Making the Transition to a Low-Carbon Economy: The Key Challenges for China

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Abstract

China has realised that for its own sake and from the international community’s perspective, it cannot afford to continue on the conventional path of encouraging economic growth at the expense of the environment. Accordingly, the country has placed ecological goals at the same level of priority as policies on economic, political, cultural and social development. Specifically, meeting the grand goal involves not only capping China’s nationwide coal consumption to let it peak before 2020 and carbon emissions peak around 2030, but also putting in place a variety of flagship programs and policies. This article argues that the 2030 carbon emissions peak goal is ambitious but achievable and concludes by arguing why there is reason to be optimistic about China’s ‘green push’.

Key words: low-carbon economy, carbon emissions peaks, carbon pricing, energy prices, resource tax reform

JEL Classification: H23, P28, Q42, Q43, Q48, Q53, Q54, Q58

1. Introduction

Following three decades of rapid economic growth, China is facing a variety of daunting environmental challenges. Domestically, the dense smog and haze that frequently hits Beijing and other major cities, alongside steeply rising oil imports, raises concerns about the state of China’s environment, health and energy security. Internationally, China is under great pressure—both inside and outside international climate negotiations—to be more ambitious in combating global climate change. Given that China is already the world’s largest energy consumer and carbon emitter, and that its energy use and carbon emissions will continue to rise rapidly as its economy grows, it is crucial that it is involved in any international efforts to mitigate climate change. China cannot afford to continue on the conventional development path of encouraging economic growth at the expense of the environment.

China’s leaders are fully aware of these pressing challenges. In response, the 18th Conference of the Central Committee of the Communist Party of China adopted a general policy that aims to achieve an ‘Ecological Civilization’. This policy identified ecological goals as of equal priority to existing policies on economic, political, cultural and social development, and emphasised that China would work toward fully implementing an Ecological Civilization in all aspects of economic development.

Beyond the grand vision of an Ecological Civilization, the issue is how China will explore concrete, constructive and realistic solutions in the 13th five-year plan (FYP) and
afterwards in order to successfully complete its transition to a low-carbon, green economy. The second section of this article argues that China’s key energy-related environmental challenges lie in capping nationwide coal consumption so that it peaks during the 13th FYP (between 2016 and 2020) and carbon emissions peak around 2030. It then discusses flagship programs and policies that China has put in place in order to genuinely transition into a low-carbon economy. The article concludes by arguing why there is reason to be optimistic about China’s ‘green push’.

2. Cap Coal Consumption by 2020 and Carbon Emissions by 2030

Burning coal contributes to the overwhelming majority of total sulphur dioxide emissions, dust, nitrogen oxide emissions and carbon dioxide (CO₂) emissions in China. This has given rise to unprecedented environmental pollution and health risks (Zhang 2007, 2011a; CCCCPPRP 2014). Given that China’s energy mix is coal-dominated, cutting China’s carbon intensity to meet its climate commitments by 2020 also means a cut to its energy intensity. Mitigating CO₂ emissions in China will act to rein in its energy consumption in general and its coal consumption in particular. When China’s coal consumption peaks is crucial as it will determine when China’s carbon emissions will peak—and help realise China’s goal of achieving an Ecological Civilization.

2.1. Cap Nationwide Coal Consumption to Enable its Peak in the 13th FYP

Both China and India rely heavily on coal to fuel their economies, but coal accounts for a much larger share in China’s energy mix than that of India. As the world’s largest coal producer and consumer, China produces and consumes about twice as much coal as the USA, the world’s second-largest producer and consumer. Coal has accounted for over two-thirds of China’s primary energy consumption for several decades. Coal-fired power plants dominate total electricity generation and account for more than half of China’s total coal use. As a result, China’s total installed capacity of coal-fired power plants is more than the current total of the USA, the UK and India combined.

China’s National Energy Administration initially proposed to cap total national energy consumption when the 12th FYP was being drafted, but that national cap was not included in the plan for a variety of reasons (Zhang 2011a). A crucial impetus behind plans to cap coal consumption this time around has been mounting public concern over air quality. The dense smog and haze that frequently affect Beijing and other places in China, which is the combined effect of heavy airborne pollution and meteorological conditions, has underwritten China’s determination to cap coal consumption and combat air pollution. The so-called Atmospheric Pollution Prevention Action Plan released by The State Council (2013) aims to scale down the proportion of coal in China’s overall energy consumption to 65 per cent by 2017. This would reduce the concentration of hazardous particles, including fine particular matter, by 10 per cent in all cities compared with 2012 levels.

In physical terms, coal production in China increased by an average of 200 million tons per year over the past 10 years, but increased by only 50 million tons in 2013. In percentage terms, that is an increase in coal use of 9 per cent per year over the past 10 years, but only a 2.6 per cent increase in 2013. The key challenge for China during the 13th FYP is to let coal consumption peak in 2016–2020. This means undertaking strict measures. If coal consumption peaks in 2016–2020 then the resulting CO₂ emissions are estimated to peak in 2025–2030. In this scenario the share of coal in the total energy mix is estimated to be below 50 per cent in 2030 (Wang 2014; Zhang 2014).

2.1.1. Energy Conservation and Carbon Mitigation in Key Energy-Consuming Industries

Given that industry accounts for about 70 per cent of China’s total primary energy consumption, reforming a few key energy-consuming sectors is crucial for China to meet its own energy-saving and carbon mitigation goals. The Chinese government has therefore
taken great efforts towards changing the current energy-inefficient and environmentally-unfriendly pattern of industrial growth. During the 13th FYP, China needs to further explore and enhance industrial policies to encourage technical progress, strengthen pollution controls, upgrade industry practices and promote energy conservation in order to meet the increasingly stringent energy saving and emissions cutting commitments.

A sectoral approach could serve as the first step under a prospective international climate treaty. Wang et al. (2015a) argue that the cement, steel and aluminium sectors in China can be among the first group to be covered under a sectoral approach. This recommendation is in line with the proposal made in Zhang (2000) that the most stringent proposal that China can realistically make around or beyond 2020 is a combination of a targeted carbon intensity level with an emissions cap at a sector level.

2.1.2. Cut Coal Consumption in Absolute Terms in Severely Polluted Regions

Capping coal consumption not only requires enhanced efforts in key energy-consuming sectors but also unprecedented, coordinated regional efforts, particularly in the more developed and severely polluted regions. The Atmospheric Pollution Prevention Action Plan (The State Council 2013) sets more stringent concentration targets for hazardous particles in more-developed areas, with Beijing-Tianjin-Hebei region, Yangtze River Delta and Pearl River Delta required to cut pollution by 25 per cent, 20 per cent and 15 per cent, respectively. To that end, the coal consumption in these more advanced and severely polluted regions should not increase and must be further cut in absolute terms in the 13th FYP.

2.2. Capping Carbon Emissions Around 2030

2.2.1. Why Should China Cap Absolute Emissions by 2030?

Many factors need to be taken into consideration in determining when China should take on absolute carbon emissions caps (Zhang 2011a, 2011b). The fourth assessment report of the Intergovernmental Panel on Climate Change recommends that global greenhouse gas emissions (GHG) should peak by 2020 at the latest and then turn downward, to avoid catastrophic climate change. China is already the world’s largest carbon emitter, so the earlier it implements emissions caps, the more likely the 2020 goal can be achieved. However, given China’s relatively low development stage and its rapidly growing, coal-fueled economy, its carbon emissions are still on climbing trajectories beyond 2030, even when some energy-saving policies and measures are factored into projections. All the integrated assessment models examined by the European Commission-funded Low climate IMpact scenarios and the Implications of required Tight emission control Strategies (LIMITS) project foresee that China’s carbon emissions under the baseline scenario would peak in the second half of this century, with 2080 as the median year across models (Tavoni et al. 2015). A recent joint study by Tsinghua and Massachusetts Institute of Technology (MIT) suggests that in the so-called continued effort scenario, under which China maintains its Copenhagen pledge momentum and achieves a carbon intensity reduction rate of approximately 3 per cent per year from 2016 through 2050,1 China’s carbon emissions would not peak until 2040. Under a baseline scenario China’s carbon emissions would not peak until 2050 (Zhang et al. 2014).

The United Nations Framework Convention on Climate Change allowed Annex I (industrialised) countries a grace period of 16 years before legally binding commitments were applicable. The starting point for this grace period began with the Earth Summit in June 1992 when Annex I countries promised

1. At the Copenhagen climate change summit, China pledged to cut its carbon intensity by 40–45 per cent by 2020 relative to its 2005 levels. This raises questions as to whether such a pledge is ambitious or just represents business as usual. See Zhang (2011a,2011c) for detailed discussion on stringency and credibility issues regarding China’s carbon intensity commitment and their implications.
to individually or jointly stabilise greenhouse gases emissions at their 1990 levels. This precedent points to a first binding commitment period for China starting around 2030.

As China is still dependent on coal to meet the bulk of its energy needs over the next few decades, the commercialisation and widespread deployment of carbon capture and storage (CCS) will be a crucial method for reducing Chinese—and global—CO₂ emissions. Thus far, CCS has not been commercialised anywhere in the world and it is unlikely, given current trends, that this technology will be implemented on a large scale either in China or elsewhere before 2030. China’s report of the Deep Decarbonization Pathways Project (Teng et al. 2014) and the aforementioned joint Tsinghua-MIT study share this view. Both of them project that there will be no CCS facilities on power plants by 2030, and CCS facilities on about 90 per cent of coal-fired power plants and 80 per cent of natural gas fired power plants by 2050 assuming that CCS technology is commercialised after 2030 (Teng et al. 2014; Zhang et al. 2014). Until CCS projects are developed to the point of achieving economies of scale and reduced costs, China will not feel confident about committing to absolute emissions caps.

Developing countries need reasonable time to develop and operate national climate policies and measures. This is well understood by informed US politicians, such as Representatives Henry Waxman (D-CA) and Edward Markey (D-MA), the sponsors of the American Clean Energy and Security Act of 2009. Indeed, the Waxman-Markey bill gives China, India and other major developing nations time to enact climate-friendly measures. While the bill called for a ‘carbon tariff’ on imports, it very much framed that measure as a last resort that a US president could impose at his or her discretion after 1 January 2025, although the night before the vote on 26 June 2009, a last-minute compromise was made to further bring forward the imposition of carbon tariffs.

Another timing indicator is the lag between the date that a treaty is signed and the starting date of the budget period. Given that the Kyoto Protocol was signed in December 1997 and the first budget period started in 2008, the earliest date that China could be expected to introduce binding commitments would be 2020. Even without this precedent for Annex I countries, China’s demand is by no means without foundation. For example, the Montreal Protocol on Substances that Deplete the Ozone Layer grants developing countries a grace period of 10 years (Zhang 2000). Given that the scope of economic activities affected by a climate regime is several orders of magnitude larger than those covered by the Montreal Protocol, it is arguable that developing countries should have a grace period much longer than 10 years after mandatory emission targets for Annex I countries took effect in 2008.

It is not unreasonable to grant China a grace period before taking on emissions caps, but it is crucial that the timing is not delayed beyond 2030. China is already the world’s largest carbon emitter, although its per capita income and emissions are still very low. In 2010, China overtook Japan as the world’s second-largest economy. After another 20 years of rapid development, China’s economy will overtake that of the world’s second-largest emitter (the USA) in size. Its baseline carbon emissions in 2030 are projected to reach 12.0 billion tons of CO₂, relative to 5.3 billion tons for the USA and 3.7 billion tons for India (IEA 2013), the world’s most populous country at that time. China’s emissions could be even greater than those of the USA, provided that the USA cuts its emissions to the levels proposed by the Obama administration under the American Clean Energy and Security Act of 2009. By 2030, China’s per capita emissions are projected to be more than 8 tons of CO₂—well above the world’s average and about 3.3 times that of India (IEA 2013). China’s carbon emissions are still on an upwards trajectory. If China does not change this, it will have lost ground by not taking on emissions caps when the world is facing ever more alarming climate change threats. Equally, developed countries will already have achieved significant emissions reductions.

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2.2.2. Peaking Around 2030 is Ambitious but Achievable

The aforementioned Tsinghua-MIT study suggests that if China maintains its Copenhagen pledge momentum and achieves a carbon intensity reduction rate of approximately 3 per cent per year from 2016 through 2050, China’s carbon emissions will not peak until 2040. Under a baseline scenario, China’s carbon emissions would not peak until 2050 (Zhang et al. 2014). From this perspective, it would be an ambitious commitment to cap carbon emissions by 2030. However, this target is achievable.

If other ways of measuring China’s carbon emissions are taken into account, the possibility—and necessity—of capping carbon by 2030 becomes clear. One way is to examine whether an emissions peak in 2030 is consistent with the international goal of keeping global surface temperature increases below 2 degrees above pre-industrial levels, which is widely considered a requirement of avoiding dangerous climate change. The LIMITS models project that China’s emissions should peak in 2020 under both 450 parts per million (ppm) and 500 ppm scenarios in order to achieve the 2 degrees target by the end of 2100 (Tavoni et al. 2015). Other studies in

Figure 1 by the Energy Modeling Forum and Shared Socio-ecosystem Pathways suggest that China’s emissions would need to peak between 2020 and 2025 in order to avoid a global surface temperature increase of more than 2 degrees by the end of 2100. Even if China commits to letting GHG emissions peak in 2030 is achieved, it would not be enough to avoid a 2 degrees temperature increase in any of the three scenarios. Moreover, as shown by Figure 1, China’s GHG emissions must decrease very quickly for the 2 degrees target to be achieved. This suggests that even if China’s emissions were to peak in 2030, the necessary emissions reductions after the peak year are unlikely to be achieved (Carraro 2015).

What would it cost to have China’s emissions peak by 2030? The China and the New Climate Economy report suggests that under a moderate growth scenario, capping China’s carbon emissions around 2030 would cost 0.02 per cent and 0.06 per cent of China’s GDP in 2020 and 2030, respectively, without considering the other benefits of carbon abatement (He et al. 2014). The European Union’s commitments to cut its GHG emissions by 30 per cent relative to 1990 levels are widely considered less stringent, partly because a European Commission analysis (Klaassen...
et al. 2012) found that a 30 per cent internal reduction compared with 1990 levels would cost 0.2 to 0.3 per cent of GDP in 2020. If this 30 per cent reduction was part of an international agreement, the impact on GDP would vary between —0.6 per cent to 0.6 per cent in 2020. In percentage terms, the estimated loss to China’s economy is very small—one order of magnitude less than that of the European Union. While China may not be expected to better Europe—which is often seen to have greater capacity, capability and responsibility to address climate change—the small loss projected for China could leave room for China’s peaking year to be brought forward.

This could be achievable. The LIMITS models project that China’s emissions would peak slightly later than 2030, based on the commitments that China made prior to the joint China–US climate statement in November 2014 (Tavoni et al. 2015). If China’s commitments to have non-fossil fuels to meet its 20 per cent of energy demand by 2030 in that joint climate statement (The White House 2014) is factored in, then China’s commitments to cap emissions by 2030 are in line with what the LIMITS models foresee in the pledge scenario (Tavoni et al. 2015). On the action ground, China started experimenting with low-carbon city development in the batch of five provinces and eight cities on 19 July 2010. This experiment was expanded to include a second batch of 29 provinces and cities on 5 December 2012 (Wang et al. 2013). While it has not mandated by the central government, all the pilot provinces and cities under the low-carbon city or region development program have set CO₂ emissions to peak in 2030 or earlier. Fifteen pilot provinces and cities have set CO₂ emissions to peak before 2020, including Shanghai and Suzhou, while Ningbo’s target is 2015 (Zhang 2015a). In 2015, the National Development and Reform Commission plans to select 10 model cities from these 42 pilots to further explore. The Commission will provide support for measures aimed at the capping emissions in these selected cities before 2030, thus leading the whole country closer to this goal (21SO 2014). The implementation of these piloted regions will set a good example of how to limit emissions and make a considerable positive contribution to the overall low-carbon development in China. This could further help China’s total carbon emissions peak occur even earlier.

2.2.3. At What Level Will China’s Carbon Emissions Peak?

Under the joint statement by the presidents of China and the USA on 11 November 2014 in Beijing, China has pledged to cap carbon emissions by 2030 or earlier (The White House 2014). However, the level at which China’s carbon will finally peak is still an open question. The peak level is crucial because it will affect the amount of carbon other countries can emit and still meet the global target of a temperature rise of less than 2 degrees. As illustrated in India’s Council on Energy, Environment and Water (2015), given the available global carbon space and China’s dominance, India would have very little carbon space left if China decides to level off its emissions at 12 gigatonnes of CO₂ as the continued effort scenario in the aforementioned Tsinghua-MIT study suggests.

In theory, China could let its emissions peak at a high level around 2030, then cut emissions from that high level and still meet its international commitments. However, China cannot afford to let its carbon emissions reach a high level because of widespread public concern about the dense smog and haze affecting major Chinese cities. Anti-pollution measures will help lower emissions.

Just as there is no consensus on when China’s carbon emissions will peak, estimates of the peaking level also differ significantly across studies. Jiang et al. (2013) suggest that China’s carbon emissions would peak at 9 gigatonnes of CO₂ in 2030 under a low-carbon scenario. Under an enhanced low-carbon scenario, China’s peak could be as low as 8.5 gigatonnes of CO₂. Yet these estimates might be too optimistic, as they assume widespread adoption of more advanced low or zero carbon technologies without factoring in the costs of adoption and behavioural changes. Teng and Jotzo (2014) suggest that China’s carbon emissions will peak during the 2020s, and reduce to
around current levels by 2040. With CO₂ emissions in 2013 estimated to be 9.1 gigatonnes of CO₂, based on the revised energy statistics released in February 2015 by the National Bureau of Statistics of China (2015), which adjusts upward coal consumption in 2013 by 589 million tonnes, this suggests an emissions level of 10.6 gigatonnes of CO₂ in 2030. The aforementioned Tsinghua-MIT study suggests that China’s carbon emissions will peak at 12.1 gigatonnes of CO₂ around 2040 if China maintains its Copenhagen carbon emission mitigation pledge momentum and 10.2 gigatonnes of CO₂ around 2030 in a so-called accelerated effort scenario (Zhang et al. 2014). Taken together, these estimates make it clear that China’s carbon emissions are unlikely to be lower than 10 gigatonnes of CO₂ in 2030.

3. Policy Initiatives to Promote the Transition to a Low-Carbon Economy

3.1. Strengthening Flagship Programs and Supportive Economic Policies

China implemented a variety of programs and initiatives to reduce carbon emissions, conserve energy and cut pollution in the 11th and 12th FYPs (Zhang 2015a). Significant flagship initiatives include the Top 1000 Enterprises Energy Conservation Action Program, the 10,000 Enterprises Energy Conservation Low Carbon Action Program and mandatory closures of small, inefficient power plants.

Supportive economic policies have also been implemented to encourage technical progress and strengthen pollution control to meet China’s energy conservation and environmental protection goals. To support energy-saving projects, the Ministry of Finance and the National Development and Reform Commission (NDRC) (2007) awarded enterprises in East China 200 renminbi (RMB) and enterprises in the Central and Western part of the country 250 RMB for every ton of coal equivalent (tce) saved per year since August 2007. The payments were made to enterprises that have energy metering and measuring systems in place that can document proven energy savings of at least 10,000 tce from technical transformation projects. Since July 2011, these awards have been increased to 240 RMB for enterprises in East China and 300 RMB for enterprises in the Central and Western part of the country for every tce saved per year. At the same time, the minimum requirement for total energy savings from technical transformation projects has been lowered to 5000 tce from the previously required amount of 10,000 tce (Ministry of Finance and NDRC 2011). China has also introduced energy management companies to promote energy conservation. The central government awards energy management companies 240 RMB for every tce saved, with a further payment of no less than 60 RMB for every tce saved from local governments.

Tax breaks are being used to promote smaller cars. The excise tax on a car with an engine below 1 litre is 1 per cent of its value, whereas car’s with a 4 litre engine are taxed at 40 per cent of the car’s value. Renewable vehicles are exempt from purchase taxes until the end of 2017. Moreover, China is implementing policies to promote flue gas desulphurisation (FGD)-equipped power plants. For example, China has imposed an on-grid tariff that incorporates the cost of desulphurisation, prioritised connecting FGD-equipped power plants to grids and allowed them to operate for longer hours than plants that have not installed desulphurisation capacity. Some provincial governments provide even more favourable policies, including priority dispatch of power from FGD-equipped unit in Shandong and Shanxi provinces (Teng et al. 2014). The government has offered a power price premium for denitration and charged differentiated power tariffs and tiered power tariffs (Zhang 2014).

China needs to further strengthen and expand these programs and initiatives to successfully conserve energy, mitigate climate change and protect the environment.

3.2. Enhancing the Development of Low-Carbon Cities

In China and around the world, cities have contributed most to economic output and,
accordingly, CO₂ emissions. In China, cities are responsible for more than 60 per cent of total energy consumption. The contribution of cities to GHG emissions will continue to increase as China’s cities grow. By 2030 China is expected to have an urbanisation rate of 65 per cent (Li 2014). Given unprecedented urbanisation, cities will play an even greater role in shaping energy demand and CO₂ emissions in the 13th FYP and beyond. Therefore, cities are the key to meeting China’s proposed 2020 carbon intensity target, as well as any future climate commitments. The low-carbon city development experiment currently underway in 10 provinces and 32 cities (see Figure 2) will serve as an important test.

Over the past three decades of economic reform, control over resources and decision-making has shifted to local governments. This devolution of decision-making to local governments has placed environmental stewardship in the hands of local officials and polluting enterprises who are more concerned with economic growth and profits than the environment. Ensuring lower-level governments have the ability and incentive to effectively implement energy-saving and pollution-cutting policies is therefore critical (Zhang 2011a, 2012). China started experimenting with low-carbon city development in an initial batch of five provinces and eight cities on 19 July 2010. This experiment was expanded to a second batch of 29 provinces and cities on 5 December 2012 (Wang et al. 2013). Compared with the pilot program, the application process of the second batch of low-carbon cities is much more transparent. The NDRC Department of Climate Change issued in April 2012 a Circular on Organization and Recommendation of Applications for the Second Batch of Pilot Low-carbon Provinces and Cities (NDRC 2012). This Circular lays out the four criteria that provinces and cities must meet to be eligible to apply. First, local government leaders must demonstrate that they attach great importance to green, low-carbon development. Second, they should have specific targets for low-carbon development, such as the target carbon intensity, the share of non-fossil fuels in the total primary energy mix or the rate at which they will implement carbon sinks.

Figure 2 Two Batches of Low-Carbon Pilot Cities in China

Source: Y. Wang et al. (2015b).
and reforestation. Third, they should play an exemplary role in promoting innovative, green and low-carbon development that would be of great value to other regions. Finally, they must submit a preliminary implementation plan (NDRC 2012). This fourth condition was not required of the first batch of low-carbon pilots until they were selected (Wang 2012). Based on the overall assessment of the submitted materials, field visits and the experts’ evaluation, 29 provinces and cities were selected out of over 40 applicants.

All these pilot provinces and cities are making efforts towards restructuring industry and upgrading technology, improving their energy mix and energy efficiency, prioritising and promoting efficient public transport, and optimising urban planning. However, Wang et al. (2013) found that these provinces and cities have been confronted with a variety of problems and challenges. These include: the absence of sound carbon accounting systems, a lack of specific systems to evaluate low-carbon strategies, insufficient government–enterprise interactions and excessive budget dependence on land sales. Moreover, the central government does not provide any preferential policies or financial support to the pilot provinces and cities, although they may be given priority if a low-carbon development special fund is established in the future.

Nevertheless, there are encouraging signs that this low-carbon pilot program is moving in the right direction. The NDRC evaluation reveals that the 10 pilot provinces cut their carbon intensity by 9.2 per cent in 2012 relative to their 2010 level, much higher than the national average carbon intensity reduction of 6.6 per cent (NDRC 2014a). In addition, all these pilot provinces and cities aim to have CO₂ emissions peak in 2030 or earlier, with 15 pilot provinces and cities even aiming to reach peak carbon by 2020 (Zhang 2015a).

3.3. Increasing the Use of Renewable Energy

Renewable energy is another long-term solution and has been identified as one of seven strategic emerging industries. Increasing the share of renewable energy in the total primary energy supply is not only environmentally friendly and conducive to good health, but would also enhance China’s energy security. China has targeted alternative energy sources to meet 15 per cent and 20 per cent of its energy requirements by 2020 and 2030, respectively.

China has set extremely ambitious renewable energy goals and, more importantly, is taking key steps to meet these goals. Solar energy had been supported with investment subsidies through the so-called ‘Golden Sun’ program. Feed-in tariffs for solar power were enacted in July 2011 to help promote a domestic solar power market. Feed-in tariffs for wind power were also introduced, replacing a bidding-based tariff that has been in use since 2003. Under the new policy, four wind energy areas are classified throughout China, based on the quality of wind energy resources and the conditions for engineering construction. On-grid tariffs are set accordingly as benchmarks for wind power projects across the nation. With an installed capacity of 103.4 gigawatts, China leads the world’s total renewable energy capacity, overtaking the USA—which has a total installed capacity of 58 gigawatts—in 2010 (Pew Charitable Trusts 2011).

However, domestic production of solar photovoltaics is still in the initial stages of development and relies heavily on the overseas market. Similarly, essential components of wind power—including the converter, gearbox, bearing and generator—are still dominated by foreign companies or imports (Yu 2013). So the key challenge for China in the renewable energy area is how to build its technological capacity to allow for domestic production of key components as well as to further enhance the pace and scale of installation.

3.4. Harnessing Market Forces

China must complement administrative measures with market-based approaches. To date, China has relied mostly on administrative means to achieve its set energy-saving goals. Qi (2011) shows that during the 11th FYP period, the total amount of CO₂ reduction reached 1.25 billion tonnes of CO₂ equivalent.
through mandatory regulations and auxiliary financial stimuli, but only 0.035 billion tCO2e was the result of market-based instruments. Administrative measures are effective but not efficient. Harnessing market forces to reduce energy consumption and cut carbon emissions will be critical if China is to genuinely transform to a low-carbon, green economy during the 13th FYP.

China’s leaders are well aware of this necessity. In 2013, the Third Plenum of the 18th Central Committee of the Communist Party of China assigned the market a decisive role in allocating resources.

3.4.1. Getting the Energy Prices Right

Getting the energy prices right is the first step in sending clear signals to both producers and consumers of energy. Since 1984, China has moved away from centrally planned energy prices towards a more market-oriented pricing mechanism, though the pace and scale of the reform differ across energy types (Zhang 2014).

The reform of electricity prices, in particular, has been slow. The government still retains control over electricity tariffs. This complicates the implementation of pilot carbon trading schemes in China’s power sector. Power pricing reforms are critical for internalising the cost of carbon in energy market prices.

Natural gas prices also need urgent reform. Given China’s current reliance on coal, increasing the share of cleaner fuel, like natural gas, in the total energy mix is a key option to meet China’s energy needs while improving environmental quality. However, the price of natural gas in China has long been set below production costs. This has not only led Chinese domestic gas producers to be reluctant to increase investments in production, but it has also constrained the importation of more costly natural gas from abroad. The government has changed the existing cost-plus pricing to a ‘netback market value pricing’ system in Guangdong province and the Guangxi Zhuang Autonomous region (NDRC 2011). Under this new pricing mechanism, pricing benchmarks are selected and are pegged to prices of alternative fuels that are formed through market forces to establish price linkage mechanism between natural gas and its alternative fuels. Gas prices at various stages will then be adjusted accordingly on this basis. The pilot schemes in Guangdong and Guangxi provide a way to move towards a market-oriented natural gas pricing mechanism. China should closely examine the results of the two pilot schemes and determine what adjustments and improvements are needed regarding the choice of alternative fuels, the selection of the pricing reference point and the creation of a ‘netback market value pricing’ formula in order to implement the program nationwide (Gao et al. 2013; Zhang 2014).

3.4.2. Resource Tax Reform

Even if energy price reform is undertaken, energy prices would still not reflect the full cost of production across the whole value chain from resource extraction and production to use and disposal. Thus, getting energy prices right also requires China to reform its current narrow coverage of resource taxation and to significantly increase the resource tax levied (Zhang 2014, 2015a). An important first step in this direction was taken on 1 June 2010 when Xinjiang Uighur Autonomous Region began levying resource tax on crude oil and natural gas by revenues rather than by existing extracted volume. This policy has been applied nationwide since 1 November 2011 and was extended to include coal in December 2014. The Task Force on Green Transition in China of the CCICED (2014) recommends that a higher resource tax should be imposed on fossil fuels, with tax rates raised to at least 10 per cent preferably 15 per cent for domestic and imported coal, and to 10–15 per cent for domestic and imported oil by 2025. This reform will increase local government revenue, allowing them to focus on key policy goals beyond simply economic growth alone (Zhang 2010, 2011a).

3.4.3. Imposing Environmental Taxes or Carbon Pricing

Getting energy prices right from a perspective of the whole value chain also means...
including negative externalities. Imposing environmental taxes or carbon pricing can internalise externality costs. Such market-based instruments, if established, would serve as a cost-effective supplement to the expensive administrative means that China has mainly relied on to date.

While the introduction of environmental taxes to replace current charges for sulfur dioxide emissions and discharged chemical oxygen demand has been discussed in both academic and policy circles in China for quite some time, Draft tax law on environmental protection was released in June 2015 for public comments (Legislative Affairs Office of the State Council of China 2015), but the timing of its revision and eventual passage of Chinese legislature as a law is unknown, and accordingly, its exact implementation date has not yet been set. The sooner these environmental taxes are imposed the better, but it should not be later than 2020. Other countries’ experiences with environmental taxes suggest that such taxes will initially be levied with low rates and limited scope, but their levels will increase over time. Environmental taxes should be shared taxes, with the majority of the revenues going to local governments.2

Amending the existing environmental law and promulgating an environmental tax law will take time. Until this is completed, there will be no legal basis to authorise the levy of an environmental tax. In the meantime, there is the pressing need to meet energy and emissions targets in a cost-effective way. One solution would be emissions trading.

In late October 2011, the NDRC (2011) approved seven pilot carbon trading schemes in Beijing, Shanghai, Tianjin, Chongqing, Guangdong province, Hubei province and Shenzhen. These pilot carbon trading schemes all ran from 2013 to 2015. Unlike in the European Union’s system, they included indirect emissions from both electricity generated within the pilot region and imported electricity from outside. All carbon trading pilots incorporated some mechanism to address supply–demand imbalance and the resulting price uncertainty. During the pilot phase, banking was allowed, but allowances cannot be carried forward beyond 2015, which is the ending date of the pilot period. Borrowing to improve the liquidity of the carbon market was not permitted. As shown in Table 1, all pilots allow to use the China Certified Emission Reductions (CCERs) to some degree, ranging from 5 per cent of their CO2 compliance obligation in Beijing and Shanghai to 10 per cent in Guangdong, Shenzhen and Tianjin.

The seven pilot regions were given considerable leeway to design their own schemes. The pilot schemes have different coverage of sectors, ranging from four sectors in Guangdong to 26 sectors in Shenzhen. The threshold to determine whether an emissions source is covered differs across pilots, ranging from 5,000 tCO2e per year in Shenzhen from 2013–15 to 60,000 tons of coal equivalent in Hubei. There were significant differences in the number of entities covered under the program, from 114 in Tianjin to 635 in Shenzhen, and the share of total emissions covered, from 36 per cent of all emissions in Hubei and 38 per cent in Shenzhen to 57 per cent in Shanghai.

Table 1 The Allowable Use of China Certified Emission Reductions (CCERs) in the Seven Carbon Trading Pilots

|                | Maximum allowable use as percentages of the caps (%) | Local origin requirements (%) |
|----------------|-----------------------------------------------------|-------------------------------|
| Beijing        | 5                                                   | 50                            |
| Chongqing      | 8                                                   | No                            |
| Guangdong      | 10                                                  | 70                            |
| Hubei          | 10                                                  | 100                           |
| Shanghai       | 5                                                   | No                            |
| Shenzhen       | 10                                                  | No                            |
| Tianjin        | 10                                                  | No                            |

CCERs have to meet the requirements of China’s national monitoring, reporting and verification regulation.

Source: Zhang (2015b).

2. The central government intends to replace existing environmental fee and charge by an environmental tax. But 90 per cent of the revenue for the environmental fee and charge goes to the local governments (Tian and Xu 2012). That means that if environmental tax at the beginning is charged at a level that could replace the existing environmental charge and fee, the majority of that revenue should be local in order to respect current distribution of the revenue between central and local governments.
Regimes also differ regarding the origin of CCERs. Shenzhen specifies that all CCERs have to be generated inside China but outside the city, but Hubei requires that all have to come from inside the province (see Table 1).

The method of allocating allowances also differed across pilots. While all pilots allocate all or the majority of allowances for free, allocations were based on either grandfathering, benchmarking or a combination of both. Chongqing based its allocations on the highest emissions of any year between 2008 and 2012, while other pilots based their allocations on the average emissions levels over the entire 2009–12 period. In one given pilot, grandfathering in some sectors was based on their historical emissions or their historical emissions intensities.

The pilot programs also required varying compliance obligations. Some pilots like Shanghai and Shenzhen auction additional allowances to help enterprises meet their emissions targets, although Beijing does not. All pilots impose a fine on non-complying entities. However, the severity of the fine varies widely from deducting a certain amount of shortfall allowances from the following year’s allowance to charging the non-complying entities at 3 times the yearly average market prices for each shortfall allowance. Non-complying entities in the Hubei pilot face both fines and deduction of shortfall allowances. They are charged at 1–3 times the yearly average market prices for each shortfall allowance—up to a maximum penalty of 150,000 RMB—and double the amount of their shortfall allowances is deducted from the following year’s allocation.

As shown in Table 2, the performance of the five pilots during their first compliance year was generally positive. The better than expected performance of the pilots will be important in encouraging other regions to develop carbon trading. If China is to cap its carbon emissions by 2030 it must urgently extend these pilot programs and develop a nationwide emissions trading scheme (ETS) to complement existing administrative measures (DCCNDRC 2015).

There are two ways for China to establish a national carbon market. One is to establish a nationwide ETS by linking the existing pilot carbon trading schemes into an integrated national system. Another way is to develop a national ETS based on the experience and lessons learned from the pilot schemes. In the latter scenario, regional ETS schemes will be expanded and continue to function in parallel until a fully-fledged national ETS is established. The threshold for a nationwide regime is expected to be much higher than most of the existing regional carbon trading pilots.

China seems to have opted for the second option, and the central government will determine the coverage of greenhouse gases and scope of sectors included. In February 2015 a senior NDRC official announced that China plans to initially include six sectors in its national ETS: power generation, metallurgy and nonferrous metals, building materials, chemicals and aviation. The threshold for an emissions source to be covered will be set at 26,000 tons of CO2 equivalent (or at least 10,000 tce) per year, making China’s total carbon market an estimated 3–4 billion tons of CO2 emissions (Lin 2015). This would make China’s ETS the world’s largest scheme, twice the size of the European Union’s ETS. The nationwide carbon market will have a 3-year pilot phase and become fully functional after 2019 (DCCNDRC 2015; Lin 2015).

As China develops a nationwide ETS, it is important to ensure that all emissions data are properly measured, reported and verified so that the scheme is reliable, and existing fragmented regional carbon markets are successfully integrated. China will also need to take into account trading allowances across regions to ensure that a nationwide carbon ETS functions properly. To that end, national ETS
legislation needs to be established to provide united guidelines and methodologies on ETS design and operation, enforcement of measurement, reporting and verification procedures and minimum penalties for non-compliance. National legislation should also ascribe allowances as financial assets and define their valid duration in order to generate economically valuable and environmentally credible emissions reductions. The recently released interim measures for carbon emissions trading (NDRC 2014b) are an important move in the right direction, but it is not enough. The specific details of the interim measures and, more importantly, provisions for governing emissions trading across regions within China are needed. It is crucial that the rules governing domestic trade of carbon are solidified in law. Given that process may take much time, they are needed to be elevated at least to the State Council’s regulation. The necessity is at least because disputes could become more intensive and frequent as carbon market expand beyond the institutional jurisdiction of administrative regions.

4. Concluding Remarks: The Case for Cautious Optimism

China’s recent determination to improve energy efficiency and reduce pollution was sparked by a range of pressing environmental stresses and increased concerns over energy security because of steeply rising oil imports. However, China’s green push is not completely new. Former president Hu Jintao and premier Wen Jiabao recognised the seriousness of environmental degradation in China and insisted that encouraging economic growth at the expense of the environment had to end. As an important first step to clean up the country’s development act, Hu and Wen incorporated energy-saving and environmental goals into China’s national 5-year economic blueprint for the first time. This change was a double-edged sword. It distinguished their vision for China’s development from that of their predecessors, but also tested their leadership. Overall, China had limited success on the environmental front during their tenure.

Environmental compliance costs are now even higher and will likely continue to rise, as emissions targets become increasingly stringent amid widespread non-compliance with environmental regulations. Despite this, there is reason to be optimistic about the outcomes this time around.

Maintaining social harmony and stability has been the top priority in China. Environmental issues, particularly pollution disputes and environmental emergent incidents have been one of the leading causes of social unrest in Chinese society (Zhang 2007). Dense smog and haze has become a major issue. Mounting public complaints about smog, coupled with rising standards of living, has convinced the public that anti-pollution measures are necessary. If not addressed appropriately, widespread dissatisfaction could challenge the authority and legitimacy of the ruling Communist Party.

The need for environmental reforms is now of unprecedented importance. In March 2014, Chinese Premier Li Keqiang announced that China will ‘declare war against pollution as we declared war against poverty’ after nearly every Chinese city monitored for pollution failed to meet state standards in 2013. This public acknowledgement at the highest level that China is facing an environmental crisis is a major cause for optimism. China is attempting to cap coal consumption and is making unprecedented efforts toward upgrading the economy, eliminating outdated energy producers and industrial plants, tackling the perennial problem of overcapacity and promoting clean and green technology.

China is also increasingly harnessing market forces to reduce its energy consumption, cut carbon and other conventional pollutants and genuinely transition to a low-carbon, green economy. China is moving towards a more market-oriented energy pricing mechanism, reforming its current narrow coverage of resource taxation, experimenting with

3. In 2013 there were 712 environmental emergencies in China. While the number of such incidents reduced to 471 in 2014, this figure still means nine incidents every 7 days (MEP 2014 and 2015).
sevenpilot carbon trading schemes and implementing a system for ecological compensation. The Beijing-Tianjin-Hebei region, Yangtze River Delta and Pearl River Delta now increasingly act collectively rather than on their own to address the many cross-border environmental problems. These collective and coordinated efforts significantly increase China’s effectiveness in combating pollution.

Of course, implementation is key. There are encouraging signs that the Chinese government is strengthening existing efforts and is taking additional steps towards implementing its ambitious environmental goals. Strict implementation and coordination will be a decisive factor in determining whether China will clean up its development act, meet its carbon intensity target in 2020 and honour its commitments to cap its carbon emissions around 2030.

China can accomplish a great deal on the environmental front. It is in China’s interest to not only sustain its economic growth, but to also ensure its standing in the world community. If President Xi Jinping and Premier Li Keqiang can make China ‘green,’ history will indeed record their contribution as equal to that of Mao Zedong and Deng Xiaoping. 

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References

Carraro C (2015), On the Recent US-China Agreement on Climate Change, January 19, Available at: http://www.carlocarraro.org/en/topics/climate-policy/on-the-recent-us-china-agreement-on-climate-change/

China Coal Consumption Cap Plan and Policy Research Project (CCCCPPRP) (2014) Contributions of Coal Use to Air Pollution in China, Natural Resources Defense Council China Program, October, Beijing, Available at: http://www.nrdc.cn/coalcap/console/Public/Uploads/2014/12/30/Air-PollutionContribution.pdf

China Council for International Cooperation on Environment and Development (CCICED) (2014) Evaluation and Prospects for a Green Transition Process in China, CCICED Task Force Report, December, Available at: http://www.cciced.net/encciced/policyresearch/report/201504/P020150413497198320874.pdf

Council on Energy, Environment and Water (2015) India’s INDCs: Renewable Energy and the Pathway to Paris, New Delhi, Febrary, Available at: http://ceew.in/pdf/ceew-india-indes-re-and-the-pathway-to-p.pdf

Department of Climate Change of National Development and Reform Commission (DCCNDRC) (2015) On the Basic Conditions and Work Plan to Promote the Establishment of a Nationwide Carbon Emissions Trading Market. China Economic & Trade Herald 1, 15–16.

21SO (2014) NDRC Will Select the Model City from Low-carbon Pilots City to Promote the Implementation Measures Towards Emissions Peaking, November 19, Available at: http://www.21so.com/content/62-7449.html

Gao M, Wang Z, Wu Q, Yang Y (2013) Natural Gas Pricing Mechanism Reform and its Impacts on Future Energy Options in China. Energy and Environment 24(7-8), 1209–1228.

He J, Teng F, Qi Y, He K, Cao J (2014) China and the New Climate Economy, Washington, DC, Available at: http://newclimateeconomy.report/china/

IEA (2013), World Energy Outlook 2013, International Energy Agency (IEA), Paris.

Jiang K, Zhuang X, Miao R, He C (2013) China’s Role in Attaining the Global 2 C Target. Climate Policy 13, S55–S69.
Klaassen G, Nill J, Van Ierland T, Saveyn B, Vergote S (2012) Costs and Benefits of Reducing the EU’s Greenhouse gas Emissions by 30% in 2020. Review of Business and Economics 57, 157–178.

Legislative Affairs Office of the State Council of China (2015) A Circular on Call for Public Comments on “Environmental Protection Law of the People’s Republic of China (Draft)”, Beijing, June 10, Available at: http://www.gov.cn/xinwen/2015-06/11/content_2877863.htm

Li W (2014) Study on China’s Future Energy Development Strategies, People’s Daily, February 12, page 12, available at: http://www.drc.gov.cn/zxxw/20140212/1-223-2878725.htm

Lin H (2015) NDRC: Nationwide Carbon Market is to Launch in 2016. China Economic Net, 4 February. http://www.ce.cn/xwzx/gnxw/20150204/ t20150204_4516588.shtml

Ministry of Environmental Protection (MEP) (2014) Bulletin on Environmental State in China, June, Available at: http://jcs.mep.gov.cn/hjzl/zkgb/2013zkgb/

Ministry of Environmental Protection (MEP) (2015) Ministry of Environmental Protection Reveals the State of Sudden Environmental Incidents in 2014, January 23, Available at: http://www.zhb.gov.cn/gkml/hbb/qt/201501/t20150123_294725.htm

Ministry of Finance and National Development and Reform Commission (NDRC) (2007) A Circular on Interim Measures for Fund Management of Financial Incentives for Energy-Saving Technical Transformation, Beijing, August 10, available at: http://www.mof.gov.cn/zhengwuxinxi/caizhengwengao/caizhengbuwengao2007/caizhengbuwengao200711/200805/t20080519_27902.html

Ministry of Finance and National Development and Reform Commission (NDRC) (2011) A Circular on Measures for Fund Management of Financial Incentives for Energy-Saving Technical Transformation, Beijing, June 21, available at: http://www.gov.cn/zwgk/2011-06/24/content_1891712.htm

National Development and Reform Commission (NDRC) (2012) A Circular on Organization and Recommendation of Applications for the Second Batch of Pilot Low-carbon Provinces and Cities, Department of Climate Change, April 27, Available at: http://www.ahpc.gov.cn/upload/xxmr/1002320125232330.pdf

National Bureau of Statistics of China (2015) Statistical Communiqué on the 2014 National Economic and Social Development of China, Beijing, February 26.

National Development and Reform Commission (NDRC) (2011) A Circular on Pilot Reform on Natural Gas Pricing Mechanism in Guangdong Province and Guangxi Zhuang Autonomous Region. NDRC Price [2011] No. 3033, December 26, available at: http://www.ndrc.gov.cn/zcfb/zcfbtz/2011z/t20111227_452929.htm

Pew Charitable Trusts (2011) Who’s Winning the Clean Energy Race?: 2010 Edition: G-20 Investment Powering Forward, Philadelphia, March, Available at: http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/G-20Report-LOWRes-FINAL.pdf

Qi Y (ed) (2011) Annual Review of Low-Carbon Development in China 2011-2012. Social Science Academic Press, Beijing.

Tavoni M, Kriegler E, Riahi K, et al. (2015) Post-2020 Climate Agreements in the Major Economies Assessed in the Light of Global Models. Nature Climate Change 5(2), 119–126.

Teng F, Jotzo F (2014) Reaping the Economic Benefits of Decarbonization for China, CCEP Working Paper 1413, Crawford School of Public Policy, The Australian National University, Canberra.
Teng F, Liu Q, Gu A, et al. (2014) China. In: Sachs J, Tubiana L (eds) Pathways to Deep Decarburization: 2014 Report, pp. 83–92. Sustainable Development Solutions Network and Institute for Sustainable Development and International Relations, New York and Paris.
The State Council (2013) Atmospheric Pollution Prevention Action Plan, September, Beijing.
The White House (2014) U.S.-China Joint Announcement on Climate Change, November 11, Washington, DC.
Tian S, Xu W (2012) On the Distribution of Environmental tax Revenue in China. Public Finance Research (12), 18–21.
Wang C, Lin J, Cai W, Zhang ZX (2013) Policies and Practices of Low Carbon City Development in China. Energy & Environment 24(7-8), 1347–1372.
Wang C, Yang Y, Zhang J (2015a) China’s Sectoral Strategies in Energy Conservation and Carbon Mitigation, Climate Policy 15, Supplement on Climate Mitigation Policy in China Guest Edited by ZhongXiang Zhang, pp. S60–S80.
Wang E (2012) NDRC Determined the Second Batch of 29 Pilot Low-carbon Provinces and Cities, 21st Century Business Herald, December 3, Available at: http://www.21cbh.com/HTML/2012-12-3/3ONDE3xZu3NTk30A.html
Wang L (2014) China’s Coal Consumption Peaks at 4100 mt in 2020. Economic Information Daily, March 5, Available at: http://finance.chinanews.com/ny/2014/03-05/5910245.shtml
Wang Y, Song Q, He J, Qi Y (2015b) China’s low-Carbon City Pilots: Practice and Policy Implications, Tsinghua University, Beijing.
Yu YS (2013) The Opportunities and Challenges of China’s Green Power Development, Keynote at 2013 China Green Power Summit, November 8, Beijing.
Zhang X, Karplus VJ, Qi T, Zhang D, He J (2014) Carbon Emissions in China: How Far Can New Efforts Bend the Curve?, MIT Joint Program Report No. 267, MIT Joint Program on the Science and Policy of Global Change, Massachusetts Institute of Technology, Cambridge, MA.
Zhang ZX (2000) Can China Afford to Commit itself an Emissions Cap? An Economic and Political Analysis. Energy Economics 22(6), 587–614.
Zhang ZX (2007) China Is Moving away the Pattern of ‘Develop first and then Treat the Pollution’. Energy Policy 35(7), 3547–3549.
Zhang ZX (2010) China in the Transition to a Low-carbon Economy. Energy Policy 38, 6638–6653.
Zhang ZX (2011a) Energy and Environmental Policy in China: Towards a Low-carbon Economy, New Horizons in Environmental Economics Series, Edward Elgar, Cheltenham, UK and Northampton, USA.
Zhang ZX (2011b) In What Format and under What Timeframe Would China Take on Climate Commitments? A Roadmap to 2050, International Environmental Agreements: Politics, Law and Economics 11(3), 245–259.
Zhang ZX (2011c) Assessing China’s Carbon Intensity Pledge for 2020: Stringency and Credibility Issues and their Implications. Environmental Economics and Policy Studies 13(3), 219–235.
Zhang ZX (2012) Effective Environmental Protection in the Context of Government Decentralization. International Economics and Economic Policy 9(1), 53–82.
Zhang ZX (2014) Energy Prices, Subsidies and Resource Tax Reform in China. Asia and the Pacific Policy Studies 1(3), 439–454.
Zhang ZX (2015a) Programs, Prices and Policies Towards Energy Conservation and Environmental Quality in China. In: Managi S (ed) Handbook of Environmental Economics in Asia, pp. 532–551. Routledge, London and New York.
Zhang ZX (2015b) Crossing the River by Feeling the Stones: The Case of Carbon Trading in China. Environmental Economics and Policy Studies 17(2), 263–97.