**Article**



**Journal Title:** Chinese journal of population resources and environment.

**Vol/Issue/Date/Pages:** 7 2 2009 71-75

**Article:** Xin, J., Zongxian, F., Chi, Z. Application of tradable emission permits in europe

**Imprint:** Jinan, Shandong, China ; Chinese Journal of Population Resources and Environment

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# Application of Tradable Emission Permits in Europe

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**Abstract:** The purpose of this study is merely to review the current situation in the designing and implementation of the emission trading programs in Europe. Historical data show that although there is a series of shortcomings in their current functioning, employing such instruments for GHG reduction policy making is strongly expected to be efficient and effective. The European Union Emission Trading Scheme (EU ETS), Clean Development Mechanism (CDM) and Joint Implementation (JI) are just a few examples of the ambitious EU initiative that heavily relies on such instruments. We dwell on their operations and achievements by far and all the content in this article is expected to convince the Chinese government and regional public authorities to take positive actions and attitudes in promoting these instruments.

**Key words:** emission trading program, market-based instrument, EU ETS, CDM, JI

## 1 Reasons of market-based instruments

According to the basic theory of microeconomics, due to negative externality, the amount of pollutants discharged from industrial and agricultural production as well as household life is always beyond their social optimal levels. This problem cannot be dealt with in pure market economy (Baumol and Oates, 1988). In order to remove the externality and reset the pollutants to an optimum level, where the marginal revenue of production equals its marginal pollution cost, four groups of instruments are often employed as the key. The first is to calculate a common use standard of emission and oblige all the producers to keep their pollutant discharges under this level, i.e. command and control regulation. The second is to make use of economic instruments (market-based instruments, MBIs) to induce polluters to rearrange their production plans to a reasonable level voluntarily. Because this method saves great amounts of supervision cost and guarantees polluters' compliance to a large extent, it is normally regarded as a more cost-effective way in comparison with the first group (Hahn and Axtell, 1995). The third and fourth are the means of legislation and technology improvement respectively. Since their functions are apparent, they don't need to be discussed here.

Although MBIs are praised and recommended by many literatures, the application of them in practice just stays at the beginning phase. Even in Europe, only limited instruments have been handed out to polluters and are being exchanged in specified markets. More facts are needed to prove that the schemes runs well and can indeed propel the society to approach its optimum pollution level. We know MBIs are often classified into five main categories:

1) Tradable permits, which are designed to achieve reductions in pollution (such as emission of $CO_2$) or use of resources (such as fish quotas) in a most effective way through the provision of market incentive to trade;

2) Environmental taxes, which are designed to increase the cost of pollution, thus internalizing the externality, as well as raising the government's revenue;

3) Environmental charges, which are designed to cover (in part or full) the costs of environmental services and abatement measures such as waste water treatment and waste disposal;

4) Environmental subsidies and incentives, which are designed to stimulate the development of new technologies, to help create new markets for environmental goods, services, and technologies, to encourage changes in consumer behaviour through green purchasing schemes, and to temporarily support the achievement of a higher level of environmental protection by companies;

5) Liability and compensation schemes, which aim at ensuring adequate compensation for damage resulting from activities dangerous to the environment and providing means of prevention and reinstatement (Chavez, 2000).

In China, only the second and third categories are implemented, while as the most effective way by literature, tradable emission permits have not yet been put into practice. That may due to the complexity of designing and managing

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such a system. Thus it will be quite meaningful and instructive to observe and analyze the dynamics of tradable permits operating in the European market, and get to know the extensive influence caused by such a system. That is just the main objective of this study. Since the principles of issuing, trading, and administrating different kinds of tradable permits are quite similar, we just take one of them-tradable carbon permits-as an example to indicate the problems we should pay attention to during its operation.

## 2 Practical examples of tradable emission permits

Since the Kyoto Protocol entered into force on 16 February 2005, the international carbon market-the cornerstone of the Kyoto agreement-has already shown healthy signs of increasing volumes. While the market for greenhouse gas (GHG) allowances and reduction credits has been in operation for some years already, the market has only recently moved beyond the embryonic stage. However, growth has continued in all segments of the market, and the carbon market is indeed alive and well, although it has probably only reached the toddler stage.

Next, we shall provide a brief overview of the global carbon market for those who might not be familiar with the detailed and often highly complex structure of this new commodity market. Particular attention is given to the EU Emission Trading Scheme (ETS) and the project-based Clean Development Mechanism (CDM) and Joint Implementation (JI). These market segments are by far the most advanced of the Kyoto-related market mechanisms, although, as we shall see, they are at very different stages of maturity.

### 2.1 EU ETS

#### 2.1.1 Introduction to EU ETS

As the first EU-wide economic instrument and the first supranational emission trading system in the world, the European Union Emission Trading Scheme started to be used in January 2005. The scheme currently covers $CO_2$ emission from all of the larger sources in the power and heat sector, oil refineries and cokes ovens, and the production of ferrous metals, cement clinker, glass, tiles, bricks, porcelain, pulp, paper and board, about 11 000 installations in all.

The EU ETS works, simply put, by placing GHG emission limitations on a number of installations within specific sectors, and allowing the emission targets to be met through the trading of EU emission allowances (EUAs). The National Allocation Plans (NAPs), developed by each member state and approved by the commission, set the overall structure of EU ETS by outlining the upper level of allowances to be issued (the caps) and how these are allocated to sectors and individual installations within each member state. The EU Commission has approved in total EUR 6.3 billion allowances to be issued for the period of 2005–2007, excluding allowances set aside for new installations, resulting in an average of EUR 2.1 billion allowances to be distributed each year. However, member states' initial applications were even more.

Taking account of many reasons in reality, the EU ETS is designed to be a cap-and-trade system, which requires that at least 95% of the initial allowances are grandfathered. As appears from the finalized national allocation plans, only Denmark has made full use of the option of 5% auctioning. Most countries have not provided for auctioning.

Banking is allowed in this scheme within the first phase. However, none of the member states has allowed banking into the first commitment period, beginning in 2008. Furthermore, the EU ETS provides a limited borrowing option: allowances for the current year are provided by the end of February, whereas commitment for the previous year must be demonstrated by the end of April.

Monitoring is performed by the national 'competent authority', which issues allowances and checks the sufficiency of allowances surrendered by liable installation managers. The basis for monitoring and enforcement is a national registry as an electronic bookkeeping system for issuing, holding, transferring and canceling allowances. All transfers of information between national registries are supervised and checked by a transaction log run by a central administrator.

Penalties for non-compliance amounts are EUR 40 per ton of $CO_2$ in the first phase and EUR 100 per ton of $CO_2$ in the second phase. These are rather severe given the allowance prices that have emerged during initial trading, which run from EUR 7 to EUR 20 per ton of $CO_2$.

#### 2.1.2 Distribution of allowances

The EU Committee ended up cutting almost 300 Mt of al-

lowances, or more than 4% of the total volume, from the initial volume of allowances as submitted in the draft NAPs. Comparing this to 2003 emission, we find that the EU ETS covers 44% of all greenhouse gas (GHG) emission in the EU.

The annual average cap is distributed among the member states as shown in Fig.s 1 and 2. Germany is by far the member state with the highest number of allowances (488 Mt/year), followed by Italy, Poland and the UK pending around 250 Mt each for the first trading period, and France and Spain around 150 Mt. Together, these six countries constitute 71% of the total allowances in the market.

Fig.s 1 and 2 also show calculated $CO_2$ emission for the years of 1990 and 2003 in the sectors now covered by the EU ETS. The majority of the countries have had to reduce their emission compared to their 2003 level. Within each member state the allowances are allocated to the existing installations in five main sectors. Fig. 3 illustrates the distribution of allowances between these sectors. The power and heat sector is by far the largest sector, accounting for 55% of all allowances in the system, making the EU ETS primarily dependant on activities and changes within this sector.

Nearly 10 000 installations now have commitments within the EU ETS. Fig. 4 illustrates the distribution of allowances and installations categorized relative to the size of the installations. According to the currently available installation lists, there are 92 large installations with an allocation of more than 10 Mt $CO_2$ in the 3-year period of 2005–2007. Altogether these account for only 0.9% of the total number of installations but for a whopping 34% of the total allowances. At the other end of the scale, we find that there are close to 9000 small installations emitting less than 1 Mt $CO_2$, totaling only 19% of the allowances but more than 90% of all installations. However, it is the medium-

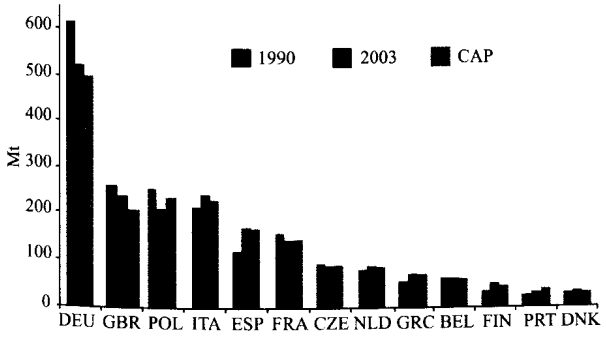


**Fig. 1 EU member states with more than 100 Mt in aggregated allocations for the 2005–2007 period with emissions in ETS sectors in 1990, 2003 and allocated in 2005 in Mt $CO_2$**

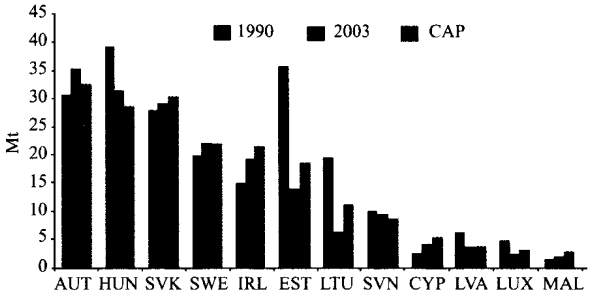


**Fig. 2 Total allocations to some of the smaller EU member states, aggregated for the period of 2005–2007: Emissions in ETS sectors in 1990, 2003 and allocated in 2005 in Mt $CO_2$**

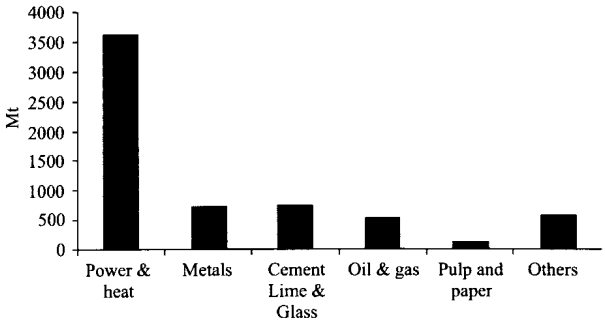


**Fig. 3 Total EU ETS allocations on the sector level, aggregated for the 2005–2007 period in Mt $CO_2$**

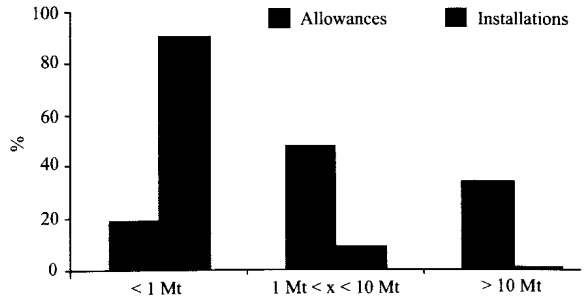


**Fig. 4 Distribution of allowances and number of installations according to size categories for installations**

sized emitters, between 1 and 10 Mt, which have the largest amounts of allowances, accounting for 47% of the total amount.

In addition to allocating allowances to the existing installations, the member states have in their NAPs set aside some allowances for new installations, the so-called new entrant reserves (NERs). Based on the current version of NAPs, the total potential supply of allowances from NERs for the 2005–2007 period is between 120–180 Mt. Unused NERs might be made available on the market later in the first trading period.

#### 2.1.3 Evaluation of EU ETS

The value of emission trading lies in benefiting from the differences in marginal abatement costs, allowing participants to choose their own optimal solutions with flexibility. The larger the variation in economic activity and geographical location under the cap, the larger the differences in abatement costs are likely to be (Brady, 1983). The market for EU ETS is certainly deep and wide enough. By the way, we think China owns this priority to implement emission trading programs as well.

The system does not cover all activities and gases relevant to climate change. About 2.15 billion allowances (of one ton of $CO_2$ each) have been allocated, covering roughly half of all $CO_2$ emission. The other five gases in the Kyoto basket, which account for 20% of European greenhouse gas emission, are not yet included in the system. In particular, transport is not covered by the system either, though it is undoubtedly a large and increasing source of greenhouse gases. Aviation is likely to have a much larger impact on climate change than what is associated with $CO_2$ only. The emission of water vapour, sulphate aerosols, soot, and the creation of cirrus clouds through con-trails should also be taken into consideration, while all of these cannot be solved by present EU ETS.

Another criterion to evaluate such a system is its simplicity and transparency in operation. The barriers to trade and the associated transaction costs should be as low as possible. The EU ETS has achieved simplicity to a considerable extent. Price information is readily available, since the transactions are accommodated by brokers. The consequences of examination from the above aspects show the scheme is basically satisfactory.

### 2.2 CDM & JI

While the EU ETS is a consequence of countries taking on their Kyoto commitments, the two project-based mechanisms are actually specified in the Kyoto Protocol itself.

The CDM is the only mechanism under the Kyoto Protocol involving countries that are not subject to binding greenhouse gas emission caps by the protocol, so called non-Annex I countries, primarily consisting of developing nations. Under the CDM, investors from Annex I states, i.e. industrialized countries, receive certified emission reduction units (CERs) for the actual amount of greenhouse gas emission reduction achieved through an emission reduction project, subject to host country agreement. Certified emission reduction units can be produced from projects initiated after 2000, and although most current projects are only contracted until 2012, there is no specific end date for the mechanism itself.

A key component of the CDM is the requirement of additionality. Certified emission reduction units generated under the CDM will only be recognized when the reductions of greenhouse gas emission are additional to any that would occur in the absence of the certified project activity.

Joint Implementation is the sister mechanism of CDM, allowing for GHG emission reduction projects to be carried out jointly between two or more developed Annex I countries, where one will act as investor/buyer and the other as host/seller. These projects will result in the so-called emission reduction units (ERUs), which can then be used for compliance by countries or companies. Although a test program for JI has existed since 1999, the actual transfer of allowances will not begin until 2008.

There are two broad categories under the JI, called Track 1 and Track 2. Whereas Track 2 is essentially the same as the CDM (*see* above) with strong additionality requirements, Track 1 is a very simplified procedure. The issuance of ERUs from a Track 1 initiative can be conducted provided the following criteria are fulfilled by both the buyer and seller: 1) both participants are parties of the Kyoto Protocol; 2) both participants have a national system for identification of GHG emission from sources and storage using sinks; 3) both participants have a computerized national registry compliant with international requirements; 4) both participants have submitted a report for determining

their initial assigned amounts; 5) both participants annually submit a current inventory protocol fully compliant with Kyoto requirements.

Hence, Track 1 system leaves much more up to the host nation than does Track 2 and the CDM. Track 1 JI projects are still, however, required to substantiate additionality.

While the above describes the project market in very broad terms, it is in fact a highly complicated market, with several steps and bureaucratic processes to go through before credits are issued and can be used for compliance purposes. Fig. 5 shows a very simplified picture of the different steps needed for a CDM project to produce credits, and some of the risks involved at different stages. In this context, the process for JI Track 2 can be assumed to be

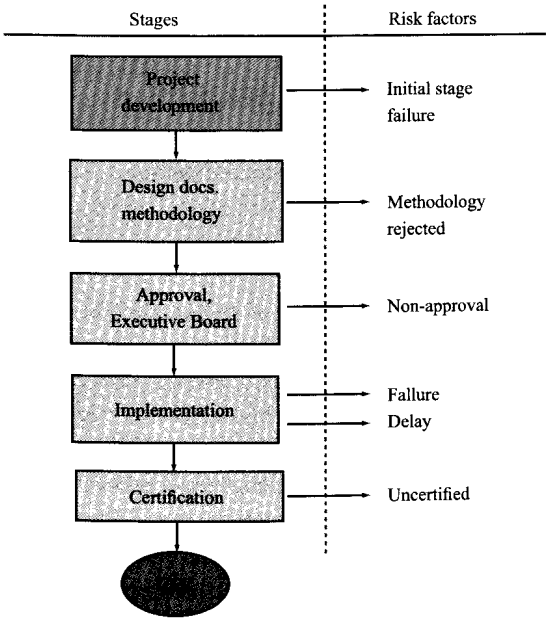


**Fig. 5 Different stages for a CDM project and some of the risk factors that might arise at different stagess**

fairly similar, although there will be different institutions involved.

## 3 Further discussion

While the concept of carbon ($CO_2$ emission) trading has been on the radar screen since the signing of the Kyoto Protocol in 1997, it has only started to gain momentum through the European Emissions Trading Scheme ('EU ETS') in recent years. There is now a live traded price for $CO_2$ similar to any other commodity and importantly this price is now giving signals to participants in carbon intensive industries, covered by the EU ETS, for their future investment decisions. In addition to EUAs (EU Allowances, which are the permits allocated to participants in the EU ETS) the flexibility mechanisms of Kyoto (CDM and JI) have created a class of carbon credits (CERs and ERUs) that provide another source of $CO_2$ units globally and are now fully fungible in the EU ETS. On top of these two basic carbon commodities, increasing commercial interest and traded volume have led to a small but developing market for more complex carbon instruments. There now is a platform for the development of an increasingly sophisticated liquid and at some stage global market for carbon emissions.

Increasing volume and more widespread use of project-based credits show the development of a global carbon market. The price of $CO_2$ is becoming an integral factor in carbon intensive sectors and gaining recognition beyond. In particular, the increased involvement from the financial sector increases both the activity and complexity of the market, while it might lead to significant price volatility according to the past experience of EU. However, from a longer-term perspective, the apparent misallocation of allowances in the early stages of the ETS can be seen merely as teething problems in a new and fast growing market. The long-term drivers and emerging platform are increasingly in place for the development of a liquid global market for $CO_2$.

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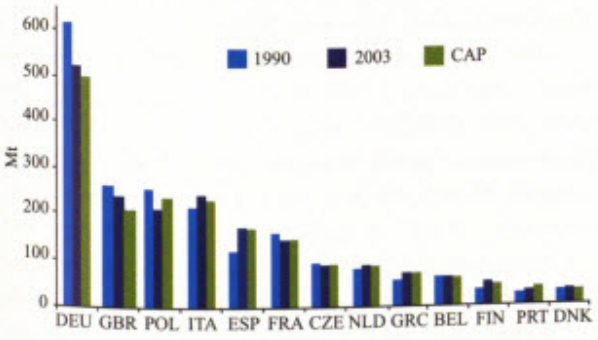


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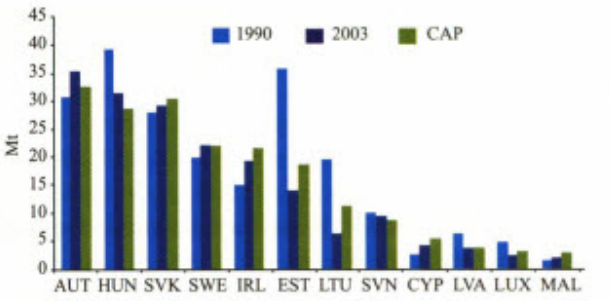


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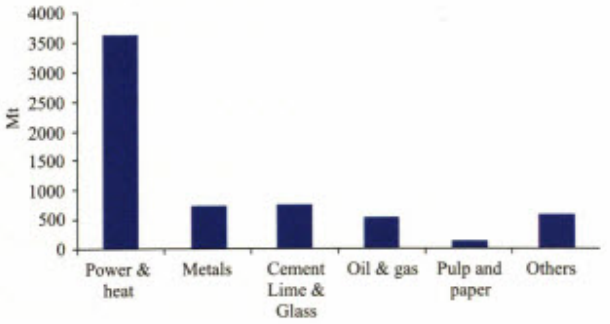


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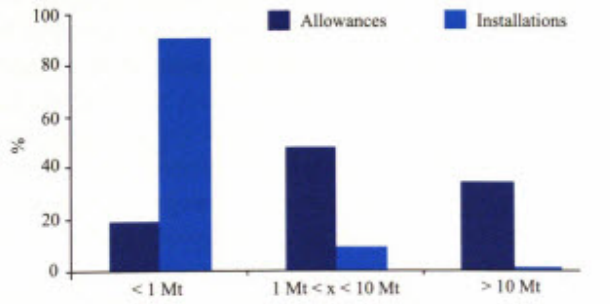


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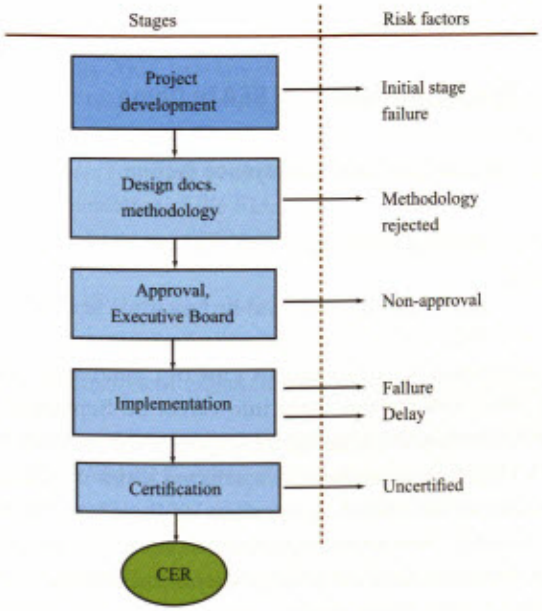


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