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China and climate change: the good, the bad and the ugly

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Theme

The exhaustion of China's old economic model based on investment and manufacturing has had, at least, one positive outcome: a 'new normal' development pathway that is less energy and emissions intensive. Although much remains to be done by China (and others) to set the world on a climate-bearable path, China's efforts are significant and its ratification of the Paris Agreement ahead of the G-20 meeting is a key step for the entry into force of Kyoto's successor.

Summary

China's double-digit economic growth rate of the past three decades has brought with it economic, social and environmental problems. In addition to fostering a profound restructuring of the Chinese economy, these problems are at the core of the country's shift in domestic action against climate change. Arguably, they have also motivated, at least in part, China's uptake of a prominent role in international climate negotiations. This paper will briefly discuss China's climate-change policy. It will be argued that, although impressive in pace and scale, Chinese climate commitments are not consistent, at present, with limiting global mean temperatures to 2ºC compared with pre-industrial levels. Given this outlook, some policy recommendations for future action will also be suggested.

Analysis

Context

The 'Kaya identity' shows the main drivers of CO_2 emissions globally. These include: population, economic growth, energy intensity and CO_2 intensity. Data for China for each of these variables justifies the critical role the country has in the fight against climate change. With a population of 1.3 billion, over half of which lives in cities, China is the world's most populated country and its second-largest economy. The 13th Five-Year plan (henceforth 13FYP) establishes an average annual economic growth rate of 6.5% between 2016 and 2020. China is the world's largest energy consumer (accounting for 23% of global energy consumption currently, compared with 10% in 1971), producer and importer. According to the Energy Information Administration (EIA), China's energy intensity was just under four times that of the US and approximately six times that of Japan, so energy efficiency gains are still feasible.

Additionally, China's primary energy consumption is overwhelmingly fossil-fuel based (see Table 1 below) with coal, the highest CO_2 emitter per unit of energy, overwhelmingly dominating the energy mix. A positive development, however, is the recent evolution of carbon intensity in the power sector, which has been decreasing since 2005.

Table 1. Primary energy consumption in China

		2010		2020		2030	
		Million TCE	Share (%)	Million TCE	Share (%)	Million TCE	Share (%)
Fossil energy	Oil	617	91.36	744	84.76	885	76.12
	Natural gas	143		418		762	
	Coal	2210		3255		2940	
Non-fossil energy	Nuclear	25	8.64	152	15.24	335	23.88
	Hydro	213		358		504	
	Solar	13		61		157	
	Wind	16		113		233	
	Biomass	14		110		210	
	Total	3251	100	5211	100	6026	100

Source: Y. Zhang (2015), 'Reformulating the low-carbon green growth strategy in China', *Climate Policy*, vol. 15, nr 1, p. 49.

International and domestic commitments

China emitted over a fifth of greenhouse gases (GHG) globally in 2011 according to the World Resources Institute, making it a key player in the climate change arena.

Internationally, China has been involved in climate negotiations since 1992. In fact, it was one of the first countries to ratify the United Nations Convention on Climate Change. This does not mean, however, that China has historically been a leader in climate action. Its developing-country status, its argument that countries should act according to common but differentiated responsibilities while taking into account their capabilities and national circumstances, and its perennial focus on economic growth have, until recently, relegated the country to a peripheral role in international climate action.

In Copenhagen (COP15) China's peripheral stance on international commitments started to shift as it pledged to reduce its carbon intensity between 40% and 45% below its 2005 level by 2020. This was the first time China made international climate commitments. Additionally, it pledged to increase forest cover by 40 million hectares by 2020 compared with 2005 levels and to augment its forest stock by 1.3 billion cubic metres by 2020 compared with 2005 levels.

In November 2014 a joint announcement was made by the US and China on climate change by which China, for the first time, accepted GHG mitigation targets ahead of developed countries. China also stated its intention to reach its peak in CO_2 emissions by 2030 and strive to reach this peak earlier, a first for a developing country. On 30 June 2015 China submitted its Intended Nationally Determined Contribution (INDC). This voluntary commitment reiterates China's mitigation target of reaching a peak in CO_2 emissions around 2030 (aiming to peak earlier). It also pledges to reduce its carbon intensity by 60% to 65% below 2005 levels by 2030 and to increase its forest stock by 4.5 billion cubic metres by 2030 compared with 2005 levels. More recently, a day ahead

of the G-20 summit, China ratified the Paris Agreement (as did the US). Being the top two emitters, the Chinese and US ratifications will, in all likelihood, be the tipping point for the Paris Agreement entering into force shortly.

Domestically, climate change was not a priority for China until 2006, when it became the world's largest GHG emitter, which increased both international and national pressure to step up Chinese climate action. From 1992 until 2006 climate actions were driven by the co-benefits from fighting other environmental problems such as air pollution. During this period, civil society (especially in urban areas) put pressure on the government via social media and demonstrations to curb air pollution. Institutionally, climate change was dealt with at a scientific level rather than at a political level via the Chinese Meteorological Administration (CMA). Moreover, broader environmental issues were addressed through a government agency rather than through the Ministry of Environmental Protection, which was created in 2008. Additionally, it was not until the 11th Five-Year Plan (2006-10) that climate change was mentioned in development guidelines. This greater concern for climate change is the result of the Chinese authorities' increased awareness, under the aegis of Hu Jintao, who sought to ensure the sustainability of China's economic model in order to sustain the regime.

From 2007 onwards climate change institutions were developed in China, aside from the pre-existing and science-focused CMA. Climate governance structures and regulations were also developed post 2007. More recently, the 13FYP (2016-20) includes targets for the reduction of both China's energy intensity per unit of GDP and carbon intensity per unit of GDP. China also pledges to increase the proportion of non-fossil fuels in its primary energy consumption to 15% by 2020. The main targets in the 13FYP are shown in Table 2 below.

Table 2. Major targets in 13FYP (2016-20)

Indicator		2015	2020	Average Annual Growth Rate
Domestic Economy				
GDP (trillion RMB)		67.7	>92.7	>6.5
Tertiary Industry Value Added (%)		50.5	56	-
Social Development				
Poverty Population in Rural Area (million)		55.75	0	-
Basic Pension Insurance Enrolment Rate (%)		82	90	-
Innovation				
R&D Investment Intensity (%)		2.1	2.5	-
Patent Ownership per ten thousand population (Number of Items)		6.3	12	-
Internet Coverage	Fixed Broadband Coverage (%)	40	70	-
	Mobile Broadband Coverage (%)	57	85	-
Natural Resources & Environment				
Energy Intensity Per Unit of GDP (%)		-	-	-15*
Carbon Intensity Per Unit of GDP (%)		-	-	-18*
Proportion of Non-fossil Energy in Primary Energy Consumption (%)		12	15	-
Air Quality	Percentage of Days with Air Quality Rating 'Good' or 'Excellent' in Cities (%)	76.7	>80	-
	PM 2.5 Density in Cities (%)	-	-	-18*
Reduction of Major Pollutants Emission (%)	Chemical Oxygen Demand	-	-	-10*
	Ammonia			-10*
	Sulphur Dioxide (SO_2)			-15*
	Nitrogen Oxides (NO_x)			-15*
Note: Figures with * represent cumulative growth rate over the five years.				

Source: UNDP (2016), *13th Five-Year Plan: what to expect from China*, Issue Brief, Domestic Policies, p. 2.

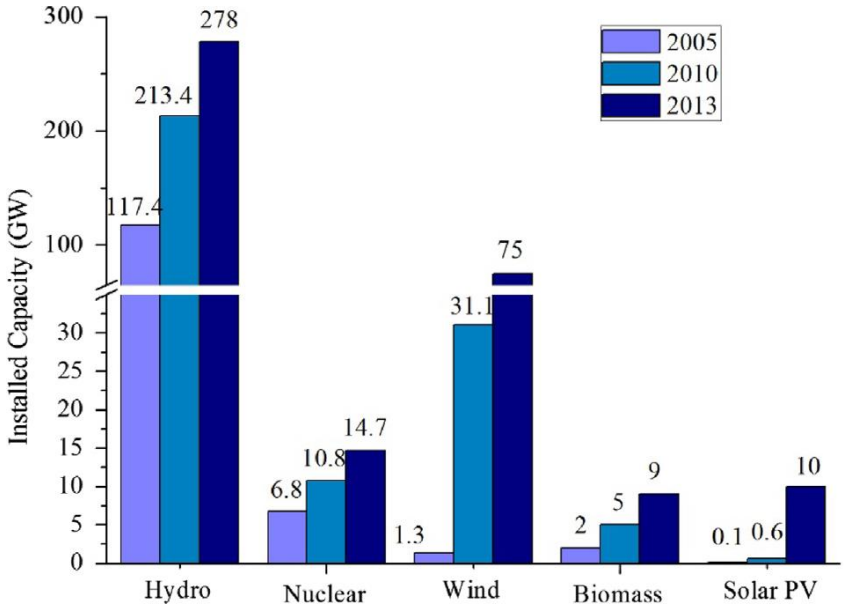
The good, the bad and the ugly

The good news for climate change comes from the exhaustion of China's old economic model and from the profound restructuring of the Chinese economy as a result. The current weight of investment and heavy industry (very intensive in GHG emissions) in China's economic structure is being reduced in favour of consumption and services (less intensive in GHG emissions). Overcapacity in highly polluting industries is being managed by the Chinese government through supply-side structural reforms. Capacity cuts are taking place in the steel and coal sectors. For instance, a reduction of 100 to 150 million metric tonnes in yearly crude steel capacity (13% of current capacity) by 2020 was announced earlier this year. Similarly, a cut in coal output of 500 million metric tonnes (9% of current capacity) will take place in the next three to five years. Local governments are being asked to cooperate in the provision of information to develop plans for capacity cuts and penalties are being announced for non-compliers. As a result, the first six months in 2016 have seen a 1.5% drop in steel production and an 8.5% drop in coal production. These developments have, *inter alia*, led to what is known as China's 'new normal' economic development.

Other elements that are also providing the basis for a structural shift towards China's low carbon green growth include: slower expected GDP growth and energy demand; China's push for competitiveness –through the promotion of high value added industries, including renewables (see the significant growth in Graph 1 below)–; and a greater focus

on environmental protection and energy efficiency, plus its Ecological Civilisation concept. The latter is an extension of the concept of sustainable development whereby nature and mankind must co-exist harmoniously.

Graph 1. Development of non fossil fuels in China (2005-13)

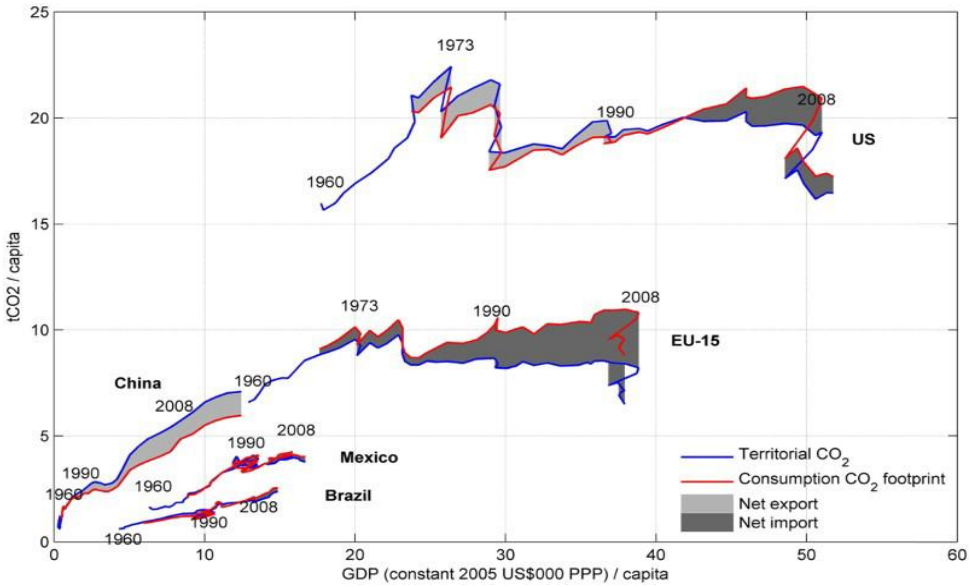


Source: Wang *et al.* (2014), 'Estimate of China's energy carbon emissions peak and analysis on electric power carbon emissions', *Advances in Climate Change Research*, Vol. 4, nr 5, p. 185.

Climate change action seems to be aligned with China's development priorities. Climate policy has not hindered economic growth in China to date. China's energy transition could have moderate or even negative costs (benefits) in terms of GDP, according to Stern and others. Climate policy can furthermore help advance China's 'war on pollution', tackling concerns about citizen's health. In the international arena, climate action (eg, the ratification of the Paris Agreement ahead of some developed countries such as the EU) can grant future leadership status to China. It should not therefore come as a surprise that the Chinese leadership is increasingly committed to tackling climate change, if only to further its future economic growth and its international clout, retain political legitimacy among its citizens and appease existing competitiveness concerns.

When evaluating China's efforts towards decarbonisation some experts believe Chinese action is ambitious. This position could be further backed by the fact that embodied emissions, which refer to emissions generated in the production of exported goods, account for a significant proportion of the country's emissions. Some studies even contend that emissions associated to exports are eight times higher than emissions associated to imports. Graph 2 below shows an analysis of per capita territorial CO_2, consumption CO_2 footprint, and exports and imports of CO_2 for different GDP levels from 1960 to 2008 in the US, the EU and China.

Graph 2. Evolution of per capita GDP and CO_2 emissions by major region



Source: Grubb *et al.* (2015). 'A review of Chinese CO_2 emission projections to 2030: the role of economic structure and policy', *Climate Policy*, nr 15, p. S13.

Analysis by Climate Action Tracker, on the other hand, states that China's Copenhagen commitment and its INDC are rated as 'medium', except for the energy intensity target in China's INDC that is rated 'inadequate'. The medium rating awarded to China's commitments is on a par with those awarded to the EU and to the US.

The 'good news' is that, although medium ratings will not ensure having a likely chance of limiting mean global temperatures to 2ºC above pre-industrial levels, China is known for under-promising and over-complying, and the profound restructuring of the economy will help it in doing just that. In fact, China's peak coal is said to have already been reached, with a drop in coal consumption (in volume) of 2.9% in 2014 and 3.6% in 2015, while the economy grew by 7.3% and 6.9% respectively. Given the above data regarding China's energy mix, its post coal growth could be seen as a welcome development.

An additional positive development in terms of collective action is that China and the US seem to be cooperating rather than competing in other climate-related areas. In addition to the ratification of the Paris Agreement, China and the US have agreed to collaborate on the amendment of the Montreal Protocol, aiming to eventually phase out hydrofluorocarbons (HFC's) and to participate in the pilot phase of a market-based mechanism in the aviation sector, should it be agreed upon in the upcoming ICAO conference.

The bad news come from a global analysis of commitments. China's commitments are insufficient to limit climate change to a bearable level. For instance, Climate Action Tracker's analysis of INDC's warns that with current commitments global mean temperatures will miss the 2ºC target by about 1ºC. Only mitigation pledges submitted by Bhutan, Costa Rica, Ethiopia, Morocco and The Gambia are rated as sufficient by Climate Action Tracker, although together they account for less than 1% of global emissions. This sufficient rating means that commitments by these countries are in the

stringent part of the 2ºC range, although commitments have to be effectively implemented. If other governments undertook similar efforts, there would be a likelihood of limiting global average temperatures below 2ºC compared with pre-industrial levels.

Transition costs, implementation, uptake of market instruments and development of a well functioning nation-wide emissions trading system are part of the 'ugly' in the Chinese mitigation equation. As regards the latter, the seven pilot emission trading systems (ETS) in China are heterogeneous in their coverage and rules, they lack penalties, they are argued to suffer from legal uncertainty and, to date, there is no futures market. These characteristics could lead investors to shy away from the national Chinese market that will operate from 2017 onwards (Luca Taschini, personal comment).

An additional challenge is China's focus on economic growth (remember the Kaya identity), coupled with the energy security needed to deliver this growth and the fact that energy is still heavily fossil-fuel based. Breaking the fossil dependency is expected to be a slow process.

The potential for reducing emissions in the industrial sectors is diminishing and policies for tackling emissions in the diffuse sectors are still evolving. The challenge is to engage all stakeholders in future emission-reduction policies as the economic model shifts towards consumption.

Although China has become a powerhouse in renewable energy manufacturing, domestic deployment has been slower. Ramping up deployment and integrating it with existing infrastructures and institutions will be a complex task, especially when local authorities receive more revenues from coal-fired power plants than from renewable alternatives.

Finally, if China is gradually reducing its role as the world's manufacturer due to the exhaustion of its old growth model and its ageing population, other countries with lower wages will take this role. Hence, global climate mitigation policies will have to take into account broader macroeconomic trends.

Recommendations

As regards China's energy sector, its weight in global energy consumption, which is mostly fossil-fuel based, calls for interfuel substitution and greater uptake of low carbon technologies. China therefore needs to further cap coal consumption and keep advancing on renewable energy deployment. In addition to reducing CO_2 emissions, these measures help advance China's goal of increasing energy security and independence while tackling health problems derived from air pollution.

The global market for green technologies is expected to double (or treble) by 2020 (up from the €1,000 billion per annum estimated in 2012 by the EU). Investment in low-carbon technologies and a greener growth model bodes well with China's goals of being an innovation-driven country that strives for sustainable development.

Economy-wide emission targets coupled with a continuously increasing carbon price are needed to guide investment and consumption towards a low carbon pathway. These policies are expected to nudge China's energy efficiency, which is currently low vis-à-vis other countries. Increases in energy efficiency are of interest to the Chinese authorities as they can also bring financial savings. Care should, however, be taken to avoid a rebound effect that would increase energy demand. Improvements in China's monitoring, reporting and verification system are also recommended in order to ensure a well-functioning climate policy.

In addition to the use of market and non-market based instruments, a change in local priorities is a must. While local governments continue to be fixed on the growth bandwagon, well-being and low carbon development will be difficult to achieve. In this respect, the 3rd Plenary Session of the 18th Central Committee of the Communist Party of China (November 2013) discussed the possibility of evaluating local governments according to new criteria (ie, in addition to economic performance) so that they were incentivised to protect the environment. The effective implementation of evaluation criteria that take environmental performance into account is of paramount importance in China's effective engagement with a low-carbon economic model.

Guidance from the central government as regards the downscaling of the low-carbon transition is required. Related to changing local governments' priorities is the issue of urbanisation, one of the key trends in the 21st century. Considering the long-lasting effects of urban planning on greenhouse gas emissions, compact, connected and coordinated cities are needed in China (and elsewhere).

Conclusions

China's GHG growth has been fuelled by several factors. Its population, the breath-taking pace of its economic growth, and energy and carbon intensity are the key elements of China's emissions. Economic growth, in turn, has been powered by cheap and emission-intensive energy, pre-eminently coal.

External factors such as the 2008 crisis as well as internal factors such as the restructuring of the economy, and health and environmental concerns (eg, air pollution), are the main elements that have reduced the pace of Chinese GHG emission growth. In the energy sector these internal and external factors have resulted in a reduction in the use of coal, an increase in energy efficiency, increases in the deployment of renewable energy and a substitution of gas for coal.

China's climate change efforts are significant. However, as with other large greenhouse gas emitters, the US and the EU included, its efforts are not enough to limit global mean temperature increases to 2ºC above pre-industrial levels. China's energy transition will be shaped by its macroeconomic policy, development guidelines, and energy and environmental policies. Following the Chinese (and US) ratification of the Paris Agreement, the spirit of Paris seems to live on. The litmus test will come when implementation and increased ambition are gauged against the 2ºC yardstick.