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China's National Emissions Trading System

Implications for Carbon Markets and Trade

By Jeff Swartz, International Emissions Trading Association (IETA)

ICTSD Global Platform on Climate Change, Trade and Sustainable Energy

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ICTSD welcomes feedback on this document. This can be forwarded to Sonja Hawkins, shawkins@ictsd.ch.

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LIST OF ABBREVIATIONS

BAU	Business-as-Usual
BCAs	Border Carbon Adjustments
CDM	Clean Development Mechanism
CCER	Chinese Certified Emissions Reduction
CER	Certified Emissions Reduction
CFCs	Chlorofluorocarbons
CO_2	Carbon Dioxide
COP	Conference of the Parties
DRC	Development and Reform Commission
ETS	Emissions Trading Scheme
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IETA	International Emissions Trading Association
INDC	Intended Nationally Determined Contribution
JCM	Japan Crediting Mechanism
JI	Joint Implementation
MRV	Monitoring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission [China]
OECD	Organisation for Economic Co-operation and Development
PAT	Perform, Achieve and Trade
PMR	Partnership for Market Readiness
REC	Renewable Energy Credit
SOE	State-owned Enterprise
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

FOREWORD

The recently-adopted Paris Agreement charts a fundamentally new course for international climate governance. As the first truly universal climate deal, it commits all parties to undertake emissions reductions to achieve its ambitious temperature goals. Its nature is, however, fundamentally different from the top-down Kyoto Protocol style of climate governance in that it provides countries with flexibility to set their own targets through so-called "nationally determined contributions", or NDCs.

Carbon markets will undoubtedly be a key tool in the post-Paris mitigation effort. Over the past decade, emissions trading schemes (ETSs) have emerged as an increasingly popular measure, with 17 jurisdictions responsible for 40 percent of global GDP now operating such schemes.

The introduction of a national ETS in China – the world's largest emitter of greenhouse gases and a key player in global trade – will be a significant addition to the carbon market landscape. Due to start in 2017, China's ETS will certainly send a powerful signal about the country's mitigation commitment and the growing importance of carbon markets.

Given China's role in the global economy, the presence of a national carbon price can reduce competitiveness and carbon leakage concerns in other jurisdictions, with potentially significant impacts on the further uptake of carbon pricing schemes and increasing ambition in existing schemes. The announcement of China's national ETS in the run-up to Paris most likely already contributed to the successful conclusion of the Paris Agreement, and through its impacts on climate action in the years to come, the Chinese ETS will be an important element in the global effort to implement the agreement.

Cooperation on carbon markets, such as bilateral linkages of schemes or the formation of plurilateral carbon market clubs, can help to further alleviate competitiveness and carbon leakage concerns. Article 6 of the Paris Agreement provides a multilateral hook for cooperative approaches, including through "internationally transferred mitigation outcomes." Putting this into practise will, however, require some harmonisation amongst the various schemes and trust in their environmental integrity. China will therefore have to first ensure the smooth operation of its ETS at the domestic level. As other countries with well-established schemes start forming such cooperative arrangements, China can, however, ensure to develop its scheme in a way that facilitates future harmonisation and cooperation. At the same time, those starting on such plurilateral arrangements need to take into account the new reality of a carbon market landscape heavily influenced by China, which may involve some harmonisation in line with China's scheme.

This paper is an important contribution to the discussion and thinking on the role of carbon markets and climate clubs that has the potential to contribute to initiatives supporting the implementation of the Paris Agreement. We hope that you find the paper to be a thought-provoking, informative, and stimulating piece that proves useful for your work.

Ricardo Meléndez-Ortiz
Chief Executive, ICTSD

EXECUTIVE SUMMARY

Emissions trading is gaining traction as the preferred type of carbon pricing policy instrument for many governments around the world. The number of emissions trading schemes (ETSs) has more than tripled since 2012, going from five to 17. But the carbon markets of 2016 look very different from those of a decade ago. The world has shifted from the top-down policy architecture, initiated by the Kyoto Protocol, into a bottom-up architecture under the newly adopted Paris Agreement where governments set targets at a national level, so-called "Nationally Determined Contributions" (NDCs), and adopt various policy approaches, not all of which are market-based. The current fragmentation into national and regional carbon markets may pose a challenge for creating a more globally-connected carbon market in the future. Whether such a global market emerges through bilateral linkages or plurilateral carbon market clubs, China's participation will matter as both the world's largest emitter of greenhouse gases (GHGs) and soon as the host of the world's largest carbon market.

China will launch a national carbon market in 2017, building on ten years of emissions trading experience, initially through the Clean Development Mechanism (CDM) and more recently through its seven pilot carbon markets. China's national ETS will expand the scope of global GHG emissions covered by such systems from nine to 16 percent. It will include eight sectors and 18 sub-sectors which consume over 10,000 tonnes of coal equivalent per year.

China's ETS is likely to face challenges in areas that are critical for the smooth functioning of ETSs, including: ensuring compliance and enforcement; applying uniform rules on monitoring, reporting, and verification (MRV) across the country; reducing absolute emissions under the intensity target it has set as its contribution to the Paris Agreement; preventing over-allocation of allowances; avoiding low liquidity; and allowing for trading in both spot and exchange transactions.

The presence of a Chinese ETS will have major implications for climate policymaking around the world and will substantially change the dynamics and status quo of current carbon markets. With an expected cap size of at least four billion tonnes, China's ETS would be twice the size of the European Union's ETS and greater than all existing carbon markets combined. The presence of a national carbon market in the country which is the world's largest emitter of GHGs and a key player in world trade has the potential to create a dynamic towards scaling up climate action through carbon markets, for example by incentivising other countries to implement carbon pricing policies, scaling up ambition in schemes, and encouraging further carbon market cooperation. This can ultimately help support the implementation of the Paris Agreement.

China's advancements in emissions trading have already caught the attention of other major and emerging economies. China's move towards imposing a cap-and-trade system will send a strong signal that carbon pricing is no longer just an OECD-led policy construct. As more and more countries are exploring the introduction of ETSs, the risks of carbon leakage and competitiveness distortions could be reduced, both within China and in third party countries. Over time, China may look at ways to cooperate internationally to help strengthen its market and further reduce competitiveness and carbon leakage concerns.

One form of international carbon market cooperation is through the formation of carbon market clubs, where groups of countries agree to work together by following the club's rules in exchange for exclusive membership benefits, such as the right to trade emissions units among themselves. China's participation in a carbon market club would first require that its carbon market is designed in such a way that it can be sufficiently harmonised with other systems in the future.

China, and other countries operating carbon markets, will benefit from the adoption of the Paris Agreement. Article 6 provides a multilateral hook for carbon market cooperation between groups of countries by recognising their ability to engage in international transfers of mitigation outcomes. The agreement also includes specific policy tools on universal accounting and tracking of emission reduction units, which will allow for countries to more easily link their respective carbon pricing policies in the future.

A carbon market club would need a fungible trading unit in order to function effectively, but if it was to allow China's intensity-based ETS to participate, it might have to impose trading restrictions on the number of units that could be imported or exported from the club by China, or establish an exchange-rate mechanism for members with intensity-based targets. With that in mind, China might first explore linking with one of its key trading partners or joining a smaller regional club where it also has well-established economic and trading ties. This could reduce the risks that may emerge when Chinese firms become market price makers or price takers.

In order for China's national ETS to perform effectively, and for it to eventually join a plurilateral carbon market, or carbon market club, there are several policy recommendations for ETS policymakers in China. First, setting the cap right is key. Covering as many sectors as possible will ensure liquidity, which improves price discovery and the formation of a forward carbon price curve. Second, China needs to manage and avoid overlapping policies as this could inhibit the effectiveness of the national ETS. Third, China will have to establish a strong compliance and enforcement regime in order to reduce its overall GHG emissions and peak emissions in the decade ahead. Having a binding emissions reduction target, with an ambitious cap supported by the rule of law, will enable the national ETS to be an effective climate policy instrument. Moreover, China should reduce the risk of carbon leakage by protecting energy-intensive and trade exposed sectors until carbon pricing is more widespread and harmonised amongst China's major trading partners, yet ensure that it stays "linking ready." Finally, the national ETS should allow spot trading of allowances and offsets, as well as futures. The more trading products are available, the greater the liquidity will be. Together with allowing foreign participation in the ETS, the appetite for linkage will surely increase amongst both Chinese and third-party policymakers.

China's national ETS will mark the start of a new era in climate policy for the country. The locus for carbon market policymaking will continue to pivot towards Beijing over the coming years, providing ample opportunities for policymakers in China to benefit from the experience gained by countries and companies already subject to a carbon market. In return, China's policy approaches to emissions trading will provide new insights and lessons for ETSs already in maturity, and under development. As China embarks on a country-wide ETS and global climate policy continues to shift towards national capitals, there will be many opportunities for China to benefit from both best practices in carbon markets and by ensuring its ETS is ready to link up with others.

1. INTRODUCTION

The People's Republic of China has actively participated in the global carbon market since 2005 through the Clean Development Mechanism (CDM) under the United Nations Framework Convention on Climate Change (UNFCCC). The CDM was the world's first global carbon market, allowing developing countries who had ratified the Kyoto Protocol to develop and transfer emission reductions from low-carbon projects to industrialised countries for compliance with their targets under the Kyoto Protocol. As a result, China now has ten years of emissions trading experience through the CDM and through piloting seven carbon markets during the past three years. Last year marked an important year for emissions trading globally: the European Union (EU) celebrated ten years of its emissions trading market in May 2015, and a historic announcement was made in September by President Xi Jinping on the American White House lawn that China's national carbon market will be launched in 2017.

The carbon markets of 2016 look very different from the carbon markets a decade ago. The world has shifted from the top-down policy architecture initiated by the Kyoto Protocol into a bottom-up architecture where governments set targets at a national level and adopt various policy approaches, not all of which are market based. This is quite distinct from the previous Kyoto approach where globally-agreed emission reduction targets for so-called Annex 1 countries[1] led to the first global carbon market in the form of the CDM, joint implementation (JI), and international emissions trading.[2] The current fragmentation into national and regional carbon markets may pose a challenge for creating a more globally-connected carbon market in the future. Whether such a global market emerges through bilateral "linkages" of policy programmes or through a plurilateral "carbon market club," China's participation will matter as both the world's largest emitter of greenhouse gases (GHGs) and soon as the host of the world's largest carbon market.

Just as global climate policy has evolved throughout the last ten years, China's (climate) policies have also evolved. China has slowly transitioned from being a seller of emission reduction units into the UN carbon market to establishing seven pilot carbon markets in 2011[3] and is now preparing for a nationwide emissions trading system (ETS). Its experience with the CDM and subnational pilot carbon markets has given China confidence in setting a pledge of reducing carbon intensity by 60 to 65 percent by 2030 as its contribution to the new climate agreement.[4] China, through its enthusiastic participation in the Kyoto Protocol's CDM and its efforts to pilot carbon markets at the subnational level, has embraced emissions trading more than most developing countries and this will have far-reaching policy implications in the years to come.

The objective of this paper is to examine how the emergence of a national ETS in China will affect carbon market developments globally and the potential formation of plurilateral carbon markets. The paper first maps out the architecture of the new climate regime and discusses the carbon market landscape. It then explores the background of China's seven ETS pilots as well as the policy design and architecture for its forthcoming national ETS. The paper aims to help policymakers and climate change professionals better identify any potential competitiveness, carbon leakage, and free-riding implications that may arise with the launch of China's carbon market, as these issues often accompany emissions trading policies in a world of asymmetric climate action. Therefore, it explores how carbon pricing in China may affect competitiveness and carbon leakage concerns in other countries, and consequently the design and ambition in the area of carbon markets. The paper also examines why China needs to address leakage concerns in its national ETS. Finally, the paper evaluates the linkage of ETSs and the concept of "carbon market clubs," within the context of the Chinese ETS.

2. CARBON MARKETS UNDER THE PARIS CLIMATE REGIME

2.1 Intended Nationally Determined Contributions: Moving Towards Bottom-up Global Climate Action

China's decision to move ahead with a national ETS has also been influenced by the overall evolution of the international climate change negotiations over the past five years. A major shift towards "bottom-up" climate policies and away from the previous "top-down" limited participation structure took place at the 17th UNFCCC Conference of the Parties (COP) in Durban, South Africa, in 2011. This negotiation culminated in the "Durban Mandate" which put countries on the path to work on and deliver a universal, legally-binding climate agreement to help fulfil the ultimate objectives of the Climate Convention.[5] The Convention aims to stabilise GHG emissions at a level that would prevent dangers to society from the worst effects of climate change, with industrialised countries taking the lead on emissions reductions and creating new funds and mechanisms to help developing countries grow in a low-carbon manner. COP 17 was a moment of self-realisation for all countries that the Kyoto Protocol style of international climate policy architecture – whereby emissions reductions were only required from a limited number of developed countries – was now out of date and would not help stabilise GHG emissions. The Kyoto Protocol did not include targets for so-called "developing countries," and its second commitment period from 2013 to 2020 covers less than 15 percent of global GHG emissions.[6] Therefore, the Durban Mandate was a crucial first step towards securing universal participation on climate action and emissions reductions. In Durban, and in subsequent UNFCCC negotiations since 2011, China played a meaningful and constructive role in delivering the new climate agreement, the Paris Agreement.

At COP 19 in Warsaw, Poland, in 2013, Parties to the UNFCCC agreed to "initiate or intensify preparation of their Intended Nationally Determined Contributions,"[7] also referred to as INDCs, meaning that they committed to outline the efforts they intended to take under a future agreement. These INDCs were meant to be submitted in time for the negotiations at COP 21 in Paris, France, and just over 180 countries covering 96 percent of emissions had done so by that time.[8] As of February 2016, 160 INDCs representing 187 countries had been submitted, covering almost 100 percent of global 2010 emissions levels.[9]

The wording "Intended Nationally Determined Contributions" was chosen as a compromise between the term "commitment," used until then for developed countries, and the wording "nationally appropriate mitigation action" (NAMA), previously used for developing countries. The choice of a common policy framework at the UNFCCC is indicative of the willingness by China and other developing countries to pursue a more organic bottom-up led approach. INDCs are a bottom-up process, allowing Parties to put forward their individual pledges and efforts as part of the universal Paris Agreement where the overall aim has to be ambitious enough to stabilise and reduce global emissions and to limit the global temperature rise to well below two degrees Celsius compared to pre-industrial levels.

The 12-page Paris Agreement, adopted at COP 21 in Paris on 12 December 2015, sets a long-term goal of stabilising GHG emissions at well below two degrees Celsius compared at pre-industrial levels and commits parties to make efforts to limit it to 1.5 degrees Celsius. The aim is to peak emissions "as soon as possible" and to achieve emissions neutrality in the second half of the century. The agreement sets out a timeline for all countries to take action, based on their "common but differentiated responsibilities and respective capabilities, in the light of different national circumstances," with a global stocktake on countries' climate action progress set to occur every five years.[10] The language on "common but differentiated responsibilities" in the Paris Agreement was largely borrowed from the joint US-China Climate Change Agreement

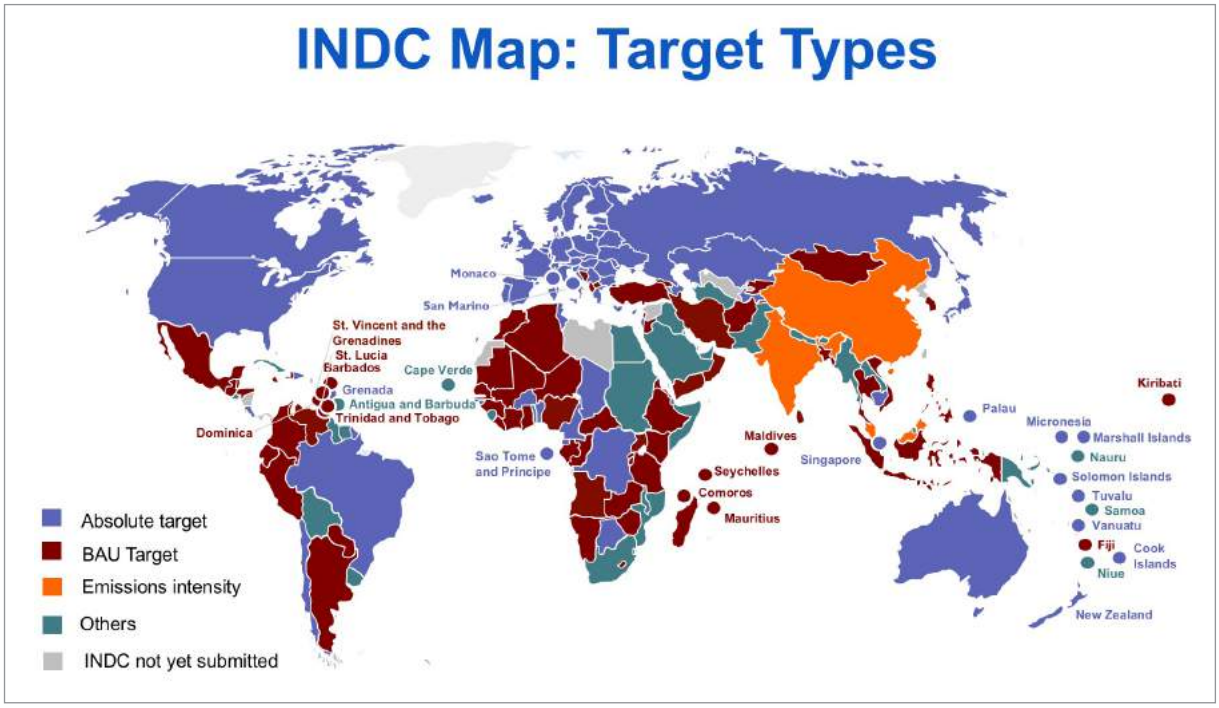
from November 2014.[11] While all countries will contribute to climate action under the new climate regime, developed countries shall take the lead in areas such as mitigation and climate finance. The Paris Agreement includes strong provisions on how countries are to monitor and transparently report on their progress in reducing emissions and, once implemented, its future mechanisms and climate funds could help countries finance low-carbon development more effectively. The agreement's transparency provisions are key for assessing countries' individual actions during the five-yearly stocktake, which is to feed into countries' new "nationally determined contributions" (NDCs). Countries are required to submit such new NDCs with increasing ambition every five years. This process will start in 2020, following a one-off facilitative dialogue in 2018, which will be replaced by the binding stocktake from 2023.

Rather critically, the Paris Agreement does not include provisions that could address concerns around competitiveness that may arise in the future between countries with a cap on emissions who frequently trade with countries that do not have carbon caps or prices. This issue will surely arise in the future – either in the UNFCCC or perhaps in the World Trade Organization (WTO). The paper will explore this issue in the context of China's national ETS in Chapter 5.

2.2 The Role of Carbon Pricing in the New Climate Governance Framework

There is a great degree of diversity amongst the INDCs submitted to date. Targets largely fall into two main blocks: absolute emission reduction targets (mostly members of the Organisation for Economic Co-operation and Development, the OECD) and business-as-usual (BAU) targets which allow for emissions to grow (the trend for many developing countries). Unlike most countries, China as well as India have set carbon intensity-based targets, whereby emissions per unit of gross domestic product (GDP) will be reduced. This will impact the design of China's ETS as the overall cap will be based on a nationwide intensity target rather than an absolute target for economic sectors covered under an ETS, which has been standard practice amongst established ETSs to date (see Chapter 5 for more details). Most OECD countries focus on mitigation in their INDCs, which in their view was the clear intention of the Warsaw Decision, and should therefore be the central element of the INDC process. However, almost all INDCs submitted to date also emphasise the importance of adaptation, technology transfer, and climate finance – elements that have also been clearly recognised in the Paris Agreement.

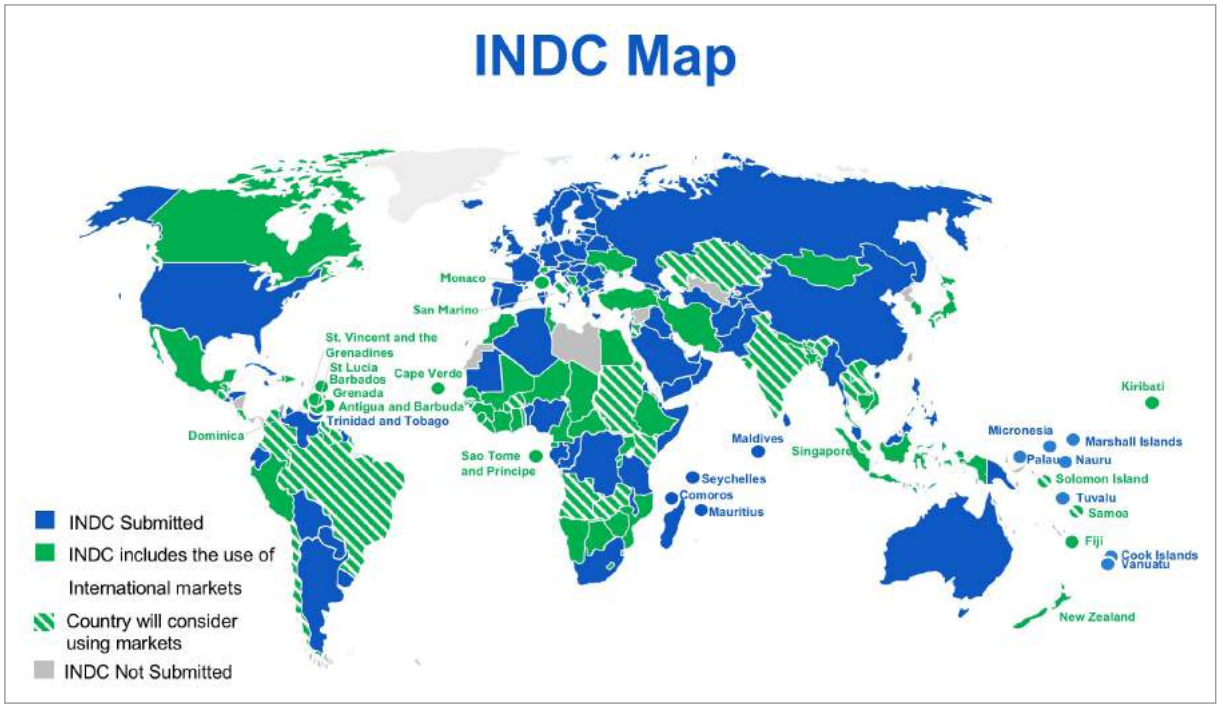
Figure 1. INDCs submitted by target type



Map provided by IETA's INDC Tracker. 20 November 2015.

There are 90 INDCs which explicitly seek access to some form of international carbon market mechanism.[12] The UNFCCC's INDC Synthesis Report, released on 30 October 2015, highlights the fact that over half of the INDCs plan to use, or are considering, market mechanisms.[13] Many of the countries which have specified in their INDCs that they want access to international market mechanisms are low-income countries that would likely become net sellers of emission reductions in a post-2020 international carbon market. China, the EU, and the United States did not specify in their INDCs that they want access to international carbon markets, but all three already have carbon markets in place at the national or sub-national level. This situation provides both momentum and a challenge: How can we create a global carbon market in a process where climate policy and emission reduction targets are set at the national level? And how can policymakers avoid a situation where there are too many sellers of emission reduction units and not enough buyers, as had happened under the CDM? This paper will not explore those policy scenarios in specific detail, but they are additional major policy questions that climate practitioners will need to seek answers to in the implementation years of the Paris Agreement.

Figure 2. Carbon Markets and INDCs



Map provided by IETA's INDC Tracker. 20 November 2015.

Article 6 of the Paris Agreement should help build the foundation for a global carbon pricing framework, but a lot will depend on its interpretation.[14] The Article should at the very least give clarity and guidance to countries which plan to use market-based approaches for meeting their contributions as its first clause specifically refers to countries' ability to pursue cooperation in climate mitigation to meet their NDCs. More specifically, the second and third clauses of Article 6 recognise countries' ability to voluntarily transfer "mitigation outcomes" across borders to be used for compliance with their NDCs. When engaging in cooperation involving "internationally transferred mitigation outcomes," these shall "promote sustainable development," "ensure environmental integrity and transparency," and "apply robust accounting" which shall be "consistent with guidance" developed under the Paris Agreement so as to avoid double-counting.[15] The fourth and fifth clauses establish a new mechanism, referred to as the "sustainable development mechanism," which is meant to become a successor to the CDM and JI. Through the inclusion of Article 6 in the Paris agreement, countries therefore have a multilateral hook for carbon market cooperation and, depending on the outcome of future negotiations, could have a common system to account for and track international emission reduction units.

Article 6 will mean different things to different countries. For some countries, emphasis will be placed on the sustainable development mechanism and the opportunity to export emission reduction units again as was done under the Kyoto Protocol. For others, the open-ended language on "internationally transferred mitigation outcomes" could encourage countries to move away from the top-down model of UNFCCC-issued emission reduction units and towards more plurilateral carbon market cooperation in the form of a club approach. Carbon market clubs could, for example, involve groups of countries coming together to pool their respective nationally-issued allowances and/or offsets and establish a common unit to trade with club members. Over time, as clubs become more robust and more countries consider joining, this could lead to a common international emission reduction unit or an exchange rate for various units which would enable fungibility for various carbon markets or clubs. This in turn would make it much easier for countries to link their respective carbon pricing policies over time.

China's interpretation of Article 6 is still unknown. A lot of China's interactions with the implementation of the Article and participating in some form of international transfers of mitigation outcomes will rest on whether or not it decides to cooperate and/or link with other carbon markets in the future. China supported the inclusion of Article 6 in the Agreement, but it was not one of its top priorities at COP 21.

3. THE GROWTH OF CARBON MARKETS

3.1 Carbon Market Developments around the World

To date, 56 jurisdictions, including 35 national and 21 subnational jurisdictions, have put a price on carbon through an ETS. By early 2016, jurisdictions accounting for 40 percent of global GDP had introduced an ETS.[16] Many economists and policymakers have concluded that emissions trading is a powerful policy tool as it is a proven cost-effective approach of reaching an emissions reduction cap or target. Unlike a tax, it sends a clear market-driven price signal to business and investors allowing them to measure climate abatement investments over a long-term time horizon. It sets a cap on emissions, which is meant to specifically deliver a government's emissions reduction goal. It is a "name and shame" approach to climate policy: any deviation from the cap by the government would automatically create public scrutiny unless the cap is tightened, and any company that does not fulfil their compliance obligations under the ETS is penalised by the regulator. Emissions trading provides long-term clarity for businesses about the government's target and sets predictable compliance periods. This allows companies to adequately prepare for emissions reductions investments and shift funding away from inefficient, high-emissions production.

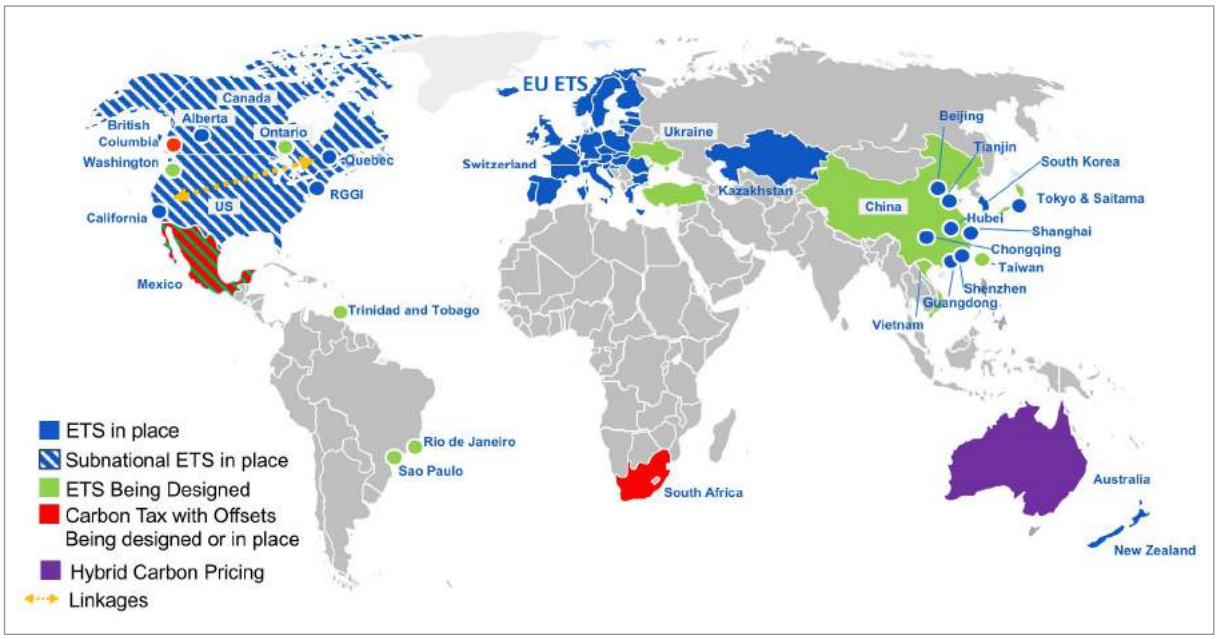
While emissions trading is a clear policy choice for a large number of jurisdictions committed to reducing GHG emissions, it is not a new policy concept. The original concept can likely be traced as far back as 1960, when Ronald Coase wrote a groundbreaking paper titled *The Problem of Social Costs*, which argued that a market must be created to apply property rights to air pollution or other actions by business that cause harm to others.[17] Academics further developed these arguments in the following decades and the concept was first put into policy practice under the Montreal Protocol to phase out chlorofluorocarbons (CFCs). It was then applied under the administration of President H.W. Bush who directed the US Environmental Protection Agency to successfully reduce sulphur dioxide and nitrous oxide which were then responsible for dangerous levels of acid rain in the northeast and midwestern regions of the United States. By the 1990s, academics, policymakers, businesses, and environmental groups began referring to the concept as "cap-and-trade" and were gearing up for the first market-based policies to address carbon dioxide (CO_2) emissions.

The first ETS – and still the largest until China's national system is launched – is that of the EU. It entered into force in 2005 and was predicated on the UK, Dutch, and Danish carbon markets. The EU ETS covers over 11,000 installations across the EU's 28 member states as well as in Iceland, Norway, and Liechtenstein (the members of the European Economic Area). It currently covers around 45 percent of the bloc's GHG emissions.[18] Following the EU ETS, carbon markets have been put into place in Alberta (2007), Switzerland and New Zealand (2008), 9 northeastern US states under the Regional Greenhouse Gas Initiative - RGGI[19] (2009), Tokyo (2010), Saitama (2011), California, Québec, and Kazakhstan (2013), seven Chinese provinces and cities (five in 2013 and two in 2014), as well as South Korea (2015).[20] There are also several other countries who are exploring ETSs through their participation in the World Bank's Partnership for Market Readiness (PMR). These include Vietnam, Mexico, Turkey, Morocco, Thailand, and Indonesia, amongst others.[21] Taiwan and the Canadian provinces of Ontario and Manitoba are also working on introducing ETSs, while Japan and Mexico are exploring setting up schemes in the future.

With the launch of the South Korean ETS in 2015 and the recent announcement of plans for a national Chinese ETS in 2017, emissions trading is gaining traction as the preferred type of carbon pricing policy for many governments around the world, as shown in Figure 3. The number of ETSs in place has tripled since 2012, going from five to 18 in just a few short years. China's national ETS will expand the scope of global GHG emissions covered by such

schemes from nine to 16 percent.[22] Countries that are in the process of designing their own climate policies can draw from the experience of carbon pricing worldwide, learning from both the achievements and the challenges of the UNFCCC's carbon market and the various national and subnational carbon markets already in operation.

Figure 3. Emissions trading worldwide



Map provided by IETA. 20 November 2015.

3.2 Linking Carbon Markets

Linkages between ETSs and the use of carbon crediting mechanisms enable greater net emissions reductions than if governments attempt to achieve their targets in isolation. This is an important factor for governments to consider when they look at how to fulfil the temperature targets set out in the Paris Agreement. Access to other markets that uphold robust accounting rules and ensure environmental integrity could therefore enable countries to go beyond their NDC commitments – and at a lower cost. According to Bodansky et al., linking can be a "strategy to narrow or eliminate differences in the marginal cost of abatement through policies that allow carbon regimes in different political jurisdictions."[23]

Linkage of ETSs and crediting mechanisms could also help reduce compliance costs, contribute to harmonising carbon prices, and help address competitiveness concerns amongst industry as well as the risk of carbon leakage. The current fragmented approaches to climate policy and carbon pricing affect competitiveness and consequently global trade of goods and services. Some firms in carbon-capped jurisdictions are subject to carbon prices, whereas some of their direct competitors operate in jurisdictions without or with less stringent carbon caps. This asymmetric status quo of fragmented carbon prices and climate action more generally can also lead to "carbon leakage" which refers to companies shutting down operations after being subject to a carbon price in a capped jurisdiction and moving to a jurisdiction with no or less stringent carbon pricing policies or caps. Often cited examples of carbon leakage are in the industrial manufacturing sectors such as iron and steel, or cement, amongst others. This type of outcome would undermine the effectiveness of the policy as the exact emission sources it is meant to address are simply "leaked" to another jurisdiction. For example, some industries in Europe have argued that they have had to shut down operations or shift them to China, or other developing countries, as a result of

being subject to compliance under the EU ETS. However, most studies to date find no evidence of carbon leakage.[24]

There are different ways to address competitiveness and carbon leakage concerns. Many economists would argue that the best way of avoiding carbon leakage would be to impose border carbon adjustments (BCAs) which would level the playing field between domestic and foreign products through adjustments on imports and/or exports. Such measures are however administratively, legally, and politically challenging to implement and have consequently not been taken up to date. A frequently used, albeit often sub-optimal, alternative is through the free allocation of allowances. European regulators have set up a "carbon leakage list" for emissions-intensive and trade-exposed industries to receive free allowances. However, free allocation is being increasingly reduced and one of the lessons that the EU has learned from its ETS is to not be too generous with the companies it includes on its carbon leakage list as it becomes harder to tighten the cap-size over time. Finally, a promising alternative to both BCAs and free allowances is the linkage of carbon pricing policies. The EU is, for example, working in multilateral and bilateral forums to create a more global carbon market through ETS linkages. The UK Department of Energy and Climate Change has estimated that linkage could reduce costs for operators by up to 70 percent and allow global GHG emissions to be reduced by an additional 40 to 50 percent at the same cost.[25]

For countries who decide to pursue ETS linkages, some harmonisation of their national policies will need to occur on multiple fronts. This would entail harmonising (to some degree) monitoring, reporting, and verification (MRV) rules; offset protocols; trading rules on banking/borrowing and permitted trading products; absolute versus intensity-based targets; policy timelines; and non-compliance penalties. Experience from the California-Québec linking discussions highlights that there are key steps each government must take towards harmonisation before full linking can take place. Frequent technical meetings were scheduled in Sacramento and Montréal during the years 2012 to 2014 to ensure that their respective programmes had the right "linkability" factors. In those discussions, offset rules, MRV provisions, market infrastructure, and technology fund design options all had to be harmonised before full linking occurred in 2014. In the linking experience between the EU and Norway, not all policy aspects were completely harmonised as for example allocation, MRV rules, treatment of new entrants, and trading periods were maintained, which shows that national systems can continue to operate with autonomy despite being linked with another market.[26] The EU and Switzerland have been carrying out negotiations to link their respective ETSs and successfully concluded their technical negotiations on linking in January 2016. The process lasted for six years and included seven rounds of official negotiations. The final issues to be agreed upon by both sides were the inclusion of aviation GHG emissions, registry operations, and auctioning of allowances.[27]

According to recent research carried out by the Harvard Project on Climate Agreements[28], the Paris Agreement could have allowed for a network of linkages to emerge by:

- Defining key terms, in particular the units that are used for compliance purposes with the Agreement;
- Establishing registries and tracking mechanisms;
- Including default or model rules, from which nations are free to deviate at their discretion.

Ultimately, Article 6 of the Paris Agreement includes three main elements on carbon markets:

1. A provision encouraging countries to voluntarily increase their climate ambition through mitigation cooperation involving "internationally transferrable mitigation outcomes;"

2. A new crediting mechanism referred to as the "sustainable development mechanism;" and

3. A goal to establish rules for the accounting of internationally transferrable units at the first session once the Paris Agreement has entered into force.

Voluntary participation in the provisions set out in Article 6 will hopefully allow countries to achieve a greater outcome than the mere sum of the INDCs pledged to the UNFCCC thus far. Article 6, once implemented, should offer tools for countries to increase their ambition - either by transferring units from another country or by investing in the mitigation mechanism. More climate ambition could emerge either bilaterally or plurilaterally through trading clubs of countries. The implementation of Article 6 could help strengthen future linkages between various carbon markets by creating a universal accounting rule set for emissions transfers and establishing a robust global emissions reduction unit transfer tracking and monitoring system. If the world is to move towards or below the two degrees Celsius limit cost effectively, international transfers of emissions reductions will need to occur rapidly amongst a wide set of countries that work in tandem with UNFCCC future market rules and provisions.

3.3 A Club of Carbon Markets: A Post-Paris Reality?

Ahead of COP 21 in Paris, the overall UNFCCC negotiating process was widely ridiculed as being too slow or hindered by obstructionist countries who did not want to advance global climate policy. In some aspects, these issues have hampered the functionality and ambition of a global carbon market to date. David Victor has argued that the overall lack of global progress on climate change to date is in large part due to the difficulties in bargaining between a very large number of countries at the UNFCCC. He contends that diplomatic "club" arrangements of a small number of countries addressing specific climate policy issues would be more effective than the "big tent" of countries' status quo.[29]

Climate clubs are a particular type of cooperation arrangements whereby groups of countries agree to work together on a specific issue by following the club's rules in exchange for exclusive membership benefits; meaning benefits that would only accrue to club members. The notion of exclusivity is important to incentivise compliance among members and create interest in joining the club among non-members. This concept can contribute to scaling up ambition and action at the global level, and potentially manifest into future carbon market clubs.

Climate clubs could be formed around a range of different issues. Given the proliferation of carbon markets and the gains from cooperation, this is a particularly promising area. A carbon market club could work outside yet in parallel to the UNFCCC by enabling countries that are operating ETSs to exclusively recognise other countries' emission reduction units and harmonising standards on accounting and MRV. In theory, it would be easier to put into practice than the international emissions trading provisions and flexibility mechanisms from the Kyoto Protocol as it would be an easier negotiation amongst a willing coalition of countries. It would likely emerge amongst wealthier countries or OECD member countries first, rather than a mix of countries as would be the case in a global carbon market established under the UNFCCC.

A carbon market club could potentially emerge as a result of a specific provision in Article 6 of the Paris Agreement, which recognises countries' ability to engage in cooperative approaches involving "internationally transferred mitigation outcomes." Some countries might interpret this provision as endorsing or allowing them to develop bilateral or plurilateral carbon markets outside the UNFCCC process. Those markets will need to report back into the UNFCCC process for purposes of compliance with the Agreement and the five-yearly stocktake process. This could

be interesting for some ambitious countries who perceive the UNFCCC negotiating process as "too slow" and/or having a monopoly on the governance of carbon markets. There is a perceived danger, however, that many developing countries would likely be left out of initial club arrangements and would thus not able to partake in the club's benefits. This could potentially undermine broader multilateral climate policy efforts at the UNFCCC and weaken the ultimate goals of OECD countries' climate diplomacy. In order to deal with this challenge, non-members of the clubs could for example be given observer status, which would not only increase transparency, but could also pave the way for them to eventually join the club.[30]

One of the most anticipated gains from club participation would be greater cost-effectiveness in meeting various national emission reduction targets. The cost savings could lead to greater ambition amongst club member countries to reduce emissions, for example by scrapping free allocations, increasing the schemes' coverage, and tightening caps. This increased ambition is likely the most important global benefit, especially in light of the more ambitious 1.5 degrees Celsius goal established by the Paris Agreement. A carbon market club would need to produce common market infrastructure such as registries, accounting rules, and offset protocols, and could provide club members with intrinsic benefits in the form of exclusive trading of emissions units, increased liquidity, price stability, and policy support from other club members. Technical issues such as MRV, unit tracking, and so on should be worked out amongst club members in a transparent and open working group. Moreover, members of the carbon market club could gain political and reputational benefits from joining a club with higher ambition and more robust trading architecture rather than simply following a unilateral carbon market approach. This could help overcome political restraints that large emerging economies may have about joining the club. Criteria for joining a carbon market club might include the type of emissions cap countries impose, the long-term emissions reduction goal of a country's policy, and/or the level of financial and political commitment a member would bring to the club. China's participation in a club would yield both positive and potentially negative impacts which the paper will address in Chapter 5.

4. THE CHINESE ETS: FROM SUB-NATIONAL PILOTS TO A NATIONAL ETS

As the Kyoto carbon markets were slowly winding down, China's seven ETS pilots were formally announced in October 2011.[31] At that time, China had already spent six years actively participating in the CDM and was aware of the concepts and advantages of a market-based system for reducing emissions. Major state-owned companies from the power, petrochemical, and cement sectors, among others, were active participants in the CDM and had benefitted from Certified Emission Reduction (CER) trading arrangements with European and other OECD country trading partners over the prime years of the CDM. This direct experience with the CDM by China's major industrial firms likely had a large influence on the NDRC's policymaking and confidence in establishing the seven pilots, and also led to the creation of the Chinese Certified Emissions Reductions (CCER) offset programme.

The seven ETS pilots cover five cities and two provinces that together represent 26.7 percent of China's 2014 GDP.[32] Over 57 million tonnes of carbon have been traded under the pilots until 31 July 2015 which is valued at US$308 million.[33] Each pilot has been designed locally by a combination of the relevant provincial and municipal Development and Reform Commission's (DRCs), local emissions trading exchanges, and thought leaders in universities and think tanks. These tripartite policymaking entities largely designed and implemented the seven pilots on their own, with frequent consultation with NDRC policy officials in Beijing.

Figure 4. Location of the seven ETS pilots in China

Illustration provided by IETA.

4.1 The Chinese Pilots' Coverage

As a result of the ETSs being designed at local levels, the seven pilots cover a range of sectors and have different thresholds for inclusion. Listed in the table 1 are examples of sector coverage and other factors for the pilots.

Table 1: Coverage of the Chinese ETS pilots

	Beijing	Shanghai	Guangdong	Shenzhen	Tianjin	Hubei	Chongqing
Emissions reduction target (intensity-based)	18% over 2010 levels	19% over 2010 levels	19% over 2010 levels	15% over 2010 levels	15% over 2010 levels, with a further goal of less than 1.69 tonne/CO_2 per 10,000 RMB GDP	17% over 2010 levels	20% over 2010 levels
Emissions compliance threshold	+ 5,000 tonnes CO_2 per year as the average from 2009 to 2011	+ 20,000 tonnes CO_2 per year for industrial sectors in 2010 or 2011, above 10,000 tonnes per year for other sectors	+ 20,000 tonnes CO_2 per year from 2010 to 2012	+ 3,000 tonnes CO_2 per year and any building larger than +20,000 sqm	+ 20,000 tonnes CO_2 per year in any year since 2009	+ 60,000 tonnes coal consumption for major sectors in 2010 or 2011	+20,000 tonnes CO_2 per year from 2010 to 2014
Cap coverage	50% of the city's total emissions: Around 1000 companies from heat supply, power generation, cement, petrochemical, car manufacturing, and public buildings	57% of the city's total emissions: 191 entities are listed (steel, petrochemical, chemical, non-ferrous metal, power, building materials, textile, paper, rubber, and the chemical fibre industry)	42% of the province's total energy consumption: 242 firms are listed (power, cement, steel, ceramics, petrochemical, non-ferrous, plastics, and paper)	635 entities listed from 26 sectors which cover various forms of industry in addition to power, gas, and water supply. Participation is open to any financial institution, 197 public-use buildings	60% of the city's total emissions: 114 entities including iron and steel, chemicals, electricity, heat, petrochemical, oil and gas mining, and civil construction	35% of the province's total carbon emissions: 138 entities are listed (steel, chemical, cement, automobile manufacturing, power generation, non-ferrous metals, glass, paper, etc.)	125 million allowances were issued to 242 companies in the electricity, aluminium, iron and steel, cement, and other industrial sectors
Baseline years	2009 to 2011	2009 to 2011	2011, 2012	2009 to 2011	2009 to 2013	2010, 2011	2010 to 2014

Information from this table stems from a policy briefing the author wrote for the International Emissions Trading Association's member companies (IETA).

4.2 Allocation, Carbon Leakage and Cost Containment Provisions under the Pilots

The seven ETS pilots' first trading periods, from 2013 to 2015, are part of China's 12th Five-Year Plan which ran from 2011 to 2015. The pilots will then transition into a national ETS which will commence during the 13th Five-Year Plan which runs from 2016 to 2020. Some of the main characteristics for allocation and carbon leakage provisions in the seven ETS pilots are described below.

Table 2: Allocation and carbon leakage provisions in the Chinese ETS pilots

Policy		Explanation
Main carbon leakage/Cost containment measures	**Free allocation**	The seven ETS pilots use free allocation to address leakage concerns. Allocation differs between the systems, and some also use allowance auctioning, although free allocation is currently the primary allowance method in the seven pilots. Auctions already take place in Guangdong and Hubei as a complementary allocation method.
	Offsets	Domestic offsets (CCERs) have been included as a flexibility mechanism in the seven ETS pilots. Currently, CCERs are the only offsets allowed for compliance. Limits are in place, but differ between the pilots (see table 3).
	Price floors and ceilings	Price intervention in the seven ETS pilots has varied. Interventions have taken place as a result of the price being too high (in the case of Shenzhen), but have not yet taken place for low prices. The lowest recorded price for allowances in the Shanghai pilot, for example, occurred in March 2016, when prices hit RMB 8.5 (US$1.30).[34]
	Banking and borrowing	Some pilots allow unlimited banking of surplus allowances to future trading periods. Borrowing of allowances has not yet been defined.
Review mechanism for leakage provisions		Currently there are no review mechanisms in the ETS pilots for leakage provisions as these lists have not yet been fully established. Review mechanisms for leakage provisions are important as they consider which emissions-intensive trade-exposed companies should maintain their status on the government's "carbon leakage list."

Compensation and support mechanisms, like those that have developed in the EU ETS for Member States which joined the EU after 2004 are being considered by ETS policymakers at the local and national level in China. The EU mechanisms include free allowances to industry and the power sector, compensation to industry for indirect costs within the EU's state aid rules, as well as a specific modernisation fund which will be capitalised from a specific batch of allowances and will be used to modernise energy systems.

4.3 Monitoring, Reporting, and Verification in China's ETSs

Whilst there are policy differences between the ETS pilots due to the diversity of China's industrial development, all have been successful in subjecting companies to annual MRV processes. China's progress with MRV in the seven ETS pilots can also be credited to the NDRC and to a grant it had received from the World Bank's Partnership for Market Readiness (PMR).[35] The funds from this grant will also help China develop a national MRV

process in anticipation of the nationwide ETS. Highlighted below are the recommendations the NDRC has sent to local authorities to ensure MRV is conducted with efficiency:

i. **Monitoring:** In a national system, monitoring would be self-conducted by covered entities directly. Those reports, once finalised, would set up the MRV system. Practicability, monitoring costs and appropriate parameters for the monitoring methods are all considered to be of top importance to the NDRC.

ii. **Reporting:** Reporting of emissions and subsequent emissions reductions will be self-fulfilled by covered entities in the ETS. The report must be sent to third party verifiers. The report sent to the verifier must include specific documents, activity data, and follow a strict reporting period.

iii. **Verification:** The third party verifiers will issue a verification report which is sent to the covered entities for further adjustment and a cross-check. The seven ETS pilots only allow Chinese verification companies to perform verification services at this time.

These MRV provisions will all likely feed into the national MRV system.

The MRV measures China has put into place to date are typical of existing cap-and-trade programmes. China is quite protective of its emissions data and is notorious for not reporting full indicators of its emissions data to international organisations like the United Nations, although this is slowly changing.[36] Not surprisingly, international (non-Chinese) companies are currently not allowed to perform data verification services in the seven ETS pilots.

4.4 Compliance and Penalties under China's Pilots

Compliance with the ETS pilots amongst Chinese firms appears to have been largely stable to date, with little news reportage of non-compliance. All of the seven pilots have some form of financial penalties. These range from €1,500 to €7,000 per violation, and there is an over 99 percent compliance rate across the ETS pilots to date.[37] Companies must pay the financial penalty as well as surrender the original allowances which were not submitted at the time of the compliance "true-up" period (i.e., the due date for surrendering allowances to the local governments). In comparison, in the EU ETS, penalty fines are over €1 million per violation. The DRCs have also issued other penalties that are unique to China. In Shanghai, for example, if a company is found to be in non-compliance the following penalties can also be imposed:

1. The Shanghai DRC can annul the company's qualifications to gain future government financial support (subsidies), and annul its qualification to participate in government competitions as a "good performer" in energy-saving and other emissions reduction policies.

2. The Shanghai DRC and other relevant government bureaus can ignore the application of new projects from the non-compliant company; in effect, revoking or not issuing construction or operating licenses for the company.

3. If the company is a State-Owned Enterprise (SOE), the violation will be included into the annual performance assessment system of the firm by the government. This system is connected to the salary of the chief executive (the CEO). In effect, the CEO and the SOE's performance review will now include compliance with the Shanghai ETS.[38]

4.5 The Pilots' Offset Measures

On 13 June 2012, the NDRC released the "Interim Measures on China's Voluntary Emissions Trading."[39] Although the title of this interim measure mentions the term "voluntary emissions trading," it means offsetting carbon emissions voluntarily by using credits produced from certified projects. These interim measures have assisted the seven ETS pilots in China by offering an offset mechanism in addition to their respective local allowance units. The NDRC commissioned "experts" to assess around 200 CDM project activity types already approved by the UNFCCC

CDM Executive Board and Methodology Panel. In that assessment, frequency of methodology use, applicability in China, and complexity of methodology were cited as factors leading to the decision to approve 52 project types.[40] The NDRC then converted these 52 methodologies into voluntary CCER project types.

There are four types of CCER projects which can be registered and issued by the NDRC:

1. CDM projects registered by the UNFCCC with unissued CERs;

2. CDM projects approved by the NDRC, but not yet registered by the UNFCCC;

3. CDM projects approved by the NDRC with emission reductions produced before registration with the UNFCCC ("pre-CDM" projects); and

4. Projects that adopt the methodologies approved by the NDRC.

To date, 33 million CCERs have been issued by the NDRC, with the majority being "pre-CDM" projects.[41] There are over 330 CCER projects which have been approved by the NDRC to date.[42] 2015 was the first year that CCERs could be surrendered for compliance in the seven pilots.

Each of the seven pilots have now implemented the NDRC's CCER measures, and CCERs can be used to offset companies' actual emissions (based on the offset limit set by each pilot). As noted in table 3, all of the pilots allow CCER offsets in their respective systems, but the limits on offset use differs.

Table 3: Offset limits in the Chinese ETS pilots

	Beijing	Chong-qing	Guangdong	Hubei	Shanghai	Shenzhen	Tianjin
Compliance eligibility (% CCER)	5%, but at least 50% must be located within the Beijing municipality	8%	10%, but 70% of the total amount must be located within Guangdong province	10% for new entrants* 15% for pilot ETS partici-pants	5%	10%	10%

**Any entity that joins the ETS after the "launch" of the pilot ETS.*

Challenges in the ETS pilots remain, however, with a variety of policy issues that could affect the operation of China's national carbon markets. Section 4.7 will look at those challenges in more detail.

4.6 Carbon Prices and Trading in the Pilots

The seven ETS pilots have yielded seven different carbon prices in China. Allowances and offsets are only permitted to trade on local emissions exchanges in the seven pilots, and this has produced a long data set of carbon prices since trading began in 2013. Current prices in China range from €1.75 to €7 per tonne, but have risen to over €15 in the Shenzhen pilot.[43]

During some periods in 2013 and 2014, carbon prices in China's ETS pilots were sometimes higher than in the EU ETS. The largest reason for price fluctuations in the seven ETS pilots is over-allocation of allowances and policy uncertainties held by ETS participants on banking/borrowing allowances from the ETS pilots to the national ETS. The overall uncertainty of whether or not allowance-holders in the ETS pilots can bank or carry over their allowances to the national ETS has been a major factor in the emergence of a carbon price in China to date. Lack of transparent market information and uncertainty over the transition to the national ETS also affect market behaviour across the seven pilots, which in turn may have dampened demand for carbon

allowances. As a result, the total volume traded in the pilots to date is lower relative to the cap size as that in other markets like the EU and California.

4.7 The National ETS: Background Information

Since President Xi's landmark announcement last September on establishing the national ETS, draft legislation for the national ETS has been tabled by the NDRC with China's State Council. In order for the national ETS to go into effect, the State Council must approve the plans put forward by the NDRC. It is expected that these plans will be approved at some point in 2016 after the 13th Five-Year Plan also goes into effect.

On 19 January 2016, the NDRC circulated a notice about China's national ETS to all provincial DRCs, government administrations, the civil aviation administration, SOEs, and major industry associations in China.[44] The notice specified that firms from eight sectors and 18 sub-sectors, which consume over 10,000 tonnes of coal equivalent per year, would be included in China's national ETS. Those sectors and subsectors include:

1. Power (generation, heat-power cogeneration, and grid operators);
2. Petrochemicals (crude oil refining and processing and ethylene);
3. Chemicals (methanol, ammonia, and carbide);
4. Iron and Steel;
5. Non-ferrous metals (copper smelting and electrolytic aluminium);
6. Building production and materials (clinker and plate glass);
7. Pulp and Paper; and
8. Aviation (civil commercial, cargo, and airports)

The notice specifies that companies in each of these sectors should establish an internal "compliance plan" this year to prepare for the national ETS.

The NDRC will determine the total quantity of allowances available to operators. Some allowances will be set aside for market stabilisation and a new entrants reserve/ innovation fund. A hybrid free allocation/ auctioning system will be implemented, and it is expected that the ETS will be moving towards auctioning over time after 2020. The total amount of allowances will be set by the NDRC only, and all allowances that are issued by the NDRC to emitters for free will have to be surrendered for compliance in the first phase. The NDRC is also looking at a pilot phase from 2016 to 2017 where operators can perform a non-compliance trial of allowance allocation and surrender to familiarise themselves with the process. Under the national ETS, allowances that are not used for compliance can be traded in the open market on exchange platforms that have been approved by the government. China will use a mix of historical emission data and industrial benchmarks to decide how many CO_2 allowances emitters will receive. In some sectors allowances will be grandfathered, while in others they will be benchmarked (power, petrochemicals, chemical manufacturers, and aviation).

The national ETS will include most, if not all, of China's SOEs where leakage is not expected to be an issue considering their ownership structure. Manufacturing costs in some sectors are still comparatively low in China. Hence, leakage might not be a large concern, but caution is still warranted amongst China's ETS policymakers. There is a possibility that trade-exposed industries, such as aluminium or steel, will be put on a "carbon leakage list" like industries in the EU, but this information still rests on a final rule from the government which was not yet defined at the time of writing this publication.

Free allocation will be determined by the NDRC, but provinces are required to send a list of which companies in their local regions will be included in the national ETS. The NDRC will operate a national registry. Revenues from allowance

auctions will be recycled for an innovation fund (both at the national and regional level) which is still being designed by policymakers.

The NDRC will soon designate several exchanges for trading, and trading info will be made publicly available. The NDRC will nominate verifiers to perform MRV services, and covered entities will have to submit annual emissions reports to their provincial DRCs. Covered entities will be able to offset part of their compliance obligations with CCERs. There will be penalties for non-compliance which will be both financial and political in scope.

4.8 Challenges for China's National ETS

China's national ETS will be designed based on best practices and lessons learned from the seven ETS pilots and other ETS jurisdictions, but it will also be shaped to function in the context of China's socialist market economy and the state-run electricity market.[45] China's national ETS is likely to face many challenges in areas that are critical for the good functioning of ETSs. Those issues include:

- **Enforcement and compliance:** Under the ETS pilots, compliance has been enforced at the local – provincial or municipal – level. This has allowed for the operators to negotiate their free allocation relatively easily and to be in constant contact with their regulators. Under a national ETS, there will be less flexibility for local DRCs to negotiate free allocation for operators and enforce compliance in a local context (see the case of Shanghai in Section 4.5) until China's State Council regulation on enforcing the ETS is implemented at both the national and provincial levels. The administrative burden of enforcing compliance will fall on the NDRC and this could pose challenges in the future where the total number of operators is much greater than currently in the ETS pilots. Such challenges largely involve expanding the institutional and staffing arrangements for the NDRC's Climate Change Department which is a smaller department than other more established units at the NDRC. Like many energy and environmental regulations in China, the NDRC's compliance provisions will need to have a strong "buy-in" by local DRCs for the ETS to be effectively enforced.

- **Carbon intensity target:** China's INDC is to reduce the carbon intensity of its economy by 60 to 65 percent by 2030. This differs from an absolute cap on emissions like the EU or California has imposed. The NDRC will need to strongly enforce the intensity targets in order for the ETS to function effectively, as an intensity target does not discourage companies from decreasing overall production. Allocations under intensity targets are adjusted ex-post, and this could lead to over-allocation or liquidity problems down the road for the national ETS.

- **Allocation:** Most of the seven ETS pilots have over-allocated emissions permits and done so for free in order to generously compensate operators for their initial participation. The NDRC will have to weigh carefully the merits and risks of over-allocation in the national ETS in order to avoid a policy outcome similar to what has caused the current surplus of allowances in the EU ETS, for example. The NDRC should consider moving towards auctioning over time as other ETS jurisdictions have done.

- **MRV:** While China has set up a robust MRV programme under the seven ETS pilots, the sheer size of China's national ETS and the number of potential companies and installations that will be included will prove to be a challenge in scaling-up MRV across the country. It could take several years for the MRV process in China to be reliable enough for the government to move away from free allocation to auctioning and this could also delay any subsequent policy discussions on linkage with other ETSs.

- **Low liquidity and trading:** Trading in the seven ETS pilots to date has been very low and this has caused liquidity to be abnormally low compared to other cap-and-trade programmes. Low liquidity and low trading volumes have made it difficult for the seven ETS pilots to show that they

are more than just compliance mechanisms. Liquidity has increased, however, with non-Chinese trading houses being permitted to trade in some of the ETS pilots (Shenzhen, Guangdong, Hubei, and Shanghai). The national ETS will need to be effective in design so as not to over-allocate allowances and to allow for trading to be conducted in both spot and exchange transactions. China will also need to introduce carbon trading options (futures, forwards, etc.) in order for liquidity to be robust, and for the uniformity of its carbon units to be compatible with any jurisdiction it could link with. China is likely to establish a price containment mechanism to keep prices stable, but details are not yet available.

In preparation for the national ETS, the NDRC along with local DRCs have already entered into agreements with foreign environmental ministries and agencies on technical and ETS policy work. Agreements have been signed between the seven ETS pilot DRCs and California, the UK, France, Norway, Finland, Germany, Québec, and the European Commission. China has also received US$8 million from the World Bank's PMR in 2013 to study the feasibility of and make recommendations for establishing a national ETS under the 13th Five-Year Plan. Many of the challenges with implementing China's national ETS are being raised in government-to-government forums, such as the World Bank's PMR and the EU-China Climate Programme. There are also business-to-business technical ETS dialogues, such as those run by IETA's "Business Partnership for Market Readiness" (B-PMR), and through technical ETS trainings for Chinese businesses funded by the EU and Germany.

5. IMPLICATIONS OF CHINA'S ETS FOR CARBON MARKET DEVELOPMENTS AND COOPERATION

China's national ETS will have major implications for climate policymaking around the world and will substantially change the dynamics and status quo of current ETSs. It may well incentivise other countries to establish a carbon price and encourage further carbon market cooperation, as well as support the implementation of the Paris Agreement.

To start with, China's ETS will be the world's largest cap-and-trade system with some estimates stating that its cap could be at least twice the size as that of the EU, where emissions are currently capped at around two billion tonnes.[46] If China was to adopt a cap size of at least four billion tonnes, its ETS size would be greater than all the existing carbon markets combined. The implementation of a national ETS in the world's biggest GHG emitter which is also a key player in world trade has sent an important signal about its climate effort and commitment. The effects of President Xi's announcement that China will have a national ETS by 2017 will continue to be felt in many countries over the next few years.

5.1 Implications for Existing Markets

It is still too early to tell what impacts China's national ETS will have on carbon prices and competitiveness concerns in jurisdictions that already price carbon, for example the EU, California, or South Korea, amongst others. Policymakers in China may deliberately decide to impose a price floor or ceiling in the Chinese ETS to keep the prices stable and lower than carbon prices in other jurisdictions. China may decide to follow the approach of California and adopt a price floor and ceiling for its carbon market. Would it do so primarily to set a price lower than its competitors, or would it be caused by the government's strong interest in stability in its trading markets? In the short term, the carbon price in China may have a positive effect on existing carbon markets as it will likely reduce competitiveness concerns amongst emissions-intensive and trade-exposed industries and large manufacturers. It is too early to understand what implications this will have on existing carbon markets, for example increasing their reduction targets, phasing out free allocation or reducing the cap size. Nevertheless, the short-term effect will likely be positive as it will be reassuring to policymakers in existing systems that the world's largest economy will also have a carbon market. Once the carbon market is operational in China, however, industries in other jurisdictions that already pay a carbon price may become more sophisticated in their understanding of the Chinese ETS and what carbon prices their competitors in China are facing. This could lead to renewed carbon leakage and competitiveness concerns from firms in carbon-capped jurisdictions in the future.

China will likely issue allowances for free under its national ETS for the first few years. This should allow operators to begin setting their respective carbon budgets and prepare for participation in allowance auctions. However, auctioning of allowances could be introduced at any time at the government's choosing. China could also adopt similar measures on carbon leakage as can be found in the EU ETS with special allocation rules for firms on a "carbon leakage list." This would help reduce the risk of China's carbon-intensive, trade-exposed industries moving their facilities to other countries that do not have an ETS in place. After 2020, when China has moved into a robust process of auctioning allowances, policymakers should look at the merits of linking China's ETS with others in the region or joining a carbon market club. China's existing and future cooperation and information sharing with other countries on carbon market design will undoubtedly help steer the process of linkage in the future.

5.2 Implications for Countries without Carbon Markets

China's advancements in emissions trading have already caught the attention of other major and emerging economies to look at developing cap-and-trade systems. It is quite evident that China's move towards imposing a carbon cap-and-trade system will send a strong signal to other large economies that carbon pricing is no longer just an OECD-led policy construct.

Until March 2014, Russia considered developing an ETS pilot, based on China's approach of smaller regional ETS pilots. Vietnam has announced that it will launch a pilot ETS after 2020[47], and both Indonesia and Thailand set up voluntary carbon markets in 2014. Taiwan passed the Greenhouse Gas Reduction and Management Act in June 2015 which has set in place a process to establish an ETS. Brazil and India have, however, been silent on the topic so far. As more and more countries are exploring the introduction of ETSs, the risks of carbon leakage and competitiveness distortions amongst China's major industries could be reduced. Below are a few examples of how the implications of China's national ETS may be felt in non-capped major economies:

Implications of China's ETS for Japan:

Japan currently has no national ETS, although the city of Tokyo has a cap-and-trade programme and the region of Saitama also maintains a voluntary carbon market programme. Japan launched the "Japan Crediting Mechanism" (JCM) in 2012 to help promote low-carbon technology and services between Japan and other countries. The emissions reductions gained from such activities will help Japan achieve its emission reduction target of 3.8 percent below 2005 industrial levels by 2020.[48] The JCM is not a carbon market yet, as it does not have a tradable and issued unit. Japan does have a carbon tax in place for hydrocarbons, which is in the amount of ¥1370 to 2800 (US$12 to 25).[49] With both South Korea and China having a carbon market in place by 2020, there is tremendous political pressure on Japan to enact a policy to impose a carbon price across its economy.

Implications of China's ETS for India:

India has no form of carbon market, although it does have a unique policy called "Perform Achieve and Trade" (PAT), which rewards Indian firms which reduce their energy intensity. It also has a renewable energy credit (REC) market.[50] Indian academics and policymakers have long argued that developed countries must address and finance solutions to reduce emissions. As such, India has not yet taken any concrete steps towards putting a price on carbon. The launch of China's national ETS, however, will pose a challenge to that argument as it will be the first real-world case of a developing country applying a carbon price across its economy. This will undoubtedly raise questions amongst India's political and economic establishment and could lead to discussions to introduce pilot emissions trading schemes as China has already done. Indian firms will likely want to know exactly how China's manufacturing hubs are faring under a carbon price and which carbon price in China would lead to the "breakeven" point for a Chinese firm.

Implications of China's ETS for Russia:

Once a national ETS in China is in full operation, Russia's top two trading partners (the EU and China) will both apply a carbon price across their economies. The risk of BCAs is already an issue that some Russian export conglomerates and firms are aware of, and once China's ETS is operational, pressure to adopt a carbon price amongst Russia's trade-exposed industries will emerge. Whilst there is very little current discussion in Russia on developing a domestic carbon market, its trade exposed industries may raise concerns with their government once China's ETS is operational. This is especially true if one takes into account the massive natural gas volumes which Russia is set to export to China in the coming years.[51]

Implications of China's ETS for Brazil:

While the states of Rio and Sao Paulo made early steps to establish a voluntary carbon market[52], to date the Brazilian federal government has made very few steps towards

setting up a carbon market in Brazil. China's national ETS experiences may be less relevant to Brazil considering land-use change is the largest source of Brazilian emissions. Brazil may be more driven to adopt a carbon price by emissions trading and carbon pricing policies that are developed by its neighbours in Latin America or through the UNFCCC.

China has yet to identify what measures it will establish under its national ETS to avoid carbon leakage whereby Chinese firms would shut down production in China and shift that production abroad. Most production that has already shifted away from China is in the light manufacturing sector where firms have moved to Southeast Asia due to lower labour costs than in China. It is too early to argue that a carbon price in China would further incentivise firms to shift production to other Asian countries and the government may decide to compensate or maintain free allowances for emissions-intensive, trade exposed firms in China under the ETS.

5.3 China's National ETS: Implications for Carbon Market Cooperation and Implementation of the Paris Agreement

China's ETS pilots and its commitment to a national ETS has sent a political signal that has the potential to create a dynamic towards an increasing uptake of ETSs, which, in turn, could enhance cooperation on carbon pricing through linkages and the development of a plurilateral carbon market club. Whether or not China would link its ETS or join such a club will become clear over time, although the national ETS is only likely to move from free allocation to auctioning. Before this policy change takes place, it will be difficult to envisage any other ETS linking with China's as there will likely be little demand for extra allowances during the free allocation period given that the NDRC is expected to generously issue allowances to operators during the first or second phases of the ETS, and it is rather unlikely that China would increase its carbon intensity reduction target before 2020.

China's non-participation in a plurilateral carbon market would not, however, stop other countries from forming one. Several INDCs – Canada, Mexico, New Zealand, Switzerland, or South Korea, amongst others – have firmly stated that they need access to international market mechanisms in order to achieve their respective emission reduction targets. These countries are the likely candidates for creating a plurilateral carbon market, or a club, and they will do so regardless of policy outcomes from China. Moreover, 18 countries led by New Zealand and including Canada, the US, Australia, Korea, and Japan, signed a ministerial declaration on carbon markets at COP 21.[53] This declaration features a pledge by countries to work together to quickly develop standards and guidelines for international market mechanisms to support the Paris Agreement and the UNFCCC.

The countries who signed up to this declaration would be the likely candidates to form a plurilateral carbon market club and to develop standards and norms for carbon market cooperation in the future. These countries may decide that in order for them to fulfil the targets they set out in their respective INDCs, it is easier to agree on provisions for accounting, offset use, and allowance transfers outside of the UNFCCC process rather than within it. They could, for example, agree on mutual rules for international carbon trading which could then feed into the UNFCCC process on similar rules under Article 6 of the Paris Agreement. Considering the nature of the countries who signed up to the Declaration – they are mostly members of the OECD and have export-driven economies – the rules and standards they would set for international carbon markets in a plurilateral trading club might be of a higher calibre than what could be established under the UNFCCC with over 190 countries as part of the multilateral decision-making process. Moreover, the US and Canada, as signatories of this declaration, would bring real-world experience to the discussion from their cross-border carbon trading cooperation between California and Québec.

China was not one of the declaration's signatories, and does not seem to be posturing to the wider group of countries with carbon markets that intends to lead on carbon market cooperation in the pre-2020 period. However, China's policy officials responsible for the implementation of the national ETS have expressed an interest in potential linkage with South Korea over recent months.[54] China did not take a vocal lead on the development of Article 6 at COP 21, and instead used its pavilion within the COP grounds to highlight the experiences and challenges from its ETS pilots and what is to come next under the national ETS. It is quite clear from the set-up of China's ETS that the government wants to perfect emissions trading in China before looking abroad for any type of cooperation. China should weigh cautiously joining any plurilateral trading club until it has undergone at least one compliance phase and all aspects of its ETS have been properly tested and evaluated by its ETS regulator.

It is difficult to foresee whether China would be a net seller or buyer in a carbon trading club, but its intensity target will be a factor in any scenario in which China participates. If Chinese firms subject to an intensity target buy less expensive units from an international club, it could lead to a scenario where production costs are then less expensive in China and unnecessary production increases in China would occur. Cheaper units from a club could be used for compliance by firms in China and, therefore, it would cost them less to comply with the overall target and emissions may actually grow. This would undermine the effectiveness of reducing emissions through the ETS. If firms from China sell Chinese-issued units into a club, there could be unforeseen variations in the level of Chinese units made available depending on the level of economic activity in China at any given time. This could lead to a club whereby its members with absolute caps are subject to a higher degree of price volatility compared to their domestic systems.

A carbon market club would need a fungible trading unit in order to function effectively. However, if it was to allow China's intensity based ETS to participate, it might have to impose trading restrictions on the number of units that could be imported into or exported from the club by China, or establish an exchange-rate mechanism specifically for China or other members with intensity-based targets. With that in mind, China might explore linking first with one of its strongest trading partners or joining a smaller regional club where it also has well-established economic and trading ties. This could reduce the risks that may emerge when Chinese firms were to be market price makers or price takers. Any potential ETS linkage by China would first require that its carbon market is designed in a way so that it can be harmonised with other systems in the future. The EU has invested in both the Chinese and Korean ETSs through EuropeAid projects that aim to ensure lessons learned from the EU ETS are applied in both systems.[55] This project, along with policy officials in China and Korea steadfastly ensuring that their systems are designed so they are "linking ready" in the future, could go a long way to ensuring a future carbon market club does emerge.

6. CONCLUSION AND POLICY RECOMMENDATIONS

China's national ETS is being shaped in large part by how other jurisdictions have adopted emissions trading as their preferred policy approach to reduce emissions. At the same time, its ten years of experience with emissions trading through the CDM has given both policymakers and companies in China the confidence to implement and participate in an ETS at the local level. China's allowance and offset market in the seven ETS pilots has shades of the UNFCCC's CDM in their design. As China begins the shift towards a national ETS to be implemented from 2017, global climate policy making is undergoing a massive shift away from a top-down Kyoto-style policy architecture towards a bottom-up approach through the development of INDCs and the new Paris climate agreement adopted at COP 21 in December 2015. Over the next few years, a policy congruence should emerge whereby China's climate policy evolution towards a national ETS will both directly and indirectly affect the growth of emissions trading worldwide. In order for China's national ETS to perform effectively and for it to eventually join a plurilateral carbon market, several policy recommendations for ETS policymakers inside and outside China should be followed:

- **Setting the cap right:** Covering as many sectors as possible under China's ETS will ensure liquidity, which improves price discovery and the formation of a forward carbon price curve. This helps participants in the ETS make long-term low-carbon investment decisions. The government should avoid over-allocating emissions permits and identify ways to transparently share data on allocation methods and volumes across the eight main sectors included in the national ETS. A robust cap and target will also signal to policymakers from other ETS jurisdictions that China's ETS is ambitious. This is a key prerequisite for other ETSs who may then want to link with China.

- **Manage and avoid the overlapping policies conundrum:** Unlike the EU with its ETS, emissions trading in China will not be the "flagship" policy for reducing emissions. Rather it will be one policy in a broader policy basket that the central government will use to combat rising emissions levels. Other policies include renewables and energy efficiency goals as well as phasing out coal power. Although the two policy approaches by the EU and China are different, they both are at risk of overlapping policies which will render all policies less effective once implemented. The government should try earnestly to avoid overlap of policies as it could inhibit the market effectiveness of the national ETS.

- **Establish a strong compliance and enforcement regime:** China faces a serious challenge in reducing its overall GHG emissions and aiming to peak its emissions in the decade ahead. Having a binding emissions reduction target, with an ambitious cap supported by the rule of law, will enable the national ETS to be an effective climate policy instrument. China must ensure that its industries understand the ETS is a carrot-and-stick approach: there are rewards for effective participation, but negative legal consequences if a company is non-compliant. However, several of the seven ETS pilots have enacted a strong compliance and penalties regime that the NDRC can build on.

- **Avoid the risk of carbon leakage, but stay "linking ready":** Sectors or installations in China that are determined to be energy-intensive and exposed to international competition by the NDRC should be protected from national carbon prices until carbon pricing is more widespread and more harmonised amongst China's major trading partners. Extensively using allowance auctioning as a for-payment approach has been widely demonstrated in both the EU

ETS as well as in other carbon markets such as RGGI, California and Québec. Experience has shown that auctioning of allowances provides the greatest price transparency and allows the resulting price signal to have maximum effect on choices and behaviours. China's national ETS should adopt best practices on ETS allowance methods and ETS auctions from existing carbon markets. This will also help improve the opportunities for ETS linkages to occur.

- **Multiple trading products:** The national ETS should allow for allowances, offsets, and carbon offsets and futures. The more trading products available, the greater the liquidity. Combining this with allowing for foreign participation in the national ETS, and the appetite for ETS linkage will surely increase by both Chinese policymakers and those from other jurisdictions.

China's national ETS will mark the start of a new era in climate policy for the country. The locus for carbon market policymaking will pivot towards Beijing over the coming years, providing ample opportunities for policymakers in China to benefit from the experience gained by countries and companies already subject to a carbon market. In return, China's policy approaches to emissions trading will provide new insights and lessons for ETS already in maturity, for those under development, and for those countries who join a plurilateral carbon market or a new carbon market club. As China embarks on a national ETS and global climate policy continues to shift towards national capitals, there will be many opportunities for it to benefit from both best practices in carbon markets and by ensuring its ETS is ready to link up with others if, amongst other factors, the policy recommendations listed above are addressed. Carbon market policymakers outside China should be prepared for it to create links and remember Napoleon's words on the Middle Kingdom that when the dragon wakes, "she will move the world."

ENDNOTES

1 Annex 1 countries are nations who achieved industrialisation by the time the UNFCCC was ratified in 1992 and agreed to emissions reduction targets under the Kyoto Protocol. They include most OECD economies. A full list of those countries is available on the UNFCCC website at http://unfccc.int/parties_and_observers/parties/annex_i/ items/2774.php.

2 The Kyoto Protocol offered three "flexibility mechanisms" - the CDM, JI, and international emissions trading - for Annex 1 countries to meet their respective targets. A further definition of these mechanisms is available on the UNFCCC website at http://unfccc.int/kyoto_protocol/mechanisms/items/1673.php.

3 National Development and Reform Commission. October 2011. "Notice on launching carbon emissions trading pilot." http://www.sdpc.gov.cn/zcfb/zcfbtz/201201/t20120113_456506.html. Last accessed 9 March 2016.

4 National Development and Reform Commission. June 2015. "Enhanced Action on Climate Change: China's Intended Nationally Determined Contributions." http://www4.unfccc.int/submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf. Last accessed 9 March 2016.

5 United Nations. 15 March 2012. "Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. Addendum. Part Two: Action taken by the Conference of the Parties at its seventeenth session." UNFCCC, FCCC/CP/2011/9/Add.1. http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf. Last accessed 9 March 2016.

6 Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. October 2015. "Kyoto Protocol." http://www.bmub.bund.de/en/topics/climate-energy/climate/international-climate-policy/kyoto-protocol/. Last accessed 9 March 2016.

7 United Nations. 31 January 2014. "Report of the Conference of the Parties on its nineteenth session, held in Warsaw from 11 to 23 November 2013. Addendum. Part two: Action taken by the Conference of the Parties at its nineteenth session." *UNFCCC*, FCCC/ /CP/2013/10/Add.1. http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=3. Last accessed 10 March 2016.

8 ICTSD. 30 November 2015. "BioRes Paris Update #1 | 'We cannot abandon hope,' the driver behind talks on a new climate regime." *ICTSD Bridges Trade BioRes*. http://www.ictsd.org/bridges-news/biores/news/biores-paris-update-1-%E2%80%9Cwe-cannot-abandon-hope%E2%80%9D-the-driver-behind-talks-on-a. Last accessed 9 March 2016.

9 Climate Action Tracker. December 2015. "Tracking INDCs." http://climateactiontracker.org/indcs.html. Last accessed 9 March 2016.

10 United Nations. 12 December 2015. "Adoption of the Paris Agreement." *UNFCCC*, FCCC/CP/2015/L.9/Re.1, 12. https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf. Last accessed 9 March 2016.

11 The White House. 11 November 2014. "U.S.-China Joint Announcement on Climate Change." *Office of the Press Secretary*. https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change. Last accessed 9 March 2016.

12 International Emissions Trading Association. February 2016. "IETA INDC Tracker." https://docs.google.com/spreadsheets/d/1YgIQiiucWW9vuDUAMeRstzzLxTXi6zFWtFVClqtRTe4/edit?pref=2&pli=1#gid=0. Last accessed 9 March 2016.

13 United Nations. 30 October 2015. "Synthesis report on the aggregate effect of the intended nationally determined contributions." *UNFCCC*, FCCC/CP/2015/7. http://unfccc.int/resource/docs/2015/cop21/eng/07.pdf. Last accessed 9 March 2016.

14 See United Nations, above 10.

15 See United Nations, above 10, at 24.

16 International Carbon Action Partnership (ICAP). 2016. "Emissions Trading Worldwide: Status Report 2016." https://icapcarbonaction.com/images/StatusReport2016/ICAP_Status_Report_2016_Online.pdf. Last accessed 9 March 2016. *Note: The report counts 55 schemes, omitting Alberta.*

17 Ronald Coase. 1960. "The Problem of Social Cost." *The Journal of Law and Economics*, 3: 1-44.

18 European Commission. March 2016. "The European Union Emissions Trading System (EU ETS)." http://ec.europa.eu/clima/policies/ets/index_en.htm. Last accessed 9 March 2016.

19 There are nine U.S. states that are members of RGGI, including: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

20 See International Carbon Action Partnership (ICAP), above 16.

21 World Bank. 2016. "Participants." *Partnership for Market Readiness*. https://www.thepmr.org/content/participants. Last accessed 9 March 2016.

22 See International Carbon Action Partnership (ICAP), above 16, page 26.

23 Daniel Bodansky et al. November 2014. "Facilitating Linkage of Heterogeneous Regional, National, and Sub-National Climate Policies Through a Future International Agreement: Executive Summary." *Harvard Project on Climate Agreements*. http://belfercenter.ksg.harvard.edu/files/ieta-hpca-es-sept2014.pdf. Last accessed 9 March 2016.

24 Hans Bolscher et al. September 2013. "Carbon Leakage Evidence Project – Factsheets for selected sectors." *Ecorys in consortium with Öko-Institut e.V., Cambridge Econometrics and TNO.* http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/cl_evidence_factsheets_en.pdf. Last accessed 9 March 2016.

25 House of Commons. January 2012. "The EU Emissions Trading System." *Energy and Climate Change Committee,* Tenth Report of Session 2010-12, Volume I. Page 21. http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/1476/1476.pdf. Last accessed 9 March 2016.

26 Sonja Hawkins and Ingrid Jegou. March 2014. "Linking Emissions Trading Schemes: Considerations and Recommendations for a Joint EU-Korean Carbon Market." *International Centre for Trade and Sustainable Development (ICTSD).* http://www.ictsd.org/sites/default/files/research/linking-emissions-trading-schemes-considerations-and-recommendations-for-a-joint-eu-korean-carbon-market.pdf. Last accessed 10 March 2016.

27 Federal Office of the Environment. March 2015. "Seventh Round of Swiss-EU negotiations on linking of emissions trading systems." http://www.bafu.admin.ch/klima/13877/14510/14882/15415/index.html?lang=en. Last accessed 9 March 2016.

28 Daniel Bodansky et al. November 2014. "Facilitating Linkage of Heterogeneous Regional, National, and Sub-National Climate Policies Through a Future International Agreement." *Harvard Project on Climate Agreements*. http://belfercenter.ksg.harvard.edu/files/harvard-ieta-linkage-paper-nov-2014.pdf. Last accessed 9 March 2016.

29 David Victor. January 2015. "The Case for Climate Clubs." *E15 Initiative. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum*. http://www.ictsd.org/sites/default/files/research/E15_Climate_Victor_FINAL.pdf. Last accessed 10 March 2016.

30 Kasturi Das. August 2015. "Climate Clubs: Carrots, Sticks and More." *Economic & Political Weekly,* 50 (34). http://www.epw.in/journal/2015/34/commentary/climate-clubs.html. Last accessed 10 March 2016.

31 See National Development and Reform Commission, above 3.

32 Josh Margolis, Daniel Dudek and Anders Hove. September 2015. "Rolling out a Successful Carbon Trading System." *Paulson Institute*. Page 14. http://www.paulsoninstitute.org/wp-content/uploads/2015/09/5-Emissions-Trading-EN-final1.pdf. Last accessed 10 March 2016.

33 Ibid.

34 Stian Reklev. 7 March 2016. "CN Markets: Shanghai CO2 Price Finds Fresh Depths as China's Pilot Markets Face Difficult Year." *Carbon Pulse*. http://carbon-pulse.com/16664/. Last accessed 10 March 2016.

35 National Development and Reform Commission. February 2013. "Market Readiness Proposal: Establishing a National Emissions Trading Scheme in China." *Partnership for Market Readiness*. http://www.thepmr.org/system/files/documents/China_MRP_final_19-02-2013rev_0.pdf. Last accessed 10 March 2016.

36 Angel Hsu, Andrew Moffat and Kaiyang Xu. 22 December 2015. "Data Transparency: New Dynamic at COP-21 in Paris." *China FAQs*. http://www.chinafaqs.org/blog-posts/data-transparency-new-dynamic-cop-21-paris. Last accessed 10 March 2016.

37 Zheng Xipeng. No date. "National Perspective of Chinese ETS." *Sino Carbon Innovation and Investment presentation*. https://ieta.wildapricot.org/resources/China/Presentations/National%20Perspective%20of%20Chinese%20ETS%2020160302.pdf. Last accessed 10 March 2016.

38 Shanghai DRC. July 2013. "Draft Measures on Emissions Trading." http://sh.eastday.com/m/20130712/u1a7516879.html. Last accessed 10 March 2016.

39 National Development and Reform Commission. 2012. "Interim Measures on China's Voluntary Emissions Trading." http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2894.pdf. Last accessed 10 March 2016.

40 Ibid.

41 Stian Reklev. 9 November 2015. "China Issues 9.4 million CCERs." *Carbon Pulse*. http://carbon-pulse.com/11620/. Last accessed 10 March 2016.

42 See Xipeng, above 37.

43 Xing'an Ge. 9 October 2014. "State and Trends of Shenzhen Carbon Market." *China Emissions Exchange presentation*. https://www.iea.org/media/workshops/2014/23XING_ANGEStateandTrendsofShenzhenCarbonMarket.pdf. Last accessed 10 March 2016.

44 National Development and Reform Commission. January 2016. "Landmark Notice on National ETS Guidance." http://www.sdpc.gov.cn/zcfb/zcfbtz/201601/t20160122_772123.html. Last accessed 10 March 2016.

45 Clayton Munnings et al. October 2014. "Assessing the Design of Three Pilot Programs for Carbon Trading in China." *Resources for the Future discussion paper.* Pages 14-36. http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-14-36.pdf. Last accessed 10 March 2016.

46 ICIS. No date. "China ETS Portal." http://www.icis.com/energy/carbon-emissions/china-ets-portal/#. Last accessed 10 March 2016.

47 Stian Reklev. 28 October 2015. "Vietnam PM approves carbon market plan." *Carbon Pulse.* http://carbon-pulse.com/11090/. Last accessed 10 March 2016.

48 Department of Energy & Climate Change and Edward Davey. November 2013. "Reduction in Japanese carbon emissions target for 2020: Statement by Edward Davey." https://www.gov.uk/government/news/reduction-in-japanese-carbon-emissions-target-for-2020-statement-by-edward-davey. Last accessed 10 March 2016.

49 Ministry of the Environment, Japan. No date. "Details on the Carbon Tax (Tax for Climate Change Mitigation)." https://www.env.go.jp/en/policy/tax/env-tax/20121001a_dct.pdf. Last accessed 29 March 2016.

50 EDF, CDC Climat, Caisse des Depots and IETA. May 2015. "India: An Emissions Trading Case Study." http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/india_case_study_may2015.pdf. Last accessed 10 March 2016.

51 James Paton and Aibing Guo. 10 November 2014. "Russia, China Add to $400 Billion Gas Deal with Accord." *BloombergBusiness*. http://www.bloomberg.com/news/articles/2014-11-10/russia-china-add-to-400-billion-gas-deal-with-accord. Last accessed 10 March 2016.

52 EDF, CDC Climat, Caisse des Depots and IETA. May 2015. "Brazil: An Emissions Trading Case Study." http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/brazil_case_study_may2015.pdf. Last accessed 10 March 2016.

53 Ministry for the Environment. December 2015. "Ministerial Declaration on Carbon Markets." http://www.mfe.govt.nz/sites/default/files/media/Ministerial-Declaration-on-Carbon-Markets.pdf. Last accessed 10 March 2016.

54 Ben Garside. 5 December 2015. "China's Xie touts prospect of China-Korea ETS link." *Carbon Pulse*. http://carbon-pulse.com/12922/. Last accessed 10 March 2016; Stian Reklev. 17 December 2015. "Korea, Beijing carbon exchanges to cooperate, study ETS links." *Carbon Pulse*. http://carbon-pulse.com/13497/. Last accessed 10 March 2016.

55 European Commission. February 2015. "Emissions Trading System in the Republic of Korea." *Europe Aid*. https://webgate.ec.europa.eu/europeaid/online-services/index.cfm?do=publi.welcome&nbPubliList=15&orderby=upd&orderbyad=Desc&searchtype=RS&aofr=136705. Last accessed 10 March 2016; European Commission. May 2015. "Supporting the Design and Implementation of Emissions Trading Systems in China." *EuropeAid, Cooperation and Development Section, Delegation of the European Union to China and Mongolia*. http://eeas.europa.eu/delegations/china/documents/projects/overview/2ets_fact_sheet_may_2015.pdf. Last accessed 10 March 2016.

REFERENCES

Bodansky, Daniel et al. "Facilitating Linkage of Heterogeneous Regional, National, and Sub-National Climate Policies Through a Future International Agreement." *Harvard Project on Climate Agreements* (2014). Last accessed 9 March 2016 http://belfercenter.ksg.harvard.edu/files/harvard-ieta-linkage-paper-nov-2014.pdf

---. "Facilitating Linkage of Heterogeneous Regional, National, and Sub-National Climate Policies Through a Future International Agreement: Executive Summary." *Harvard Project on Climate Agreements* (2014). Last accessed 9 March 2016 http://belfercenter.ksg.harvard.edu/files/ieta-hpca-es-sept2014.pdf

Bolscher, Hans et al. "Carbon Leakage Evidence Project – Factsheets for selected sectors." *Ecorys in consortium with Öko-Institut e.V., Cambridge Econometrics and TNO* (2013). Last accessed 9 March 2016 http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/cl_evidence_factsheets_en.pdf

Climate Action Tracker. Dec. 2015. "Tracking INDCs." Last accessed 9 March 2016 http://climateactiontracker.org/indcs.html

Coase, Ronald. "The Problem of Social Cost." *The Journal of Law and Economics,* 3 (1960): 1-44.

Das, Kasturi. "Climate Clubs: Carrots, Sticks and More." *Economic & Political Weekly*, 50 (34) (August 2015). Last accessed 10 March 2016 http://www.epw.in/journal/2015/34/commentary/climate-clubs.html

Department of Energy & Climate Change and Edward Davey. "Reduction in Japanese carbon emissions target for 2020: Statement by Edward Davey." (Nov. 2013). Last accessed 10 March 2016 https://www.gov.uk/government/news/reduction-in-japanese-carbon-emissions-target-for-2020-statement-by-edward-davey

EDF, CDC Climat, Caisse des Depots and IETA. "Brazil: An Emissions Trading Case Study." (May 2015). Last accessed 10 March 2016 http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/brazil_case_study_may2015.pdf

---. "India: An Emissions Trading Case Study." (May 2015). Last accessed 10 March 2016 http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/india_case_study_may2015.pdf

European Commission. "Emissions Trading System in the Republic of Korea." Europe Aid. (Feb. 2015). *Last accessed* 10 March 2016 https://webgate.ec.europa.eu/europeaid/online-services/index.cfm?do=publi.welcome&nbPubliList=15&orderby=upd&orderbyad=Desc&searchtype=RS&aofr=136705

---. "Supporting the Design and Implementation of Emissions Trading Systems in China." *EuropeAid, Cooperation and Development Section, Delegation of the European Union to China and Mongolia*. (May 2015). Last accessed 10 March 2016 http://eeas.europa.eu/delegations/china/documents/projects/overview/2ets_fact_sheet_may_2015.pdf

---. "The European Union Emissions Trading System (EU ETS)." (Mar. 2016). Last accessed 9 March 2016 http://ec.europa.eu/clima/policies/ets/index_en.htm

Federal Office of the Environment. "Seventh Round of Swiss-EU negotiations on linking of emissions trading systems." (Mar. 2015). Last accessed 9 March 2016 http://www.bafu.admin.ch/klima/13877/14510/14882/15415/index.html?lang=en

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. "Kyoto Protocol." (Oct. 2015). Last accessed 9 March 2016 http://www.bmub.bund.de/en/topics/climate-energy/climate/international-climate-policy/kyoto-protocol/

Garside, Ben. "China's Xie touts prospect of China-Korea ETS link." *Carbon Pulse*. (5 Dec. 2015). Last accessed 10 March 2016. http://carbon-pulse.com/12922/

Ge, Xing'an. "State and Trends of Shenzhen Carbon Market." *China Emissions Exchange presentation*. (9 Oct. 2014). Last accessed 10 March 2016 https://www.iea.org/media/workshops/2014/23XING_ANGEStateandTrendsofShenzhenCarbonMarket.pdf

Hawkins, Sonja and Ingrid Jegou. "Linking Emissions Trading Schemes: Considerations and Recommendations for a Joint EU-Korean Carbon Market." *International Centre for Trade and Sustainable Development (ICTSD)*. (Mar. 2014). Last accessed 10 March 2016 http://www.ictsd.org/sites/default/files/research/linking-emissions-trading-schemes-considerations-and-recommendations-for-a-joint-eu-korean-carbon-market.pdf

House of Commons. "The EU Emissions Trading System." *Energy and Climate Change Committee*, Tenth Report of Session 2010-12, Volume I (2012). Last accessed 9 March 2016 http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/1476/1476.pdf

Hsu, Angel, Andrew Moffat and Kaiyang Xu. "Data Transparency: New Dynamic at COP-21 in Paris." *China FAQs*. (22 Dec. 2015). Last accessed 10 March 2016 http://www.chinafaqs.org/blog-posts/data-transparency-new-dynamic-cop-21-paris

ICIS. "China ETS Portal." (No date.) Last accessed 10 March 2016 http://www.icis.com/energy/carbon-emissions/china-ets-portal/#

ICTSD. "BioRes Paris Update #1 | 'We cannot abandon hope,' the driver behind talks on a new climate regime." *ICTSD Bridges Trade BioRes*. (30 Nov. 2015). Last accessed 9 March 2016 http://www.ictsd.org/bridges-news/biores/news/biores-paris-update-1-%E2%80%9Cwe-cannot-abandon-hope%E2%80%9D-the-driver-behind-talks-on-a

International Carbon Action Partnership (ICAP). "Emissions Trading Worldwide: Status Report 2016."(2016.) Last accessed 9 March 2016 https://icapcarbonaction.com/images/StatusReport2016/ICAP_Status_Report_2016_Online.pdf

International Emissions Trading Association. "IETA INDC Tracker." (Feb. 2016). Last accessed 9 March 2016 https://docs.google.com/spreadsheets/d/1YgIQiiucWW9vuDUAMeRstzzLxTXi6zFWtFVClqtRTe4/edit?pref=2&pli=1#gid=0

Margolis, Josh, Daniel Dudek and Anders Hove. "Rolling out a Successful Carbon Trading System." *Paulson Institute*. (Sep. 2015). Last accessed 10 March 2016 http://www.paulsoninstitute.org/wp-content/uploads/2015/09/5-Emissions-Trading-EN-final1.pdf

Ministry for the Environment. "Ministerial Declaration on Carbon Markets." (Dec. 2015). Last accessed 10 March 2016 http://www.mfe.govt.nz/sites/default/files/media/Ministerial-Declaration-on-Carbon-Markets.pdf

Ministry of the Environment, Japan. "Details on the Carbon Tax (Tax for Climate Change Mitigation)." (No date). Last accessed 29 March 2016 https://www.env.go.jp/en/policy/tax/env-tax/20121001a_dct.pdf

Munnings, Clayton et al. "Assessing the Design of Three Pilot Programs for Carbon Trading in China." *Resources for the Future discussion paper* (2014). Last accessed 10 March 2016 http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-14-36.pdf

National Development and Reform Commission. "Enhanced Action on Climate Change: China's Intended Nationally Determined Contributions." (Jun. 2015). Last accessed 9 March 2016 http://www4.unfccc.int/submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf

---. "Interim Measures on China's Voluntary Emissions Trading." (2012). Last accessed 10 March 2016 http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2894.pdf

---. "Landmark Notice on National ETS Guidance." (Jan. 2016). Last accessed 10 March 2016 http://www.sdpc.gov.cn/zcfb/zcfbtz/201601/t20160122_772123.html

---. "Market Readiness Proposal: Establishing a National Emissions Trading Scheme in China." *Partnership for Market Readiness*. (Feb. 2013). Last accessed 10 March 2016 http://www.thepmr.org/system/files/documents/China_MRP_final_19-02-2013rev_0.pdf

---. "Notice on launching carbon emissions trading pilot." (Oct. 2011). Last accessed 9 March 2016 http://www.sdpc.gov.cn/zcfb/zcfbtz/201201/t20120113_456506.html

Paton, James and Aibing Guo. "Russia, China Add to $400 Billion Gas Deal with Accord." *BloombergBusiness*. (10 Nov. 2014). Last accessed 10 March 2016 http://www.bloomberg.com/news/articles/2014-11-10/russia-china-add-to-400-billion-gas-deal-with-accord

Reklev, Stian. "China Issues 9.4 million CCERs." *Carbon Pulse*. (9 Nov. 2015). Last accessed 10 March 2016 http://carbon-pulse.com/11620/

---. "CN Markets: Shanghai CO2 Price Finds Fresh Depths as China's Pilot Markets Face Difficult Year." *Carbon Pulse*. (7 Mar. 2016). Last accessed 10 March 2016 http://carbon-pulse.com/16664/

---. "Korea, Beijing carbon exchanges to cooperate, study ETS links." *Carbon Pulse*. (17 Dec. 2015). Last accessed 10 March 2016 http://carbon-pulse.com/13497/

---. "Vietnam PM approves carbon market plan." *Carbon Pulse*. (28 Oct. 2015). Last accessed 10 March 2016 http://carbon-pulse.com/11090/

Shanghai DRC. "Draft Measures on Emissions Trading." (Jul. 2013). Last accessed 10 March 2016 http://sh.eastday.com/m/20130712/u1a7516879.html

The White House. "U.S.-China Joint Announcement on Climate Change." *Office of the Press Secretary*. (11 Nov. 2014). Last accessed 9 March 2016 https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change

United Nations. "Adoption of the Paris Agreement." *UNFCCC*, FCCC/CP/2015/L.9/Re.1, 12. (12 Dec. 2015). Last accessed 9 March 2016 https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

---. "Report of the Conference of the Parties on its nineteenth session, held in Warsaw from 11 to 23 November 2013. Addendum. Part two: Action taken by the Conference of the Parties at its nineteenth session." *UNFCCC*, FCCC/CP/2013/10/Add.1. (31 Jan. 2014). Last accessed 10 March 2016 http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=3

---. "Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. Addendum. Part Two: Action taken by the Conference of the Parties at its seventeenth session." *UNFCCC*, FCCC/CP/2011/9/Add.1. 9 (15 Mar. 2012). Last accessed March 2016 http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf

---. "Synthesis report on the aggregate effect of the intended nationally determined contributions." *UNFCCC, FCCC/CP/2015/7.* (30 Oct. 2015). Last accessed 9 March 2016 http://unfccc.int/resource/docs/2015/cop21/eng/07.pdf

Victor, David. "The Case for Climate Clubs." *E15 Initiative. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum*. (Jan. 2015). Last accessed 10 March 2016 http://www.ictsd.org/sites/default/files/research/E15_Climate_Victor_FINAL.pdf

World Bank. "Participants." *Partnership for Market Readiness*. (2016). Last accessed 9 March 2016 https://www.thepmr.org/content/participants

Zheng, Xipeng. "National Perspective of Chinese ETS." *Sino Carbon Innovation and Investment presentation*. (No date). Last accessed 10 March 2016 https://ieta.wildapricot.org/resources/China/Presentations/National%20Perspective%20of%20Chinese%20ETS%2020160302.pdf

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