Key Issues on Designing and Implementing Emissions Trading System in China

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Abstract

The mitigation of carbon emissions has been the subject of gradual policy development in the international community during recent years. China, as the world's most populous and largest developing country, is a large greenhouse gas (GHG) emissions source that grows rapidly in line with its industrialisation and urbanisation. Extensive air pollution within China today, however, is endangering the lives of countless citizens and sapping the nation's economic vitality. In response, the Chinese government is considering adopting appropriate environmental policy instruments to mitigate emissions, among which emissions trading system (ETS) is of great concern.
This article firstly makes a brief introduction to the status quo of China's emerging carbon market. In this context, two types of ETS are defined and a review of pilot programs on carbon emissions trading in part of China is provided. Before discussing the key elements on designing and implementing ETS in China, the methodology of a multi-criteria approach is explained in Section II, which is used to evaluate this market-based environmental policy instrument throughout the article. In order to develop a scientifically sound, economically rational and politically feasible ETS, key issues including the scope of cap's coverage, cap setting, system's point of regulation, allowance distribution methods as well as "cost-containment" mechanisms are identified and discussed in Section III. Finally, an outlook on ETS in China is provided as a brief conclusion on the basis of the above study.

Key Words: Emissions Trading System, Greenhouse Gas, Climate Change Mitigation, China

1. Introduction

The mitigation of carbon emissions has been the subject of gradual policy development in the international community during recent years. China, as the world's most populous and largest developing country, is a large greenhouse gas (GHG) emissions source that grows rapidly in line with its industrialisation and urbanisation. Extensive air pollution within China today, however, is endangering the lives of countless citizens and sapping the nation's economic vitality. In response, the Chinese government is considering adopting appropriate environmental policy instruments to mitigate emissions, among which emissions trading system (ETS) is of great concern.

The Outline of the Twelfth Five-Year Plan for National Economic and Social Development of the People's Republic of China (2011-2015) puts forward the application of emissions trading, anticipating the "step by step establishment of carbon emissions trading markets" to ensure further GHG mitigations throughout the economy (NDRC 2011). Based on this Outline, carbon emissions trading has been concretized through specific pilot programs in part of China. When discussing the initiative pilot programs of carbon emissions trading in China, it is necessary to clarify two types of ETS. The first is voluntary emissions trading, which is established upon previous pilot programs conducted at local level. The second is pilot ETS spread out in four municipalities, two provinces and one local level city in China (Figure 1). Given that industries included into these pilot ETS programs are compulsory to comply with their commitments under the pilot ETS, the nature of pilot ETS could be considered as a mandatory nature compared to the voluntary emissions trading, although there is no official definition on it yet (Tuerk et al. 2013).

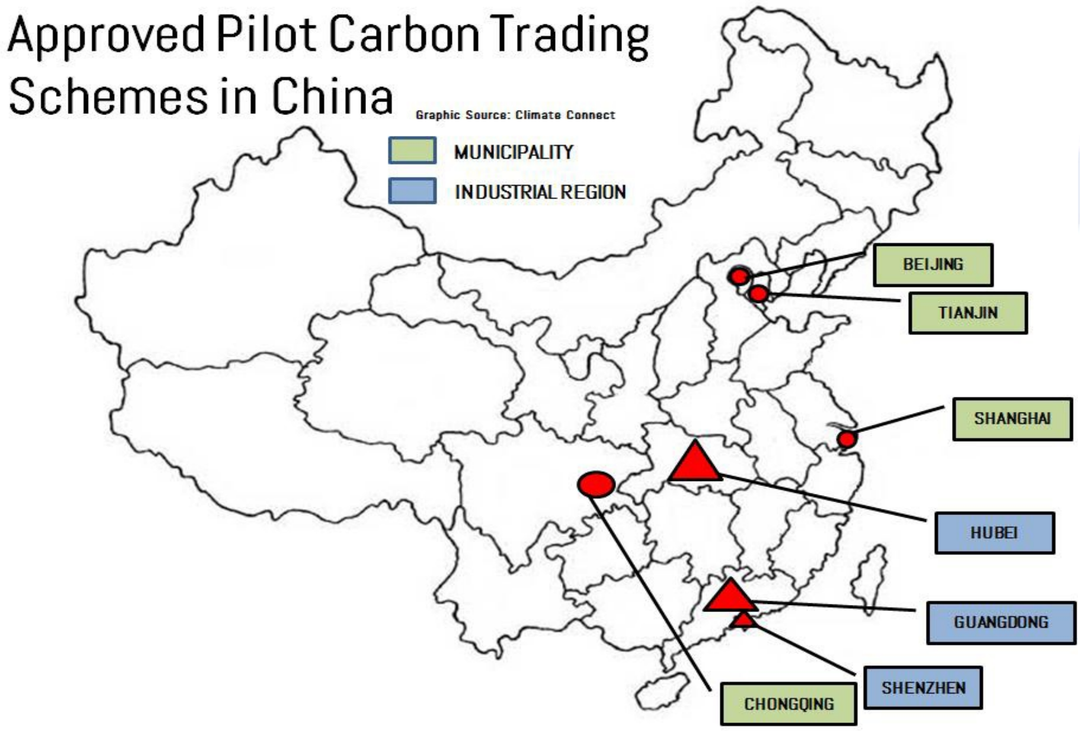

Figure 1 Pilot Carbon Trading Schemes in China (Source: Climate Connect)

Figure 1 clearly shows current pilot carbon trading schemes in China. Cities with green background are municipalities, including Beijing, Tianjin, Shanghai and Chongqing. Regions with blue background are industrial regions, among which two are provinces, including Hubei and Guangdong, and the other is a local level city Shenzhen located in Guangdong province. In the year 2011, a serious of pilot programs for carbon emissions trading operating in a similar way to the EU ETS were initiated by the National Development and Reform Commission (NDRC) in these seven regions (NDRC 2012). In general, these seven regions aggregately account for 18 percent of China's population and 28 percent of its national gross domestic product (GDP), but their energy and carbon intensity are below China's national average level (Tuerk 2013). Given that ETS is usually a learning-by-doing process and that learning costs during the early stage might be relatively high due to high uncertainties of economic growth and development, the primary cause why these regions are selected as pilot regions to conduct pilot ETS is not their energy and carbon intensity, but their capacity to pay for the high learning costs (Tuerk 2013). It is generally recognized that choosing richer regions as pilot regions firstly can minimize national wide learning costs in the long run, when other regions, especially poorer regions, can run ETS later upon the experience and lessons learned from these pilot regions (Tuerk 2013).

Although these seven designated regions are selected to conduct pilot ETS programs at local level, their development are not synchronous, which are divided into three groups. The first group is considered as first movers of pilot ETS in China, including Beijing, Shanghai and Guangdong. Beijing is the first pilot region announcing that its pilot ETS implementation plan has been formulated in March 2012, even though this implementation plan has not been published yet (*Progress on pilot ETS programs in seven provinces and cities* 2013).[1] Following Beijing, Shanghai (Shanghai Municipal People's Government 2012) and Guangdong (People's Government of Guangdong Province 2012) set out and published their implementation plans in July 2012 and September 2012, respectively. Following first movers, Tianjin (General Office of Tianjin Municipal People's Government 2013) and Hubei (General Office of the Government of Hubei Province 2013) published their pilot ETS implementation plans in February 2013 successively. Up to now, there are only two pilot regions, *i.e.* Shenzhen and Chongqing, without official implementation plans, where local pilot ETS implementation plans are still under drafting and preparation.

2. Research Methodology

In terms of research methodology, the methodology of a multi-criteria approach is clarified before discussing the key elements on designing and implementing ETS in China. The multi-criteria approach used in this study is founded on the premise that various criteria are needed to evaluate a policy (Venmans 2012). Indeed, evaluation is by nature normative and therefore a variety of specific criteria must be utilized as a basis for these normative judgements (Mickwitz 2003). There are all sorts of evaluation criteria, and different authors use different criteria to assess environmental policies (Mickwitz 2003, Harrington et al. 2004, Konidari & Mavrakis 2007, Baldwin 2008, Mundaca & Neij 2009, Wang et al. 2009, IPCC 2007, Stechow et al. 2011,

[1] Since there is no public access to Beijing's pilot ETS implementation plan, materials and data used in this thesis are based on secondary data, which is provided by people having internal materials.

Goers et al. 2010, and Stavins 2008). Based on the practical aims of China's ETS, this study follows the criteria proposed by the 4th assessment report of the Intergovernmental Panel on Climate Change (IPCC 2007), which distinguishes four principal criteria for evaluating environmental policy instruments.

The first and most important criterion is environmental effectiveness, which means the extent to which a policy achieves its intended environmental target or realizes positive environmental outcomes (IPCC 2007). For market-based environmental policy instrument, which aims at achieving the environmental goal through an economic-incentive manner, the second important criterion is cost-effectiveness, which indicates the extent to which the policy can meet its objectives at a minimum cost to society (IPCC 2007). A well designed policy scores also high in terms of distributional considerations, which presents the incidence or distributional consequences of a policy, including dimensions such as fairness and equity (IPCC 2007). The last but not least is institutional feasibility, showing the extent to which a policy instrument is likely to be viewed as legitimate, obtain acceptance, adopted and implemented by public society (IPCC 2007). These above mentioned four criteria are used to evaluate the ETS throughout this topic.

3. Key Issues on Designing and Implementing ETS in China

A scientifically sound, economically rational and politically feasible instrument for reducing carbon emissions is supposed to be well designed and properly implemented. In developing a carbon ETS in China, some key issues must be identified before designing and implementing such a market-based environmental policy instrument.

3.1 Scope of the Cap's Coverage

In the first place, the scope of the cap's coverage, or what emission sources and types of GHG emissions will be subjected to the overall cap, must be determined by the policymakers. The GHG ETS is designed to achieve the goal of carbon emissions reduction, thereby realizing the ultimate goal of mitigating climate change. Thus anthropogenic carbon dioxide (CO_2) emissions (*i.e.*, emissions produced by human activities) are the major focus of this environmental policy instrument, which arise from a broad range of activities involving the use of different fuels in many different economic sectors. Although CO_2 makes a significant contribution to the global warming, some non-CO_2 GHG, such as Methane (CH_4), Nitrous Oxide (N_2O) and Ozone (O_3), have impacts on the GHG concentrations (Blasing 2012) that should not be ignored. For example, biological sequestration and reductions in non-CO_2 GHG emissions can contribute substantially to minimizing the cost of limiting GHG concentrations (Reilly et al. 2003, Stavins & Richards 2005, and Stavins 2008). Therefore, some non-CO_2 GHG emissions might also be controlled and reduced under the same framework as CO_2 in a multi-gas ETS.

In addition to the types of GHG emissions, the ETS may vary by the number and type of sectors covered. For example, the EU ETS covers only electric utilities and heavy industry. Some other systems ignore households, agriculture, and small entities. Therefore, how to set sectoral boundary is also required to be determined by policymakers.

3.2 Cap Setting

Setting reasonable and feasible emissions targets, *i.e.* emissions caps, is one of the essential elements of the ETS, since the targeted emissions mitigation of this policy over the horizon of time is among the most important determinants of policy cost and its climate benefits (Paltsev et al. 2007).

When discussing cap setting, two types of caps need to be identified. One is absolute caps, which imply an absolute level of emissions during a defined period (Goers et al. 2012). The other is relative caps, which are defined by a certain activity, *e.g.* emissions per unit of output (Goers et al. 2012). Compared to absolute caps, relative caps provide more flexibility and certainty regarding the costs, while score lower in environmental effectiveness. Most countries and regions with existing ETS have adopted absolute caps, which are equivalent to their commitments under the Kyoto Protocol. However, during the first commitment period of the Kyoto Protocol, China has no binding emissions reduction targets under the Kyoto Protocol as a developing country. Therefore, the Chinese Government has not considered setting an absolute cap for its overall GHG emissions. This situation may be changed later, given that a legally binding agreement covering all countries is supposed to be prepared until 2015 and to enter into force by 2020, which has been confirmed by the United Nations Climate Change Conference (UNCCC) held in Doha in 2012 (Goers et al. 2012). In this context, China's policymakers need to reconsider this issue.

Due to the long-term nature of the climate problem, it is difficult to estimate when emissions reductions actually occur, which has significant flexibility. Phased-in targets, including short-term targets, medium-term targets and long-term targets, are introduced into the policies to deal with this "when flexibility".

Generally speaking, short-term targets taking stringent action too quickly may be associated with many costs due to the sacrifice of a continued high economic growth rate. However, these costs can be avoided by setting annual emission targets that gradually increase in stringency, without sacrificing environmental benefits (Wigley et al. 1996), as premature retirement of existing capital stock and production and siting bottlenecks arising in the context of rapid capital stock transitions can be avoided (Stavins 2008). In addition, gradually phased-in targets provide time to merge advanced technologies into long-term investments (Jaffe et al. 1999). Therefore, a climate policy's cost can be reduced by setting gradually phasing emissions targets.

By contrast to short-term targets, long-term targets are more likely to address the climate problem in lower costs due to the long-term nature of the climate problem and the need for technology change to bring about lower-cost emissions reductions. Developing advanced low-carbon and other relevant technologies themselves take a long time, and the adoption of these technologies will depend on the predictability of future carbon prices, which are influenced by the cap's constraints (Stavins 2008). Thus, it is essential that the ETS policy incorporate medium-term targets to long-term targets rather than short-term targets, making caps constitute a long-term trajectory.

Considering the relationship of games between economic development and climate change mitigation, a gradually increasing trajectory of emissions reductions over time, especially setting long-term gradually phasing emissions targets, is a reasonable and feasible means to achieve a win-win goal, sacrificing neither economical nor environmental benefits.

3.3 System's Point of Regulation

A related decision regards the system's point of regulation is a primary determinant of an ETS's cost on ensuring the achievement of the national emission targets. A cap on energy-related CO_2 emissions can be enforced by requiring fossil fuel suppliers to surrender allowances for the carbon content of their fuel sales ("upstream regulation"), or by demanding final emitters to surrender allowance for their emissions ("downstream regulation") (Jaffe & Stavins 2008). More precisely, an upstream point of regulation requires first sellers of fossil fuels to hold allowances (Stavins 2008), whereas a downstream point of regulation is exactly the opposite, requiring firms or gasoline stations to hold allowances. These two different points of regulation, however, have different impacts on the system's cost of achieving a particular national emissions target.

Generally speaking, an upstream point of regulation tends to create an economy-wide scope of coverage, which provides the greatest certainty that national emission targets will be achieved, whereas a downstream point of regulation is apt to limit the scope of coverage to a subset of emission sources, which leads to emissions uncertainty (Stavins 2008). It is obvious that an economy-wide cap effectively covers all sources of CO_2 emissions throughout the economy, thus is the principle element on ensuring the achievement of the national emission targets. For one thing, variations in emissions from unregulated sources may cause national emissions to deviate from expected targets (Stavins 2008). For another, limiting the scope of coverage to a subset of emission sources can cause "leakage", since market adjustments resulting from a regulation may lead to increased emissions from unregulated sources outside the cap which will partially offset reductions under the cap (Stavins 2008). Therefore, in order to ensure the achievement of the national emission targets, an economy-wide cap should be created, which can be realized by employing an upstream point of regulation.

Apart from ensuring the achievement of a particular national emissions target, an economy-wide cap with broad coverage of emission sources can also reduce the cost of achieving such a target (Stavins 2008). First, the broader the cap is, the more low-cost emissions reduction opportunities are provided, which can contribute to achieving the national emissions target (Stavins 2008). Second, given uncertainties in emissions reduction costs across sectors, an economy-wide cap can provide significant flexibility to meet the emission targets with lower costs (Stavins 2008). Third, an economy-wide cap can bring about incentives for innovation that is conducive to cost saving in all sectors of economy (Stavins 2008). Thus, an upstream regulation should be employed to create such an economy-wide coverage.

In contrast with a downstream regulation, a key advantage of an upstream regulation is that it lowers an ETS's administrative costs through its effect on the number of sources that must be regulated. Apparently, the system's administrative costs to regulators and firms will increase if the number of regulated sources rises. An upstream point of regulation makes an economy-wide ETS possible to cap almost all CO_2 emissions through regulation of limited upstream entities, making it administratively feasible.[2] Furthermore, an upstream program eliminates the regulatory need for facility-level GHG emissions inventories, which would be essential for monitoring and enforcing an ETS that is implemented downstream at the point of emissions (Stavins 2008). Therefore, an upstream point of regulation should be adopted to save the ETS's administrative costs.

3.4 Allowance Distribution

Policymakers must determine how to allocate allowances and these allocation decisions will have significant distributional consequences. Allowances can be freely distributed without charge to any persons, firms or other organizations in the economy, or they can be auctioned, or be allocated through employing a hybrid of the two methods. Theoretically speaking, the choice between auctioning allowances and freely distributing allowances does not have impact on firms' production and emission-reduction decisions, since firms face the same emissions cost regardless of the distribution approaches (Stavins 2008). When using an allowance that was freely received, a firm loses the opportunity to sell that allowance. Realizing this "opportunity cost", it will decide to use the allowance instead of investing emissions reduction technologies which will increase the cost. Consequently, in many respects, this allocation choice (freely allocating allowances) will not influence a cap's aggregate costs. However, these different approaches may affect an ETS's overall cost at different levels in practice.

In terms of auctioning, since it generates government revenue that can be put towards innumerable uses, it is recognized that auctioning has the potential to reduce a climate policy's economy-wide costs. One important example is that government revenues raised by selling emissions allowances (auction revenue) may sufficiently offset the need to raise revenues through distortionary taxes on beneficial activities such as capital (corporate income, dividends or capital gains) and labor (earned income) (Smith et al. 2002). In this context, the GHG ETS would yield not only an environmental dividend but also an economic one. Bovenberg and Goulder's studies show that "recycling" auction revenue through reducing personal income tax rates could offset 40 to 50 percent of the economy-wide social costs that a cap would impose if allowances were freely allocated (Bovenberg & Goulder 2003). Thus, the economy could be improved while also improving environmental conditions through auctioning allowances under an ETS (Smith et al. 2002).

Compared to auctioning, free distribution of allowances forgoes opportunities to reduce the costs of the existing tax system or fund other socially beneficial policies due to the absence of the opportunity to sell the allowances, thus will not influence a cap's overall costs in many respects. However, it can affect the distribution of a climate policy's economic impacts by redistributing a cap's economic burdens. Free allocations can be issued to the most influenced entities to mitigate impacts and compensate the most burdened sectors and individuals, contributing to the establishment of consensus on an ETS that achieves significative emissions reduction target. Given that free allocations may generate more costs compared to auctioning, it is important to consider how to distribute allowances freely in order to achieve

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[2] For example, in US, an economy-wide ETS was possible to cap nearly all US CO_2 emissions through regulation of just 2,000 upstream entities in the year 2005. *See* Stavins 2008.

specific compensation goals. Two dimensions are often concerned when discussing this problem. For one thing, it is crucial to consider what kind of entity is entitled to be distributed allowances freely. Since free distribution aims to redistribute a cap's economic burdens and compensate financial losses of affected sectors and individuals, this allocation choice should be applied to the most affected and burdened entities rather than entities that are not influenced or less influenced by the climate policy. For another, it is important to decide what share of allowances needs to be freely allocated to affected entities. Studies indicate that freely allocating all allowances in perpetuity to affected firms would significantly overcompensate them for their financial losses in aggregate (Goulder 2001, Smith et al. 2002, and Bovenberg & Goulder 2003). Therefore, it is not recommended to freely allocate all allowances to affected firms at the beginning and the share of allowances that are freely allocated is suggested to diminish steadily over time.

Considering the important differences in the implications of free allocation and an auction, there seems to be an "equity-efficiency" trade-off in the allocation decision. Although free allocation of any amount of allowances would reduce the potential efficiency improvements from revenue-recycling which could be realized by auctioning, it could provide an opportunity to address the distribution of an ETS's economic impacts, thereby compensating affected entities for equity losses. Faced with the dilemma between equity and efficiency, the best alternative is to start with a combination of the two approaches, wherein part of the allowances are freely allocated to affected entities that are burdened by the ETS and the rest are initially auctioned. In order to give equity-value compensation to affected entities, the share of allowances that are freely allocated should diminish over time until there is no free distribution into the program, since the private sector, including industries with long-lived capital assets, will have an opportunity to adjust to the carbon constraints (Bovenberg & Goulder 2003). The particular time-path of the numerical division between the share of allowances that is freely allocated and the share that is auctioned need to be analyzed by the economists, being consistent with the principle of targeting free distributions to burdened sectors in proportion to their relative burdens. Considering the complicated and changeful economic situation, it is feasible and practical to distribute the allowances more generous in the early years of the program, moving towards a rigorous allocation of the allowances steadily over the time.

3.5 "Cost-Containment" Mechanisms

A key concern about uncertainty regarding compliance costs is often expressed as concern about the level and volatility of allowance prices, deriving from the possibility of unexpectedly and unacceptably significant cost increases. In response to this concern, much attention has been given to the opportunity of including "cost-containment" mechanisms in the ETS to reduce cost uncertainty, such as allowance banking and borrowing, safety-valve provisions, and credits (offsets) mechanism.

Allowance banking and borrowing are often used to reduce some of the undesirable consequences of cost uncertainty by giving firms the flexibility to shift their emission reductions obligations across periods, when confronting unexpectedly and temporarily high or low costs, instead of undertaking costly reductions. Banking of allowances allows firms to undertake extra emission reductions (over-comply) earlier and save ("bank") unused allowances for use in future years, adding greatly to the cost effectiveness of previous ETS (Stavins 2003). However, banked allowances would be exhausted eventually if costs remain high over extended periods. This problem may be particularly acute and severe in a cap's early years, when relatively few allowances have been banked in the face of unexpectedly high costs. Therefore, allowance banking is not a useful form of cost protection in an earlier year. On this occasion, borrowing of allowances, which allows firms to under-comply their emission reductions obligations and use ("borrowing") allowances that will be issued in future years by shifting the deficit forward to the obligations in subsequent periods, is introduced to an ETS to demonstrate compliance in a cap's early years. Compared to banking that is allowed by many ETS, provision for borrowing is less common due to its default risk. When undertaking this cost-containment mechanism, it is necessary to establish credible mechanisms, ensuring that the use of borrowed allowances can be offset by future emission mitigations.

Although allowances banking and borrowing can be used to abate long-term cost uncertainty, the possibility of drastic short-term volatility of allowance prices may ask for bringing a sensible cost-containment mechanism into an ETS. Such an insurance mechanism is called "safety valve", which places a ceiling on the allowance prices and provides firms the option of purchasing additional allowances at this predetermined price (the safety-valve "trigger price") in the face of unexpectedly high costs (Stavins 2008, Jaffe & Stavins 2008). In this context, no firms would undertake emission mitigations more costly than the trigger price, which is an upper bound of the allowance prices (Jacoby & Ellerman 2004). Therefore, the "safety valve" put a ceiling on the compliance costs (abatement costs) as well. The trigger price is set at a sufficiently high level to avoid any impacts on normal allowances trading unless allowance price demonstrates factually dramatic spikes (Stavins 2008). Whether the safety valve could be triggered is controlled by joint selection of the number of allowances issued (the "cap") and the safety valve price (the predetermined fee) (Paltsev et al. 2007). Generally speaking, in the absence of the safety valve, the tighter the cap is, the higher the expected allowance price is, and vice versa (Paltsev et al. 2007). It is worth noting that this predetermined fee should be set at the maximum incremental emission-reduction cost that the society is willing to endure, otherwise this insurance mechanism would be less likely to be triggered (if the predetermined fee is set relatively high in relation to the expected allowances price), or it is better thought of as an emissions tax with allocated exemptions (if the predetermined fee is set relatively low in relation to the expected allowances price) (Paltsev et al. 2007).

Another cost-containment measure is credits (offsets) mechanism, which allows regulated entities to offset some of their emissions with credits from emissions mitigation mechanisms that are outside the ETS's scope of coverage, thereby achieving compliance obligations (Jaffe & Stavins 2008). The credits should be issued for selective use in this cost-containment mechanism, such as non-combustion uses of fossil fuels in some petrochemical feedstock and fuel exports that generate no emissions in process (Stavins 2008). Other emissions mitigation mechanisms, such as carbon capture and storage (CCS) (Stavins 2008) and biological carbon sequestration through afforestation and retarded deforestation (Stavins 2008) are supposed to be included into the credits mechanism as well.

3.6 Other Issues Concerning the Design and Implementation of ETS

In addition to the above mentioned key elements, some issues need to be considered when designing and implementing an ETS in China as well.

First of all, robust, transparent, consistent and accurate monitoring and reporting of GHG emissions are essential for the effective operation of the ETS. Monitoring systems that allow for credible measurement, reporting and verification of emissions trading activities are among the most critical elements for the successful implementation of any ETS. Generally speaking, monitoring, reporting and verification (MRV) works are conducted by a designated third party, and local firms are usually prioritized.

Secondly, when a national wide ETS is established, possible linkage will be considered as an alternative bottom-up approach to keep the idea of emissions trading on a global scale alive, which is not achieved yet by the international society through a top-down approach (Goers et al. 2012). The benefits of linking ETS between different countries and districts are obvious. It can not only reduce the overall costs of compliance in concerned systems while improving the overall economic efficiencies of the ETS, but also provide internationally competing companies with a wider regulatory framework due to a single price of carbon (Goers et al. 2012). Two types of linkage are available when discussing this issue. The first is linking China's ETS with other countries and regions, such as linking China's carbon market with the EU or Australia. The second is linking ETS with other scheme type, such as emission reduction credit system. Since the issue of possible linkage is usually discussed after the establishment of the ETS, therefore no further study is conducted in this study.

Another two issues which need to be considered when evaluating the effectiveness of the ETS are the competitiveness and the hidden peril of carbon leakage. The competitiveness of industries included into the ETS is often associated with carbon leakage, since one of the channels for carbon leakage is competitiveness leakage channel. The impacts of carbon pricing on firm's production costs are closely connected with the competitiveness of energy-intensive and trade-exposed ETS industries. When facing emissions limitations from the ETS, these industries may lose competitiveness. As a result, they will change their operation and investment decisions, for example increase emission-intensive production abroad, generating carbon leakage outside the region of the ETS.

4. Outlook on ETS in China

It is anticipated that a national wide ETS is expected to be established from 2015 after the pilot ETS programs in China between 2013 and 2015. It is obvious that the pilot ETS is conducted under a nation-wide bottom-up approach. However, a lot of questions need to be addressed before establishing such a national wide ETS in China, causing more uncertainties for China's future carbon market.

Firstly, It is obvious that the pilot ETS is conducted under a nation-wide bottom-up approach. However, a lot of questions need to be addressed before establishing such a national wide ETS in China, causing more uncertainties for China's future carbon market.

Secondly, the experience learning period of pilot ETS in seven regions from 2013 to 2015 is relatively short, making policymakers lack enough time to accumulate sufficient information. It is obvious that current pilot ETS programs at the local level are still immature, given that detailed provisions are insufficient in implementation plans of pilot regions, which needs to be further refined by policy makers. In this context, policy makers will be confronted with substantial challenges due to the lack of experience with sophisticated requirements of the ETS in terms of emissions data, administrative capacity, and solid regulatory frameworks, which are integral to a robust ETS (Tuerk et al. 2013).

Thirdly, from an international perspective, the downturn of EU's carbon market serves as a signal to participating enterprises that low-carbon technologies may not bring in expected profit, discouraging their enthusiasm in creating emissions quotas. Therefore, the ETS may be resisted by industry sectors and stakeholders, making launching a national wide ETS become infeasible.

Regardless of these above mentioned uncertainties and difficulties, the nature of the national wide ETS needs to be further clarified by the government. Policymakers need to determine whether this national wide ETS is voluntary or it is mandatory like pilot ETS programs in the seven regions, which will directly influence the linkage with other countries and regions. They also need to identify whether there is a transitional period for previous pilot regions. The articulation point between pilot ETS programs and the national wide ETS needs to be further explored by the Chinese Government in the near future.

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