Emission Trading For China
the inspiration from the European Union
Emissions Trading Scheme

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ROYAL INSTITUTE OF TECHNOLOGY
Abstract

How to avoid and deal with dangerous climate change, which will have catastrophic economic and social consequences, has already become the focus worldwide. From the UNFCCC to the UN Climate Change Conference in Copenhagen, the international community has been trying to find effective means to reduce GHGs. Facing both internal demand and external pressure, as the largest carbon dioxide emitter, China needs to make further efforts to reduce CO$_2$ emissions.

So far, emission trading, especially the EU ETS has proved to be a good system to reduce emissions with low cost. In this thesis, the valuable experience and lessons of the EU ETS and the current situation of China are reviewed. The necessity, feasibility and limitations of applying the EU ETS in China are analyzed through comparative study and SWOT – PEST analytical model. In the light of the analysis result that establishing its own emission trading scheme based on the EU ETS will be a good choice for China, several recommendations are put forward concerning both the process of the “Sino ETS” and various stakeholders.

Key words: emission trading, EU ETS, China
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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAUs</td>
<td>Assigned Amount Units</td>
</tr>
<tr>
<td>AGCC</td>
<td>Action for a Global Climate Community</td>
</tr>
<tr>
<td>AR4</td>
<td>4th Assessment Report of IPCC</td>
</tr>
<tr>
<td>AWG-KP</td>
<td>Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol</td>
</tr>
<tr>
<td>AWG-LCA</td>
<td>Ad Hoc Working Group on Long-term Cooperative Action under the Convention</td>
</tr>
<tr>
<td>CAITEC</td>
<td>Chinese Academy of International Trade and Economic Cooperation</td>
</tr>
<tr>
<td>CBEEX</td>
<td>China-Beijing Environmental Exchange</td>
</tr>
<tr>
<td>CCTV</td>
<td>China Central Television</td>
</tr>
<tr>
<td>CCX</td>
<td>Chicago Climate Change</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CER</td>
<td>Certified Emission Reduction</td>
</tr>
<tr>
<td>CFI</td>
<td>Carbon Financial Instrument</td>
</tr>
<tr>
<td>CITL</td>
<td>Community independent transaction log</td>
</tr>
<tr>
<td>CMC</td>
<td>Central Military Commission</td>
</tr>
<tr>
<td>CMA</td>
<td>China Meteorological Administration</td>
</tr>
<tr>
<td>CMP</td>
<td>Meeting of the Parties to the Kyoto Protocol</td>
</tr>
<tr>
<td>CNCCP</td>
<td>China’s National Climate Change Program</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of the Parties (of the UNFCCC)</td>
</tr>
<tr>
<td>CPPCC</td>
<td>Chinese People’s Political Consultative Conference</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EEA</td>
<td>European Environment Agency</td>
</tr>
<tr>
<td>ERUs</td>
<td>Emission Reduction Units</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EU 27</td>
<td>27 Member States of the European Union</td>
</tr>
<tr>
<td>EUAs</td>
<td>European Union Emission Allowance Units</td>
</tr>
<tr>
<td>EU ETS</td>
<td>European Union Greenhouse Gas Emission Trading Scheme</td>
</tr>
<tr>
<td>GHGs</td>
<td>Greenhouse Gases</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>JI</td>
<td>Joint Implementation</td>
</tr>
<tr>
<td>MEP</td>
<td>Ministry of Environmental Protection</td>
</tr>
<tr>
<td>MtCO₂e</td>
<td>Metric Tonne Carbon Dioxide Equivalent</td>
</tr>
<tr>
<td>MUS$</td>
<td>Million US dollars</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>NAP</td>
<td>National Allocation Plan</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Statistics</td>
</tr>
<tr>
<td>NDRC</td>
<td>National Development and Reform Commission</td>
</tr>
<tr>
<td>NGOs</td>
<td>Non-Governmental Organizations</td>
</tr>
<tr>
<td>NLGCC</td>
<td>National Leading Group on Climate Change</td>
</tr>
<tr>
<td>NPC</td>
<td>National People’s Congress</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>PAP</td>
<td>Provincial Allocation Plan</td>
</tr>
<tr>
<td>PCC</td>
<td>The Party Central Committee</td>
</tr>
<tr>
<td>PRC</td>
<td>People’s Republic of China</td>
</tr>
<tr>
<td>SEAUs</td>
<td>Sino Emission Allowance Units</td>
</tr>
<tr>
<td>SEEE</td>
<td>Shanghai Energy &amp; Environmental Exchange</td>
</tr>
<tr>
<td>Sino ETS</td>
<td>Emission Trading Scheme of China</td>
</tr>
<tr>
<td>SPC</td>
<td>Supreme People’s Court</td>
</tr>
<tr>
<td>SPP</td>
<td>Supreme People’s Procuratorate</td>
</tr>
<tr>
<td>TCX</td>
<td>Tianjin Climate Exchange</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
</tr>
</tbody>
</table>
1. Introduction

1.1 Background
How to avoid and deal with dangerous climate change, which will cause catastrophic economic and social consequences, has already become the focus that the entire international community has paid increasingly attention to at present. In fact, the threats and potential risks, the increase of global temperature and the extreme weather events for instance, caused by climate change are already obvious. Hence, facing this global challenge, the international joint efforts are especially significant.

As the biggest carbon dioxide emitter, China has responsibility to make further efforts to reduce greenhouse gases emissions (GHGs). Moreover, it is necessary for China to find an appropriate system to tackle the emissions reduction issue, which in all probability will become an obligation of China in the near future.

Along with the development of carbon market, emission trading is seen to be an efficient measure to reduce greenhouse gases with relatively low cost in a region, although there is no unified global market of emissions trading now. As a leader in the field, the European Union contributes a lot and its emissions trading scheme (EU ETS) is considered as the biggest and relatively perfect system that offers referential experience. Certainly, copy the mode of the EU ETS completely will be unworkable for China, since different countries or regions have different actual situations. However, the theory and practice of the implementation of the EU ETS will provide great inspiration for China in exploring the suitable measure of GHG emissions reduction.

1.2 Literature review
Since Emissions Trading was presented as one of the three flexible market based mechanisms under Kyoto Protocol and during the implementation of the EU ETS, numerous scholars have been contributed to the relevant research in different perspectives.

Dutschke and Michaelowa (1998) clarified the history, concept and goals of emission trading. Zhang (1998) compared greenhouse gas emission trading with carbon taxes and states the advantages of emission trading, such as achieving the agreed target and more attractive to firms. Also the basic requirements for setting up emissions trading were discussed in the paper. Zhu, Liu and Sun (2003) analyzed the impacts from international emissions trading for different kinds of countries including developing countries.

introduced the overall situation. Feng (2009) showed the framework of global carbon trading market and the EU ETS as a “Cap-and-Trade” system was the leader. In addition, the experiences from the EU ETS were discussed in Wang (2009)’s article.

Along with the increase of awareness in reducing CO₂ emissions in China, more and more research relate emissions trading with China, and try to find measures to reduce GHG emissions in China. In the article named Emission Trading Policy Briefs (2003), the benefits for China from joining the emissions trading were presented. Sun (2009) analyzed the impacts of international emissions trading and its development trend on China’s economy from the perspective of international trade. Sun (2009) discussed from the perspective of climate exchange house and provided a proposal for establishing a carbon trading platform for newly founded Shanghai Energy and Environment Exchange. Besides, Zhang (2006), Ren and Lu (2009) and Bi (2009) put forward some ideas about building Chinese emissions trading market respectively.

Nevertheless, most of the literatures about emissions trading for China referred to Clean Development Mechanism (CDM), which is another flexible mechanism under Kyoto Protocol to reduce GHG emissions and is the only mechanism that could be used by developing countries.

Recently, several researchers noticed that the European Union and its EU ETS can also offer good experiences for China. Bo and Chen (2009) introduced the efforts from both the European Union and China in tackling climate change. As two representatives, Zhuang (2009) and Wang (2009) reviewed the EU ETS and discussed the referential significance from the EU ETS for China.

Although the topics of these articles were all about the EU ETS for China, the focus was still introducing the EU ETS itself instead of analyzing the inspiration from it. Also, some of the papers discussed about reducing sulfur dioxide (SO₂) rather than carbon dioxide (CO₂) emissions in China. Moreover, there are few relevant literatures after the Copenhagen Conference on Climate Change. Hence, this thesis will focus more on the inspiration from the EU ETS for China and provide up-to-date information about China’s efforts in reducing CO₂ emissions.

### 1.3 Aim and objectives

The aim of this thesis is to review the experience of the European Union in implementing emissions trading scheme under Kyoto Protocol, and discuss the inspiration of reducing CO₂ emissions in China from the EU ETS.

To achieve this aim, the thesis is designed to fulfill the following objectives:
- Identify the basic relevant concepts of emissions trading and the milestones of the efforts from the international community in reducing GHGs.
- Review the experience from the European countries — the EU ETS.
• Discuss the current situation of China and analyze the necessity, feasibility and limitations to apply the EU ETS in China.
• Summarize the recommendations for reducing CO₂ emissions in China.

1.4 Methodology
This thesis is mainly based on literature research. The information and data are collected from books, journals, dissertations, authoritative up-to-date internet resources, and so forth, in both Chinese and English. Besides, comparative study and SWOT – PEST analysis are used in the thesis.

1.5 Delimitations
According to the Kyoto Protocol, the six kinds of greenhouse gases which should be reduced by emissions trading include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) (United Nations, 1998). However, since the quantities of other GHGs can be calculated in CO₂ equivalents in order to assure comparability, and the EU ETS only focus on the most important GHG, CO₂, in the prophase, the focus of this thesis will be CO₂ also.
2. Climate change and emissions trading

2.1 Climate change – a global problem

“Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer)” (US EPA, 2010). It may due to whether natural variability or human activity as shown in the following table.

<table>
<thead>
<tr>
<th>Natural variability</th>
<th>Human activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural factors (e.g. changes in the sun’s intensity; slow changes in the Earth’s orbit around the sun)</td>
<td>Changing the atmosphere’s composition (e.g. through burning fossil fuels)</td>
</tr>
<tr>
<td>Natural process within the climate system (e.g. changes in ocean circulation)</td>
<td>Changing the land surface (e.g. deforestation, reforestation, urbanization, and desertification)</td>
</tr>
</tbody>
</table>


Since the Industrial Revolution, human activities become the main reason of climate change, especially for the warming that has occurred over the last 50 years. According to the data from the European Commission (EC), since 1850, the Earth’s average surface temperature has increased by 0.76°C (EC, 2010). If the required measures are not taken, in the light of the prediction of the Intergovernmental Panel on Climate Change (IPCC), the average surface temperature will continue to rise by a further 1.8-4.0°C, even may up to 6.4°C, which will definitely lead to irreversible and even catastrophic result (EC, 2010).

In fact, the threats and potential risks, such as the increase of global temperatures, the accelerated melting of ice and the rise of sea levels, caused by climate change are obvious. Coastal communities and low-lying islands are being threatened (e.g. Bangladesh, the island state of the Maldives), species are endangered, and people certainly will also be influenced by the extreme weather events and infectious diseases (e.g. malaria), and so forth, which are all due to the climate change.

Of course, climate change has always been a hot topic of the media, including newspapers, television, radio, and internet and so on. Nevertheless, when they describing the issue, they show different attitudes, which can be divided into four types:

- Maintain consistency with the government
- No own opinion but echo others’ view
- Try to offer scientific information
- Exaggerate to attract more attention and obtain benefits
As the media’s attitudes, different countries or organizations have their own interests and people also hold various views. So far, there is no fully consensus solution to tackle climate change and that result from and result in the various conflicts. However, the universally accepted fact is the climate change is a significant, global problem and it calls for joint efforts from all sides.

2.2 Milestones – the efforts of the international community

In order to reduce the emissions of CO₂ (the main gas contributed to climate change) and other greenhouse gases, and keep the average temperature from rising to more than 2°C (European Communities, 2007), many measures have already been taken. The IPCC which was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 is the leading body to assess and present the current state and potential consequences of climate change (IPCC, 2010). And based on IPCC’s increasing certainty that human activities has become the main cause of climate change, several important international agreements associated with this issue have been adopted. Four of them are representatives:

**United Nations Framework Convention on Climate Change**

The United Nations Framework Convention on Climate Change (UNFCCC) is a convention that sets an overall framework for intergovernmental efforts to tackle the climate change. It aims to stabilize the amount of GHG in the atmosphere so that the ecosystems could adapt them naturally, and also to ensure the food safety and sustainable social, economic development. After the United Nations initiated the UNFCCC in 1990, 154 countries signed it at the UN Summit in Rio de Janeiro in 1992. Nowadays, 192 countries including the US have ratified this convention. (Copenhagen Climate Council, 2010)

The supreme body of the convention is the Conference of the Parties (COP)¹, which consists of delegates from all the signatories. Besides engaging in the main tasks such as examining the emissions accounts submitted by Parties and the effects of the efforts taken by Parties, and assessing the advances of convention’s work, the COP gathers to discuss how to achieve its goals in the best way every year. (Copenhagen Climate Council, 2010)

**Kyoto Protocol**

The Kyoto Protocol is an international agreement (the first binding treaty) that was adopted at the third Conference of the Parties to the UNFCCC (COP 3) in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005 in a bid to commits the industrialized countries to control their GHG emissions (UNFCCC, n.d.).

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¹ COP is held every year since 1995. The detailed information about the annual meetings of COPs can be found in Appendix I.
In the Kyoto Protocol Annex B, the Convention’s Annex I Parties which will take the main responsibility to reduce GHG emissions and their individual targets are listed.\(^2\)

There is an important principle adopted by the UNFCCC named “common but differentiated responsibilities”. Under the Protocol, 37 industrialized countries and the European Community have to reduce their carbon dioxide equivalent emissions of the GHGs listed in Annex A\(^3\) by an average of 5% against 1990 levels during the commitment period from 2008 to 2012 (UNFCCC, n.d.), whereas the Non-Annex I countries including China do not have to introduce any new commitments due to their specific national and regional development priorities, objectives and circumstances, and also the “common but differentiated responsibilities” principles (United Nations, 1998). Certainly, all of the countries have the responsibility to do their utmost to reduce their GHG emissions.

Besides the national measures, countries with commitments under the Protocol to reduce GHG emissions (Annex B Parties) can adopt three innovative market-based mechanisms called Emissions Trading, Clean Development Mechanism (CDM), and Joint Implementation (JI) respectively to achieve their targets (UNFCCC, 2010).

- **Emissions Trading**

The targets which were accepted by the Annex B Parties of the Kyoto Protocol are expressed as levels of allowed emissions (“assigned amounts”) over the five-year commitment period. The allowed emissions are divided into AAUs—“assigned amount units” (UNFCCC, 2010).

As set out in Article 17 of the Protocol, Emissions Trading allows the emission units trading between the Annex B countries when one side has excess permitted emissions units and the other side emits over its targets (UNFCCC, 2010). Certainly, another trading precondition for the latter is that the cost of purchasing the emission units is less than reducing emissions by itself.

- **Clean Development Mechanism and Joint Implementation**

Both JI and CDM are project-based mechanisms which feed the carbon market. JI can be used by the Annex B Parties (industrialized countries) to carry out joint implementation projects with other Annex B countries (countries with economies in transition usually) to earn emission reduction units (ERUs) (UNFCCC, 2010). CDM enables the Annex B Parties to invest in emission-reduction projects in developing

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\(^2\) Belarus and Turkey which belong to the Convention’s Annex I are not in the Protocol’s Annex B, since they were not Parties to the Convention when the Protocol was adopted. Also, Kazakhstan has similar situation and is not listed in the Annex B. (UNFCCC, 2010) Besides, the US signed the Protocol on November 12, 1998 but formally withdraw from it in 2001 due to the opinion of the Bush Administration (Fletcher, 2005).

\(^3\) As mentioned in the delimitation and limitation part, 6 GHG are listed in the Annex A of the Kyoto Protocol including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)
countries and earn saleable certified emission reduction (CER) credits (UNFCCC, 2010). Hence, these mechanisms provide the flexible and cost-efficient measures for the Parties to fulfill a part of their Kyoto commitments by benefiting from foreign investment and technology transfer (UNFCCC, 2010).

**Bali Road Map**

After the IPCC published its AR4 (the 4th assessment report) and ensured the trend and terrible consequents of climate change without actions immediately (Clémençon, 2008), the COP 13 UNFCCC summit (also the CMP 3, the 3rd meeting of the Parties to the Kyoto Protocol) that held in Bali, Indonesia in December 2007 culminated in the adoption of the “Bali Road Map” (Decision 1/CP.13), which aims to agree on a course for arriving at a new post-Kyoto regime (a binding agreement) to tackle climate change by the time of holding COP 15 in Copenhagen, Denmark in December 2009. (Copenhagen Climate Council, 2010)

As a main decision, the Bali Action Plan reiterated the common but differentiated responsibilities of Parties and defined four foundational measures for a new agreement: mitigation, adaptation, technology transfer, and financing. (Clémençon, 2008)

- **Mitigation**: relates to emission control and reduction
- **Adaptation**: necessary and affordable for the Parties including developing countries, especially for the low-lying and small island states
- **Technology transfer and financing**: occur between developing countries that need support and developed countries with commitments

An ad hoc working group name “AWG-LCA” was established under the Bali Action Plan to negotiate long-term cooperative action among all the Parties to the Convention on how to achieve the objectives of the Convention (Convention Track). Together with the “AWG-KP”, which is another ad hoc working group that was set to discuss future commitments for developed countries at COP 11 in Montreal under the Kyoto Protocol (Kyoto Protocol Track), the “Double Track” was created since both of them have to complete the work at COP 15 in Copenhagen. (COVERING COPENHAGEN, 2010)

In addition, there is another bright spot that the road map involved the biggest emitter among developed countries — the US (Clémençon, 2008), which belongs to the UNFCCC Parties but formally withdraw from the Kyoto Protocol in 2001.

**United Nations Climate Change Conference in Copenhagen**

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4 Each ERU or each CER equivalents to one tone of CO₂ (UNFCCC, 2010).
5 The full name of “AWG-LCA” is the Ad Hoc Working Group on Long-term Cooperative Action under the Convention.
6 The full name of “AWG-KP” is the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol.
The high-profile COP 15 (CMP 5, AWG-KP 10, and AWG-LCA 8) was held in Copenhagen, Denmark during 7-19 December 2009. This Conference attracted unprecedented participation and raised climate discussions to a new level. For instance, there were 120 heads of State and Government attendance the conference, 10500 delegates, 13500 observers and more than 3000 media representatives took part in the conference and more than 1000, 400 and 300 meetings were held involved Parties, observers and media respectively. (UNFCCC, 2010)

However, the Bali Road Map negotiations could not be concluded in Copenhagen, that is, there was no further binding agreement (actual and verifiable obligations, or binding emissions targets) was reached among the Parties to ensure the second commitment period after 2012 , and negotiations will continue in 2010. (UNFCCC, 2010)

Certainly, the Conference in Copenhagen is not entirely nonsensical. As said by the UN’s top climate change official Yvo de Boer, the Copenhagen Accord, which was put forward at the end of the Conference after the intense and strenuous negotiations among Parties, includes a clear pledge by industrialized nations to provide short-term and long-term finance for developing countries for adaptation and mitigation, and it is a first step for the formal negotiations towards a successful outcome in Mexico in 2010 (UNFCCC, 2010). Moreover, the Conference in Copenhagen has drawn greater attention on climate change from all over the world.

### 2.3 Current situation of international emissions trading market

So far, there is no unified global emissions trading scheme. However, the international emissions trading market has been developed rapidly in recent years and different systems were established in many regions. According to transaction types, international emissions trading market can be divided into allowance-based market (the EU ETS for example) and project-based market (such as CDM and JI), whereas according to market attributes, it includes regulated market (for instance, the EU ETS) and voluntary market (such as CCX, Chicago Climate Change). The following tables show the annual volumes and values of transactions on the main allowance-based markets and project-based markets respectively.

#### Table 2. Carbon Market at a Glance

<table>
<thead>
<tr>
<th>Allowances</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU ETS</td>
<td>Volume</td>
<td>Value</td>
<td>Volume</td>
<td>Value</td>
</tr>
<tr>
<td>NSW</td>
<td>321</td>
<td>7908</td>
<td>1101</td>
<td>24357</td>
</tr>
</tbody>
</table>

| NSW        | 6 | 59 | 20 | 225 | 25 | 224 | 31 | 183 |

7 MtCO₂e means Metric Tonne Carbon Dioxide Equivalent
8 MUS$ stands for “million US dollars”
As can be seen from the above table, the overall carbon market grew rapidly in these years, reaching a total value of transaction of about US$ 126 billion (€ 86 billion) in 2008, which was more than ten times of its 2005 value. Also, most of them (more than US$ 92 billion, € 63 billion) was accounted for by transactions of allowances, and the EU ETS occupied the main part of the whole market.

**The EU ETS**


The first phase of the EU ETS was from 2005 to 2007 (“warm-up” phase), followed by phase II (2008-2012, in consistent with the commitment period under the Kyoto Protocol) and phase III (2013-2020), and it will be continued (European climate exchange, 2010). The initial focus of the EU ETS is only on CO$_2$ from big industrial emitters, the power and heat generation industry and selected energy-intensive industrial sectors such as combustion plants, iron and steel plants, pulp and paper factories, and so on, whereas other GHGs emissions and more and more sectors are being involved gradually (European Communities, 2005). So far, the EU ETS covers more than 10000 installations$^9$ across the 27 Member States of the European Union (the EU 27, see Appendix IV). Besides, Iceland, Liechtenstein and Norway also joined in the ETS (European Commission, 2010).

As a cap-and-trade system, the EU ETS has its own institutional arrangement. The main aspects are as follows (Wang, 2009):

---

$^9$ An installation is defined as “a stationary technical unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution” (European Commission, 2003)
Firstly, the European Commission distributes the emission reduction targets to the Member States in consistent with the “common but differentiated responsibilities” principle, which means that all the Member States have the responsibility of reducing CO\textsubscript{2} emissions but the targets should be allocated according to different Member States’ actual conditions, various developmental levels for instance.

Secondly, the Member States set emissions limitations (fixed amount of emissions allowances, that is, the “cap”) for all obligated installations in their countries; that is, drawing up the National Allocation Plan (NAP), submits the NAP to the European Commission to review and approval before a certain deadline and makes it known to the public. The European Commission has power to require changes or even reject them, and the final approved NAPs cannot be changed any more (European Communities, 2005). Although the Member States have some flexibility in deciding their allocations, there are several common criteria\textsuperscript{10} contained in the Directive that they must comply with. Moreover, it is required that the allocation of emission allowances will be largely free, though up to 5% of allowances are auctioned in phase I and up to 10% in phase II (Kruger & Pizer, 2004).

Thirdly, the European Union Emission Allowance Units (EUAs) could be traded among the installations, as AAUs that was mentioned before. One EUA equals to one tonne of CO\textsubscript{2} equivalent. The “cap” can ensure the scarcity so that the EUAs trading market exist. The installations that have excess EUAs, through improving technologies or restricting outputs for instance, can sell them to other installations that emit over their allowance.

Fourthly, the monitoring and reporting system and the heavy fine ensure the implementation of the EU ETS. Each installation in the ETS must have a permit, which sets out the emissions monitoring and reporting requirements, issued by its competent authority. That is, the permit is also a certificate to show that the operator is capable of monitoring and reporting the plant’s emissions. The installations which fail to produce sufficient allowances to cover their emissions must pay €40 in phase I and €100 in phase II as a fine for each excess tonne emitted (European Communities, 2005).

In addition, instead of printing, the allowances traded in the EU ETS will be held in accounts in electronic registries set up by Member States. All of the registries and each transaction will be overseen by a Central Administrator at EU level through the Community independent transaction log (CITL). (European Commission, 2010)

Furthermore, Banking and some degree of borrowing of allowances are allowed

\textsuperscript{10} Three main rules are: 1."an allocation plan has to reflect a member state’s Kyoto Protocol targets as well as its actual and projected progress towards meeting it.” And the key is the total quantity of allowances. 2."allocations to installations must take account of their potential for reducing emissions from each of their activities, and must not be higher than the installations are likely to need.” 3."where member states intend to use JI and CDM credits to help them reach their national emission target – thereby giving their companies more scope to emit – these plans must be substantiated, for example through budgetary provisions.” (European Communities, 2005)
within any compliance period. However, the rules between trading periods are more complicated. Banking and borrowing was not allowed between the first and second trading periods (phase I and phase II), in order to prevent any compliance failure during the “warm up” phase from spilling over into phase II and thereby complicating the fulfillment of the EU’s Kyoto commitments. For phase II and subsequent trading periods, unrestricted inter-period banking, but not borrowing, is allowed. (Ellerman & Joskow, 2008)

Moreover, besides the installations covered by the ETS, anyone else including individuals, institutions and NGOs (non-governmental organizations) for example, is free to trade in the market in the same way (European Communities, 2005). Also, the market of the EU ETS is EU-wide, however the emission reduction opportunities are also in the rest of the world through the use of CDM and JI (Kyoto offsets), and provides for links with compatible scheme in third countries. (European Commission, 2010)

In summary, the basic model of the EU ETS can be shown as the following chart:

![Figure 1. Basic Model of EU ETS](image)

* Installation A has the surplus allowances through improving technology, using clean energy or limiting outputs.
* Installation B emits above the targets and trades EUAs with installation A under the EU ETS.
* Installation C emits above the targets without purchasing the allowances, hence, it
has to pay a heavy fine.

Actually, the EU ETS model has been constantly improved and the performances of the EU Member States have been getting better as well. However, more efforts are needed to reach the Kyoto Protocol targets especially for the countries that did not do well.

<table>
<thead>
<tr>
<th>EU MEMBER STATE</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>KYOTO TARGET 2012</th>
<th>% UNDER KYOTO TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATVIA</td>
<td>10.7</td>
<td>10.7</td>
<td>10.9</td>
<td>11.7</td>
<td>12.1</td>
<td>23.2</td>
<td>48.07%</td>
</tr>
<tr>
<td>ESTONIA</td>
<td>21.2</td>
<td>21.2</td>
<td>20.7</td>
<td>19.2</td>
<td>20.0</td>
<td>40</td>
<td>45.00%</td>
</tr>
<tr>
<td>LITHUANIA</td>
<td>10.7</td>
<td>21.1</td>
<td>20.0</td>
<td>22.8</td>
<td>24.7</td>
<td>44.1</td>
<td>43.99%</td>
</tr>
<tr>
<td>ROMANIA</td>
<td>NO DATA</td>
<td>100.1</td>
<td>143.7</td>
<td>153.9</td>
<td>163.3</td>
<td>558.8</td>
<td>41.60%</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>NO DATA</td>
<td>88.9</td>
<td>89.8</td>
<td>71.5</td>
<td>75.7</td>
<td>127.3</td>
<td>40.33%</td>
</tr>
<tr>
<td>HUNGARY</td>
<td>93.3</td>
<td>70.5</td>
<td>90.6</td>
<td>78.9</td>
<td>75.9</td>
<td>114.9</td>
<td>33.54%</td>
</tr>
<tr>
<td>SLOVAKIA</td>
<td>51.1</td>
<td>46.8</td>
<td>48.7</td>
<td>40.0</td>
<td>47.0</td>
<td>87.2</td>
<td>30.00%</td>
</tr>
<tr>
<td>POLAND</td>
<td>502.5</td>
<td>556.7</td>
<td>589.</td>
<td>553.8</td>
<td>586.5</td>
<td>551.7</td>
<td>37.70%</td>
</tr>
<tr>
<td>CZECH REPUBLIC</td>
<td>147.0</td>
<td>147.1</td>
<td>145.6</td>
<td>141.8</td>
<td>150.8</td>
<td>150.6</td>
<td>15.10%</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>70.9</td>
<td>69.7</td>
<td>67.6</td>
<td>63.8</td>
<td>64.5</td>
<td>75.2</td>
<td>12.03%</td>
</tr>
<tr>
<td>UNITED KINGDOM</td>
<td>006</td>
<td>006</td>
<td>007</td>
<td>007</td>
<td>007</td>
<td>007</td>
<td>007</td>
</tr>
<tr>
<td>FRANCE</td>
<td>580.0</td>
<td>586.1</td>
<td>581.4</td>
<td>541.7</td>
<td>521.1</td>
<td>564</td>
<td>5.35%</td>
</tr>
<tr>
<td>GREECE</td>
<td>137.6</td>
<td>137.0</td>
<td>136.2</td>
<td>128.1</td>
<td>131.5</td>
<td>130.6</td>
<td>9.18%</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>147.0</td>
<td>147.6</td>
<td>145.6</td>
<td>136.6</td>
<td>131.5</td>
<td>135.6</td>
<td>3.02%</td>
</tr>
<tr>
<td>GERMANY</td>
<td>1024.4</td>
<td>1025.1</td>
<td>1001.5</td>
<td>980.0</td>
<td>990.1</td>
<td>972.8</td>
<td>1.73%</td>
</tr>
</tbody>
</table>

In Figure 2, countries in the green do well and emit less than their 2010 target, whereas the countries in the red emit over their Kyoto targets

**Chicago Climate Exchange (CCX)**

“CCX operates North America’s only cap and trade system for all six GHGs, with global affiliates and projects worldwide.” It is another representative in the international emission trading market. Since 2003, CCX launched trading operations. All CCX Members achieve annual GHG emission reduction targets through making a voluntary but legally binding commitment. (CCX, 2010)

The CFI\textsuperscript{11} contract (each represents 100 metric tons\textsuperscript{12} of CO2 equivalents), which is consist of Exchange Allowances and Exchange Offsets, is the commodity traded on CCX. The trading model is also base on emission trading mechanism: the CCX Members that reduce below the targets have surplus allowances to sell or bank;

\textsuperscript{11} CFI: Carbon Financial Instrument
\textsuperscript{12} Metric tons = tonnes
whereas anyone who emits above the targets complies by purchasing CCX CFI contracts. (CCX, 2010)

Certainly, there are many other markets in Australia, Canada, Japan, England, Norway, and other regions. Nevertheless, the EU ETS and CCX are the representatives, which show the basic structure and the trading principles in the international trading market nowadays.

2.4 Lessons from the EU ETS

Certainly, the EU ETS is not a perfect emissions trading scheme. Several problems emerged gradually after implementing the EU ETS and provoked discussion or even came under criticism.

- Over-allocation

One of the main focuses is “over-allocation” of the allowances. (Ellerman & Joskow, 2008) The Member States tried to establish a loose policy so as to meet the target easily. However, it will result in over allocation (the allowance over the real emission, see the table 3 for instance) and the decrease of the EUAs price. Also, over allocation cannot reach the aim of the ETS and reduce GHG emissions actually.

Table 3. Allowances & Verified Emissions in Most Sectors

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>Average 2005/2006</th>
<th>EU 25</th>
<th>Number of installations</th>
<th>Allocated allowances (1000 EUA)</th>
<th>Verified emissions (Kt CO₂)</th>
<th>Difference between allocation &amp; verified emissions (1000 EUA)</th>
<th>Difference between allocation &amp; verified emissions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustion installations</td>
<td></td>
<td></td>
<td>7093</td>
<td>1455735</td>
<td>1461660</td>
<td>-5925</td>
<td>-0</td>
</tr>
<tr>
<td>Mineral oil refineries</td>
<td></td>
<td></td>
<td>156</td>
<td>159463</td>
<td>149921</td>
<td>9542</td>
<td>6</td>
</tr>
<tr>
<td>Coke ovens</td>
<td></td>
<td></td>
<td>20</td>
<td>22789</td>
<td>20247</td>
<td>2542</td>
<td>11</td>
</tr>
<tr>
<td>Metal ore roasting or sintering</td>
<td></td>
<td></td>
<td>12</td>
<td>8679</td>
<td>7885</td>
<td>794</td>
<td>9</td>
</tr>
<tr>
<td>Production of pig iron or steel</td>
<td></td>
<td></td>
<td>233</td>
<td>167087</td>
<td>136481</td>
<td>30606</td>
<td>18</td>
</tr>
<tr>
<td>Production of cement clinker or lime</td>
<td></td>
<td></td>
<td>518</td>
<td>188424</td>
<td>178594</td>
<td>9830</td>
<td>5</td>
</tr>
<tr>
<td>Manufacture of glass incl. grass fibre</td>
<td></td>
<td></td>
<td>406</td>
<td>22291</td>
<td>19834</td>
<td>2457</td>
<td>11</td>
</tr>
<tr>
<td>Manufacture of ceramic products</td>
<td></td>
<td></td>
<td>1116</td>
<td>18050</td>
<td>14772</td>
<td>3278</td>
<td>18</td>
</tr>
<tr>
<td>Production of pulp, paper and board</td>
<td></td>
<td></td>
<td>809</td>
<td>37035</td>
<td>30092</td>
<td>6943</td>
<td>19</td>
</tr>
<tr>
<td>Other activity opted-in</td>
<td></td>
<td></td>
<td>437</td>
<td>427</td>
<td>293</td>
<td>134</td>
<td>134</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>10800</td>
<td>2079781</td>
<td>2019572</td>
<td>60209</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Chalmers University of Technology, 2010
- Free allocation and windfall profits

There is another controversial topic associated with allowance allocation: free or auction? According to the EU ETS, including the big emitter, the emission allowances were given largely free in the early stage. What is more, some industries such as power sector can obtain windfall profits under the EU ETS. “The windfall profits are financed from the pockets of electricity consumers (both domestic and industrial) who are not compensated by the scheme (Betz & Sato, 2006).” To a large extend, it is a matter of fairness, which should be paid much attention to.

- Transferring emissions

Under the demanding regulations, some installations which were covered by the EU ETS transferred CO₂ emissions to other countries that outside of the scheme and have relatively loose environmental policies. This phenomenon has received increasing concern as well since it leded to an economic and environmental loss, through weakening the ETS and reducing job opportunities for instance. (Rouhaud, Layton & Whitfield, n.d.)

- Not all sectors are covered

As not all GHGs are covered, several significant sectors such as transport are not involved in the EU ETS. According to the report from AGCC (Action for a Global Climate Community), transport accounted for 21% of EU-15 (see Appendix IV) emissions in 2005. Airlines emissions occupy the ratio of European emissions has increased by 87% since 1990 to 3% nowadays, and it expected to double by 2010. (Rouhaud, Layton & Whitfield, n.d.) Therefore, it is necessary to involve more important sectors and industries in the EU ETS as soon as possible.

- Difficulties for small installations

The lack of data at the level of the installation was a big problem even concerning the whole ETS. Especially for the small installations, it was difficult to collect emissions data, monitor and report well. From another point of view, involving small facilities may not be worthwhile due to the statistics from every Member States. For example, 20% of the sites occupy 94% of emissions and 80% of the sites contribute only 6% of the emissions in the UK (Buchner, Carraro & Ellerman, 2006). Although these small installations need to be included in the ETS in the long run, it required longer time and higher costs but gained little effects at early phases compare with the bigger emitters.

Of course, there are some other issues require attention. For instance, the scope of using other mechanisms (i.e. CDM) should be given a fixed limit so as to avoid weakening the cap. Also, double counting of the emissions reduction or emission allowances (between EUAs and AAUs for example) need to be avoided.¹³

¹³ Hungary sold 1,700,000 tonnes CERs in March 2001. However, it was reported that these CERs has been sold twice, which means Hungary will get profits through selling CERs and buying AAUs (since the price of CERs and AAUs are different). According to the statements from the chairman of carbon market and investor association, this action may lead to double counting of the CERs and price falling of both CERs and EUAs. (People’s Daily Online, 2010)
As the matter of fact, the EU ETS has been improved continuously. In order to meet the emission reduction targets, the European Commission introduced a proposal for a directive amending the ETS in January 2008. Besides, the hot debate about the EU ETS among scholars, companies and the public also promote the improvement of the scheme. “Aviation will be covered by the EU ETS from 2011 for flights between EU airports, and from 2012 for all flights originating from or arriving in the EU. (Rouhaud, Layton & Whitfield, n.d.)” The allocation of the allowances has become more reasonable in the phase II as well.
3. Applying EU ETS in China—the current situation

In the past several years, CDM as a Kyoto Protocol Mechanism received much concern in China since it is the only mechanism that associated with developing countries. Also, according to emission trading systems, the CCX model becomes a good example for China in more and more people’s opinion. However, as the biggest and relatively perfect system in the world, the EU ETS could offer referential experience as well. It will be meaningful to review the current situation of China and consider if it is possible to apply the EU ETS in China.

3.1 Basic information

Located in East Asia, on the western shore of the Pacific Ocean, the People’s Republic of China (PRC) is the third largest country in the world, which has a land area of about 9.6 million square kilometers (Website of China, 2010). China is a united multi-ethnic country which is composed of 56 ethnic groups (around 92% are the Han Nationality and 8% are ethnic minorities). The total population of China is about 1.3 billion, which is the largest in the world. In China, the regime is the National People’s Congress system and the capital is Beijing.

There are three basic levels of administrations area in China including province (autonomous region, special municipality), county (autonomous country, city) and village (minority town, town). Wherein the first level (provincial administrative district), there are 23 provinces, 5 autonomous regions, 4 special municipalities and 2 special administrative regions, that is 34 in total (Administrative Division, 2010) (see Figure 3). However, the economy, environment, climate and people distribution in eastern, western and midland China are divergent, and the big differences even exist among different provinces or cities.
China’s basic political system is the system of multiparty cooperation and political consultation under the leadership of the Communist Party of China. Besides, in order to understand the decision making process in China, it is necessary to know the state organs, which apply the principle of democratic centralism. The structure of the state organs of China is shown in the following figure 4.

![Figure 3. Map of China (Provinces)](image)

**Figure 4. The State Organs of China**

Source: Chinaview, 2010
3.2 National condition and challenges in tackling climate change

There is no denying that China has developed rapidly in the recent decades and its influence has been enhanced a lot as well. Nevertheless, generally speaking, China is a developing country with a huge population, weak economic foundations, complex climate conditions and fragile ecological environment, which is vulnerable to climate change. In addition, several aspects, the coal-dominated energy structure and huge regional differences for example, are difficult to be substantially changed in a short time.

According to the report from China Meteorological Administration (CMA), the average surface temperature of China has risen by 1.1 °C during the past century (1908-2007). Also, the sea level and sea surface temperature in the coastal zones of China has risen by 90 mm and 0.9 °C respectively (White Paper of the Chinese Government, 2008). Besides, people and the national economy have been threatened by the increasing extreme weather events such as high temperature, drought, flood and snow storms.

Nowadays, China is facing the pressure from keeping steady economic development, reducing poverty, and controlling GHG emissions, and many other aspects. As stated by the Government of China, “the basic conditions of China present the country with great challenges in addressing issues regarding climate change” (White Paper of the Chinese Government, 2008) (The detailed information is listed in Appendix II.)

3.3 The argument of tackling climate change in China

In recent years, lots of concepts including “low-carbon economy/life”, “recycling economy”, “sustainable development”, “conservation-oriented society”, “energy saving and emission reduction” and “harmonious society” have become hot topics in China. Hitting headlines almost every day in various media ensures these issues are gradually acknowledged by the public, even if not everyone can understand and follow them. More and more people, especially the experts and politicians, support the actions of reducing CO₂ emissions and explore effective strategies for China. Also, during the NPC & CPPCC¹⁴ in 2010, “Low-carbon economy” becomes one of the focuses. Based on the support from the governments at different levels, the concept of “Low-carbon” has permeated into each domain.

Certainly, different voices exist at the same time. For example, as a famous economist Xianping Lang (Larry H. P. Lang) talked about these issues a lot in a news commentary TV program named “Finance & Economics from Lang’s eyes”, such as:

- New energy: an opportunity or a pitfall for Chinese economy. 2009-09-13

¹⁴ NPC & CPPCC means the National People’s Congress and the Chinese People’s Political Consultative Conference. It is held every year that the representatives, who stand for the public, will deliver the demands to the Chinese Party Central Committee (PCC) after collection and arrangement.
During the program, Professor Lang and other experts reminded that producing new energy (i.e. polysilicon of solar cell) may lead to high energy consumption and high pollution, and actually excess production capacity has occurred in wind power and polysilicon industries in China nowadays. The US struggles for the power of speech with the EU. However, anyway in the international market, China does not have pricing power, and under the high standards established by both EU and the US, China must increase purchasing of advanced equipments from them, since China does not master the core technology. Besides, Carbon Tariff will be another trade barrier that hit China’s export industries. In fact, climate change is already utterly complex since it is politicized or even it is just a scam that the developed countries can stand on the moral high ground to restrict the development of developing countries. (Finance & Economics from Lang’s eyes, 2009, 2010)

Also, many politicians and expects reiterated that GHG (CO₂) emissions issues are mainly result from the unconstrained emissions of developed countries during the industrialization process in recent a hundred years. By comparison, developing countries including China have much shorter history of emissions and both cumulative emissions and per-capita emissions are quite low. Moreover, a large part of CO₂ emissions in China comes from producing goods for the consumption of developed countries, which have exported lots to manufacturing industries to China.

Among the people that strongly support to reduce CO₂ in China, the arguments increased as well recently. Basically, the focus is how to reduce CO₂ emissions in China. Most people pay much attention on CDM since it has a great benefit in a short term and the EU has declared recently that CDM will be continued after the Kyoto Protocol expires in 2012 (International Newenergy, 2010). However, in the light of the uncertainties and the pressure of China to tackle climate change, other people suggest building emission trading system in China. On the one hand, considering the current situation, several expects put forward to carry out voluntary emission trading system. On the other hand, the EU ETS attracts increasingly attention.

3.4 China’s efforts for tackling climate change

Although there are arguments for reducing CO₂ emissions, the Chinese government has made it clear that as a responsible developing country, China sets great store by climate change issues and is sincere in presenting the voluntary targets. As stated by Chinese Premier Wen Jiabao, China will never take the old path of “polluting first and cleaning up later” as developed countries.

As a Party of the UNFCCC and Kyoto Protocol, China promised to reduce CO₂
emissions along with other developing countries and took several measures to contribute to the Bali Roadmap, such as taking environmental protection as one of its basic national policies, using scientific outlook on development as one of the administrative concepts, formulating and promulgating “China’s National Climate Change Program” (CNCCP), establishing the National Leading Group on Climate Change (NLGCC), and so forth. Also, as Chinese Premier Wen Jiabao said in 2007, Chinese government had already put forward the clear targets of controlling GHG emissions, such as reducing the energy consumption per-unit GDP by about 20% by 2010 compared to that of 2005 and increasing the ratio of renewable energy in the structure of primary energy consumption to 10% (The Central People’s Government of the People’s Republic of China, 2007).

Before the UN Climate Change Conference in Copenhagen, Chinese government announced the target of controlling GHG emissions that reducing CO₂ emissions per-unit GDP in 2020 by 40% - 45% compared to the level of 2005. In 2020, the extent of increasing the ratio of renewable energy in the structure of primary energy consumption will be 15 % (CCTV, 2009).

Besides, after the Copenhagen Conference, almost all activities in China pursue a low-carbon style. Shanghai World EXPO is a good example. Besides encouraging people to travel by the public transportation, only the vehicles powered by clean energy are allowed to use. “Green Travel Plan” also includes Low-carbon Transportation Card\(^{15}\) and Carbon Calculator, which can calculate CO₂ emissions of each trip mode and guide the public to choose a low-carbon road to visit the EXPO. The water of green lands irrigation is all from Rainwater Recycling System there. Moreover, solar power and degradable materials are widely used. (CCTV, 2010)

In addition, the main legal instruments and policy documents associated with environment and climate change in China can be summarized in the following table:

<table>
<thead>
<tr>
<th>Contents</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Cleaner Production promotion Law of PRC”</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>“Use and Management Regulation on Levying Pollution Discharge Fees” &amp; the regulation on fee collection</td>
<td>2003</td>
<td>Including air pollution but not GHGs</td>
</tr>
</tbody>
</table>

\(^{15}\) Low-carbon Transportation Card is a part of Carbon Neutral program: the customer will donate a specified amount of money to environmental protection and public welfare establishments in order to neutralize their carbon emissions during the trip when they buy the card.
<table>
<thead>
<tr>
<th>Document Title</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Administrative Punishments Measures of Environmental Protection”</td>
<td>2003</td>
</tr>
<tr>
<td>“Renewable Energy Law of PRC”</td>
<td>2005</td>
</tr>
<tr>
<td>“the Outline of the 11th Five-Year Plan for National Economic and Social Development of China”</td>
<td>2005</td>
</tr>
<tr>
<td>First “National Climate Change Assessment Report”</td>
<td>2006</td>
</tr>
<tr>
<td>“China’s National Climate Change Program”</td>
<td>2007</td>
</tr>
<tr>
<td>“Medium and Long Term Renewable Energy Development Plan”</td>
<td>2007</td>
</tr>
<tr>
<td>Policies about statistics, monitoring and assessment of the main pollutants emission reductions</td>
<td>2007</td>
</tr>
<tr>
<td>NPC &amp; NPPCC</td>
<td>2008</td>
</tr>
<tr>
<td>“Circular Economy Promotion Law of PRC”</td>
<td>2008</td>
</tr>
<tr>
<td>“Guidelines on Developing Low-carbon Economy”</td>
<td>2009</td>
</tr>
<tr>
<td>UN Climate Change Conference in Copenhagen</td>
<td>2009</td>
</tr>
<tr>
<td>NPC &amp; NPPCC</td>
<td>2010</td>
</tr>
<tr>
<td>Proposal of “Low-carbon Economy Promotion Law of PRC”</td>
<td>2010</td>
</tr>
</tbody>
</table>

* The starting time is behind China ratified the UNFCCC in 1992.

Indeed, China has made efforts to tackle climate change issues and already obtained certain effects. After making clear the targets of saving energy and reducing emissions, from 2006 to 2008, China has shut down inefficient thermal power plants with a total capacity of 44.21 GW, and eliminated backward production capacity of more than 224 million tons. During the same period, the energy consumption per unit GDP reduced by 10.08%. Also, renewable energy increased by 51%, representing an annual growth rate of 14.7% between 2005 and 2008. In the countryside, about 30.5 million households gained access to biogas which equivalent to a reduction of over 49 million tons of CO₂ emissions. Besides, China ranked first in the world in terms of installed hydro power capacity, nuclear power capacity under construction,
the coverage of solar water heating panels and photovoltaic power capacity. China has the largest area of man-made forest, and from 2003 to 2008, the net increase of forest areas and stock volume achieved 20.54 million hectares and around 1.1 billion cubic meters respectively. (Wang, 2010)

Hence, although China does not have Kyoto targets, great efforts of tackling climate change have already been made as the voluntary actions in recent years.

The efforts are being continued and even promoted in China. Building the emission trading system is a trend in the future. So far, the emission trading market, especially the carbon market, has just started.

<table>
<thead>
<tr>
<th>Main Exchanges</th>
<th>Time of Foundation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CBEEX (China Beijing Environment Exchange)</strong></td>
<td>2008</td>
<td>The first one at national level</td>
</tr>
<tr>
<td><strong>SEEE (Shanghai Energy &amp; Environment Exchange)</strong></td>
<td>2008</td>
<td>Environment and energy field</td>
</tr>
<tr>
<td><strong>TCX (Tianjin Climate Exchange)</strong></td>
<td>2008</td>
<td>Tripartite funding: the asset management unit of PetroChina, the municipal government of Tianjin and CCX</td>
</tr>
</tbody>
</table>

The Exchanges mentioned in the above table are the main three exchanges in China associated with CO$_2$ trading. After this, “Asia Carbon Exchange” was launched in Shenzhen in Guangdong province, followed by various carbon exchanges that established in Hubei, Zhejiang, Yunnan, Shandong and Shanxi province since 2009. Besides, the proposal of building “China Carbon Exchange” shows the ambitions of Sichuan province and the “carbon trading craze” phenomenon in China nowadays. Certainly, there is another reason that energy saving and emission reduction has become a criteria of appraising the performance of cadres now in China.

In short, China had recognized the significance of tackling climate change and reducing GHG emissions, and has been working on this issue in various aspects, which can be seen in the targets, policies and the degree of attention, and so forth. This trend will continue and the real domestic emission trading market will be built finally.
4. The comparison between the EU and China

The suitable environment is a precondition of applying a trading system. Since the EU ETS has been carried out well in the EU, before discussing the feasibility and limitations, comparing the situation of applying the EU ETS in EU and China is necessary.

<table>
<thead>
<tr>
<th>Similarities</th>
<th>EU</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management system</td>
<td>The EU (European Commission) → Member States</td>
<td>The PCC (Central Government) → Provinces</td>
</tr>
<tr>
<td>Unified language</td>
<td>Yes, English</td>
<td>Yes, Mandarin</td>
</tr>
<tr>
<td>Regional disparity</td>
<td>Yes</td>
<td>Yes (big disparity)</td>
</tr>
<tr>
<td>Responsibility of reducing CO₂</td>
<td>High accumulative emissions &amp; has ability (capital &amp; technology) now</td>
<td>The largest emitter now</td>
</tr>
<tr>
<td>Paying attention to tackle climate change issues</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Basic aim</td>
<td>Sustainable development</td>
<td>Sustainable development</td>
</tr>
<tr>
<td>Research</td>
<td>Quite a lot</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Differences</th>
<th>EU</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed degree</td>
<td>Developed</td>
<td>Developing</td>
</tr>
<tr>
<td>Population</td>
<td>Around 0.5 billion (Eurostat, 2010)</td>
<td>Around 1.3 billion</td>
</tr>
<tr>
<td>Size</td>
<td>More than 4 million km² (27 countries (Europa, 2010))</td>
<td>About 9.6 million km² (34 provinces)</td>
</tr>
<tr>
<td>Binding target of reducing CO₂</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Attention degree</td>
<td>High</td>
<td>Increasingly high but far from enough</td>
</tr>
<tr>
<td>Public participation</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Independent legislative power of the parts</td>
<td>Yes (Member States of the EU)</td>
<td>No (Provinces in China)</td>
</tr>
<tr>
<td>Independent monitoring system</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Supporting laws and policies</td>
<td>Good</td>
<td>Far from enough</td>
</tr>
<tr>
<td>Technology</td>
<td>Advanced</td>
<td>Lack of core emissions reduction technology</td>
</tr>
<tr>
<td>Degree of marketization</td>
<td>High</td>
<td>Depend on administrative means</td>
</tr>
</tbody>
</table>
Infrastructures associated with applying the ETS

<table>
<thead>
<tr>
<th>Development of carbon market</th>
<th>Good</th>
<th>Lack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has developed rapidly</td>
<td>Infancy</td>
<td></td>
</tr>
<tr>
<td>The focus of emission trading</td>
<td>EU ETS</td>
<td>CDM</td>
</tr>
</tbody>
</table>

Table 6 shows the comparison associated with applying the ETS in both the EU and China. There are several common points which will be good for applying the EU ETS in China. In the EU, although the Member States have a large degree of autonomy, it is a kind of “up-to-down” management system, which is similar with the management system in China. (Wang, 2009) Both of the EU and China have a common language internally to ensure the easy communication (including emissions reduction data collection and exchange). In the EU, different Member States have different situations (i.e. the level of economic development), which create a precondition of trading due to various emissions reduction costs. (Li, 2010) Similarly, the disparities are obvious among different areas/provinces in China.

When it comes to CO₂ emissions reduction, both the EU and China have the responsibility since the former have high accumulative emissions and good abilities (capital and advanced technologies) in reducing emissions, and the later has become the largest emitter in the world. In addition, both the EU and China pay much attention to tackle climate change issue and lots of researchers are engaging in the study of the theory and practice of reducing CO₂ emissions. What is important is that basically the EU and China have the same aim of sustainable development and they maintain the cooperation in this field. (CAITEC, 2010)

Besides the similarities, there are many differences between the EU and China associated with applying the ETS. Compared with the EU, China has much bigger size either in population or land area. Also, the huge differences among 34 provinces could be disadvantages as well. All of these features result in the difficulty, however at the same time offer the necessity of applying the EU ETS in China to reduce CO₂ emissions. Though the Member States in the EU seems similar with the provinces in China, there are many differences of course. One of the important aspects is that the Member States of the EU are independent countries which have independent legislative power; however the provinces in China are the parts of the country and directly in the charge of the central government. In the EU, the degree of marketization is high, whereas in China, administrative means are depended on usually (Lei, 2010). Another difference is that nowadays most of the people in China focus more on CDM instead of the “cap and trade” ETS. One significant reason is, as mentioned before, CDM is the only Kyoto mechanism related with developing countries. Moreover, the carbon market in the EU has already developed rapidly while in China carbon market is just in its infancy. (Zhao, 2010)

Other differences are also the weak points of China to applying the EU ETS. Compare
to the EU, the lack of supporting laws and policies, independent monitoring systems, relevant infrastructures and core emissions reduction technologies will be the block in the process of applying the ETS. The awareness of the public is inadequate in China, although it has been increased. Also, the degree of the public participation in the EU is higher than that in China. (Wang, 2009) Here is a significant reason, which is also the obstructive factor that China is still a developing country with low economic level and there is no international binding target of reducing CO₂ emissions for China yet. As a developing country, China has demand for further development and economic growth. (Zhang, 2007) It is understandable that the EU has better motivation to focus on the emission reduction issues due to its Kyoto binding targets and emissions reduction abilities.

More analysis about the feasibility and limitations of applying the EU ETS in China will be shown in the following parts through a “SWOT-PEST” model.
5. Analysis

Based on the introduction of the EU ETS and the current situation of China, the analysis associated with applying the EU ETS in China are made in this chapter.

5.1 The importance of EU ETS for China

The theory and practice of the EU ETS offers both advanced experience and lessons for China. According to the process of implementing the EU ETS, the main aspects can be listed as follows.

- **Overall target**: Establishing the overall target is a precondition of applying the ETS. For the EU ETS, the emission reduction target is the Kyoto target.

- **Timetable design**: The EU ETS was designed to carry out in phases. Also, it is a gradual process which starting with a “warm up” phase and making progress in the subsequent phases after summing up the experience and lessons.

- **The range of GHG**: It is necessary to clarify the range of tradable GHG, such as only CO\(_2\) or all of the six kinds of GHGs listed in the Kyoto Protocol. In the EU ETS, the focus of the earlier phases is CO\(_2\) whereas other GHGs will be included gradually in the following phases.

- **The range of industries and installations**: The EU ETS covers the main emitters at the beginning which can ensure the success of fulfilling the scheme and its effects. Of course, along with the development of the ETS, all significant sectors, such as transport and construction, must be involved in order to ensure the effects of emission reduction.

- **NAPs**: The NAPs ensure there is a good plan for each Member State. Although the European Commission will review and determine the final NAPs, the Member States are given great power to decide their plans.

- **Allocation of the allowance**: How to reasonably determine the total allowance and allocate them is a difficult decision for both the European Commission and the Member States. The European Commission makes the decision base on the NAPs from different Member States and their Kyoto targets. Similarly, the Member States distribute the EUAs to different installations due to the assessment.

However, equity and efficiency cannot be ensured during the process of assessment and allocation. It is not easy to practice the “common but differentiated responsibilities” principle. Moreover, the “false high” allocation of the allowances (Zhu 2008) is unavoidable in the practice, especially at the beginning of implementing the ETS. Hence it is necessary to adjust the amount of allowances in time and try to avoid “over allocation”.

Concerning another controversial topic associated with allowance allocation:
free or auction. Actually, although it seems wrong to allocate allowance free to the installations (especially the big emitters), the free allowances could promote the stable operation of the scheme and is necessary at the beginning in practice. Certainly, the windfall profit phenomenon requires great concern and the percentage of the free allocation needs to be decreased gradually as the ongoing improvement in the EU ETS.

- Monitoring, reporting and heavy fine: Good monitoring and reporting system can offer support for the well operation of the ETS. Also, the heavy fine is necessary to promote all of installations do their utmost to reduce emissions and perform their obligations according to the rules of the EU ETS.

- Electronic registries and CITL: This advanced management method ensures the convenience for both trading and monitoring. Besides, it is easier to collect and exchange data by using this system than using paper. Certainly, adequate attention is needed for the network security so as to avoid system vulnerability, or even the hackers.

- Banking and borrowing: The proper rules of banking and borrowing of allowances will ensure the flexibility of the scheme and the liquidity of the EUAs on the one hand, and avoid speculation to some extent on the other hand.

- Other traders: Involving all the possible traders besides the installations covered by the scheme can enrich the emission trading market and extend the ETS's influence.

- Linkage with other mechanisms: For example, the credits from CDM can be used in the ETS according to several detailed rules, so that the installations have more flexibility and can combine these mechanisms to meet their emission reduction objectives.

From the installations’ perspective, the tight timetable and challenges of meeting their targets with the lowest cost bring a lot of pressure. Also, numerous installations may fear that trying the best to decrease emissions beyond their allowance will lead to lower allocations and influence the baselines in the following phases (Kruger & Pizer, 2004).

In addition, many other aspects are also worth attention, such as making supporting laws, regulations and policies, people’s awareness, avoiding emissions transfer, NGOs and media’s efforts, and so forth.

5.2 The necessity of applying EU ETS in China

Although China has worked hard to deal with climate change issue these years according to its actual national conditions, the further efforts are required. The reasons why China should consider applying a suitable ETS could be listed as follows.
- The largest emitter: China has become the largest CO\textsubscript{2} emitter in the world\textsuperscript{16} and should try its best to contribute to emission reduction as a responsible country.

- Increasingly international pressure: Along with becoming the largest emitter in the world, China is facing more and more pressure from the international communities. What is more, the “carbon tariff” which is being brewed by the US and EU will threaten the foreign trade export of China and lead to the outflow of domestic revenue resources as well.

- Enhancing the power of speech and international image: Facing the international pressures and the fact that core technology and criteria are held by developed countries, establishing the emission trading scheme can reduce emissions and enhance voice and good international image of China.

- Gathering experience: As a developing country, there is no binding target for China at present. However, reducing CO\textsubscript{2} in all probability will become an obligation of China in the near future. Hence, building the emission trading scheme now can accumulate practical experience which will definitely be good for both the authority and the installations in China.

- Real domestic emission reduction: CDM has its advantages and will benefit the developing country\textsuperscript{17}, some companies especially, whereas ETS can help China to achieve the real domestic emission reduction under a unified national system.

- Avoiding losses: More and more companies of China apply CDM to reduce their emission today; nevertheless, the CERs are always purchased with low price. After building the ETS, the installations of China can trade with each other and of course under the law and policies of China. Also, the domestic emission trading market will be promoted and contribute to the trading process for both ETS and CDM in China.

- Management and monitoring: A united emission trading scheme is needed in China so as to manage the resources and emission trades and monitor the process easily. Also, the increasingly exchanges in China which will waste of resources due to the lack of trades need the ETS.

- Reducing CO\textsubscript{2} emissions through market mechanism: Nowadays, the main measures of reducing CO\textsubscript{2} emissions within China belong to “direct regulation”, which is the administrative means of the government. However, the establishing the ETS can provide the installations with flexibility of emission reduction and sustainable motivation to reduce CO\textsubscript{2} emissions.

\textsuperscript{16} Although Chinese government did not agree, according to the report from Netherlands Environmental Assessment Agency, China’s 2006 total CO\textsubscript{2} emissions surpassed those of the US by 8% and became the largest carbon dioxide emitter in the world for the first time (Netherlands Environmental Assessment Agency, 2009). The detailed information about global CO\textsubscript{2} emissions can be found in the Appendix III.

\textsuperscript{17} As mentioned before, the developing countries could get financial and technical supports from the developed countries through CDM.
under the market mechanism.

- The advantages of EU ETS: Certainly, building ETS or applying the EU ETS is because it is a good system that has been tested in practice, although there are still some aspects that need to be improved.

- Besides, as mentioned before, the coal-dominated energy structure of China is difficult to be changed in a short time. Instead of the total denial of Chinese traditional industries, the ETS will encourage the development of new technologies and reduce CO₂ emissions with low cost, and will be helpful for transforming and upgrading the traditional industries in China.

In the light of the current situation of China internally and externally, and the analysis above, it is necessary to establish a suitable emission trading system in China to reduce CO₂ emissions.

5.3 The feasibility and limitations of applying EU ETS in China

5.3.1 “SWOT - PEST” analysis

In order to analyze the feasibility and limitations of applying the EU ETS in China, an analytical approach, SWOT and PEST analysis, will be introduced. Actually, it includes two parts: SWOT analysis and PEST analysis. Both of them are strategic planning/management methods. “SWOT” means strengths (S), weaknesses (W), opportunities (O) and threats (T), while “PEST” stands for political (P), economic (E), social (S) and technological (T) factors (Ha & Coghill, 2008).

The analysis is made based on literature review and information collection from the media and personal communications. The potential stakeholders including a professor, a company director and an officer of the government in China offered their opinions and relevant information.

**Strengths**

The political system of China, the system of multiparty cooperation and political consultation under the leadership of the Communist Party of China, could be a big advantage for applying the EU ETS in China. On the one hand, the plans and policies are stable since they are unaffected by the replacement of parties with different point of views (Song, 2010), on the other hand, the “up to down” management system makes it easier to allocate resources and ensures the implementation of the policy once making the decision of applying the EU ETS in China (the governments at different levels and all sectors of the community will follow the policy). (Wang, 2009) Nowadays, there are several regulations and policies already in China which will be helpful for applying the EU ETS (see Table 4). Moreover, Chinese government pays increasing attention to sustainable development under the guide of the Scientific Outlook of Development (Xu & Yu, 2008).
In economic aspects, China’s economy has developed a lot in the recent decades and is growing steadily which is an economic basis of tackling climate change issues. Although the economic levels of different provinces are diverse as mentioned before, it is also a good precondition of implementing the EU ETS (emission trading) due to their various emission reduction costs.

The main social strength about applying the EU ETS in China is the social stability and “low-carbon fever”\(^\text{18}\) in China. Undoubtedly, the stability of society is the guarantee of development including establishing the EU ETS in China of course. Besides, along with the popularity of low-carbon development concept, more and more people accept the policy of emission reduction and start to go into action. Certainly, the media plays an important role in influencing people’s opinion. In addition, the public begin to emphasize the environmental impacts of the products and the companies pay attention to set up a good corporate image as well which will encourage them to actively participate in the EU ETS. According to an online survey about the awareness of “low-carbon” concepts conducted by China Investigation Website, 83.5% of the participants agree to practice “low carbon” concepts (China Investigation Website, 2010).

Technologically, Chinese government pays much attention to independent innovation and introducing advanced technology from developed countries. The referential experiences of implementing the EU ETS from the EU are also important. Furthermore, China has some experience\(^\text{19}\) of dealing with pollution, SO\(_2\) or water for example, through allocating emission permits and levying pollution fees and so forth measures. In addition, the existing exchanges for CO\(_2\) trading will be a significant part of Chinese emission trading market (see Table 5).

**Weaknesses**

Politically, “up to down” management model also has disadvantages, for instance the degree and passion of public participation are not high enough (Wang, 2009). Many internal problems such as inefficiency and corruption are also the obstructive factors. In addition, the lack of independent monitoring institution will be a big issue for applying the EU ETS in China.

From economic perspective, China is still a developing country with low economic level. According to the report of the World Bank in 2009, China has about 254 million people expend less than the international standard of poverty line per day (Chinaview, 2009), which means that reducing poverty is still a focus of Chinese government with high priority. By comparison, applying the EU ETS is important but

\(^{18}\) “low-carbon fever” means recently the word “Low-carbon” is very popular in China. This word is frequently mentioned by all kinds of media, and the public become familiar with this word.

\(^{19}\) From 2005, China carried out (SO\(_2\)) emissions permits trading experiments in some selected places, such as Tianjin, Nanjing and Shaoxing. Until the beginning of 2008, more than 30 deals were done and offered meaningful experiences in using “cap and trade” mechanism. (Zhao, 2010)
not the central issue for China. Beside, Chinese traditional management methods depend more on administrative means instead of market-oriented levers such as the EU ETS. (Lei, 2010) In China, there is no real well-operated carbon market as a good basis of building the EU ETS nowadays, to some extent due to the lack of targets and demands.

Regarding social factors, the lack of relevant laws and regulations, insufficient sense of participation of the companies and awareness of the public in taking part in reducing CO₂ emissions in practice are still limiting factors. Also, the power and influence of the scanty NGOs in China are far overshadowed by the NGOs of the UN. (Wang, 2009)

Technologically, in spite of introducing a large number of advanced technologies, China does not master the core technology²⁰ according to emission reduction and of course has no experience of applying the EU ETS. Moreover, lack of emission data and difficulty of data collection are obstacles in applying the ETS.

**Opportunities**

Concerning political aspects, the ongoing UN climate change conferences and the increasing awareness of reducing CO₂ emissions by the international community offer the good international environment and necessity of applying the EU ETS in China. Internal, Chinese government pay more and more attention to climate change issue and is going to take measures to contribute to emission reduction. The clear target of China such as “reducing CO₂ emissions per-unit GDP in 2020 by 40% - 45% compared to the level of 2005” will definitely promote the establishment of the EU ETS. Actually, this target is a kind of “Cap” that could be used in the EU ETS in China.

The first economic strength is the rapid development of China’s economy of course. The positive trend will be continued in the further. Also, there is a huge market in China concerning the carbon trading activity which means the EU ETS has a great potential to be well operated in China. Along with the development of economic system of marketing in China, the preconditions of applying an ETS have initially established, and the carbon market is burgeoning (Lei, 2010). Besides, the promise of providing financial support from the developed countries will help China to carry out the emission reduction events if they fulfill their commitments.

From social aspect, in China, CO₂ emission reduction becomes a hot topic and the awareness of people is increasing as well. Brain gain, especially the talents with relevant background will be very helpful for implementing the EU ETS in China. (Zhao, 2010) Moreover, the support from the international community is important also.

In terms of technology, the developed countries have responsibility and promised to

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²⁰ 70% of core technologies for reducing emissions depend on import in China. (CHINANEWS, 2010)
transfer advanced technologies to help China dealing with CO\textsubscript{2} emission reduction problems and the real actions will undoubtedly become a good opportunity for China. In addition, both the internal innovation and international cooperation (especially between the EU and China) in technological field will be good for applying the EU ETS in China (Bo & Chen, 2009).

**Threats**

According to the climate-change game, China has to take care of the interests of other numerous developing countries and face great pressures from developed countries at the same time (Zhuang, 2009). Furthermore, the fact that China has no binding targets about CO\textsubscript{2} emission reduction and the uncertainties associated with the UN climate change negotiations in the future will be hindering factors for applying the EU ETS in China.

In terms of economy, the global economic crisis will threaten all countries’ economy and development including China. Although the EU ETS maintains well functioning due to the mature attitude of installations and advantages of the EU ETS’s banking and borrowing system, the EU ETS was influenced by the economic crisis as well (China Market Order Web, 2010). Hence, applying the EU ETS in China must prepare for the test of the global financial crisis. Certainly, the impact from applying the EU ETS itself on China’s economy will be considered before taking the action. Besides, as a developing country, China is in sore need of financial support to reduce CO\textsubscript{2} emissions, however it still needs more actions from the developed countries. Instead of providing enough capital, the carbon tariff that is being brewed by the developed countries will be an embarrassment for China and make internal carbon tax becomes necessary (Global Times, 2010).

In social aspect, the frequent natural disasters and increasing extreme weather events offer necessity of reducing emissions on the one hand and attract much attention and financial support on the other. Besides, the objections both internally and internationally according to climate change may weaken the resolve of applying the EU ETS in China.

Concerning technological factors, the developed countries hold the core technologies of reducing emissions and in all probability will not try their utmost to transfer the advanced technologies to China. Also, the degree of the EU could offer the help in establishing the EU ETS in China is unknown. At present, CCX has cooperated with China’s exchanges and is going to copy their system or at least offer their experience to China. (China Beijing Environment Exchange, 2010) However, the EU is noncommittal on helping China to apply the EU ETS or build its own systems.

**5.3.2 Summary of the analysis**

The following Table 7 shows the summary of the SWOT and PEST analysis.
Table 7. SWOT-PEST Analysis of applying the EU ETS in China

<table>
<thead>
<tr>
<th>SWOT-PEST</th>
<th>Strengths (S)</th>
<th>Weaknesses (W)</th>
<th>Opportunities (O)</th>
<th>Threats (T)</th>
</tr>
</thead>
</table>
| **Political aspect (P)** | - Political system of China  
- Increasing support policy  
- Increasing attention & the Scientific Outlook of Development | - “Up to down” system & insufficient public participation  
- Internal problems such as inefficiency & corruption  
- Lack of independent monitoring institutions | - Ongoing UN climate change conferences  
- Increasing awareness both internally & internationally  
- Chinese government’s further actions  
- Clear target (the “cap”) | - China’s dilemma (developed & developing countries)  
- No binding targets  
- Uncertainties of climate change negotiations |
| **Economic aspect (E)** | - Rapid and steady economic development  
- Regional disparity in China offer the trading preconditions | - Developing country with low economic level  
- Focus more on administrative means but not market-oriented layers  
- No real well-operated carbon market | - Repaid development of China’s economy  
- Huge and potential market in China  
- Burgeoning domestic carbon market  
- Financial support from the developed countries | - Global economic crisis  
- EUETS’s impacts  
- Lack of financial supports  
- Carbon tariff |
| **Social aspect (S)** | - Social stability  
- “Low-carbon fever”  
- Increasing awareness of the public  
- Companies pay attention to good image  
- Media’s efforts | - Lack of relevant laws and regulations  
- Insufficient sense of participation of the companies  
- Insufficient awareness of CO2 emission reduction becomes a hot topic | - People’s awareness is increasing  
- Brain gain & increasing research  
- Support from | - Frequent natural disasters  
- Objections according to climate change |
Considering both internal and international situations, it is necessary for China to establish an emission-trading scheme. The relevant laws, regulations, monitoring and reporting systems are needed to help the implementation of the ETS. The analysis about the importance of the EU ETS for China showed the referential experience and lessons, following by the necessity analysis.

The SWOT – PEST Analysis shows the strengths, weaknesses, opportunities and threats of applying the EU ETS in China in political, economic, social and technological aspects. Although there are many difficulties to apply the EU ETS in China, the strengths and opportunities are also obvious. Therefore, considering the necessity of applying the ETS, it will be a good choice to apply the EU ETS with proper adjustment in China in the near further. That is, China could establish its own emission-trading scheme based on the model of the EU ETS. Certainly, giving play to the advantages, seizing the opportunities and at the same time trying to deal with the negative factors need to be done so as to ensure the well implementation of the ETS of China.
6. Recommendations

In the light of the analysis above, several recommendations are made to contribute to the decision-making and the implementation of the ETS in China.

Concerning the process of applying “Sino ETS”, every aspect should be well considered and done.

- Setting overall targets: The overall target must be clear at the beginning. As mentioned before, “reducing CO₂ emissions per-unit GDP in 2020 by 40% - 45% compared to the level of 2005” can be the first “cap” of the “Sino ETS”.

- Designing the timetable: “Sino ETS” should also be implemented in phases. According to the overall target, the “warm up” phase can be designed till 2020. However, shorter phases will be easier to carry out and adjust in time. For example, the first phase is from 2010 to 2012, which consist with the expiring date of the Kyoto Protocol. The second phase can be another three years, 2013-2015, which will accord with the expiring date of China’s Twelfth Five-Year Plan. The following phases can be designed according to China’s national plans, emission reduction targets and the results of the UN climate change conferences then.

- Identifying the trade objects: At the beginning, CO₂ will be the only trade object. The other five kinds of GHGs can be involved gradually after 2020 if the ETS is well operated then.

- Clarifying the scope: The scope here means the range of industries and installations that should be involved in the “Sino ETS” and the region distribution also. As the EU ETS, the main industrial emitters such as power and heat generation industry and other energy-intensive industrial sectors must be covered. Besides the installations that need to be covered, other companies or individuals who want to join in are welcome. Concerning the regions, some provinces which have imbalanced development of the economy among different cities can be selected as the experimental regions in the early phase. Then, the whole country will be involved in this scheme after the successful experiment.

- Confirming the responsible competent department: Since there are many departments are related with this issue such as the NDRC (National Development and Reform Commission) and the MEP (Ministry of Environmental Protection) of China, it is necessary to clarify that which one will in charge of the “Sino ETS”. Actually, the NLGCC headed by premier Wen Jiabao is a good chose that can ensure the reasonable deployment and well implementation among different departments since the State Council is the highest administrative organ in China. Besides, the NLGCC is the special working group which designed for tackling climate change issue.

- Allocating the allowances: This aspect can also take the EU ETS as a reference.
Every provinces of China submit the Provincial Allocation Plan (PAP) to the NLGCC for review and approval before a certain deadline. The NLGCC will distribute the overall targets to each province according to the PAPs and their different actual conditions under the “common but differentiated responsibilities” principle. The final Plans will be implemented in the following phase. At the early phase, the allowances can be allocated free. Furthermore, there is another aspect needs to be noticed that, as that in the EU ETS, the allowances can only be allocated to the installations which have the permits of “Sino ETS”. Moreover, the free allowances are necessary at the beginning of applying the ETS.

- Enhancing information collection system: Data collection is an important work not only during the trading process but also before allocating the allowances. So far, it is difficult to find information about CO₂ emission amount of China even in the database of the NBS (National Bureau of Statistics). Hence, both of the Bureau of Statistics at different levels and the installations themselves must try their utmost to collect data associated with CO₂ emissions from now on. Based on the up-to-date, accurate information, the over allocation will be possible to be avoided in “Sino ETS”.

- Ensuring circulation and trading of the allowances: First of all, as EUAs of the EU ETS, the Sino Emission Allowance Units (can be named as “SEAUs”) must be identified to be traded among the installations in “Sino ETS”. One “SEAU” equals to one tonne of CO₂ equivalent. Secondly, electronic registries and trading system can be established as that in the EU ETS. This is a requirement in technological aspect and also the trend of modern trading systems. Thirdly, the banking and borrowing system of the EU ETS can be used as well.

- Establishing monitoring, reporting and punishment systems: The EU ETS’s monitoring and reporting systems are good to be applied in “Sino ETS”. Especially, China has no independent monitoring institution and there is no special administrative department of emission trade monitoring. Hence, independent monitoring system should be built or at least one existing institution should be in charge of monitoring the “Sino ETS”. In addition, heavy fine (much higher than the emission reduction cost) is necessary to ensure the implementation of the “Sino ETS” by the installations; otherwise, some companies may pay no attention to rules of the ETS, try to use the loopholes of the laws and regulations or even take a risk to break the rules.

- Other aspects: there are many other work should be done for applying the “Sino ETS”, such as ensuring the transparency during the whole process, encouraging the public participation, perfecting the relevant laws and regulations, well managing the development of the exchangers, and proper involving other systems (i.e. CDM) as the offset, and so forth.

Besides the recommendations associated with each link of establishing the “Sino ETS”, suggestions for the different stakeholders are also proposed as follows since
building the “Sino ETS” needs joint efforts and will influence all stakeholders.

Certainly, the stakeholders associated with applying the ETS in China should be identified. A stakeholder can be a person, group, organization or system that affects or can be affected by the action (Wennersten, 2009). Therefore, for establishing the regulated emission trading scheme in China, the main stakeholders will be the politicians, experts, companies, media, NGOs (Non-Governmental Organizations), GHGs exchanges, the public of China and of course other countries and so forth.

**Internal**

Politicians (Government) have a great power to make a decision especially in China. Based on the reports from the experts and other relevant information, they will make the final decision such as whether to establish an ETS in China or not and which type of ETS should be selected. On the other hand, establishing the ETS in China will help the politicians have more power of speech in the international climate negotiations. Hence, for establishing the “Sino ETS”, the government should use both administrative and market-based measures, pay much attention to every aspect of the building and operating process, improve legal system, issue the corresponding policies and regulation, establish and perfect the assessing and monitoring system, ensure the investments, encourage the development of technologies, enhance the environmental education and increase people’s awareness. In addition, the government should try the best to achieve the emission reduction targets under the supervision of the NPC of China.

The experts (research center or universities) play a significant role in applying the “Sino ETS”. First and foremost, the precondition of applying the ETS, global warming and the impacts of CO₂ emissions needs to be further confirmed. Besides, either the legislation process or trading technologies promotion needs the contribution of the experts (jurisconsults, economists, statisticians, etc.). All in all, the reports and opinions of the experts will be important and influence the public opinions and the final decision making to a large extent. Therefore, the experts and the research institutions should try the best to make contributions in this field. At the same time, they must have the sense of responsibility and offer the accurate information and independent results without any utilitarian or selfish consideration.

The companies which are involved in the “Sino ETS” will be the main players. They should familiar with the procedure and rules of the ETS, collect and submit their actual data about CO₂ emissions, take part in the ETS to reduce their CO₂ emissions through limiting outputs, improving technologies or allowances trading; otherwise they will face a heavy fine and even a bad reputation. Besides the relevant installations, other companies can join in the trading market as well.

Media, including newspapers, television, radios, and internet and so on, is import for establishing the “Sino ETS” especially in providing relevant information, drawing
attentions and generating debates about the ETS, and guiding public opinions. Hence, the media should play a positive role and report sufficient information truly, transparently and objectively. Also, oversight is the responsibility of the media.

The relevant NGOs usually have a great influence in the US and the European countries. However, people seldom hear the voice from the NGOs in China. NGOs should enhance their power of speech and influences, and contribute to establishing and well operating the ETS in China.

The exchanges are an indispensable component of the “Sino ETS” that should be further developed. The quality of the exchanges must be ensured and the advanced technologies and managerial experiences from mature exchanges of developed countries are needed to improve the exchanges in China.

Besides the “up to down” managerial model, the bottom-up mechanism is also needed to extend the public participation. The public can take part in the emission trading activity and become the supervisors of the “Sino ETS”. In addition, it will be helpful for reducing CO₂ emissions if the public pay attention to this issue and consider the performance of the companies before purchasing their products.

**External**

Certainly, other countries are also the stakeholders of applying the “Sino ETS”. On the one hand, the pressure from the developed countries will promote China’s action of reducing CO₂ emissions. On the other hand, applying the “Sino ETS” and reducing CO₂ emissions will benefit the whole world especially the coastal communities and low-lying islands. China can give a good reply to the developed countries and contribute to emission reduction as a representative of developing countries through establishing the “Sino ETS”. That is, the “Sino ETS” can help China to reduce CO₂ emissions, and at the same time contribute to solving China’s dilemma in international climate negotiations. Hence, both developed countries and developing countries should support China to establish the “Sino ETS” as well.

Moreover, the foreign media, companies, NGOs, and experts are the stakeholders as well. They will affect or be affected by the “Sino ETS”, especially if the “Sino ETS” is connected with the other ETSs or even is involved in the global ETS in the future. Chinese companies can learn the experiences from the foreign companies and gain advanced emission trading technologies and offsets through CDM. Also, the research results or suggestions from the foreign experts can help a lot for establishing the “Sino ETS” and emission reduction issue. The NGOs and media in developed countries usually have sufficient freedom of speech and good power of execution which also offer different information to China as references.

In addition to the recommendations associated with the process and main stakeholders of applying the ETS in China, another aspect which is necessary to point
out is that the cooperation between China and developed countries, especially the EU, in establishing the “Sino ETS” is important. Basically, both the EU and China have the same aim of sustainable development. Besides, enhancing the bilateral cooperation will be a “win-win situation”, since cooperating with China is important for the EU’s ambitious strategy of global emission reduction under the UN frame, while China needs the advanced technologies and experience from the EU for its emission reduction as well.

In short, applying the “Sino ETS” and reducing CO₂ emissions in China call for joint efforts from all sides both internally and externally. What is important is that the efforts will be necessary and worthwhile due to the contribution of the “Sino ETS” for both China and the whole world.
7. Discussion

In order to make it more clear, according to the recommendations, each aspect is discussed as follows. Besides, the discussion about how to use the SWOT-PEST analysis, what are the uncertainties, weakness in the analysis, which part is the most significant/difficult part in applying the ETS in China and how to solve the problem are also included in this section.

What should be pointed out is that it is necessary to attach importance to reduce CO$_2$ emissions and tackle climate change issues. The efforts should be continued even facing the doubts.

In the long run, applying the ETS will be a better means comparing with carbon tax. Of course, the proper combination of these two efficient measures could obtain good emissions reduction effects. When it comes to the type of ETS, regulative ETS as the EU ETS could be a good choice for China.

Basing on the EU ETS model and considering actual conditions of China, a domestic ETS should be established in China to reduce CO$_2$ emissions with a relatively low cost and prepare for the future obligations under international agreements.

As mentioned before, the name of the ETS can be “Sino ETS”, which shows it is an emission trading scheme of China and ensures the form consistent with the EU ETS.

Concerning the attitude of dealing with climate change and reducing CO$_2$ emissions, nowadays, the main opposing opinions in China are due to two fears. One is the doubt about climate change and the contributions of CO$_2$ emissions; another one is the worry about China’s interests in the global climate negotiations.

As mentioned before, there are several experts in China doubt that climate change and reducing CO$_2$ emissions is a scam for restrict China’s development. Also, it can be seen from the Internet and other media that lots of people including some experts all over the world have questions about the truth of climate change and the necessity of reducing CO$_2$ emissions, especially after IPCC’s unprecedented credit crisis. As a scientific intergovernmental body which is specific to climate change issue, IPCC reports are famous for its unassailable authority and indeed contribute a lot to tackling climate change all over the world. However, when the fact that some climatologists falsified data to prove global warming was exposed and some inaccurate perceptions$^{21}$ were found, it is understandable that people will doubt

$^{21}$ One good example is that the Nobel Prize-winning IPCC said in its 2007 report: “Glaciers in the Himalayas are receding faster than in any other part of the world and, if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate”, which led to a widely fear to some extent. However, it turns out to be a egregious error and the correct year should be “2350”. It is not hard to imagine that many people accused the IPCC of being “alarmist” then. (BBC News, 2009)
about both the IPCC’s authority and the truth of climate change.

This question is directly related to the precondition of this thesis, since the analysis, discussion and efforts for establishing emission trading scheme and reducing CO₂ emissions will make little sense if the judgment of climate change and GHGs’ impacts are not a scientific result. Nevertheless, no one can make sure that climate change, which due to GHG emissions, is a pseudo-proposition nowadays. Even people can reach a consensus now, it will be too late if the global temperature rise sharply and lead to catastrophic result in the future. Hence, the efforts for reducing CO₂ emissions still should be taken continually in case of the irreversible situation.

Another worry is that establishing the ETS in China will departure from the “common but differentiated responsibilities” principle under the UN framework and harm China’s interests. Actually, the China’s ETS could be an emission trading system inside China, and at least in the early phases, the emission reduction targets in the ETS can be China’s voluntary targets instead of the binding targets of the international agreements. That is, applying the domestic ETS will not shake the “common but differentiated responsibilities” principle but help China to prepare for having the binding targets in the future.

Hence, making efforts to reduce CO₂ emissions and tackle climate change issues are necessary for China. However, there are still two important questions here needs to be considered:

1. *Carbon Tax or ETS?*

There is no carbon tax²² or the ETS in China now, whereas both of them are efficient measures to reduce CO₂ emissions. Hence how to choose is an issue that aroused much debate.

### Table 8. Comparison between Carbon Tax & ETS

<table>
<thead>
<tr>
<th></th>
<th>Carbon Tax</th>
<th>ETS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention means</strong></td>
<td>Price</td>
<td>Amount</td>
</tr>
<tr>
<td><strong>Implementing cost</strong></td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td><strong>Difficulty of realization</strong></td>
<td>Easier</td>
<td>Harder</td>
</tr>
<tr>
<td><strong>Targets of emission reduction</strong></td>
<td>Unclear</td>
<td>Clear</td>
</tr>
<tr>
<td><strong>Effects of emission reduction</strong></td>
<td>Uncertainty</td>
<td>Much Better</td>
</tr>
<tr>
<td><strong>Promoting the development of clean technology</strong></td>
<td>Ok</td>
<td>Better</td>
</tr>
<tr>
<td><strong>Increasing revenue</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Time span &amp; Strategy type</strong></td>
<td>Short-time</td>
<td>Long-time</td>
</tr>
<tr>
<td><strong>Reducing emissions with low cost</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

²² Carbon tax is the other market-based options to reduce CO₂ emissions besides ETS which imposed on emissions of carbon dioxide including CO₂ formed as through burning of fossil fuels such as coal, oil and natural gas. (Climate Lab, 2010)
As showed in Table 8, carbon tax and the ETS have their advantages and disadvantages respectively. Carbon tax is a kind of price intervention which needs the information of each emitter’s emission reduction cost and social cost to ascertain the optimal tax rate. However, it is easy to implement immediately and will of course increase the revenue of the country. By comparison, the implementation of the ETS is relatively complex since building a system needs more infrastructures (i.e. exchanges, regulatory system), more cooperation among different departments and of course more time. However, for the ETS, every emitter’s information is needed to ensure the equity, but only social cost is essential to set the target of the country. Besides, in the case of carbon tax collection, the emitters will choose to limit the outputs, reduce CO\textsubscript{2} emissions through new technologies or directly pass the extra costs onto customers through increasing the price of the products. It is easy to understand that only the second choice will reduce CO\textsubscript{2} emissions actually. Whereas, under the ETS, the installations will choose limit outputs, using new technologies or purchasing the allowance, however all of them, which are flexible mechanisms to minimize the cost, will reduce CO\textsubscript{2} emissions indeed since achieving the overall target already means the reduction. (Zeng, 2009) Furthermore, the ETS can reduce emissions with relatively low cost in a region.

Therefore, in the long term, China should apply the ETS to reduce CO\textsubscript{2} emissions and the proper combination of the carbon tax and the ETS will be good for the emission reduction effects. \textsuperscript{23}

2. Regulative ETS or Voluntary ETS?

After make clear that establishing the ETS will be a good choice for China, there is another controversial topic about the type of the ETS. As mentioned before, the EU ETS has been proved as a good scheme to reduce CO\textsubscript{2} emissions. The reason people gave for supporting voluntary ETS is that they thought china has no binding target of CO\textsubscript{2} reduction and applying the EU ETS in China is radical, whereas voluntary ETS is realistic and suitable for China’s current situation. Besides, before entering the Chinese market, the CCX had already branched out into other place such as Australia and Canada.

That is, they choose voluntary ETS without denying the advantages of the EU ETS. Besides, CCX is not necessarily suitable for China as well. For instance, the US is a federal system country so that all states have their independent legislative power and can set binding targets respectively even if there is no binding target of emission reduction for the country, whereas China has totally different national condition. Furthermore, the regulative ETS will be more powerful and has more general influences, so that it will get better effects in China. What is more, considering the

\textsuperscript{23} Carbon tax can be used when it is difficult for the emitters to pass on their cost of emission reduction. For example, if the price elasticity of demand of their products is high, carbon tax will be effective since higher price will greatly reduce sales.
current situation of China reviewed above and the feature of the EU ETS, it is not impossible to build this kind of regulative ETS in China.

Therefore, applying regulative ETS as the EU ETS (the biggest and relatively perfect regulative ETS in the world) could be a good choice for China. The comparison of the basic situation between the EU and China showed the similarities and differences before. For the similarities (i.e. management system, basic aim, and so on), it could be the positive condition for applying the EU ETS in China. Concerning the differences (degree of development, public awareness and participation for instance), some of them show the weak points that should be improved if building the ETS; the others remind that China must consider its actual conditions when applying the ETS.

Actually, the contents of this comparison between the EU and China have been involved in the SWOT-PEST analysis. Through the SWOT-PEST analysis, the feasibility and limitations of applying the EU ETS were showed. On the whole, the analysis contains four parts: strengths, weaknesses, opportunities and threats of applying the EU ETS in China. When using this analysis, it is important to discuss which part is the most important part or difficult part. If the most important part belongs to “Strengths” or “Opportunities” and the difficulties could be solved, it is possible to achieve the goal (applying the ETS in China). Otherwise, it is hard to enforce it in the near future.

Based on the collected information, the most important aspect in applying the ETS in China could be ideas about reducing CO₂ emissions. That is, how to realize the “low-carbon” concept into the practical implementation level in the whole society and make it becomes the working methods of the government, the surviving means of the enterprises and the life styles of the public. At the same time it may be the most difficult part as well. “Want to” and “should to” are different and will lead to different effects. It will be much easier to tackle climate change if all the actions of reducing emissions are done of people’s own accord.

In the SWOT analysis, this most important aspect was mentioned both in the positive part (Strengths and Opportunities) and negative part (Weaknesses and Threats). That is, the awareness of reducing CO₂ emissions has enhanced in China but still need more efforts. Of course, it is not easy to change people’s ideas; however some measures can be taken to deal with the problem. For the government and the companies, the most important and efficient way could be establishing and using the scientific and practical assessment system in China. For example for the government in different levels in China, if implementation of “low carbon” concept can be involved in the evaluation of the performance instead of only focusing on the GDP, it will promote a lot in emissions reduction issues. For the enterprises, assessment is also significant. The measures of rewards and punishment will guide them and boost them to develop sustainably. Actually, applying the domestic ETS can be seen as a good way to involve companies to reduce emissions. In the ETS, the “rewards and
punishment” (getting money from selling extra allowances or gaining heavy fine) are not depending on administrative means but rest with installations’ performance to a large extent. Similarly, for the public, active propagandizing and educating can enhance awareness and guide actions.

Considering the other aspects mentioned in the SWOT analysis, the strengths and opportunities also could support that it is feasible to apply the EU ETS in China. Nevertheless, the Weaknesses and Threats cannot be ignored. That is, completely copy the EU ETS model will not be worked well in China (it also can be understood in comparison between the EU and China). Hence, establishing a domestic regulative ETS (Sino ETS) basing on the EU ETS and concerning the actual situation in China could be good for China to reduce CO$_2$ emissions.

Many “Weaknesses and Threats” can be tackled under the “Sino ETS”. For example, there is no international binding target for China; however, the domestic emission reduction targets could be the “cap”. Besides, depending on administrative measures was listed as a weakness; but on the other hand, it could be an efficient means to build and operate the ETS well in China. The lack of relative laws and regulations are also can be improved. This work is very important for applying the ETS but is easier than changing people’s mind actually. In the case of insufficient financial and technological supports, the help from developed countries especially the EU will be significant. It will be not a big issue if China is willing to establish the Sino ETS and the EU really wants to reduce CO$_2$ emissions worldwide.

During the process of establishing and implementing the “Sino ETS”, it will definitely encounter various difficulties and problems. The stakeholders have different frames and their own interests, which will impact on the decision making process, however it will promote a better preparation for the practice also. Combining with the classification for Political, Economic, Social and Technological aspects in the SWOT-PEST analysis, the stakeholders could be related as well. Especially, for the weaknesses and threats, each stakeholder can find matching aspects to improve.

So far, every recommendation has been discussed except relatively detailed suggestions according to the process of applying the “Sino ETS”. Since some explanations have been mentioned when giving the recommendation, the complementary discussions are showed here.

- Setting overall targets: Taking “reducing CO$_2$ emissions per-unit GDP in 2020 by 40% - 45% compared to the level of 2005” as the first “cap” of the “Sino ETS” could be a good choice. On the one hand, “no binding target” problem has been solved, although it is a domestic target. On the other hand, this target has already announced by Chinese government, hence, it will not be a huge pressure for China. On the contrary, the “Sino ETS” will help China to fulfill the promise.

- Designing the time table: The reasons of the recommendations have been
showed before. It is necessary to point out here that the time table needs to be designed properly. Too loose schedule will limit the emissions reduction effects, whereas too tight schedule may dampen the installations’ enthusiasm and all stakeholders’ confidence for the ETS.

- Identifying the trade objects: There is no denying that a good ETS should not only involve CO₂ as the trade object. However, at the beginning, it is too complicated to include all GHGs in the “Sino ETS”. Certainly, the other GHGs should be involved gradually if the ETS is well operated.

- Clarifying the scope: Although not including all sectors was listed in the lessons learnt from the EU ETS, it is difficult to cover all emitters into “Sino ETS” in early stage. Concerning the regions, the measure selecting experimental regions are used often in China and usually obtain satisfactory results. Hence, it can be tried here in the early phase of “Sino ETS”. Then, the whole country can be involved in the scheme after the successful experiment.

- Confirming the responsible competent department: The reason why choosing NLGCC has already discussed when putting forward the recommendation. Anyhow, the question that who will in charge of this issue must be confirmed before applying the “Sino ETS”.

- Allocating the allowances: This aspect can also take the EU ETS as a reference. About the free allocation issue, as analyzed before, it could promote the stable operation of the scheme and is necessary at the beginning in practice. The windfall profit phenomenon requires great concern and the percentage of the free allocation needs to be decreased gradually as the ongoing improvement in the EU ETS. In addition, scientific, fair assessment for installations’ and Provinces’ performances are important.

- Enhancing information collection system: The importance and solutions about data collection were presented before. It is really a problem both before allocation allowances and during the implementation of the ETS. The emissions data collection of every installations and the whole country should be started immediately even if the ETS will not be built in the near future.

- Ensuring circulation and trading of the allowances: For this part, the experiences from the EU ETS are meaningful. What is important is to formulate regulations as perfect as possible to avoid double counting phenomenon and other speculative behaviors.

- Establishing monitoring, reporting and punishment systems: As mentioned before, independent monitoring system should be built or at least one existing institution must be confirmed to in charge of monitoring the “Sino ETS”. In fact, supervising and restricting among several parties (government, companies, monitoring institutions, NGOs, media, the public and so on) could ensure the fairness and transparency, which are significant in applying the “Sino ETS”. In addition, the “heavy fine” in the “Sino ETS” must be heavy enough; otherwise it
will not make sense.

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  Other aspects: there are also some other problems, for example, how to involve CDM into the “Sino ETS”, need to be considered. As the buyer, the EU countries can use CERs as the offsets in the EU ETS through CDM. However, China as a developing country is a big seller due to its large CO₂ emissions amount and low emissions reduction costs. That is, when a company from the EU countries develops a CDM project with a Chinese company, finally the certified emission reduction credits will be calculated as the former’s emission reduction. Therefore, if the “Sino ETS” involve these CERs, it will result in double counting and even make all installations of the “Sino ETS” rush forward to CDM market. Whereas, it will deal a serious blow to the CDM market and increase Chinese companies’ pressure of emission reduction by not allowing these CERs come into the “Sino ETS”.

Moreover, the global ETS will be a desired emission trading scheme in the future which need more efforts and a gradual process. Applying the “Sino ETS” will be a meaningful part of this course. If the US can be involved in after China, it will be promising to establish a unified EST worldwide in the future. This issue will not be further discussed in the thesis since building the global ETS will face much more difficulties and will not be achieved in the near future. Certainly, it is necessary to point out that building ETS is a means of reducing GHGs emissions and protecting global environment but not a final aim.

“Actions speak louder than words”. The beginning of establishing “Sino ETS” will be hard, whereas it is a worthwhile effort of reducing CO₂ emissions for China. Also, the pertinent, detailed suggestions must be put forward after taking the “Sino ETS” into practice.

Many uncertainties exist of course concerning the EU, China and the international community. The uncertainties of the international climate negotiations (e.g. to what extent the different countries can reach a consensus; whether China will have a binding emissions reduction targets under the international agreement) will influence decision making. For the EU, the degree of its help (in technological aspect for example) is uncertain as well. Concerning China itself, for instance, the degree of attention on applying the ETS (even emissions reduction issues) or other hot topics from the central government is uncertain. Recently, China suffered by lots of natural disasters, such as earthquakes, drought, landslides and so forth, which become the focus of the whole country. As for applying the “Sino ETS”, when it will be addressed is unknown.

Certainly, the analysis in the thesis is not perfect. Firstly, the “SWOT-PEST” analysis has its limitation itself. Although both SWOT analysis and PEST analysis are very popular analytical tools and the matrix form makes the analysis more intuitive and simple, the precision are not good enough. Besides, the classification between inside
(strengths and weaknesses) and outside (opportunities and threats) aspects actually ignore the interaction between these internal and external factors. Making a distinction between advantages and disadvantages ignore the transformation among strengths, weaknesses, opportunities and threats. (Song & Pan, 2010) Furthermore, it is also difficult to judge which factor belongs to which aspects in the PEST analysis. In addition, the analysis in this thesis is done based on literatures, authoritative up-to-date internet resources, personal communications and so forth; however, my research about the EU ETS are not yet deep enough and the understanding about the national condition of China are not thorough enough due to time limit and condition restriction, and some opinions or expression may not wholly accurate. What is important is that more and more people could pay attention to and launch into the discussion, and promote emissions reduction issues to tackle climate change.
8. Conclusion

Climate change which may mainly due to GHGs emissions is a great global challenge nowadays. Effective measures must be taken immediately to avoid irreversible and catastrophic result in the future. During the past decades, the international community has made some efforts to tackle climate change such as adopting the UNFCCC and Kyoto Protocol, designing the Bali Roadmap, and holding the United Nations Climate Change Conference in Copenhagen. Although these efforts and the real effects are far away from enough, and the climate negotiation is really tough, the climate change issue has attracted wide attention and increasing actions are being taken to reduce GHGs all over the world.

As the biggest emitter, China should make further efforts to reduce CO₂ emissions not only for its responsibility but also will benefit itself. Along with the development of international emission trading market, establishing an emission trading scheme can be a good choice for China to reduce CO₂ emissions. As the biggest and relatively perfect emissions trading scheme in the world, the EU ETS offers referential experiences and lessons for China.

After reviewing the current situation in China, the comparison between the EU and China shows their similarities and difference about the basic condition of applying the ETS. The similarities (i.e. management system, basic aim, and so on) could be the positive condition for applying the EU ETS in China. Concerning the differences (degree of development, public awareness and participation for instance), some of them show the weak points that should be improved if building the ETS; the others remind that China must consider its actual conditions when applying the ETS.

Through the analysis, the experiences learned from the EU ETS are showed. Also, it is necessary for China to applying the EU ETS to reduce CO₂ emissions indeed. Actually, China has lots of strengths and opportunities to establish the ETS in political, economic, social and technological aspects, such as the regime and political system, rapid developing economy with regional disparities, increasing awareness of both the government and the public, and the valuable experience from the EU ETS. However, many weaknesses and threats for building the EU ETS in China exist as well, such as the lack of relevant laws and regulations, no binding targets of emissions reduction, insufficient financial and technological supports, and objections inside the country and so forth.

In the light of the feasibility and limitations analysis, a number of recommendations are put forward for establishing the ETS in China. Firstly, it is necessary to attach importance to reduce CO₂ emissions and tackle climate change issues. The efforts should be continued even facing the doubts. Basing on the EU ETS model and considering actual conditions of China, a domestic regulative ETS, “Sino ETS”, should be established in China. Concerning the process, the basic design is according to
the EU ETS; whereas some adjustments are also need to be done so as to be suitable for the specific condition of China. For instance, the National Leading Group on Climate Change headed by premier Wen Jiabao can play the role as European Commission in the EU ETS and the provinces will work as the EU Member States. Moreover, in the early phases of the “Sino ETS”, the CO₂ emission will be the only trading object and the emission target can be China’s voluntary emission trading target. For both internal and external stakeholders, the corresponding suggestions are also provided. Politicians, experts, companies, media, NGOs, GHGs exchanges, the public of China and other countries should do the utmost to contribute to applying the “Sino ETS” and reducing CO₂ emissions. Last but not least, enhancing the cooperation between the EU and China is important for both sides and addressing climate change issue worldwide.

In order to make everything more clearly, each aspect of the recommendations is discussed in the thesis. Besides, several questions such as how to use the SWOT-PEST analysis, which part is the most significant/difficult part in applying the ETS in China and how to solve the problem, what are the uncertainties, weakness in the analysis are also discussed. Among all the aspects, ideas (awareness) about reducing CO₂ emissions could be the most important and difficult part. What should be done is to realize the “low-carbon” concept into the practical implementation level in the whole society and make it becomes the working methods of the government, the surviving means of the enterprises and the life styles of the public. Some measures such as applying the scientific and practical assessment system, active propagandizing and educating can be taken to enhance awareness and guide actions in China. Of course, some uncertainties concerning applying the “Sino ETS” are still exist such as the degree of the EU’s help, the Chinese government’s focus, and the following results of international climate negotiations.

In summary, although there are some problems and uncertainties, and many people still skeptical, establishing the “Sino ETS” is necessary for China to reduce CO₂ emissions and will be worthwhile and meaningful for both China and the world in tackling climate change. What is more, establishing “Sino ETS” is feasible to be achieved in the near future through the joint efforts of all stakeholders. It is necessary to point out that building ETS is a means of reducing GHGs emissions and protecting global environment but not a final aim. Hope more and more people could pay attention to and launch into the discussion, and promote emissions reduction to tackle climate change issues.
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## Appendix I.

### Conferences of the Parties of the UNFCCC

<table>
<thead>
<tr>
<th>COPs</th>
<th>Date</th>
<th>Site</th>
<th>Main Contents &amp; Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COP1</td>
<td>Mar. 1995</td>
<td>Berlin, Germany</td>
<td>Berlin Mandate (Launched a process to decide on stronger commitments for Annex I Parties)</td>
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<tr>
<td>COP2</td>
<td>Jul. 1996</td>
<td>Geneva, Switzerland</td>
<td>Geneva Declaration (Renewed the momentum of the Kyoto Protocol negotiations)</td>
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<tr>
<td>COP3</td>
<td>Dec. 1997</td>
<td>Kyoto, Japan</td>
<td>Kyoto Protocol (Set legally binding targets and timetables for cutting the GHGs emissions of Annex I Parties)</td>
</tr>
<tr>
<td>COP4</td>
<td>Nov. 1998</td>
<td>Buenos Aires, Argentina</td>
<td>Buenos Aires Plan of Action (Set out program of work on issues under the Protocol; Established deadline for completion as COP 6 in 2000)</td>
</tr>
<tr>
<td>COP5</td>
<td>Oct. 1999</td>
<td>Bonn, Germany</td>
<td>No declaration (Negotiated technical issues, such as technology transfer from developed to developing countries)</td>
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<tr>
<td>COP6</td>
<td>Nov. 2000</td>
<td>Hague, Netherland</td>
<td>Bonn Agreement (Part I could not reach agreement, mainly due to the US, so resumed in Bonn; Part II reached the Bonn Agreement-political package; Between two Parts, the US announced it would not ratify the Kyoto Protocol)</td>
</tr>
<tr>
<td>COP7</td>
<td>Oct. 2001</td>
<td>Marrakesh, Morocco</td>
<td>Marrakesh Accords (Translated Bonne Agreement into decisions setting out detailed rules for the implementation of the Protocol and took important steps toward implementation of the Convention)</td>
</tr>
<tr>
<td>COP8</td>
<td>Oct. 2002</td>
<td>New Delhi, India</td>
<td>Delhi Declaration on Climate Change and Sustainable Development (Reaffirmed development and poverty eradication as overriding priorities in developing countries and highlighted the importance of adaptation)</td>
</tr>
<tr>
<td>COP9</td>
<td>Dec. 2003</td>
<td>Milan, Italy</td>
<td>No declaration (President’s summary of round table)</td>
</tr>
<tr>
<td>COP</td>
<td>Year</td>
<td>Country</td>
<td>Discussions Included in Report of the Session</td>
</tr>
<tr>
<td>-----</td>
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<td>-----------------------------------------------</td>
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</tbody>
</table>
| COP10 | Dec. 2004 | Buenos Aires, Argentina | **Buenos Aires Programme of Work on Adaptation and Response Measures; seminar of government experts**  
(Calls for action on issues to address the adverse effects of climate change and response measures; seminar to promote an informal exchange of information on mitigation and adaption, and on policies and measures) |
| COP11 /CMP1 | Nov. 2005 | Montreal, Canada | **Montreal Action Plan**  
(Under the Protocol, a new working group, AWG-KP was established to discuss future commitments for developed countries for the period after 2010; a long-term global cooperative action to address climate change was launched; set the framework for implementation of the Protocol) |
| COP12 /CMP2 | Nov. 2006 | Nairobi, Kenya | **Nairobi Work Programme**  
(Outcomes were reached for helping developing countries to tackle climate change) |
| COP13 /CMP3 | Dec. 2007 | Bali, Indonesia | **Bali Roadmap**  
(Includes a number of forward-looking decisions that represent the various tracks; includes the Bali Action Plan, which charts the course for a new negotiating process designed to tackle climate change, with the aim of completing this by 2009) |
| COP14 /CMP4 | Dec. 2008 | Poznan, Poland | **Adaptation Fund; 2009 Work Plan**  
(No breakthrough; Delegates agreed on principles of financing for a fund to help poor nations tackling the effects of climate change and pass the plan of 2009) |
| COP15 /CMP5 | Dec. 2009 | Copenhagen, Denmark | **Copenhagen Accord**  
(Much-anticipated further binding targets was not included; negotiations will continue in 2010; some agreements on CDM, Funds and so on) |
| *COP16 /CMP6 | Nov. 2010 | Cancun, Mexico | ? |

Source: (UNFCCC, 2010), (UNDP, 2008) & (People's Daily Online, 2010)
Appendix II.

The basic conditions of China present the country with great challenges in addressing issues regarding climate change.

— A complex climate and a fragile eco-environment determine that China's task of adapting itself to climate change is arduous. China is characterized by a continental monsoon climate, and most parts of China have a wider range of seasonal temperature change compared with other continental areas at the same latitude. Many places in China are cold in winter and hot in summer, and high temperatures generally prevail in the country at large in summer. Precipitation is unevenly distributed in time and space, concentrating in the flood season, and annual precipitation decreases from the southeast coast to the northwest interior. China has a fragile eco-environment, with serious soil erosion and desertification and a forest coverage rate of 18.21 percent, only 62 percent of the world's average. The area of natural wetlands is comparatively small; most grasslands are highly frigid meadows and desert steppes; temperate grasslands in northern China are in danger of de-generation and desertification due to the impacts of drought and deterioration of the eco-environment. With a coastline over 18,000 km long, China is vulnerable to the adverse effects of sea level rises.

— A large population and a relatively low level of economy determine that China's development task is a formidable one. The population of the mainland of China reached 1.321 billion at the end of 2007, accounting for 20 percent of the world's total. China has a comparatively low level of urbanization, with an urbanization rate of 44.9 percent in 2007, lower than the world's average. The large population also brings huge employment pressure. New urban labor force entrants of 10 million and above need jobs every year; as the urbanization process moves forward, tens of millions of rural laborers transfer to the urban areas every year. Statistics from the International Monetary Fund show that the per-capita GDP (gross domestic product) of China in 2007 was US$2,461, ranking 106th, a low-to-middle place, among 181 countries and regions. China is characterized by unbalanced regional economic development and is still nagged by a large income gap between urban and rural residents. The country is still troubled by poverty, with an impoverished rural population of 14.79 million inadequately fed and clad. Those who just have enough to eat and wear and earn an unstable, low income number 30 million nationwide. Moreover, China has a relatively low level of science and technology and weak capacity of independent innovation. Developing the economy and improving people's lives are imperative tasks currently facing China.

— China's ongoing industrialization process and its coal-dominated energy mix determine that its task of controlling greenhouse gas emissions is a tough one. Historically, China's greenhouse gas emissions have been very low. According to data from relevant international research institutions, from 1904 to 2004, carbon dioxide emissions from fossil fuel burning in China made up only 8 percent of the world's total over the same period, and cumulative emissions per capita ranked 92nd in the world. China's carbon dioxide emissions from energy consumption in 2004 totaled 5.07 billion tons. As a developing country, China still has a long way to go in its industrialization, urbanization and modernization. To advance further toward its development objectives, China will strive for rational growth of energy demand, which is the basic precondition for the progress of all developing countries. However, its coal-dominated energy mix cannot be substantially changed in the near future, thus making the control of greenhouse gas emissions rather difficult.

### Appendix III.

**Largest Carbon Dioxide Emitters (Top 20) in 2009**

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Emissions (Million metric tons of CO₂)</th>
<th>Per Capita Emissions (Tons/capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>6017.69</td>
<td>4.58</td>
</tr>
<tr>
<td>United States</td>
<td>5902.75</td>
<td>19.78</td>
</tr>
<tr>
<td>Russia</td>
<td>1704.36</td>
<td>12.00</td>
</tr>
<tr>
<td>India</td>
<td>1293.17</td>
<td>1.16</td>
</tr>
<tr>
<td>Japan</td>
<td>1246.76</td>
<td>9.78</td>
</tr>
<tr>
<td>Germany</td>
<td>857.60</td>
<td>10.40</td>
</tr>
<tr>
<td>Canada</td>
<td>614.33</td>
<td>18.81</td>
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<tr>
<td>United Kingdom</td>
<td>585.71</td>
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<td>South Korea</td>
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<td>Iran</td>
<td>471.48</td>
<td>7.25</td>
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<td>Italy</td>
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</tr>
<tr>
<td>South Africa</td>
<td>443.58</td>
<td>10.04</td>
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<tr>
<td>Mexico</td>
<td>435.60</td>
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<td>15.70</td>
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<td>Australia</td>
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<td>372.61</td>
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<td>Poland</td>
<td>303.42</td>
<td>7.87</td>
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Source: Union of Concerned Scientists, 2009
Major Trends of Global CO₂ emissions, 1970-2005
Appendix IV.

Countries and Country Groups

<table>
<thead>
<tr>
<th>Countries and Country Groups</th>
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<th>EU-25</th>
<th>EU-27</th>
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Scope of the EU ETS

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<th>Participation to the EU ETS</th>
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(Source: EEA, 2010)