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Emission Trading Systems as an Instrument in the Toolkit of Decarbonization Strategies [1]

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Abstract

At the 2021 Conference of the Parties to the United Nations Framework Convention on Climate Change in Glasgow (COP 26), many leading economies cemented their intention to achieve carbon neutrality by mid-century (2050–70). However, the geopolitical and economic crisis of 2022 threatens to reduce the priority of decarbonization policy and postpone the introduction of more restrictive measures. In the face of growing constraints, the choice of climate policy instruments becomes even more complex and important. It is necessary to analyze different options from the low-carbon development policy toolkit to understand their strengths and weaknesses and their potential to be used to build a comprehensive policy. This article analyzes the strengths and weaknesses of an emissions trading system (ETS) as a tool for direct carbon pricing—a measure that experts from international organizations, as well as the academic community, believe is essential for achieving climate goals.

Despite the fact that carbon taxes (the second option of direct pricing) are easier to implement and administer, many jurisdictions still opt for an ETS. Several factors influence the choice of an ETS as a decarbonization tool: if optimally designed, a market-based mechanism provides cost-effective emission reductions, there is potential for linkage into larger systems, and the flexibility of the instrument may provide additional benefits—China's national ETS is a good example of exploiting this flexibility. Political and administrative characteristics (the European Union (EU), Germany, the UK, California), Kyoto, Brussels, and Organisation for Economic Co-operation and Development (OECD) effects (Mexico and other jurisdictions) play an important role in the choice in favour of an ETS.

The experience of complex and comprehensive low-carbon development strategies already being implemented shows that it is not necessary to place the ETS at the centre, as the cornerstone of policy. The role of an ETS in the entire set of decarbonization measures can be central, supportive, or enabling. They can have different objectives and stimulate not only direct emission reductions, but also technological transformation and energy transition.

For Russia as a federal state, conducting pilot projects with different instruments of carbon pricing implemented in different regions seems to be the best solution for the near future in order to find the right instruments for the Low Greenhouse Gas Emissions Development Strategy.

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Introduction

Most of the world's leading economies have, in the last three years, announced their intention to significantly reduce greenhouse gas emissions to ensure achievement of the Paris goals. The Conference of the Parties to the UN Framework Convention on Climate Change (COP 26), which took place in Glasgow at the end of 2021 solidified this trend: achieving carbon neutrality by mid-century (2050–70) has been set as a major target for a large number of countries. Following the formalization of climate goals, both through nationally determined contributions and national strategic documents, the process of elaborating low-carbon development policies and tools has intensified in the leading economies. Both developed and developing countries have begun working on the initiatives to introduce or tighten various restrictive measures, without which the achievement of climate goals is almost impossible [de Mooij et al., 2012].

The geopolitical and economic crisis of 2022 led to unprecedented inflationary pressures and increased fiscal and budgetary constraints, threatening to de-prioritize the development of decarbonization policies and lower climate ambitions in general, thus delaying the introduction of necessary restrictive measures. Developed countries, which have more financial resources at their disposal, put the energy transition at the centre of future energy security and have already introduced a number of pricing mechanisms. Tighter restrictions constitute the backbone of low-carbon development policies, but at the same time the need for supportive, compensatory, and redistributive measures to protect the most vulnerable has become more and more evident and is being increasingly articulated by both national governments and international agencies. In developing countries, the introduction of new restrictions to ensure the achievement of climate goals while the inflation and budget deficits are rising will not be welcomed by society and business and may create additional barriers to growth. However, the need to address the climate crisis to enable future economic development ensures the relevance and urgency of decarbonization, despite the current challenges. In the face of growing constraints, the choice of climate policy instruments becomes an even more complex and important task. It is therefore necessary to analyze different options of the low-carbon development policy toolkit, understand their strengths and weaknesses, and assess their potential to become part of a comprehensive policy that includes a broad set of measures to ensure decarbonization while minimizing negative effects.

This article analyzes the place of an emission trading system (ETS) in the overall toolkit of decarbonization policy. The ETS is a fairly common mechanism for emissions reduction, despite its obvious limitations and difficulties arising in the process of its development, implementation and management. A total of 25 such systems at various levels (supranational (EU ETS), national, regional, and municipal) are currently operational, 10 more are under development, and 14 jurisdictions consider the ETS as a possible climate policy tool [ICAP, 2022]. The Russian Federation adopted the Strategy of Socio-Economic Development With Low Greenhouse Gas

Emissions Until 2050 in 2021. It states that various carbon pricing mechanisms will be considered as possible components of a national decarbonization policy [Government of the RF, 2021]. In 2021, it was also announced that a pilot ETS project would be launched in Sakhalin, and in March 2022 a special federal law was signed that lays the legal foundation for conducting the experiments in other regions as well [Rossiyskaya Gazeta, 2022]. Thus, there is a chance that this instrument will be introduced in Russia and serious attention is being paid to it. The purpose of this article is to identify the factors that define the choice of an ETS as a policy tool, as well as its general place in the policy of low-carbon development in the current environment. To do this, the ETS and carbon tax are compared, highlighting the advantages and limitations of both instruments. This is followed by a brief overview of operational emission trading systems, analysis of the factors that influence the decision to introduce them, and a consideration of specific cases that illustrate the benefits an ETS can provide and how they are built into the overall decarbonization policy or, as in the case of Australia, why the ETS project was abandoned after all. The European emission trading system (EU ETS) is objectively the most well-studied and attracts the most attention from both foreign and Russian researchers [Bashmakov, 2018; Doroshenko, Mingaleva, 2020; Kaveshnikov, 2015, 2017]. This article intentionally places greater emphasis on analysis of other emission trading systems, including those in developing countries or those operating at the regional level, as these experiences may be more relevant.

Carbon Pricing as a Necessary Tool of Climate Policy

Carbon pricing, according to studies by international organizations such as the International Monetary Fund (IMF) [Parry et al., 2022], the Organisation for Economic Co-operation and Development (OECD) [Dellink et al., 2014], and the World Bank [2022], is the most effective tool of greenhouse gas emissions reduction. The academic community provides different assessments of the effectiveness and sufficiency of pricing as a tool: some authors share the position of international institutions, emphasizing the need for a balanced policy in which pricing can be both direct and implicit [Dominioni, 2022]; others note the insufficiency of pricing as a single instrument of climate policy [Rosenbloom et al., 2022]. There are studies that analyze the available carbon price data and come to the conclusion that the effect of pricing instruments is limited and that one cannot consider this tool truly effective [Green, 2021]. Others show that the official data on the average price for jurisdictions applying this mechanism differs from the real level of the cost per ton of emissions. These findings, however, do not prove the ineffectiveness of pricing, but rather stress the need for the right policy design at the national level and harmonization at the international level [Finch, van der Bergh, 2022]. In general, many theoretical studies find pricing efficient. Ex-post analysis often shows its limited effectiveness, which is often caused by an imperfect design and practical implementation of measures.

Despite the existing differences in assessments of the effectiveness of pricing as a decarbonization tool, international organizations have intensified their efforts over the past few years to promote the need to introduce an explicit or implicit price for carbon, as well as to set a carbon price floor for major emitters. In 2021, under the Italian G20 presidency, the IMF and the OECD presented a joint study in which they stated that “to keep temperatures below 2°C by 2030, the global average price of carbon should be set at a level of $75 per tonne and continue to be raised further.” [IMF-OECD, 2021]. The study noted that the price of carbon can be both explicit (direct) and implicit (indirect). A carbon tax and an ETS each result in explicit carbon pricing. Some energy use and fuel taxes, regulations that discourage carbon emissions, and subsidies for low- or zero-carbon technologies or behaviours result in an implicit carbon price. The key

challenge at the national level is to balance explicit carbon pricing with other stimulating and supportive instruments, such as incentives and regulations, which may be less effective but would be more acceptable to society because of their smaller or indirect impact on energy prices. Other supporting policy elements, according to the IMF and OECD, include public investment and technology policies; effective and equitable use of revenues generated by taxes or emission trading systems; support for vulnerable households, workers, and regions to ensure a fair transition; and measures to improve industrial competitiveness. They noted, however, that "explicit carbon pricing is the only tool that automatically leverages all mitigation options and provides a cost-effective balance between the measures taken" [Ibid.].

Carbon taxes and the ETS are two basic tools for setting an explicit price for carbon. In its pure form, carbon taxes provide emissions price certainty, while the volume of emissions is determined by market factors. For the ETS, the situation is the opposite: emissions volume is set by introducing a ceiling (cap), while the emissions price is determined by the market (trade). In the absence of uncertainty, the carbon tax rate can be set in such a way as to result in the same emission reduction as the cap under the ETS, taking into account the schedule of marginal abatement costs—at the same price for carbon, both instruments will have the same revenue potential (if quotas under the ETS are auctioned) [Parry et al., 2022].

Carbon taxes, which are usually implemented by finance ministries, are easy to administer. They can be integrated into the collection procedures of existing fuel taxes and extended to other fossil fuels—much of the legal and administrative infrastructure needed to impose carbon taxes already exists. An ETS is usually administered by environmental ministries and tends to require more complex management and may have a more limited scope. Such schemes usually apply to large stationary installations in the energy and industrial sectors. New bodies are usually created to enforce an ETS, that is, to monitor emissions and oversee permit registries and market trading. For this reason, an ETS may not be viable in countries with limited institutional capacity, particularly in many developing countries, or where the market for trading permits will not be sufficiently saturated because of the limited number of economic entities subject to regulation. The introduction of amendments to ETS regulations generally requires legislative changes, which can entail a lengthy notification and consultation process. Changes in carbon tax rates, meanwhile, can be introduced in a budget and a corresponding finance bill. In addition, the IMF noted that the revenue from the tax is easier to redistribute in the economic system and thereby support the most vulnerable populations and regions [Parry et al., 2022]. In the case of the ETS, profits from the sale of permits can also be redistributed, but the system will only be effective if the permits are auctioned, which is not always the case for currently operating schemes.

Thus, carbon taxes are easier to introduce, adjust, and collect; they create a lower administrative burden without requiring the introduction of new bureaucratic institutions, provide emissions price certainty for producers, and, with the proper calculation of tax size, ensure achievement of the required emissions levels. However, many jurisdictions at various levels still opt for an ETS, despite much higher transaction costs.

Overview of the Functioning and Scheduled Emission Trading Systems

Currently, there are 25 operational emissions trading systems, which cover 17% of the world's greenhouse gas emissions: one supranational (EU+ Iceland, Liechtenstein and Norway), eight national (China, Germany, Kazakhstan, Mexico, New Zealand, Korea, Switzerland, and the UK), nine regional (Alberta, British Columbia, Newfoundland and Labrador, Nova Scotia, Quebec, Saskatchewan, Fujian, Guangdong, Hubei, Massachusetts, California, and the Regional

Greenhouse Gas Initiative (RGGI) in the United States) and seven city-level systems (Beijing, Chongqing, Shanghai, Shenzhen, Tianjin—before the launch of a nationwide ETS in China, which will gradually become part of a single scheme—and in Tokyo and Saitama). It is estimated that emission trading schemes have been introduced by jurisdictions accounting for 55% of global gross domestic product (GDP) [ICAP, 2022]. By the end of 2021, ETSs around the world collectively generated more than $161 billion to their respective budgets [Ibid.].

The EU ETS introduced in 2005 is the first functional ETS. It has since gone through several phases of development with the gradual reduction of the emission ceiling, as well as the number of freely allocated emission permits and the introduction of a special mechanism to maintain market stability (market stability reserve), that is, the price level of permits. It is the main source of empirical quantitative data for research on the efficiency of ETSs and a role model for implementation and operation in other jurisdictions [Borghesi, Montini, 2016]. Subsequently, some EU members (Germany, Austria, and potentially Finland), as well as the UK, which left the union, decided to introduce a national ETS for certain sectors. Also in 2019, an agreement was signed to link the European scheme with the Swiss ETS (launched in 2008), and we can expect linkage of a separate British system with the EU ETS in the future, as there was no disagreement on this aspect of EU policy. In addition, Ukraine and Montenegro are currently developing ETSs, and Turkey is also considering the introduction.

In North America, there is one functioning national ETS—a pilot project in Mexico, which was launched in 2019 and should become fully operational by 2023. The remaining schemes are regional and cover individual states, groups of states (the RGGI includes 11 jurisdictions) or, in the case of Canada, provinces. There are linkage projects for regional schemes (California and Quebec signed an agreement to merge their systems in 2014). Some U.S. states are considering joining regional initiatives (Pennsylvania is preparing to join the RGGI) or launching their own schemes (Washington). Virtually all schemes in North America stipulate the possibility of linking with other systems, allowing for expansion and saturation of the permits market if states or provinces choose to do so.

In South America, there is no functional ETS, but an initiative on a national ETS is being developed in Colombia; Chile and Brazil are considering the possibility of introducing this instrument.

In Asia, there are two operational national ETS schemes, in Kazakhstan and China, as well as several city-level and provincial schemes: there is an ETS in major Chinese cities, in Tokyo, and in Saitama Prefecture in Japan. Emissions trading systems in Vietnam and Indonesia are under development. Pakistan, Malaysia, Thailand, the Philippines, Taiwan, and Japan (launch of a nationwide system) are considering introducing them. Also, one of the longest functioning and most effective systems has been in operation in New Zealand since 2008. Australia developed its own ETS, but as a result of political struggle its introduction was cancelled, and an alternative was proposed.

At the moment there is only one pricing initiative in Africa, a carbon tax introduced by South Africa. No other national or regional jurisdiction is covered by direct emission pricing initiatives, neither in the north of the continent nor in the Sub-Saharan region. That said, it will be developing countries in Africa that will increase their emissions in the future due to overall economic growth. It is important to tailor national policies to each country’s level of development and consider the challenges while still introducing some kind of pricing. Implicit pricing initiatives should probably be the starting point, gradually introducing direct measures as economies grow.

As can be seen, a number of countries and jurisdictions are formally considering introducing an ETS, and some have already begun the development process. At the same time, most of them belong to the group of emerging economies, for which, according to some experts, including from the IMF, the introduction of an ETS is a much more difficult task than the adoption of carbon taxes [Parry et al., 2022]. At the moment, among developing countries and economies in transition, China and Mexico have already launched their pilot and actually functioning projects. Their experience, especially if successful, may encourage even more jurisdictions to implement an ETS. In addition, there are a number of factors that may influence the choice of an ETS as a decarbonization policy tool.

Factors Influencing the Choice in Favour of Emissions Trading Systems

The analysis of existing as well as planned emissions trading systems allows us to identify several factors that determine the choice in favour of this instrument. The first group of factors stems from the mechanism itself, its design features and options and ways of functioning; the second group includes external conditions and trends formed in the international system and the global economy.

Beneficial Inherent Features of an ETS

Market Mechanism

The main argument in favour of introducing an ETS according to the documents describing the design and implementation in various jurisdictions is the market mechanism inherent to such systems. It is repeated as a mantra that they "allow to reduce emissions where it is cheaper to do so," which provides greater cost-effectiveness as well as flexibility. Under ideal conditions, where the number of economic entities falling under the regulation is substantial and most emission permits are allocated through auctions, the market mechanism does result in flexibility and competitive price levels. But the number of market participants and allocation rules must necessarily be taken into account to ensure the effectiveness of the ETS. Given that many schemes use free distribution of allowances in the first stages (either entirely or for certain sectors at risk of carbon leakage), the market approach does not lead to the desired price levels and emission reductions because of the sub-optimal design of the ETS. The distribution of free allowances was implemented in the early stages of the EU ETS and Korea's ETS, but in some jurisdictions, such as Germany and California, auctions were held from the beginning. It is important to note that Germany already had extensive experience with the EU ETS by the time the national ETS was launched, while in California the cap-and-trade mechanism began to be implemented as an environmental policy tool even before the Kyoto Protocol was adopted and became one of the first successful cases of practical implementation of this approach, so ETS schemes were not introduced there from scratch.

Possibility of Linking

A second frequently cited benefit of an ETS is the opportunity to link different schemes into larger systems. There is the potential to create a truly global market for permits, which would stabilize the price, ensure its predictability, and enhance the ability to reduce emissions in jurisdictions where it is cheaper to do so [Dellink et al., 2014]. In the long run, merging national or regional systems into larger markets could indeed bring great benefits to quota buyers, and it would also establish a market-based price level for a large number of jurisdictions [PMR, 2014]. But implementing such a project globally would require uniform ETS design in different countries or regions, which is almost impossible to achieve given the differences in the legal, economic, and

political systems of different jurisdictions. Further, linkage requires a more or less equal level of ambitions and climate goals set by all actors [Verde et al., 2020]. So far, successful examples of ETS linkages are the EU and Switzerland agreement, as well as merged cap-and-trade systems in California and Quebec. For smaller schemes at the city or regional level, the possibility of linking is an important feature as it facilitates gradual pricing initiatives scaling, starting with the most prepared jurisdictions, which can then merge their emissions trading system into larger schemes.

Current trends in the global economy and politics that influence the choice in favour of the ETS

In addition to the characteristics inherent to the ETS mechanism, there are a number of factors that greatly influence the choice in favour of this decarbonization policy instrument.

Political and Legal Reasons

Taxes traditionally play a significant role in the political process; attitudes toward them often determine electoral behaviour and sometimes protest activity (such as the yellow vest movement in France). The introduction of new taxes is often perceived negatively by affected actors. The introduction of an ETS, especially with the initial allocation of free permits, provides economic entities with more flexibility and gives the opportunity to gradually adjust and modernize production.

In some cases, the choice in favour of the ETS is determined by the political or legislative process of the jurisdiction. For example, taxation in the EU has not been fully communitarized, so the adoption of an EU-wide tax on emissions would have required a full consensus in the EU bodies, especially in the Council. A qualified majority, which is a much more feasible option, was enough to push the introduction of the EU ETS. Similarly, in California the adoption of a cap-and-trade system was more feasible because it required the support of half of the legislature to approve it, while the introduction of a carbon tax would have required the approval of two-thirds [Parry et al., 2022].

Strong federalism in the United States also determined the autonomy of states in climate-related decision-making, especially in the area of taxation. Therefore, it is up to each entity to decide which decarbonization policy instruments it introduces. Unification at the federal level would require an unprecedented consensus, which is difficult to expect in the foreseeable future. In Germany, too, there are certain constitutional limitations on the introduction of new taxes, so the choice was made in favour of a national ETS for buildings and transport; this has already been launched and it will be interesting to observe how it will interact with the European-wide ETS for these sectors if the bill introduced as part of the Fit for 55 package is approved. The UK has certain administrative features as well: emission levels are determined for specific constituent states, but the British government is responsible for introducing fiscal instruments, so the ETS was seen as more in line with the existing institutional structure. Continuity was also an important factor for firms accustomed to participating in the EU ETS.

The Kyoto Effect

The next important factor that influences the choice in favour of the ETS is a path dependency resulting from the implementation of the Kyoto Protocol and its mechanisms. The Kyoto Protocol was adopted on 11 December 1997 and entered into force on 16 February 2005. It became the most important achievement in the development of global climate regulation, a breakthrough in the joint international efforts to combat climate change, and for a long period it defined the governance regime in this area despite the fact that some important emitters never ratified the

treaty, and the functioning of its mechanisms was not unproblematic. The Kyoto Protocol established cap-and-trade as the main mechanism for reducing emissions. Under the protocol, countries were supposed to meet their targets mainly through national measures. But it also offered them additional means to reach their targets through three market mechanisms: international emissions trading, the clean development mechanism, and joint implementation [UNFCCC, 1997]. These mechanisms would ideally encourage greenhouse gas emission reductions where it is most cost-effective, such as in developing countries. Implementation of projects within the framework of Kyoto Protocol mechanisms allowed the accumulation of certain experience both for developed and developing countries, provided real-life testing of the cap-and-trade principle, and made it understandable for decision-makers and business. The development of the first emissions trading systems went in parallel with the implementation of the Kyoto Protocol (EU, Switzerland, New Zealand). There are references to the protocol in the documents establishing an ETS in the EU, Switzerland, New Zealand, and Mexico, and a mention was made in the cancelled project in Australia.

The U.S. has never ratified the Kyoto Protocol, although the fundamental cap-and-trade principle was developed there. But inside the country the principle was successfully implemented: Clean Air Act (1977), Clean Air Act (1980) in the part devoted to fighting acid rains. Therefore, for those states that are generally ready to introduce climate regulation, an ETS seems to be the most effective and familiar tool.

The Brussels Effect

The European Union has positioned itself as a leader in the international fight against climate change, seeking through its example as well as the adoption of legal norms with extraterritorial effect to induce other actors to adopt more ambitious policies [EC, 2019]. Climate regulation is one of the areas cited to illustrate the so-called Brussels effect, which is the "externalization of European norms and standards" outside the union [Bradford, 2012]. Using the attractiveness of its market, higher standards, the principle of priority of consumer and citizen protection, and an experienced bureaucracy, the EU directly and indirectly influences the development of climate policy in partner countries, as well as the international regulatory regime in this area. In the case of emissions trading systems, the EU does not directly force other actors to impose similar schemes of their own. The introduction of emissions trading becomes inevitable only for EU candidate states, as it will simplify integration into the European climate policy in the future. Therefore, Ukraine and Montenegro are currently developing their own ETS mechanisms, and Turkey is also considering this mechanism as an option.

The EU's expertise and willingness to promote similar systems in other countries plays a major role in the dissemination of the ETS option. Direct bilateral cooperation has included the development of an ETS for Korea (providing technical assistance), China, and Australia. The EU is also an active participant in two international platforms that facilitate the development of an ETS in all willing jurisdictions: the International Carbon Action Partnership and the Partnership for Market Readiness. These two platforms, supported by other international institutions, primarily the World Bank, accumulate expertise in the development, implementation, and administration of the ETS. The experience of all existing ETS schemes is analyzed within these structures and, based on the conclusions, specific practical recommendations are formulated to maintain the ETS at all stages of functioning from the initial project to reform, as in the case of the EU ETS. Accordingly, jurisdictions that decide to implement the ETS receive information and expert support from the EU, both directly and through international platforms, where it is one of the main actors.

The OECD Effect

Membership in the OECD can also be considered one of the factors that influence the decision to introduce an ETS. Most of the existing ETS schemes are located in jurisdictions that are members of this organization. The OECD is one of the main proponents of market-based carbon pricing mechanisms, promoting the idea of their cost-effectiveness. Expert groups of the OECD regularly produce publications highlighting the benefits of a market-based approach and the possibility of linking individual systems into larger carbon markets. Meanwhile, there is consensus among leading international organizations that pricing is a necessary element of any effective climate policy, but there is no consensus on the best instrument. The World Bank is active in the Partnership for Market Readiness, also producing an annual analysis of pricing mechanisms in general, including taxes. The IMF is perhaps the main mouthpiece for the need to impose an emissions price in any available but effective way. In July 2022 it presented a working paper in which the benefits of the tax become obvious; the publication noted the many disadvantages and limitations of the ETS. The OECD, on the other hand, remains a supporter of the market approach.

Complexity as an Advantage

Another factor that may influence the choice in favour of an ETS is its flexibility, extended development time, gradual phased implementation, and the possibility of launching the scheme without starting direct pricing. The decision to introduce an ETS signals that a jurisdiction takes its climate commitments seriously and is willing to impose restrictive measures in the form of direct pricing. This is an important image aspect, making it possible in some cases to deflect accusations of unwillingness to meet emissions targets, and in others to become a more attractive and responsible actor in the eyes of potential investors in the energy transition. The need to create institutions for verification and oversight and market structures for the purchase of emission permits allows for more time between the immediate start of pricing and the introduction of additional costs for businesses, allowing for a period of adjustment. The choice of certain sectors, the size of enterprises, the method of setting the ceiling of emissions, and the possibility of free allocation of permits in different volumes give maximum flexibility in the first stages of the implementation of an ETS. All of these factors have a negative impact on the effectiveness of direct emission reductions, which hinders the achievement of the Paris goals but allows smoother and more gradual introduction of pricing in those jurisdictions that are not ready for drastic measures.

Mexico's ETS as an Illustration of the Kyoto, Brussels, and OECD Effects

The most striking example of the combination of the Kyoto, Brussels, and OECD effects is Mexico. By the time of the official pilot ETS's launch, the country already had a functioning carbon tax but it was decided that emissions trading should also be an important tool for implementing the General National Climate Law after the 2018 amendments [Gonzalez, 2021]. Partnership for Market Readiness, led by the World Bank, which provides systemic support and financing to develop technical and institutional capacity and pilot new market instruments [World Bank, 2021], the German Agency for International Cooperation, which provided technical assistance and shared experience in developing and implementing the EU ETS [Lucatello, 2022], and the combined California and Quebec ETS assisted Mexico in developing its ETS pilot.

The first phase of operation is set to last three years, two years will be considered a pilot, and the third will be a transitional phase to a fully operational ETS, with a full launch scheduled

for 2023. To facilitate the inclusion of Mexican industry in this new instrument development and to meet the conditions of Congress (the pilot programme must have no economic impact), it was decided that the allocation of allowances during the pilot programme would be free, based on the historical emissions and climate goals of the country.

In June 2018, Mexico completed its first ETS simulation, involving more than 100 Mexican businesses (from different sectors: electricity, hydrocarbons, aviation chemicals, petrochemicals, steel, mining, automotive, cement, paper, forestry, glass, food, construction, consumer goods, and finance), which together are responsible for 67.8% of the country's carbon emissions. Based on the information from the simulation, participants decided on strategies to implement carbon management to meet regulatory goals and cost-effectiveness [Prat, 2020].

In November 2019, Mexico's Ministry of Environment and Natural Resources (SEMARNAT) announced the emission cap for the upcoming pilot phase of the ETS for 2020 and 2021, setting it at 271.3 million emission credits [Ibid.].

The pilot programme covers direct CO2 emissions, about 45% of the total, from about 300 facilities with annual emissions of more than 100,000 tons of CO2. The pilot programme will have no economic impact on regulated entities and aims to test system design, build emissions trading capacity, and create a reference value for emission allowances and offsets during the operational phase [Ibid.].

Thus, Mexico took advantage of the expertise and technical assistance of the EU, Germany, the World Bank, and the OECD to develop its own ETS and launch its pilot. The rather significant role of hydrocarbon production in the economy was not an obstacle to the development and introduction, first of a tax, and then of a pilot ETS. Not all countries and jurisdictions are ready to do this, even with maximum expert and financial support from partners.

When Political Factors Played Against an ETS and the Effects of Kyoto, Brussels, and the OECD: The Failure of Australia's Project

As discussed earlier, for many of the jurisdictions that ended up opting for the ETS, an important decision-making factor was the smoother promotion of the instrument through the political and legislative process. In Australia, however, it was political differences between the parties that led to the rejection of the already developed and ready-to-launch project, which was not only supposed to launch quota trading, but also to merge almost immediately with the EU ETS. In this case, the choice was not made in favour of the tax either, as the unwillingness to introduce restrictive instruments in a country with a significant role of hydrocarbons in the economy was stronger than the desire to introduce effective measures to ensure decarbonization.

The election of the Australian Labor Party to government on 24 November 2007 led to a significant change in Australia's climate change policy. The Rudd government immediately ratified the Kyoto Protocol and confirmed its intention to introduce a national emissions trading scheme, which was set to become operational in 2010 [Wilder, Fitz-Gerald, 2008]. In July 2008, the Australian government proposed the Carbon Pollution Reduction Scheme (CPRS), which outlined the initial framework for the creation of the Australian emissions trading system. The CPRS was originally intended to cover 767 facilities, which accounted for 80% of Australia's greenhouse gas emissions. Parliament introduced three CPRS bills, in May 2009, October 2009, and February 2010. Although the first two bills passed the House, they did not receive Senate approval. The last bill was introduced in the Senate in February 2010, but in September of that year it was stopped as a new parliamentary session began [EDF, 2015].

In September 2011, former Prime Minister Julia Gillard introduced the Clean Energy Futures package of legislation, which was passed in November of that year. The Clean Energy Act, as part of the package, introduced a carbon pricing mechanism. It went into effect 1 July 2012 but was repealed two years later after a change of government. Initially, the draft provided a fixed price for carbon at which permits could be bought from the government, which was to be the basis for the development of the Australian ETS. It was to be established in 2015 [Ibid.]. The fixed price for carbon was initially set at A$23 per ton of CO2e and increased by 2.5% per year (in real terms). After moving from the fixed price to the ETS, the intention was to link the scheme to the EU ETS on 1 July 2015. It was supposed to cover about 60% of Australia's greenhouse gas emissions and five main sectors: energy, oil and gas, industrial processes, fugitive emissions processes, and waste. However, after the Liberal-National Coalition won the parliamentary election in September 2013, Prime Minister Tony Abbott announced that the Clean Energy Act 2011 would be repealed along with the introduction of the carbon price and the planned ETS. The repeal was passed by the House of Representatives in November 2013 and the Senate in July 2014 [Ibid.].

Instead of the generally more effective pricing mechanism that met such fierce resistance, an incentive measure was introduced, which is still one of the main instruments of Australian climate policy. The Emissions Reduction Fund (ERF) provides financial incentives to reduce emissions through investments in new and more efficient technologies. ERF covers projects from a wide range of sectors: agriculture, construction, electricity, combustion, forestry, industry, transport, and waste. The fund gives businesses the opportunity to earn Australian carbon credit units for every ton of carbon dioxide equivalent that a business reduces or avoids emissions through the implementation of new methods and technologies.

Thus, the attempt to introduce carbon pricing in Australia failed because of political pressure; instead, an incentive measure was introduced that attempts to build in the generally accepted concepts of carbon units but is unlikely to be sufficient to ensure that Australia achieves carbon neutrality by 2050.

China's Emissions Trading System as an Illustration of Instrument Flexibility

Before the decision was made to establish a nationwide ETS, several pilot projects were launched after 2013 in major cities and provinces: Fujian, Guangdong, Hubei, Beijing, Chongqing, Shanghai, Shenzhen, and Tianjin. They were deemed successful and in 2017 the decision was made to introduce a nationwide system. China's national emissions trading scheme went into effect in 2021, requiring more than 2,000 major emitters in the energy sector to report their emissions produced in 2019 and 2020. The ETS currently covers annual emissions of about 4.5 billion tons of CO2 per year, about 40% of China's total emissions [Tan, 2022]. Unlike similar schemes, such as the European Union's, in China the allocation of emission quotas is not determined in advance with an absolute cap, but is based on the intensity of emissions. All covered companies receive emission quotas free of charge. The distribution is based on the method of national benchmarking, in which the average carbon intensity of key sectors and products is calculated and compared to the carbon intensity of individual emitters. Each emitter will be allocated quotas equal to its verified emissions. Given this approach, China's national scheme does not yet actually meet the principle of cap-and-trade, as the limit of emissions is not defined [Roldao, 2022].

So far, activity has been limited: in 2021, a total of 412.05 million tons of quotas have been sold under the ETS, including quotas under regional pilot schemes and domestic compensatory measures. However, a slow start is not uncommon: in the first year of trading in 2005, 321 million quotas were sold in the EU ETS, but by 2021 the figure was over 12 billion [China Dialogue,

2022]. China's pilot ETS schemes continued to operate in parallel, but trade volumes declined as energy sector issuers increasingly turned to the national system.

The main results of the first year of operation were as follows. Emission allowances at the end of 2021 were worth 54.22 yuan ($8.52) per ton, up 13% from the opening price on 16 July. Including on- and over-the-counter (OTC) trading, the weighted average price of quotas in 2021 was 43.85 yuan ($6.89) per ton. A total of 179 million tons of quotas changed hands over 114 trading days in 2021. Of these, 148 million tons (83%) were OTC [Tan, 2022].

An important distinction of the Chinese ETS is that it primarily incentivizes the use of more efficient coal-fired power plants instead of less efficient ones. Intensity-based allocation does not create a clear incentive to switch from coal to renewables. Therefore, China's ETS is likely to encourage earlier closure of very inefficient coal plants that are already operating at low capacity. This, conversely, could improve the profitability of coal power as a whole, since there are currently significant cross-subsidies that would be reduced [Roldao, 2022].

One of the key objectives of China's ETS is to improve the quality of greenhouse gas emissions accounting and reporting. This will help policymakers predict and monitor progress toward China's climate goals. However, China's system takes a different approach to emissions monitoring, reporting, and verification (MRV) compared to other markets. In Europe, emissions verification is assigned to third-party auditors; in China, the Ministry of Ecology and Environment assigns verification to provincial environmental and ecological offices, which must conduct audits of emissions reports submitted by companies and require third-party verification for those whose data are questionable. There are doubts about the technical capacity of these offices to do this work, and, given that most emitters are government-owned, possible conflict of interest issues [Ibid.].

At the time of writing, the China-wide ETS, although far from the optimal design to create incentives for maximum decarbonization, energy transition, and technological transformation, is still an important tool for national low-carbon development policy as well as the effort to achieve global goals given China's importance as an emitter [Nogrady, 2021]. Some pilot projects in the country, which have been in operation for much longer, have more stringent requirements, such as the floor and price ceiling in the Beijing ETS, and covering of the industrial sector, not just the energy sector. Going forward, it is important to incorporate successful experiences from regional systems into the national system without losing their advantages as the main quota trade moves to the national system. The success of the Chinese ETS could be a real breakthrough in the application of carbon pricing and make the practice more acceptable to developing countries, becoming a closer, non-western model compared to the advanced and long-established EU ETS.

ETS in the Canadian Decarbonization Framework

In jurisdictions where there is nationwide ETS or, as in the case of the EU, a supranational one, they most often become the centrepiece of decarbonization policy, that is, its cornerstone (as the EU calls its emissions trading system). However, it is not at all necessary to place an ETS at the centre of policy without providing alternatives. Canada is an important example of how an ETS can be embedded in an overall decarbonization policy without becoming its backbone and main instrument. By giving different options to its regions and introducing other important elements of low-carbon development policies, it makes climate policy as flexible and varied as possible, while ensuring the necessary minimum level of carbon prices. Canada is a decentralized federation in which provinces and territories have a high level of autonomy and responsibility in policy decisions, including those related to the environment and energy. In its Greenhouse Gas Pricing

Act, the Canadian federal government has developed a contingency carbon pricing policy that prescribes a minimum benchmark for carbon pricing (in terms of rigour and coverage), but gives sub-national governments the flexibility to define an instrument (that is, a carbon tax or emissions trading system) [IEA, 2020]. Any jurisdiction that does not reach a benchmark would be subject to a default regulation consisting of a carbon tax for the transportation and construction sectors (the so-called "fuel tax" component) and an emissions trading system based on results (benchmarking) for electricity and industry [IEA, 2020]. A key advantage of this approach is that it provides a minimum benchmark price for carbon across the country, while allowing sub-national governments to develop and manage their own carbon pricing policies.

Quebec, Ontario, and Nova Scotia have chosen the ETS as their primary carbon pricing tool, but Ontario suspended its scheme in 2018.

The introduction of carbon pricing is inevitable if a jurisdiction seeks to achieve its climate goals, so at a certain stage of development it will at least have to consider the need to introduce some kind of mechanism.

In 2013, Quebec launched a cap-and-trade system to reduce the cost of reducing greenhouse gas emissions. Quebec has been a member of the Western Climate Initiative (WCI) since 2008 and officially merged its system with California's in 2014. The system covers emissions from fuel combustion in energy, buildings, transportation, and industry, as well as emissions from industrial processes, covering a total of 80% of the province's emissions [ICAP, 2022]. In 2021, the average price for an emissions permit was $22. The sale has brought in $4.53 billion since the programme began.

The Nova Scotia quota and trade programme set a cap on the total amount of greenhouse gas emissions allowed in covered sectors of the province for 2019–22. Final rules for the cap-and-trade programme were adopted in November 2018. The programme regulates industry, energy, heating (buildings), and transportation and covers over 80% of Nova Scotia's GHG emissions. The Nova Scotia programme was created to meet the federally mandated benchmark imposed in the Pan-Canadian Clean Growth and Climate Change Framework. Since May 2018, Nova Scotia has been a member of the WCI, which provides technical services and support for the province's cap-and-trade programme. It is not affiliated with any jurisdictions.

While carbon pricing is a critical element of Canada's Clean Growth and Climate Plan, it is not the only policy measure in the plan to reduce greenhouse gas emissions, as it would require a very high carbon price. Additional policies and measures, such as a clean fuel standard, methane standards, and a coal phase-out, are important to combat emissions that are not covered by carbon pricing and can help make carbon pricing more effective.

Thus, the introduction of Canadian-like model can be considered by other federal states or countries with strong regions as a possible option for building a flexible decarbonization policy. In contrast to the U.S., where only the states determine their goals and instruments without federal coordination, Canada still imposes regulation to ensure the stipulated price level. But the freedom to choose the instrument makes the policy more acceptable to individual actors.

Conclusion

The economic downturn and falling incomes in some countries, unprecedented inflationary pressures, and growing fiscal constraints threaten to deprioritize the implementation of decarbonization measures. However, the urgency of solving the climate crisis still forces countries to develop their low-carbon development policy toolkit. The introduction of carbon pricing is

inevitable if a jurisdiction seeks to achieve its climate goals, so at a certain stage of development it will at least have to consider the need to introduce some kind of pricing.

Emissions trading systems are complex mechanisms, the development of which requires large financial, administrative, and transactional costs. Their effective functioning depends on a sufficient number of market participants, the right level of emission ceilings, and a well-thought-out system of quotas allocation. For developed countries, the task of developing, introducing, and maintaining an ETS can be feasible. They may be preferable to countries and jurisdictions where the fiscal system and its reform is too complex or requires considerable, almost consensus, support in the legislature to introduce a carbon tax. Practice shows that for federal states, the choice of an ETS at the level of individual entities may also be a preferable option, making it possible to take into account regional interests.

Developing countries, for which the current conditions of economic and geopolitical crisis create even more tangible constraints, the introduction of a carbon tax is still easier and therefore preferable. Tax revenues go directly to the budget and can be more effectively redistributed to support the most vulnerable populations; further, all the necessary administrative infrastructure for the collection already exists so there is no need to expand the bureaucratic apparatus. That said, if a country does opt for an ETS, it can turn to international organizations and the EU for support, as Mexico and China have done. Also, flexibility of ETS mechanisms allows them to be designed with all national characteristics in mind. Such systems may not initially be optimal in terms of emission reductions, but at least they can give time to adjust, get the system up and running, and eventually become the second best choice.

The experience of already implemented comprehensive low-carbon strategies shows that it is not necessary to put the ETS at the centre, making it the cornerstone of policy. The EU has virtually no other option for securing union-wide pricing, which is why the EU ETS is the main instrument. In Canada, which can afford more flexibility, the ETS is presented as an option that willing regions can choose to implement. This approach, with some common denominator, may be more acceptable for complex states. Therefore, the role of the ETS in the entire set of decarbonization measures can be either central or supporting. In addition, it can have different objectives and stimulate not only the direct reduction of emissions, but also technological transformation and energy transition.

For Russia as a federal state, the implementation of pilot projects with different carbon pricing instruments seems to be the optimal solution for the near future and the assembly of the Low Greenhouse Gas Emissions Development Strategy toolkit. The main criterion for the pricing system should be its simplicity and transparency [Makarov, Stepanov, 2017]. The introduction of a pilot ETS in some subjects with a sufficient number of actors for the functioning of the market and developed bureaucracy and introduction of taxation in smaller regions, seems to be a good solution in the short and medium term. In the long term, it is possible to implement an approach similar to the Canadian one, in which the national level sets the requirements for the covered sectors and the severity of regulation, and the regions (subjects) themselves decide the best way to introduce a price for carbon.

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