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Emerging Emissions Trading Schemes (ETS) in China
Capstone RNK Capital LLC

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EXECUTIVE SUMMARY

In its 12th Five-Year Plan, the Government of China announced its plan to use market-based mechanisms such as a cap and trade scheme to reduce carbon emissions. Seven Emission Trading Scheme (ETS) pilots are to be rolled out in China during 2013. Amid the excitement of launching potentially the biggest ETS in the world, there are many uncertainties associated with its design and its effectiveness. In this paper we examine the seven pilots’ design, through currently available public information, interviews with experts from China and abroad, as well as comparisons to other established ETS. Specifically the report looks into the power sector, which is the biggest emitter, and will be a significant participant in the ETS. The paper studies how the power sector is likely to interact with the ETS market. We argue that the current ETS designs not only lack transparency, but also face seemingly unresolved challenges. Considering other existing policies, we conclude that the short-term objectives of current pilots are not to achieve actual carbon emission reduction but rather to test out whether such a complex tool could work in the very special market environment in China. Furthermore, there is very limited opportunity for international engagement in the short to medium term.
I INTRODUCTION

China is the largest greenhouse gas (GHG) emitter in the world (Friedman L. 2012), and is characterized by rapidly increasing per capita emissions due to the emerging middle class’ energy consumption. Despite rapid growth, China differs from developed countries in its need to improve the standard of living for a large population of citizens still living in relative poverty. In its 12th Five Year Plan, China (W. Wang), announced its intention to reduce carbon intensity by 40–45% by 2020, and also introduced market-based mechanisms in the form of emissions trading schemes (ETS) to achieve this target. As a result, seven ETS pilots (Figure 1) (Climate Connect) are being developed in seven important economies at the provincial and city level. RNK Capital, a New York-based hedge fund active in environmental markets, desires to further understand the evolving market opportunities that may arise from these pilots and any subsequent national emissions-trading scheme. The Capstone team analyzed the current situation and prospects of these Chinese ETS pilots, with an emphasis on the electricity sector, and has provided RNK Capital with a situational analysis and perspectives on this emerging market as input for further exploration and decision-making.
II OVERVIEW OF SEVEN ETS PILOTS

2.1 Rationale of ETS Introduction

There are various driving forces for China, a developing country, to introduce an ETS first at local levels, and then ultimately at a national level. Broadly they can be classified into two groups, that is, political and economic. These two are not necessarily exclusive, but rather complementary to each other, so that as a whole, they function as a strong rationale for China’s plan to have the world’s largest carbon market, if it is successfully launched and operated as planned.

2.1.1 Political Needs to Respond to Climate Change

First, environmental degradation following a rapid economic growth over the past three decades has presented one of the most serious political challenges for the Chinese leadership. In particular, climate change has impacted severely the lives of people in China in recent years. One government report confirmed that weather and climate disasters negatively affected 430 million people in 2011 alone (National Development and Reform Commission, “China’s Policies and Actions for Addressing Climate Change 2012”). Recently, citizens started to directly ask the Chinese authorities to handle the problems, for instance, in their street protests over large environmentally unfriendly projects (Bradsher), making the government highly sensitive to a potential social instability due to environmental degradation. On the other hand, the world has pushed China to address climate change in a more responsible manner, since China has become the world’s biggest GHG emitter, surpassing the United States in 2006 (Graph 1).\(^1\) So it can be said that faced with the limitations of the command-and-control approach, China decided to

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\(^1\) Since China acceded to the World Trade Organization in 2002, the country has played a role as the world factory, making its GHG emissions much more rapidly rising while those of its developed trading partners are stabilizing or decreasing. There is a common view that without mitigating China’s emissions, it would be increasingly difficult for the world to address the challenges due to climate change.
introduce ETS as a practical and strategic policy tool for accommodating the ever growing internal and external pressures.

**Graph 1: GHG Emissions of Key Countries (The World Bank)**

(in thousands of tons CO₂ equivalent)

2.1.2 Economic Costs and Industrial Restructuring

In addition to political concerns, there have also been worries about the economic cost of environmental damages in China. According to a recent government study, environmental damages reached approximately US$ 230 billion in 2010, or 3.5 percent of China’s GDP, three times the amount in 2004 (Wong). In 2011, climate-related natural disasters alone caused direct economic losses of 309.6 billion Yuan (National Development and Reform Commission, “China’s Policies and Actions for Addressing Climate Change 2012”). Such rising costs pose a big challenge to the sustainability of the Chinese economy which depends largely on manufacturing industries. Moreover, with rising production costs and a rapidly aging
population, China has an urgent need to re-orient the economy towards services to decrease the burden on natural resources and to create jobs outside manufacturing. Under these circumstances, an ETS might be one important instrument not only for mitigating CO2 emissions but also for boosting a gradual economic transition. In fact, Xie Zhenhua, current vice head of the National Development and Reform Commission (NDRC), once mentioned “restructuring the economy through carbon trading” (C. Liu).

2.2 Internal Comparison

2.2.1 Carbon Emissions and Reduction Target

The seven pilots are subject to the central government’s pledge to lower China’s carbon intensity (emissions per unit of GDP) by 17 percent over the 2011-2015 period (State Council, “国务院关于印发‘十二五’控制温室气体排放工作方案的通知”), ultimately targeting at a 40-45 percent reduction from 2005 levels by 2020. (State Council, “国务院常务会研究决定我国控制温室气体排放目标”) A letter issued on October 29, 2011 by NDRC, China’s authority overseeing climate policy, told seven pilot cities and provinces to impose absolute caps on emissions and to draw up allocation plans as soon as possible (National Development and Reform Commission, “国家发展改革委办公厅关于开展碳排放权交易试点工作的通知”). Unlike the Interim Regulation on Voluntary Trading Greenhouse Gas Emissions published by the same commission on June 13, 2012 that covers six types of GHG emissions (National Development and Reform Commission, “国家发展改革委关于印发 温室气体自愿减排交易管理暂行办法》的通知”), the seven government-designated pilots are expected to cover only CO2 emissions.

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2 According to a UNFRA report, China has 181 million people over 60 years in 2012, triple the number in the US, and by 2050, it will have 439 million seniors, accounting for a third of its population. (UNFPA and HelpAge International)

3 The factual information on the seven ETS pilots, unless otherwise indicated, is based on the contents of the website of International Carbon Action Partnership at www.icapcarbonaction.com.
In response, Guangdong province has announced that, in addition to a target to reduce carbon intensity by 19.5% over the 12th Five Year Plan (FYP) period ending in 2015, it would cap its 2015 CO2 emissions at 660 million tons, 30% above the 2010 emissions with the final permission from the central government (City Asset Partnership). However, the other six regions have only made public their plan to reduce carbon intensity so far. Shanghai, Tianjin, Hubei, and Chongqing committed to reduce 17%. Beijing, the capital of China, is expected to cut 18% and Shenzhen, the smallest emitter and the only non-provincial-level city, has an ambitious 21% intensity reduction target.\(^4\) The project team’s calculations based on the carbon intensity and annual GDP growth rate target by each local government plus the estimates of a recent Thomson Reuters Point Carbon on 2010 emissions (Chai) reveal that the total amount of emissions of the seven regions will reach approximately 2,126 million tons at the end of 2015, equivalent to about 25 percent of China’s total emissions (Table 1).\(^5\)

Similarly, the caps for ETS pilots have not been publicly announced thus far. Since the cap on emissions determines the scarcity of permits and their price, it is of critical importance to define the cap appropriately in each of the pilot markets. As the ETS pilots are expected to launch over the next 16 months at the latest (K. Chen, Reklev, and Allan, “China’s Guangdong Names 239 ETS Participants”; Reklev and K. Chen; Reklev and Valerie), the overall cap of each region’s pilot should be known soon. Our simple calculations using the Thomson Reuters Point Carbon’s (J. Yang and Kwiatkowski) estimates anticipate the amount will be approximately 922 million tons in total,\(^6\) accounting for around 11 percent of the country’s overall amount of carbon emissions expected in 2015 (Table 1). We use a growth projection that is articulated in the FYP of the central government. However, it should be noted that the Thomson Reuters Point Carbon’s

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\(^4\) Shenzhen is also the first in China to have announced its start date of ETS pilot on June 17, 2013. (Anderson)

\(^5\) IEA data was used for the estimate of China’s total emissions in 2010. (International Energy Agency)

\(^6\) Bloomberg New Energy Finance forecasts that it will reach 800 million to 1 billion tons by 2015. (J. Yang and Kwiatkowski)
estimates for the proportion of emissions covered by each pilot are based on the emissions in 2010. Hence, they have clear limitations for calculating future emissions. Furthermore, during one interview by the team, the expert pointed out that the actual cap would be set per sector based on sector growth projection. Moreover, another expert expects the actual caps to be more conservative, although some of the pilots might be more progressive such as Beijing, which is better prepared to reach “peak” emissions in the medium term. A tendency for the governments to set a GDP growth rate target at a lower level than the actual growth rate further would certainly enlarge the gap.

Table 1: Emission Targets and Estimates of Seven ETS Pilots

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Beijing</th>
<th>Tianjin</th>
<th>Shanghai</th>
<th>Guangdong</th>
<th>Shenzhen</th>
<th>Hubei</th>
<th>Chongqing</th>
</tr>
</thead>
<tbody>
<tr>
<td>12th Five-Year GDP growth target (%)</td>
<td>8</td>
<td>12</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>12.5</td>
</tr>
<tr>
<td>12th Five-Year carbon intensity target (%)</td>
<td>18</td>
<td>17</td>
<td>17</td>
<td>18.5</td>
<td>21</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Emissions from energy sources in 2010 (Mt CO2)</td>
<td>121</td>
<td>159</td>
<td>254</td>
<td>520</td>
<td>74</td>
<td>356</td>
<td>167</td>
</tr>
<tr>
<td>Emissions from electricity in 2010 (Mt CO2)</td>
<td>178</td>
<td>250</td>
<td>573</td>
<td>754</td>
<td>119</td>
<td>577</td>
<td>301</td>
</tr>
<tr>
<td>Emissions covered by the ETS (%)</td>
<td>146</td>
<td>233</td>
<td>310</td>
<td>615</td>
<td>94</td>
<td>479</td>
<td>250</td>
</tr>
<tr>
<td>Emissions covered by the ETS (% of total)</td>
<td>50</td>
<td>60</td>
<td>43</td>
<td>42</td>
<td>54</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Emissions covered by the ETS (% of total)</td>
<td>73</td>
<td>140</td>
<td>133</td>
<td>256</td>
<td>51</td>
<td>167</td>
<td>100</td>
</tr>
</tbody>
</table>

* Thomson Reuters Point Carbon estimates (Chai) / ** Project Team calculations

2.2.2 Trading Sectors Covered and Thresholds

Given the fact that electricity generation accounted for 44% of China’s total CO2 emissions in 2010 - a higher level than the global average - (Baron, André Aasrud, et al.), it’s natural and essential for all of the seven pilots to include the power sector. However, certain
characteristics of the Chinese power sector such as government-regulated electricity prices, heavy dependence on coal, state-owned enterprise dominance, and inefficient small and medium-sized generators (Baron, André Aasrud, et al.) require more detailed analysis. The implications of these unique characteristics on ETS in China will be further discussed later in the report. In addition to the power sector, major carbon-emitting sectors including heating, iron, steel, cement, petrochemicals, metals, textiles and paper production are covered across the board.

Other sectors are also included, reflecting the industrial structure and major emission sources of each pilot. For instance, Beijing includes major public buildings and the Tianjin pilot covers oil and gas exploration enterprises. The Shanghai pilot is scheduled to include airlines, ports, airports, and railway as well as commercial, hotel and financial sector buildings. While Hubei includes automobile manufacturing in the pilot period, Guangdong plans to include transportation, construction and the building sector only from 2015 onwards. Different sectors might call for different approaches. According to one Beijing-based expert, Shenzhen plans to have a separate scheme for the building sector that is small in scale, and thus could be more easily dominated by a small number of building owners, causing difficulties to policy-makers. However, how ETS works in different sectors and/or at different administrative levels is definitely one of the important aspects the central government intends to look at through this market-based experimentation.

In most of the pilot schemes, the threshold level for inclusion is 20,000 tons of CO$_2$ (tCO$_2$) per year with the exception of Beijing at 10,000 tCO$_2$ per year and Hubei at 60,000 tons of standard coal equivalent (tSCE). These levels are calculated including both direct and indirect emissions. In addition, there are separate thresholds for mandatory reporting of emissions in Shanghai and Guangdong at the level of 10,000 tCO$_2$ per year, and in Hubei above 8,000 tSCE.
per year. Depending on the reduction target and threshold level, the number of emitters covered by each ETS pilot ranges approximately from 120 to 830 entities. Shanghai announced its first round list of 197 companies to be included in the pilot while Guangdong and Shenzhen named part of the participants, 239 and 417 respectively. (Shanghai Municipal Development and Reform Commission; M. Y. Li; K. Chen, Reklev, and Allan, “China’s Guangdong Names 239 ETS Participants”) Including entities subject to mandatory reporting, those covered reach 850 in Shanghai and 1,850 in Guangdong respectively.

2.2.3 Allocation and Offset Credits

The standard method for distributing allowances is “grandfathering”, based on historical emissions data in the past few years, with consideration of sector characteristics or mitigation costs. However, for the purpose of price management and cost containment, the local governments of Tianjin, Shanghai and Hubei may reserve some allowances. At the same time, auctioning may be used as a complementary method in Beijing, Tianjin, Shanghai, Shenzhen, and Guangdong pilots for a small portion of allowances. Shenzhen plans to increase the portion towards full auctioning in the future. Hubei is unique in that it will reserve 20% of initial allowances for early action rewards. Banking is also expected to be allowed in Beijing, Shanghai, and Guangdong during the pilot phase.

Nationally approved project-based carbon offset credits such as China Certified Emission Reductions (CCERs) may be allowed in Beijing, Tianjin, Shanghai, Hubei, Guangdong, and Shenzhen. In addition, Chongqing and Guangdong are likely to include carbon credits from forestry projects as eligible offsets, while Shenzhen will include offset credits from renewable investment projects by Shenzhen investors in western China. In March, 2013, The NDRC

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7 Hubei province will only allow offsets generated within the province. (K. Chen and Reklev)
published a list of 52 project types that can generate eligible offset credits in regional carbon markets, including the construction of wind and hydro power plants as well as the destruction of HFC 23 at refrigerant plants in China (National Development and Reform Commission, “国家发展改革委办公厅关于温室气体自愿减排方法学（第一批）备案的函”). In terms of quantitative restrictions, in the Tianjin ETS, the ratio of offsets to total permits would not be more than 10% (K. Chen and Reklev). No specific figures in the other regions are publicly available at the moment, but it is presumed that allowed offsets will be mostly in the range of 5-15% (K. Chen and Reklev). Strongly driven by the central government's initiative to reduce its domestic carbon intensity, the pilots and potential nation-wide ETS are not likely to allow UNFCCC CERs from countries other than China to be eligible in the near future.

A common view among the experts interviewed is that the seven pilots are not likely to trade actively, particularly at their early stages due to free allocation of allowances, combined with a limited level of permit auctioning. Local governments are politically constrained from imposing a stringent allocation due to consideration of impacts on their economies. For instance, too strict an allocation can cause industry complaints and resistance due to a corresponding rise in total production costs, leading likely to implementation problems without strong penalties. In addition, eligible offset credits from various types of projects could contribute to a slow evolution of the pilots, while lowering the need of emitters to actively trade permits in the markets. One expert expressed his concern that particularly “HFC 23 offset projects will flood future CCER market” in China.” Ideally, allowance distribution and offset limits would be set

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8 One worrying issue is that few facilities have complete records on what they have emitted in China, and thus there is a high possibility that allowances are generously distributed with emitting entities demanding more than their historical level. (C. Liu)

9 It is generally known that a higher level of auctioning lead to a more liquid market by causing participants to trade permits more often than otherwise. One expert anticipated, with caution, that domestic financial institutions, let alone foreign ones, would not have access to these incipient markets, resulting in less liquidity.

10 This was one of the main reasons for a steep fall in international offset credit prices in 2011, affecting negatively EU ETS. (K. Chen, Reklev, and Allan, “China to Allow HFC 23 Offsets in Domestic CO2 Markets”)
with consideration of both historical emission level and carbon intensity target in each locality, but political considerations may encourage provincial governments to set their caps too generously.  

2.2.4 MRV and Enforcement Mechanisms

A credible emissions measurement, reporting and verification (MRV) system is a prerequisite for an ETS to be successful. Each of the seven pilots has been working on completing its guidelines for carbon emissions measurement for entities, building an emissions inventory, and requesting verification by a third party, mostly government-run institutes such as National Climate Centre in Beijing and Tianjin Low Carbon Development Research Centre. Enforcement mechanisms and penalties have not yet been specified - Shenzhen is the only pilot to stipulate penalty provisions so far. According to Article 8 of the Shenzhen ETS bill, companies failing to surrender enough CO₂ permits to match their emissions will be fined three times the market price for permits (Shenzhen City Council Standing Committee).

The MRV system is not new to China. According to interviewed experts, the Clean Development Mechanism (CDM) projects generated relevant methodologies and protocols that are adapted to the pilot ETSs with further refinements. For instance, MRV methodologies that have been applied to CCER in the past would be useful resources for the ETS pilots. However, data and transparency is still a concern about the MRV systems due to the insufficient amount of data collected, as well as its quality and integrity. Mandatory reporting, an important data source and regulation tool, has been introduced in Shenzhen and Shanghai, in addition to the publication of accredited verifiers. Mandatory reporting is expected to be implemented in other provinces by

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11 For instance, in the case of Shenzhen with 21 percent of carbon intensity target over 5 years, after adjusting for its 10 percent of annual GDP growth rate, 79 to 100 percent, depending on different factors affecting each sector and other emission reduction policies, could be freely distributed.
end of 12th FYP. The Chinese ETSs are creating its own capacity to manage MRV systems training, personnel. Thus, major international certification providers will have limited involvement.

2.2.5 Institutions Involved

The national and local Development and Reform Commissions (DRCs) are the main coordinating government entities for each of respective pilots. Related government commissions and bureaus, for instance, Finance Bureau, Forestry Bureau, and State Asset Commission in the case of Chongqing, participate as well. In the process of designing the policy framework, research institutions including universities and institutes, public and private associations, and existing commodity exchanges in each region are also involved. Existing energy and environment exchanges such as China Beijing Environment Exchange, Tianjin Climate Exchange, Shanghai Environment and Energy Exchange, Wuhan Optical Valley United Property Rights Exchange, China Shenzhen Emission Rights Exchange, and Guangzhou Emission Credits Exchange, are expected to further develop their trading platforms.

The development of market infrastructure for the ETS in China is complex due to the multiple institutions, companies ownership type (e.g. SOEs) and levels of jurisdiction (e.g. national, provincial and cities) involved. There are also concerns about market manipulation. For instance, while the Chinese exchange operators of the respected pilots are actively participating in the overall design of the national ETS, there is hesitation to allow financial institutions to participate as liquidity providers. Since it is foreseen that only a primary market will be established at the moment without a secondary market, only spot prices will be generated (Chai). Thus, it is early for any financial institutions including those from foreign investors to participate actively, according to one of the experts. In addition, the China’s Securities
Regulatory Commission (CSRC) will not allow real time/electronic trading but only Over-the-Counter, restricting the market activities even further.

The relationship between the State-Owned Enterprises (SOEs) and the regulatory body is perhaps another concern. Experts mentioned that it is expected the SOEs will be treated/regulated as private companies, however this might not be always the case. This would cause potential conflict of interests, particularly in the highly controlled electricity sectors, impacting the effectiveness of the pilot ETSs. Furthermore, there are still unsolved issues in the inter-institutional relationship and the regulatory framework of these emerging Chinese ETSs, creating uncertainties about this experimental phase.

2.3 Comparing the Chinese ETS with the California and EU ETS

Based on the International Carbon Action Partnership (ICAP) ETS map-database (ICAP), the Overview of Climate Change Policies and Prospects for Carbon Markets in China (W. Wang) and our experts’ opinions, the following comparisons among the emissions trading schemes (ETS) of China, the EU, and California are identified.

With regard to the timeline, China is a latecomer. The EU ETS was launched in 2005 while the California ETS, had a long preparation process before its ETS was adopted in January 2013 following an initial decision in 2007. In contrast, the seven pilots in China emerged only two years after the NDRC’s 2011 announcement of the effort in the 12th Five Year Plan. Having responsibility for designing and implementing an ETS requires far more input and governance than China’s participation in the Kyoto Protocol and the Clean Development Mechanism. Like the EU and California, all the pilot ETS programs in China are mandatory. They typically cover major GHG emitters, principally the power/electricity sectors (upstream and downstream)
including both direct and indirect electricity. However, the details of how this will be done in relation to allocation, and the avoidance of double-counting, has not been finalized yet (“ICAP’s Interactive ETS Map”). The numbers of emitters covered in China’s pilots are in the range of 100 to 830, making a total approximate of 2300 – 2637 companies (W. Wang), while California includes 350 entities at present (although additional entities will be covered starting in 2015), and the EU ETS more than 11,000 power stations and manufacturing plants in the 27 EU states.

The gross GHG emissions expected to be reduced in the global emissions trading schemes varies in terms of metrics and sectors covered. The California ETS anticipates abating 457 MTCO₂e (excluding LULCUF) compared to 1990. For example the EU ETS sets absolute targets of a 20% carbon emission reduction by 2020 and an 80-95% reduction by 2050, compared to 1990 levels. The EU ETS has been working with annual basis as following: 4.6m, 4.7m and 4.6m tCO₂e respectively in 2009, 2010 and 2011. In contrast, the GHG emission targets for the Chinese ETSs use different units, for example a reduction in carbon or energy intensity, specifically carbon intensity at national level. The Chinese ETS pilots cover only CO₂, with no regulation of other GHGs, while the EU and California ETS do have specific regulations on other gasses. For example, California includes CO₂, CH₄, N₂O, SF₆, HFC, PFC, NO₃ and other fluorinated GHG.

The banking and borrowing of carbon credits is limited in most of the ETS schemes. Borrowing is more limited than banking in the all the three ETS markets discussed, principally in the EU ETS, where full banking of EUAs is allowed between Phase II and III, but there was no banking between Phase I and Phase II/III. However, borrowing is not allowed. The EU allows member states some discretion. With regards to offsets and credits, the EU ETS is still open to UNFCCC-recognized offset credits of many CDM/JI categories; however, there is a quantitative
limit of the number of offsets, with restrictions varying according to the EU members. There are also some exclusions based on project type; forestry projects, projects involving the destruction of HFC-23 and N₂O are excluded, and large hydro projects are subject to additional requirements. Also, only CERs from projects registered prior to the end of 2012 or from later projects in the Least Developed Countries are eligible for compliance. The California ETS and Chinese pilots are open only to domestic offset projects.

Other important differences between the seven ETS in China and the EU ETS include the intention to cover the building sector under some Chinese ETS (e.g. Beijing), the plan to introduce price floors and ceilings in some ETS pilots, the government plans to set aside an amount of permits (15%) to regulate the market, and the possibility that the government may pay third-party verification fees to avoid conflict of interests between verifiers and clients (W. Wang).

The implementation history of EU ETS and the California ETS has generated some useful lessons for the design and improvement of emerging ETSs in China. However, because of the EU and US market and business environment operate more freely than in China, there are differences. For instance, in the national targets, the carbon intensity defined in the 12th FYP in China gives more flexibility for economic growth policies to take precedence, while the EU ETS has a more straightforward absolute CO₂e targets in its cap-and-trade scheme. The ETS option in China comes after some strong and successful and at time costly command-control policy based on energy intensity during the past years. While China has the power to enforce emissions reduction through the pilot ETSs, the EU ETS and California programs are more dependent on the free market dynamics, presenting differences in the government influence on the ETSs. Perhaps one of the most important lessons of the EU ETS and the California ETS would be the reactions and resilience of this market-based mechanism in a context of international economic
crisis.

2.4 Interaction with Carbon Tax

Recently, there has been a debate over introducing a carbon tax in China that was initiated by Jia Chen, head of tax department, Ministry of Finance (MoF). In February 2013, he published an article advocating that China would proactively introduce a set of new taxation policies designed to preserve the environment, including a tax on CO₂ emissions (Qiang). According to Chen, the government is also looking into the possibility of taxing energy-intensive products such as batteries, as well as luxury goods such as private aircraft. In order to conserve natural resources, the government will push forward resource tax reforms by taxing coal based on prices instead of sales volume, as well as raising coal taxes. In fact, this is not the first time a carbon tax was mentioned by the ministry. In 2010, MoF experts suggested levying a carbon tax in 2012 at 10 RMB per ton of carbon dioxide, increasing to 50 RMB per ton by 2020, which was not adopted (Qiang).

On the one hand, the introduction of a nation-wide or localized carbon tax could make the Chinese ETS pilots more effective and efficient than otherwise, as local governments would have an additional policy instrument to impose a price on the emissions from sectors not covered by the ETS. This change would alleviate competitiveness concerns and help to prevent a possible carbon leakage from ETS participating to non-participating entities within the same region or to those in non-pilot regions. In addition, with a progressive increase in the tax rate giving a long-term price signal, emitters, driven by the need to cut costs, would be encouraged to develop or deploy emissions reduction technologies. Inefficient entities, however, are forced to

12 In the case of Sweden, a carbon tax, charged only to non-ETS sectors and households, has increased from 7 and 11 to 34 and 29 euros per ton respectively since its first introduction in 1991 while holding total tax burden unchanged by reducing income taxes. (Altmann et al.)
buy the permits that efficient ones sell on the market. A few experts we interviewed said that the two policy instruments could be complementary not necessarily contradictory, which might be the intention of MoF.

On the other hand, having both a carbon tax and an emission trading program may be seen by industries as duplicative and overly-burdensome. It is also possible that too much price intervention could prevent the ETS from functioning as a true market, presumably resulting in less efficiency and cost-savings. While some experts were in favor of a taxation approach to carbon reduction, the majority of the experts interviewed for this project were skeptical of the idea of introducing a carbon tax in parallel with ETS in China. One expert interviewed expressed his concern by saying that a carbon tax would make China’s carbon emissions reduction plan more complicated because there are already a lot of issues to be solved regarding the ETS markets, so “it is too ambitious for China to have both ETS and tax at the same time.”

At this time, it is too early to predict the impacts of a potential carbon tax on the ETS pilots and ultimately the national ETS. If it is imposed, design details such as starting time, tax rate, coverage, coordination mechanisms between tax and ETS, (none of which have been known to date), will critically determine the combined effects of the two policy instruments to mitigate carbon emissions. In fact, the current debate surrounding a carbon tax in China seems to be more of a conflict of interests between two government agencies with different policy mandates rather than an issue of actual implementation, particularly since the recent ascension of the new leadership to power. As one analysis concluded, it would be more reasonable to say that “depending on the progress and the reception of the pilot ETSs, the attention around carbon tax

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13 For reference, for the first time, the UK recently introduced a carbon price floor policy which requires companies to pay, in the form of a tax, the differential between the prefixed floor price (starting from £16 per ton this year and rising to £30 by 2020) and the EU-ETS permit price, causing concerns on UK firms’ competitiveness.(Clark and Tighe)
might heat up again during the 13th FYP period (2016-2020),” and “at that time, if carbon trading appears to be too challenging, …the State Council could consider carbon tax as an alternative emission control policy tool (Chai).”.

III ELECTRICITY AND ENERGY MARKET IN CHINA AND ITS IMPLICATION FOR EMISSIONS TRADING

3.1 Electricity Market in Brief

China’s economic growth depends on the development of the electricity sector. In the past several decades, it has seen tremendous growth in the electricity sector, with total installed generating capacity reaching 1144 GW, and the annual output of electricity growing to 4,230 GWh in 2011 (Information Office of the State Council). Since 2009, China has ranked number two in the world, after the US in terms of both installed capacity and electricity produced (Ma). Projected demand for power in China is perhaps even more important. Demand for electricity in China is growing more rapidly than the economy. The China Electricity Council estimates in 2013 that demand for electricity will increase 9-10% per year, while targeting at a 7.5% economic growth (China Electricity Council). This increased demand for power makes achieving the energy and carbon intensity goals more challenging, in that the absolute increase in electricity needed is so great, but rising demand also creates many opportunities for investment in cleaner power.

China’s electricity sector depends heavily on fossil fuels (EIA). About 71% of installed capacity (or 79% in generation capacity) came from fossil fuels in 2011, dominated by coal with 65%, oil and natural gas each contributing 3% respectively, followed by 22% from hydropower (EIA). Traditional thermal plays a key role in electricity generation and shows rising carbon emissions (Graph 2). The trend will not reverse in the short term due to the abundance of coal
(although China changed from a net exporter of coal to a net importer for the first time in 2009) and the growing demand for energy to support a fast-growing economy and improvement in living standards. The emissions reduction potential in the electricity sector is discussed further in Section 3.4.

**Graph 2**: China’s electricity generation by fuel type, 2000 – 2010 Source (US Energy Information Administration International Energy Statistics)

3.2 Coal Market in Brief

In 2010, China produced 3.19 billion metric tons of coal, while consumption was 3.23 billion. The gap is filled through imports. The three sectors that use the most coal are power generation, coking (for steel production), and heating. These account for 48%, 15% and 5% of total consumption respectively (CS Bureau).

China’s heavy reliance on coal and other non-renewable energy is likely to continue for this decade. In the Twelfth Five-Year Plan, 2011-2015, the government committed to reduce energy consumption per unit of GDP by further 16%; and reduce CO2 emissions per unit of GDP by 17% (Baron, André Aasrud, et al.). Given the roughly equal drop in energy and carbon
Emerging ETS in China

Capstone RNK Capital

intensity, coal will likely remain the dominant source of energy. Thus understanding China’s coal market is crucial for analyzing China’s emission trading system.

Domestically, coal is mainly bought and sold through the following means (Yushi, Hong, and Fuqiang):

• The National Coal Ordering Meeting, organized by the National Development and Reform Commission, Ministry of Transportation, National Bureau of Safe Coal Production Supervision and China National Coal Association to provide a unified trading market for coal producers, consumers and transporters.

• Regional trading centers such as Taiyuan Coal Trading Center, South China Coal Trading Center and Qinhuangdao Coal Trading Center; these are large scale trading markets in which registered national or regional players participate, including coal suppliers and consumers.

• The above two platforms account for 48% and 44% of coal traded domestically, the remaining 8% is captured by the one-on-one trading between coal producers and consumers based on a long-term relationship.

Currently, there is only a futures market for coking coal, (which has been purified and refined for steel manufacture), and not for the energy market power generators generally acquire coal in three ways (B. Wang): (1) through three-way contracts, under government-guided prices signed by coal, electricity, and transportation entities together, with a transportation guarantee provided by the Ministry of Railways (Ministry of Railway was merged into Ministry of Transportation in 2013); (2) contracts under government-guided prices but without a transportation guarantee, which have a greater chance of default due to transportation limitations; and (3) from the coal market, arranged by generating firms themselves. The first two contracts
are signed in a Coal Ordering Meeting once a year under the coordination of the central government. Coal for electricity is coal that meets a certain calorific value. The majority of China’s coal production is high calorific. Without regulation, coal for electricity and coal for other usage are in the same market. However, as a result of government intervention in the coal market, prices of coal for electricity generation have historically been lower than the market price by around 10% to 30%, depending on their sources (L. Zhang). Since most of the suppliers of coal to electricity generators are state-owned, this could be viewed as a government subsidy to the electricity tariff. However, coal producers have no incentive to provide additional coal beyond their mandated quantity to generators in times of high demand which leads to power failure. On Dec. 25, 2012, the NDRC issued a new policy aimed at fully liberalizing China’s thermal coal pricing mechanism (Pu). The new policy eliminates the government's role in setting the price for coal for electricity. In particular, the NDRC intends to encourage coal suppliers and power plants to sign medium- or long-term contracts with durations of three to five years during the annual thermal coal contract meetings. This movement marks the end of China’s dual track price mechanism for coal.

China’s coal price is composed of two major parts: mine mouth sales price and transportation, with the latter accounting for more than half of the delivered price (Morse and He; Tu). The reason for high transportation costs in China lies in its geography. Most of China’s coal production is concentrated in the west and the north, especially in the provinces of Shanxi, Shaanxi and Inner Mongolia. However, coal consumption is mostly located in the coastal areas in the east and south. The majority of the transportation is done in two-steps. Coal is first transported by rail from hinterland production sites to Qinhuangdao, and then shipped by sea to southern coastal provinces. This transportation pattern is driven by two factors: first, coastal
transportation is cheaper than railway, and second, there is bottleneck in railway capacity, especially for transportation from the north to the south.

Internationally, transportation also accounts for a significant share of the total delivered cost of coal, and effectively divides the world coal market into two regional markets: Atlantic and Pacific. China has become an increasingly active player in both these markets, and trades with other countries in the transpacific region. The two major global coal-exporting nations in the region are Indonesia and Australia. While these countries are located at long distances from China, there is lower cost for sea storage. Coal buyers in Southeast China therefore have two options: to buy domestic coal delivered by sea from Northern Chinese ports, or to buy international coal. This arbitrage opportunity allows Chinese coal buyers to take advantage of the price differential between domestic and international coal prices. Graph 3 shows the Dry bulk freight rates for shipping coal to Guangzhou from various sources. The figure shows that the shipping cost from China’s main coal importing countries are close to the cost of shipping coal from Qinhuangdao. The reason for this is that smaller boats are used for coastal shipping in China’s domestic routes, while international routes use larger boats and cost less on a per unit base. Since there is no systematic difference on shipping costs, the relative competitiveness of coal from various sources depends on the local production price. In another words, from the perspective of a power plant in southern China, coal from Australia or Indonesia is perfect substitute for coal from Qinhuangdao (which is actually coal transported from Northern China by railway). As a result, we see from Graph 4 that the price differentials between China’s domestic price (QHD, Qinhuangdao) and the price in Russia, Australia and Indonesia are small after the adjustment of import tariffs and transportation costs.
The implementation of ETS or a carbon tax could have impacts on both China's domestic coal market and demand for coal imports. Presumably, imposing a carbon price on coal will lead China to use and import less coal. A carbon price on coal could effectively reduce China's coal demand and prices in the short run, while having a relatively smaller effect on China's major coal exporters (They could export the coal to other coal importing countries in the Asia Pacific region like India or Japan). The coal price excluding the carbon price is likely to drop more in China's domestic market than in Australia or Indonesia. (The exact magnitude will depend on the supply and demand elasticity in these markets). Thus, imposing a carbon price on coal will lead China to use and import less coal.

**Graph 3:** Dry Bulk Freight Rates from FOB Ports to Guangzhou (GZO) Port in China. Rates are based on historical quotes for specific shipping routes. All international quotes are based on capsize vessels; China domestic quotes are based on 40-50,000 dwt vessels. Source (Morse and He)
Graph 4: – Energy Equivalent Coal Price Indices (6,700 kc/kg GAD). Source (Morse and He)

3.3 Emission Reduction Potential in Electricity Market

Looking at carbon emissions directly relating to the electricity sector, there are four key drivers of carbon intensity reduction:

The first measure to improve carbon emission intensity is to improve generation efficiency. For the past decade, China has been closing down smaller scale generators to improve efficiency via the policy “Closing down small and building large”. This policy is one of the most important policies for the power sector in the 11th Five-Year Plan, and it has been continued in the 12th Five Year Plan. By 2010, power plants with generation capacity below 300 MW will contribute to 26.8% of overall coal-based power generation (Baron et al.). In 2005, one study estimated that Chinese coal-fired plants were nearly on-par with the average efficiency of the aging US power fleet, and were about 17% less efficient than the most efficient country, Germany (Cai et al.). Standard coal use per kWh in 2012 is on average 326g/kWh, a 3g decline from 2011. While there are many methodologies to calculate power plant generation, one case study from the OECD/IEA shows there is potential for further improvement of overall efficiency
by adjusting the dispatch order of different power plants by their efficiency level. An official report from the China Electricity Council co-published with NRDC (Z. Wang et al.), suggests that Chinese coal-fired plants have already attained an average coal consumption level on par with international standards. More importantly, more than 70% of current installed capacity has been built within the past ten years, leaving little room for additional efficiency improvement at individual plants, meaning the strategy of closing down smaller plants cannot continue to deliver major results much beyond the 12th Five Year Plan. This view is echoed by the expert interviews conducted. In the meantime, China is actively experimenting with new clean coal technologies such as supercritical and ultra-supercritical systems, integrated gasification combined cycle (IGCC), liquefaction of coal, and carbon capture and storage (CCS).

Transmission and distribution efficiency improvements will be determined by other players in the power sector. Although the sector has attracted significant investment, it “has been mainly focused in … generation capacity but not sufficient in infrastructure development,” (H. Yang). There are plans to develop a high-voltage transmission network, which could more efficiently transfer hydro power from western regions to the east. However, it is unclear what incentive the emissions trading schemes would have on major infrastructure projects of this kind, particularly given that the pilot schemes would cover only a small portion of demand. One report from the China Electricity Council (Z. Wang et al.) argues that, similar to generation technology, efficiency in transmission and distribution has improved significantly already and that the current efficiency loss from transmission is about 6.53% in 2010 lower than countries like England, Australia and close to the US’s standard. Hence, if the transmission and distribution system is already operating at high level of efficiency, this presents limited room for improvement.
Beyond efficiency improvement, the next possibility is fuel shifting. As noted earlier in this paper, coal is the dominant fuel for the Chinese power sector due to its low cost and abundance. Although the government has ambitious targets for the expansion of wind energy and other renewable energy, the absolute expected increase in megawatt hours generated is still rather limited. China’s Copenhagen Accord pledge includes a target to meet 15% of its primary energy demand from non-fossil source by 2020 (Brown et al.). Hydropower is the number one resource in this category, and by 2010 contributed to over 23% of total generation capacity, or about 16% of total generation in kWh (Z. Wang et al.). Based on “China’s Energy Policy 2012” (Information Office of the State Council), the installed generating capacity of hydropower reached 230 GW in 2011, ranking first in the world. Wind is the second most important non-fossil energy resource in China, with 75.5 GW of installed capacity in 2012, also ranking the top in the world (GWEC). Based on the latest targets, China has ambitious goal for non-fossil fuel power generation for 2020, counting about 33% from renewable and nuclear (and nuclear counts for only 13% the non-fossil fuel mix), in terms of generation capacity (Baron, Andre Aasrud, et al.). While this growth in non-fossil energy is very impressive, 67% of electricity is still expected to come from thermal sources in 2020.

The above discussions on generation, transmission and distribution efficiency and fuel switching are from the electricity supply side perspective, but there is also potential to reduce emissions on the demand side. Demand response presents a complex landscape, with over 77% of electricity consumption in China coming from industrial and commercial users and about 11% from household users, with the rest going to low-income regions and agricultural users (L. Zhang). Differential pricing is in place for industries and households to encourage more efficient use of electricity. Regarding electricity usage in industry, the most important policy is the
differential pricing targeting eight energy-intensive sectors, such as cement and iron-and-steel. Under the differential pricing policy, the enterprises in the respected sectors are categorized into four categories – “disallowed”, “restricted”, “allowed” and “encouraged” based on their technology used. Companies in the latter two categories pay the normal rate for electricity, while those who fall into the first two categories are charged a premium rate, which also has increased through time. Based on a report on the impact of this policy (Junfeng Hu et al.), during 2004-2009, it accounts for a drop of about 115 TWh in electricity use, representing a 10% energy savings compared to the base-case. However, the same demand-response may not carry over to non-industrial sectors; the Center of Research for Public Policy in China (Jungfeng Hu) conducted a recent study on the effect of electricity price increase on households usage, and found that residential users are less responsive to price changes, with a 1% increase of electricity prices leading to a decrease in demand of only 0.186%.

Since the power sectors will be included in the ETS pilots, a functioning ETS in theory could impact all areas above for the power sector, depending on how robust the market is and the price level. However, in practice how an ETS will interact with the power sector is subject to other considerations such as the political cost of raising the electricity price, which will be discussed further in the next section.

3.4 Pricing Scheme of the Electricity Market

An important principle driving policies in China’s electricity market is the notion of a “social contract,” or commitment to “balance the multitude of interests of different stake holders” (Ngan). In particular, the government wants to ensure that prices do not increase too rapidly for consumers or industry, while still ensuring that utilities and generators receive enough revenue to operate sustainably and to invest in continued growth. Electricity was once managed
solely by the electric power bureaus of central (and then later, provincial) governments. Since 1995, important legislation such as the Electricity Law has been implemented to reform and regulate the sector. In 2002, China’s State Council changed the landscape of the sector, by ending the monopoly of the State Power Corporation (SPC) and dividing it into two electric power grid operators/utilities, five electric power generation companies and four relevant business companies (Figure 2). This group of five power generation companies owns 50 – 60% of generation assets. With the other five major power companies such as China National Nuclear Corporation and China Three Gorges, these 10 state-owned companies totaled 450 GW of installed capacity in 2008, out of total 780 GW for the whole country, representing almost 60% of the power sector (Baron, André Aasrud, et al.).

Figure 2: Current Structure of China Electricity Market. Source (John Loffman)
The pricing scheme of the electricity market reflects the compromise of interests among government agencies (central and local) and the stakeholders active in the value chain of electricity supply. There are five parties involved in the electricity value chain: central and local Development and Reform Commissions, the coal producers, the power producers (generators), the grid operator/utilities (State Grid and China Southern Power Group), and the end-users (L. Zhang). Government is involved in the market both at the stage of generators selling power to the grids, as well as setting the retail price from grids to the consumers (L. Zhang). The retail price of electricity depends upon the wholesale price paid by grid operators to generators, and this price itself depends on underlying fuel (coal) costs.

On-grid prices are generally set by the price bureau of the NDRC, which allows the power producer to cover its costs and earn a profit margin of 8-12% return of equity for further investment. The pricing formula is based on industry average costs, so each generator has an incentive to lower their costs and improve margins. The NDRC’s pricing formula reflects the varying levels of economic development across the regions. Yet there are still price differences across generators in the same region. The individual prices in a power purchase agreement are negotiated between individual power generators and the state planner. The price differences across generators are negatively correlated with profitability and price, which suggests that the states compensates less profitable producers to “balance” the different players and incentivize further investments. This “balanced” pricing could function as an unofficial feed-in tariff for renewables and for highly efficient (but more expensive) coal gasification generators (L. Zhang).

End-user prices are also set by the NDRC, typically in consultation with local government. There is not one price per region, but a “catalogue price.” There are adjustments for different end-users. (For example, the price for “poor counties irrigation” was one-quarter of the
price for “commercial service sector users” in 2004). Even among household users, the government has introduced a pilot “staircase” price system in different cities to curb electricity demand. While this multi-tiered pricing model can make it difficult for Chinese utilities to forecast their sales revenue, it also provides an existing system to impose costs (such as those related to efficiency increases and the implementation of an ETS) only on end-users with the ability to pay, while minimizing impacts on lower-income consumers or fragile industries (L. Zhang).

3.5 Imbalance of Electricity Sector in the Seven ETS pilots (Lindner et al.)

Another significant issue for the electricity sector in China is the imbalance of production and consumption across different regions. There are significant differences in accountability for emissions from a production vs. consumption perspective. For example, Beijing imports all of its electricity from outside the municipal area. Hubei is the only pilot ETS area that produces more electricity than it consumes.

On a per capita basis, the calculation is even starker. Not only does Beijing depend largely on out-of-city electricity supply (about 60% according to one expert interview), it also has very high per capita emissions. In contrast, Guangdong is relatively balanced, producing and consuming equal amounts of energy. Even, outside of the pilot ETS schemes, provinces have varying footprints. While Shanghai, Beijing and Tianjin rely almost entirely (90%) on fossil fuel for power generation, Huibei sources less than 50% of its energy from fossil fuel.

In summation, this is an area to consider when determining the details of the ETS pilots. Questions such as 1) whether the emission cap will be also capture “imported” electricity at points of electricity usage; 2) which sectors and companies will be required to participate in the
pilots; and 3) how to account for indirect emissions in the case of manufactures, as well as buildings. There are unfortunately no detailed answers released yet on those specifics.

3.6 Other Policy Instruments

There are also other policies in China that impact the power sector; the important ones are highlighted below:

- The closure of small coal plants, as discussed earlier in this paper; during the period of 11th Five-Year Plan, 76 GW of smaller plants were shut down, 53% more than the target stipulated in the plan (Z. Wang et al.).

- Support for the development of renewable energies through a quota, such as a mandatory renewable energy obligation of 3% output for power companies (Baron, Andre Aasrud, et al.) or a feed-in tariff for wind and solar (Baron, Andre Aasrud, et al.). China could also make direct investments into renewable energy.

- Controls on other pollutants such as NOx and SO₂ control, including a trading market for SO₂, could provide lessons for domestic emissions trading.

- A trial implementation of the “Energy Saving Power Dispatch Method”, which aims to change the current system by prioritizing daily unit commitment for conventional thermal generators on the basis of heat and emission rates (Kahrl, Williams, and Junfeng Hu). In theory, such method could bring large carbon saving, as a high-efficiency ultra-supercritical unit with capacity of 1000 MW uses 40% less standard coal compared to a conventional coal-fired generating unit with the capacity of 50 MW (Ding and H. Yang). However in other simulations conducted in the Guangxi Zhuang Autonomous Region, such a scheme only brings a modest
(2-4%) reduction in heat rate, while facing potential political difficulties as most of the smaller scale generators are local government assets while the large ones are national companies (Kahrl, J. H. Williams, and Hu).

- Demand side management policy, such as “1000 Enterprise” program, requires some of the biggest industry players to achieve energy saving objectives. Out of 901 enterprises included in the 2009 monitoring scheme, 96% reached their required targets (Z. Wang et al.). The program has been extended to the “Top 10,000 Enterprises Energy Conservation Program” with actual coverage of more than 16,000 enterprises (World Bank). Another possibility is implementation of “punishment (electricity) price” for companies which are highly inefficient in specific sectors, mentioned one of the experts interviewed, being considered as an extension to the “industry differential pricing” mentioned above.

Overall, there are multiple tools in place to manage the power sector and steer it towards a more carbon efficient future. In contrast to the emission trading scheme which we will discuss further in the next section, most of these tools are more “command and control” style. Many Chinese policy experts have expressed the general sentiment that some of the “command and control” schemes work well and have been effective, such as the “punishment price”, but some less so, such as the “1000 Enterprises” scheme. Fundamentally, although some of the policies, such as supporting renewable energy development, are necessary and complementary to pricing-based incentives, many of the existing pricing schemes are effectively substitutes to a market-based pricing scheme in the power sector.
IV DISCUSSION AND CONCLUSIONS

4.1 Development and Challenges of Seven Pilots

Given the political and economic challenges caused by climate change and the current economic and administrative realities faced by China, it is practical and strategic for China to launch an ETS. In other words, the rapidly rising carbon emissions due to increasing fossil fuel consumption in China are causing not only serious political burdens for the leadership from inside and outside the country, but also huge economic costs on the economy. To address these challenges, ETS, a market-based instrument, could be a timely option for China to take.

The absolute cap of the seven pilots will be around 922 million tons CO₂ in total, accounting for about 11 percent of the country’s aggregated CO₂ expected to be emitted in 2015. However, the actual level is likely to be larger than this number because governments in China tend to set their GDP growth rate targets in a conservative manner, and thus the actual growth rates, in most cases, are generally higher than targets, which, in turn, will lead to a higher absolute ETS cap.

The seven pilots cover major carbon-emitting sectors such as power, heating, iron, steel, cement, petrochemicals, and metals. In addition, other sectors reflecting each region’s typical economic structure and major emission sources are included. Policy-makers in Beijing can gain a good sense of how ETS works under various circumstances, prior to its scheduled nation-wide scheme, which is the very reason these pilots are being attempted despite the local governments’ lack of experience and capacity with regards to permit trading.

Given the possibility of free allocation of allowances, coupled with a limited level of permit auctioning, different types of offset credits, and that financial institutions are not allowed
to access the markets, the seven pilots are not likely to be actively traded at their early stages. Local governments, concerned about negative economic impacts, are potentially politically constrained to impose a stringent allocation, which might face complaints and resistance from industries. As a result, it is anticipated that a gradual approach, as taken in the past economic reform process, would also apply to these newly developing carbon trading markets as well.

The MRV systems of the seven pilot ETSs in China are forming in a record time due to the mandate of the 12th FYP. The acquisition of knowledge and data, training of local human resources and assimilation of the Chinese CDM experience, among others actions, are creating their own MRV systems in an experimental fashion. Each ETS pilot is working on slightly different MRV systems and at different stages of development. Some pilots such as Shenzhen and Shanghai appear to be more advanced.

The market infrastructure is evolving principally based on the directives and guidelines of the central and local governments. In this context, most of the ETSs’ emissions exchanges are established and the MRV systems are in accelerated process of consolidation. It is envisioned that the primary market will be based mostly on free allowances allocation (“grand-fathering”). Since there is no plan to establish secondary market just yet, market liquidity is limited and there will be only spot price generated from the primary market. Currently there are many restrictions on domestic and international financial institutions’ participation in the market, which will impact negatively the market dynamic. Indeed, the trading infrastructure is one of the key challenges of the pilots ETSs. However, since these pilots are trials of market-based tools for emission reductions, there is the chance of adjustments in the ongoing process.
Depending on design details such as starting time, tax rate, coverage, price coordination between tax and ETS, a carbon tax could support or work against the Chinese ETS pilots. It could lower the possibility of carbon leakage among companies and regions. On the contrary, overlapping of a carbon tax and an emissions trading program may increase the burden of the participating industries. At this juncture, there is nothing known regarding such details. In addition, MoF’s mentioning of the possibility of introducing a carbon tax on top of the ETS pilots decided and promoted by NDRC appears to reflect a conflict of interests between the two institutions. Given the fact that the ETS pilots will be implemented gradually over the next few years, it is likely that a carbon tax would not be introduced soon. Only if ETS turns out to be ineffective, the leadership may consider a carbon tax as an alternative to reduce carbon emissions.

The timeline defined by the 12th FYP gained support and commitment from the NDRC and local DRCs. As a result many actions were implemented to put ETS to work on the planned schedule. The central government is intending to launch the national ETS as early as 2016, taking into account the experiences from the 7 pilots ETS. Most of these pilots are expected to be launched between June and December 2013 (eg. Shenzhen in June 2013). However, all experts are pessimistic about the planned national ETS schedule, some expecting it to be launched by 2020. Disregarding the different opinions, the seven pilots are advancing steadfastly to launch the experimental cap-and-trade schemes.

Theoretically, ETSs are intended as a market-based approach to reduce carbon emissions. While there have been advances in introducing market reforms, there are still uncertainties about the effectiveness of a market-based policy because there is a high degree of market intervention by the government in China, which may be a weaknesses of this experimental cap-and-trade
mechanism. Since the 12th FYP have carbon intensity target, it gives flexibility to adjust GHG reductions to the economic growth (national, local and sectorial), then this policy seems to be more economic and socially adequate, than the command control based on energy intensity targets in advancing towards a low-carbon economy. The experts interviewed generally consider the ETS pilots as an opportunity for experimentation rather than an immediate tool to reduce carbon emissions. However the progress of ETS pilots gives a positive signal to the domestic population as well as the international community about the Chinese government’s commitment to tackling climate change.

4.2 ETS and the Power Sector

The complex interaction among the electricity sector, the underlying coal market, and the nascent emissions trading pilot schemes is a topic requiring further study. Six of the seven pilot ETSs have officially announced to cover the electricity sector, meaning that many of the unanswered questions explore in this paper will soon become more pressing. How will the electricity sector participate in the carbon market? Some possible scenarios include the following models:

**Status quo:** Under the existing system, both on-grid wholesale price and end-user electricity prices are determined by NDRC, without the objectives to necessarily minimize marginal cost of generators. Furthermore, the price in the ETS market is largely depending on supply of allowance. In order not to distort the balance between power generators and consumers, the government could initially supply generous allowance to generators, as the allowance is set per sector. If the price is low in the market (especially under the scenario where the market is generally over-supplied with allowance), there is no motivation or necessity for the generators to make changes in production. Alternatively, even if electricity generators need to buy emissions
credits directly from the market, instead of investing in efficiency improvements, as they could negotiate to transfer the cost of carbon price to utilities, which could in turn pass on costs through higher end-user prices. Depending on the extent of price increases, end-users might initially accept higher electricity prices, but may ultimately resist. Given the Chinese government’s serious concern about social unrest, electricity rates will probably not be allowed to rise rapidly. If the government intervenes in the market to keep electricity prices low to industry and consumers, while imposing costs on generators, this could result in significant losses for the power generation sector. The government could use general tax revenue to shore up power generation, which could dampen the price signal of the ETS. In either case, the generators are not incentivized to change behavior. Certain demand side behavior could be seen if the end-user electricity price is allowed to change reflecting the carbon price.

Reform coupled with robust ETS market: If the NDRC continues to push for further electricity sector reforms and let the market decide both on-grid as well as retail (end-user) prices. In this case, the different coal-fired generators will immediately face competition with each other. Admittedly this is not a likely scenario. If the ETS pilots proved to be robust, generators with higher efficiency hence lower marginal cost to generate extra unit of electricity could produce more by buying emission permits from less efficient generators. High on-grid price could also translate to a higher end-user price, hence drive behavior change from the demand side. Whether such changes will boost renewable development depends on many factors, such as the actual carbon price signaled by ETS, the cost of generation through different renewable technologies considering transmission cost, as well as the availability of infrastructure connecting renewable sources to the electricity grid.
**Moderated Reform:** the NDRC and local DRCs continue step-by-step reforms, which could be implemented through relaxing or increase some of the parts based on planning and negotiation to aid the effect of a market scheme. One possibility would be control for limited end-user price changes as well as on-grid price increases, hence transfer the burden of carbon cost at least partially to generators. Alternatively, NDRC and local DRCs can limit or eliminate the differences of on-grid prices to different generators, which in effect work as a subsidy to less efficient generators. Under more transparent price competition, generators of smaller scale, typically also of less advanced technology, could generate shorter hours and sell the emission permits to generators that are more efficient and find it cost effective to generate more capacity with the ETS market price.

One recent study (Baron, Andre Aasrud, et al.) co-published by the International Energy Agency and the Energy Research Institute, which is affiliated with NDRC, supports the argument that emission trading market can have an impact on the electricity sector if the electricity sector could provide the necessary flexibility to work with ETS. Viewing the role of State Owned Enterprises (SOEs) in ETS, the reports points out the drawback that SOEs “may not always respond to economic incentives like enterprises driven by profit maximization”. It makes hard to predict its reactions in facing potential carbon price pressure. However it also states that they typically have “direct access to funding”, which could make such investment decision to change technology more feasible. Most importantly, the paper conducted a simulation with carbon price at 40 and 150 RMB/tCO₂ to evaluate its cost impact to generators. In the case of 90% “grand-fathering” allowance, the cost of buying allowances appears to be moderate (see Table 2).
Table 2: How Large Could the Cost of CO2 be for an USC Coal Plant? Source: Baron, Andre Aasrud, et al.

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Here we assume the managers running the generators are rational and maximize profits, and that the price of electricity is the same given to these different types of generators. Whether or not a sub-critical plant will choose to reduce production and to sell allowance to ultra-super critical (USC) or natural gas plant that are of much higher efficiency, depends on the carbon price. How attractive a particular carbon price is, is based on the difference of CO₂ intensity (or coal intensity). Following graph (Figure 5, this is a Graph not a Figure) shows a specific scenario based on an assumed coal price of 700 RMB/tce and gas price of 1060 RMB/tce, the marginal cost of CO₂ from an additional MWh would be more than offset by increased operating revenue for both USC and gas plants, assuming emission allowance purchased from a sub-critical plant at the price range of 125-225 RMB/tCO₂.
Graph 5: Comparison of CO2 cost with gross operating revenues: USC and gas plant. Source: Baron, Andre Aasrud, et al

Note: Assumes a coal price of CNY 700/tce and gas price of CNY 1060/tce.

However whether such case could happen depends on 1) whether generation plants are working as a rational economic entity; 2) whether flexibility could be seen for electricity price to accommodate carbon price generating from ETS; and 3) whether the cap and allowance would be stringent enough to generate an actual market. We feel that the study advocates effectively on how the NDRC should design the ETS to push for changes in the power sector; however whether this is the actual purpose of the current ETS pilots is unknown.

On the other hand, during our interviews with different experts working in China ETS and other climate policy programs, all but one see real potential of the current ETS pilots bringing real changes to the electricity market. A common sentiment was expressed that an ETS would not be the driver of the reform in electricity market. Although power sector players are to
be included in the ETS, it is likely that they will be given rather loose cap and plenty of free allowances that no further cost pressure will be imposed onto the generators, who are already obviously under pressure from the rising coal price. As discussed earlier, the interviewed experts do not believe that current ETS is the right instrument to reform electricity sector; hence they do not foresee major impacts or changes in the power sector in the short run. It seems flexibility of electricity pricing is not expected in the current reform stage. On the other hand, a highly regulated electricity price might make it hard to implement supply-side improvement through ETS; however it might facilitate the deployment of other demand side instruments.

Another common theme mentioned by the experts that we spoke to was also the necessity to coordinate among these different instruments, such as various policies and the market mechanism, in order to provide predictability and certainty to the very important power sector. As the experts see at least some of the command and control policies as more effective and realistic tools, hence they concluded that ETS would not target to actually reduce emission from the power sector directly.

In general, under all uncertainties in terms of policies, in the next one to two years we do not see ETS to be the main driver of the reform in the electricity sector; depending on the effectiveness of the initial pilots, further reform of the electricity sector by introducing more flexibility in pricing could in return support the development of the ETS.

4.3 Opportunities of International engagement

The emerging Chinese ETSs are designed and for domestic participation only. Thus, opportunities for international organizations and foreign businesses are restricted (eg. emission exchange management, MRV, brokerage and trading). Additionally, these pilot schemes are not
expected to link with other countries’ ETSs, restricting even more opportunities for international trading in the Chinese carbon markets.

4.5 Conclusion

ETS pilots in China mark a new chapter in China’s journey to mitigate climate change and reduce carbon emissions. Although many view the provinces as unprepared to implement such a complex tool, the value of these pilots is to provide an experimental ground and sufficient time to plan for a national system which will have significant impact to the world. Due to the nature of the pilot schemes as being a learning opportunity and pathway rather than actual tool to bring CO₂ reduction, coupled with the importance of the power sector in China, we do not foresee a dramatic change of the power sector reform agenda in the near term. The coming few months would be exciting to watch when each pilot starts their own trading. There are some important unresolved questions, such as how would an ETS scheme work with both direct and indirect emission, and how would electricity price react in permit trading, are to be further researched on.
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- Roman Zeltser, *Columbia Green Group*, Founding Partner
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