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Guest Editorial

Emissions trading in China: Emerging experiences and international lessons

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ABSTRACT

China has implemented emissions trading schemes in seven cities and provinces, and is planning a national cap-and-trade scheme. The seven pilot schemes show marked differences in design and operate in very diverse economic circumstances. Challenges encountered in the pilot schemes include the risk of over-allocation of emissions permits, unpredictable underlying growth trends, robust measurement and verification procedures, and the interaction with regulation in the energy sector. In addition, experiences from developed countries' emissions trading schemes, in particular the EU ETS, can help inform the decisions about the design of a future Chinese national scheme. We find that Chinese policymakers will need to pay particular attention to the operation of emissions trading in a heavily regulated electricity sector. Setting emission caps in the context of a national emissions intensity target creates specific difficulties. Related price developments are uncertain and depend largely on underlying emissions growth rates. The option of auctioning permits and using the proceeds for other purposes is not taken into consideration extensively. Finally, implementing reliable systems for monitoring, reporting and verification of emissions remains a major task. This paper serves as an introduction to the special issue "Emissions trading in China" and draws on insights from the papers in the special issue.

1. Introduction

China is the world's largest emitter of greenhouse gases. Its economy is growing fast, energy intensity is high, and coal dominates the energy supply. Consequently, China offers by far the largest potential for emissions reductions of any nation. China's leadership has progressively strengthened its commitment to climate change mitigation. Although China insists on the principle of common but differentiated responsibilities in the international climate negotiations, at home China is implementing ambitious policies to improve energy efficiency and switch from coal to cleaner energy sources, including renewable power. This is in line with a belief in the existence of global climate change by the vast majority of Chinese (Dai et al., 2014).

Climate policy goes hand in hand with other Chinese policy objectives, in particular reducing local air pollution, improving energy security and attaining a leadership position in advanced manufacturing technologies. Various targets to 2020 for emissions, energy use and energy technologies reflect this. China appears on track to achieving these existing targets to 2020, but action commensurate with strong global climate change mitigation during the following decade will require a continued and increasing policy effort.

Until recently, the Chinese climate policy repertoire consisted almost exclusively of regulatory interventions, as well as state-directed investment. But China is preparing to give a role to market-based mechanisms for emissions control. Seven emissions pilot schemes covering over 260 million people were initiated during 2013 and 2014. The central government has announced that a national emissions trading scheme (ETS) will be implemented before 2020, and design efforts are underway currently. In creating such a scheme, China can draw on extensive international experiences, starting with the EU ETS, as well as the (now revoked) Australian carbon pricing mechanism, the Californian ETS, and schemes in Canada, the US East Coast states, and New Zealand.

But making emissions pricing effective in China is incomparably more difficult than in any of the national and sub-national schemes already in operation. China's economy still has strong elements of state control, and regulation is ubiquitous in the energy sector. Effective and cost-efficient emission pricing can only be achieved with energy market reform. And ahead of comprehensive market reform, there are complex challenges to be addressed.

In this paper, we review emerging experiences with ETS in China and lessons from international experience, and draw some conclusions for the design of a national ETS for China. We base our review in large part on findings from the papers in this Special Issue of *Energy Policy*, produced by ongoing collaborations between researchers in China and developed countries, and

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through a workshop at the Centre for European Economic Research (ZEW) in Mannheim in November 2012.

This paper is organized as follows. In Section 2 we discuss China's emissions trends and targets, and underpinnings of China's climate change policy. In Section 3 we review the design and early insights about the operation of some of the emissions trading pilot schemes. In Section 4 we review lessons from international emissions trading schemes that are of relevance to China. Section 5 concludes.

2. Emissions trends, targets and underpinnings of China's climate policy

2.1. Emissions trends and targets

China has been the world's largest emitter of carbon dioxide since 2006. In 2011, China accounted for 21 per cent of global energy demand, 49 per cent of global coal use by energy content and 26 per cent of global energy-related carbon dioxide emissions (International Energy Agency (IEA), 2013a,b). China's carbon dioxide emissions rose by 140 per cent between the year 2001 and 2011, because of China's exceptionally rapid economic growth, the energy intensive nature of economic growth during that particular period, and the fact that the carbon intensity of energy supply remained practically unchanged. China's emissions growth has slowed in recent years and emissions intensity of the economy since 2005 is on a declining trend in line with China's target to reduce emissions intensity by 40 to 45 per cent from 2005 to 2020 (Table 1).

China's economy is highly carbon intensive. Carbon dioxide output per dollar of GDP, adjusted for purchasing power in 2011, was twice that of the United States and three times that of Europe —and even higher for GDP at exchange rates. The high emissions intensity is due firstly to a comparatively high energy intensity of GDP, on account of a high shares of heavy industries and capital investment, and because of relatively low average efficiency levels in energy use. Second, the relatively high carbon intensity of energy supply is driven by the dominance of coal. Both aspects provide great potential for improvement of China's emissions intensity, and ultimately reductions in China's absolute emissions levels.

2.2. China's climate policy framework

President Xi Jinping has stated that China should pursue a new mode of growth to promote 'more efficient, equal and sustainable economic development' (The Economist, 2013). This does not appear to be just rhetoric but policy intent, and climate change mitigation plays a prominent part in the attempt to re-define Chinese economic growth.

Climate policy goes hand in hand with other Chinese policy objectives, in particular reducing local air pollution, improving energy security and attaining a leadership position in advanced manufacturing technologies (Boyd, 2012). Urban air pollution is taking an increasingly stark toll in terms of health impacts and is driving policies to cut coal combustion in coastal urban areas and Beijing.

There is also an increasing understanding that reducing the share of fossil fuels in the energy system will reduce the exposure of the economy to energy price shocks, and that higher energy productivity may have positive economy-wide effects (Teng and Jotzo, 2014). A host of regulatory interventions to improve energy efficiency and reduce the carbon intensity of China's energy system is in place. One example is the mandatory energy-saving and emission-reduction program launched as part of the 11th National Five-Year Plan (2006–2010), which generated notable improvements in energy efficiency and environmental quality (Levine et al., 2010).

But China is preparing to give a role to market-based mechanisms for emissions control. Seven emissions pilot schemes are in place (see Section 3). The central government has announced that a national emissions trading scheme (ETS) will be implemented before the end of the decade (Zhang et al., 2014). The China-based expert community has a strong expectation that an ETS, and perhaps a carbon tax, will be in place by the year 2020 (Jotzo et al., 2013).

Table 1
China's energy use, CO_2 emissions from energy use and GDP, 2005–13.
Sources: International Energy Agency (IEA) (2013b) for data to 2011; Teng and Jotzo (2014) for 2012–2013 data.

	Annual growth (%)	Index (2005=1) at 2013
Energy/GDP	−3.8[a]	0.74
CO_2/Energy	−0.5[a]	0.96
CO_2/GDP	−4.3	0.71
GDP	10.1	2.16
Energy	6.0	1.59
CO_2	5.4	1.52

2.3. Emissions trading in a highly regulated energy sector

China's leadership has stated that it intends to continue and accelerate the process of giving markets a greater role in the economy, but the challenges of putting the energy sector on a market footing are enormous. Work is underway within the bureaucracy to decide the design parameters of a national ETS. But making emissions pricing effective in China is incomparably more difficult than in any of the national and sub-national schemes already in operation.

China's economy still has strong elements of state control, in particular in the energy sector, which is a key sector for successful emissions trading. Although a gradual process of deregulation is underway, regulation remains ubiquitous, including both energy prices and operational aspects such as dispatch times for power stations. Further, many of the largest corporate consumers of energy are state-owned.

Making emissions trading work in these circumstances is a challenge for scheme design (Howes and Dobes, 2010; Baron et al., 2012). Full effectiveness and cost-efficiency can only be achieved with energy market reform. Teng et al. (2014) assess the institutional barriers to an effective ETS in China inherent in China's current electricity market model. They find major challenges from the "equal share" dispatching model for power stations and from regulated electricity pricing. They suggest that in the short term, ahead of price liberalization, emissions pricing in China could proceed as a "supply side" model with an "energy saving" model of electricity dispatch from generators. Li et al. (2014) find that rigid electricity prices mean that carbon pricing is less effective than it would otherwise be, but consider that the existing regulated electricity sector is a feasible starting point.

The discussions of a suitable ETS structure for China can also learn from Korea, which is planning a national ETS and where electricity markets are government controlled as well. Park and Hong (2014) discuss the consequences of cheap electricity price controlled by the government in the implementation of a possible Korean ETS. The strictly regulated electricity price blocks the cost pass-through not only in the electricity trading market but also in the carbon market. This leads to the suggestion that intensity measures apply exclusively to the power sector, while an absolute emission cap applies to the remaining regulated sectors. Park and