# United Nations Handbook on carbon taxation for developing countries

## Chapter 2: An Introduction for Policymakers; and Annex 1: Carbon Taxation in the Context of the United Nations

***Please note that the version below is not final, and might change prior to publication***

# Table of Contents

## Chapter 2: Carbon Taxation: An Introduction for Policymakers

*2.1. The Environmental Problem: Carbon emissions ..... 3*
2.1.1. Carbon emissions: a global policy problem ..... 4
2.1.2. Countries' commitments to lower greenhouse gas emissions ..... 6
*2.2. Carbon pricing ..... 7*
2.2.1. Carbon Tax ..... 9
2.2.2. Carbon pricing and cost efficiency ..... 11
2.2.3. Social cost of carbon emissions and the role of markets ..... 13
*2.3. Motives for the introduction of a carbon tax ..... 15*
2.3.1. Fighting climate change by reducing carbon emissions (the "green" dividend) ..... 16
2.3.2. Generation of budgetary sources ..... 17
2.3.3. Promotion of investment in new technology ..... 17
*2.4. Policy considerations in the introduction of a carbon tax ..... 18*
2.4.1. Certainty and predictability of the price of carbon ..... 19
2.4.2. Administration of the carbon tax ..... 20
2.4.3. Potential distributional implications and need for corrective measures ..... 20
2.4.4. Safeguarding the competitiveness of domestic industries ..... 21
*2.5. Conclusions ..... 21*
*2.6. Bibliography ..... 23*

## Annex 1: Carbon Taxation in the context of the United Nations

A1.1. The United Nations Framework Convention on Climate Change ..... 25
A1.2. The Kyoto Protocol and Emission Trading Systems (ETS) ..... 26
A1.3. The Paris Agreement ..... 28
A1.4. The Broader United Nation Agenda: The Sustainable Development Goals ..... 29

## 2.1. 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.

---

[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

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 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.

### 2.1.1. 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 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

[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.

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.

### 2.1.2. 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.

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

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

[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.

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.

## 2.2. 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 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).

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

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 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 6 (interaction between carbon tax and other instruments).

[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.

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 3.4 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

### 2.2.1. 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 3.

[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.

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 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 3 for a discussion and for examples).

### 2.2.2. 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

[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.

(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 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.

### 2.2.3. 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 5, 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 labour 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 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;

[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.

[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

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 3 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.

## 2.3. 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 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.

[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

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.

### 2.3.1. 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 III (design of the 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.

### 2.3.2. 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 V of the Handbook (Use of revenues).

### 2.3.3. 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.

## 2.4. 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 3.

### 2.4.1. 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.

### 2.4.2. 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 IV (Issues in the administration of carbon taxes).

### 2.4.3. 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 3C 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 V (Use of revenues).

### 2.4.4. 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 3C for more details).

## 2.5. 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

[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

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 has to be well designed. In the next chapter, we will go into more detail on 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.

## 2.6. Bibliography

*[Bibliography to be polished in editing phase]*

Baumol William J, 1972, On Taxation and the Control of Externalities, The American Economic Review, Vol. 62, No. 3 (Jun., 1972), pp. 307-322

Baumol and Oates, 1988, The theory of Externalities, Macmillan

Bovenberg, A. Lans and Lawrence H. Goulder, 2002. "Environmental Taxation and Regulation," in Handbook of Public Economics. A. Auerbach and M. Feldstein eds. New York: North Holland.

Bovenberg, A. L. and L. H. Goulder (2002), "Environmental taxation and regulation", in A. J. Auerbach and M. Feldstein (eds.), Handbook of Public Economics, Vol. 3, Amsterdam: North Holland Elsevier.

Carbon Pricing Leadership Coalition (CPLC), 2017. Report of the High-Level Commission on Carbon Prices. Available online at: https://www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices/

Coase, Ronald (1960), "The Problem of Social Cost" (PDF), Journal of Law and Economics, The University of Chicago Press, Vol. 3 (Oct., 1960): 1–44, doi:10.1086/466560.

Goulder, Lawrence H. and Andrew R. Schein (2013). Carbon Taxes versus Cap and Trade: A Critical Review. Climate Change Economics, Vol. 4 (3), pp. 1-28.

Goulder, L. H. (1995), "Environmental taxation and the double dividend: a reader's guide," International Tax and Public Finance, Vol. 2, No. 2 (August), pp. 157–83.

Goulder, L. H., I. W. H. Parry, and D. Burtraw (1997), "Revenue-raising versus other approaches to environmental protection: the critical significance of pre-existing tax distortions," RAND Journal of Economics, Vol. 28, No. 4 (Winter), pp. 708–31

IPCC, 2018. "Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C 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." [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. https://www.ipcc.ch/sr15/

Keohane, Nathaniel O., Richard L. Revesz, and Robert N. Stavins, 1998. "The Choice of Regulatory Instruments in Environmental Policy." Harvard Environmental Law Review 22(2):313-67.

Murray, Brian and Nicholas Rivers. "British Columbia's Revenue-Neutral Carbon Tax: A Review of the Latest 'Grand Experiment' in Environmental Policy." Energy Policy 86 (2015): 674–683. Retrieved from doi: 10.1016/j.enpol.2015.08.011.

OECD, 1991, Recommendation of the Council on the Use of Economic Instruments in Environmental Policy, OECD/LEGAL/0258

Parry, I. (1995), "Pollution taxes and revenue recycling", Journal of Environmental Economics and Management, Vol. 29, Issue 3 Part 2 (November), pp. S64–S77.
Partnership for Market Readiness (PMR) and International Carbon Action Partnership (ICAP). 2016. Emissions Trading in Practice: A Handbook on Design and Implementation. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO

https://icapcarbonaction.com/en/icap-pmr-ets-handbook

Pasurka, C. 2008. Perspectives on pollution abatement and competitiveness: theory, data, and analyses. Review of Environmental Economics and Policy 2(2):194–218.

Pigou, A. C. 1920. "The Economics of Welfare". London: Macmillan.

Pizarro, Rodrigo, F. Pinto, y S. Ainzúa, 2017 a "Estrategia de los Impuestos Verdes en Chile" GIZ/MMA. https://www.4echile.cl/4echile/wp-content/uploads/2018/05/1.-Estrategia-de-los-Impuestos-Verdes-en-Chile.pdf

Stavins, R. N. (2003), "Experience with market-based environmental policy instruments", in K.-G. Mäler and J. R. Vincent Stern, N. (2006), The Economics of Climate Change, HM Treasury, London. Tietenberg, T. H. (2001), "Economic instruments for environmental regulation", in D. Helm (ed.), Economic Policy Towards the Environment, pp. 86–111, Oxford: Basil Blackwell.

Environmental policy and directed technological change: evidence from the European carbon market. Review of Economics and Statistics 98(1):173–91.

Tietenberg, T. (1995), "Tradeable Permits for Pollution Control When Emission Location Matters: What Have We Learned?" Environmental and Resource Economics 5:95-113.

United Nations, 2015. "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.

Weitzman, Martin (1974). Prices vs quantities. Massachusetts Institute of Technology. Available online at: https://scholar.harvard.edu/weitzman/files/prices_vs_quantities.pdf

World Bank (2016). *State and Trends of Carbon Pricing 2016*. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/25160

World Bank (2019). *State and Trends of Carbon Pricing 2019" State and Trends of Carbon Pricing (June)* World Bank, Washington, DC. Doi: 10.1596/978-1-4648-1435-8.

# Annex 1: Carbon Taxation in the context of the United Nations

*Last updated on 12 April 2020*

82. 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)[18] (United Nations 1992), the Kyoto Protocol (United Nations 1997),[19] and more recently, the Paris Agreement.

### A1.1. The United Nations Framework Convention on Climate Change

83. 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] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."*

84. 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.

85. 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.

86. In spite of that, the UNFCCC foresaw (and brought into the body of the Convention)[20] all of the principles of environmental protection that are still employed to date, when devising new

[18] United Nations (1992). *Framework Convention on Climate Change.* Doc.FCCC/INFORMAL/84. June 4, 1992.
[19] United Nations (1997). *Kyoto Protocol to the United Nations Framework Convention on Climate Change.* December 11, 1997.
[20] 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.

economic and 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.

87. 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,[21] and of international environmental taxation.

### A1.2. The Kyoto Protocol and Emission Trading Systems (ETS)

88. 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.[22]

89. 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).[23]

90. 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).

91. 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

[21] N. Sadeleer, *Environmental Principles – From Political Slogans to Legal Rules* (Oxford University Press, 2008),
[22] T. Falcão, "*BEPS and the Paris Agreement: Unthinkable Bonds"* Intertax Law Journal, Issue 11, Volume 45, pp. 688 – 700, October 2017.
[23] 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.

certain developed economies (listed Annex I countries), applying the principle of common but differentiated responsibilities as a justification for that approach.[24]

92. 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,[25] (ii) being complex instruments of difficult administration, not easily implemented by developing and least developed countries;[26] (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.[27]

93. 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,[28] 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.

94. 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.

---

[24] 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

[25] 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.

[26] 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.

[27] 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.

[28] 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.]

### A1.3. The Paris Agreement

95. 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.

96. 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[29] to the extent it formally acknowledges a broader array of instruments to fight climate change and reduce Greenhouse Gas Emissions.

97. 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.

98. 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.

.

[29] T. Falcão, *A Proposition for a Multilateral Carbon Tax Treaty*, IBFD Doctoral Series, 2019

99. The UNFCCC,[30] 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 ($NF_3$). [31]

100. $CO_2$ 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.

101. 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 ($CO_2e$).

### A1.4. The Broader United Nation Agenda: The Sustainable Development Goals

102. 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.

103. 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

[30] 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.

[31] 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.

to achieve gender equality. They are integrated and indivisible and balance the three dimensions of sustainable development: economic, social and environmental.[32]

104. 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,[33] with a dedicated action plan specifically referencing it – SDG 13 on Climate Action.

105. 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.[34]

106. 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.

107. 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.

---

[32] 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.

[33] 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.

[34] 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.