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ETS – A PATH TOWARDS A GLOBAL CO_2 PRICE?

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ANALYSIS

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Emissions Trading Systems: A path towards a global CO_2 price?

A report for the Friedrich Naumann Foundation for Freedom

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EXECUTIVE SUMMARY

For climate protection to be effective, a way has to be found for the international community to supply a global public good. This requires international agreements which eliminate free-rider options, the single greatest obstacle to achieving this goal.

Economists the world over are in agreement that a uniform global CO_2 price is needed to resolve the climate challenge. Such a price is the only way to implement cost-efficient policies that minimise the burden of climate policy while maximising its impact. However, an approach based on international cooperation was not followed in Paris. Instead, the participating countries only agreed on national commitments, an approach which make it impossible to harmonise marginal avoidance costs across countries.

Of all the tools that might allow a global price to be set and enforced, the most promising is an Emissions Trading System (ETS). The European Union's ETS has performed exceptionally well since being introduced in 2005. It has led to enormous CO_2 savings at a very low cost. For instance, compared to Germany's Renewable Energies Act, the EU ETS saved seventeen times as much CO_2 at a mere hundredth the cost per tonne of that incurred by the German *Energiewende* or energy transition.

In the context of Germany's climate package, the country is planning to engage in an ETS that includes the heating and transport sectors. But the approach chosen is not at all convincing because it lacks all of the constituent elements of an ETS (quantity restrictions, trade, pricing by markets).

From a European perspective, there are three potential paths to a global ETS. Firstly, one can attempt to agree on global trade through a top-down approach at a climate conference. The likelihood that this approach will succeed is low.

Secondly, the EU ETS could be integrated with other ETS established in recent years. This approach could create substantial trade across several continents. The third option is for the EU to expand its own ETS incrementally by adding individual countries. This would provide an opportunity to leverage the fact that an ETS enables international redistribution.

Introducing a global CO_2 tax is even less likely to succeed than implementing a global emissions trading system. Over the past decade, the ETS concept has gained in importance. Despite the prevailing obstacles and challenges, creating a global trading system appears feasible. In the search to find a climate policy approach with global impact, emissions trading is currently humanity's best hope.

1 STATUS QUO

1.1. BASIC ECONOMIC PRINCIPLES

For the first time in history, humanity is confronted with a problem that can only be solved through cooperation. Anthropogenic greenhouse gas emissions and the climate change they cause are global problems of unprecedented scale.

From an economics perspective, the entire climate system is a global public good. This has several important implications. Public goods are characterised by the fact that nobody can be excluded from their consumption and that there is no competition in consuming them. It means that there are no markets through which such goods can be supplied. For any market supply to be created, a price sufficient to cover the costs of providing the good has to be found. But as public goods can be consumed even when no price is paid for them (nobody can be excluded from consuming them), rational consumers have no reason to pay any price at all.

The reason why there is no viable way to exclude anyone from consuming a public good is that there is a lack of enforceable property rights. The existence of such rights is an elementary precondition for market interactions to take place. Such rights can evidently not be created in the case of the climate system.

However, creating pollution rights offers a way out because in contrast to the climate system (or the atmosphere) *per se*, the right to use it as a dumping place for emissions is a private good. But such rights, too, do not emerge spontaneously and magically turn into tradable goods. In the absence of regulatory intervention, a market for pollution rights will not emerge. Because markets are not available as allocation instruments in the provision of public goods, there are only two way of establishing them: through voluntary cooperation or through collective decisions.

Voluntary *cooperative behaviour* requires people to forego individual benefits to create cooperation gains for others. Their sacrifice is balanced against the benefits resulting from the cooperative contributions of others, meaning that in the case of mutual cooperation, a better situation is achieved overall compared to the situation where nobody cooperates. The problem is that the benefits flowing from the cooperation of others can also be enjoyed by parties that do not make a cooperative contribution themselves. Therefore, making voluntary contributions to the creation of public goods is not a rational strategy. The result is a *social dilemma*.

Experimental economists have conducted extensive research into the question of what happens when people find themselves in such a position. In numerous experiments with small groups, it was found that even under ideal laboratory conditions, people are generally unable to overcome social dilemmas. Contrary to theoretical predictions, some level of cooperative behaviour does emerge, but it is quantitatively too weak and not stable over extended periods.[1] Weimann et al. (2019) showed that larger groups exhibit very similar behaviour. In the best

[1] A more recent overview may be found in Chanduri (2011) and an earlier one in Ledyard (1995).

case, voluntary contributions can produce between 20 and 30 percent of the cooperative contributions required for an efficient solution.

For this reason, public goods tend to be supplied based on collective decisions. Such decisions require a state that holds the monopoly on the use of force and which is in a position to enforce collectively rational decisions.[2] The threat of force eliminates the so-called free-rider problem which is always present when a public good is provided purely on the basis of voluntary participation.

In respect of the climate system as a global public good, the option of collective decision-making is not available for obvious reasons. These options only exist within states; states themselves have a free-rider option that cannot be eliminated. For this reason, climate protection agreements can only come into existence based on voluntary international treaties. Economists have studied the question of whether there are any prospects for success in the case of such negotiations, assuming that individual states make rational decisions. Game theoretic analyses of this question arrived at an unambiguous result which is negative overall.[3] Assuming that behaviour is rational and focused on each state's national interests, larger coalitions are not expected to emerge. A follow-up question is whether improved outcomes of negotiations should be expected when a single state or a group of states takes the lead. In a game-theoretic analysis, Hoel (1991) showed that the opposite should be expected. Sturm & Weimann (2009) confirmed the result experimentally. Konrad & Thum (2014) studied the impact of unilateral upfront investments under conditions of asymmetric information and also found that upfront investments by a single state tend to be counterproductive. Hoffmann et al. (2015) confirmed this result experimentally.

This paints a picture where the prospects of achieving the international cooperation required to provide the global public good "climate protection" are poor. Starting in 1990, regular international climate conferences took place, but up to the Paris climate summit in 2017 – a timespan of 27 years – it was not possible to get a binding agreement signed. At this point, the value of the Paris Agreement is still inconclusive. But so far, empirical experience has confirmed the theoretical and experimental findings of economics regarding the question of international climate agreements.

International cooperation is further inhibited by the fact that CO_2 emissions are very unevenly distributed across the world. Figure 1 (overleaf) shows the per capita emissions of selected countries.

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[2] For more detail, see Weimann (2009).

[3] See Barrett (1999) and Carraro & Siniscalo (1993), for example.

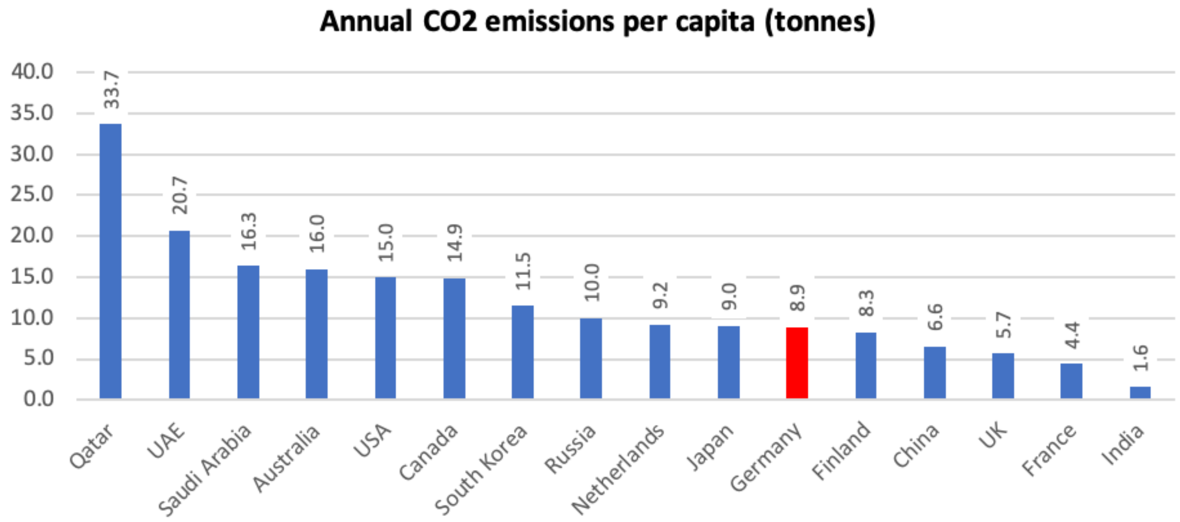

Figure 1: Annual per capita CO_2 emissions, selected countries. Source: IEA 2019, cited by Statista 2019 (https://de.statista.com/statistik/daten/studie/167877/umfrage/co-emissionen-nach-laendern-je-einwohner/, accessed on 5 November 2019)

Ranking countries by their share of global emissions presents a different picture, as shown in Figure 2:

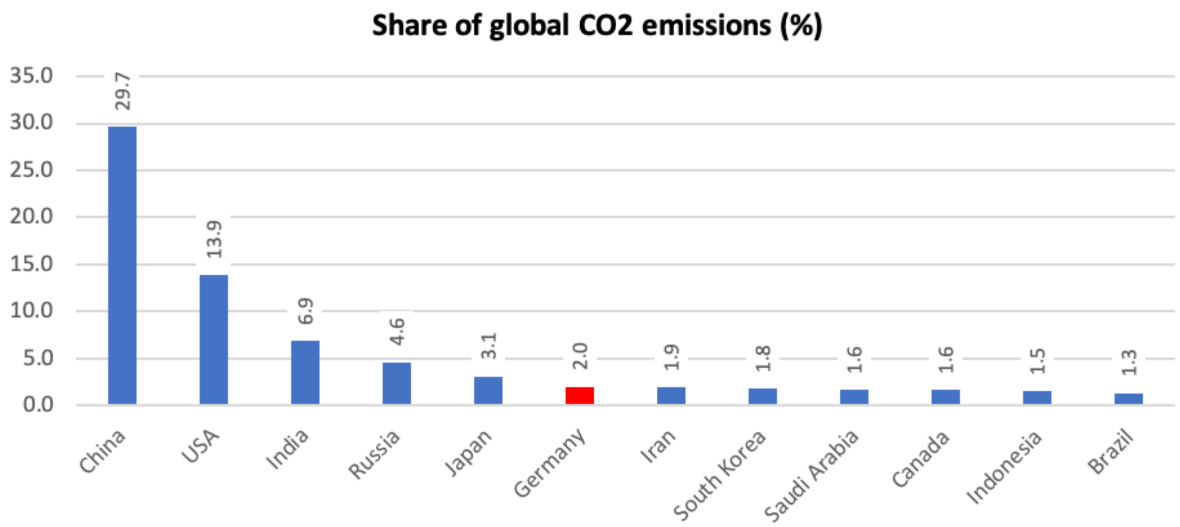

Figure 2: Share of global CO2 emissions in percent, selected countries. Source: Gütschow, J.; Jeffery, L.; Gieseke, R. (2019): The PRIMAP-hist national historical emissions time series (1850- 2016). v2.0. GFZ Data Services. doi:10.5880/pik.2019.001.

Figure 2 makes it clear that successful climate policy is dependent on cooperation by the three major emitters – China, the USA and India, who together are responsible for about half of global CO_2 emissions – while still needing to herd together the remaining states, which each contribute a relatively small share to global emissions.

Regarding the three major emitters, the prospects for a quick reduction in emissions are very slim. China has announced that the earliest it will be able to prevent further increases in its CO_2 emissions is 2030. The USA have have left the Paris Climate Agreement. India's emissions are

[4] An assessment of the Paris Agreement is provided in the following section.

low on a per-capita scale. If the country follows an economic growth trajectory similar to that of China, its CO_2 emissions are likely to increase dramatically.

In summary, the status quo of global climate policy can be described as follows: it is clear that anthropogenic warming can only be limited if many countries contribute to achieving this goal. Even if the three largest emitters managed to reduce their emissions (which is unlikely to occur over the next decade), many “minor emitters” would still have to be persuaded to forego their free-rider options and make voluntary contributions. Cooperation requires individual countries to be willing to incur costs to create a cooperation benefit for others. It is obvious that the likelihood of a cooperative solution being found depends among other things on designing international climate protection at minimum cost, i.e. in a way that is *cost efficient.*

Cost efficiency is a requirement for climate policy at the national level too, because it implies that in relation to the resources employed, the amount of climate protection obtained (i.e. the CO_2 emissions saved) should be maximised. In the international context, it means that the burdens imposed on individual states to achieve successful climate protection should be minimised, which increases the probability of finding a cooperative solution to the climate problem. Ignoring the demand for cost efficiency leads to massive resource wastage and the imposition of high burdens on the population, as Germany has shown. Hoping for widespread international cooperation on that basis is futile, especially when it is meant to include poorer countries. Making global cooperation work means that the economic tools used have to be cost efficient.

From an economist’s perspective, analysing the requirements of cost-efficient climate policy is comparatively easy. The analysis delivers a clear result which almost all environmental economists subscribe to: the existence of a global uniform price for CO_2 is a necessary and sufficient condition for cost efficiency. Such a price would mean that emitters everywhere in the world take it into account when deciding how best to reduce emissions. CO_2 emissions will then be avoided until the marginal avoidance costs reach the level of the tax rate. If this is the same for everyone, then the logical conclusion is that the marginal avoidance costs will also have to be the same everywhere at equilibrium. This ensures cost efficiency because different marginal avoidance costs create space for cost savings by shifting sources with high marginal avoidance costs to sources with low marginal avoidance costs. Cost savings only become unavailable when the marginal avoidance costs are identical everywhere. A global uniform price therefore makes it possible to exploit the considerable cost differentials that exist between countries in order to reallocate avoidance activities to where they incur lower costs.

Economists are in agreement regarding this mechanism and its high value. However, two questions in particular are disputed. Firstly, how high the CO_2 price should be and secondly, whether it should be implemented via a general CO_2 tax or through emissions trading. The first question is really only relevant in the context of a CO_2 tax[5] because emissions trading is a quantity instrument where the price is an endogenous outcome resulting from a given quantity

[5] On this topic, see Buchholz (2009), Paqué (2009), Cranton et al. (2017).

restriction and given technology.[6] The second question is explicitly discussed in this report because it has a direct impact on the policy options under discussion.

In the economics literature, reference is often made to Weitzman (1974) when it comes to the question of whether it is better to set a CO_2 price by means of a tax or to set a quantity in the context of emissions trading. The question is discussed under the assumption that the impact of pollution is uncertain. The conclusion is then that in situations where marginal avoidance costs rise sharply while marginal avoidance benefits increase very slowly, price control is to be preferred. On the other hand, quantity control makes sense when the impact of increasing pollution is potentially serious, because then avoiding these impacts can be achieved with a higher likelihood of success through quantity control (Wissenschaftlicher Beirat 2019, p. 9). If one follows Weitzman's line of argument, then the impact of climate change, as assessed on the basis of scientific findings, determines whether price control or quantity control is preferable. If there is a high risk that humanity will exceed critical thresholds relatively soon, then emissions trading is recommended; but if the negative impact lies further away in the future, then price control is preferable. However, Weitzman's analysis ignores the question of political implementability in the context of international negotiations. In chapter 3 of this report, we will argue that emissions trading enjoys a competitive advantage compared to a CO_2 tax because initial allocations represent an additional degree of freedom which can make international negotiations considerably easier.

The current political status quo is characterised not only by the economic requirements described above, but especially by two international factors that exert a considerable influence on political action in Germany. They are the Paris Climate Protection Agreement and the EU's climate policy.

1.2 THE POLITICAL CONTEXT

At the end of 2015, 188 countries signed an agreement at the Paris climate change conference which many observers described as a historical event. In his comprehensive review of the Paris Agreement, Bodansky (2016) set out what made the agreement so innovative. Among other points, he highlighted the following:

- Unlike the political declarations issued at prior climate conferences, the Paris Agreement is legally binding (Bodansky, p. 3[7]).

There are indeed several aspects of the agreement that are nominally "binding". However, whether international agreements are truly binding is debatable, as sovereign states cannot be forced to comply with agreements they have signed. The US, which recently decided to exit the Paris Agreement, is a perfect example.

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[6] The German debate, which focusses on the claim that the price in European emissions trading is too low, therefore makes no sense. At most, one might criticise that the quantities specified are too generous. But then the political target of a cut by 40 percent by 2030 would also have to be discussed.

[7] Quoted from a draft of the paper published in 2016.

- The agreement is global because its 188 signatories represent 95 percent of global emissions *(ibidem)*.

However, with the exit of the US, this value dropped to about 80 percent. Bodansky also mentions the following points:

- The agreement replaces the previously predominating form of top-down approaches characterised by rigid conditions with a flexible instrument that takes into account individual countries' circumstances and developments, and which follows a bottom-up approach.

- It has a long-term focus, is transparent and is designed to be reviewed at five-yearly intervals.

The so-called NDCs or Nationally Determined Contributions form a core element of the Paris Agreement. They represent national reduction commitments which each country had to submit prior to the Paris conference and which place certain obligations relating to CO_2 reductions on each country. The truly innovative aspect of the Paris Agreement was that these commitments were chosen by the countries themselves, rather than being imposed externally. Together with transparent monitoring, the hope was that countries would develop a high willingness to actually fulfil their commitments. Whether or not this hope was justified will be seen in 2020, when the first five-year review is due. But considering that global CO_2 emissions rose even after 2015 (and most recently at a slightly increasing rate), it is probably wise not to raise expectations about a significant breakthrough.

The great problem of the Paris Agreement lies in its approach of letting countries choose their commitments. To maximise buy-in, the decision was made to let countries set their own CO_2 reduction targets. This precludes the possibility of international arbitrage between marginal costs, a precondition for cost-efficient avoidance, from the outset. Furthermore, countries which are catching up economically and therefore have to increase their energy consumption were mostly left alone. The Paris Agreement does not provide any mechanism for linking the need for global climate protection to the economic development needs of poorer countries. China will start attempting to reduce its emissions from 2030 at the earliest. It is doubtful that India is in a position to avoid increasing its energy consumption considerably. In combination with the exit of the US, the scenario that presents itself is one where the world's three greatest emitters will make almost no contribution to reducing CO_2 emissions. It is unlikely that the remaining nations – foremost among them the developing countries – will be willing to accept significant burdens under these conditions.

Global climate collection urgently needs an instrument capable of leveraging the avoidance cost differentials between countries, minimising the burden of climate protection and which can give countries dependent on rapid economic growth options that allow such growth to be combined with climate protection. An appropriately designed form of global emissions trading could be just such an instrument.

As will be shown in greater detail below, the EU already has a working emissions trading system which has proved that significant CO_2 reductions can be achieved at a very low cost. One would think that the obvious course of action would be for the EU to leverage its successful model to create political pressure for the European ETS to be used as the core of a larger trading area by incrementally adding other countries. However, the EU's climate policy is not particularly consistent, and the expansion of the ETS is being approached with great hesitancy.

The EU introduced emissions trading in 2005 and specified that the member states themselves would be responsible for CO_2 avoidance in non-ETS sectors. But the EU did not leave it at that. Instead, it defined country-specific conditions for these sectors. This policy contradicts the core concept of emissions trading, which is to enable the exploitation of marginal cost differentials that exist between sectors and countries by means of trading. A command-and-control policy, as is being used for the other sectors, stands in direct opposition to this objective.

The purpose of the German government's climate package, which was adopted in September 2019, was to allow the country to meet its commitments regarding the non-ETS sectors, which to date had only been addressed to a very limited degree. The duality of European climate policy (emissions trading on the one hand and a policy of conditionality on the other) is also reflected in the German government's actions. On the one hand, it decided to start pricing CO_2[8], while on the other hand numerous isolated, dirigiste measures were adopted which do not even begin to ask the question of which CO_2 avoidance costs they will incur. The measures range from banning oil heating to giving the railway company sales tax relief. But no attempt is being made to design climate policy in a cost-efficient way.

All of this means that the political framework conditions for the next decade's climate policy are extraordinarily challenging. The many conditions and international commitments to which Germany is subject make it very difficult to deploy the kinds of flexible instruments that make it feasible to achieve cost efficiency. This despite the fact that a counter-model to the dirigiste approaches is available. As stated earlier, it involves globally standardised CO_2 prices. This counter-model will be described in greater detail in the following section. Afterwards, I will address the question of how this model could be implemented in reality despite the politically unfavourable status quo.

2. CO_2 PRICING

2.1 EMISSIONS TRADING

2.1.1 How emissions trading works

Emissions trading is especially suitable for allocating global pollutants in a cost-efficient way. In contrast to surface pollutants, global pollutants are dispersed extremely widely, meaning

[8] See the side note on p. 13.

that hotspots, i.e. local or temporary pollutant concentrations, play an insignificant role. Atmospheric pollutants are therefore ideal candidates for being reduced cost-efficiently through emissions trading. Although emissions trading has a long history in the academic literature, it is only a recent addition to the environmental policy toolkit, having first been deployed in the USA in 1990. With the Clean Air Act, passed in 1970 in the US, the country embarked on a highly ambitious clean air policy, which enjoyed great success under the EPA (Environmental Protection Agency), which was also set up around that time. Figure 3 shows the changes in important atmospheric pollutants since 1980. The ambit of the Clean Air Act was considerably expanded in 1977 and 1990 (Currie & Walker 2019). The 1990 reform introduced emissions trading for the first time, which proved to be extremely successful at dramatically reducing the sulphur dioxide emissions responsible for acid rain at a very low cost.

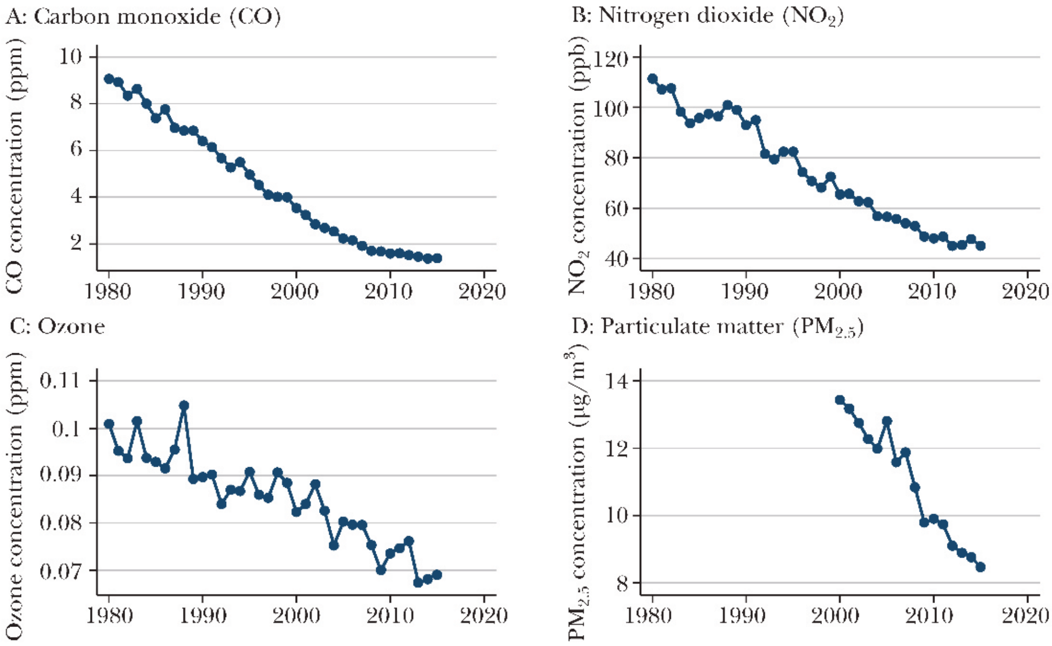

Figure 3: Clean air policy in the USA. Source: Currie & Walker (2019).

In addition, emissions trading was also used to regulate ozone emissions and other pollutants (see Schmalensee & Stavins 2019).

Initial experiences with emissions trading indicated that market-generated prices for pollution rights which reflected the marginal avoidance costs were considerably lower than had been anticipated. This is a pattern repeated across other emissions trading systems. It is an important factor in interpreting price developments on the European emissions rights market. We will return to this point at a later stage.

Correctly assessing emissions trading requires properly understanding its operating principle. The public debate – including politicians, journalists and scientists – often relies on the following narrative regarding how emissions trading works: trading allows a market for emission rights to emerge, and this market allows a price to be established. The higher the price of emission rights – in other words, the more expensive it becomes to emit CO_2 – the more CO_2 emissions are reduced. One implication of this narrative is that the price on the European emissions trading market was too low for a long time (ranging from €5 to €8 per tonne) and that its level after the 2018 reform (about €25) is appropriate for making trading effective. However, this narrative is incorrect.

It is by no means true that the price of emission rights determines the quantity of emissions avoided. On the contrary, it is the quantity of emissions avoided that determines the price of emission rights. The reason is that the emissions trading system is based on a two-step approach. First, regulators determine which emitters are to be subject to emissions trading. These emitters are then only permitted to emit CO_2 if they are in possession of an emission allowance (also referred to as a certificate or emission right). In the EU, the sectors covered by the ETS represent 45 percent of European CO_2 emissions. At the same time as the ETS sector is defined, the permitted total volume of emissions is set: the so-called cap.[9] Emission rights are only issued for the volume of CO_2 that may still be emitted after the cap has been put in place.

Defining the cap is a highly restrictive intervention by the state which has nothing to do with a "market-based solution". Quite the contrary. The intervention is necessary to correct a massive market failure. As the atmosphere is devoid of any property rights, anybody can access this good without paying a price – at least in the absence of regulatory intervention. Put differently, everybody has the right to use the atmosphere because it belongs to nobody. By defining a cap, the right to use the atmosphere as storage for CO_2 is first nationalised and subsequently partially privatised by issuing pollution rights. At this point it is important to understand that defining the cap unambiguously sets and simultaneously implements the avoidance target, which was decided at a political level. As rights are only issued for the permissible remaining emissions, the cap cannot be exceeded. In a sense, adherence to the limit is guaranteed administratively. For this reason, the price has no effect whatsoever on the volume of CO_2 emissions avoided. The volume is exclusively determined by the cap, which is politically defined.

The second step of the ETS consists in allowing the state-issued emission rights to be traded. The only purpose of trading is to allocate the avoidance of CO_2 emissions – politically decided and enforced – to emitters in a way that is cost efficient overall. In other words, the purpose of trading is not to avoid emissions, but to allocate a fixed avoidance volume. The state decides which quantity of CO_2 emissions is to be avoided, while the market determines where, how and by whom they are avoided.

The mechanism which leads to a cost-efficient allocation of avoidance activities is very simple. Emitters who have high avoidance costs are interested in owning emission rights and therefore act as buyers on the market for emission rights. Emitters with relatively low avoidance costs prefer to reduce their emissions and then sell the rights they no longer need to the buyers. As long as the price level lies between the avoidance costs of the two parties, an exchange takes place which is beneficial for both. The price which avoiding emitters obtain for the rights they

[9] Emissions trading systems are also known as cap-and-trade systems.

sell is higher than their avoidance costs. Buyers of such rights avoid having to spend money on reducing their emissions, and instead spend a lesser amount on acquiring the right to continue emitting at the existing level. The greater the marginal avoidance cost differentials, the more opportunities there are for profitable trade. Emitters with the lowest marginal avoidance costs have the strongest incentive to participate in the market as sellers. The consequence is that CO_2 is always avoided where doing so incurs the least cost. Ultimately, emission rights will continue to be traded until there are no more marginal avoidance cost differentials. At equilibrium, all beneficial exchanges have taken place and the marginal avoidance costs have adjusted to the same level, which effectively means that CO_2 avoidance has been allocated in a cost-efficient way.

The market price signals at which marginal avoidance cost level it was possible to avoid the quantity of emissions previously decided at the policy level. The price is determined by the interplay between the quantity specified and the current state of avoidance technologies. These two factors determine the price rather than the other way around. European emissions trading has shown that the target of reducing CO_2 emissions by 40 percent in the ETS sector (compared to the 1990 baseline) was possible at a marginal cost ranging from €5 to €7 (as of 2017). If, instead, it had turned out that the specified quantity could only have been avoided at a marginal avoidance cost of €50 per tonne, not a single additional tonne of CO_2 would have been avoided – reaching the target would simply have been ten times more expensive.

The incorrect interpretation of the price, which is persistently asserted in German climate policy circles, has paradoxical consequences. In reality, a low price should be welcomed. It shows that the burden of achieving the politically specified target is very low. It also creates an opportunity to lower the cap without causing major, politically problematic burdens. Until 2017, the EU had an unprecedented opportunity to link a cost-efficient climate policy tool with even more ambitious avoidance targets. Even as it was in 2017, the European ETS was one of the world's most successful climate policy instruments, and it could have been made even more successful.[10] But unfortunately, the EU reformed the system in 2018 in a way which raised the price five-fold almost overnight, negating key benefits of trade.

Understanding the extent to which the European ETS could be used to arrive at a global uniform price for CO_2 requires analysing the impact of the 2018 reform. The purpose and effects of the reform will be briefly outlined below along with some empirical findings on the ETS, before being compared with the results of Germany's national climate policy. The analysis is prefaced with a brief summary of the significant benefits of emissions trading.

- Like CO_2 taxation, emissions trading can lead to the cost-efficient avoidance of emissions. But in contrast to a CO_2 tax, emissions trading is a well-established tool in the EU which generates a uniform CO_2 price and which can evidently be successfully deployed in an international context.
- The ETS provides a safe and effective way to steer CO_2 emissions. In the battle to combat climate change, it is not the price of CO_2 which matters, but the quantity of

[10] See Weimann (2019).

CO_2 emitted. Being able to accurately control quantities therefore helps to achieve global climate targets. The potential price volatility associated with quantity control could be regulated through trading rules (price corridor, open market policy etc.) to ensure that it does not pose a risk to the economies involved.

- The ETS creates massive dynamic incentive effects, especially when the policy objective is to reduce the cap over the long term. Once it becomes obvious that the available amounts of CO_2 will decrease over time, and when emitters know that developing new avoidance technologies will result in immediate economic benefits, it may be safely assumed that significant technological advances will occur. In all likelihood, the low price in the context of the European ETS is largely due to this dynamic incentive effect.

- The ETS is a system that can be easily steered from a policy perspective. It is sufficient to decide on a cap and then ensure that emission quantities are monitored. The latter condition is already given in Europe.

SIDE NOTE: GERMANY'S FORAY INTO CO_2 PRICING

With the climate package adopted in the autumn of 2019, the German government made an attempt to embark on CO_2 pricing. Unfortunately, the attempt was an utter failure. The position paper on the climate package states: "From an economics perspective, a cross-sectoral, uniform price for greenhouse gas emissions is the most cost-efficient way to meet climate targets" (p. 3). But this insight is not backed up with corresponding policy decisions in the remainder of the paper. The climate package consists of over 60 different regulatory interventions, from banning oil heaters to reducing sales taxes for the railways. CO_2 avoidance costs are not mentioned even once in relation to these measures. The term "cost efficiency" appears only once, as quoted above. The only glimmer of hope is the statement that the federal government intends to work within the EU to expand emissions trading to include other sectors. But in light of the government's own approach to emissions trading, a large question mark hangs over the credibility of that statement. The 2018 reform, which places emissions trading at serious risk, was decisively supported by the German government. Together with the foray into CO_2 pricing as part of its climate package, the measures can be seen as clear indications that the German government has zero trust in using markets to regulate CO_2 emissions.

More specifically, a decision was made to introduce "emissions trading" for the transport and heating sectors. However, it is emissions trading without trading because the emission rights created by the state are issued at an initial fixed price of €10 per tonne, without a cap, and without being tradeable. This is not even a parody of emissions trading. Economically, it's equivalent to simply raising the energy tax. For diesel, it means a price increase of 2.66c per litre. Such an increase is less than the average price difference between two filling stations chosen at random on a given day, and will therefore not have much of a steering effect. But a steering effect is exactly what this "emissions trading" needs, precisely because – in contrast to true emissions trading – the quantity of emission rights is not limited. This means that the only way for an environmental effect to unfold would be by means of the price – a complete inversion of the logic of emissions trading.

End of the side note

The 2018 reform of emissions trading and the way in which the German government disregards emissions trading (see side note) represent important political framework conditions for the option of using emissions trading to achieve the overarching goal of a global, uniform CO_2 price. The following sections will explore the question of which fundamental opportunities emissions trading offers in this respect.

2.2 FROM A EUROPEAN TO A GLOBAL ETS

How could existing emissions trading systems be expanded to achieve the ultimate goal of global trade? There are three basic strategies. The most direct approach would be top-down: here, world climate conferences would be used to implement mandatory global emissions trading. The other two strategies are based on using existing emissions trading systems as a starting point. Either several such systems could be joined together to form larger units, or an existing ETS could be expanded by adding more countries and sectors. Of course, these three strategies are not mutually exclusive. They are discussed below.

2.2.1 The top-down approach

The EU ETS was introduced in 2005. At the time, the EU was the only world region to regulate CO_2 emissions by means of emissions trading. The EU ETS is still the world's largest emissions trading system. It covers about 45 percent of Europe's CO_2 emissions, representing an emission volume of about 2.1 gigatonnes (2019)[11]. By 2011, practically nothing had changed regarding the EU ETS's unique position. Only New Zealand, the city of Tokyo and the province of Alberta had introduced their own, local markets. However, between 2011 and 2019 the number of ETS increased rapidly around the world. In 2020, the EU ETS will lose its position as the world's largest emissions trading system to China, which will introduce national emissions trading covering about 3.2 gigatonnes of emissions (Figure 5). If one includes the Chinese ETS, about 8.4 gigatonnes or 15 percent of global CO_2 emissions will be covered by emissions trading systems by 2020. These more recent developments show very clearly that the emissions trading instrument has greatly gained in prominence and stature over the past decade. As recently as ten years ago, it was extraordinarily difficult to promote emissions trading in public debates. In Germany, the instrument was seen as a theoretical oddity that looked good on paper, but which was doomed to fail in practice and was therefore not perceived as a serious alternative to direct state intervention. The argument was buttressed by reference to the low prices in the European ETS, which were read as a sign of its failure.

Today, the situation is different in the sense that it is becoming increasingly clear that an ETS is by far the superior system and that it works perfectly well in practice. Price is still wrongly

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[11] https://carbonpricingdashboard.worldbank.org/map_data, last accessed on 14 November 2019.

used as an indicator of the effectiveness of an ETS[12], but the fact that the EU ETS is now achieving prices of €25 per tonne is interpreted as meaning that emissions trading can work in principle.

The fact that China in particular is going to great lengths to make prominent use of emissions trading as an instrument of its climate policy has greatly increased its acceptance. With this in mind, it is not inconceivable that global emissions trading could be a topic of discussion at future world climate conferences. The negotiations that would then be required would need to establish agreement on two key questions: the global cap, and the initial allocations to countries. What would not need to be negotiated is the CO_2 price, because that would be determined endogenously on the emission rights market.

Possibly the greatest benefit of emissions trading compared to CO_2 taxes is that the decision of how many trading rights to assign to each state before trading begins represents a useful distribution mechanism that makes it possible to combine cost-efficient climate protection with international redistribution. The consequence is that when negotiating the introduction of a global trading system, compensation mechanisms are available which can bring even countries for which climate protection is not a top priority on board.[13] This is especially true for poorer countries.

In less developed countries especially, the marginal avoidance costs for CO_2 are often very low because old technology is used to generate and utilise power. At the same time, these are the countries for which climate protection is a luxury good because their low level of development means that other things are far more important. Countries with pervasive poverty, weak infrastructure and underdeveloped or non-existent social security systems are usually not particularly interested in assigning a high priority to climate protection investments. Emissions trading creates an opportunity to issue these countries with emission rights free of charge at a level that covers their own emissions plus a growth reserve. Poor countries thus equipped have a great incentive to invest in energy efficiency because doing so provides them with an export good: emission rights which are no longer needed domestically.[14]

For developed countries, such a strategy could also create advantages. True, they would have to buy emission rights from poorer countries at scale, which would represent a real north-south transfer; but on the flip side, this would create strong demand for the energy-saving technologies developed in the north. An appropriately designed emissions trading system would help ensure that poorer countries are equipped with the resources they need to invest substantial amounts in their energy infrastructure. The resulting demand for capital goods would benefit the north at first, but would also mean that the countries of the global south would get better development opportunities, enabling them to become better integrated in international value chains. This would enable development policy to be combined with cost-efficient climate policy.

[12] Not only by politicians, but also by scientists. For example: Feist et al. (2019).

[13] See also Sachverständigenrat (2019).

[14] Feist et al. argue that a CO_2 price would have to be negotiated even when pursuing a top-down approach. But choosing such a approach would significantly reduce the opportunities to compensate poorer countries, depriving emissions trading of its greatest benefit.

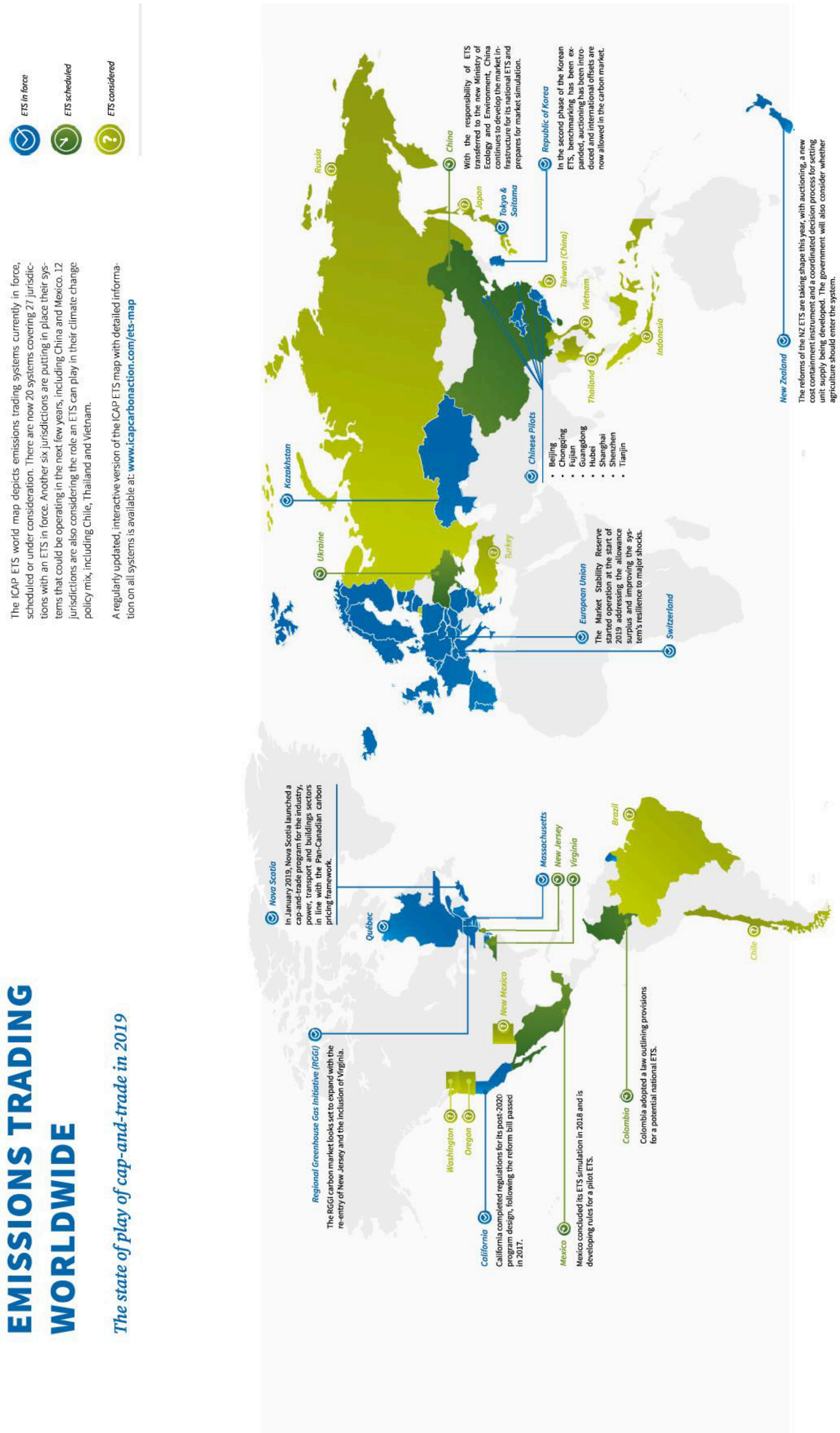

Figure 5: ETS worldwide. Source: https://icapcarbonaction.com/en/, last accessed on 17 November 2019.

Even though implementing global emissions trading seems at least conceivable, it is unlikely to happen in the short to medium term. Despite all the plaudits heaped on emissions trading in recent years, strong reservations remain in many countries, including in the EU. Even if these could be overcome, negotiating a global agreement represents a mammoth task. The interests of the countries involved are as varied as the countries themselves. As mentioned above, the only way to boost the prospects of this approach would be if it involved a considerable transfer from north to south. From the perspective of the donor countries (the north's industrialised nations), this redistribution is a public good. It is not possible to exclude individual countries from enjoying the benefits of global emissions trading, even if such a country does not participate in the redistribution needed to make it happen, or does so only to an insignificant degree. Difficult negotiations would have to take place not just between poor countries and rich countries, but also within the group of developed countries.

Global emissions trading has the benefit of minimising the burden associated with effective climate policy. The industrialised countries themselves would also derive a considerable benefit from this, as the German example shows quite clearly. Achieving CO_2 savings on German territory is extremely expensive and is highly constrained.

2.2.2 Connecting existing ETS

Figure 5 shows the world's emissions trading systems. It also highlights that Russia and Brazil, two of the world's largest countries in terms of territory, have considered introducing an ETS. But a closer look reveals two noteworthy and important blank spots: no ETS for CO_2 emissions have been introduced in Africa or India. Nevertheless, the chart shows that there are already enough, sufficiently large ETS for mergers to be an option.

Such a merger has already occurred in the EU ETS and another is under discussion. From 2019, the Swiss ETS was integrated with the European ETS. But at a coverage of just 6m tonnes, the Swiss ETS is very small. California's ETS is significantly larger: it covers 85 percent of the state's total emissions. No other ETS achieves such a high coverage rate. The EU is in regular talks with California about a merger, but without any concrete results to date. In total, there are currently about 27 ETS in operation, covering about 10 percent of global emissions. In 2020, China will introduce its national ETS, which will cover 3.2 gigatonnes on its own, boosting the share of global emissions covered to 15 percent[15]. The ICAP (International Carbon Action Partnership) provides a list of all existing systems and their most important characteristics, which is constantly updated[16].

Feist et al. (2019, p .20) present a snapshot of prices being generated in the most important ETS. It shows that the EU ETS price level of about $24 is the highest in the world. Only South Korea and Alberta come close. Most emissions markets produce prices significantly below $10. This is especially true of the Chinese pilot markets, where prices are closer to $5.

What challenges should be expected when attempting to merge multiple ETS? The core problem is best illustrated with reference to the necessary step of deciding on a cap. Such

[15] Feist et al. (2019), p. 16.

[16] https://icapcarbonaction.com/en/ets-map

determinations are an expression of political decisions. In the case of the EU ETS, they represent the outcome of a complicated negotiation process within the EU. The cap can be interpreted as the consistency and intensity with which a given region wants to pursue climate protection. As the strictness of the cap ultimately determines the price level, the price shows how ambitious climate policy is in the region. Interpreted in this light, the price overview provided by Feist et al. (2019) illustrates that there are significant differences when it comes to political decisions on climate policy. Such differences would have to be overcome to achieve a merger because once implemented, the joint cap represents the level of effort the merging partners are dedicating to their shared climate policy.

Merging ETS therefore requires the political will to agree on a joint climate policy. This requirement goes beyond just agreeing on a cap. For instance, the EU ETS is currently generating surpluses which are being transferred into a reserve. The decision to shut down a considerable part of this reserve by 2023, thereby suddenly lowering the cap, contributed to the price increase from €5 to €25 per tonne. In the hypothetical case of a merger with another ETS under a highly restrictive cap, the consequence could be that this ETS could access the surpluses of the EU ETS, meaning that they would no longer be transferred to the reserve. This would reduce the EU's possibilities of combating the redundancy argument – a vexing issue in various national political contexts – via shutting down the reserve. From an economics perspective, this would be a welcome development, but seen politically it would be highly problematic and could complicate negotiations.

The same applies in the opposite case. If the EU ETS were to fuse with an ETS where the price is on the order of \$5, it would mean that the price in the merged ETS would be significantly lower than \$25 and significantly higher than \$5. This would be a problem both for the EU, which clearly values a high CO_2 price very highly, albeit for incomprehensible reasons, and for the partner ETS, which would probably see its prices rising steeply. Quantity restrictions and the resulting prices are difficult political decisions in the context of an ETS. Any merger negotiations will require difficult decisions to be made. In contrast, the question of which sectors to include under an ETS is less problematic. For instance, there would be no fundamental objection to merging the EU ETS, which excludes the heating and transport markets, with an ETS that includes these sectors.

An ETS consists of more than just the decisions regarding which sectors to include and at which level to set the cap. There is a whole series of regulations that have to be decided and which need to standardised when two ETS merge. This brief report cannot address all aspects of such a process in detail, but here are the most important points in overview:

Choice of trading periods

Emissions trading usually takes place during sequential trading periods. The transition from one period to the next is often used to amend or adjust institutional arrangements. For instance, in the EU ETS, the rate at which the cap is being lowered is accelerated in the course of the transition to the fourth trading period in 2020.

Banking

An important characteristic of emission rights is their transferability to later years, even across trading periods. When such transferability is not given (as was the case in the first trading period of the EU ETS, for example), the emission rights market cannot produce reliable scarcity signals because it simply trades bets on whether the cap is sufficient (in which case the price drops to zero) or not (in which case it rises to the penalty payment due for emissions exceeding the permitted limit).

Offsets

In principle, the scope of an ETS can be extended by providing offset opportunities. In the EU ETS, for example, it was possible to create additional emission rights by leveraging CO_2 avoidance outside of the EU in the context of the Clean Development Mechanism (CDM). Offsets are aimed at achieving the same result as merging ETS does. The market is enlarged and additional opportunities are created to exploit avoidance cost differentials to reduce costs.

Monitoring and penalty mechanisms

Like all instruments for regulating CO_2 emissions, an ETS also relies on monitoring actual emission quantities, and punishing any party that generates unlicenced emissions. The corresponding rights would have to be standardised in the case of a merger of ETS.

Initial allocation of emission rights

Before trading in emission rights can be launched, the rights have to be transferred to the potential trading partners. There are various ways of doing this. In the EU ETS, a part of the emission rights was issued free of charge using the so-called grandfathering approach – mainly to companies with a high risk of carbon leakage. About 60 percent of rights were sold at auction and generated direct state revenue (or EU revenue). This procedure would also have to be standardised in a merged ETS.

Trade on the secondary market

This means the actual trade of emission rights. Designing it to be efficient requires suitable trading platforms and functioning exchanges. They have to be provided with monitoring and penalty mechanisms, as mentioned above. Here, too, there is considerable need for coordination when merging ETS.

The list shows that merging ETS is not without its pitfalls and that it involves solving numerous coordination tasks. But none of the tasks present insurmountable obstacles because the vital interests of the states involved are not affected at any point. When it comes to the question of setting the cap, things are a little different. The high volatility of prices illustrates that the countries and regions which have introduced an ETS clearly have a very divergent understanding of how restrictive climate policy should be. The following section assesses the potential suitability of the ETS in California and China for integration with the EU ETS.

California[17]

California's ETS was launched in 2012 and has been connected to that of Quebec since 2014. Apart from the energy sector, it also includes transport as well as agriculture and forestry. The system covers about 80 percent of California's greenhouse gas emissions. It differs from the EU ETS in one important aspect, which is that it includes all greenhouse gas emissions, not just CO_2. However, the targets are very similar. The goal is to return to 1990 levels by 2020, cut emissions to 40 percent below that level by 2030, and by 80 percent by 2050. The latter two values are similar to the EU targets, although in the EU emissions dropped to below 1990 levels a while ago. The unweighted average auction price was $14.91 per tonne of CO_2 equivalents in 2018. This puts it relatively close to the EU ETS price. The fact that California is currently approximately at the 1990 emission level, but intends to reach the same target as the EU by 2030, means that its cap reduction rates are significantly higher than in the EU. The annual reduction rate will accelerate from 3.3 percent per year at present to 4.1 percent per year from 2021. In contrast, Europe's rate will be 2.2 percent then.

The approach chosen for the distribution of initial allocations was also very similar to that of the EU. Here, too, it consisted of a combination of free initial allocations and auctions. In California, too, the free allocations were created to prevent potential leakage effects. The share of rights sold at auction is higher in California (75 percent) than in the EU ETS (60 percent). The mechanisms designed to prevent excessively rapid price increases are similar in both ETS. In both systems, emission rights can be offered from an existing reserve when prices rise too quickly. In addition, there is an upper price limit of $60 in California. If this threshold is reached and no emission rights can be bought at this price, the state is entitled to issue such rights, provided that it uses the resulting revenue to compensate the additional emission rights by avoiding emissions elsewhere.

Overall, the two ETS are similar enough to create a basis for serious negotiations regarding integration. The inclusion of additional sectors and greenhouse gases – one of the main differences between the Californian ETS and that of the EU – is not an insurmountable obstacle to integration. As mentioned above, the EU is in regular talks with California about joining the two systems, but so far without any concrete results.

China[18]

The situation in China is significantly more complex and complicated than in California. This is mainly because there are eight different ETS in China, which were launched in different regions as pilots. The Chinese government is currently preparing to introduce a national ETS that is intended to be launched in 2020. The plan is to maintain the pilot ETS for now and operate them in parallel to the national ETS, but in the medium term they are meant to be integrated. The problem is that not much can be said about the specific configuration of the

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[17] All data on the California ETS was sourced from International Carbon Action Partnership, EZS Detailed Information, as of 29 October 2019. Downloaded from https://icapcarbonaction.com/en/ on 17 November 2019.

[18] The information provided on the Chinese ETS is from the same source as that given for California.

national ETS at this stage because many details are simply not yet known. The ETS sector of the national system will be very large at over 3.2 gigatonnes, but it is not yet clear at which level the cap will be set.

Presumably the limit set on emissions will not be excessively strict. As China will only reach its peak emissions in 2030 and because the Chinese economy is continuing to grow strongly, the cap will likely be set at a level that does not place growth at risk. The prices generated by the eight pilot ETS suggest that the climate policy being pursued is not particularly strict or ambitious in terms of its reduction targets. For seven of the eight pilot ETS, the price ranged between \$0.55 (Shenzhen, Chongqing) and \$4.13 (Hubei). The only outlier is Beijing, where the price rose from just over \$5 in 2018 to \$11.19 in 2019.[19] Both the pilot ETS and the planned national ETS include far more sectors than the EU ETS does. This is important because it means that both California and China can serve as a kind of template for the EU when it comes to including further sectors in the EU ETS.

Linking the EU ETS and China's national ETS would be politically problematic, given the different levels of development in the context of decarbonising energy production. Linking a relatively tight EU cap to a more generous Chinese cap means that emission rights would flow from China to Europe. The CO_2 price would drop for Europeans and increase for the Chinese. This contradicts both European climate goals and China's growth plans. Europeans would avoid fewer CO_2 emissions, while for China, supplying energy for its growth would become more expensive. Both outcomes would presumably be difficult to justify politically. However, this does not change the fact that such a merger – which would cover over 5 gigatonnes – would be economically beneficial. It is highly probably that emissions could be avoided at a lower cost in China than in Europe. From a cost-efficiency perspective, shifting avoidance to China would therefore be highly welcome.

In summary, we can state that the EU certainly offers considerable potential to further the aim of a global market by integrating its ETS with other, existing ETS. The significance of such a step is illustrated by the following consideration. As a general rule, the price established in an ETS is lower the more opportunities exist to exploit cost differentials through trade. Such opportunities are directly dependent on market size. The larger the ETS market, the lower the avoidance costs at equilibrium, and the lower the CO_2 price. This also means that a merged ETS with a sufficiently large market volume can supply emissions avoidance at a lower cost than a smaller market. And this in turn could make it attractive for existing smaller ETS to join a larger market to exploit the cost-saving potential it offers. Creating a large ETS through mergers could thereby create a strong dynamic for merging existing ETS into a single system.

However, even if all currently existing ETS were merged, this would only cover about 15 percent of global emissions. It would still be a long way from achieving a truly global ETS, as the current ETS map still has too many large blank spots. For this reason, the third strategy for creating a global ETS is particularly important. It is discussed in the next section.

[19] International Carbon Action Partnership, EZS Detailed Information, as of 29 October 2019. Downloaded from https://icapcarbonaction.com/en/ on 17 November 2019.

2.2.3 Expanding the EU ETS

Enlarging the EU ETS by merging it with other, existing ETS is an important strategy. A critical limitation is that not many ETS are in existence yet. Creating a global ETS can therefore only succeed by persuading states which have not yet introduced emissions trading to do so. One possible way of doing this is by offering them accession to the EU ETS, in other words: enlarging the EU ETS by adding countries that are currently still blank spots on the ETS map. Two of the most important blank spots are India – the world's third-largest CO_2 emitter, and soon to be the world's most populous nation – and Africa. Currently, both regions are still characterised by comparatively low per capita CO_2 emissions: 1.56 tonnes for India, and lower still for Africa. But two processes currently underway mean that these two regions will nevertheless play a critical role in tomorrow's climate policy debates. The first is their persistently high population growth rates. The second is their economic development, with catch-up growth occurring particularly in India, but presumably also in many African states. Against this background, it could be highly worthwhile to actively integrate the two regions in the EU ETS.

In general, the task this represents for the EU is very similar to that described under 1.1, namely hosting a world climate conference with the aim of creating a global ETS. The main objective would be to persuade poorer countries to join the EU ETS. This will only be possible if the EU can offer corresponding incentives to the countries. As stated above, emissions trading offers precisely this opportunity because it means having to create emission rights and deciding on initial allocations. Specifically, the EU's offer would need to consist in equipping the countries in question with emission rights which the EU needs for its own CO_2 emissions and which it would then have to buy back from the newcomers. The resulting increased resource flow to these countries would put them in a position to invest in cost-efficient climate protection, making additional emission rights available for export.

Such a bilateral expansion of the EU ETS would not only have a direct impact on the countries involved, but could also act as a template for later negotiations at a world climate conference. If the EU can show that an ETS allows development policy to be combined with cost-efficient climate protection, this could positively influence the willingness of poorer countries to join a global ETS.

All of the options for incrementally developing a global ETS discussed here require the political will to do so. Currently, this political will does not exist in Germany. The resolutions of the German government regarding the 2019 climate packages represent a clear vote of no confidence in emissions trading. There is a lack of trust in market forces despite the overwhelming evidence in support of the superiority of this approach compared to state-directed climate policy. As long as the federal government makes every effort to sell the German variant of the energy transition against all opposition and using arguments that fly in the face of economic rationality, its commitment to emissions trading is not credible. But such a commitment to this instrument would be needed to create a dynamic in Europe that makes creating a global ETS a top priority.

2.3 THE COUNTER-MODEL: A CO_2 TAX

The proponents of CO_2 pricing by means of a tax mention several benefits of taxation compared to emissions trading.[20] One obvious benefit is that in the case of a tax, the long-term CO_2 price is known to all stakeholders and there is no price volatility. Conversely, significant price fluctuations under emissions trading systems were not just predicted theoretically, but also observed empirically. On the one hand, this is because the cap creates supply rigidity, meaning that increases in demand resulting from exogenous causes can lead to considerable price increases. On the other hand, it is because low prices tend not to lead to increased demand because the demand for emission rights is not primarily determined by their price, but by avoidance costs and the demand for energy.[21]

However, the price stability which a CO_2 tax enables is associated with volatile CO_2 emission avoidances. At a given CO_2 tax rate, CO_2 emissions will rise despite taxation when the demand for energy increases as a result of exogenous changes (for instance when world trade is growing strongly, when favourable economic policies in emerging markets lead to high growth or similar). Ultimately, the choice is between different types of volatility.

A second advantage of taxation versus emissions trading results from the double dividend which a CO_2 tax makes possible in principle. Whether or not such a second dividend really exists was a matter of controversial debate for a period, but ultimately it was found that the monies raised through a CO_2 tax can in principle be used to achieve a second dividend by using them to replace other distorting taxes. The result is an efficiency gain because the additional burden caused by the tax is reduced.[22] However, it means that the states collecting the tax have to be willing to return the revenue they raise to taxpayers. Experience has shown that politicians prefer using tax revenues to pursue other preferred objectives. Scepticism is warranted when it comes to the viability of a second dividend in economic and political practice.

Apart from the benefits which a CO_2 tax may have, it also has several disadvantages and problems which emissions trading avoids either wholly or in part. The first issue is deciding at which level to set the CO_2 tax. In the ideal case, the relationship between the tax rate and the resulting avoidance of CO_2 emissions is known. But in reality, it is usually unknown because it is primarily determined by the real avoidance costs that would be incurred at the sources. This kind of information is private. Central planners are not able to obtain it because emitters are unwilling to share it truthfully for strategic reasons.[23] Furthermore, the attempt to determine an optimal CO_2 price is doomed to failure. Because of the long time periods over which climate policy measures have an impact, it would require taking into account current costs and future benefits. And this in turn would require determining a discount factor with which to discount future benefits. The debate around the question of how to decide that value erupted mainly in connection with the so-called Stern report[24]. It showed that a value-free decision regarding the

[20] Cramton et al. (2017).

[21] Tietenberg (2013) p. 326.

[22] Regarding the double dividend debate, see Schöb (2006).

right discount rate is impossible. In the absence of such a value, it becomes possible to calculate almost any "optimal" price.

For any form of CO_2 pricing, a critical question is how it can be implemented internationally. A CO_2 tax only generates a cost-efficient international allocation of avoidance activities when the same tax rate is applied uniformly across all countries. Deciding what to tax and at which rate is a fundamental right of sovereign states. A global CO_2 tax has to assume that the governments of many countries would be willing to surrender this right and submit themselves to taxation collectively decided by a community of states. What makes this even more complicated is that taxing fossil fuels would impact different countries in very different ways. The impact would depend on the economic situation of the country, its level of development, and the availability of renewable energy sources such as hydropower. It should be kept in mind that a CO_2 tax, despite its ecologically positive effects, generates additional economic burdens as a result of the taxation. This means that a uniform tax rate would impact different countries in different ways. A global CO_2 tax provides almost no space to balance such inequalities. The implication is that negotiations about introducing such a tax would be exceedingly difficult.

A further difficulty with introducing a CO_2 tax is that fossil fuels are already taxed in many countries. Depending on the type of taxation, it may in effect already be a CO_2 tax, even if under a different name and with a different political treatment. Germany's climate and energy policy provides an illuminating example of how this can lead to significant complications. In Germany, fossil fuels are subject to the so-called "energy tax". This tax takes the form of a quantity tax, in other words: a fixed amount is charged per litre of diesel, petrol or heating oil. In effect this is a CO_2 tax, because when burning these fuels, the same amount of CO_2 is released per litre burned for each fuel type. For instance, burning one litre of diesel causes 2.67kg of CO_2 to be emitted.[25] Consuming 375 litres of diesel means releasing a tonne of CO_2. At the current energy tax rates (47.04 cents per litre, plus value-added tax), one tonne carries an additional cost burden of €215.10 in the form of a *de facto* CO_2 tax. However, the tax rates vary considerably. For instance, a tonne of CO_2 emitted from the exhaust of a petrol-engine car is taxed at €328.60, while the same amount of CO_2 is taxed at just €28.10 when emitted from the oil heater at home.[26]

The example illustrates some of the problems associated with introducing a standardised CO_2 tax. If such a tax were introduced in Germany at a level of €100 per tonne, for instance, the energy tax on diesel and petrol would have to be reduced and that on heating oil massively increased in order to achieve a uniform tax rate. Driving your car would become much cheaper, while heating your home would become much more expensive. It is easy to picture that this kind of political price-setting would engender considerable resistance. In Germany, neither politicians nor the general public are willing to admit that the energy tax is in fact a CO_2 tax. This leads to grotesque consequences.

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[23] See Weimann (1995) and the literature cited there.

[24] Stern (2007). Also see the literature cited in footnote 5.

[25] Spicher und Matousek (2014).

[26] Own calculations, see Weimann (2019).

Introducing a uniform CO_2 tax nationally is a considerable challenge, as the example of Germany shows. Introducing a uniform international CO_2 tax would be incomparably more difficult. Even within the EU, it has not been possible to harmonise taxes on fossil fuels, and that is without even mentioning a uniform sales tax rate. For example, Ireland has five different sales tax rates (ranging from 4.8 to 23 percent), Italy has four (from 4 to 22 percent) and Germany has two (19 and 7 percent). The right to draw up budgets and the right to set tax rates are some of the most important rights a government has. Giving them up in the interests of harmonisation is not possible even within the EU. The prospects of introducing a uniform global (or even international) CO_2 tax are exceedingly slim.

3. CONCLUSION

Even a conservative reading of this report indicates that emission trading systems offer enormous opportunities. They allow climate policy to be conducted successfully and in a way that is highly cost efficient: the promise this tool holds is that it offers maximum climate protection while imposing a minimal burden. But the analysis also includes the insight that the opportunities offered by an ETS can only be exploited when the requisite political will is available. This is currently not the case, at least not in Germany. This implies that there is an opportunity for political entrepreneurs to use this instrument to mobilise voters and build majorities for rational climate protection policies.

A further finding of the analysis is that an ETS would in all likelihood be the most suitable instrument for establishing and implementing a uniform CO_2 price. The system makes it possible to link efficient climate protection with redistribution in favour of developing countries in a way that benefits both parties. A uniform CO_2 price is more than just wishful thinking. It is probably the only way to create a climate policy that is successful at an international level. Only when the avoidance potential available globally can be leveraged in a way that is cost efficient will it be possible to reduce CO_2 emissions sufficiently quickly. If the community of states foregoes the cost-reducing impact of a uniform price, the climate protection measures required to meet international targets will very likely become so expensive that many countries – too many – will not be able to afford it.

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