COLUMBIA | SIPA
Center on Global Energy Policy

CAN CHINA'S CO_2 TRADING SYSTEM AVOID THE PITFALLS OF OTHER EMISSIONS TRADING SCHEMES?

BY NOAH KAUFMAN AND JONATHAN ELKIND
FEBRUARY 2018

For those focused on the need to mitigate the risks of climate change, 2017 ended with a bang. After a decade or more of internal policy development, public stakeholder engagement, and pilot trading systems in seven cities and provinces, China introduced the first phase of its nationwide carbon dioxide emissions trading system (ETS), focusing on emissions from the electric power sector. Simply in terms of its scale, the first phase of China's nationwide ETS represents a remarkable milestone. Nationwide implementation for the power sector alone will cover roughly 3.5 billion tons of CO_2 emissions per year[1]—roughly one-third of Chinese CO_2 emissions[2]—a figure that is almost double the size of the next largest ETS by emissions coverage.[3]

China's ETS is a bold policy departure for the country. Only a decade ago, such an announcement would have seemed implausible. Economic growth and poverty reduction were such fundamental goals in China that they crowded out other objectives, including environmental and climate protection. Only recently has China emphasized the quality of economic growth—including by engaging in rigorous environmental enforcement in order to protect urban air quality.[4]

China's ETS is also an important milestone for global efforts to mitigate the risks of climate change. Gone are the days of China insisting that the solutions to climate change had to come from the developed world. This about-face from China has the potential to encourage climate action by other nations, including in the developing world, where GHG emissions are growing fastest. For all of these reasons, some observers are hailing the China ETS as game-changing progress.[5]

It may be early for such a conclusion, however. Whether China's ETS will drive significant emissions reductions remains to be seen. To achieve that outcome, China will need to overcome challenges that have limited the effectiveness of other prominent ETSs in their early years of implementation.

In this essay, we examine the emerging details of the new Chinese ETS in relation to the system designs and course corrections of four GHG emissions trading programs: the European Union's Emissions Trading System (EU-ETS), California's cap-and-trade system, the nine-state Regional Greenhouse Gas Initiative in the northeastern United States, and the Republic of Korea's Emissions Trading Scheme (KETS).

We focus on three key questions that will determine whether China's ETS is likely to drive significant reductions in China's GHG emissions that would not have otherwise occurred: (1) What emissions sources are covered by the policy? (2) Are targets stringent? and (3) What systems are in place to verify that emissions reductions are real?

Then, we describe a pair of additional issues that will have important implications on both the economic and environmental effectiveness of the Chinese ETS: (1) whether revenue is generated, and how it is used; and (2) if the carbon price signal can be passed on to consumers.

In each case, we bring in examples from the experiences of the world's four largest ETSs outside China, including ways they have been successful and ways they have not.

Strengthening the Existing Emissions Trading Schemes

The first greenhouse gas emissions trading systems were implemented just over a decade ago, making each of the early ETSs somewhat of an experimental undertaking. Policymakers had to design new and unique markets for GHG emissions that would encourage emissions reductions without severe impacts on the producers or consumers of fossil fuels. This has largely been uncharted territory.

Not surprisingly, the early ETSs have encountered bumps in the road. Policy makers have struggled to implement programs that follow through on promises to significantly drive down emissions compared to business-as-usual trajectories. But decision makers in each jurisdiction have learned with time, from the experience of their own ETS and from others. The world's four largest ETSs outside of China are all in the process of implementing changes that are intended to increase efficiency or ambition:

- The EU-ETS has been in operation since 2005, covering just under half of the GHG emissions in 31 countries. After years of chronically low prices of emissions permits, the EU is reviewing a proposal to revise the EU-ETS for the years after 2020. If approved, the changes will include a steeper decline in emissions limits that will enable covered entities to reduce their emissions by over 40 percent below 2005 levels by 2030, a new market stability reserve that will address the surplus of emissions permits that has built up in the ETS, and the creation of new funds that will use ETS revenues to promote innovation and modernization in covered industries.

- California's ETS has gradually expanded in scope since its implementation in 2013, and it now covers about 85 percent of the state's emissions. In July 2017, California passed new legislation that extends the cap-and-trade program and significantly lowers the cap on emissions levels to enable the state to achieve emissions reductions by 2030 of 40 percent below 1990 levels.

- The Regional Greenhouse Gas Initiative (RGGI, pronounced as "Reggie") has covered electricity generators in nine northeastern US states since 2009. Like the EU and California programs, permit prices have been lower than anticipated, and RGGI is implementing significant changes to strengthen the program's ambition. In August 2017, the participating states proposed a new plan with various changes intended to spur additional emissions reductions, including emissions cap levels declining so that covered entities achieve emissions reductions in 2030 of 30 percent below 2020 levels. In addition, following the election of new governors in both New Jersey and Virginia, both states are likely to join the program in 2018.

- Last, the Republic of Korea's ETS, which covers about two-thirds of the country's GHG emissions, just completed the first phase of its program, which began in 2015. At the end of 2017, the Korean cabinet allocated initial allowances for 2018, and it is now determining the emissions caps through 2020, the year Korea has pledged to achieve a 37 percent reduction in GHG emissions below business-as-usual levels.[6] The changes to the Korea ETS will include a gradual move away from the free allocation of all emissions permits.

The impact of these changes remains to be seen. But the ETSs appear to be building on the experiences they have accumulated with the goal of producing more efficient, effective, and long-lasting programs.

Chinese policy makers have had the benefit of learning about the existing ETSs through a number of official exchanges and workshops with other governments as well as informal consultations with scholars and policy experts. These lessons learned, along with the deliberate process China is using to gradually implement its nationwide program, provide China with the opportunity to leapfrog the problems of the early ETSs if Chinese policy makers so desire. Nevertheless, the same factors that limited the success of other ETSs could limit the China policy as well.

Three Key Questions That Will Determine the Emissions Reductions from China's ETS

1. What emissions sources are covered by the policy?

The scope of an ETS is determined by the breadth of emissions sources obligated to obtain permits/allowances to emit CO_2. An ETS with a broad scope covers most emissions sources in the economy, whereas an ETS with a narrow scope may cover just one sector. No ETS is truly "economy-wide" because a small portion of emissions sources will have characteristics that make them impractical to cover under the policy.

An ETS with a broader scope will achieve greater emissions reductions for the same reason that casting a wider net will catch more fish. If, for example, the price of emissions permits is $20 per ton of CO_2, the policy will encourage all emissions reduction opportunities that can be achieved for less than $20 per ton. Of course, there are more of these opportunities across the entire economy than in any single sector. A broader scope also adds some administrative complexity because a greater number and variety of emissions sources are covered by the policy.

Another advantage of an ETS with a (near) economy-wide scope is that the recipe for achieving a national emission target becomes relatively simple, at least in theory: set the emission cap to correspond to the desired emissions level in a given year and voilà, target achieved. In contrast, a narrow ETS can only be a small part of a strategy to achieve an economy-wide emissions goal because the emissions that are outside the scope of the policy could increase. This recipe also becomes more complicated if the ETS does not place an actual cap on emissions, as we discuss in the context of the China program below.

The problems with a narrow program scope are illustrated by the experience of New York, the largest US state in the RGGI cap-and-trade program. New York has pledged to reduce total GHG emissions by 80 percent by 2050.[7] But RGGI covers only power sector emissions, or roughly a quarter of total emissions across these economies. Between 2012 and 2015, power sector emissions fell by nearly 10 percent in New York, but the state's overall CO_2 emissions from energy increased by 4 percent over the same period due to rising emissions from heating and transportation.[8]

In contrast, California's ETS covers about 85 percent of total GHG emissions,[9] and according to the state's Air Resources Board's Scoping Plan, declining annual emissions caps will be used to ensure that California achieves its 2030 target.[10] Because the cap is near economy-wide, California's ETS is a credible tool to help ensure an overall emissions targets is achieved.

China's nationwide ETS is intended ultimately to cover most of the country's CO_2 emissions, but the scope of the policy has been a moving target over the last several years. The country's city- and provincial-level ETS pilots, which were implemented starting in 2013 and 2014, covered different parts of the economy in the various jurisdictions.[11] When President Xi Jinping first declared the intention to establish a national scheme in September 2015,[12] he said that China would start a national emissions trading system in 2017 that covers sectors including power generation, iron and steel, chemicals, building materials, papermaking, and nonferrous metals.[13]

In the period between that announcement and December 2017, Chinese decision makers evidently changed their minds, electing instead to start with electric power generation only. The initial phase will cover roughly 1,700 facilities rather than the roughly 7,000 facilities that could be covered if the trading system were expanded to cover all of the sectors in the original plan.[14] This means that the initial phase will cover roughly one-third of China's total CO_2 emissions from fossil fuels. While the scope is considerably narrower than originally planned, from a global perspective, it remains massive, covering roughly 10 percent of global CO_2 emissions from fossil fuels.[15]

Starting with a narrow scope and broadening it over time is an understandable approach, as it facilitates a smooth transition for regulators as well as greater predictability for decision makers in industry. It is of course preferable to launching a program before the administrative mechanisms are ready. Both the EU and California likewise started narrowly and expanded their scope. The downside is also evident, however: a narrow scope will significantly reduce the emissions impact of the China policy in the near term. As long as the ETS covers only the power sector, similar to the RGGI states, it will not be capable of ensuring economy-wide emissions reductions.

2. Are the targets stringent? That is, will the ETS achieve an emissions trajectory that is significantly lower than what would be achieved without the policy?

The emissions reductions caused by an ETS depend on its targets. Achieving significant emissions reductions generally requires policymakers to take the following three steps:

a. Forecast future emissions volumes or emissions rates in the absence of the ETS (a "baseline" or "business as usual" forecast).
b. Set emissions (or emissions rate) limits at levels that are significantly below the baseline forecast.
c. Issue or auction emissions permits that correspond to these limits.

However, early ETSs have had relatively weak targets, for reasons that include bad timing, bad incentives, and bad forecasts. In what follows, we describe each of these problems and how they can be overcome, and then we explain the specific challenges that China faces in avoiding the same problems of the early ETSs.

The first ETSs were designed and implemented in the early 2000s. At least two unforeseen and important events followed: (1) the Great Recession hit in 2008, leading to much slower-than-expected economic growth; and (2) a boom occurred in natural gas production, leading to far lower natural gas prices in some regions. Both of these events caused emissions to be lower than anticipated when the ETSs were designed. For instance, emissions covered by the RGGI program were about 125 million tons in 2009, but the 2009 emissions cap was set at over 180 million tons.[16] An ETS with an emissions cap far above actual emissions levels is like a diet with a daily limit of 10 pieces of cake: an irrelevant push in the right theoretical direction.[17]

An ETS can be designed to drive significant emissions reductions even when unforeseen events cause emissions targets to be weak. When actual emissions are near or below emissions cap levels, the price of emissions permits collapses due to reduced demand. Putting in place a "price floor" on emissions permits (a minimum price below which the permit price is not allowed to fall) prevents this price collapse. When permit prices hit the floor, the fixed carbon price drives emissions reductions as opposed to the emissions cap; in effect, the ETS has been converted into a carbon tax with the tax rate at the level of the price floor.

Indeed, given the oversupply of permits and persistently low permit prices in the EU-ETS, the United Kingdom has implemented a price floor on emissions from electricity generation that has caused a precipitous shift away from carbon-intensive coal-fired electricity generation since 2013.[18] The California and RGGI programs have price floors as well, and the price of permits has commonly been at the price floor in both programs. California and RGGI are gradually increasing the levels of their price floors as part of the program extensions to 2030. In addition to price floors, some RGGI states are taking a second step to address weak targets, called an "emissions containment reserve," in which permits are withheld (essentially lowering the cap) when permits prices fall below specified thresholds.[19]

Bad timing is not the only cause of weak emissions targets. The incentives for policy makers to implement weak climate change policies have also played an important role. Governments are pressured by regulated industries to design programs with higher emissions limits and/or to issue additional permits once the program is underway. And government decision makers do not want to be seen as putting restrictions on domestic industries that could constrain short-term economic growth. Because climate change is a global and intergenerational problem, avoiding the harmful impact of an increase in national GHG emissions will rarely be as politically attractive as short-term relief from compliance costs.

In initial years of the EU-ETS, individual countries were able to set their own caps and issue free permits as they saw fit, using processes that were not always transparent to outside stakeholders. Such rules gave each country little incentive not to cave to pressure to "over-allocate" free emissions permits.[20] More recently, in 2016, the Korean government made various changes to its 2016 emissions cap when permit prices were higher than expected, including issuing additional permits and enabling regulated entities to borrow additional permits from future years' allocations.[21]

Such incentive problems can be assuaged or avoided by aligning the ETS emissions caps with transparent long-run emissions targets. Korea's caps are not directly tied to 2020 or 2030 national emissions targets. In fact, at the time the adjustments were made to the cap in 2016, caps for the program had only been specified through 2017, and the program only covers about two-thirds of Korea's emissions. Consequently, weakening the cap had an upside for Korean policy makers (relief for regulated entities) but little downside in terms of a missed target. In contrast, as noted above, California's near-economy-wide ETS is aligned with state legislation that mandates 40 percent emissions reductions by 2030. If the California government were to issue additional permits that put this target in jeopardy, stakeholders would surely notice, and policymakers would suffer political repercussions.

Bad or outdated forecasts are a third cause of weak ETS emissions caps. Forecasting the future of the energy system is rife with uncertainty, but policy makers who wish to understand the stringency of an ETS (and thus the costs and benefits of the policy) must make forecasts of where emissions are headed in the absence of the policy. If these projections systematically over- or underestimate future emissions, they will give policy makers a misleading impression about the likely stringency of emissions caps. Indeed, in recent years, the most commonly used energy sector forecasts have consistently underestimated the progress of low-carbon technologies in the power sector, leading to overestimates of future emissions.[22] This has led some jurisdictions to design ETSs with weak emissions caps.

For example, in the United States, the Obama administration's Clean Power Plan (CPP) established limits for power plant emissions in each US state and encouraged states to implement ETSs to achieve the targets. According to the US government analysis released alongside the CPP, the ETSs were expected to cause significant emissions reductions in virtually every state.[23] However, this analysis relied on forecasts for solar energy, wind energy, and energy efficiency that were far more conservative than expert forecasts for each individual technology,[24] thus making the CPP appear more stringent (or onerous, from the perspective of some interest groups) than it was likely to be. Independent studies showed that CPP emissions limits were relatively weak, with many states on pace to achieve their emissions targets even without the regulation.[25]

While the Clean Power Plan will not be implemented (as designed by the Obama administration), some states are moving forward with power sector ETSs, and these state programs may be subject to the same concerns of weak emissions caps. Virginia, which plans to join RGGI, released an ETS plan in November 2017 that proposes setting emissions targets that start at either 33 or 34 million tons in 2020 and decline by 3 percent annually. Analysis by the Rhodium Group shows that in the absence of the ETS, Virginia's emissions are likely to be lower than these cap levels during the 2020 to 2030 period.[26] Unless these caps are adjusted, they may not drive emissions reductions in the state.[27]

The stringency of China's ETS remains to be seen because China has not yet published the targets for its ETS. But there are reasons to expect that China's approach may also be susceptible to—or perhaps intended to create—weak emissions targets.

The first warning sign about the stringency of the Chinese ETS, perhaps counterintuitively, relates to the progress China is already making in improving local air quality and slowing GHG emissions growth. Until recently, China was on pace for rapid emissions growth of both conventional pollutants and GHGs for the foreseeable future—indeed, emissions more than doubled between 2000 and 2010 alone. But much has changed in recent years. As part of China's transition to a new growth model, its economy has slowed and begun to shift away from energy-intensive industries like construction and manufacturing, which in turn has slowed emissions growth. China has also implemented aggressive policies both to restrict the use of coal and to support the emergence of clean energy technologies. For example, the 13th Five Year Plan (2016–20) included a ban on new coal power plants until 2018. Consequently, while China expects continued growth in energy demand and GHG emissions over the next decade, its coal use and its emissions trajectory appear to be approaching a plateau. (Some projections suggest emissions will peak before 2030 under current policies.)[28] Aligning China's ETS targets with its national objective to peak emissions by 2030[29] may therefore be a recipe for a weak ETS that will not drive down emissions below levels that are likely to be achieved anyway. Of course, China can change its national targets and/or align its ETS with more stringent goals.

The second concern is that unlike the other trading systems covered in this essay, China is not proposing an ETS with volumetric emissions limits (or "mass-based caps"). Instead, China has proposed using "rate-based" emissions caps, which means that the performance of covered facilities will be assessed on the basis of how their emissions relative to their own output (or "emissions rate") compare to the emission rate benchmark set for their category of facilities. In the power sector, these benchmarks are likely to be set in terms of emissions per megawatt hour. It is expected (though as of this writing, not entirely clear) that emissions rate targets will differ for different facility categories (e.g., different classes and sizes of coal plants).[30]

Rate-based targets can be stringent if they are set well below baseline emissions rate levels. However, rate-based approaches are less efficient than mass-based approaches at reducing emissions by a given level.[31] The advantage of rate-based systems is they can lead to improved emissions rates with limited price impacts, while also enabling the continued growth of output and emissions when economic conditions warrant. From the perspective of economic decision makers in China, this translates into a strong selling point; it avoids overly abrupt impacts on producers and consumers in the power system. From the perspective of environmental advocates, the flexibility of rate-based trading is a potential liability because emissions can grow rather than shrink.[32]

Finally, a third concern relates to the complexity of China's program. Compared to a mass-based program with a single emissions cap, under a rate-based program with different emissions rate limits for a long list of facility categories, it will be more difficult for decision makers—and even more so outsiders—to assess the stringency and effectiveness of China's program targets. Like the EU and Korea examples described earlier, this complexity may create a political environment in which regulators do not have the incentive to design and retain a stringent policy. A market for permits with a clear price signal can be one solution, because price levels should be an indication of the stringency of the emissions rate limits.

None of these considerations implies that China's ETS is fated to fail in driving significant emissions reductions. Chinese policy makers can use the lessons from the early ETSs to help design a policy with stringent targets if they so desire. For the time being, it appears that the Chinese policy designers have chosen to prioritize caution, flexibility, and broad signaling about the direction of emission intensity.

3. What systems are in place to verify that emissions reductions are "real"?

The integrity of the ETS depends on strong rules ensuring that regulated entities cannot avoid submitting emissions permits unless the required emissions reductions have been achieved. Regulated entities often have two options to avoid submitting emissions permits for compliance. First, they can take actions that reduce or eliminate their own emissions. Second, if allowed by the ETS, regulated entities can pay for emissions reductions from a source that is not subject to the ETS, for which they receive an "offset" certificate. If the offset costs less than the ETS permits, regulated entities can save money by using offsets for compliance.

Rigorous monitoring is needed to ensure that a permit is surrendered for all emissions subject to the ETS. Otherwise, regulated entities may be able to falsely claim lower emissions levels or fail to surrender permits. Fortunately, to the credit of early ETSs, there has been little evidence of such problems. Programs typically require reported emissions levels to be verified by an accredited independent party, and they include monetary penalties (typically many multiples of the emissions permit price) for the failure to surrender permits when required.[33] Perhaps also contributing to these successes is that regulated entities are commonly given experience monitoring and verifying emissions before the ETS is launched, such as the GHG and Energy Target Management System in Korea, which has been in place since the 1990s.[34]

Ensuring the integrity of emissions reductions from offsets has been more problematic. Because these emissions reductions take place outside the scope of the program, and sometimes also outside the legal jurisdiction that governs the ETS, the regulators enforcing the ETS may have less of an ability to verify that emissions reductions have taken place. In addition, offsets commonly involve actions that are inherently more difficult to monitor than fossil fuel GHG emissions, such as emissions reductions due to land use change. Indeed, this difficulty is often why they are excluded from the ETS in the first place.

Finally, if the action that created the offset would have happened in the absence of the ETS, then the ETS will not have created any additional emissions reductions. Indeed, a large portion of "emissions reductions" in the early years of the EU-ETS were from offsets produced from the destruction of a GHG called HFC-23, a common by-product of industrial manufacturing processes in developing countries. Close scrutiny of the finances of these HFC-23 projects suggested that many were creating HFC-23 for the primary purpose of destroying it and earning money from the offset market; thus, these offsets were not creating real emissions reductions.[35]

Because of these difficulties and the widespread perception that emissions reductions from offsets are less reliable than those from regulated entities, the early ETSs have all placed limits on the use of offsets for compliance.

Ensuring reliable emissions reductions may prove especially challenging for the new Chinese ETS. To begin with, the Chinese energy sector does not have systems in place to ensure the same widely available, timely, and accurate data and statistics that early ETS nations have benefited from.[36] This could make it easier for regulated entities to report inaccurate emissions performance and more difficult for regulators to enforce the ETS rules.

China can overcome these challenges. Indeed, China has demonstrated time and again its ability to build systems—both physical and institutional—that respond to what China's leaders determine to be the major challenges of the day. And China is gradually investing in energy data systems through its National Bureau of Statistics (NBS), National Energy Administration (NEA), and National Development and Reform Commission (NDRC). Moreover, foreign partners such as the US Department of Energy (DOE) and the International Energy Agency (IEA), among others, have devoted significant priority and made available significant resources to facilitate China's progress in this arena.[37] The success of these efforts will significantly influence the degree to which the new Chinese ETS can drive reliable emissions reductions.

Of course, the rules of the Chinese ETS will influence the reliability of emissions reductions as well. China can benefit from the examples set by other ETSs with strong rules related to monitoring, reporting, and verification of emissions reductions. And China can avoid the problems of early ETSs related to offsets by putting in place rigorous regulations that ensure emissions reductions from offsets are real, if offsets are allowed at all.

Given the deliberate pace of the phasing in of China's ETS, there will be ample time for China to put in place strong rules and data systems that ensure reliable emissions reductions. Even the introduction of the ETS in the power sector alone will occur over a three-year period.

The first phase, which is to run for roughly one year from December 2017, will focus on "infrastructure construction"—the establishment of the monitoring, reporting, and verification (MRV) system, the registration system for allowances, and the trading platform. The second year will focus on "system testing"—a time to test out the allocation, trading, registry, and compliance systems. The third phase—"development and improvement"—involves the full implementation of the ETS in the power sector, with an expansion to other sectors in the years after that.[38] This slow pace of development and deployment will limit what the Chinese ETS will achieve in the near term but will also make it easier for Chinese regulators to develop a strong and lasting program.

Two additional questions will help determine whether China's emissions reductions are achieved cost-effectively:

China's ETS will drive significant emissions reductions if it successfully navigates the three issues described earlier—a broad scope, stringent caps, and strong rules to ensure emissions reductions are real. But other factors are important as well, both in determining the emissions and economic impacts of an ETS. A comprehensive list is outside the scope of this essay, but we mention two examples here: (1) whether revenue is generated from the distribution of allowances, and how any revenue is used; and (2) whether the carbon price signal can be passed on to consumers.

Revenue generation and productive use

An ETS can either auction emissions permits or allocate permits to regulated entities for free. There are various reasons to design an ETS with a portion of permits allocated for free, particularly in the early years of the program, including to protect domestic industry, to ease the transition to the new policy regime, and to gain political support for the policy. But economists widely agree that to maximize the cost-effectiveness of the policy, an ETS should eventually auction the bulk of the emissions permits and use the resulting auction revenue in productive ways. After all, allocating permits for free is equivalent to transferring assets to entities responsible for emissions.[39] By turning those assets into government revenue, they can be used in ways that are likely to be more beneficial to the economy, such as funding investments in public goods, reducing taxes, or protecting vulnerable households from increasing prices.

Revenues from permit auctions can also be used to invest in low-carbon technologies and strategies, such as funding clean energy sources. Indeed, the California, EU-ETS, and RGGI programs use at least a portion of auction revenues to invest in activities intended to achieve additional emissions reductions. The Korea ETS, on the other hand, freely allocated 100 percent of permits between 2015 and 2017 and plans to freely allocate 97 percent of permits in the second phase of the program that begins this year.

It is unclear whether any emissions permits will be auctioned in China's ETS or how such revenue would be used. Some commentators suggest that permits will be given away for free, at least in the initial operations of the new ETS,[40] while others say that this has not yet been decided.[41] Two of the seven city- or province-based ETS pilots did employ auctions to distribute a share of their allowances: Hubei auctioned less than 30 percent of the allowances, and Guangdong auctioned only 3 percent.[42]

China's ETS can yield large and low-cost emissions reductions regardless of how permits are allocated, but auctioning permits and using the revenues in productive ways can yield significant additional economic and environmental benefits for the Chinese people.

Enabling a strong carbon price signal

An ETS creates a carbon price that increases the costs of actions that cause GHG emissions, which leads to fewer of these actions, thus reducing emissions. The ETS is most cost-effective when both producers and consumers can observe a strong carbon price signal so that each has the incentive to seek out less GHG-intensive goods and services. If, instead, the price signal is muted, the carbon price will not encourage emissions reductions wherever and however they can be achieved at the lowest cost.

Muted price signals can occur due to the structure of the economy. If energy prices for some consumers are fixed, for example, then these consumers will not see any price changes due to the ETS and will have no incentive to conserve or use energy more efficiently, even if these actions are among the cheapest ways to reduce emissions. When emissions permit prices are at the price floor (in which case the caps are not ensuring a certain emissions level), then the muted price signal would lead to lower emissions reductions caused by the ETS.

Another cause of muted price signals is overlapping regulations. If the jurisdiction implementing the ETS is also implementing other policies that mandate specific low-carbon actions, this hinders the ETS from encouraging the lowest cost emissions reduction opportunities. California, for example, has stringent emissions caps when compared to a "no climate policy" baseline, but the price signal from the ETS remains relatively weak due to other policies that address GHG emissions directly or indirectly, such as fuel efficiency standards, a low-carbon fuel standard, a renewable portfolio standard, and energy efficiency policies. California estimates that between 2020 and 2030, the ETS will be responsible for under 40 percent of emissions reductions achieved in the state, whereas other policies will be the cause of over 60 percent of emissions reductions.[43] The European Union and RGGI states have important overlapping policies as well. An overlapping policy is not necessarily duplicative; other measures often have separate policy rationales, such as promoting innovation, reducing air pollution, or increasing energy security. Politics are an important rationale as well; the costs associated with regulations such as renewable portfolio or fuel economy standards are typically less visible to consumers compared to those from a carbon price.

Whether China's ETS produces a sufficiently strong price signal that induces behavioral changes among producers and consumers remains to be seen. As discussed, China has various other clean energy policies, many of which were outlined in the country's Paris climate pledge. These could mute price signals if emissions targets are not set to be stringent.

Perhaps even more important to the eventual price signal is the nature of energy pricing in China. The Chinese economy is fundamentally not market based.[44] Many energy prices are set administratively rather than by economic fundamentals; therefore, it is more difficult for increased or decreased compliance costs (for example, for inefficiently or efficiently operated power plants) to be passed along to the consumer.[45] In the power sector, input price changes do not automatically get reflected in the cost of electricity that is delivered to consumers. Instead, pricing can be affected by administrative decisions, dispatch protocols, and behind-the-scenes power of state-owned enterprises.

Conclusions

China's announcement of its national ETS has captured the attention of the international community focused on mitigating climate change risk, and for good reasons. China's rollout of the initial elements of its nationwide carbon emissions trading system is an important milestone—both because of the massive scale of emissions that will be covered by the program and because China is a developing country whose actions will influence the climate policies throughout the world. Moreover, the country's leaders have introduced the ETS in a careful, stepwise manner, after studying existing emissions trading models and analyzing options deeply.

Despite all of these laudable considerations, we simply do not yet know whether the Chinese ETS will exert significant influence on China's future GHG emissions, and there are reasons to have modest expectations. Early ETSs have had limited success implementing policies with stringent emissions limits that drive real emissions reductions. And early indications, like the narrow scope and the lack of emissions limits, suggest that Chinese policy makers are not prioritizing large emissions reductions from the ETS in the near future. The benefits to the global climate arising from China's new ETS may thus be less significant than many would hope. Only time will tell.

Notes

1. Robert Stavins, "What Should We Make of China's Announcement of a National CO2 Trading System?," An Economic View of the Environment (blog), January 7, 2018, http://www.robertstavinsblog.org/2018/01/07/make-chinas-announcement-national-co2-trading-system/.

2. "CAIT Climate Data Explorer: China," World Resources Institute, http://cait.wri.org/profile/China.

3. The EU-ETS covers just under two billion tons of CO_2-equivalent emissions. See Easwaran Narassimhan, Kelly S. Gallagher, Stefan Koester, and Julio Rivera Alejo, Carbon Pricing in Practice: A Review of the Evidence (Medford, MA: Climate Policy Lab, 2017), 10, https://sites.tufts.edu/cierp/files/2017/11/Carbon-Pricing-In-Practice-A-Review-of-the-Evidence.pdf.

4. Gabriel Wildau, "China's Pollution Curbs Hit Growth as Policy Priorities Shift," Financial Times,

December 17, 2017, https://www.ft.co m/content/1b245c3e-e08e-11e7-a8a4-0a1e63a52f9c. Also see Gabriel Wildau, "China Backs Away from Long-Term GDP Targets," Financial Times, October 26, 2017, https://www.ft.com/content/f7c4d9ec-ba24-11e7-8c12-5661783e5589.

5. See, for example, Paula DiPerna, "The Game Changes: China Officially Announces National Power Sector Cap-and-Trade," CDP, January 11, 2018, https://www.cdp.net/en//articles/climate/the-game-changes-china-officially-announces-national-power-sector-cap-and-trade, and Michael Holder, "China's 'Monumental' New Emissions Trading Scheme," GreenBiz, December 21, 2017, https://www.greenbiz.com/article/chinas-monumental-new-emissions-trading-scheme.

6. "South Korea," Climate Action Tracker, November 6, 2017, http://climateactiontracker.org/countries/southkorea.html.

7. "Governor Cuomo, Joined by Vice President Gore, Announces New Actions to Reduce Greenhouse Gas Emissions and Lead Nation on Climate Change," New York State, October 8, 2015, https://www.governor.ny.gov/news/governor-cuomo-joined-vice-president-gore-announces-new-actions-reduce-greenhouse-gas-emissions.

8. "State Carbon Dioxide Emissions Data," US Energy Information Administration, https://www.eia.gov/environment/emissions/state/.

9. See program summary on C2ES website: https://www.c2es.org/content/california-cap-and-trade/.

10. California Air Resources Board, California's 2017 Climate Change Scoping Plan, November 2017, https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

11. Mengya Zhang, Yong Liu, and Yunpeng Su, "Comparison of Carbon Emission Trading Schemes in the European Union and China," Climate 5, no. 3 (September 2017): 70. doi:10.3390/cli5030070.

12. This statement was made during a state visit to Washington, DC, as part of US-Chinese efforts to provide leadership in advance of the 21st Conference of Parties to the UN Framework Convention on Climate Change in Paris (December 2015).

13. "U.S.-China Joint Presidential Statement on Climate Change," White House, September 25, 2015, https://obamawhitehouse.archives.gov/the-press-office/2015/09/25/us-china-joint-presidential-statement-climate-change.

14. Matt Carr and Feifei Shen, "China Is Creating a Massive Carbon Market to Fight Climate Change," Bloomberg, December 19, 2017, https://www.bloomberg.com/news/articles/2017-12-19/china-heads-toward-carbon-price-in-climate-fight-quicktake-q-a.

15. Figures derived from Zeke Hausfather, "Analysis: Global CO2 Emissions Set to Rise 2% in

2017 after Three-Year 'Plateau,'" CarbonBrief, November 13, 2017, https://www.carbonbrief.org/analysis-global-co2-emissions-set-to-rise-2-percent-in-2017-following-three-year-plateau, and Robert Stavins, "What Should We Make of China's Announcement of a National CO2 Trading System?" Resources for the Future, January 8, 2018, http://www.rff.org/blog/2018/what-should-we-make-china-s-announcement-national-co2-trading-system .

16. Lara Dahan et al., Regional Greenhouse Gas Initiative (RGGI): An Emissions Trading Case Study, IETA, April 2015, http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/rggi_ets_case_study-may2015.pdf.

17. For economic downturns like the Great Recession, the fact that ETS drives fewer emissions reductions can be seen as a feature rather than a bug of the ETS—regulated entities benefit from compliance costs when they can least afford to pay them. Economic downturns are just one of many potential causes of lower-than-expected emissions.

18. David Hirst, Carbon Price Floor (CPF) and the Price Support Mechanism, House of Commons Library Briefing Paper no. 05927, January 8, 2018, 20.

19. Dallas Burtraw and Bill Shobe, "Preview of Analysis of an Emissions Containment Reserve," June 14, 2017, http://www.rff.org/files/document/file/170614_AnECRforRGGI_Burtrawetal.pdf. The RGGI emissions containment reserve performs a similar function to that of the EU-ETS's proposed new "market stability reserve."

20. European Commission, EU ETS Handbook (Brussels: European Commission, 2015), 43, https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf.

21. International Carbon Action Partnership, "Korea Emissions Trading Scheme," February 2018, https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=47.

22. David Roberts, "Energy Forecasters Consistently Underestimate Wind and Solar: A Critic Explains Why That's a Problem," March 25, 2016, https://www.vox.com/2016/3/25/11306064/eia-forecasts-critics.

23. "Clean Power Plan for Existing Power Plants: Regulatory Actions," US Environmental Protection Agency, https://archive.epa.gov/epa/cleanpowerplan/clean-power-plan-existing-power-plants-regulatory-actions.html.

24. Noah Kaufman and Eleanor Krause, "The Economic Impacts of the Clean Power Plan: How Studies of the Same Regulation Can Produce Such Different Results," World Resources Institute, January 2017, http://www.wri.org/publication/economic-impacts-of-clean-power-plan.

25. John Larsen and Whitney Herndon, "What the CPP Would Have Done," Rhodium Group, October 9, 2017, http://rhg.com/notes/what-the-cpp-would-have-done.

26. John Larsen and Whitney Herndon, "RGGI Expansion: The Road Ahead," Rhodium Group, January 3, 2018, http://rhg.com/notes/rggi-expansion-the-road-ahead.
27. Note that the Virginia's proposed ETS does include a price floor and an emissions containment reserve, which could both reduce emissions in the event of a weak cap.

28. This paragraph draws from information and sources from the Climate Action Tracker website: http://climateactiontracker.org/countries/china.html.

29. China's nationally determined contribution under the Paris climate agreement calls for nonfossil energy sources to grow to at least 20 percent of total primary energy supply by 2030, for the carbon intensity of the Chinese economy to improve by 60 to 65 percent by 2030 from a baseline of 2005, and for the country's CO_2 emissions to peak not later than 2030 and sooner if possible.

30. Lawrence Goulder and Richard Morgenstern, "China's Rate-Based Approach to Reducing CO2 Emissions: Strengths, Limitations, and Alternatives," December 15, 2017, https://www.aeaweb.org/conference/2018/preliminary/paper/Adat9KGT; William Pizer and Xiliang Zhang, "China's New National Carbon Market," December 31, 2017, https://www.aeaweb.org/conference/2018/preliminary/paper/Tbf4SdTS.

31. Carolyn Fischer, Rebating Environmental Policy Revenues: Output-Based Allocations and Tradable Performance Standards, RFF Discussion Paper no. 01-22. (Washington, DC: Resources for the Future, 2001).

32. This potential problem may be exacerbated by having various categories of facilities within the power sector with different targets. For example, hypothetically, if the rules of the Chinese ETS did not require comparatively aggressive emissions rate reductions from high-emitting technologies such as subcritical and even supercritical coal-fired power plants and if more such plants were built on the basis of comparative cost effectiveness, one could see absolute emissions grow rather than shrink.

33. See, for example, program summaries of the International Carbon Action Partnership at https://icapcarbonaction.com/en/.

34. Stefan Niederhafner, "The Korean Energy and GHG Target Management System: An Alternative to Kyoto-Protocol Emissions Trading Systems?," TEMEP Discussion Paper no. 2014:118, October 1, 2014, http://dx.doi.org/10.2139/ssrn.2508143.

35. Michael Wara and David G. Victor, "A Realistic Policy on International Carbon Offsets," Program on Energy and Sustainable Development Working Paper no. 74, April 1, 2008, https://law.stanford.edu/publications/a-realistic-policy-on-international-carbon-offsets/.

36. There are statistical yearbooks and energy data sets that one can receive in certain publications, such as the China Statistical Yearbook, in which chapter 9 covers energy (http://www.stats.gov.cn/tjsj/ndsj/2016/indexeh.htm). Nonetheless, the existing offerings do not reach

the levels of timeliness, accuracy, and availability that one customarily requires to inform a smooth-functioning market. For an example of the data requirements under RGGI, see https://www.rggi.org/allowance-tracking/emissions. For similar information under the EU-ETS, see https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1.

37. One of the authors (Elkind) worked previously to support collaborations on this topic both during his tenure at DOE and through his tenure as a vice chair of the IEA's governing board.

38. Pizer and Zhang, "China's New National Carbon Market."

39. Even worse, in the early years of the EU-ETS, power generators were granted emissions for free but then still passed on the costs to consumers, earning windfall profits in the process. See European Commission, EU ETS Handbook, 43.

40. See, for example, Nectar Gan, "Will China's Carbon Trading Scheme Work without an Emission Cap?," South China Morning Post, January 3, 2018, http://www.scmp.com/news/china/policies-politics/article/2125896/big-black-hole-chinas-carbon-market-ambitions.

41. See, for example, Stavins, "What Should We Make of China's Announcement of a National CO_2 Trading System?"

42. Zhang, Liu, and Su, "Comparison of Carbon Emission Trading Schemes in the European Union and China."

43. California Air Resources Board, California's 2017 Climate Change Scoping Plan.

44. We do not mean to be facile with this argument. In many countries, including those whose economies are based on free-market principles, the energy industry and especially the power sector blend together market, regulatory, and administrative instruments.

45. Goulder and Morgenstern, "China's Rate-Based Approach to Reducing CO2 Emissions."

About the Authors

Noah Kaufman is an economist and research scholar at the SIPA Center on Global Energy Policy (CGEP) at Columbia University. Jonathan Elkind is a fellow and senior adjunct research scholar at CGEP and served previously as assistant secretary for international affairs at the US Department of Energy. The authors are thankful to David Sandalow, Tim Boersma, and Matthew Robinson for helpful feedback on earlier drafts.

ABOUT THE CENTER ON GLOBAL ENERGY POLICY

The Center on Global Energy Policy provides independent, balanced, data-driven analysis to help policymakers navigate the complex world of energy. We approach energy as an economic, security, and environmental concern. And we draw on the resources of a world-class institution, faculty with real-world experience, and a location in the world's finance and media capital.

Visit us at www.energypolicy.columbia.edu

@ColumbiaUenergy

ABOUT THE SCHOOL OF INTERNATIONAL AND PUBLIC AFFAIRS

SIPA's mission is to empower people to serve the global public interest. Our goal is to foster economic growth, sustainable development, social progress, and democratic governance by educating public policy professionals, producing policy-related research, and conveying the results to the world. Based in New York City, with a student body that is 50 percent international and educational partners in cities around the world, SIPA is the most global of public policy schools.

For more information, please visit www.sipa.columbia.edu