

The Master in Advanced European and International Studies – Anglophone branch 2015-2016

Thesis Topic: Facilitation of linkage of EU-ETS and China-ETS in responding to climate change issues



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<sup>&</sup>lt;sup>1</sup> Sanghi (2011)

## Abstract

EU has operated Emission Trading System (ETS) since 2005 and China will be commencing its national-ETS from 2017, while EU and China has more frequent cooperation in climate action, this thesis explores the feasibilities to facilitate EU-China ETS linkage with the focus on Cap structure and Trading Platform. Linkage designs are also discussed in addressing potential ETS and linkage problems, including price signals, carbon leakage, market manipulation, speculation, excessive allowances and Enron loophole.

Keywords: Carbon market, emissions, EU-ETS, China-ETS, auction, exchange, speculation, NDRC, European Commissions, speculation, decarbonization, allowances, climate actions

## Abbreviation

- BCAs = Border carbon adjustments
- CCERs = Chinese Certified Emission Reductions
- **CCP** = Central Counterparties
- **CCS** = Carbon Capture and Storage
- **CDM** = Clean Development Mechanism
- CNEEEX = China Environment and Energy Exchange (Shanghai)
- **CEEX** = China Emissions Exchange (Guangdong)
- **COP** = Conference of Parties
- **EU** = European Union
- ETS = Emission Trading System
- **GHG** = Greenhouse gases
- **INDCs** = Intended Nationally Determined Contributions
- IOSCO = International organization of Securities Commissions
- **JI** = Joint Implementation
- LCAs = Life-cycle assesments
- **MAD** = Market Abuse Directive
- **MiFID** = Markets in Financial Instruments Directive
- MRC = Macro Regulation and Control Strategies
- **MRV** = Measuring, Reporting and verification
- Provisional Measures = Provisional measure for the administration of carbon emission rights trading
- **R&D** = Research and Development
- **SDGs** = Sustainable Development Goals
- **SME** = Small and Medium Size Enterprise
- **TFSS** = Task Force on Short Selling
- The Protocol = Kyoto protocol
- Yuan = RMB = ¥ = Chinese currency unit

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## **Chapter I - Introduction**

#### **1.1 BACKGROUND**

Nowadays climate change is affecting the whole world due to particularly increase in anthropogenic carbon emission after industrialized period, global temperature has been increasing significantly since 1990. Global warming not only reduces biodiversity and distort ecosystem, but also create social inequality due to rise in sea level and increasing extreme weather as well as conflict of resources.

Anthropogenic carbon emission is the main sources of source of carbon in which 'Tragedy of Common' applied due to anarchy in carbon emission, before late 20<sup>th</sup> century no industries or states were proactive to take part in reducing carbon emission because of profit maximization and national interest respectively, providing that impact of climate change is not emerging when compared with other topics.

In late 20<sup>th</sup> century, countries started to be aware of the significance of climate change to environment and human being; in 1992 Earth Summit in held in Rio de Janeiro to in response to climate change, United Nation Framework Convention on Climate Change (UNFCCC) was established. Conference of Party (COP) was held under the mandate of UNFCCC, the 1<sup>st</sup> COP (COP 1) was in Berlin.

At COP 3 in Kyoto, Kyoto Protocol (KP) is signed, and Article 17 of KP<sup>2</sup> set out the application of carbon market. Carbon market is an Emission Trading System (ETS) for industries, it is also known as 'carbon cap and trade' system because government set a cap for carbon emission to certain companies according to their size and other production and operational factors. If a particular company exceeds the limit, it needs to spend extra to buy the positive surplus from the other companies which have a negative surplus (produce less than the cap). According to Griskevicius et al. (2012), relative status is more valued by rational actors, a company would perceive the needs to develop

<sup>&</sup>lt;sup>2</sup> Article 17:"The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3. Any such trading shall be supplemental to domestic actions **for the purpose of meeting quantified emission limitation and reduction commitments** under that Article".

low-carbon technology when it could enjoy more profit compared to those with positive surplus for such development, and carbon market is the market strategy applying the concept of relativity.

Currently European Union (EU), Switzerland, some states of USA and Canada, six cities in China, South Korea, three cities in Japan, Kazakhstan, Australia and New Zealand are implementing carbon market, while Thailand, Turkey, Brazil, Chile, Ukraine and some other states of USA and Canada are planning to implement, as shown in Fig. 1.

Among the countries listed above, there have been plans to link the carbon markets, including EU-China and EU-Australia, EU-Switzerland, and US-Canada, they are linked through bilateral agreements that the involved countries agreed to have transfer of credits.



Fig. 1.1 Global status of application of carbon market (Kossoy et al., 2015)

#### **1.2 Problem in Carbon Market**

From 2005 the first emission trading mechanism emerged, there are two problems associated with implementation of carbon market that hinder the effectiveness of carbon reduction efforts: efficacy and connectivity

#### <u>Efficacy</u>

Carbon market has been operating for more than 10 years across different continent, it successfully boosted certain climate-smart initiatives and investment; however, efficacy has been bogged down due to systematic problems of carbon market. The emission trading scheme became financial-oriented gradually that the focus was shifted to economic approach instead of carbon reduction, there is also risk that carbon credit would be hijacked by speculation activities that distort the objectives of carbon market establishment. Besides, there are too many carbon credit surplus in the market that drive down the carbon price because of additionality that too many credit were granted and carbon banking system, carbon credit scarcity was failed to be created as exemplified by EU-ETS. Apart from that, carbon leakage happens when carbon reduction in certain region lead to increase in carbon emission in other region, creating insignificant or even negative overall carbon reduction.

### <u>Connectivity</u>

Currently countries are using different market system according to their domestic needs, leading to challenges in addressing the efforts of those climate-combating strategies, as mentioned by World Bank Group (2014):

"...However, it has also led to a certain amount of regulatory fragmentation across jurisdictions, which has made it increasingly complex to track progress, compare achievements, and link actions across jurisdictions...". The problems of scattered carbon markets include fluctuation of carbon price, difficulties to quantify and compare carbon-reduction efforts, low liquidity in climate-initiative financing, weak market signal for carbon reduction priority, individual system development.

To achieve a connected carbon market, there are a numbers of technical issues needed to be harmonized or simplified, including the cap and auctioning design and trading system.

#### **1.3 AIM OF THIS THESIS**

This thesis is to respond to one question: 'How to overcome heterogeneity to link the EU-ETS and China-ETS for better climate actions?' The arguments of this thesis are to solve the problems on 'efficacy' and 'connectivity' of the existing carbon markets.

Another aim is to take references on the existing ETS problems and provides preventive solutions for the proposed linkage.

### **1.4 Scope of work**

EU-China ETS linkage is the focal point of this thesis, operations and linkages of other ETS will be used to supplement the focal point.

Besides, this thesis only discuss the 'Cap Structure' and 'Operational System' of the EU-China ETS, the other areas of the compatibility of Carbon Market including Coverage, International Offsets and Monitoring, Reporting and Verification would not be focused or covered. Pre-linkage harmonization and linkage coordination are discussed.

#### **<u>1.5 OUTLINE OF THESIS</u>**

After this Chapter of 'Introduction', Chapter II is the 'Holistic Review'. It mentioned the climate actions of both jurisdiction in terms of Kyoto Protocol, INDCs, and long-term decarbonization roadmap, a review to EU-ETS and Chin-ETS is covered. This chapter also discussed the benefits of linkage and pre-linkage considerations, before outlining the need for the thesis.

Chapter III is about the 'Cap Structure', it introduces the idea of 'dual-track transition' through improving free allowance and increasing the shares of auctioning to free allocation. Besides, adjustment of cap is discussed, it is argued that market scarcity and coherence with long-term decarbonization roadmap is the key to facilitate the linkage rather than simply the cap design. In addition, carbon leakage situation in EU and China is discussed, it is argued that carbon leakage list should be reformed to include 'foreign emission' rather than simply providing free allowance to the on-list industries. After that, the benefits and barriers of implementation of Border Carbon Adjustments (BCAs) to address carbon leakage are discussed, suggestions are made to the barriers, it is also suggested that EU and China should undergo joint researches to investigate the feasibility of BCAs.

Chapter IV is about the 'Operational system', it illustrated the joint-auction and optimal auction design, and the necessity in creating market scarcity of allowances. Than it moved onto the Trading platform section which mode of training are discussed, it is argued that proposed linked market should mainly be operated in form of spot market, existence if future market should be supplementary and regulated. After that, Five market malfunctioning are discussed, including market manipulation, speculation, excessive allowances and Enron loophole. In addition, complementary benefits both jurisdictions are discussed, it is mentioned that EU can provide insights and lessons learnt to operation of China-ETS, while China can potentially provide intelligence for EU-ETS regarding Market control strategies on financial operation and speculation

The 'Conclusion' Chapter summarizes the line of arguments throughout the thesis, while the Recommendation' Chapter provides incite for future investigations on relevant topics.

# Chapter II: Comparison of EU-ETS and China-ETS &

# Prelude of linkage issues

This part will outline the INDCs and long-term decarbonization roadmap of EU and China, as well as the current situation of EU-ETS and China-ETS. It also analyzes the challenges of both system and makes suggestions on the pre-linkage preparation work, the 'need for the thesis' will also be discussed.

## 2.1 From Kyoto Protocol to INDCs to long-term decarbonization roadmap of EU and China

## 2.1.1 Kyoto Protocol Target

Kyoto Protocol (the Protocol) was signed in 1997 COP 3 and became effective in 2005 after Russia Federation ratified the Protocol to the UNFCCC in 2004 (Walsh, 2004). Article 10 of the Protocol reaffirmed the principle of UNFCCC that countries has *'common but differentiated responsibilities'* towards emission reduction, non-Annex I countries <sup>3</sup> would not be introduced with new commitments.

Under the Protocol, the EU (formerly the European Economy Community EEC) had the emission reduction target of 8% below 1990 level in first compliance period 2008-2012 while China has no reduction target for being non-Annex I countries. The compliances of the targets are mainly fulfilled by the international offsets<sup>4</sup> created under the Clean Development Mechanism (CDM) and the Joint Implementation (JI). EU met the first compliance target by achieving 19% reduction below 1990 level within 2008-2012, 11% more beyond the Kyoto target. (European Commission, 2016 i)

## 2.1.2 INDCs targets

<sup>&</sup>lt;sup>3</sup> Annex I countries include Australia, Austria, Belarus, Belarus, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxemburg, Netherlands, new Zealand, Norway, Poland, Portugul, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America

<sup>&</sup>lt;sup>4</sup> International credits was defined as 'the financial instruments that represent a tone of CO2 removed or reduced from the atmosphere as a result of an emissions reduction project', they are generated through CDM and JI. (European Commission, 2016)

Conference of Parties (COP) applied top-down approach to achieve emission reduction, the reduction targets of countries would be discussed in COP meeting and set as the milestone form countries to achieve within certain period, as demonstrated by Kyoto target. However, due to the political failure during 2011 COP 17 in Copenhagen to achieve commonly agreed consensus, prior to COP 21, for the first time UNFCCC proposed to start using Intended Nationally Determined Contributions (INDCs) to enhance political feasibility in achieving consensus in COP 21.

INDCs is bottom-up approach that countries decided their domestic reduction targets after evaluation of their own capacities, it prevented deadlocks in COP 21 and Paris agreement was viewed as one of the breakthroughs in climate actions history. EU pledged to reduce 40% below 1990 level by 2030 without usage of international offsets such as CDM and JI credits starting from 2020<sup>5</sup>, while China pledged to reduce carbon intensity by 60-65% below 2005 level by 2030 and attain emissions peak by 2030 or before.

By 2014 EU has attained 23% below 1990 level, which has overshoot the target of 20% reduction by 2020 set in the 2020 EU energy and climate package (EC & EEA, 2015); and China was believed to be capable of peaking its emission by 2025 instead of 2030 (Tollefson, 2016). Recently, there is more cooperation between China and EU in climate actions. For instance, in 2015 EU-China Summit, both sides agreed "to further enhance existing bilateral cooperation on carbon markets"; besides, China and EU have co-organized a side event advocating low-carbon and energy efficient economy during COP 21, "With both the EU and China committed to emissions trading, two major international players are championing carbon markets as a key policy tool to curb greenhouse gas emissions and put a price on carbon. This is a strong signal and crucially needed by companies and stakeholders. I am confident it will encourage others to follow suit", said by EU Commissioner for Climate Action and Energy Miguel Arias Cañete. (EEAS, 2015)

#### 2.1.3 Long-term decarbonization roadmap of EU

**EU-ETS** was considered as a key tool in combating climate change through reducing GHG emissions. According to Emission trading Directives 2003/87/EC

<sup>&</sup>lt;sup>5</sup> International offsets will not be allowable for compliances from 2020 so as to pave the road for domestic emission reduction target (80% based on 1990 level) in 2050.

published in 2003, EU-ETS would be established to promote reduction of GHG in a 'cost-effective and economically efficient manner', the details of EU-ETS are in Section 2.2.

Besides, in the **2020 EU energy and climate package** published in 2009, EU decided by 2020, to reduce 20% GHG from 1990 level, increase the deployment of renewable energy to 20% of total energy production shares and fosters 20% improvement in energy efficiency. It also mentioned that international offsets are not allowed to use to achieve such targets. For the **2030 Climate and Energy Framework** published in 2014, EU decide to, by 2030, reduce 40% GHG reduction from 1990 level<sup>6</sup>, increase the deployment of renewable energy to 27% of total energy production shares and fosters 27% improvement in energy efficiency<sup>7</sup>

In 2015, the Commission issued a long-term decarbonization document called **2050 low-carbon economy roadmap**, EU sought to reduce 80% from 1990 level by 2050 through domestic reduction efforts, but it is based on the precondition that 40% and 60% reduction target was achieved by 2030 and 2040 respectively.

The documents also mentioned that all sectors would be involved. The main objectives of the roadmap is to promote clean technology reduce resources conception, foster less dependence on imports of oil and gas, as well as encounter the health benefit while achieving the improvements, to make the decarbonization feasible and affordable, EU will increase its investment to 1.5% of GDP annually on relevant measures in next 4 decade. The ambitions of GHG reduction included power production (93-99% from 1990 level), Industrial sector (83-87% from 1990 level), transportation (54-64% from 1990 level), residential and service (88-91% from 1990 level) as shown in Fig. 2.1.

<sup>&</sup>lt;sup>6</sup> The 2030 reduction target is the same as the INDC target and equal to 43% GHG reduction from 2005 level.

GHG reductions compared to 1990	2005	2030	2050
Total	-7%	-40 to -44%	-79 to -82%
Sectors			
Power (CO <sub>2</sub> )	-7%	-54 to -68%	-93 to -99%
Industry (CO <sub>2</sub> )	-20%	-34 to -40%	-83 to -87%
Transport (incl. CO2 aviation, excl. maritime)	+30%	+20 to -9%	-54 to -67%
Residential and services (CO <sub>2</sub> )	-12%	-37 to -53%	-88 to-91%
Agriculture (non-CO <sub>2</sub> )	-20%	-36 to -37%	-42 to -49%
Other non-CO <sub>2</sub> emissions	-30%	-72 to -73%	-70 to -78%

Fig. 2.1 Sectoral reduction in the EU (European Commission, 2011)

## 2.1.4 Long-term decarbonization roadmap of China

China has been unprecedentedly ambitious on climate action within the decade, showing more than 13 times increase in investment on clean energy from \$7.5 billion in 2005 to \$101.2 billion in 2015 (Ng et al., 2016). In the 13<sup>th</sup> Five Year Plan (FYP13) published in 2016, it sets out to reduce 48% carbon intensity from 2005 level by 2020 (compared to 40-45% reduction in Copenhagen pledge) (Henderson et al., 2016), it put carbon reduction, adaptation and international cooperation as the strategies in combating climate change, and carbon market pilots projects was the main to in response to achieve GHG reduction with facilitation of national-wide China-ETS. (Xinhua, 2016)

When **compared with EU**, China has experienced drastic increase in clean technology. As shown in Fig. 2.2, China has exceeded EU in investment on clean energy in 2013 and the Chinese investment has been 2.5 times more than that of EU in 2015. Internationally, 5 out of top 10 wind turbine companies and 3 out of top 10 solar panel companies are in China.



Fig. 2.2 Comparison of clean energy investment in China and the EU (Ng et al.,

In addition, China has planned by 2020 to double its wind energy capacity, treble its solar capacity and have a ten-fold increase in electric vehicles. Research and Development has risen by 73% from 2009 to 2014. (Ng et al., 2016)

## 2.2 A REVIEW ON EU-ETS

This section outlines the facts about EU-ETS, the challenges if encountered since establishment, the current solutions and suggestions on EU-ETS reform to facilitate the EU China-ETS linkage.

## 2.2.1 Factsheet of EU-ETS

### <u>Timeline</u>

EU-ETS operation **started from 2005** under Emission Trading Directive and it is the first international ETS in the world, it is also the biggest ETS that covered the largest shares of GPD (replaced with China-ETS after 2017). Until 2015, it covered 45% of total emissions within EU and absolute cap was used, the coverage included Power production, Industry, Residential and Services, Transportation, Agriculture and other non-CO2 sectors.

EU-ETS was divided into 4 phases. **Phase I** (2005-2007) is a 'learning –by-doing' period that the Commission tried to grasp the first hand experience to operate the system so as to learn from it. In **Phase II** (2008-12), the cap was lowered by 9.5% and aviation section fell under the coverage. Besides, Iceland, Liechtenstein and Norway joined the system in 2012. While in **Phase III** (2013-20), the coverage expanded to more industrial activities and Croatia joined the system, linkage between EU-ETS and Swiss-ETS was started to negotiate in 2013. The major reform is that the EU-cap limit reduction was set to be 1.74% annually. Starting from **Phase IV** (2021-2028), no international offsets from CDM/JI could be used by industries to fulfill their compliances.

## Allowance allocation

Allowance in EU-ETS can be from free allocation, auctioning<sup>8</sup> or exchange

<sup>&</sup>lt;sup>8</sup> Auction was defined as 'selling of the emissions allowances through an auctioning platform where participants can bid for the allowances. Allowances sold at the auction will be allocated to the highest bidders' (European Commission – Climate Action, 2014); auction design will be discussed in section 4.2

from international offsets, benchmarking was used as evaluation tool for free allocation. One of the long-term goals of EU-ETS is to progressively increase the shares of auctioning allowance to free allowance so that companies will bear more responsibility for their emission, it can also incentivize companies with well performance that they can earn by selling the excessive free allowances. As shown in Fig. 2.3, in Phase II 2012 the free allocation accounted for more than 2000 tCO2e, while from Phase III 2013 there was much less free allowances, it is because cap for free allowances allocation was determined by EU instead of Member States. In addition, to ensure the real climate actions were taken place among European companies, international offsets are not allowed starting from 2020 as discussed in section 2.1.2. (IETA & EDF, 2015)



Source: European Commission, 2015. Available at: <u>eur-lex.europa.eu</u>

Fig. 2.3 EU-ETS cap from 2013-2020 excluding aviation sector (IETA & EDF, 2015)

#### **Common auctioning within EU-ETS**

As auctioning is the main tool for businesses to attain allowance, common auctioning platforms were introduced, **European Energy Exchange** (EEX) was appointed to be the EU official platform. However, there were opt-out options for Germany, UK, Denmark and Poland regarding common auctioning, for instance, **ICE Futures Europe** (ICE) was the auctioning platform for UK. For the auctioning revenue, EU-ETS Directive mentioned that at least half of the revenue to be used by the Member States in climate and energy related activities, in the case of 2013, 83.3% of the revenue was spent on areas such as sustainable transportation and energy efficiency. (European Commission, 2016 ii)

#### Carbon leakage

Carbon leakage<sup>9</sup> means the movement of production from a country with higher stringency of climate policy to a lower one, resulting from undermined overall carbon reduction.

To prevent potential carbon leakage, EU applied its first **carbon leakage lists** in 2013 and they are reviewed every 5 years (European Commission, 2016 & DG Climate Action, 2013). According to article 10(a) of the Directive, industries with risks of carbon leakage will have higher shares of free allowance allocation, most of them receive 100% free. A sector or sub-sector is deemed to be exposed to a significant risk of carbon leakage if:

- Direct and indirect costs induced by the implementation of the directive would increase production cost, calculated as a proportion of the gross value added, by at least 5%; and
- The sector's trade intensity with non-EU countries (imports and exports) is above 10%.

A sector or sub-sector is also deemed to be exposed if:

- The sum of direct and indirect additional costs is at least 30%; or
- The non-EU trade intensity is above 30%.

The reasoning behind the criteria setting is that, the EU tried to include the industries that are considerably affected by the carbon pricing, and the industries should involve significantly in international trade. It is because the EU tried to prevent the introduction of carbon pricing would significantly increase the burden of industries with high international trade volume; otherwise, it would adversely impact the international competitiveness of European business and the terms of trade of EU (the ratio of exports volume to imports volume).

According to the most updated carbon leakage list which is effective from 2015-2019, mainly manufacturing industries were deemed to be at risk of carbon

<sup>&</sup>lt;sup>9</sup> Carbon leakage is defined in the European Commission – Climate Action (2014) as 'the risk that increased cost due to climate policies in one jurisdiction, such as the EU, could lead companies to transfer their production to other countries that have laxer standards or measures to cut GHG pollutants emissions', more overall emission could be existed then that without the stringent climate polices such as strict cap-setting in carbon market. For example, industries in France need allowances to cover its carbon emission under emission trading Directive but not in Algeria, so the French industry may move its factories to Algeria to avoid buying allowance to fulfill the compliance. It seems that there is carbon reduction, however, it simply moved the pollution from France to Algeria, and reduction efforts are undermined.

leakage (European Commission, 2014).

## 2.2.2 Challenges of EU-ETS

#### <u>Carbon leakage list problem</u>

The **parameters to identify** if a sector is under the risks of carbon leakage is outdated and unrealistic, they still assume that the price of emission per ton is 30 Euros, and the industrial sectors actually are less prone to carbon leakage as evaluated as industry-intensive countries like China are starting its carbon market. Furthermore, free allowances are **over-granted** to the on-list industries as demonstrated by ArccelorMittal case<sup>10</sup>.

#### Excessive surplus and Weak price signal

During phase I, most EU-member states were **granted more allowances then they actually need**. The business under carbon leakage lists were granted excessive allowance as discussed above, and the economic recession in 2008 created less demand of the allowances. Besides, international offsets from CDM/ JI were allowed to be used for compliance. Therefore, there is excessive surplus in EU-ETS.

Demand and supply of allowance is closely related to price. As demand of allowance dropped in phase II due to recession, and supply of allowance increased due to weak targets and international offsets, the price dropped from 30 Euros per ton in 2008 to nearly 5 Euros per ton in 2014 as shown in Fig.2.4. Fig. 2.5 showed the main contributors of surplus are due to the weak targets & recession and international offsets.

<sup>&</sup>lt;sup>10</sup> Steel company ArccelorMittal has surplus allowance of 123 million, costing 1.6 billion Euros (Carbon Market Watch, 2015 i). They could either earn a windfall profit for banking them or sell them in phase IV in a higher price, or they could use them for future compliance, meaning that they could lower their climate investments in the coming years.









### 2.2.3 Current solution

#### Progressive Scope expansion

The coverage was increasing since phase I. Aviation sectors was included since phase II 2012 and aluminium, basic chemical production were also included in the EU-ETS since 2013. In 2015, it has covered 45% of total EU's emission (Andersone, 2013).

## Progressively less free allocation

The long-term targets of EU-ETS was to increase the shares of auctioning to free allowance allocation as discussed in section 2.2.1

#### Market Stability Reserves and Backloading

EU-ETS has created market instability due to excessive surplus and weak price signal, undermining the emission reduction efforts as described in section 2.2.2. Therefore, the Commission has decided to run **Market Stability Reserve** starting from 2018, the aim is to bank the excessive allowance in market to a reserve and they would be available in the market in phase IV (2021-2028).

However, it is **criticized** that the reserve simply delay the effects of over-allocation to phase IV instead of solving the problem, the price is expected to dropped significantly when the reserve reappear to the market.

Another Market stabilizing tool is called **Backloading** in which the auctioning process would be delayed until achieving a strong price signal; however, again it simply delay the problem of having excessive allowances as the amount of the overall allowance remain the same.

Therefore, there is necessary to apply other mechanisms and would be further discussed in 'Dynamic Distribution' and 'Market Scarcity' section.

#### Seeking for bilateral linkage: Australia, Norway, RGGI, Suisse, Korea and China

As described in the introduction section, benefits of carbon market linkage exceed the cost, EU-ETS has been seeking linkages with different jurisdiction. It has sought to link with Australia in 2005 but the Australian prime Minister step back on climate actions after running into office, and he refused the agreement of such linkage. Still there is successful story between EU-ETS and Norway-ETS in 2007.

Currently, there are several ETS that are considered by the EU as **potential linkage targets**, they are Swiss-ETS, RGGI-ETS, Korea-ETS and China-ETS (Finet.hk, 2015). Among the options, coming 2017 China-ETS is the only system that will replace EU-ETS for covering the largest emissions volume, and it may provide more flexibility and lower cost mitigation options to EU-businesses. (Hawkins and Jegou, 2014)

#### 2.3 A REVIEW ON CHINA-ETS

This section outlines the facts about China-ETS, the challenges in the pilot

#### projects and the path to 2017 national-ETS.

## 2.3.1 Factsheet of China-ETS

## <u>Timeline</u>

In 2011 'Notice on carbon emission trading pilots' was published by NDRC that assigned Beijing, Shanghai, Guangdong, Shenzhen, Chongqing, Tianjin and Hubei as pilot projects while Shenzhen is the first project to be launched in 2013. In 2014, NDRC released a draft notice on '10 national standards in GHG emission accounting methods and reporting guideline' as well as 'Provisional measure for the administration of carbon emission rights trading' (Provisional measures), showing the NDRC efforts in deepening the operation of China-ETS. Fig.2.6 showed the timeline of the establishment.





## Allowance allocation

For the allowance allocation, most pilot projects applied free allowance using **grandfathering** method, with limited portion of auctioning as the aim of pilot projects was to try out the operation of China-ETS instead of achieving real reduction. However, there is needed to have the reform in allocation methods in 2017 national-ETS together with EU-ETS, namely 'dual track transition' which is discussed in 'Allocation of free allowance' section.

## Auctioning and trading

Auctioning are only **supplementary** methods to attain compliance in the pilot projects except Chongqing and some of which have set the price floor, for example, the price floor in Guangdong and Shanghai are RMB 40 (around 6 Euros) and RMB 46 in Shanghai (around 6.6 Euros) respectively.

The auctioning and trading processes were separately done in **district level**, such as China Emissions Exchange (CEEX) and Shanghai Environment and Energy Exchange for Guangdong and Shanghai respectively. There is not yet common auctioning and trading platform in phase I, but there is information and technology platform namely 'www.tanpaifang.com' providing professional supports on carbon financing and trading.

## 2.3.2 Challenges of China-ETS

#### 2017 transition to national-ETS

'Unification with flexibility' will be the guiding principles in facilitating national markets based on the pilot projects. The major obstacle is the way to coordinate the old system in pilot projects and the 2017 new system (Sino Carbon, 2016).

As China-ETS is planned will soon be started at 2017, NDRC and the carbon exchanges have been pushing the **preparation** processes. For example, NDRC has published Measuring, Reporting and verification (MRV)<sup>11</sup> guidelines and materials for various industries in March 2016. The Provisional Measure has listed out the framework of allowance management, trading, MRV, legal basis and competence sharing between NDRC and district government, more efforts are still needed on areas such as cap-setting, detailed allowance allocation method, MRV and capacity building (Wang, 2015).

Besides, there is **progress** in various cities. For instance, NDRC published '*Notice on implementing national-ETS key starting works*' required each city to submit its own carbon auditing result by 30<sup>th</sup> of June 2016. Shaanxi government has finished its first large-scale carbon audit, and although not being one of the pilot projects, it has great compromise within the province to implement

<sup>&</sup>lt;sup>11</sup> MRV is defined as "all measures which states take to collect data on emissions, mitigation actions and support, to compile this information in reports and inventories, and to subject these to some form of international review or analysis" (International Partnership on Mitigation and MRV, 2014)

low-carbon strategies. In 24<sup>th</sup> May 2016, the Capacity Building Centre of National-ETS was established in Chongqing. CNEEEX in Shanghai also organized a forum with Shanxi Environment and Energy Exchange to promote emission reduction works in Shanxi through ETS, it was one of the example of experience sharing between pilot projects and other provinces (CNEEEX, 2016).

Currently eight sectors including Power, Petro-chemical, chemical, non-metallic minerals, non-ferrous metal , ferrous, metal, paper-making and aviation were decided to be covered in China-ETS as shown below. Only businesses with annual GHG emissions above 10,000 ton CO2 from 2013-2015 will be covered under the scheme. NDRC is still collecting the list of covered companies from local government, it is estimated that there would be around 7,000 companies covered, accounting for around 40%-45% of total CO2 emission. Besides, only CO2 will be involved in the calculation of emission in the China-ETS, excluding the other GHG emission such as methane (CH4). Besides, the exact allocation method for each industry is not yet decided, but it is estimated that most allowances would be freely allocated through benchmarking. (PMR, 2016)

Sectors	Sub-sectors		
	power generation		
Power	co-generation of heat and power		
	Grid		
Petro-chemical	crude oil processing		
Chemical	ethane		
	synthesis ammonia		
	acetylene		
	methanol		
Non metallic minerals	cement		
Nort metalle minerals	glasses		
Non-ferrous metal	electrolytic aluminum		
	Copper Smelting		
Ferrous metal	steel		
Papar making	Paper pulp		
r aper-making	Paperboard making		
Aviation	Passenger transportation		
	Goods transportation		
	airport		
Legal entity with energy consumption	above 10,000 tons of tce		

Fig. 2.7 Coverage design of future China-ETS (PMR, 2016)

## Development of national cap-setting

EU set the cap according to Member state decision and China can use its central-decision on the cap in evaluation process, it is not very crucial to the overall performance of the linked market. There are mainly 2 types of cap, the Absolute-cap which evaluate the cap according to the historical emission with discount, and the Intensity-cap carbon intensity. In the case of China, there are more benefits in using **intensity-cap** than absolute-cap in this moment.

**Political** reason: In 2015 INDCs, China pledged to reach the emission peak at 2030, maybe 2025 if China is ambitious enough in climate action; however, there is very low possibility to have degrowth of overall carbon emission within 2025 trajectory.

For the countries applying of absolute cap, they are demonstrating their climate action by annual reduction of absolute emission. However if absolute cap is used by China, it would demonstrate annual increase in absolute emission which is not politically convincing, it is because the effort in emission reduction is not revealed in the absolute emission. On the other hand, application of intensity-cap can demonstrate the efforts of climate action in China by showing the annual reduction of emission intensity.

**Economic** reason: Chinese economy experience fasting growing trend, even the growth rate was lowered since 2010, 2015 still showed GPD growth rate of 6.9%. Absolute cap could potentially limit the growth of Chinese economy due to uncertain economic growth in 2017; absolution cap can adversely impact to the poverty lifting efforts and Chinese development, so that it has contradiction with the fasting growing economy. On the other hand, intensity-cap can demonstrate growing economy with reduction efforts (Han et.al, 2012).

Administrative reason: It is concurrent to the INDCs pledges and standards in the pilots projects (except Guangdong), which allow easy comparison. Besides, applying intensity-cap can provide extra information showing which sectors have more energy efficiency as well as research and development progress, it is an useful information in determination of the FYP 14 (2022-2027) and long-term decarbonization strategies. Also, it allows immediate comparison between sectors. Both are basically interchangeable but the selection is functional.

Regarding the cap-setting after linkage, it would be discussed in 'Adjustment of the cap limit'.

#### **2.4 Benefit of EU-China linkage**

#### Economic benefit

A linked carbon market can provide **liquidity** in climate-smart financing and stabilize the carbon price, it provides options with lower abatement costs to the emitters. Fig. 2.8 and Fig. 2.9 demonstrated how mitigation cost can be lowered, assume firm A is Chinese factories with lower abatement cost, and firm B is European factories with higher abatement cost, they both have to limit their emission to level e. Assume there is no change in economic activities and production, without linkage of carbon market (Fig. 2.8), both firm emit to level e and firm B pay more than firm A; in the case of linkage (Fig. 2.9), instead of self-mitigation for compliance, firm B can pay part of the mitigation cost to firm A through purchase of allowance.

Overall, both firms fulfill their compliances, firm B can have lower cost option through purchase of allowance from firm A, while firm A is incentivized to reduce emission. Most importantly, cost can be saved due to the linkage as represented by the red triangular area P, and the reduction target can be achieved.



Fig. 2.8 Abatement cost without linkage (European Commission, 2016 v)



Fig. 2.9 Abatement cost in linkage market (European Commission, 2016 v)

The other benefit is that EU business could overcome the domestic competitiveness concerns. EU and China trade frequently but generally European products are more expensive than the Chinese one; for example, some Chinese steel business was state-led and produced cheaper steel than EU industries, which were "impeding risks of collapse" as described by some EU Member States (Pooler, 2016), showing that EU businesses have concerns about the domestic competitiveness. The linkage can reduce the carbon price differences between China and EU due to the price convergence effect after linkage (to be discussed in Section 2.5); as China increases its carbon pricing, the selling prices of their products are expected to increase, reducing the gap of competitiveness between EU and Chinese products.

#### Administrative benefit

EU-ETS was started to operate since 2005, now it is the 3<sup>rd</sup> phase. Through the linkage, there would be deepening of EU-China cooperation in ETS, China can get valuable experiences from EU-ETS operations, system design and lessons learnt.

#### Political benefit

Linkage may not lead to same carbon price in both jurisdictions, but the climate-combating efforts are easier to be compared and quantified, it provides a **common ground** for the politicians to negotiate in future climate-related conferences. The linkage can also gain media attraction for being the world largest carbon market, and let the public know about the determination and importance in implementing ETS.

Besides, **experience sharing and system support** can be facilitated for having a connected market, states will not be individual to tackle the complicated problem aroused from operation and reform of mechanism. Most importantly, it provides clear signals for various industries in the world that carbon reduction is entwined into everyday business, it also gives a **strong signal** to political leaders, under anarchical circumstance, to work on bilateral/ multilateral agreement in combating climate change as their liability is extended from domestic in international level.

In addition, there is increasing cooperation in climate actions between EU and China as discussed in section 2.1.2, the linkage can have spillover effect for both sides to work more closely in combating climate change.

#### Societal benefit

Apart from that, there will be indirect non-economic alleviation of poverty in China. First, the trading platform provided a good pioneer for 'internalizing externalities'. If the linkage is successfully implemented, credibility is built on the pollution-trading system, and it can help strengthen the role SO2 trading system in Shanghai as well as initiate trading on other pollutants like chemicals and wastewater discharge.

In addition, there are additional benefits including promotion of the concept of circular economy, energy efficiency, as well as creation of green jobs in China. Therefore, it helped China to achieve the Sustainable Development Goals of United Nations, such as 'Good Health and Well-being', 'Affordable and Clean Energy' as well as 'Responsible consumption and Protection'.



Fig 2.10 Sustainable Development Goals (SDGs) (European Environmental Bureau, 2016)

## **2.5 Pre-linkage considerations**

### Price issue

Now the price in China-ETS is around  $\in$  6 (40 Yuan). In 2007 participation of other Chinese provinces in China-ETS means lower overall ambition as they have fewer low-carbon technology compared with the 7 pilot cities, level of cap in terms of carbon intensity is lower, so it will decrease the overall ambitions and hence the carbon price. In 2017, it is predicted that the carbon price of EU-ETS and China-ETS is predicted to be around  $\in$  8 and  $\in$  5.46 respectively (Reklev, 2013)

The expected price gap will not be very big; besides, there would be more competition and technological progress in China, enhanced EU-China cooperation in climate change, as well as tightening of China's cap, the Chinese carbon price would not remain static but increase, China Carbon Pricing Survey 2015 also showed strong evidence of rising Chinese carbon price (Boer et.al, 2015), the **price convergence** between China and EU-ETS is expected to be deepened. Therefore, it is not a foreseen problem that a great amount of money will flow from EU to China, or EU business will rely on China allowance for compliance.

However, there is dilemma between price convergence and economical

efficiency, and it will be discussed in section 3.3.2.

### Political barriers of Linkage

EU should be aware of the impact of linkage towards international competitiveness, agricultural sector (only accounted for 10% of total emission) should not be included in this moment; however, there should be communication and evaluation on implementation regarding future coverage.

Since 2008 the carbon price continually to dropped from 30 Euros per ton to currently around 5 Euros per ton, the Commission has long been discussing various strategy to maintain price signal; however, the implementation process of mitigations were slow and the mitigations such as backloading could only provide limited efforts to maintain price signal (to be discussed in section 4.3.3.2). The main obstacles for the EU to implement climate policy and make reform on climate actions are the various lobbyists from power sectors and industrial sectors due to the democratic nature of the Commission.

Therefore, the Commission should seek to persuade the business in supporting the linkage. One of the main concerns of the business over the reforms of EU-ETS is about the abatement cost, businesses are afraid that measures like cancellation of surplus and speed-up of full auctioning application would jeopardize their profits, so they have been seeking to influence the Commission's decision over the reform process, letting the Commission only took coward or even no steps to stabilize the carbon market.

For example, industries were defined as sectors with potential risk of carbon leakage and were subjected to receive 100% free allowance; however, the assumption method by ETS directive is outdated and unrealistic that they had more allowance that they really want so that they sold them to earn huge amount of profit. For instance, steel company ArcelorMittal has received 123 million free surplus allowance and they were sold to make 1.6 billion Euros. However, the inaction of the EU has made the situation continued. (Carbon Market Watch, 2014)

EU China-ETS linkage can provide a lower cost solution for business to fulfill the compliance, thus it could be the 'carrot' (or trade-off) for the EU industries, in exchange of more proactive reform and stringent targets to be proposed by the Commission, making the 'unofficial' bargaining process smoother.

#### Find a right time to link

In EU-China summit 2015, both sides discussed extensively on climate issues, and agreement was made through EU-China Joint Statement on Climate Change. According to the Joint Statement, EU and China will *"further enhance existing bilateral cooperation on carbon markets building upon and expanding on the on-going EU-China emission trading capacity building project and work together in the years ahead on the issues related to carbon emissions trading"* (EU-China summit, 2015 i); however, there was **no concrete timetable** for the linkage arrangement. It is suggested to start the linkage between 2022 and 2023 and the reasons are illustrated below.

From 2017-2020, EU needs to improve and evaluate on Market Stability Reserve and market price level, it will also share different ETS experience with China; on the other hand, China will be busy in running its national-ETS.

Even NDRC put the exploration of linkage with other ETS beyond 2020, EU and China should have **deepened experience sharing on operation of carbon** (with possibly political dialogue about linkage) **before 2020**. By 2019, China has gained 2-year experience in operation of national ETS, NDRC starts to be familiar with various kinds of market stability tools, trading platform, MRV process and allowance allocation, market and business can also start to adapt the new settings of Chinese climate policy. It can also take the time to improve according to its observed flaws and lessons learnt from other ETS. Besides, it provides the time for EU-China harmonization and coordination.

In EU-China EU and China can **advocate the establishment of carbon market linkage** on COP 25 in November 2019 and may potentially influence the 2<sup>nd</sup> INDCs which would be brought to COP 26 in late 2020.

As negotiation should start earlier, the linkage issue could be brought to the **front desk** of the 2<sup>nd</sup> National Plan on Climate Change (2021-2027) and 14<sup>th</sup> Five-Year Plan (2021-2025), and be **incorporated in the review** of 2020 EU energy and climate package.

If the trial linkage could be started by 2022-2023, it could provide the

insights for other countries and may indirectly influence on 3<sup>rd</sup> version of INDCs in COP 31 2025.

As 2025 marks the 2<sup>nd</sup> five year period of INDCs from 2020 COP26, countries would start to adjust its national pledges according to the climate policy development before 2025, if the linkage could start between 2022-2023, **both China and EU can both adjust its national goals according to the efficacy of the linkage**; in addition, COP 31 will be marked as a special climate convention as most countries would start to evaluate the 5-year works from 2020, if China-EU ETS linkage is a successful story, they can **suggest other countries to consider** to adopt their own carbon market or start potential **linkage** with. If the linkage cannot be started before 2025, avocation efforts by EU and China regarding establishment of carbon market in other countries would be dampened, it is likely there would have delayed climate action through establishment of carbon market.

## **2.6 NEED FOR THE THESIS**

Linkage of EU China-ETS would form the largest carbon market in the world, it provides various benefit as discussed in the introduction section. However, although China and EU had intention to deepen the cooperation in carbon market, currently both jurisdictions have put the focus on their own carbon market, there is yet exact plans or forms in facilitating the linkage.

Furthermore, there is no intensive researches or policy brief on the EU China-ETS linkage, therefore, this thesis can fill the research gap of and sets an important starting point in investigating on such linkage, with the focus on cap-structure and operational system.

## **Chapter III Cap structure**

This Chapter outlines the concept of 'Dual-track transition' <sup>12</sup>. Grandfathering should be gradually replaced by benchmarking; free allowance should be gradually replaced by auctioning. Then the discussion is moved to the Adjustment mechanism of the cap limits, followed by analysis on prevention of carbon leakage.

#### **3.1 Improving Allocation of Free Allowance**

In this section the focus is on the allocation method of free allowances, namely Grandfathering and Benchmarking. Both methods are described as well as their pros and cons, the application situations of these methods in EU-ETS and China-ETS are elaborated, followed by the comparison. It is finally suggested that Benchmarking should be applied to China-ETS as soon, and it is one of the elements of 'Dual-track Transition'.

## 3.1.1 Grandfathering

Grandfathering means the evaluation method of the amount of free allowance to an industry according to its historical emission of a base year or base period with a reduction factor, it applies a retrospective approach and the evaluation can be quantified as shown below:

#### $A = E \times RF$

,where A = free allowance allocated , E = historical emission and RF = Reduction factor (Matthes, 2012)

It is the most commonly used way of free allocation in Chinese pilot projects, the evaluation approach the coverage of allocation is shown in the Fig.3.1. Fig.3.2 shows an example in Beijing pilot project. In the service entities, the emission data of 2010 was taken as the base year and the reduction factor for each year is gradually more stringent, from 99% in 2013 to 96% in 2015.

<sup>&</sup>lt;sup>12</sup> Dual track transition = increase in the shares of benchmarking in free allowance allocation + increase in shares of auctioning in total allocation

	Free allowances		Auctioning	
	Grandfathering	Benchmark		
Beijing	all covered sectors	new entrants and expanded capacity	small proportion of allowances	
Chongqing	all covered sectors*	-	no	
Guangdong	power (Combined Heat and Power units), cogeneration, mining in cement, petrochemical, iron, streel scrap processing	power (coal and gas fired units), cement and long process steel, new entrants	Auctioning is used as a complementary method (2014 compliance floor price is ¥25 for the first auction of the year, climbing to ¥40 for the final one)	
Hubei	all covered sectors	-	3% of this reserve can be auction ned (floor price ¥20)	
Shanghai	industrial, manufacturing and public buildings	energy, airlines, ports and airpots	Auctioning is used as a complementary method only to fulfill compliance obligation (2013 compliance floor price: ¥46)	
Shenzhen	-	all covered sectors	Auctioning used as a complementary method only to fulfill compliance obligation (2013 compliance floor price ¥35.4)	
Tianjin	all covered sectors	new entrants and expanded capacity	small proportion of allowances	

Fig. 3.1 Allowances allocation methods in the Chinese pilot projects (IETA & CDC Climate Research, 2015)

	2013	2014	2015
Manufacturing and other industrial companies	98%	96%	94%
Service entities	99%	97%	96%
Gas combustion facilities in thermal power plants	100%	100%	100%
Coal combustion facilities in thermal power plants	99.9%	99.7%	99.5%
Gas combustion facilities in heating plants	100%	100%	100%
Coal combustion facilities in heating plants	99.8%	99.5%	99.0%

Fig.3.2 Emission Reduction factors ( =  $\frac{\text{emission in particular year}}{\text{emission in 2010}} \times 100\%$  ) for

different sectors in the Chinese pilot projects (Qian et al., 2014)

In terms of administration, the historical emission is easy to be obtained. Besides, grandfathering makes industries mainly to compare their current emission with its based year emission, the reduction is progressively in accordance to the reduction factor, they would bear less cost throughout the process; therefore, it is politically feasible.

However, it puts no penalty on historically heavy polluters; instead, the pioneer of emission reduction within an industry would bear more cost. (ICAP, 2014)

#### **3.1.2 Benchmarking**

Benchmarking method facilitates intra-industry comparison, free allowance is not granted according to historical emission but benchmark emission instead. Regulation entity first collects the emission data and activities of all companies with an industry, and then it will set a performance benchmark according to emission per activity, reduction factor is usually applied as similar to the grandfathering method. The allocation formula is shown below:

#### A=AR x BM x RF

, where A is the free allocation, AR is the activity rate, B is the Benchmark and RF is the reduction factor (Matthes, 2012)

One of the benefits of applying benchmarking is that it can **incentivize the best performers** implementing emission reduction measures. For example, in EU-ETS, products benchmark is set on 10 % best performing installations, the upper 10% can sell the credits to the market and earn money (incentive to be the top 10%) while the rest 90% need to go through auctioning process or buy allowance from emission trading platform

Besides, it lets the new entrants<sup>13</sup> **aware of the importance** of incorporating emission reduction measures due to the benefit mentioned above. Actually incorporating emission reduction measures **in an early stage** is more economically and environmentally efficient than applying energy transition few years after the establishment (e.g. use renewable energy in early stage, no need to waste money and resources in installing coal or natural gas facilities). In addition, it sets a standard for new entrants to refer to.

However, it is complex as it needs abundant data to determine the activity rate and benchmarks. Besides, it is less politically feasible as the companies would bear more cost in emission reduction.

#### **3.1.3 Comparison and Analysis**

Benchmarking allows the comparison between companies, the rewards to the best performers and the 'comparatively' extra cost born by the 90% drive

<sup>&</sup>lt;sup>13</sup> New entrants: Newly established companies which fall under the type of industry covered by carbon market

them to perform better. As discussed in the introduction section, the sense of satisfaction is stronger when the improvement leads to comparative profits.

Benchmarking can create such satisfaction because of the introduction of the concept of carbon intensity, it provided a platform for comparisons. The benefits of applying carbon intensity in China-ETS is discussed in section 2.3.2 'Development of national cap-setting'.

On the other hand, grandfathering mainly bases on historic emission data, the problem is i) it awards the dirty business as it has a 'too easy' starting point; ii) no incentives/ awards for the best performers, no intra-industry competition implies slow improvement progress; iii) new entries has no reference point, also they are not incentivized to begin with 'green' starting point.

Furthermore, application of grandfathering faces the problem of dilemma. If the annual reduction target is loose, it provides little overall reduction results. if the target is aimed high, reduction result will be significant; however, it will lead to unfairness to the best performers. In a company point of view, the best performers have contributed significantly to climate actions but their efforts are not recognized; in addition, possible and viable measures to reduce emission are most likely taken already, in short-term it could be hard for them to explore further reduction methods so they would need to buy the allowances, overall they spends more resources on the system just because they are ambitious in climate action, it creates a sentiments of distrust and dissatisfaction to the ETS.

#### Benchmarking in the linkage

Therefore, in the linkage market, in order to avoid the distrust and dissatisfaction among the best performers, allocation method should be harmonized and benchmarking should be applied in the linked market.

Benchmarking in linked market involved two steps, the **first step** is done within future national-ETS. The pilot projects is currently using grandfathering as the major free allocation method, NDRC should seek to speed-up the process in transition to benchmarking before 2022, so that it is compatible with the EU-ETS. The future national-ETS should collect emission data and set up own benchmarks for various industries.
For the **second step**, after the smooth transition to benchmarking in national-ETS, both jurisdictions should seek to establish joint-benchmarking. While having joint-benchmarking, all companies of same industry in EU and China will be compared, they are ranked according to their carbon intensity for determination of the benchmark. Future national-ETS and the EU-ETS can have a trial to apply joint benchmarking on some industries with similar carbon intensity, before applying to industries with more variant carbon intensity, the trial can allow better mix in the ranking of European and Chinese companies; otherwise, companies of one jurisdiction maybe heavily concentrated above the benchmark and receive significant inflow of money from the other jurisdiction, creating political barrier for the trial and long-term implementation of joint-benchmarking.

One of the **benefits** is that it allows intra-industry comparison within both jurisdictions, it is expected to be having more experience sharing among European and Chinese businesses regarding low-carbon economy. Besides, it is expected that an increase in the demand of Chinese allowance along the transition, the price of Chinese allowances will also be increased, it indirectly solve the problem of 'influx of European money to Chinese businesses' due to price variation.

# 3.2 PATH TO PHASE-OUT FREE ALLOWANCE

Currently in both EU-ETS and China-ETS, free allowances existed and it mainly dominated the manufacturing industries in EU-ETS and the entire pilot projects in China-ETS. Especially in China-ETS, auctioning allocation is simply a supplementary method to free allocation, the linkage market should have increased transition from free allocation to auctioning allocation which is a long-term solution in climate actions.

# 3.2.1 Consequence of using free allocation

Carbon emission is an external cost to the society that it is neither strongly addressed by government, it is mainly because this social cost is chronic, long-term and less tangible when compared with other types of pollution. For wastewater discharge, the environmental impact can be visualized or spot by dead-fishes situation in the lake; for air pollution, the environmental impact can be acknowledged through observing the plume of the chimney or morbidity of respiratory disease. Unlike the above two cases, carbon emission will not trigger immediate environmental impacts but chronic loss and damage.

Sadly, the loss and damage failed to make public aware of the correlation between everyday emission and the incidents, because half-life of news is short to let public remember the emission 20 years ago. Therefore, governments should take steps to internalize the externality of emission through climate policies like ETS.

However, free allocation cannot let the industries fully aware of the external cost of emission as the externality is the completely internalized. Instead, it produces a sense of justified emission for them.

In addition, the allocation of free allowance framed the ambitions of the companies in carbon reduction. While analyzing the structure of the companies, the free allowance limit the functionality of climate-related department and generalization of climate policies due to cost-benefit analysis, under the principle of profit maximization, buying allowances would still be the first priority in response to the ETS regulations.

Subsequently, there will be less demand of low-carbon products and climate-related professions as the national climate policy cannot get into the core agenda of companies, green businesses are simply supplementary industries in a society; thus, 'green job leakage' may happen that the green business and professionals will moved to other countries with more stringent climate policy for development.

# 3.2.2 How the linkages help the path?

The process of phasing-out free allowance involves lobbying and business interests, the focus is not on what industry to be phased out in which year; instead, there should be **political compromise** between China and EU to commonly phase out the **main pollution sectors** especially on Energy sector. It is argued that the linkage of carbon market will further deepen the cooperation in Power sector.

As shown in the graphs below, carbon emission by energy sector in EU and China accounted for 57.2% and 56.1% (43.9% + 12.2%), followed by transportation and industrial production. However, China has larger share on

industrial production then transportation but EU has the reverse order. Since the energy sector on both side have contributed more than half of the emission, the following arguments would be on power sector only.



Fig.3.3 GHG emission within the EU by industries in 2013 (Eurostat, 2015)



Fig. 3.4 GHG emission in Chin by industries in 2013 (Chinabaike, 2014)

In 2005 the first EU-China Summit, both sides has agreed to establish Partnership on climate change with the focus on energy-related issues, including 'zero emissions' coal technology, Carbon Capture and Storage, as well as promotion of clean energy, energy conservation, renewable energy and energy efficiency. The Partnership also sought to reduce energy intensity through cooperation and facilitate experience sharing of EU-ETS (European Commission, 2005).

Besides, Joint Declaration on Climate Change was signed after the 2005 Summit, clause 5 of the declaration agreed the key areas of cooperation to be:

- Energy efficiency, energy conservation, and new and renewable energy;
- Clean coal;
- Methane recovery and use;
- Carbon capture and Storage
- Hydrogen and fuel cells
- Power generation and transmission

In the 2015 EU-China Summit, both sides also discussed extensively on climate and energy issues, clause 20 of the joint statement outlined that '*The EU* and China expressed their commitment to cooperate in the field of energy in order to tackle jointly the multiple challenges related to energy security, global energy architecture, climate change and environmental degradation. In order to take their cooperation forward, the two parties agreed to prepare an energy cooperation roadmap for signature in the coming months' (EU-China Summit, 2015), showing the focus on energy issues.

Currently EU and China tackle the energy issues mainly in technical, political and environmental perspective. However, there is still cooperation gap to be filled. If the EU-ETS and China-ETS can be successfully linked, it would strengthen the cooperation in market-based approach. At that time, there will be higher necessity for businesses and governments of both sides to have a comprehensive discussion on energy issues more comprehensively. The linkage not only provides a new way of EU-China cooperation but also solidify the existing technical and political dialogues; in addition, EU-China can sets as an model for other countries to follow through leading by example, as the linkage market covered nearly 40% of global GHG emission, such cooperation strengthen the power of both sides in future international agreements.



Fig. 3.5 Global CO2 Emissions from Fossil Fuel Combustion and some industrial processes in 2011 (EPA, 2014)

# 3.3 Adjustment of the cap limit

For EU-ETS, 1.74% annual reduction for phase III (2013-2020), 2.2% for phase IV (2021-2030), showing linear reduction factor; China should have similar ambition in order to maintain the widening gap that can create reliance on China-allowance in offsetting.

# 3.3.1 Situation of cap in EU and China-ETS

For **long term international pledge**, EU pledged in COP21 to reduce GHG emission against 1990 level by 20% and 30% by 2020 and 2030 respectively. On the other hand, China pledged in COP 15 to reduce its carbon emission intensity by 40-45% against 2005 levels by 2020, as well as pledge in COP 21 INDCs for peaking the absolute carbon emission by2030.

For **yearly reduction**, EU uses the yearly 1.74% reduction of last year's cap to determine the value of the cap this year. In contrast, China-ETS has not yet developed its own yearly absolute reduction target as there is not decided to use absolute cap yet.

Basically EU and China are in different phase of carbon reduction, EU is with reducing the absolute reduction but China is still increasing. However, as long as the caps are decided to express market scarcity, this variation would not be detrimental to decarbonization. The reason is as follow: China pilot ETS did have a lot of free allowance, but after 2017 the establishment of national-ETS, more cities will be involved and the carbon intensity cap will be tightened with more auctioning needed. If the linkage started before 2020, China-ETS, which is in the initial stage, would still have certain amount of free allowance; however, GDP is still growing and there would be more business, also there would not be EU-China common auctioning in most industries, EU business can only get Chinese allowance in clearing house<sup>14</sup>. However, Chinese allowances are needed for domestic compliances, so there would not be excessive amount of Chinese allowance in the market.

Even after 2020, there are more joint-auctioning, China would have tightened its cap and carbon price would be higher and similar to that of EU; therefore, **market scarcity** is the key to maintain a well-functioning linkage market, despite of the different direction of absolute emission level in EU and China.

However, in terms of political commitment, still China should set its yearly carbon intensity in matching with the EU-tightening of cap, and for China itself to fulfill the INDC pledges. Now China-ETS generally have emission target of averagely 20% carbon intensity reduction over 2010 levels in trial compliance period 2013-15

# **3.3.2 Arguments against 'variation of stringency of targets would be the barrier for EU-China ETS linkage'**

Ambitions of carbon markets were generally acknowledged to be the barrier to facilitate bilateral linkage, as Ranson and Stavins (2013) argued that 'countries with very different emissions-reduction ambitions may find it difficult to negotiate a link' due to variation of allowance price and the opinions on which side to pay for emission reduction.

Besides, Carbon Market Watch (2015 ii) showed **pessimistic** view on EU-ETS and China-ETS linkage in the coming future due to the different in stringency of

<sup>&</sup>lt;sup>14</sup> Clearing house is the intermediate agency of buyer and seller of allowances. For example European Commodity Clearing AG of EEX is responsible for clearing and settlements of allowance-related commodities in EU-ETS. (ECC, 2006) Mode of trading will be discussed in section 4.2.1.

targets. It pointed out that China pledged in INDC to reduce **carbon intensity** by **40-45%** against **2005 level** by 2020 whereas EU has target to reduce **absolute** cap of **20%** against **1990 level** by 2020. Apart from that, the report mentioned that when compared with historical emission, overall emission in China-ETS is unlikely to be reduce by 2020, but EU-ETS will show at least 2.2% reduction from 2008-2012 level.

In fact, the arguments above may hold true to some extent. Stringency of targets directly affects the price, if the stringency of a system is low, it is expected to have a low price and price signal. When the lower price system such as RGGI are linked with higher price system (with higher stringency) such as California-ETS, large amount of money will significantly influx from California to RGGI as shown in Fig.3.6, creating political barrier from the California business as policy implementation can never be separated from lobbying and compromise from the business sectors. Therefore, it is important to have similar but different of stringency of target.





However, there are two areas needed to be aware of: the decisive role of price signal on linkage; and the factors affecting the price.

Price and price signal is actually the most important factors, instead of the stringency of targets. Definitely stringency of target does directly impact the price as discussed above; however, stringency of targets is only one of the determinant factors of the price, the other areas like carbon market control, functioning of auctioning and trading also play an important role in the market price. Therefore,

it is not a strong argument to determine that the lower ambition of China-ETS will create the monetary influx problem.

The allowance price of China-ETS is predicted to be around 5.46 Euros in in 2017, and it is predicted that the increase in China-ETS price will be faster than that in EU-ETS due to rocketing climate-related investments in China. Therefore, although EU and China are having different ambition and abatement cost, it is possible to overcome the significant monetary influx problem from EU-ETS to China-ETS.

Still there is dilemma between price convergence and economic efficiency of the linked market. If there is huge price differences between systems, there would be more economic efficiency for business to look for the cheapest mitigation options; however, it would cause the monetary influx problem as mentioned in section 2.5. In return, although price convergence can solve the problem of monetary influx to the lower price system (potentially China-ETS after linkage), it potentially undermines the original principle that the linkage is to help companies look for 'the cheapest options'. For example, as the carbon price of both jurisdictions come close, European steel firms will save less money through buying allowances from Chinese steel firms with lower mitigation cost for compliances.

In short term, there is uncertainty to the price level of EU-ETS due to the surplus allowances, if the EU implement policies allowing the governments to buy back, the current price level is possible to be stabilized; otherwise, the price level may dropped back to 5 Euros per ton, which may be even below the allowance price in China-ETS. However, as long as the linkage exists, there are various options and adjustments to resolve the dilemma through such as fine-tuning the market control mechanism or regulations in common auctioning. If price convergence still exists despite of the fine tune, it may be the time for EU and China to look for the third market to link.

## 3.4 DIRECT AND INDIRECT CONTROL MECHANISM ON PRICE

It is important for not letting it drop too low because if price of allowance is **lower than the mitigation price**, business will simply **rush to buy allowances** to cover its emission instead of lowering their own emission as the first resort. It could be argued that as allowances are limited, companies finally need to reduce its own emission to fulfill the compliance; however, the **awareness happened too late** as if students are finishing homework in the last day, business may not have enough allowance to fulfill the compliance, also even they can get enough, last-minute purchase of allowance or reduction of production are not good practices for deep decarbonization, bacuase businesses lose the motivation to implement strategic planning of operation and overall structural reform.

Furthermore, even they can get enough at the final stage, the low price level simply discourage business to develop its **long-term emission strategy**, company may not even establish a proper functioning environmental department as carbon reduction is not falling under the main agenda of company policy, it would be **detrimental to deep decarbonization process** 

There have been practical cases that the price variation has hindered proposals of linkage, for instance, California-ETS has refused to link with RGGI due to its weak price signal, and the price collapse in EU-ETS since 2005 has induced the rejection of California-ETS to start linkage.

**Price floor** could be the solution to address the low price issues, it is the direct control mechanism on price and the level should be set right above the marginal mitigation price of a particular sector in both jurisdictions. For example, if the China-ETS has lowest mitigation options to be RMB 50 per ton, the price floor could be set at RMB 60 per ton so that not every business will be rushing to buy the 'invaluable' allowances apart from doing real mitigations. The price signal can be maintained.

**Price floor** can be applied to both jurisdiction, it is a very direct method among all price management mechanism, it can prevent the price being too low as exemplified by EU-ETS; however, if the supply is excessive, the price could remained in the price floor level for long period that make the market adjustment mechanism failed. Therefore, price floor cannot stand alone and should be supplemented with other indirect price control mechanism as to be discussed in section 4.3.3.



Fig.3.7 Creation of surplus due to price floor (McAfee, 2012)

# 3.5 Prevention of Carbon leakage while preserving international competitiveness

#### 3.5.1 Situation in EU and China

EU has established carbon leakage list in 2013. It includes most manufacturing industries, and they were allocated with excessive free allowance. The situation of carbon leakage and the criteria of the list, as well as the problem of the list are mentioned in section 2.2.1 and 2.2.2 respectively.

Same as EU, NDRC should create a **carbon leakage** list after 2017. However there should be reform in the function of the list. Currently EU-ETS has given excessive free allowance to the on-list industries as mentioned in section 2.2.2, it would disincentivize the energy transitions/ carbon reduction of business. Therefore, the design of carbon leakage list should avoid this problem.

Instead, both China and EU ETS should consider counting the 'foreign emission' (emission of domestic company having production outside the country) into the emission inventory of that company – internalizing the 'foreign emission'.

Carbon leakage mainly happened in EU industry, manufacturing industries is the most vulnerable area to date. Currently it has 31% manufacturing imports from China as shown in Fig.3.8. As EU- and China linked, China establishes a national-ETS in 2017 and Chinese factor of production gradually increase, carbon



leakage problem from EU to China will be gradually resolved.

Fig.3.8 Major trading partners of manufactures of the EU (Eurostat, 2014)

However, there is potentially EU manufacturers will move the plants to other non-countries with less cheaper factors of production which not covered under ETS.

On the other hand, as a world's largest exporter and manufacturing country, China does not face the carbon leakage problem in short-term; however, as factor of production is expected to rise due to continues economic growth and carbon-pricing establishment, China may face carbon leakage to other Asian countries such as Indonesia and Philippines, it is also important for China is evaluate the risk of carbon leakage alongside with regulating the operation of China-ETS.

Through the linkage of carbon market, China and EU can have more experience sharing in dealing with carbon leakage. Besides, border carbon adjustment to be discussed in following section poses challenging political barrier, linkage can increase the leverage of both jurisdictions on international arena regarding WTO-legality and bilateral agreements to sign.

# 3.5.2 Is Border carbon adjustments (BCAs) the way out?

According to DECC (2004), there are mainly 4 strategies to deal with carbon leakage including increase in free allocation, exemptions, border carbon

adjustments (BCAs) and compensation as shown in Fig. 3.9.

For the first option, **free allowances** are granted to on-list companies based on current output, it can reduce the risk of carbon leakage; however, it not only make heavy polluters earn windfall profit from the free allowance as discussed in section 2.2.2, but also lower the price signal due to extra supply of allowances, the overall emission may not be significantly reduced. **Output based Compensation** means provision of financial credits to on-list, it would not seriously disturb the price signal, but same as output-based allowance, it would offer the right to pollute for the on-list companies and thus compensation has low environmental effectiveness. For **compensation based on historical output** (i.e. extra production would not be compensated), although it can help lower some emission, it cannot maintain the competitiveness of extra production of the on-list industries. **Exemption** of on-list companies can solve the leakage problem; however, it provides no inputs for environmental effectiveness due to the narrowing of ETS coverage.

All the above three options cannot strive for the balance between carbon leakage and environmental effectiveness; instead, the third option **BCAs** is the best to relief dilemma as shown in Fig.3.9 below. BCAs can be done though purchase of allowances for imports or pay for tax/ charges for imports, the ultimate goal of BCAs is to equalize the carbon price between the ETS district and the destination countries (import areas). (DECC, 2014)

	44.57	Output- based free allowances	Exemptions	Border carbon adjustments	Compensation
Leakage	Carbon leakage	0	$\bigcirc$	$\bigcirc$	$\bigcirc$
Environmental effectiveness	Global emissions	0	$\bigcirc$	-	
Efficiency	Cost to Europe	O	<u> </u>	$\bigcirc$	<u> </u>
	Cost global	0	$\bigcirc$	$\bigcirc$	0
Feasibility	Domestic	0	-		<u> </u>
	International	•	•	0	$\bigcirc$
	Institutional	•	0	0	0
Administrative cost	Admin cost	0	0	0	0

Fig.3.9 Policy comparison of various carbon leakage solutions (DECC, 2014)

It has been widely discussed regarding implementing the BCAs to solve the carbon leakage problem as it cannot only tackle the underlying cause of the leakage, the differing carbon price, but also promote the environmental effectiveness as shown in the graph above. However, it poses various problems such as administrative cost and political barrier as well the loophole can possibly increase the overall emission. The focus of this section would be on the political barrier and loophole of resources shuffling to implement BCAs.

# Political barrier - WTO legality

BCAs seek to impose carbon price on imports, it is criticized to be kind of tariff for international trade which is regarded as a backlash to free-trade principles of WTO, it makes BCAs an option with low political feasibility. (Whitmore, 2013)

There are mainly 3 areas that government can advocate the establishment of BCAs, they are leakage prevention, competition preservation and leverage exertion. While designing the BCAs settings, governments should explicitly focus on the leakage prevention rather than the other two, otherwise it would be seem as violating international trade law for being 21<sup>st</sup> century eco-imperialism. (Cosbey, 2012) Even BCAs can be an effective tool in addressing carbon leakage and help reduce emission, it could face international opposition, and the US Shrimp-Turtle case (Annex II) demonstrated how an environmentally beneficial measure was rejected by other countries and WTO. (World Trade Organization, 1998)

Therefore, EU and China should have more researches on implementation of BCAs, proving its environmental benefits so that BCAs would be granted in line with GATT principles by Appellate Body. (Cosbey, 2008)

Furthermore, EU and China should proactively seek to investigate the political feasibility with WTO and other potential leakage destination developing countries, due to the huge market size of EU and China, they could exert more leverage in multilateral discussion regarding implementation of BCAs. In a mean while, it is important to reduce the coercive impact of BCAs on other countries, as other developing countries would have their concerns on losing international competitiveness, economic growth is prior to climate action in their position; thus, it is important to consider their opinions and stances while establishing agreements regarding BCAs.

# Resources shuffling

Resouces shuffling means the tactic used by the industries to switch around the resouce flows to reduce or avoid payment of BCAs, it reduces the effectiveness of overall emission reducting from manufascture, by leading to an increase in transport costs and associate emissions (Whitmore, 2013).

Xiaomi is a Chinese brand of mobile phone, currently some of the components are manufactured in China and the phone is assemblied in Shenzhen, production of Xiaomi phone was taken as an example of potential resouces shuffling. As China-ETS will impose a price on production from 2017, provided that the carbon price and in order to reduce the carbon-cost, Xiaomi may move all the manufature procedures of components to other countries without an ETS such as Indonesia. If China succesfully imposes BCAs to Indonesia to address carbon leakage, Xiaomi can further internationalize the chain of production, for instance, procuring screen from Taiwan and capacitor from Thailand, and assembling them in Philipine. Overall the emission cost increase due to transport and shipment but Xiaomi can successfully escape from the payment of BCAs.

Houser et al. (2008) also pointed out the problem of resourcces shuffling of US businesses, if China and Japan export five million tons of steel and two million tons of steel to US respectively, BCAs application on Japan will increase the imports from China, and vice versa.

The above examples demonstrated the impact of resources shuffling, imports and breakdowns along the chain of production should also be included in BCAs analysis except domestic production. Life-cycle assessments (LCAs) is a tool to evaluate carbon footprint of a product from cradle to grave, including the process from procurement, production, to waste management. Due to the difficulties to sign BCAs with all developing countries, it is suggested to apply LCAs to the manufactures so as to internalize the supply chain emission, it is crucial to perform a comprehensive 'Foreign Emission Analysis' to manufactures.

However, there would still be problems in defining the scope of LCAs, China and EU should put more efforts in investigating how far should the chain of production be included in the LCAs analysis, in the Xiaomi case, it is needed to determine whether the raw material extraction of the components should be involved. Another challenge falls on double counting issues, the components may be produced in non-ETS country but the raw materials are extracted from a ETS-country. There are more researches needed on BCAs to overcome various technical issues, EU-and China should jointly cooperate on the studies of BCAs in a proactive manner, before the carbon leakage issues become prominent to carbon market functioning.

# Administrative barrier

As the administrative barrier is not the focus, it is mentioned in the Annex III for reference.

# **Chapter IV Operational system**

This Chapter will focus only on the topics related to the auctioning and the trading platform of proposed linked market, these two sections outlined the **solutions** in **single level** (i.e. problem able to be solved in auctioning level or trading platform level). In the final section, comprehensive approaches are proposed to address various ETS-linkages and functioning problems, it illustrated the **multi-level solutions** involving combination of policies and cooperation of governments.

# 4.1 AUCTIONING

Auctioning is another way of allowance distribution except free allocation. In ETS, sellers are the Carbon Exchange agencies on behalf of governments implementing the relevant climate policies, and the buyers is the companies of various industries, sellers will set the lowest bidding price to the allowances that allow the buyers to bid on, the allowances are allocated to the companies with the highest bids.

Currently **EU-ETS use more shares of auctioning to free allocation than that in all Chinese pilots projects**, which the latter mainly use the auctioning as supplementary tool in allocation, but both ETS showed ambitions to increase the auctioning ratio in the coming future.

As section 2.2.1 and 2.3.1 has outlined the auctioning situation in EU-ETS and China-ETS respectively, this section **focuses** on the issues related to **joint-auctioning**; besides, this section illustrates the coordination needed in **creating market scarcity**.

# 4.1.1 Possibility of joint-auctioning

#### Joint-Auctioning

Currently **EU** has implemented the Auctioning Regulations that it outlined the administrative arrangement of EU-ETS auctioning to ensure the fairness, openness and efficiency of the auctioning (European Commission, 2016 iii). Different exchanges has different period for open-window bid, for example, EEX allowed 2-hour open-window bids every Monday, Wednesday and Friday. All the exchange platforms applied seal-bid, single-round and uniform price to the ETS, meaning that the bidders will get the same treatments. Bidders can have several bids for certain amounts of allowances with a price above the minimum auctioning price, for example, company A can submit bids for 1000 allowances with 15 Euros/ ton and another 2000 allowances with 20 Euros/ ton, provided that the minimum auctioning price is 10 Euros/ ton. Then bids are arranged from the highest to the lowest bidding price, the price that can just clear all the allowances would be set as the clearing price, say 18 Euros, only the bids with bidding price at or above the clearing price can get the required allowances. For company A, it can get 2000 allowances with 18 Euros/ ton but its first bid of 1000 allowance is rejected.

In the **Chinese pilot projects**, except Guangdong, auctioning is only used for compliances such as that in Shanghai and Shenzhen. Currently mainly Guangdong-project was using auctioning in primary market; however, the percentage of auctioning is still very low, among the 388 mt ton CO2 allocated in Guangdong-ETS in 2014 (IETA 2014, China-ETS), only 2.06% (8 million ton) was allocated through auctioning. In the recent NDRC work progress, there was still no concrete path of having auctioning after establishment of national-ETS in 2017 (Sino Carbon, 2016 ii).

Before discussing the joint auctioning of EU-ETS and China-ETS, **experience** of California and Quebec-ETS linkage is valuable as being a successful story of linkage and they applied common auctioning platform in November 2014 right after their linkage in January 2014. Prior to the linkage both ETS had well-established individual auctioning systems already with considerable shares of auctioning, and both were applying single round sealed-bid. The major difference was that uniform price was applied to California solo-auctioning but not in that of Quebec.

Besides, both have **similar auctioning prices** prior to the joint-auctioning, they were around 11.5 Euros and 10.5 Euros per ton for California-ETS and Quebec-ETS respectively as shown in the graph below. The first joint-auctioning began with allowance for power and industrial sectors, resulting in around 11.2 million allowances sold; while in the second joint auctioning in Feb 2015, transportation sector and wholesale gasoline supplier were included, around 76.9 million of allowances were auctioned.



Fig.4.1 Settlement price of California-ETS and Quebec-ETS (Huetteman, 2015)

Prior to joint-auctioning, as demonstrated by the California-Quebec case, both **jurisdictions must have well-established auctioning**; therefore, China-ETS should be proactive in implementing dual-track transition, so that there would be more auctioning before 2020. Guangdong-project is the first one to apply auctioning; however, the on-going auctioning is highly imposed by regulating entities instead of demand-led purchase, it is mandatory for the Guangdong businesses to buy the allowances from 3% in 2013 to 10% in 2015, it is a practical trial for the market system, but the imposition should be eliminated soon the national-ETS starts in 2017. If the linkage starts between 2022 and 2023 then China-ETS could have a few years to gain enough relevant experiences before handling with joint auctioning.

As in California-Quebec case, the joint-auctioning **started from Power and industrial sectors** before moving onto the other sectors like transportation, it is a valuable reference for the proposed linkage. Currently EU-ETS has more auctioning shares in Power sector, and by 2020, it will be opened to full auctioning. For the Chinese pilot projects, there is still no concrete plan for which sectors to have increasing auctioning. The best case for national-ETS is that all the sectors should be involved in provincial auctioning; or else, **at least power-related sectors** should be covered in the auctioning after **in post-2016 national-ETS**, so that there would be time for market to adapt to the system.

In terms of **joint-auctioning**, **power sector** is also an appropriate starting point because it is the largest emission sector in both EU and China-ETS as

mentioned in section 3.2.2. Subsequently, the industrial and transportation sectors, with the second and the third largest amount of emission, can also be considered once the first joint-auctioning is smoothly operated.

Regarding the rules of joint-auctioning, auctioning in California-Quebec ETS and EU-ETS give a good insights and experiences. Both auctioning apply three rules: **sealed-bid**, **single round** and **uniform price** that Deutsch Bank research (Chlistalla & Zähres, 2010) describe it '*as being best suited for carbon auctions to be open, transparent, harmonised, simple, non-discriminatory and to avoid distortion of competition*', the proposed EU-China joint-auctioning should apply auction designs based on these three principles.

**Sealed-bid** can isolate the bidders' thought and provide more uncertainty to them, business cannot get the information of other bidding price as in open-bid, so that they would tend to bid in a higher price, generating more revenue to the regulation entities. Besides, in open-bids, bidders know the expected price of others, big companies would be easier to dominate the market through purchasing a large amount of allowances. However, sealed bids can attract more small bidders due to uncertainty (Athey & Seira, 2010), it minimizes the market domination impacts, so that the allowances could be more widely allocated to business of different sizes.

**Single round** system can intensify the benefit of sealed-bid as bidders do not know the action and price expectation of the other companies, when they know the information, the auctioning result is already fixed without possibility to adjust according to others' bids.

**Uniform price** allowed the fairness among the companies and it indirectly encourage higher bidding price. Companies reckons that submitting higher bidding price would not affects final clearing price in a significant way provided that there is enough participation and considerable amount of bids, but it can increase the chance for the business to get the allowance; therefore, companies would tend to set higher prices and auctioning revenue can be increased.

Furthermore, **participation is crucial** to the setting of auctioning except the benefit to application of uniform price. Higher participation can trigger price competition and minimize the possibility of collusion behaviours and allowance

sharing. In the future design of joint-auctioning, participation of business from various sectors should be encouraged, it can be accomplished by speeding up the annual reduction of free allowance in China-ETS and shifting allowances from national auctioning to joint-auctioning.

# Revenue of common auctioning

EU and China should establish **climate fund** financed by the revenue of common auctioning, it is especially essential on Carbon Capture and Storage (CCS)<sup>15</sup> projects. CCS projects involve huge project sum and need more Research and Development (R&D) when compared with other renewable energy projects. For example, Germany has given up its CCS investigations in 2013 due to budgeting, the proposed climate fund provides an appropriate mean and strong political signals in supporting CCS project by both China and EU.

# 4.1.2 Creation of market scarcity and flexibility- need coordination

The auctioning can be done **several times a year instead of one-off**. From the business point of view, it creates adequate amount of uncertainties for companies whether it will get enough allowance for a particular compliance period, so that it encourages business to explore more carbon reduction strategies in between the auctions. Besides, it provides flexibility to the companies so that they would not tend to accumulate excessive allowances in a short period, triggering the price to fluctuate drastically.

In addition, the auctions **cannot be too regular**. There are needs to strive for a balance between participation and scale limitation, so as to prevent collusion behaviour and prevent distortion to the trading platform (i.e. secondary market) respectively. Frequent auctioning can limit the scale but also reduce the participation of each auctioning and increase the administrative cost. Deutsch Bank research described **quarterly auctioning** to be the most appropriate option. (Chlistalla & Zähres, 2010) while balancing various factors.

Most importantly, frequent auctioning **created flexibility** to the industries but **failed to create market scarcity**. Through the 2<sup>nd</sup> level analysis (i.e.

<sup>&</sup>lt;sup>15</sup> CCS means the technology 'capturing CO2 produced by large industrial plants, compressing it for transportation and then injecting it deep into a rock formation at a carefully selected and safe site, where it is permanently stored' (Global CCS Institute, 2015), it can lower the atmospheric carbon content, so that global warming effect can be reduced.

organizational analysis), companies perceive the allowance as abundant and innovative climate mitigation would not fall under the main agenda of daily operation, they would tends to rely on the purchase of allowances in fulfilling the compliances.

For the **frequency** of the joint-auctioning, it should also be maintained to have around 4 times. Nonetheless, there is a need for coordination between China-ETS and EU-ETS.

Currently Guangdong-ETS has 4 auctions per compliance year, it is expected the auctioning in other Chinese cities will roughly follow this pattern as Guangdong-ETS is the so far the only auctioning-model to follow in China. On the other hand, EU-ETS has too frequent auctioning from weekly to monthly in EEX and ICE as shown in Fig.4.2, EU-ETS has the need to reduce the auctioning frequency.

Auction platform	States	Details
EEX	Participating Member States/EEA EFTA States	Weekly auctions on Mondays, Tuesdays and Thursdays
EEX	Germany	Weekly auctions on Fridays
ICE	United Kingdom	Fortnightly auctions on Wednesdays
EEX	Poland	Monthly auctions on Wednesdays from 8 January to 5 March 2014.

Fig.4.2 Allowance auctioning frequency of EU-ETS excluding aviation sector (European Commission, 2016 iii)

If the EU-ETS keeps the current frequency of solo-auctioning, European companies will rely on the weekly or monthly EU-auctioning due to extreme flexibility. Even the joint-auctioning is designed to be operated quarterly, there would be low participation of the European companies compared with Chinese companies, making the joint-auctioning meaningless. Therefore, EU could consider to limit its frequency of auctioning as well.

# 4.2 TRADING PLATFORM

Auction is **primary market** that allowances are freshly allocated to companies, while the trading platforms (i.e. allowance exchange) are the **secondary market** that the major market participants are buyers in the primary market, they trade throughout a compliance year to achieve their most convenient and cost-effective way. Currently the main trading platform for EU-ETS is EEX and ICE, and that of the Chinese pilot projects are the regional exchanges such as CNEEEX and CEEX.

After the linkage, EU-China carbon exchange platform will be the first institutional arrangement established to facilitate the trading of allowance, but the mode of trading is crucial to the functioning of the linkage. Common mode of ETS-trading is spot market and derivative markets (future market, forward market), and they can be operated in an Over-The-Counter method, they are defined and illustrated below.

#### 4.2.1 Illustration on mode of trading

**Spot market** is a market that the commodities or securities (allowances for carbon market) are traded immediately in a spot price (i.e. the price in that moment), the orders are settled instantly without significant delays to future dates (FX-Web, 2010). Currently EU-ETS allowances are auctioned in form of spot products, the maximum period of settlement is 5 days. (European Commission, 2016 iii)

**Derivative market** is the market with the allowances are traded in the future, and the price is set according to, or derived from the current situation such as spot price and allowance distribution,. Besides, the allowances may or may not exist while dealing.

**Future market and forward market** are the common type of derivative market, Fig.4.3 demonstrated the difference between two system. Future market is the standardized market that certain amount of commodity is traded at a specific time in the future at an agreed price (Environomist, 2016), meaning that the provisions of contracts of allowance trading are formulated by the Central Counterparties (CCP) such as the exchange, so it is non-OTC trading.



Fig.4.3 Illustration of non-central clearing forward market (left) and central clearing future market (right) (Europe Economics, 2016)

On the other hand, forward market is similar to future market that the allowances are trade based on business-to-business agreements at a specific time in the future at an agreed price. However, the major difference to future market is that the Carbon forward contract is **non-standardized**, meaning that it is not a centralized trading but an OTC tool instead. There is higher flexibility to the businesses to customize the provisions of contract but the trade is not supervised by the centralized clearing house, and so the risk of default is higher than that in spot market and future market. Besides, forward market is easier to be used by speculators (Environomist, 2016).

## 4.2.2 Suggestions on mode of trading

Currently **EU-ETS** involved about **80% of future market** trading and 20% of spot market trading, while **China only used spot market** trading in the pilot projects as NDRC banned the futures reading to avoid price fluctuation potentially triggered by speculative activities. This section only focus on selection of mode of trading, details about **speculation** will be discussed in section 4.3.2.

In terms of international carbon trading, the **complexity of clearing and settlements are higher than that within a jurisdiction**, the risk of market distortion and importance of smooth settlements outweigh the benefits of eagerly introducing various financial instruments. Within EU-ETS, the settlements are less susceptible to f as they are supervised and guaranteed by the same institutional arrangement the European Commission; comparatively, the settlements between two jurisdictions involved more administrative works and legal obligations, if the complexities create arguments regarding settlement, or market disturbance between Chinese and European businesses, the negative sentiment would potentially have spillover effects on the other trades that will affect the trade volume and the price of the linked market, and subsequently jeopardize the credibility of the linkage.

Due to the **vulnerability** as well as the **risk of speculation** and **default** as mentioned in section 4.2.1, the linkage of EU-China ETS should **mainly** apply **spot market** to be traded in a **non-OTC** way. It is because spot market under supervision provides greater stability to both jurisdictions, and it can prevent the Enron loophole that will be discussed in section 4.3.4.

**Derivative markets** can be used in proposed linked market to **increase flexibility** of trade and market liquidity, so that the linkage will be more attractive and the potential of the linked market can be used in a maximal way; however, there must be **enough regulations** on the trading conditions such as trading amount and period of settlements. Therefore, application future market is more preferable than forward market, and future market should only be used as a supplementary mode of trading when compared with spot market. Besides, there should be a probe to the future markets before implementation; even after implementation, there must be on-going Macro-control and close supervision on the trading of derivatives, the Macro-control strategies will be discussed in section 4.4.

#### **4.3 Prevention of Market Malfunctioning**

Carbon market has been operated as **regulated markets** because they are under supervision that can provide a number of safeguards in the conduct of their operations. These safeguards include, among others, arrangements to identify and manage the potential adverse consequences of any conflicts of interest, to identify and manage risks that the market is exposed to, and to have transparent and non-discretionary rules and procedures for fair and orderly trading. (European Commission, 2016 iii)

Market malfunctioning can cause market instability and price fluctuation while affecting the proper functioning of ETS, five malfunctioning are discussed as follow:

#### 4.3.1 Market manipulation – competition rules

There are potential market manipulation through cartel (collusive price fixing, allowance division in auctioning or allowance manipulation) and short

selling (short selling to be discussed in section 4.3.2), these actions can significantly drive the price down and can be detrimental to the operation of carbon market. Even if price floor is in place, the price may remain around the floor level, creating a weak price signal and malfunctioning of price adjustment mechanism. Furthermore, if the market manipulation happens in one of the linked market, it will have spillover effect to the other jurisdiction, which will lead to lack of trust on the linkage.

Besides, according to Matthes et.al (2008, role of auction), auction should be designed to **support efficient operation and ensure fairness**, while helping avoid collusion and market manipulation is one the elements to achieve economic efficiency. Therefore, it is necessary to formulate regulations in alleviating the market manipulation activities. European Commission can provide intelligence in this issues as the Commission has a well-established Competition policy as listed in Article in 101 to 109 of TFEU and the subsequent directives.

# <u>A review to the EU market oversight</u>

To safeguard the conduct of the EU-ETS operation, EU-ETS was designed as a regulated markets bound by the Markets in Financial Instruments Directive (**MiFID**) and the Market Abuse Directive (**MAD**) to provide a number of safeguards in the conduct of their operations. European Commission describes the functions of regulation are 'to identify and manage the potential adverse consequences of any conflicts of interest, to identify and manage risks that the market is exposed to, and to have transparent and non-discretionary rules and procedures for fair and orderly trading.' (European Commission, 2016 iii)

**MiFID** applied to emitters and intermediaries, it restricted that auction can only be done in authorized market, it reduced risks of unclear market allowances, it also increases the transparency of markets, as well as enhances the investors' protection, market integrity and efficiency. **MAD** applied to all market participants and it mainly deals with market manipulation and insider dealing (DG Climate Action, 2012)

#### <u>Auctioning purchase limit</u>

Auctioning should be designed to let the bidders attain the allowances according to their needs and expectation to their emission reduction efforts, and the system should ensure the allowance could be allocated to **wide range of** 

bidders regardless of their size and industries.

However, consortia may dominate the auctions by purchasing large amount of allowance, they can perform market manipulation through accumulation of allowance and marginalization of SME successful bids, and they can earn profits through various market strategies including selling the allowances to the market before the compliance deadline. Therefore, regulations on auctioning purchase limit are needed.

There were **counter arguments** including Neuhoff & Matthes (2008), they expressed that there should be no restrictions on bids to ensure a simple and robust auction, provided that the volume and frequency of auction is high; however, as mentioned in the section 4.1, quarterly auction is the optimal frequency. Besides, the EU-China linkage implied increasing amount of firms eligible in common auctioning; however, the beginning allowance is limited, even if the frequency of linked market would be set higher than 4 times per year and volume of allowance auctioned in proposed linked market is huge, large scale companies may try to have high bid as to probe the market capability or investigate on possibility of price moving. It could turn out that the trial common auctioning become the clubs of oligarch, and there would be low participation and successful bids from the Small and Medium Size Enterprise (SME).

Due to the risk of market manipulation, there is example applying purchase limit. For example, in **California-Quebec linkage**, the covered entities or emitters can only purchase 25% of allowances offered in a particular auction. Currently there is no any purchase limit in both Chinese pilot projects and EU-ETS, but there should be limitation in the linkage market, especially during the trial period, it is very important to let the common auctioning allowances allocated to companies with different sizes, it helps the regulation entities gain valuable data about market responses as well as prevention of market manipulation.

# Holding limit<sup>16</sup>

In California and Quebec-ETS, the holding limits calculated and stored in

<sup>&</sup>lt;sup>16</sup> Holding limit is defined as 'the maximum number of GHG allowances that may be held by an entity or jointly held by a group of entities with a direct corporate association' (ARB & WCI, 2016), it is supplementary to the auction purchase limit, acting as the means to prevent companies in gaining market dominant position. The holding limit is calculated based on each market participants and are impacted by the emission data of emitters and the type of participants.

Compliance Instrument Tracking System Service account. Prior to the auctioning, both jurisdictions will send to Auction Administrator the holding limit of each auction participants.

Same as the case of purchase limit, currently there are **no holding limits** in both Chinese pilot projects and EU-ETS, and such limit should be set up in the linkage market, with the institutional and systematic arrangements in lines with purchase limit.

## <u>Competition law</u>

Emission trading Systems are operated in market approach to achieve emission reduction through encouraging businesses to seek for mitigation involving the least cost, competition is the basis for a functioning ETS as the businesses will be incentivized to reduce GHG. The competition rules should be included through the auctioning and trading of the proposed linkage.

In EU, According to Clause 7 of **Directive 2003/87/EC**, 'Community provisions relating to allocation of allowances by the Member States are necessary to contribute to preserving the integrity of the internal market and to avoid distortions of **competition**'.

Besides, Article 24 (1) of **Directive 2003/87/EC** mentioned that, '...*Member* States may apply emission allowance trading in accordance with this Directive to activities, installations and greenhouse gases...provided that inclusion of such activities, installations and greenhouse gases is approved by the Commission...taking into account all relevant criteria, in particular effects on the internal market, potential distortions of **competition**, the environmental integrity of the scheme and reliability of the planned monitoring and reporting system.'

Furthermore, **Auctioning Regulation** (AR) addressed the rules on auction design auction calendar, accessibility to auction, auctioneer, auction monitor, auction platform, clearing and settlements, transparency and confidentiality as well as other relevant aspects. (AR No.1031/2010).

For China, it has kind of **anti-competition law** since 1993, article 6 mentioned that 'public enterprise or other legitimized monopolies cannot limit the purchase of others through their market status, or marginalize the fair

competition of other businesses'; besides, article 11 mentioned that 'businesses cannot sell the underpriced goods in order to marginalize other competitors'. Except article 6 is more relevant to operation of ETS, article 11 and other clauses covered areas such as trademarks and business secret which are more related to normal commodity markets instead of ETS (NPC, 1993).

As China does not have a formalized competition law, in June 2016 NDRC proposed to establish fair competition review system to prevent regional protection, monopoly and safeguard market competition and price fixing. (NDRC, 2016)

In comparison, **EU has more solid experience in dealing with competition policy**, Article 101 and 102 of TFEU covered cartels and dominant position respectively, it addressed anti-competition behaviours such as collusive price fixing, market, market abuse. Weishar et al. (2008) also mentioned that Article 81 and 82 competition law should be applied to the auctioning. Therefore, in the proposed linkage, EU can have more knowledge sharing of competition law regarding auctioning process and trading in order to achieve fair and economically efficient ETS. However, the design should be more tailored-made for carbon market.

# **4.3.2 Prevention of speculation**

Financial market will attract investors easily; however, it will attract speculation activities as well. Speculation can be **beneficial** to the operation of carbon market due to its contribution to risks and price management. IOSCO (2009) mentioned that there are benefits of short-selling activities including correction of overpriced stock, facilitation of price discovery, facilitation of hedging and other risk management, as well as promotion of liquidity through market making.

However, it can also be tragic to functioning of a market (the importance of control on speculation is illustrated in Annex I). As mentioned by Technical Committee of IOSCO that, 'short selling should operate in a well- structured regulatory framework in the interests of maintaining a fair, orderly and efficient market. The primary objective of such regulation would be to reduce the **potential destabilising effect** that short selling, used in an abusive manner, can cause without exerting undue impact on securities lending, hedging and other

types of transactions that are critical to capital formation and to reducing volatility'. (IOSCO, 2009)

This section will address how to preserve the benefits of speculation while addressing its destabilizing effect.

# 4.3.2.1 Re-emphasize the focus of carbon market

Carbon markets are originally designed to fulfill carbon reduction targets in a market approach, the **ultimate goal** of the linkage is to provide higher degree of flexibility to the business for compliances; however, the flexibility should not be transformed to a tool for the speculators to gain profits.

# 4.3.2.2 Limit the market participants – indirectly limit the role of financial intermediaries

Currently there is more financial intermediaries providing service for the traders in assisting them in speculation, it is because there are demand from various market participants including non-emitter. To address the involvement of the intermediaries that potentially distort the market functioning through speculative services, it is necessary to control through the demand side by limiting the market participants that will indirectly reduce the supply from the intermediaries.

Besides, carbon market is **designed for the emitters to seek the least costly options**, as China and EU-ETS link, there are plenty of low cost options and finance in the market, the participation of individuals are not a must to provide financial liquidity to the market. Furthermore, they do not have the necessity to join the market as they are not emitters under coverage and do not need to participate in the market in order to achieve emission reduction or fulfill compliances, their main purpose are simply speculation and gain profits. Therefore, they should only receive limited access to the market.

# 4.3.2.3 Decommodification

Currently in the EU-ETS market, as discussed in section 4.2.2, there are **various financial derivatives** available that future market trading involved 80% of total trade, it will make the ETS more vulnerable to abusive speculation and bear more uncertainty and risk if the proposed linkage is opened to diversified

financial derivatives.

Lohmann (2009) mentioned that there is **'increased threat to climate stability'** due to the emerging financial derivatives in carbon market, and he pointed that 'commodification' approach and the 'decommodification' approach are controversially argued in response in the threat, while the latter approach is more adopted by policy analyst. 'Commodification' means further commodify the financial derivatives with enhanced market regulations, while 'Decommodification' mean certain derivatives needs to be altered or deconstruction as being unregulable.

Actually **both** measures can be **practical** and the process **should be dynamic** rather than static, the linkage should start with simpler setting with limited amount of derivatives. If certain derivatives are proven to be beneficial to climate stability and will attract limited abusive speculation, it may go through the trial period; or else, if the derivatives are proven to be detrimental to climate stability, the regulation entities should be determinant enough to implement the 'decommodication' process, while sweeping away the setting. Besides, the process should be implemented while taking into account the market response and feedbacks of participants.

# 4.3.2.4 Short selling Control

Currently Short Selling Regulation (**SSR**) is applicable to **EU-ETS** (European Commission, 2016 vi), it includes 'Short selling Notification and Disclosure procedure', 'Individual Disclosure', 'Reporting to ESMA' and 'restriction on Naked short selling, all these measures are important to retain ETS stability and should be adopted in the linkage market with amendments.

Under the **SSR**, shorting actions by market participants are needed to be notified to the regulation entities and disclosed to the public, so that all entities would be notified about the shorting situation of the market, the short selling will be reported to ESMA; besides, there is restriction on naked short selling and failed settlement case reduced after the enforcement of SSR (European Commission, 2013).

For China, stock exchanges started to investigate short-selling control from **2015** that Reuter described *'China Securities Regulatory Commission (CSRC)* has

declared war on "malicious" short-sellers and is also scrutinizing the use of automated trading strategies favored by hedge funds to profit from market volatility.' However, it is not yet plans to implement them to the future Chin-ETS' (Taplin & Chatterjee, 2015).

While in **Hong Kong**, the short selling has been controlled under the Securities and Futures (Short Position Reporting) Rules governed by Securities and Futures Commission since 2012 and naked short selling was banned (SFC, 2012). As Hong Kong has **more experience dealing with short selling and financial derivatives**, China should gain insights from SFC for implementing short selling control in China-ETS.

For the proposed linkage, it is suggested to adopt the notification and Disclosure procedure as in SSR, and establish a report mechanism to the common financial regulation entity. Besides, naked short selling should be prohibited due to the huge market coverage of the proposed linkage market, in which the market size issue was illustrated in Annex I. Furthermore, it is suggested to maintain communication and cooperation with International organization of Securities Commissions (IOSCO) which has Task Force on Short Selling (TFSS) specified to deal with short selling issues.

# 4.3.2.5 Other measures

Other measure includes the **elimination of over-the-counter trade** that can increase the market information of the regulation entities, so that they can respond properly to potential abusive speculation, it will be discussed in section 4.3.4.

Besides, allowance purchase limit and holding limit cannot only reduce the risk of market manipulation as illustrated in section 4.3.1, but also indirectly contribute to abusive speculation prevention because the companies cannot accumulate excessive amount of allowance to undergo speculation.

Furthermore, as there is **limited analysis about preventive measures on abusive speculation on carbon market**, both entities and academia should conduct more researches on this topic.

# 4.3.3 Excessive Allowances – indirect price control mechanism

EU-ETS started earlier than the Chinese pilot projects, and it faced the problem of excessive surplus and weak price signal as discussed in section 2.2.2; therefore, the following arguments will **widely apply the lessons learnt from EU-ETS** to investigation the possible solutions in the future EU-China ETS linkage.

## 4.3.3.1 More aggressive cap

Generally climate policies apply **no-backslide principle**, meaning that the target cannot be released in case there is difficulties in meeting the target, and the target will be tightened as the system goes as mentioned in section 3.3.1 about yearly tightening cap of carbon market.

Taking the EU-ETS as a reference, the rate of yearly tightening cap (the Rate) is 1.74% currently and 2.2% after 2030. While an ETS faces excessive allowance issues, there are mainly three reasons: economic recession, increased potentiality, or over-allocation.

If the excessive allowance are due to **second or third reasons**, regulation entities, can **consider increasing the Rate**. When there is over-allocation, it means that the industries can actually perform better than expected; while in case of increase potentiality, the R&D is improved in a way greater than the anticipated rate, especially after certain scientific breakthrough in R&D, so that potential of emission reduction increase. In either case, there is a stable demand and supply gap of allowance, further increase of the Rate is necessary to fill this gap.

However, the increase should **not be applied to recession-induced excessive allowance** because the recession is rather short-term ad emission can bounce back to anticipated level within years, the further tightening may not meet the demand-and-supply pattern after the recession is gone. Besides, there should be careful market researches in the further tightening as it involves long-term decarbonization path, so it cannot be adjusted frequently.

#### 4.3.3.2 Reserving the excessive allowances and Postpone the auctioning

The excessive allowance can be put into a reserve and they will be allowed to use in certain period of time later, currently EU-ETS is adopting this measure called **Market Stability Reserve** that the excessive allowance is reserved not allowed to appear in the market again in 2020. However, it is **criticized** to be postponing the impact of excessive allowance without solving the underlying problem, as there are no changes in the total allowances, the price is expected to experience a plunge after 2020.

Another measure called **Backloading**, is used to postpone the next auctioning when there is excessive allowance enough for compliances, it also **cannot address the underlying problem** as the postponed auction allowances will appear in the market in the future auctions.

Both solutions can **only** act as a **short-term measure** in adjusting the price fluctuation; however, when the EU-China ETS faced the problem of continuous excessive allowance, the following option should be adopted instead.

## 4.3.3.3 Government buy-back of allowances/ removal of allowance

As carbon market is a highly regulated market and free market spirit may not always be applied. In case of EU-ETS, governments should intervene and **buy back** the allowances when the excessive allowances have no way out of the market. Another possible way is permanent **removal** of the allowance by the regulation entities.

However, in the linkage market, both NDRC and Commission should be aware while applying these measures. Medicine and cure and destroy at that same time, intervention can directly solve the underlying excessive problem, in a mean while, it can destroy the price discovery ability of the market and it may face opposition from the traders.

Therefore instead of implementing ad-hoc removal or buy-back frequently, the **application** of both measures **should be formulized**. For example, a **threshold** should be established that mechanism of buy-back or removal will be triggered when the allowances exceed the threshold.

If the mechanism is triggered very **frequently**, it means there is **long-term allowance imbalance** between demand and supply side, the evaluation system should be reviewed and the **first option** of further tightening of the Rate should be adopted instead.

# 4.3.3.4 Macro - computer science solution

Another possible method is **instant processing**; it is conducted by using **computer programming** to evaluate the optimal auctioning allowance according to the emission target and excessive allowances. As the amount of allowance to be allocated within certain period is fixed by the national stringency of cap, the only variable regarding the allocation (regardless of free or auction allocation) is the distribution of the allocation within the period. In the other words, for a fixed allowance in 10 years period, the **Macro**<sup>17</sup> will formulate how many allowances should be allocated in the coming auction, and the auctioning results would become the inputs for the subsequent iterations.

It has the benefit of **reduction of administrative cost** due to the computerized operation, it can also collect instant data and transaction records into a Macro and output the optimal auctioning amount in each auctioning, in which it can prevent excessive allowance. However, it takes time to investigate due to the complexity of carbon market and it **needs further computer science R&D**.

# 4.3.3.5 Non-use of international credits

There should not be use of international credits from CDM and JI, for instance, EU-ETE has decided to disallow the use of the credit in fulfilling compliances, but it cannot be achieved unilaterally as China is still using international offsets and Chinese Certified Emission Reductions (CCERs)<sup>18</sup>. However, it is not the focus of this thesis so it would not be furthrer elaborated.

#### 4.3.4 Fix the Enron Loophole for regulation entities

Enron loophole was originated from America showing the negative effects of off-balance-sheet trading<sup>19</sup>

The similar situation can happen to emission trading, if the linked market is allowed to various layer of traders and spot market (off-balance-sheet market),

 <sup>&</sup>lt;sup>17</sup> Macro means a program that transfers an array of inputs to sequence of output for performance of certain tasks.
<sup>18</sup> CCERs mean the Chinese credits created by implementation of approved climate-related

 <sup>&</sup>lt;sup>18</sup> CCERs mean the Chinese credits created by implementation of approved climate-related projects, the mechanism is similar to CDM credits (IETA & CDC Climate Research, 2015)
<sup>19</sup> In summer 2008, off-balance-sheet trades on oil market were underwent frequently without

<sup>&</sup>lt;sup>19</sup> In summer 2008, off-balance-sheet trades on oil market were underwent frequently without the knowledge of the regulators of the New York Mercantile Exchange, involving various financial intermediaries and investment banks, finally the exchange has failed to contain the speculation in timely manner that the oil price was rocketed to \$150/ barrel.

the Commission and NDRC would be very difficult to exercise monitoring and control over market activities and trading behaviours, there will be potential market fluctuation because the two central authorities cannot grasp enough knowledge on factors affecting price level and allowance situation, the Enron Loophole can induce political distrust towards the linked market.

Therefore, all the trading, no matter spot trading or futures trading, should be conducted through the official exchange or under the supervision of the regulation entities. In other words, traders should not be allowed to trade bilaterally without reporting the conditions of the trade to relevant regulation entities.

# 4.4 COMPLEMENTARY BENEFITS OF EU AND CHINA

Apart from the benefit mentioned in the introduction section, EU and China has **provide complementary benefit** in terms of market operation, the linkage cannot only push forward the climate action through ETS but also facilitate sharing on the strengths and weaknesses of market operation.

Operation of EU-ETS started on 2005, it is currently undergoing the 3<sup>rd</sup> phase of operation that it can provide many **valuable insights** to future China-ETS regarding the auctioning and trading system. Besides, it provides **lessons learnt** from its failure such as excessive surplus and weak price signals, it also offers **examples of solution** such as market stability reserve, MiFID and carbon leakage list. In addition, EU has **comprehensive legislation** in dealing with anti-competition behaviours. EU can use its experiences to assist NDRC in managing the China-ETS and prevent China-ETS getting the same problems as in EU-ETS.

On the other hand, China, with **socialism-featured economy**, has implemented Macro Regulation and Control strategies (**MRC**) for more than 30 years, it has accumulated various market control strategies that can be applicable to deal with the speculation and financial regulations. From the 1<sup>st</sup> to the 3<sup>rd</sup> MRC, China mainly applied administrative approach to regulation speculation and inflation; however, they cannot address the underlying economic structural problem, China experienced hard-landing in the 3<sup>rd</sup> MRC that commodity price index dropped from 18.5% to 2% within 1 year. For the 4<sup>th</sup> and 5<sup>th</sup> MRC, China started to use market-approach instead of administrative-control in response to

economic overheat, it applied systematic reform and impose regulations on financial markets and speculations (Hsieh, 2006, MRC). As EU is applying capitalism that has less experience in market control strategies (both MAD and MiFID do not deal with speculation and over-investment), the Chinese experiences in MRC could be beneficial to the linkage market, which requires high degree of regulations. Although carbon market is different from normal market, that NDRC cannot adjust interest rate, currency and control the economic activities in responding speculation and loopholes in carbon market, MRC experience could be valuable to carbon market and China should investigate on its applicability to carbon market control
# Conclusion

Connected carbon market has the various political and economic and climatic benefits, it provides liquidity to the market and incentivize the business to reduce emission through market approach, linkage also provide signal to international arena regarding climate action. EU and China ETS linkage would be the largest ETS in the world and successful linkage can provide insights and leading examples to other countries to establish carbon market. This essay focused on pre-linkage and linkage consideration that will be the obstacles of such linkage.

This thesis emphasized that carbon markets and linkage should be climate-orient while addressing issues on price signals, carbon leakage and market manipulation, because they are detrimental to the operation of ETS and credibility of the linkage. Carbon market is unique to general commercial market that the ultimate goal is emission reduction instead of economic growth. As carbon emission is a common good that free market rules cannot handle due to free-rider principle and common goods tragedy, it should be highly regulated. This thesis also analyzes the solutions to facilitate the linking of two jurisdictions while responding to climate change, with the focus on the cap structure and operational system.

For the design of Cap Structure, dual-track transition is proposed to increase the benchmarking portion in free allocation and the shares of auctioning to free allocation. It is also argued that the variation of stringency of targets between two jurisdictions would not be the barrier of linkage, and the price signal variation is the key obstacle but there price convergence is actually on-going in two jurisdictions, provided that there is market scarcity of allowances and both rates of yearly cap tightening is in line with the international pledges. Besides, Price Floor is recommended to implement to safeguard the price signal. In addition, carbon leakage issue is discussed and it is suggested to reform the function of carbon list through inclusion of 'Foreign emission', and both jurisdictions should have joint-investigation on political feasibility of BCAs, which is capable of addressing carbon leakage and maintaining environmental effectiveness.

For operational system, it is suggested to progressively implement

joint-auctioning starting from power sectors, while sealed-bid, uniform price and single round should be the optimal auction design. Meanwhile, the trading platform should focus on spot market due to the threat to climate stability of derivative market, future markets can be applied as supplementary mode of trading with sufficient regulations.

Apart from that, different solutions towards prevention of Market Manipulation were proposed. It is suggested that competition rules should be implemented, speculative activities should be monitored through measures such as short selling controls and decommodification. Besides, excessive allowances should be controlled through indirect price control mechanism such as tightening of the Rate and implementing government buy-back/ removal of excessive allowance, with references to EU-ETS lessons learnt. It is also suggested to ban all the off-balance-sheet trades on allowance so that both jurisdictions can grasp accurate information on market situation and factors affecting price level and allowances.

EU and China currently has manifold cooperation in climate actions and promotion of energy efficiency, as the EU is currently assisting China to establish a well-functioning China-ETS, it is believed that there would be more rooms for cooperation in ETS-linkage. EU can share experiences on ETS operation while China can provide intelligence on Macro Regulation and Control Strategies on market supervision, the linkage would be beneficial to both jurisdiction, while providing add-ons to emission reduction and global warming.

This thesis attempts to facilitate the linkage of EU-ETS and China-ETS with the focus on Cap Structure and Operational System, further researches could be done to investigate the 'Coverage', 'International Offsets' and 'MRV' regarding EU-China ETS linkage, as well as the other possible linkage options.

### Annex

#### <u> Annex I - Why speculation should be controlled in the linkage?</u>

As mentioned by NRDC (2009), 'Individual market participants and collusive groups can manipulate unregulated commodity spot markets, especially when these markets are subject to known supply constrain', and 'carbon markets regulation should limit exposures to longer term contracts and prohibit collusive behavior across exchange to avoid disruptive price manipulation activities'.

Speculation activities such as short-selling and price moving can negatively impact the functioning of carbon market by creating price fluctuation and market instability, it can destroy the credibility of carbon market and linkage itself. As carbon market is highly regulated market, some free market economy rules are not applicable here, and there must be restriction of auction condition. Following shows the devastating example of unregulated financial market:

Strategic short-selling can be devastating to the functioning of the carbon market, the linkage should be protected with decent regulations and controls. As China-ETS will be newly established and the market size is expected to twice of the EU-ETS, the huge linked market size involved plenty of variations and uncertainties, the complexity of carbon market structure make the linkage susceptible to strategic short-coming. It was generally believed that free market should be upheld in 21<sup>st</sup> century to make the economy bloom itself, government intervention was seemed to be burden for economic growth, emergency of Washington Consensus is the best example of the implementation of market deregulation under the free market ideology. However, the 1997 financial crisis has proven the vulnerability of market, there were international financial predator like George Soros strategically attacked the upcoming market in Asia, it is the most prominent example showing the political 'predation' rather than economic one, and the financial crisis left the turmoil to Thai currency, and Hong Kong Hang sang index and even Russian market. While in January 2016, Soros implicitly expressed the plan to bid against Asian currency and commodity-linked economics, it has made the Chinese mouthpiece warn him off regarding the 'war on the renminbi' (Wildau, 2016).

These incidences showed that potentially Chinese emerging carbon market and the proposed linkage could fall under financial attack, it would lead to price fluctuation and spillover to other jurisdiction, making the proposed linkage lack of credibility and vulnerable. Therefore, it is needed to set regulations and control.

### <u>Annex II - Shrimp-turtle case</u>

Catching of shrimps can have side effect on other marine lives such as killing of endangered sea turtle, in 1996 US decided to implement a ban to imports of shrimp according to section 609 of US Public Law 101-102, US government expressed that 'shrimp harvested with technology that may adversely affect certain sea turtles may not be imported into the US — unless the harvesting nation was certified to have a regulatory programme and an incidental take-rate comparable to that of the US, or that the particular fishing environment of the harvesting nation did not pose a threat to sea turtles'. In 1997 India, Malaysia, Pakistan and Thailand brought the case to WTO Appellate Body and it was ruled that the ban was an decimation between WTO members and was inconsistent to GATT Article XI and XX(g). (WTO, 1998)

#### **ANNEX III ADMINISTRATIVE BARRIER OF BCAS**

Nonetheless, there is several disadvantage of applying BCA that it becomes the barrier. It has high administrative cost due to its complexity, but it is expect to be the cheaper option than free allowance as carbon price increase. It is mentioned that 'As the substitution costs increase, it becomes more important to have a broad coverage of the carbon price within the economy, and the costs of using exemption policies rise. This rules them out as a long term option. As output leakage rises, the effectiveness of the policy in controlling leakage becomes more important'. In other words, increasing revenue from BCAs become less significantly to admin-cost, while free allowance did not provide such revenue. It is also a side reason to maintain a strong price signal as to be discussed in section 3.4.



Policy effort / carbon price



In short-term, due to the high cost burden, BCAs should first be applied to energy-intensive industries such as power production, so far the application of BCAs are all related to electricity imports, for example, California-Quebec ETS and Beijing-ETS also required purchase of allowance for electricity imports (Whitmore, 2013). However, when the implementation of BCAs and data collection processes become mature, and the administrative burden is lowered, BCAs should be considered covering manufacturing industry as well.

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