generates more public support for a carbon tax.

47. The labelling of a carbon tax can be part of a communication strategy. A 'fee-and-dividend' renaming (with lump-sum payments) has been found to be an effective labelling, when credibility of revenue recycling for households and firms is chosen to increase political acceptance.

## 4. Conclusions

48. While the first objective of carbon taxes is to provide incentives for cutting emissions, they also raise revenue. This chapter discussed several potential ways for using this revenue that are typically associated with the introduction of carbon taxes, namely the use of revenues 1.) for providing compensations for affected vulnerable industries; 2.) for compensating households, 3.) for environmental spending purposes, and 4.) for financing tax shifts. Of course, as a fifth way, which was not discussed separately in this chapter, tax revenue can also be used for financing additional spending or paying off debt.

49. The rationale for specific forms of revenue use, as opposed to contributing to general revenue raising, often lies in the quest for public support for a carbon tax. The use of revenues also co-determines their net economic benefits, affects their distributional impact, and can strengthen support for their introduction or increase.

50. There is no one-size-fits all solution or recommendation for carbon tax policy packages including revenue use. Instead, the right choice of revenue use depends on country circumstances including the pre-existing tax system, income distribution and consumption patterns, industrial structure and competitiveness, trust in government, understanding as well as acceptance of environmental taxes and environmental policy, to name the main ones. In the policy deliberation and design process leading up to a carbon tax, governments should be mindful of potential sources of political opposition towards the tax as well as key economic and social impact variables, assess the likely impact of different options of revenue use, and try to strike a balance between strengthening support and optimizing economic and distributional gains by choosing an appropriate form of revenue use or combination.

51. Practically, using carbon tax revenue for specific purposes can take the form of legal earmarking or political commitments. Earmarking is legally prohibited in some jurisdictions. When it is not possible, political commitments or concurrent measures can be used to direct revenues towards a specific priority. Where it is possible and where constraints on revenue are seen as conducive to strengthening public support for carbon taxes (e.g. because of low trust in government) earmarking can be advisable. Generally, clear commitments to a form of revenue use that is well adapted to local circumstances and their clear communication has good potential to secure public support.

# Chapter 7: Carbon Taxation: Interaction with other instruments

[For approval at 22nd Session of the Committee]

## 1. Carbon Tax to be considered in context

1. A carbon tax should not be considered, designed or introduced in a policy vacuum. Various rules and regulations that are already in place could have an impact on, or relevant interaction with, a carbon tax and its objectives. Some of these impacts could enhance or inhibit the effectiveness of the carbon tax, or even prompt additional administrative concerns about (and necessary requirements to) the implementation of a carbon tax.

2. When considering the introduction of a carbon tax, it is relevant to consider what other instruments are already in place or are considered for introduction, that could influence the effectiveness and goals of a carbon tax. Examples of these other instruments are energy or fuel taxes; emission trading schemes; or fossil fuel subsidies as well as different regulatory measures.

3. The effectiveness of a carbon tax will therefore not only depend on its design, but also on how the proposed carbon tax will interact with other known related policies and instruments. Policy interactions refer to how these policies achieve their independent objectives and may or may not have been conceived as a package. The objective of this chapter is to outline the main possible interactions between various instruments affecting the price on carbon (or carbon-generating energy); and to provide some options about how these interactions can be addressed when designing and implementing various instruments.

4. This chapter seeks to support policy makers on the following:

- To understand the significance of potential interactions between various policies and instruments that could enhance, or conflict with, the objectives of the carbon tax. Potential interactions should be considered dynamically, from the time the carbon tax starts to be designed until after the carbon tax is in place.
- To understand and look broadly at what instruments are already in place or are considered for implementation, that could affect the price on carbon and other objectives, i.e. carbon emissions reduction; revenue raising; and/or technological development and energy efficiency incentives. Here, all levels of government should be involved. If suitable, the successful introduction of an optimal designed carbon tax may require some changes to instruments already in place or being considered at the same time.

- To consider how unintended interactions can be addressed, by adjusting the carbon tax design, adjusting the pre-existing policies, introducing complementary measures, or integrating carbon tax aspects into other pre-existing policies [hybrid option].
- To share lessons learned in other countries on combining various instruments.
- Combining various instruments that are implemented with different policies and approaches to reduce carbon may be a process that requires systematic adjustments. Defining upfront the timeline and scope for any needed adjustment overtime, can reduce the uncertainty about the effects of instruments implementation and adjustments.

## 2. Assessing the interaction

5. When focusing on reducing carbon emissions, many policies may be considered to successfully and sustainably contributing towards achieving a low carbon economy; however, to avoid inefficient carbon pricing (and potentially other adverse impact, policies should be developed taking into account the context and interactions among those instruments.

6. Environmental and carbon-related policies are often designed and implemented by different government entities, and not seldomly at various levels of government. Policy consistency via coordination between the different authorities will be important.

7. Policy interactions may have direct, indirect and unintended effects on each other's' application. Unintended effects may force economic actors to make choices that may not be the most cost effective, considering the available resources and technology, thus driving up the total cost of the solution for the economy as a whole.

8. On the other hand, no single policy may be able to achieve all the desired objectives of policy makers, for the economy as a whole or for specific sectors. In practice, policymakers often resort to a combination of different policy approaches to achieve decarbonisation, often alongside separate but linked policy objectives on air pollution, energy security, revenue raising, economic development and job creation. An instrument like a carbon tax can act as a corner stone of a jurisdiction's climate policy mix, while other instruments may be complementary to facilitate carbon reduction further, and to deal with unintended consequences. See the carbon tax as the engine and other measures as lubricating oil that makes the transition run smoother and quicker.

9. An effective and coordinated policy will vary country by country. Different countries have different needs depending on local circumstances: their development priorities, types of economy, domestic

energy resources, ability to invest and national energy policies. Different needs will be balanced in different ways; hence, a multitude of combinations can exist.

10. To provide policymakers with a meaningful framework of how to assess interactions, the chapter will focus on the main types of interactions[178], whether policies are:

- Complementary, in the sense that the various policies enhance each other's performance.
- Overlapping, in that they run parallel to each other, intending the same effect.
- Countervailing, in which case that the various policies have adverse effects on the behaviour of investors, consumers etc.

### a) Complementary policies

11. Complementary policies are policies that can be introduced and applied together, with one policy improving the performance of the other. Complementary policies may have different objectives and generate different consequences. However, their combined effect is considered superior to the effect of one single policy.

12. Policies complementary to a carbon reduction policy may be less focused on reinforcing the carbon price signal, but rather address potential barriers to companies and individuals responding to the carbon price signal of the tax. They may ensure that both producers and consumers are responding to the compliance costs of their actions, including climate impacts.

**Box 1. Case of Chile**

**Key complementary policies in the energy sector in Chile that complemented the carbon tax and incentivised an energy transition**

**The Renewable Energy Law (Law No. 20257):** The first important reform for the renewable energy sector was the approval of a Renewable Energy Law, which included renewable portfolio standard (RPS). This is a quota system that encourages renewable energy generation by setting the proportion of electricity supply that must be produced from eligible renewable energy sources. The introduction of renewable energy technologies for the first time in the energy matrix in Chile dates to 2008 with the approval of Law No. 20.257. The law aimed to support the generation of electricity of non-conventional renewable sources such as biomass, small hydraulic energy (capacity of less than 20 MW), geothermal energy, solar energy, wind power and marine energy. This law was amended in 2013 (Law 20,698, better known as "Law 20/25") stating that by 2025, 20% of the energy matrix in Chile must be composed of renewable energy.

**Restructuring Public Auctions:** Another important reform in Chile was to improve renewable energy generators' ability to compete in energy auctions. Renewable energy projects without a power purchase agreement ("PPAs") used to face significant obstacles to obtain funding from commercial banks. In Chile, PPAs can be achieved by bilateral negotiations or through participation in "power auctions"—carried out by the National Energy

[178] See methodology and further examples further elaborated in "State and Trends of Carbon Pricing 2016" by the World Bank Group – Climate Change, October 2016

Commission (CNE)—for regulated consumers served by the distribution grid. Since 2005, Law 20,018 requires electricity distribution companies to contract their energy requirements by means of competitive non-discriminatory auctions (thus including renewables). A submitted bid with the lowest price is awarded a long-term contract (typically, a PPA) for the project. In 2014, three-time blocks were established in the bidding process, one block covering from 11 pm to 8 am, a second from 8 am to 6 pm, and a third at the time of peak demand between 6 pm and 11 pm. This modification in the structure of the auction scheme has greatly favoured renewable generators since they could now offer during the times of the day when they are producing energy.

**Energy Transmission:** Law 20,936, on electricity transmission, aims to create a robust interconnected transmission system allowing the unification of Chile's power grid connecting the Northern Interconnected System (SING) with the Central Interconnected System (SIC). The interconnection of the north and central grid systems will allow to merge two medium-sized markets, not only forming a more competitive marketplace, it will also allow the energy generated from large solar potentials in the north to be distributed to the central and southern part of the country.

**Distributed Energy:** The key regulatory instrument is Law 19,940 and Law 20,571, the first grants rights to connect in distribution projects for projects below 9 MW, creating the small energy generators market (bigger than residential, but that have facilities with an installed capacity of up to 9MW[179], the second is a system of net billing of residential generators. Essentially the law regulates energy self-generation based on Non-Conventional Renewable Energies (NCRE) and efficient cogeneration. The Law gives users the right to sell their surplus directly to the electricity distributor at a regulated price through net-billing.

13. The revenue raising capacity of complementary policies may be more sustainable. With the main objective of a carbon tax being carbon reduction, significant decarbonisation would eventually in a long-term perspective eliminate most of the tax base for a carbon tax. As the assumption would be that energy will be needed long after carbon is mitigated in energy products, a complementary system would retain at least part of its taxable base.

14. Depending on the features of the carbon tax as well as of the other policies and instruments, such combinations can also be overlapping. Consideration would need to be given to the design to avoid overlap of the instruments. Cooperation with the policy makers responsible for other instruments as well as expected taxpayers would help to identify potential overlap in the design face when connecting early on.

**b) Overlapping policies**

15. Where complementary policies may have different objectives and consequences whilst reinforcing each other's application, overlapping policies will in practice achieve the same goals. Overlapping policies that pre-exist or are considered together with the introduction of a carbon tax, will therefore create parallel carbon pricing.

[179] Regulated by D.S. N° 244 of Ministry of Economy D.S. N°101 of the Ministry of Energy

16. Policy makers must manage overlapping policies to achieve combined objectives and must certainly be wary of not generating an excessive economic burden on economic agents or an excessive administrative burden on governments.

17. Parallel carbon pricing may create an excessive carbon cost. In the case of a carbon tax, overlapping policies could undermine the carbon tax price signal, and lead to less cost-effective $CO_2$ abatement measures being undertaken.

18. When a carbon tax is introduced, other existing taxation per unit of production, distribution and consumption of energy needs to be considered, whether generated through a pre-existing and overlapping emissions trading system, energy related tax or other implicit pricing instruments. For example, Argentina reformed its fuel taxes maintaining the same overall revenue adopting a carbon tax rate, while the full mitigation effect is yet to be determined, the relevance of the policy is that it acted both as an important signal committing the country carbon pricing and changed the relative prices of fuels to be consistent with their carbon content.[180]

**Box 2. Introducing carbon taxation in Mexico**

The General Climate Change Law of April 2012 paved the way for both reforms to fuel taxes and the introduction of the carbon tax. In 2013, as part of a comprehensive tax reform, Mexico became the first Latin American country to impose a carbon tax. The tax was implemented through a reform of the Law on Special Tax on Production and Services (LIEPS, 1980).

The initial tax was set at MXN $ 39.80 (approximately US $ 3.2). It is an upstream tax on fuels with a rate based on the carbon (only CO2) content of fuels with exemptions for gas production and imports and instituting a price cap on some high carbon intensity fuels. Since its implementation, the tax has been adjusted annually for inflation, but it is still low, approximately US$3 per tCO2. In addition, the tax rate was limited to 3% of the sale price of the fuel.

The Mexican carbon pricing policy is interesting because it was conceived from the beginning as a strategy to develop an ETS and link with the Western Climate Initiate, it was viewed as a first step in a broader strategy, so although the tax is relatively simple, there are a series of additional features that have been implemented with the ETS in mind. MOUs were signed with the State of California, United States, the States of Ontario, and Quebec in Canada, to this effect.

Among the most important initiatives are the Law on the Special Tax on Production and Services allows the for tax-crediting by using carbon credits from Certified Emission Reductions of Mexican projects approved by the UNFCCC. The new legislation also included language for entities subject to the tax to

[180] OECD, 2019 Taxing Energy Use 2019: Country Note – Argentina online at https://www.oecd.org/tax/tax-policy/taxing-energy-use-argentina.pdf

deliver certified emission reductions (CER) from Mexican projects in lieu of the tax (CDC, EDF and IETA 2015; IEPS Law 2013). In December 2017, the regulations allowing for CERs were published allowing for credits for up to 20% of the carbon tax obligation.

Furthermore, in November 2013, a voluntary carbon exchange, MEXICO2, was established to trade carbon credits as a potential means of complying with the carbon tax. In August 2016, the Ministry of Environment (SEMARNAT) and the Mexican Stock Exchange signed a MOU to implement a simulation exercise for an ETS to develop capacities and generate more information.

In parallel the authorities have been developing the National Emissions Registry (RENE). The RENE from 2015 requires companies or facilities that emit more than 25,000 tCO2e / year to report their GHG emissions from the previous year, which includes nearly 3,000 companies from various sectors. This will be the basis for the reporting system under the linked ETS.

Although the system has experienced delays, the ETS starting, in January 2020, its three-year trial period.[181]

19. Introducing a carbon tax in a way that it is overlapping other pre-existing policies to achieve the appropriate level of carbon taxation should be managed carefully. However, in certain situations, the carbon price from a single instrument may not be sufficient or applied sufficiently broad to stimulate investment in low-carbon technologies. Especially for carbon pricing to be effective in stimulating the uptake of low carbon energy options, as well as provide a price signal to develop low carbon technologies, the price needs to be sufficiently strong and stable.

20. Faced with the reality that the level of "effective" CO2 price needed to drive the necessary changes may not be politically achievable, carbon pricing efforts through a carbon tax may be strengthened by measures such as technology mandates, emission performance standards and energy efficiency measures, creating an implicit, less transparently higher CO2 price. If overlap from such measures on a carbon tax are not considered, such policies have the potential to undermine an explicit carbon price through a carbon tax. In the context of explicit CO2 pricing mechanisms like a carbon tax, an overlapping policy can be described as any policy which results in additional emissions reductions beyond what would have been intended to and is driven by the tax. Distortions could include additional renewables targets, mandates or subsidies which support high-cost renewable energy, badly designed energy efficiency measures or levies that alter the economics of investments. These policies may be more costly in terms of reducing

[181] ICAP, 2020, online retrieved June 4, 2020 https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems[]=59, and SERMANAT, online retrieved June 4, 2020 https://www.gob.mx/semarnat/acciones-y-programas/programa-de-prueba-del-sistema-de-comercio-de-emisiones-179414

CO2 emissions, compared to emissions reductions driven by a carbon tax that reflects the marginal cost of abatement.

**c) Countervailing policies**

21. Countervailing policies refer to policies that contradict the objectives of each other. With respect to a carbon tax, a countervailing policy would be one that undermine the objectives and goals of carbon pricing. Such a type of policy may have a different set of objective and goals, e.g. support lower income groups, geographic regions or strategic economic sectors, but they could result in more carbonisation.

22. When considering introducing a carbon tax, it is particularly crucial to determine the country has policies that subsidize carbon, both at the consumption and production levels. The co-existence of such subsidies together with carbon pricing needs to be evaluated by the countries' policy makers in order to avoid confusion, complexity and ineffectiveness of a carbon price policy.

## 3. Policies and instruments interacting with carbon tax

23. Given the role of carbon, particularly as it relates to important sectors such as energy and agriculture, with great important to business and household expenditure, jurisdictions have and will consider a series of related policies and instruments to deal with energy, environment or income support that are closely related to climate mitigation. A carbon tax will therefore be embedded in a complex policy landscape.

**Table 3 Examples of policies that may interact with a carbon tax**

| Complementary | Overlapping | Countervailing |
|---|---|---|
| - Electric energy reform<br>- Energy efficiency packages, allowing for fuel switching.<br>- Facilitating energy trade and daily contracts.<br>- Regulate and incentivize smart grids.<br>- Flexible demand side response.<br>- Encourage electric storage.<br>- Policies that support the quality and availability of weather forecasting to make renewable generation more predictable<br>- Regulating methane emissions in the oil and gas sector<br>- Phasing out coal-based energy production<br>- Electric Cars<br>- Vehicle emission standards<br>- Subsdies/Investment in the charging stations and other | - Emission Trading Schemes<br>- Fuel and energy taxes<br>- Renewable energy support measures<br>- Vehicle fuel efficiency standards.<br>- Feed-in tariffs or green certificates.<br>- Environmental emissions regulations and standards.<br>- Social carbon price in investment projects.<br>- Internal carbon price in businesses<br>- Land use and deforestation policies<br>- Taxes on high emission cars<br>- Payments for ecosystem goods and services (e.g., paying farmers to retire marginal agricultural land). | - Fossil fuel subsidies<br>- Price wedge across fuels, (fuel taxes may distort prices of fuels not consistent with carbon content,eg. diesel and gasoline)<br>- Land Use change (Forest clearing) subsidies.<br>- Private car and transport subsidies.<br>- Tax rebates on high emission cars (eg. Diesel)<br>- Public Transport taxes |

| | | |
|---|---|---|
| infrastructure needed to support wide-scale adoption of transformative zero-emission options.<br>- Percentage targets for vehicle manufacturers' sales of electric vehicles (EVs);<br>- Standards for energy efficient buildings.<br>- Regulations or incentives on land management practices.<br>- Land fill regulations<br>- Offset markets for GHG reductions from waste sites | - Recycling regulations<br>- Banning organics in landfills<br>- Regulations on forest management practices Fire/pest prevention measures<br>- Retrofitting existing buildings | |



24. To allow an effective assessment of the interactions, it will be relevant to be understand other policies that are often considered in combination. Such other aspects could already be in place or they could be considered for introduction at the same time as the carbon tax. These other aspects can be managed or considered at the same time by other parts of Treasury or the Ministry of Finance, by other parts of the government in the broader sense or by other levels of government, e.g. at subnational level. Some of these aspects are tax related but others are not.

**a) Carbon tax as one of the carbon pricing mechanisms**

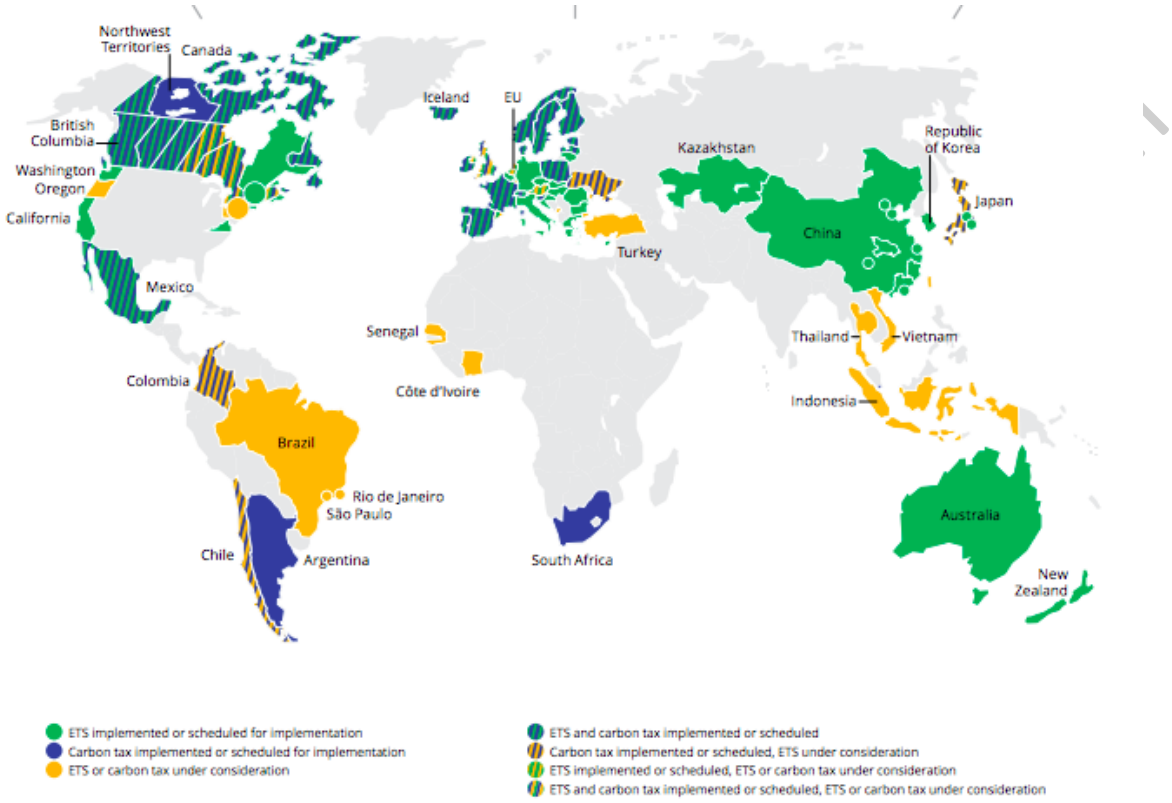
25. Imposing a carbon price[182] throughout an economy is a powerful mechanism to reduce carbon emissions.[183] Public policy to impose a cost on carbon emissions is already in place, or under consideration, in many countries - to achieve the goal of limiting global warming and climate change. Such mechanisms will put a price on the carbon involved to produce a product or service, explicitly or implicitly. Explicit carbon pricing includes carbon taxation, emissions trading, carbon crediting, and results-based climate financing. On the other hand, implicit carbon pricing creates indirectly a price on carbon through policies like fuel taxation, energy efficiency standards, fossil fuel subsidy removal and incentives for low carbon technologies. [184]

[182] The World Bank features considerable information on carbon pricing. Its website on the subject, https://carbonpricingdashboard.worldbank.org/what-carbon-pricing, explains concisely what carbon pricing is, the main types of carbon pricing, international aspects of carbon pricing as well as national and regional initiatives. It also covers forms of internal carbon pricing, how various organisations and economic participants internalise the Price of carbon in their economic decision-making.

[183] See Chapter 2 – additional information and references can be provided

[184] The World Bank's State and Trends of Carbon Pricing report presents the distinction between explicit and implicit carbon pricing (World Bank; Ecofys; Vivid Economics (2016)).

**Figure 4 Carbon pricing initiatives implemented, scheduled for implementation and under consideration**




Source: World Bank State and Trends of Carbon Pricing 2020

### b) Fuels and energy taxation

26. It is not unlikely for a carbon tax to be introduced within an existing tax framework which may include taxes on the production or consumption of fuels or energy,[185] The forms of taxation that are most closely related to the carbon tax on fuels or emissions, include types of indirect taxation on the consumption of energy and energy products, be it through excises, energy taxation or sales and consumption taxes on energy products. The scope and rates from such taxes are diverse.[186] When introducing a carbon tax, the interaction with such pre-existing taxation should be considered. Other forms of taxation could be relevant

[185] Further elaborated in Chapter 4A

[186] The OECD monitors the use of energy taxation on a regular basis. "Taxing Energy Use in 2019: Using taxes for climate action" is one of the more recent overviews, available at https://www.oecd-ilibrary.org/sites/058ca239-en/1/1/1/index.html?itemId=/content/publication/058ca239-en&_csp_=733ba7b0813af580090c8c6aac25027b&itemIGO=oecd&itemContentType=book

to the extent they impose an additional burden on energy and carbon throughout the value chain of producing and distributing energy and energy products.

27. Certain countries have a long history of taxing energy products.[187] In several countries,[188] it is the main or only tax specifically covering energy use. These types of taxes were generally not introduced for environmental reasons, but rather as a fiscal instrument used to raise tax revenue or to limit dependency on energy imports. E.g. in the EU countries, energy taxation on fossil fuels constitute on average nearly 5% of their total tax revenue[189]. Estimates for OECD countries are similar[190].

28. Apart from being an effective revenue raiser, there is ample evidence that energy taxation has improved energy efficiency and reduced demand for energy. Once energy taxation attains a certain level, it tends to affect consumer behaviour. E.g. since the introduction of the EU 2003 Energy Taxation Directive, aligning energy taxation on fuel products building on an earlier Mineral Oils Directive from the 1990's, it has had influence on energy efficiency in the EU. The car market moved to more energy efficient cars in EU Member states, rather than Europeans driving less.

29. Whether a long or a more recent history, having the infrastructure in place for taxing energy products, will generally provide a helpful framework for taxing carbon. Potential gains from interaction on the choice of type carbon tax or the collection of carbon tax will not be covered in this chapter[191].

30. Introducing a carbon tax without consideration for pre-existing energy taxation will increase the cost of energy and energy products. Where a carbon tax intends to focus on stimulating the reduction of carbon emissions, an energy tax affects volumes rather than carbon. In the total absence of coordination between the different types of taxation, the effect of both instruments will not necessary be re-enforcing carbon reduction. E.g. a number of low carbon fuels tend to have a lower energy content than more conventional, fossil fuel alternatives. Switching to a lower carbon fuel alternative may require the use of a higher volume of energy for the same effect. E.g. running a car on biodiesel for 100km will require a higher volume of biodiesel than the volume of diesel required to run a car for 100km.

**c) Investment incentives**

[187] E.g. Sweden has taxed petrol since 1924, diesel since 1937, and coal, oil and electricity for heating purposes have been taxed since the 1950's.

[188] The OECD overview on Taxation of Energy Use 2019 considers countries like Australia, China, Indonesia, Israel, Korea, New Zealand, Russia and the United States as only having fuel excise duties burdening the use of energy.

[189] https://ec.europa.eu/energy/data-analysis/energy-prices-and-costs_en?redir=1

[190] http://www.oecd.org/environment/indicators-modelling-outlooks/policy-instrument-database/

[191] Relevant interactions in this respect included in Chapter 4A

31. As for the innovation and support for investment in low carbon options, a well-designed carbon tax should drive businesses and households to lower-carbon products and services; this will not only support carbon reduction but also generate revenues which may be used to support low-carbon solutions and innovations. Depending on how the carbon tax is set up and on the low-carbon options available, the introduction of a carbon tax may not be sufficient. Targeted [tax] subsidies or incentives[192] may be needed to support investment in low carbon technology and innovations.

**d) Fossil Fuel Subsidies**

32. A policy to subsidize fossil fuels can be shortly defined as a deliberate policy action by the government that specifically targets fossil fuels, or electricity or heat generated from fossil fuels, and has one or more of the following effects (see Kojima and Koplow (2015):

- To reduce the net cost of fossil fuels and energy purchased
- To reduce the cost of production or delivery of fuels, electricity, or heat [generated by fossil fuels]
- To increase revenues (via transfers) to owners of fossil fuels, or suppliers of fossil fuels, electricity, or heat.

33. Various and more extensive definitions of fossil fuel subsidies have been elaborated by organizations such as the World Trade Organization (WTO), the OECD and the International Energy Agency (IEA). These definitions depend on the form of policy intervention by governments (WTO, OECD), or the effect of some of these measures on cost and prices (IEA). (See UNEP, OECD, IISD (2019)).

34. To measure fossil fuel subsidies, one can use: 1) The Price Gap; 2) The Inventory of Support to Fossil Fuels; and 3) The Indicator that is part of the Sustainable Development Goals (SDGs). See Box 3. In any of these measures of fossil fuel subsidies, one could add an estimate of negative externalities from energy consumption, known as the Pigouvian tax, as suggested by the IMF (see Parry and Small (2005) and Clements et al. (2013) for further details).

[192] In the framework of energy transition, subsidies and tax incentives seem most sustainable if they meet a number of conditions:

- They should be targeted to support investments that seek to reduce carbon emissions whilst being technology neutral (i.e. carbon reduction standards are set by the regulator, but firms are free to adopt the most cost-effective or otherwise appropriate technology that can meet those standards);
- Besides being focused on a specific objective, they are limited in time and gradually expire under a predictable time schedule;
- They support the discovery, development, demonstration and deployment of carbon reducing investments and innovations. They are not intended to subsidise end-users, certainly not in the long run,[i.e. the new technologies must have a horizon to be self-sustainable.

**Box 3 Methodologies to define and measure fossil fuel subsidies**

1. **The price-gap approach.** This is a widely used methodology for estimating consumption subsidies (Kosmo (1987), Larsen and Shah (1992), Coady et al. (2010), Kojima and Koplow (2015), Mundaca (2017 a,b), OECD (2018). It compares average end-user prices paid by consumers (the local price) with the price of fossil fuel that is likely sold in a deregulated competitive market (reference price, adjusted for miscellaneous costs and quality).

*Subsidy per unit of fossil fuel consumed = (Reference fossil fuel price – End-user fossil fuel price)*

This price gap can be positive or negative. It is negative when the producer in a net exporter country is subsidized.

In the estimation of the price gap, countries need to consider among other things:

- Whether their foreign exchange markets are not free floating. If they are not, it becomes difficult to convert import- or export-parity prices and consequently the estimation of the price gap.
- That the reference prices are calculated on the basis of international fuel prices and need to take into consideration costs of transportation (both international and domestic), quality, insurance, storage, distribution, and retailing. Petroleum products face international benchmark prices applicable to all countries. In contrast, coal and natural gas are traded much less frequently across national borders, and electricity even less.

For net exporters of fossil fuels, the domestic subsidies are implicit, and do not have direct budgetary impact as long as the price covers the cost of production. For net importers, subsidies are explicit, representing budget expenditures arising from the domestic sale of imported energy at subsidized prices.

Some net exporting countries might consider that the reference price in their markets should be based on their cost of production, rather than prices in international markets. Even in this case however, such countries miss the opportunity of collecting public revenues, curbing inefficient demand and production of fossil fuels, and reducing CO2 emissions.

The price gap methodology is useful because it measures the size of the net tax or subsidy, even in the presence of i) government policies that affect fossil fuels at different points in the supply chain: taxing or subsidizing the extraction, import, refining, or transportation of fuel, in ways that ultimately affect the retail price; ii) direct changes in the retail price by governments that are not necessarily taxes. The price gap measure renders an estimate of the aggregated effects of these policies (Mahdav et al. (2020)).

2. **Inventory of Support to Fossil Fuels (Inventory methodology).** The OECD has been leading and producing this inventory and maintains it online systematically (see OECD (2018)). This OECD project identifies, documents, and estimates tax expenditures and how public resources are transferred to benefit or give preference to fossil fuel production and consumption relative to alternatives. The aims are to encourage transparency about governments' budgetary policies related to fossil fuel subsidies which can be utilized for learning and sharing best practices on optimal public finance and reforms. A detailed exposition on the accounting framework for producer support estimates and consumer support estimates can be found in OECD (2018). The 2017 Inventory includes more than 1000 individual policies identified as supporting the production and consumption of fossil fuels in OECD countries and eight country partners: Argentina, Brazil, Colombia, the People's Republic of China, India, Indonesia, the Russian Federation, and South Africa. The OECD is announcing that the data for the EU Eastern Partnership countries: Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova and Ukraine) are forthcoming.

3. **Indicator of Fossil Fuel Subsidies in the Context of the Sustainable Development Goals (SDGs).** This indicator measures the amount of fossil fuel subsidies per unit of GDP (see UNEP, OECD, IISD (2019)). It requires the following information: 1) direct transfer of government funds; 2) induced

transfers (price support); and 3) (optional) tax expenditure, other revenue foregone, and under-pricing of goods and services. To design this indicator, this methodology suggests collecting national data, and supplement it with two international datasets: i) the fossil fuel subsidies from the IEA; and ii) the data on fossil fuel producer and consumer subsidies collected by the OECD (see (3) below).

These methodologies face all a common challenge: the gathering of credible and reliable information to calculate the actual subsidies. Cooperation, transparency and diffusion of information is crucial to all countries to phase out all types of fossil fuel subsidies, to minimize efficiency losses, and implement more equitable distributional solutions among the countries' citizens.

35. The International Energy Agency (IEA) finds that as a result of subsidy reforms in 42 countries that have been keeping end-user prices artificially low, consumption subsidies dropped by USD 120 billion in 2019, largely due to lower global fossil fuel market prices.[193]

36. OECD finds that as a result of tax breaks and spending programs linked to the production and use of coal, oil, gas and other petroleum products in 44 OECD and G20 economies, the total fossil fuel support rose by 10% to USD 178 billion in 2019, ending a five-year downward trend. The analysis builds on the OECD Inventory of support measures for fossil fuels.[194]

37. Important reductions in fuel consumption and consequently CO2 emissions can be achieved by reducing fossil fuel subsidies. Assuming a scenario with an increase in the price of diesel and gasoline by 20 US$ cents per litre, the reductions in the consumption and CO2 emissions can be from 50% to 10%, depending on the country and type of fuel (see Mundaca (2017b)). Coady et al. (2015) find that the MENA region as a whole could reduce average CO2 emissions by 36%.

38. Fossil fuel subsidies can have the following impacts on countries:

- Foster inefficient allocation of resources in economic activities that are more capital-intensive, but do not spur growth of productive employment. This challenge is exacerbated in countries endowed with relative abundant labour force.
- Encourage energy intensive economic activities leading to increases in $CO_2$ emissions.
- Deficits in fiscal budgets, and public debt.
- Adverse effects in the balance-of-payments of oil-importing countries; and lost opportunity of raising income in oil-exporting countries, especially when international oil prices are high.
- Divert resources away from productive public investment.
- Lead to major distortions in the production structure.
- Encourage excessive, wasteful and inefficient fossil fuel consumption.
- Benefit mostly high-income households who constitute a small proportion of the population.

[193] See IEA key findings on energy consumption subsidies: https://www.iea.org/topics/energy-subsidies

[194] See http://www.oecd.org/fossil-fuels

- Discourage investment in renewable energy.
- Create incentives for smuggling.

39. Such impacts affect the overall long-run economic performance and economic growth, and contributes to global warming, environmental pollution and other environmental problems, all of which can have significant economic consequences. (see Mundaca (2017 a,b)). People that are exposed to air pollution can also exacerbate their vulnerability to pandemics like the Covid-19 (OECD (2020)).

## 4. Addressing interactions

40. Carbon taxing policy will be more effective if it is aligned with the broader policy landscape. Once there is an overview of what policies could interact with the carbon pricing policy through the carbon tax, and the type of interactions is established, consideration should be given how to address especially overlapping and countervailing interactions. Cooperation with the policy makers responsible for other instruments as well as expected taxpayers would help to identify potential overlap in the design face when connecting early on.

41. For most effect and efficiency, the interaction should be considered both in design and implementation. When considering the interaction in design, it can be addressed:

- through adjusting the design of the carbon tax to be introduced. E.g. the scope, taxable base or rate of the carbon tax can be adjusted to avoid policies overlapping;
- through adjusting the design and/or application of the other policies. E.g. fossil fuel subsidies can be reduced in scope or phased out to avoid the overlap or even countervailing policies;
- by introducing complementary policies to address negative aspects of e.g. overlap;
- by incorporating the carbon tax into the other policies, by creating a hybrid tax or other pricing system.

### a) Adjusting the carbon tax

42. An example of an adjustment in design of the carbon tax to avoid it overlapping with a pre-existing system when a carbon tax focused in scope to be introduced only for sectors which have not been covered by another carbon pricing instrument. Whilst an ETS works well for stationary emitters, it is more problematic to introduce for example in the transport sector. Certain types of carbon pricing instruments may be more problematic to introduce for certain types of activities, e.g. an instrument based on measuring specific emissions would be more complex to apply for carbon emissions resulting from private transport. Also, carbon abatement costs are not the same for all kind of carbon generating activities. It may be more effective to look at the abatement opportunities and associated costs for different activities and tailor the

policies to elicit the desired response. This could be done by introducing overlapping instruments. By focusing the carbon tax through a reduction in scope, the negative effect of an overlap can be reduced.[195] Its efficiency would depend on what sectors are to be covered and what fuels are used. E.g. a fuels-based carbon tax taxes the carbon content of a certain fuel. If a certain type of fuel is only used for a certain type of sector, a specific carbon tax could be very relevant. On the other hand, in case the same fuel is used in different sectors, the new carbon tax would need to include specific features to avoid the double taxation of the fuel used in the sector. Facilitating two different tax rates for the same fuel tends to be fraud prone.

**b) Adjusting pre-existing policies**

43. Ideally, fossil fuel subsidies should be removed before carbon taxes are introduced to avoid confusion and uncertainty among the public about the actual goals of these policies.

44. The gradual removal of fossil fuel subsidies and implementation of carbon taxes should have both the same objectives and goals: to reduce carbon emissions and all possible environmental externalities caused by excessive fossil fuel consumption; and to avoid unnecessary fiscal deficits, while maintaining the overall spending power of poor households by means of for example cash transfers. Fossil fuel subsidies do not always benefit the poor population as it is often assumed.

45. Governments could however introduce carbon taxation, even when their countries have not yet phased-out fossil fuel subsidies. It is crucial though that they inform the public that a carbon tax will be gradually introduce and that it will therefore imply a reduction in fossil fuel subsidies, that over time the subsidies will be removed, and a positive carbon tax will rather be in place.

46. Sufficient institutional development greatly facilitates the design of effective carbon tax policies and plans to phase-out fossil fuel subsidies to achieve critical and necessary economic, social and environmental objectives (i.e., meaningful CO2 emission reductions).

47. Government leaders need to have the political will to design long-term policies for their countries, and consider the trade-off between the long-term effects of maintaining fossil fuel subsidies on climate change and long-term prosperity of their economies, versus the short-term effects of keeping fossil fuel subsidies on political acceptance and/or forthcoming re-elections.

48. Fossil fuel price reforms will be more likely to be successful and effective if they are consulted with, fully explained, and made totally understandable to the public. Citizens should have adequate

[195] Michael Skou Anderson, "Europe's experience with carbon-energy taxation" – Veolia Environnement 2010

information about the scale and scope of fossil fuel subsidies in their countries; and their effects on their countries' economies, and global climate change, to avoid mass protests.

49. It is fundamental to have correct estimates of the scale and scope of fossil fuel subsidies (See Box 3, OECD (2018); UNEP, OECD and IISD (2018); and UNEP, OECD and IISD (2019) for guidance on how to track subsidy inventories). These estimates should be regularly updated and expanded over time within sectors, across sectors within a country, and transparently become public. The governments and other stakeholders can together use this information to design and evaluate effective fossil fuel subsidy reforms, and make rigorous evaluations of the effects on fiscal deficits, and in general the costs and benefits of upholding any level of subsidies.

50. Governments need to realize, and widely communicate to the public, that a fossil fuel subsidy reform (and carbon pricing) might require economic adjustments in the short run, with increases in energy prices while technology and innovation to substitute energy generated from fossil fuels emerge. In the interim period, the poorest should be monetary compensated for the losses that they incur, but citizens in general should be recommended to be mindful and switch to greener viable consumption alternatives. Governments can use their savings from subsidies to make the cash transfers to the poorest of the population, investment in for example education, health, and research, improving public transport, and perhaps subsidize effectively green investments and make low-carbon vehicles more accessible and affordable.

51. It is desirable to implement fossil fuel price reforms in a gradual, predictable, incremental roll-out manner. Slow, continuous, and secure actions are highly likely posed to success. The public should be given the opportunity to be part of every step of the process.

52. Fossil fuel price reforms, together with the provision of economic safety nets in the poorest countries, can benefit the subsidizing countries overall in terms of higher economic growth and welfare, and reduction of CO2 emissions (Mundaca (2017 a,b), and help to achieve the Sustainable Development Goals (SDGs).87.

53. Countries seeking to make fossil fuel reforms could be aware of the World Bank's initiative called The Transformative Carbon Asset Facility (TCAF: https://tcafwb.org) which is an instrument that offers support to emerging economies in developing and implementing both explicit and implicit domestic carbon pricing policies, TCAF can contribute to building the needed momentum, knowledge and capacity for policies such as energy subsidy reform. Upon the host country's agreement to implement the proposed policy reforms, TCAF aims to provide results-based payment against the Emission Reductions (ERs) generated by the policy. TCAF is one among the World Bank's many ongoing initiatives to support

countries in taking climate action, including the new Climate Emissions Reduction Facility (CERF), an umbrella fund for climate finance.

**c) Adding complementary policies**

54. In order to steer new energy products like hydrogen or innovative uses of existing energy sources towards lower carbon options, it could be considered to adjust already existing energy taxation to keep such products out of scope for energy taxation whilst introducing a carbon tax for such new fuels.

55. Instead, complementary system would improve support for innovation and investments in low carbon initiatives for the energy products coming in scope of the supplementary system. No such effect would become available for energy products solely covered by a traditional volume-based energy taxation. Equally, when some high carbon fuels, like coal, would be covered by an additional carbon tax, it could help steer innovation primarily to lower or even zero carbon alternatives. On the other hand, by keeping a solely volume-based energy taxation in place for existing energy products, existing energy use may not receive significant price signals to reduce carbon. The revenue raising capacity of a complementary system depends on the scope and framework of the existing energy taxation. Setting up a different system for different fuels, especially when focusing the carbon tax on low carbon fuels, may only slightly increase tax revenue whilst creating the need to expand the existing collection system as well as MRV requirements. However, in countries where energy taxation does not include high carbon fuels (such as local coal or petroleum production), or in countries with low and narrow energy taxes, a supplementary carbon tax could generate significant additional revenue.

56. Policymakers should consider whether a higher carbon price would achieve better emissions reduction targets (at the lowest cost for society) and whether it is sustainable for economic actors. In case the carbon cost from the overlapping instruments is considered excessive, mitigating instruments are available and can be included in the carbon tax if and when it is introduced as an overlapping instrument.

57. However, introducing multiple instruments may duplicate the effort for government and taxpayers. The cost and resources that industry requires in order to comply with overlapping policies can be broadly grouped into two areas: administrative costs, which include the regulatory compliance costs, and the $/tonne price of $CO_2$.

58. An example of an effective overlapping approach would be a carbon tax, introduced as a bottom price for a pre-existing emission trading system [ETS]. The overlapping introduction of a carbon tax would reinforce or stabilise the price signal from the ETS. Abatement options would influence the main carbon price signal introduced through an ETS but in order to ensure a minimum price, an additional carbon tax instrument would be set up. In order to ensure an effective introduction of a carbon tax in addition to a pre-

existing ETS or in any other way in combination to an ETS, the way the carbon price under the tax interacts with the ETS price needs to be considered (price floor, additional, component of a minimum price), as the interactions will differ depending on the set up of the pricing instrument already in place. A carbon tax can be a complementary measure to an ETS as a solution to excessive price volatility, which can include combining them with taxes[196]. The UK has introduced such a tax[197].

**d) Hybrids**

59. The assessment of the interaction considers how different policies may interact in achieving their respective objectives. Generally, the assessment will consider the interaction between different instruments. Occasionally, various interacting policies can be combined into one instrument, often creating a hybrid instrument.

60. Hybrids can be created between various types of instruments and aspects of carbon taxation. E.g. a hybrid option can introduce a carbon tax system linked to emission allowances or credits, e.g. through a linked fee, which is a tax linked to the carbon price in an Emission Trading System [ETS] in the same economy[198]. It is also possible to introduce a carbon tax with features of an emission trading system.

61. [***Proposal to include Australian example in a frame***] One of the first hybrid systems to be set up was the Australian carbon tax. The explicit carbon pricing instrument was introduced as an ETS, with certificates and allowances set up but with the trading of the certificates being unavailable for the first 5 years. In absence of a market, the price per tonne/carbon was pre-set by the issuing authorities in the first 5 years. Once the market would be established, the price would be released, and trading would set that price. The priced carbon was linked to carbon emitted. As the carbon pricing was set up as an ETS, arrangements had been made for the Australian carbon market, once established, to be linked to the EU ETS market. The system came into effect in 2012 but was repealed in 2014, having never reached the stage where the market was established, the price was released and the link became effective.



[196] https://www.oecd-ilibrary.org/taxation/carbon-pricing-design-effectiveness-efficiency-and-feasibility_91ad6a1e-en

[197] This document, written by Prof. Stephen Smith of University College, London, discusses the economic efficiency and practical use of environmentally related taxes, with some differentiation in tax rates, versus tradable permit systems, with some element of grandfathering of permits. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=COM/ENV/EPOC/CTPA/CFA(2007)31/FINAL&docLanguage=En

[198] The linked fee covers targeted entities that lie outside of the ETS, and the fee is determined by an historical value of the carbon price under the ETS, and adjusted on a periodic basis. A linked fee might occur as a result of a compromise between regulators who wish to put a sector under an ETS and the regulated party who advocates for a straight tax.

62. In case there is a pre-existing energy tax framework, a carbon tax could be integrated in the energy tax framework and would become a carbon tax component of the overall taxation of energy products.

63. Carbon taxes in several countries are integrated with the excise tax system for energy products. E.g. this is the case in the Nordic countries, France and Mexico as further elaborated in Chapter 4A.

64. The main advantage of using a hybrid system, is that rather than adding an additional instrument to a pre-existing instrument, the existing system could be adapted with features from another instruments. A hybrid system can lead to a more effective use of resources, as it does not require a duplication of implementation and administration. However, adding features of other instruments may unnecessary complicate an existing instrument and it can be easier and more complex to introduce a second instrument.

# Annex 1: Carbon Taxation in the context of the United Nations

[Approved at 21st Session of the Committee]

1. The United Nations has produced three key climate change agreements foreseeing targets for the reduction of greenhouse gas emissions. In chronological order the agreements are: the United Nations Framework Agreement on Climate Change (UNFCCC)[199] (United Nations 1992), the Kyoto Protocol (United Nations 1997),[200] and more recently, the Paris Agreement.

## 1. The United Nations Framework Convention on Climate Change

2. The UNFCCC, the first international agreement on climate change, is an umbrella convention that provides a framework for both market and non-market approaches to address climate change. It was approved in 1994 and contains an open pledge *"to achieve … [the] stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."*

3. While the UNFCCC targeted all signatory countries — both developed and developing — only developed countries listed in Annex I committed to adopting national policies and taking corresponding actions to mitigate climate change by, among other things, limiting their emission of greenhouse gases. Annex II countries, a more restricted group of countries, had the supplementary obligation to provide financial resources to meet all costs incurred by developing country parties in complying with UNFCCC obligations.

4. Thus, the UNFCCC established different rights and obligations between developed and developing countries. However, it did not foresee a specific mechanism by which countries were to meet those limited rights and obligations.

5. In spite of that, the UNFCCC foresaw (and brought into the body of the Convention)[201] all of the principles of environmental protection that are still employed to date, when devising new economic and



[199] United Nations (1992). *Framework Convention on Climate Change.* Doc.FCCC/INFORMAL/84. June 4, 1992.

[200] United Nations (1997). *Kyoto Protocol to the United Nations Framework Convention on Climate Change.* December 11, 1997.

[201] Although the principles in themselves already existed prior to the ratification of the UNFCCC, the Convention arguably had the effect of making them into general principles of international law. The polluter pays principle, for example, was developed by the OECD in the 1970s. *See* OECD, *Recommendation of the Council of 26 May 1972 on Guiding Principles Concerning International Economic Aspects of Environmental Policies*, available at http://acts.oecd.org/Instruments/ShowInstrumentView.aspx?InstrumentID=4&Lang=en&Book=False ; and OECD, *Recommendation of the Council on the Implementation of the Polluter-Pays Principle*, available at http://acts.oecd.org/Instruments/ShowInstrumentView.aspx?InstrumentID=11.

fiscal instruments for the internalization of externalities, namely: the polluter pays principle, the preventive principle, the precautionary principle and the principle of common but differentiated responsibilities.

6. These four principles have formed the basis of all the international environmental agreements, negotiated since and even before the admission of the UNFCCC. They may therefore be considered the core principles of international environmental law,[202] and of international environmental taxation.

### 2. The Kyoto Protocol and Emission Trading Systems (ETS)

7. The Kyoto Protocol was adopted only five years after the UNFCCC entered into force. It was clear in introducing a market-based approach for the reduction and control of greenhouse gases. The close proximity within which the UNFCCC and the Kyoto Protocol were ratified made it appear like trading in emissions permits was, at least in political terms, the only admissible instrument under the umbrella of the Convention.[203]

8. Because of that choice, many countries and regions introduced emissions trading systems. The largest and most well-known emissions trading system is the one in the European Union, launched in January 2005, and herein referred to as the EU Emissions Trading Scheme (ETS).[204]

9. The Kyoto Protocol was therefore partially responsible for disseminating ETS regimes as the staple policy instrument in carbon pricing, for over twenty years. In spite of that, some countries, particularly in the EU, employ a mixed policy approach to carbon pricing, through the introduction of carbon taxes (i.e. Sweden, Denmark, Norway, Finland and the United Kingdom) and other types of environmental taxes (i.e. Spain, the Netherlands and others).

10. The Kyoto Protocol recognizes that developed countries are principally responsible for the high levels of greenhouse gas emissions in the atmosphere as a result of more than 150 years of industrial activity. Therefore, the protocol only places an obligation to reduce greenhouse gases on certain developed



[202] N. Sadeleer, *Environmental Principles – From Political Slogans to Legal Rules* (Oxford University Press, 2008),

[203] T. Falcão, "*BEPS and the Paris Agreement: Unthinkable Bonds"* Intertax Law Journal, Issue 11, Volume 45, pp. 688 – 700, October 2017.

[204] In the EU in particular, the decision to go with an ETS was also premised on the fact that anew tax requires unanimous approval from all Member States within the EU to be accepted. European Union (2003). Consolidated version of EC Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, OJ L 275. Oct. 25, 2003.

economies (listed Annex I countries), applying the principle of common but differentiated responsibilities as a justification for that approach.[205]

11. Over the course of the years in which the Kyoto Protocol has been in force, ETS have been criticized for (i) not being capable of inputting a high enough price on carbon,[206] (ii) being complex instruments of difficult administration, not easily implemented by developing and least developed countries;[207] (iii) never reaching the phase where the governments sell (rather than give away for free) the initial permit offering; and (iv) generating high compliance costs.[208]

12. In spite of that, it is to be recognized that both taxes and trading systems are flip sides of the same coin, meaning they are both instruments capable of inputting a price on carbon. Whereas an ETS adopts an *ex-post* approach, by allowing the market to define the price of carbon according to the market conditions,[209] a tax instrument is an *ex-ante* approach where the government imposes a price on carbon, and allows the market to adjust to that price accordingly. In short, a tax approach fixes prices and the quantities (of emissions) follow, whereas the ETS fixes quantity and the prices follow.

13. It took the U.N. and its member states over twenty years to build the momentum to achieve a new consensus in the instrumentalization of carbon pricing policies, and to formalize a broader agreement that would be capable of furthering both tax and ETS alternatives to meet the objectives of the UNFCCC. That was achieved through the adoption of the Paris Agreement.



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[205] Centre for International Sustainable Development Law, Legal Brief, *The Principle of Common but Differentiated Responsibilities: Origins and Scope For the World Summit on Sustainable Development 2002*, available at http://cisdl.org/public/docs/news/brief_common.pdf

[206] It was always expected that the permits would be a valued commodity operated in the ETS markets, but that expectation has as of yet not been fully fulfilled.

[207] That is in fact demonstrated by the Chinese pilot ETS program. Initiated in 2014, it is only expected to become fully operational in 2020, for the electricity sector. The schedule to gradually expand the coverage of the ETS to other industries is not public yet. For further information on the China ETS project see: World Bank, *Market Readiness Proposal (MRP): Establishing a National Emissions Trading Scheme in China* (National Development and

Reform Commission, World Bank,) 2013, available at: http://projects.worldbank.org/P145586/china-partnership-market-readiness?lang=en&tab=documents&subTab=projectDocuments.

[208] See for example, the Chinese experience setting up an ETS as reported in World Bank Group, *State and Trends of Carbon Pricing 2019*, June 2019, pg. 35.

[209] An ETS operation system is not dissimilar to the trading of bonds in a stock market. The greater the demand for permits, the higher the price of carbon (i.e. the higher the price of the corresponding permits). Conversely, a low demand for carbon permits will lead to a low carbon price and to market failure from an environmental perspective, to the extent the market is incapable of accounting for the environmental cost of pollution. The under-valuation of carbon in a market or fiscal approach means that society is ultimately paying for the environmental cost of production and transport of carbon intensive products and activities, because the cost of production and transport is not factored into the final price of the goods sold.]

### 3. The Paris Agreement

14. Introduced in 2015, the Paris Agreement broadened the scope of tools available for Member States to address carbon emissions specifically and climate change more generally — tools that include green financing, trading in green bonds, regulatory and fiscal instruments. It also broadened the scope of application of these instruments, by inviting all of the UN Member countries, at all levels of economic development to adopt the Agreement and to commit to the GHG reduction goals assigned under Article 2. The Paris Agreement is thus the first international environmental agreement delving on climate change of true global application, and that feat was achieved by eliminating the differing obligations originally bestowed on Annex I and Annex II countries.

15. The Paris Agreement requires all parties (developed and developing) to use their best efforts through nationally determined contributions to curb greenhouse gas emissions and to continue to strengthen those efforts in the years ahead. The agreement is thus a return to the original objective of the UNFCCC[210] to the extent it formally acknowledges a broader array of instruments to fight climate change and reduce Greenhouse Gas Emissions.

16. The Paris Agreement is either a story of success or of failure, depending on the eye of the beholder. Whereas some criticize it for having failed to deliver a binding commitment for GHG emissions reduction, others celebrate the fact that the agreement has put forward a broader set of tools to address carbon emissions (as opposed to supporting only emissions trading) specifically and climate change more generally — tools that include green financing, green bonds, and environmental taxes, amongst which are included carbon taxes, the most popular behaviour-influencing instruments aimed at setting an *ex ante* price on carbon.

17. However, targets for the reduction of greenhouse gas emissions under the agreement are voluntarily determined and reported, national pledges are often conditional, and there is no enforcement mechanism and verifiability of implementation of pledges. Some of the common criticisms attributed to the Agreement are based on the fact that it has no built-in mechanism to ensure delivery on commitments. Furthermore, intended contributions fall short of required emissions cuts and are unlikely to be able to contain global warming to the required threshold, absent an intense carbon pricing campaign that is geared towards the effective reduction of emissions.

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[210] T. Falcão, *A Proposition for a Multilateral Carbon Tax Treaty*, IBFD Doctoral Series, 2019

18. The UNFCCC,[211] Kyoto Protocol and the Paris Agreement all delve on seven GHGs in particular: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), Sulphur Hexafluoride ($SF_6$) and Nitrogen Trifluoride ($NF_3$). [212]

19. $CO_2$ equivalent emissions is a measure of the total greenhouse effect created from all GHG emissions over a given timeframe, by means of which the non-$CO_2$ emission levels may be compared to a $CO_2$-equivalent basis. According to the Intergovernmental Panel on Climate Change (IPCC), $CO_2$-equivalent emission is the amount of $CO_2$ emission that would cause the same change the global mean equilibrium temperature, over a given time horizon, as an emitted amount of a long-lived GHG or a mixture of GHGs. The equivalent $CO_2$ emission is obtained by multiplying the emission of a GHG by its Global Warming Potential (GWP) for the given time horizon. GWP is therefore basically an index of how much a GHG may contribute to global warming over a period of time, typically 100 years.

20. Therefore, under a carbon tax system, the mere use of carbon as a proxy for pollution, would allow countries to also target other GHGs through the tax, if emissions of these other gases are measures in Carbon Dioxide equivalent emissions ($CO_2e$).

### 4. The Broader United Nation Agenda: The Sustainable Development Goals

21. Fortuitously but perhaps not by accident, 2015 was also the year the Addis Ababa Action Agenda (AAAA) was adopted, providing the foundation to support the implementation of the United Nations 2030 Agenda for Sustainable Development. The AAAA foresees a global framework for financing sustainable development by aligning all financing flows and policies with economic, social and environmental priorities.

22. The 2030 Agenda for Sustainable Development is a plan of action for people, planet and prosperity, which furthers 17 Sustainable Development Goals (SDGs) and 169 targets to build on the achievements of the Millennium Development Goals. They seek to realize the human rights of all and to achieve gender equality. They are integrated and indivisible and balance the three dimensions of sustainable development: economic, social and environmental.[213]

[211] United Nations, *UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention*, FCCC/CP/2013/10/Add.3, available at: https://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2.

[212] The UNFCCC mentions broadly the term greenhouse gases without specifying the exact name of the gases it refers to. The Kyoto Protocol mentions the first 6 gases as greenhouse gases covered under the agreement, not including therefore Nitrogen Trifluoride ($NF_3$). The Paris Agreement covers all seven gases.

[213] United Nations (2015b). *Transforming our world: the 2030 Agenda for Sustainable Development*. ECOSOC Resolution A/RES/70/1, Resolution adopted by the General Assembly on 25 September 2015. Retrieved from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

23. The 17 SDGs are currently the basis against which all UN Actions Plans are reported. The environment is such an important dimension of sustainable development that it features in nine of the seventeen goals,[214] with a dedicated action plan specifically referencing it – SDG 13 on Climate Action.

24. The AAAA and the 2030 Agenda for Sustainable Development have emphasized the need for countries to mobilise resources in order to enhance development and meet the required goal. Several agencies have been set in order to monitor countries' progress in this field, and the UN itself produces frequent reports on countries' initiatives for resource mobilization.[215]

25. In the wake of the adoption of the 2030 Agenda for Sustainable Development, other parallel initiatives promoted by smaller country groupings, donor agencies, and regional associations have emerged, also with the objective of fostering the Sustainable Development Goals. The Addis Tax Initiative (ATI), for example, is one such approach. It was initiated by the Netherlands, Germany, United Kingdom and the United States to enhance the mobilisation and effective use of domestic revenues and to improve the fairness, transparency, efficiency and effectiveness of countries' tax systems. It is therefore an important tool to stimulate capacity building and policy development, particularly in developing countries.

26. It is clear from the above description of historic documents that domestic revenue mobilisation, as well as better and more comprehensive taxation systems, are becoming increasingly important in terms of financing development and are seen as an important tool with which countries can achieve the SDGs.



[214] Goals: (i) 3: Good Health and Well-being; (ii) 6: Clean Water and Sanitation; (iii) 7: Affordable and Clean Energy; (iv) 9: Industry, Innovation and Infrastructure (v) 10: Reduced Inequality; (vi) 11: Sustainable Cities and Communities; (vii) 12: Responsible Consumption and Production; (viii) 14: Life Below Water; (ix) 15: Life on Land. That is not to mention the potential for new conflict and mass migration if climate change is not addressed. Environmental issues could therefore come to affect peace and security (SDG 16) and increase poverty (SDG 1) if not addressed in a timely manner.

[215] See in this respect, United Nations, *2019 Financing for Sustainable Development Report* of the Inter-agency Task Force on Financing for Development, (2019), available through the link: https://developmentfinance.un.org/2019-financing-sustainable-development-report-preparatory-materials.