



# The impact of adjustment mechanisms on China's ETS: lessons from the pilot programs

Hao Zhang<sup>1</sup>

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## Abstract

This article examines the adjustment mechanisms which have been designed and implemented under China's experimentations with its emissions trading scheme (ETS). In China, several ETS pilot programs have adopted these mechanisms in the process of cap setting, allowance allocation and price regulation to allow regulatory intervention at different stages of the ETS operation to ensure that particular regulatory objectives are going to be achieved. Using doctrinal analysis, this article provides some critical insights into the specific regulatory design of the flexible mechanisms in China. It highlights their impact on regulatory stability and on the credibility of the ETS program. Considering that the ETS pilots are designed for and operated at local levels for the purpose of testing regulatory design and implementation in order to inform the policymakers at the central government when designing the national scheme, the lessons learned from the ETS pilots with respect to the adjustment mechanism are critical to fulfilling this strategy.

**Keywords** Emissions trading scheme · Regulatory design · Local experimentations · Adjustment mechanisms · China

## 1 Introduction

This article examines the adjustment mechanisms that have been designed and implemented under China's ETS pilot programs. As part of China's continuing effort to experiment with the market-based instrument to mitigate the country's soaring greenhouse gas emissions, these ETS pilot programs have been established in a selected number of municipalities, provinces and one city (Shenzhen).<sup>1</sup> China's

<sup>1</sup> Zhang Z (2015); Zhang D et al. (2014) Emissions Trading in China: Progress and Prospects. *Energy Policy* 75, 9; Zhang H and Xu P (2017, 2–3).

✉ Hao Zhang  
haozhang@cuhk.edu.hk

<sup>1</sup> Faculty of Law, 6/F LSK Building, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong SAR

legal framework for ETS has been gradually developed through a strategy of constructing the national ETS through local experimentations. These ETS pilots are designed for and operated at local levels for the purpose of testing regulatory design and implementation in order to inform the policymakers at the central government who are responsible for designing the national scheme.<sup>2</sup>

As China's industrial production expands, balancing environmental integrity (such as a substantial reduction in emissions) and economic prosperity becomes much harder, as the design elements of China's pilot programs have shown. Regulations underpinning an ETS will have to be continuously adjusted to maintain such integrity. This is particularly the case for large developing countries like China, whose economy is booming at an unprecedented rate, whereas reducing emissions from the existing installations (and new entrants to the market) becomes even more challenging. Balancing economic growth and the desired goal of emissions reduction has become a critical issue, considering the local variations and designs of the local pilot programs. The dilemma of allowing economic expansion to continue while simultaneously implementing emissions reduction is a problem that needs to be dealt with in an effective manner when an ETS is experimented with and tested at local levels in China. The regulatory design of China's ETS pilots, in general, is based on the cap-and-trade model.<sup>3</sup> While, in theory, the regulatory framework underpinning the cap-and-trade is relatively simple, the specific regulatory design and practical implementation of such a trading scheme is complex because the design choices of an ETS will directly influence the degree to which economic efficiency, cost-effectiveness and environmental integrity will be achieved in practice.<sup>4</sup> As observed by some commentators, an ETS is preferred by the Chinese policymakers due to its flexibility in accommodating economic development (for example, through setting a relatively loose cap) and its more straightforward adaptation to China's existing regulatory and administrative framework.<sup>5</sup> In China, the flexibility of ETS design has been used by the local policymakers to modify the traditional design of an ETS by incorporating the adjustment mechanisms.<sup>6</sup> The adjustment mechanisms are design elements which are able to impose some impacts on the ETS operation, including the flexible cap, the *ex-post* adjustment to the allowance allocation, as well as the price management mechanisms.

In China, several ETS pilot programs have adopted these mechanisms to allow regulatory intervention at different stages of an ETS operation to ensure that particular regulatory objectives get achieved. As discussed in the parts below, the regulatory objectives include reducing the compliance cost for liable entities, enabling sufficient emission space for future economic growth and stabilising the allowance price. The national ETS was launched on the 16th of July in 2021, with the aim to eventually consolidate the existing local ETS pilots. The national ETS is intended

<sup>2</sup> 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 (Notice of the NDRC on Initiating Pilot Emissions Trading Programs), 29 October 2011, NDRC Order No. (2011)2601.

<sup>3</sup> Zhang Z (2015); Zhang D et al. (2014).

<sup>4</sup> Banet C et al. (2008).

<sup>5</sup> Ibid.

<sup>6</sup> Qi S, Wang B and Jiang J (2014); Jiang, JJ, Ye, B and Ma, XM (2014).

to play a critical role to control and reduce China's carbon emissions, thereby contributing to the fulfilment of the targets of carbon peaking before 2030 and carbon neutrality by 2060 announced by President Xi Jinping at the UN General Assembly in September 2019.<sup>7</sup>

The legal scholarship so far has focused on the issues of regulatory design of China's ETS in general,<sup>8</sup> transparency rules underpinning the operation of the ETS<sup>9</sup> and particular mechanisms (such as price stabilisation mechanism) that are essential to the success of the ETS.<sup>10</sup> However, the scholarly discussion has yet to provide some holistic analysis of the adjustment mechanisms and their impact on China's ETS pilots, and this article aims to fill this gap. Using doctrinal analysis, this article, in part two, provides some critical insights into the specific regulatory design of the flexible mechanisms in the selected ETS pilots. Part three not only highlights their impact on regulatory stability but also the credibility of the ETS program and sheds some light on the lessons learned from the ETS pilots with respect to the adjustment mechanism which are critical for the process of designing and constructing the national ETS. Furthermore, part three discusses the regulatory design of China's national ETS and to what extent the design choices are based on the findings from the ETS pilots.

## 2 Adjustment mechanisms under China's ETS pilots

Given the various design features of China's ETS pilots, this article has selected the pilot programs in Beijing, Hubei and Shenzhen as the focus of this study for two main reasons. First, the three localities represent different stages of development, and they face different challenges because of their dissimilar industrial structure and energy portfolios. On the one hand, both Beijing and Shenzhen have relatively few energy-intensive industries, but the energy consumption from transport, residential and commercial sectors is increasing.<sup>11</sup> On the other hand, Hubei's GDP growth still largely relies on heavy industries that are energy and emissions-intensive. The different economic and energy contexts in these three localities have shaped some of the critical design elements of their ETS pilots. These essential design features mainly explain the last reason that underlies the selection of the three pilot programs, which is that the three ETS pilots have some distinctive design features in terms of the adjustment mechanisms underpinning cap setting, allowances allocation and price regulation. These design features are helpful examples to comparatively examine to

<sup>7</sup> Xi Announces China's Aims to Achieve Carbon Neutrality before 2060: [http://www.xinhuanet.com/english/2020-09/23/c\\_139388764.htm](http://www.xinhuanet.com/english/2020-09/23/c_139388764.htm) (accessed 31 March 2023). Worth noting is that there has yet to be any official confirmation of whether China's carbon neutrality target includes only CO<sub>2</sub> or all GHG emissions. The target to peak emissions before 2030 is also a step further compared to the previous pledge made by China in its nationally determined contribution under the Paris Agreement, which aims to peak emissions 'around 2030'.

<sup>8</sup> Zhang H and Xu P (2017, 2–3).

<sup>9</sup> Deane, F, Hamman, E and Pei, Y (2017).

<sup>10</sup> Boute A and Zhang H (2019).

<sup>11</sup> Jiang JJ et al. (2014); Zhu J, Wang, Y and Song R (2015).

what extent the local authorities are able to modify the number of allowances that are in circulation.

## 2.1 Cap setting and allowances allocation

Even though Beijing's pilot program is designed and operated under a 'cap',<sup>12</sup> information regarding the size of the cap and the total number of allowances that have been allocated is somewhat opaque. Some researchers estimate that Beijing's yearly cap is roughly around 45 million tons.<sup>13</sup> According to an official statement, the cap covers around 40% of Beijing's annual emissions.<sup>14</sup> The lack of transparency regarding the size of the cap is due to the allocation method adopted in the first phase of the pilot program (2013–2016). Allocating allowances to existing entities in Beijing's pilot program is a complex process that involves two stages, including initial allocation and allowances that are subject to final adjustment before the end of each compliance period.<sup>15</sup> Therefore the size of the cap in Beijing and the number of allowances that are made available to the liable entities are determined by both the initial allocation and the final adjustment. The challenge, however, is that the uncertainty in the process of final adjustment makes it difficult to predict the size of the cap in advance. Although different methods of calculating allowances and baseline years are applied to different sectors,<sup>16</sup> the general principle of allocation in Beijing is that it is free of charge.<sup>17</sup>

In order to steer liable entities to reduce their carbon footprint over time in the first phase, Beijing's pilot program introduced the idea of an emissions control

<sup>12</sup> 北京市人民政府关于印发《北京市碳排放权交易管理办法（试行）》的通知 (Notice of Beijing Municipal People's Government on Issuing the Interim Measures for the Administration of Carbon Emissions Trading in Beijing), 28 May 2014, Beijing Municipal People's Government Order No. (2014) 14, art. 3.

<sup>13</sup> How Many Allowances have been Allocated under each of the Seven Pilot Programs (全国七个碳交易试点各发了多少碳指标?) (Carbon Emissions Trading (碳排放交易)): <http://www.tanpaifang.com/tanjiaoyi/2017/0104/58147.html> (accessed 23 March 2023).

<sup>14</sup> Zhang G (2014).

<sup>15</sup> 北京市碳排放权交易试点配额核定方法（试行）(Appendix 3, Interim Measures for Calculating Emissions Allowances for Beijing's Carbon Emissions Trading Pilot Program), 北京市发展和改革委员会关于开展碳排放权交易试点工作的通知 (Notice of the Beijing Development and Reform Commission (DRC) on Implementing the Carbon Emissions Trading Pilot Program), 20 November 2013, Beijing DRC Order No. (2013) 5.

<sup>16</sup> Emissions of electricity generators, heating suppliers, gas and water production and supply enterprises, mobile emission facilities in the transportation enterprises are verified based on the quantity of supply, multiplied by the emissions intensity in the baseline years. Emissions from entities in petrochemical, cement, manufacturing, and fixed facilities in the transportation sector are calculated according to historical emissions during the baseline years. The baseline years for fixed facilities and mobile facilities are from 2009 to 2012, and 2011 to 2014 respectively. 关于重点排放单位2016年度二氧化碳排放配额核定事项的通知 (Notice on Checking and Ratifying Emissions Allowances for the Key Emitters in 2016), 28 September 2016, Beijing DRC Order No. (2016) 1639.

<sup>17</sup> See for example, 北京市发展和改革委员会关于做好2014年碳排放报告报送核查及有关工作的通知 (Notice of the Beijing DRC on Carrying Out the Work in relation to Reporting and Verification of Emissions under Beijing's Pilot Program in 2014), 6 March 2014, Beijing DRC Order No. (2014) 439.

coefficient.<sup>18</sup> The emissions control coefficient is a linear reduction that applies annually to the initial allocation process at the beginning of each compliance period.<sup>19</sup> Different coefficients were applied to manufacturing, service industries, power and heating entities, allowing the number of allowances to reduce over time.<sup>20</sup> In addition to the linear regression of allowances, adjustments were made possible to existing facilities during the early stage of the pilot program from 2013 to 2016.<sup>21</sup> Adjustments to the existing installations are application-based, as long as at least one of the following requirements is met: (a) the key emitter was incorporated and established in 2012, with an operational time of fewer than 12 months; (b) the key emitter increased the level of output in 2012 and the new facility is in operation for less than 12 months; (c) the entity's emissions were constantly increasing from 2009 and 2012, and the difference between the highest annual emissions and the arithmetic average of the four-year emissions is a least 20% and surpasses 5000 tons of CO<sub>2</sub>.<sup>22</sup> In practice, the adjustment mechanism allows entities with an increasing amount of emissions to claim more allowances, which results in adding extra allowances on top of the initial allocation process.

As observed by the Brookings Institution Report, the complex process of allocating allowances during the first phase of the pilot program in Beijing was, on the one hand, designed to overcome the obstacles of data accuracy and reluctance of key emitters to participate in the program.<sup>23</sup> On the other hand, such a design choice leaves much space for government intervention to strike a balance between economic development and emissions control.<sup>24</sup> As the program has been expanded to cover more industrial and services sectors, the Municipal Development and Reform Commission (DRC) maintains the different stages of allocation in the subsequent trading period starting in 2016.<sup>25</sup> The Beijing DRC has also made some changes to the process of calculating emissions, thus affecting the number of allowances for entities from different industrial and service sectors. Although detailed rules vary, the general provision is that in addition to the extra allowances that can be

<sup>18</sup> Appendix 3 (*supra* note 15).

<sup>19</sup> The idea of a linear reduction to the emissions cap is also highlighted in the 'Decision of the Standing Committee of the Beijing Municipal People's Congress on Implementing the Pilot Program of Carbon Emissions Trading in Beijing under the Condition of Strict Control of Total Carbon Emissions' (北京市人民代表大会常务委员会关于北京市在严格控制碳排放总量前提下开展碳排放权交易试点工作的决定) (Adopted on 27 December 2013, at the 8th Meeting of the Standing Committee of the 14th People's Congress of Beijing Municipality). This *Decision* has formally given the regulations and supporting measures adopted by the Beijing DRC for implementation the legal status as a formal source of law.

<sup>20</sup> Appendix 3 (*supra* note 15).

<sup>21</sup> 配额调整申请材料及相关要求 (Appendix 3, Substantive and Procedural Requirements on Application for Adjustment of Allowances), Notice of the Beijing DRC on Carrying Out the Work in relation to Reporting and Verification of Emissions under Beijing's Pilot Program in 2014 (*supra* note 17).

<sup>22</sup> *Ibid.*

<sup>23</sup> Comparative Analysis of China's Emissions Trading Pilot Programs (中国碳排放权交易试点比较研究) (Brookings Institution Report, 12 August 2015) <https://www.brookings.edu/zh-cn/research/中国碳排放权交易试点比较研究/> (accessed 31 March 2023).

<sup>24</sup> *Ibid.*

<sup>25</sup> Part 2, Notice on Checking and Ratifying Emissions Allowances for the Key Emitters in 2016 (*supra* note 16).

allocated to existing facilities, deduction of allowances from the initial allocation can also be made through the final adjustment process.<sup>26</sup> Deduction of allowances happens based on the following two scenarios: (a) a liable entity in the petrochemical and cement sectors with a reduction of emissions of more than 20% in 2016 compared to the baseline years; (b) a liable entity in the manufacturing, service and transportation sectors that has had a surplus of allowances for three years in succession (2013–2015), as well as a reduction of emissions of more than 50% in 2016 compared to the baseline years.<sup>27</sup> Therefore, the number of allowances equal to the reduction of emissions in 2016 will be deducted from the initial allocation.<sup>28</sup> Through these measures, the Beijing DRC signalled to the market participants that there is a strong possibility that the adjustment mechanism may lead to lesser allowances in circulation, hoping that the scarcity of allowances will prevent the allowances price from plummeting.

Hubei's emissions cap is set by using a combination of historical data in prediction methods, taking into account the provincial target of reducing emissions intensity and the projected GDP growth.<sup>29</sup> The total cap in Hubei reflects these considerations, as it includes the following three components: existing installations, new entrants, and the government reserve of allowances.<sup>30</sup> The historical emissions of the covered entities in the baseline years are the basis upon which the initial allocation to the existing installations is decided, except for the cement, heating and power sectors.<sup>31</sup> In order to ensure that the total number of allowances initially allocated to the covered entities is below the cap, Hubei adopts the cap adjustment factor to reduce the sum of the allowances for initial allocation.<sup>32</sup> The predicted emissions

<sup>26</sup> Part 3, *ibid.*

<sup>27</sup> *Ibid.*

<sup>28</sup> *Ibid.*

<sup>29</sup> 湖北省碳排放权交易试点工作实施方案 (Implementation Measures of Hubei's Emissions Trading Pilot Program), 18 February 2013, Hubei People's Government Order (2013) 9, part 3(2)(1).

<sup>30</sup> See e.g., 湖北省碳排放权配额分配方案 (Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program), 22 May 2014, Hubei DRC, part 3(2). The allocation plans in 2015 and 2016 maintains the same composition of the cap.

<sup>31</sup> See e.g., 湖北省2015年碳排放权配额分配方案 (Appendix 1, Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program in 2015), 省发展改革委关于印发《湖北省2015年碳排放权配额分配方案》的通知 (Notice of the Hubei DRC on Issuing the Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program in 2015), 19 November 2015, Hubei DRC Order No. (2015) 708, part 4.

<sup>32</sup> In the first compliance period, the cap adjustment factor was 0.9192, which was determined by the total emissions of the liable entities in 2010, multiplied by 97% and then divided by the sum of the average emissions by the liable entities in the baseline years. In the subsequent compliance periods, the cap adjustment factor is determined by the following formula: the factor = 1 - (the amount of remaining allowances held by the liable entities from the previous year / the total number of allowances of the current year). The adjustment factors in 2015 and 2016 were 0.9883 and 0.9856, respectively. See e.g., 湖北省2016年碳排放权配额分配方案 (Appendix 1, Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program in 2016), 省发展改革委关于印发《湖北省2016年碳排放权配额分配方案》的通知 (Notice of the Hubei DRC on Issuing the Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program in 2016), 30 December 2016, Hubei DRC Order No. (2016) 791, part 4 (1)(3). Worth mentioning is that banking is not allowed unless the allowances have been transacted, meaning that if the remaining allowances held by the liable entities are obtained through trading, they can be banked in order to use them in the following year. Otherwise the allowances will be

growth is used to set the limit of emissions increase in Hubei for new entrants and the production expansion of existing facilities. To fulfil the purposes of price discovery and price regulation of allowances, 8% of the total size of the cap is being held in a government reserve.<sup>33</sup> Compared to Beijing, Hubei has significantly improved the transparency of the cap by setting a clear and explicit cap at the beginning of each compliance period.<sup>34</sup> So far, the cap of the Hubei ETS pilot has been reduced over time, but the total number of liable entities has almost doubled since the pilot program's commencement.<sup>35</sup>

Similarly, Hubei adopts the *ex-post* adjustment mechanism to control the risks of over or under-supply of allowances on the market. In practice, the adjustment mechanism is implemented through the process of allowances allocation. The general rule is that Hubei DRC has the authority to supplement or confiscate allowances if the verified emissions of an entity differ significantly from the number of allowances initially allocated.<sup>36</sup> Although allowances are generally fully allocated through grandfathering, a hybrid method of grandfathering and benchmarking applies to cement producers, heating suppliers and power generators.<sup>37</sup> The grandfathering approach is applicable to these sectors to determine the number of allowances they are entitled to in the initial allocation round. Practically, allowances equal to 50% of their average emissions in the baseline years are allocated to these sectors in advance.<sup>38</sup> Before the end of a compliance period, entities in these sectors receive the rest of the allowances based on their realised output and the benchmark.<sup>39</sup> By doing so, Hubei's pilot program aims to achieve a slightly tighter allocation in the initial round (in contrast with Beijing). Furthermore, the Hubei DRC reserves allowances for new entrants and capacity increase through the *ex-post* adjustment mechanism. From the regulator's point of view, the risk of over-allocation poses more significant regulatory challenges than the shortage of allowances in the market, given the challenge of over-capacity in the abovementioned sectors.<sup>40</sup>

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Footnote 32 (continued)

cancelled at the end of each compliance year. This unique design of banking in Hubei's pilot program is to encourage trading of allowances, thus liquidity of the market.

<sup>33</sup> See, e.g., Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program (*supra* note 30).

<sup>34</sup> The caps for Hubei's ETS pilot program in 2014, 2015 and 2016 were 324, 281 and 253 million tons of CO<sub>2</sub>, respectively. Look up the Allocation Plans for the Allowances under Hubei's Emissions Trading Pilot Program from 2014 to 2016 (*supra* notes 30, 31 and 32).

<sup>35</sup> *Ibid.* The total number of liable entities covered by the Hubei pilot program in 2016 amounts to 236, compared to a total of 138 when the pilot first commenced operation in 2014.

<sup>36</sup> Each year before the end of the compliance period, the Hubei DRC will supplement or confiscate allowances if the difference between verified emissions and allocated allowances surpasses 20% or 200, 000 tons. Therefore, the amount of allowances, which get supplemented or confiscated equals the number of allowances that are beyond the threshold of 20% or 200, 000 tons.

<sup>37</sup> Allocation Plan for the Allowances under Hubei's Emissions Trading Pilot Program in 2016 (*supra* note 32), part 4(3).

<sup>38</sup> *Ibid.*, part 4(1)(1).

<sup>39</sup> *Ibid.*

<sup>40</sup> Qi, S, Wang, B and Jiang, J (2014).

Compared with Beijing and Hubei, Shenzhen has adopted an innovative approach to set up an intensity-based cap on emissions.<sup>41</sup> Considering the dynamic relationships between economic growth, structural transition and the demand for controlling emissions, the Shenzhen DRC has opted for an intensity-based cap to address the uncertainty in output levels due to Shenzhen's rapid growth and accelerated structure adjustment.<sup>42</sup> Shenzhen's approach aligns with the national intensity target, which is divided and newly assigned to provinces and municipalities every five years. The intensity reduction target in Shenzhen, therefore, takes account of the assigned target by Guangdong province. For example, in the first phase of Shenzhen's pilot program (2013–2015), the target assigned to Shenzhen by the Guangdong provincial government was to reduce carbon emissions intensity by 21% during the 11th Five-year period (2011–2015).<sup>43</sup> In order to achieve this goal, Shenzhen's ETS pilot program sets intensity reduction targets of 2%, 2% and 25% for the power, water supply and manufacturing sectors, respectively.<sup>44</sup> For power and water supply sectors, the intensity is determined by the amount of CO<sub>2</sub> emitted per unit of electricity or water supply.

Moreover, the intensity-based cap for power and water suppliers is calculated based on the intensity benchmarks, combined with the projected level of output.<sup>45</sup> The manufacturing sector is subject to a sector cap that is established by intensity benchmarks and projected sector production.<sup>46</sup> Practically, however, determining intensity benchmarks through standardised or uniform products in the manufacturing sector poses great challenges to implementation. To alleviate this problem, the amount of CO<sub>2</sub> emitted per unit of industrial added value is used to establish intensity benchmarks. It is combined with the projected sector output to determine the sector cap.<sup>47</sup>

The fundamental concept of intensity also underpins the initial round of allowances allocation, and the Shenzhen DRC applies another innovative method in this process. Free allowances are allocated to liable entities in the power and water supply sector through benchmarking,<sup>48</sup> whereas covered entities in the manufacturing sector are selected by a method of competitive game theory.<sup>49</sup> The competitive game theory shifts the focus of allocation from a government-led approach to a game between manufacturers. Because the sector cap is given in the initial round of allocation, liable entities compete with each other in finite repeated rounds for

<sup>41</sup> 深圳市碳排放权交易管理暂行办法 (Interim Measures for the Administration of Carbon Emissions Trading in Shenzhen), 19 March 2014, Shenzhen People's Government Order No. (2014) 262, art. 10.

<sup>42</sup> China Emissions Exchange (深圳排放权交易所) (Frequently Asked Questions under Shenzhen's Emissions Trading Program (深圳碳交易市场问答集), July 2013), [www.cerx.cn/u/cms/cn/201505/21162157si42.pdf](http://www.cerx.cn/u/cms/cn/201505/21162157si42.pdf) (accessed 31 March 2023).

<sup>43</sup> *Ibid.*, 1.

<sup>44</sup> Jiang, JJ, Ye, B and Ma, XM (2014).

<sup>45</sup> *Ibid.*

<sup>46</sup> *Ibid.*

<sup>47</sup> Interim Measures for the Administration of Carbon Emissions Trading in Shenzhen (*supra* note 41), art. 19, para. 2.

<sup>48</sup> *Ibid.*, art. 17, para. 1.

<sup>49</sup> *Ibid.*, art. 17, para. 2.



free allowances.<sup>50</sup> Each year before the end of the compliance period, Shenzhen DRC has the statutory authority to supplement or cancel allowances that have been handed out during the initial round of allocation, taking into account the intensity target applicable to the sector and the realised level of output by the covered firms.<sup>51</sup> In order to balance the demand and supply, the general principle is that the number of supplementary allowances must be lower than the number of allowances that are subject to cancellation.<sup>52</sup>

## 2.2 Price regulation and regulatory agency

A viable trading market is essential for an ETS to be successful.<sup>53</sup> For this purpose it is crucial to keep in mind the lessons learned from emissions trading practices in other jurisdictions, especially that the permit value can be affected by the initial setting of the scheme, with the critical factor being the number of emissions permits allocated through grandfathering. Too many permits, allocated through grandfathering, may decrease their individual value and affect the markets viability. Additionally the liable entities need to have enough certainty on the price signals, in order to plan strategically so that they can achieve the emission reduction in an economic way.

To address the issue of price instability, there has been a clause adopted to the Beijing's pilot program, more precisely to the *Interim Measures for the Administration of Carbon Emissions Trading in Beijing*, which limits the authority of the Beijing DRC to set aside no more than 5% of the total number of emission allowances in order to adjust the allowances allocated to the liable entities, as well as to stabilise the market price of allowances.<sup>54</sup> Furthermore some detailed and supporting measures for implementation specify the competences within the government agencies that are responsible for enforcing the price regulation provisions.<sup>55</sup> The supportive measures have also established explicit trigger prices that are essential to the price regulation of the pilot program in Beijing. The Beijing Municipal Financial Bureau (Beijing MFU) oversees the China Beijing Environment Exchange

<sup>50</sup> Ibid. In each round of the game, outcomes are notified to successful bidders and the decisions are based on the competing firm's historical emissions, level of emissions in the given sector, commitment for reduction, and comparative advantage with other firms. A firm satisfied with the allocation result may choose to accept and leave the game. Entities that are dissatisfied shall continue to compete in the game in the next round. Since the cap is given, allowances accepted by entities will be deducted from the cap. Therefore, the number of allowances will reduce during the progressive rounds of the game. In the final round, firms that are still in the game can only receive allowances from the remaining balance.

<sup>51</sup> Ibid, art. 19, para. 1.

<sup>52</sup> Ibid, art. 19, para. 3.

<sup>53</sup> Baldwin, R, Cave, M and Lodge, M (2012, 197); Tietenberg, TH (2010, 69–71).

<sup>54</sup> Art. 6, Interim Measures for the Administration of Carbon Emissions Trading in Beijing (*supra* note 12).

<sup>55</sup> 北京市发展和改革委员会 市金融工作局 关于印发《北京市碳排放权交易公开市场操作管理办法(试行)》的通知 (Notice of the Beijing DRC and Beijing MFU on Issuing the 'Measures for the Administration and Management of the Open Market Operation of Carbon Emissions Trading in Beijing (Trial)'), 10 June 2014, Beijing DRC and Beijing MFU.

(CBEEEX), through which most allowances trading occurs.<sup>56</sup> Moreover, the Beijing MFU is responsible for monitoring the trading activities conducted at the CBEEEX.<sup>57</sup> The Beijing Climate Change Research Centre under the Beijing DRC is the enforcement agency which implements the decisions of the Beijing DRC to buy back allowances from the market when the weighted average price of the allowance is lower than 20 RMB (price floor) for up to 10 consecutive days.<sup>58</sup> Beijing DRC is authorised to organise auctions on fixed dates, regardless of the allowance price.<sup>59</sup> It also has the statutory authority to organise auctions when the ceiling price is triggered.<sup>60</sup> The ceiling price is set at 150 RMB, and again it is calculated based on the weighted average price of the allowance for up to 10 consecutive days.<sup>61</sup> Despite the detailed provisions, Beijing's price stability mechanism has yet to be implemented in practice because neither the price floor nor ceiling has been triggered so far.<sup>62</sup>

As in Beijing, the price stability mechanism in Hubei's pilot program consists of auction<sup>63</sup> and buy-back of allowances to safeguard the stability of the price of the allowances. Hubei DRC is the administering authority of the stability mechanism and has the regulatory authority to initiate, coordinate and supervise the implementation of the auctioning and buying-back.<sup>64</sup> Instead of defining the price floor or ceiling, the pilot program in Hubei assesses the trigger price of allowances by monitoring the daily closing price of allowances over a period of 20 days.<sup>65</sup> If the closing price is similar to the highest or lowest value of the daily negotiating price range for a minimum of 6 days, then the Hubei DRC has an obligation to consult the advisory committee for its expert opinion.<sup>66</sup> The advisory committee comprises government officials, regulators and researchers from various government agencies and research institutions.

<sup>56</sup> Art. 3, *ibid.* Worth noting is that Beijing DRC allows trading of allowances over the counter but such trading is subject to some reporting obligations and clearance requirements. 北京市发展和改革委员会北京市金融工作局关于印发《北京市碳排放配额场外交易实施细则》的通知 (Notice of the Beijing DRC and Beijing MFU on Issuing the 'Regulation on Implementing Over-the-Counter Transactions for Beijing's Carbon Emission Allowances'), 23 November 2016, Beijing DRC and Beijing MFU Order No. (2016) 15.

<sup>57</sup> Art. 3, para. 2. Measures for the Administration and Management of the Open Market Operation of Carbon Emissions Trading in Beijing (Trial) (*supra* note 55).

<sup>58</sup> *Ibid.*, art. 36.

<sup>59</sup> *Ibid.*, art. 14, para. 2.

<sup>60</sup> *Ibid.*, art. 14, para. 3.

<sup>61</sup> *Ibid.*, art. 15.

<sup>62</sup> Despite the price fluctuation at the early stage of the program, the price of the Beijing emission allowances has been constantly between 40 and 60 RMB per ton recently. Market Performance of the Beijing's Emissions Trading Pilot Program (北京碳交易行情), <http://www.cbeex.com.cn/article/ywzx/tjyzx/> (accessed 31 March 2023).

<sup>63</sup> 省发展改革委关于印发《湖北省碳排放配额投放和回购管理办法(试行)》的通知 (Notice of the Hubei DRC on Issuing the Interim Measures of Auctioning and Buying-back of Allowances under the Hubei's Emissions Trading Pilot Program), 28 September 2015, Hubei DRC Order No. (2015) 600, ch. 3.

<sup>64</sup> *Ibid.*, art. 5, para. 1.

<sup>65</sup> *Ibid.*, art. 7, para. 1.

<sup>66</sup> *Ibid.*

Furthermore, the advisory committee is tasked with monitoring the market performance and stability of Hubei's pilot program and, most importantly, to assess whether the Hubei DRC is required to conduct auctions or buy back allowances.<sup>67</sup> As stipulated by the *Interim Measures* that underpin the market stability mechanism in Hubei, the Hubei DRC is required to gather a meeting of the members of the advisory committee, so that they vote for a decision within 2 days if the conditions of the trigger price are met.<sup>68</sup> A valid resolution by the advisory committee requires a 2/3 majority to pass. The resolution is required to address the following issues: the status quo of the market performance, the number of allowances to be auctioned or bought back, and the expected market performance afterwards.<sup>69</sup> The resolution constitutes a vital reference for the Hubei DRC. The Hubei DRC, nonetheless, has the final decision-making authority regarding the action, which should be taken to stabilise the allowance price.<sup>70</sup> Once a decision is made by the Hubei DRC, the Hubei emission exchange is responsible for implementing that decision.<sup>71</sup>

To stabilise the allowance price, Shenzhen's pilot program has established a reserve of allowances.<sup>72</sup> This reserve contains allowances which are put aside by the Shenzhen DRC, allowances for new entrants, and allowances bought back from the market.<sup>73</sup> The Shenzhen DRC, as the administering authority for the reserve, has the statutory authority to enforce the stipulated measures concerning price regulation.<sup>74</sup> Because in Shenzhen the aggregate allowance supply depends on the actual output and fixed intensity, whereas the demand depends on the actual output and uncertain marginal abatement cost, Shenzhen faces a more significant challenge of guiding the market expectation effectively. To address the potential danger of putting too many allowances in circulation, the regulators in Shenzhen explicitly require that allowances from the reserve must be sold at a fixed price and exclusively for compliance purposes, meaning they are not to be used for trading.<sup>75</sup> If there is an oversupply of allowances, the Shenzhen DRC is authorised to buy back up to 10% of the total number of allowances from the market through negotiation.<sup>76</sup> Because of the relatively stable allowance price recently, the price stabilisation mechanism in Shenzhen has yet to be tested in practice. From a regulatory point of view, however, these general provisions need to be specified, particularly the provisions governing when and how these measures can be enforced.

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<sup>67</sup> Ibid, art. 6.

<sup>68</sup> Ibid, art. 7.

<sup>69</sup> Ibid, art. 8.

<sup>70</sup> Ibid, art. 7.

<sup>71</sup> Ibid, art. 5, para. 2.

<sup>72</sup> Interim Measures for the Administration of Carbon Emissions Trading in Shenzhen (*supra* note 41), art. 15.

<sup>73</sup> Ibid, art. 21, para. 1.

<sup>74</sup> Ibid, art. 4.

<sup>75</sup> Ibid, art. 21, para. 2.

<sup>76</sup> Ibid, art. 22.

### 3 Lessons learned from the ETS pilots and design of the national ETS

#### 3.1 Lessons learned from the ETS pilots

Despite the apparent difficulty in balancing economic development and environmental outcomes, which are a factor in the design and operation of China's ETS pilots, China is at a juncture that may also present unique opportunities. Several lessons were learned from the design of adjustment mechanisms under the selected ETS pilots in China. In general, the implications of adopting the adjustment mechanisms are two-fold. On one level, the use of adjustment mechanisms could jeopardise the environmental integrity of the ETS and the legitimate expectations of the liable entities. The environmental integrity of the ETS pilots is at risk because the total cap could increase if the production level of liable entities rises. This is particularly the case for most provinces in China that are still in the process of industrialisation. The possibility of an increased cap means that, in principle, economic growth is still prioritised, even though it means sacrificing the environmental integrity of the ETS, which does not align with the fundamental objective of adopting an ETS to control emissions. As a result of the allowance adjustment mechanism, given that allowances can be reserved if production falls or additional allowances can be provided if production expands (such as in Hubei), liable entities under the ETS pilots will refrain from conducting meaningful low-carbon investments because of the uncertainties.<sup>77</sup> The uncertainties also loom large in compliance, considering that liable entities are unsure about the number of allowances they are entitled to until the end of the compliance period.<sup>78</sup> The consequence of these uncertainties is that liable entities are unwilling to actively participate in allowance trading, leading to low trading volume across the selected ETS pilots.<sup>79</sup>

On the other level, the complicated design of some adjustment mechanisms (i.e. adding or taking away allowances from liable entities) has posed challenges to both the capacity of regulators and the implementation of these mechanisms. For example, the practice of maintaining allowance reserves, which Beijing, Hubei and Shenzhen have adopted, calls for a more active role on the part of the regulator to respond promptly to the market price of allowances. The regulator needs to set the accurate term of the trigger price and decide how many permits are to be bought from the market or sold to the market. Till now, none of these price regulation mechanisms have been implemented. In Beijing and Hubei, the price of allowances has been relatively stable, and the price floor or ceiling is yet to be triggered.<sup>80</sup> In Shenzhen, the price regulation mechanism was not enforced despite the drastic fluctuation of allowance prices during the first compliance period.<sup>81</sup> As discussed above, this is due to the fact that the ETS regulation in Shenzhen lacks detailed measures for

<sup>77</sup> Qi, S, Wang, B and Jiang, J (2014).

<sup>78</sup> Ibid.

<sup>79</sup> Ibid.

<sup>80</sup> Boute A and Zhang H (2019).

<sup>81</sup> Ibid.

implementation in this regard. Furthermore it poses questions about what specific regulatory approaches need to be implemented to ensure a more effective and efficient administration of the permit reserve in practice.

As the objectives of an ETS have initially evolved from pure emissions control but now also include the goal to drive low-carbon investment, it is essential to have an allowance price level that is high and stable enough to drive such investments.<sup>82</sup> Therefore, the pricing regulation mechanism is key to achieving this objective.<sup>83</sup> Nonetheless, in China, the design and implementation of the price regulation mechanisms are still in their infancy. There is also a question about the regulatory independence, which means the ability to decide uninfluenced from intervention based on economic and political considerations when enforcing the price regulation measures. Such decision-making authority includes, for example, whether the price ceiling or floor is triggered and what specific measures need to be enforced to tackle the issue of significant price fluctuation. We can see from the experiences of the selected ETS pilots in China that regulatory independence is still severely underdeveloped. However, Hubei has deployed the institutional arrangement of having an independent regulator, known as the advisory committee. The challenge which the Chinese ETS regulator faces is to establish institutional arrangements that can ensure independent decision-making to trigger price regulation measures.

### 3.2 Design of the national ETS

The national ETS covers only the power sector (both gas and coal power) in its initial phase and obliges more than 2000 plants in the power sector, each of which emits more than 26,000 tons of carbon emissions per year.<sup>84</sup> Currently, China's economy is heavily dependent on fossil fuels which account for 85% of the energy mix in the country. China's power sector is a prime example of being fossil fuel-intensive, in which coal-fired power generation still accounts for 65% of the electricity supply and over 40% of China's carbon emissions.<sup>85</sup> Decarbonising the power sector through various regulatory interventions, notably an ETS, will therefore be critical for achieving China's climate targets. China's national ETS is expected to be the world's largest carbon market after its expansion to seven other industrial sectors. The Ministry of Ecology and Environment (MEE), the administering agency of China's national ETS, has yet to announce the specific phases for the national carbon market. It is still unclear when and how the expansion will take place in the upcoming years.

<sup>82</sup> Fell H(2016).

<sup>83</sup> Ibid.

<sup>84</sup> 碳排放权交易管理办法(试行)(The National Measures for the Administration of Carbon Emission Trading (Trial)), 5 January 2021, Ministry of Ecology and Environment Order No. (2021) 19.

<sup>85</sup> Tsinghua University and International Energy Agency, The Role of China's ETS in Power Sector Decarbonisation, 2021, [https://iea.blob.core.windows.net/assets/61d5f58d-4702-42bd-a6b6-59be3008ec9/The\\_Role\\_of\\_China\\_ETS\\_in\\_Power\\_Sector\\_Decarbonisation.pdf](https://iea.blob.core.windows.net/assets/61d5f58d-4702-42bd-a6b6-59be3008ec9/The_Role_of_China_ETS_in_Power_Sector_Decarbonisation.pdf) (accessed 31 March 2023).

The adjustment mechanisms are also an integral part of the design features of China's national ETS. Unlike the EU ETS, where allowances allocation is based on an absolute cap, China's national ETS is an intensity-based system with *ex-post* adjustments to the cap and allowances allocation based on actual production output. The intensity-based cap setting allows flexibility, which is preferred by the policymakers to manage and control the impact of emissions reduction regarding the GDP growth, and vice versa.<sup>86</sup> The allocation method for allowances is based on the power plant's generation output, depending on a benchmark determined by the policymaker for each fuel and technological class.<sup>87</sup> The *ex-post* adjustment mechanism is also adopted as part of the allocation process, as only 70% of allowances get allocated to entities based on their 2018 output multiplied by the corresponding benchmark factor. The *ex-post* adjustment then allows final allocation to be modified based on the actual output levels in 2019 and 2020. To compensate for generating units with lower load rates, a unit load adjustment factor is also adopted to distribute more allowances to such entities, which may provide more allowances to units with lower efficiency. As already seen in the ETS pilots, the *ex-post* adjustment encourages the continuation of high production levels instead of effectively controlling and reducing output and emissions.

As part of the market regulation arrangements, the adjustment mechanism is included in the market stability provisions that the MEE plans to adopt for price regulation and market protection.<sup>88</sup> The adjustment mechanism, most likely through the similar regulatory measures implemented as in the ETS pilots, will allow the MEE to intervene in the event of abnormal price fluctuations. However, the MEE has yet to define the necessary specifications with respect to such adjustment mechanisms. This shows that the regulatory design of China's national ETS is still a work in progress.

## 4 Conclusion

The adjustment mechanisms under China's ETS pilots are designed to support the economic growth while achieving emissions control at the same time. The complex design features of the selected ETS pilots in Beijing, Hubei and Shenzhen show that the adjustment mechanisms carry some significant risks which can seriously impact the operation and effectiveness of the ETS in China. The lessons learned from the ETS pilots need to be taken into account when designing

<sup>86</sup> The draft Interim Regulations for China's national ETS, released by the Ministry of Ecology and Environment, includes provisions concerning a centralised development of a cap and allocation plan, which indicates the possibility of China's national ETS adopting a top-down process of cap setting. To date, the Interim Regulation is yet to be finalised, or officially adopted.

<sup>87</sup> 2019–2020年全国碳排放交易限额设定及配额分配实施方案（发电行业）（2019–2020 National Carbon Emission Trading Cap Setting and Allowance Allocation Implementation Plan (Power Generation Industry)), 30 December 2020, Ministry of Ecology and Environment Order No. (2020) 3.

<sup>88</sup> The National Measures for the Administration of Carbon Emission Trading (Trial) (*supra* note 84), art. 22.

the national ETS, and such adjustment mechanisms need to be reduced to the possible extent. For the setting of the cap, it is of utmost importance to ensure transparency regarding the components of the cap and the number of allowances available under each component. For allowances allocation, the challenge is to minimise uncertainties when dealing with low-quality emissions data. In this regard, the inclusion of China's power sector at the initial stage of the national ETS is a response to the data quality issue because the power sector produces more accurate emissions data. As China's national ETS evolves and is subject to finetuning of its design features, the allowance allocation needs to be carefully crafted to reduce discretion and autonomy held by the covered entities because of their genuine interest in maintaining the status quo in terms of production levels. Finally, the price regulation mechanism requires precise and detailed substantive and procedural provisions to guide its implementation. For China's national ETS, the remaining challenge is to decide which existing institution is suitable to carry out this role or if a new institution is required, one that is more independent when making the relevant decisions.

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## Declarations

**Conflict of interest** The author declare that they have no conflict of interest.

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