China: Path to 'Net-Zero'

How the world's largest emitter plans to become carbon neutral

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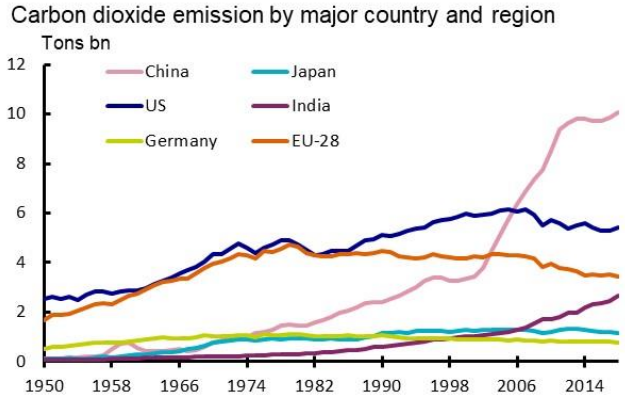
Key points

- A global race to eliminate carbon emissions is under way to save the planet from excessive temperature increases. China is late to the game but has made ambitious commitments to cut emissions at a faster pace
- Despite the near-term costs, Beijing is eyeing the structural benefits associated with becoming carbon neutral. The collective gains from damage avoidance, improved energy security, cost saving from renewables and geopolitical calculations more than offset the short-term pains induced by this green transformation
- The successful fight against pollution over the past decade has emboldened Beijing to take on a bigger challenge. With clear targets set out in the 14th Five Year Plan, China is on the path to reach its first-phase goal of capping emissions by 2030
- The real challenge lies in the second phase of its 2060 commitment, which involves bringing down net greenhouse gas emissions to zero in 30 years. This is a much faster decline than committed to by most developed countries and will require the country to make fundamental changes to its economy and energy system, and how carbon emissions are managed

Rapidly rising global temperatures and sea levels, together with increasing natural disasters linked to climate change pose an existential threat to mankind. More than 110 countries have pledged to neutralise carbon emissions by 2050, following the signing of the Paris Agreement to limiting global warming to below 2°C above pre-industrial levels. As the world's largest emitter, China's action will be critical to the success of this effort to achieving climate sustainability (Exhibit 1). At last year's United Nations General Assembly, President Xi Jinping announced China's commitment to cut carbon emissions to zero by 2060, after reaching peak emissions by 2030. If successful, this alone would lower global temperature by 0.2-0.3 degrees[1], and give the world a respite of 10 years before exhausting the emission budget set by the Paris Accord.[2]

Exhibit 1: China accounts 30% of global emissions



Source: Global carbon project and AXA IM Research, as of March 2021

[1] https://www.climatescorecard.org/2020/02/china-makes-serious-efforts-to-re-green-its-deserts/

[2] Moëc, G., "China's net zero", Macrocast #64, AXA IM Research, 19 October 2020

Encouraging as it sounds, eliminating the emissions of the world's largest energy user is no easy feat. Achieving the net-zero goal in a sustainable way will likely require fundamental changes to the ways in which the Chinese economy operates, energy is consumed, and how carbon emissions are managed.

This paper is the first of a three-part series on China's journey to carbon neutrality. It considers the reasons behind Beijing's decision to join the battle against global warming and the strategy it aims to deploy. The second paper will focus on the micro and macroeconomic impacts of this 'green transformation', while the final paper will discuss the financing of this gigantic project.

Why is China joining the fight?

China's commitment to become carbon neutral is bold but necessary. Despite being the world's largest CO_2 emitter by aggregate amount, China's emissions on a per-capita basis are less than half of the United States and lower than most of the developed nations outside Europe. With a burgeoning middle-class aspiring to western lifestyles, and China's energy system overly reliant on coal, forcing the country to rein in its emissions could be seen as denying its right to future economic growth.[3] This begs the question – what is motivating China to make a seemingly immense compromise to tackle climate challenges?

Here are four plausible explanations:

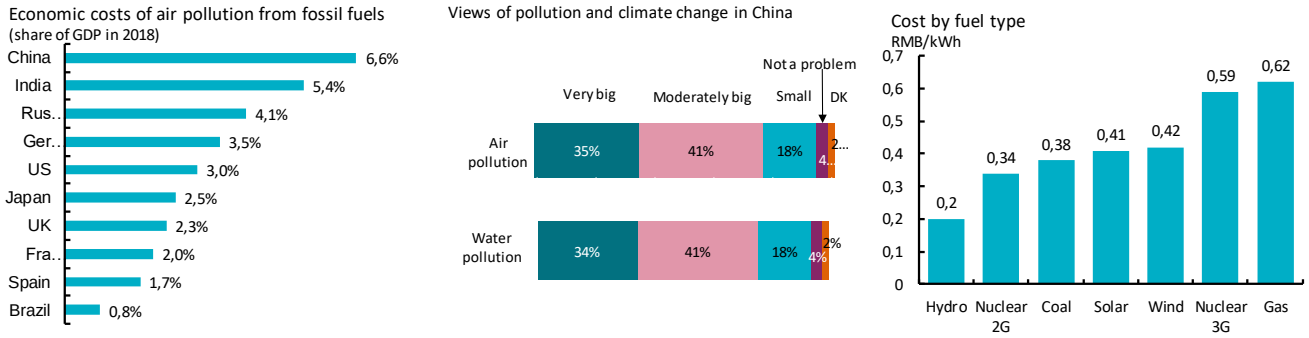
1. **The costs of environmental damage have become too great to ignore.** Rising temperatures, pollution and erratic weather patterns have incurred tremendous economic costs and pose a real threat to the welfare of the society. One estimate puts China's annual loss due to air pollution alone at 6.6% of GDP (Exhibit 2), the highest in the world. Despite the significant progress made by the anti-pollution campaign over the past decade, a recent survey shows that over 90% of Chinese remain concerned about the impact of environmental degradation (Exhibit 3). A lack of official response to wide-spread fears about climate risks could destabilise the social and political regime, adding to the already large economic costs.

2. **A faster transition away from fossil fuels can help China to mitigate energy security risks.** China is the world's largest consumer of energy, but only a proportion of this demand is met by domestic production. Over 70% of its oil and 40% of its gas are imported each year. While China is self-sufficient in coal, relying on the most polluting form of energy has been the key source of many environmental problems it confronts today. At the same time, relying on foreign energy supplies – oil from Iraq and Iran, gas from Russia, coal from Australia, or liquefied natural gas from the US – puts China in a vulnerable position against risks of regional instability (Middle East), political sanctions (Russia and Iran) and bilateral disputes (Australia and the US). Finally, transporting fuel through the South China Sea also creates the risk of flash points vis-à-vis the US. Hence, transitioning to a cleaner form of energy, which China can be self-sufficient, helps to kill two birds – climate sustainability and energy security – with one stone.

3. **Rapid cost reduction in renewables makes energy transition feasible.** Years of significant investment, heavy government subsidies and a strong regulatory push have resulted in substantial declines in the costs of wind and solar power in China (Exhibit 4). The weighted average cost of solar has fallen by over 70% in the past decade to be largely at par with that of coal. This deflationary force has been exported to many of China's trading partners in recent years, making a transition toward renewable energy increasingly affordable on a global basis.

4. **Leadership on climate issues can help China to accumulate soft power, mitigate geopolitical tensions and improve its image as a responsible nation.** The potential cooperation to fight global warming offers an avenue for China and the US to break away from the antagonism of the last few years. China and the EU – as the two largest proponents of the Paris Agreement – also have plenty of

Exhibit 2, 3 and 4: Climate change incurs economic and social costs; falling costs of renewable offers a solution



Source: Greenpeace, Centre for Research on Energy and Clean air, Spring 2015 Global Attitudes survey, AXA IM Research, as of March 2021

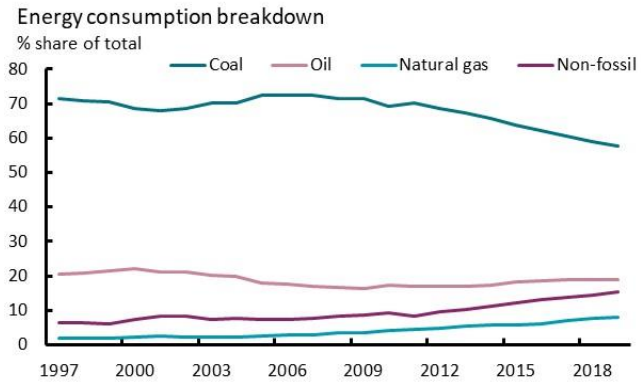
[3] This is indeed a key point of contention when it comes to sharing the responsibility of carbon reduction between the developing and developed countries.

grounds for collaboration from developing green technology, setting pollution standards, to regulating the burgeoning market for environmental, social and governance (ESG) investment. For the rest of the world, which is also growing more conscious of climate risks, taking a leadership role in addressing these challenges could enable China to build political goodwill and expand its geopolitical influence.

Progress made before the 2060 goal

The above discussions underscore the economic, social and geopolitical considerations behind China's climate ambitions. Garnering these long-term benefits won't be easy, but China has come prepared for the task. In the past decade, Beijing has imposed explicit environmental targets in successive Five-Year Plans to align the nation's social and economic developments with the improvement of climate conditions. Among these are targets on the share of power generation by renewables and other non-fossil fuel energy, such as hydro and nuclear. President Xi has made anti-pollution one of the three "key battles" for the Communist Party, which elevated environmental metrics to key performance determinants of local officials. The result was clear – a notable shift in the country's energy mix has been underway since 2011, with a steady decline in the share of coal and a corresponding rise in renewables (Exhibit 5).

Exhibit 5: Energy mix since 12th Five-Year Plan



Source: CEIC and AXA IM Research, as of March 2021

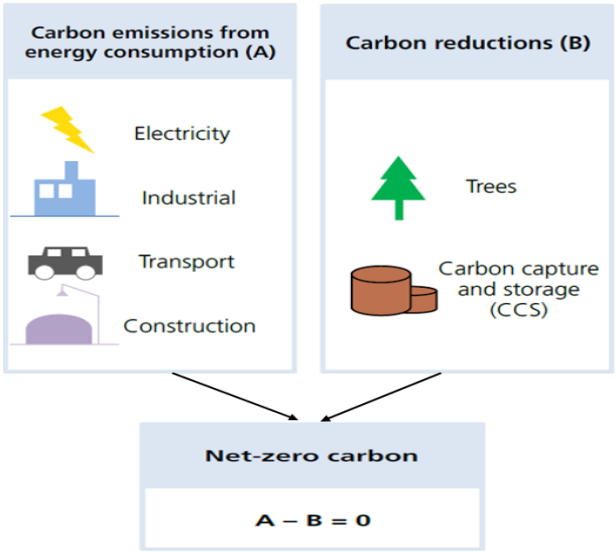
Closure of heavy-polluting coal-fired power stations and small coal miners was effective in alleviating the nation's pollution problems. These, in conjunction with a wide deployment of anti-pollution equipment, contributed to a visible decline in the number of polluting days and harmful particles in the air. For major cities, like Beijing, a substantial improvement in air quality was achieved within only a few years after its infamous 'smog crisis'.

Laying the path to carbon neutrality

Given the success of the anti-pollution drive, Beijing is now gearing up the nation for a bigger challenge. Carbon neutrality is the ultimate goal to prevent more serious climate-related disasters, and this is a race against time from which China cannot be absent. Before we analyse China's strategy to reach its 2060 goal, it's necessary to clarify a few basics, such as what it means to become carbon neutral and the key drivers of this process.

Exhibit 6 shows how a zero-emission goal can be met by offsetting the CO_2 emitted by the most polluting sectors – power, industrial, transportation and construction – by various carbon mitigation methods, including tree planting and carbon-capture-and-storage (CCS) technology. The problem is that none of the latter is reliable enough – based on current technology and conditions – to counter the anticipated emission increases to meet the Paris Agreement. Tree planting takes time and immense space,[4] while CCS technology has not yet reached commercially viable status. Hence, to tangibly reduce emissions, China (and rest of the world) will have to cut greenhouse gases at source, from where they are produced.

Exhibit 6: How "net-zero" can be achieved



Source: UBS, as of March 2021

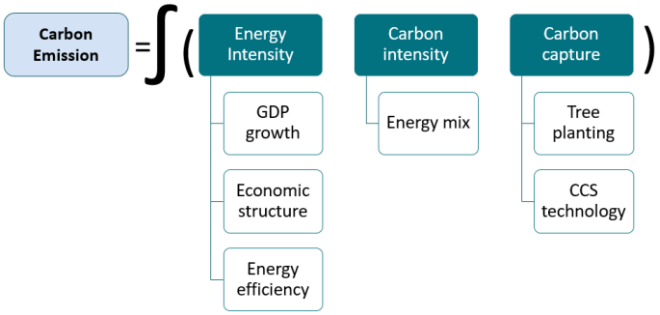
To see the necessary changes that China needs to make to tackle these challenges, Exhibit 7 breaks down carbon emissions into three drivers:

1. Energy intensity, which is the amount energy used per unit of GDP. This is related to the pace of economic growth, the composition of economic structure (i.e. the services sector is less energy intensive than industrial sector) and energy efficiency

[4] A recent study on the afforestation programme in Jiangxi province found that an average of 32 tonnes of carbon was absorbed per hectare in the above-ground biomass of the forest. To absorb the current 10 billion tonnes of carbon China emits every year, it will require 300 million hectares of new forest to be created, which is 140% of the country's current forest landmass, at 220 million hectares. For an indication of time, China added 45 million hectares of forest area in 18 years between 2000 and 2018.

2. Carbon intensity, which is the amount of carbon emissions per a unit of energy consumed. This is related to the energy mix, with fossil fuel more carbon-intensive than renewables
3. Finally, the efficacy of carbon capture

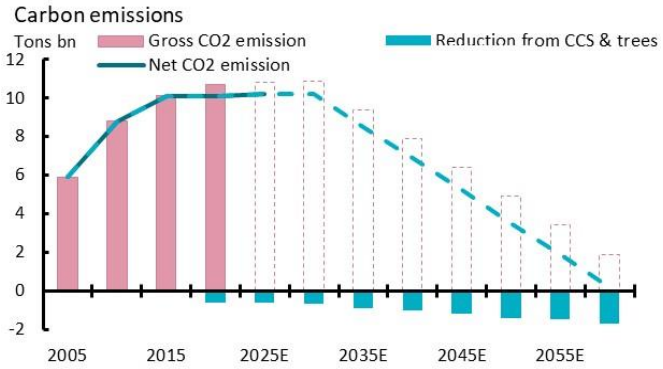
Exhibit 7: Key drivers of carbon emissions



Source: AXA IM Research, as of March 2021

Incorporating our long-term assumptions on the Chinese economy – including trend growth and a shift towards a more services-driven economy, Exhibit 8 depicts a path for China to reach its net-zero goal. It's important to note that other assumptions of this projection, including energy and carbon intensity, are taken from a detailed study by the Centre for Climate Change and Sustainable Development at the Tsinghua University[5] – a study that was widely believed to be behind Beijing's 2060 commitment.

Exhibit 8: Path to net-zero



Source: Tsinghua, UBS and AXA IM Research, as of March 2021

The exhibit decomposes net emissions into gross emissions and carbon capture. As discussed before, the latter can play only a marginal role at alleviating emission pressure, and thus, the heavy lifting needs to be done by cutting down gross emissions, which will be achieved through a two-phase process. Phase one covers the period between now and 2030 and focuses on "flattening the emission curve". This projection is plausibly attainable given the existing trends of energy-intensity reduction, renewable power adoption, and the electrification of the transportation and industrial sectors, consistent with the targets set by the 14th Five-Year Plan. The goal of capping emissions by the end of 2030 is therefore demanding but reachable.

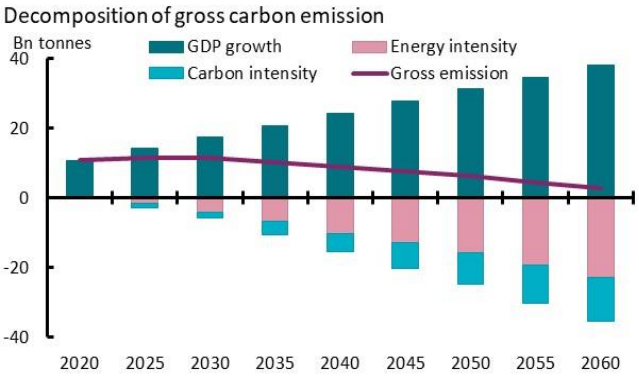
The real challenge lies in the second phase, which requires an outright reduction of gross emissions from 11 billion tons in 2030 to less than two billion by 2060, with the balance offset by CCS to bring net emissions to zero. This means that China will need to transition from peak to zero emissions in 30 years, a much faster speed than pledged by the EU and Japan (of around 50 years), despite being 10 years later in reaching carbon neutral (2060 for China versus 2050 for others).

Achieving this ambitious target will require China to make fundamental changes to its macro system, including:

- A reshaping of its economy towards carbon-light service sectors, whose share of GDP is expected to rise from 55% to 77%
- An overhaul to its energy system by substantially raising the share of non-fossil fuel from 30% to 85%
- A restructure of the transportation and industrial sectors involving electrification, and the construction of buildings with better energy-saving technology and recyclable materials

Exhibit 9 decomposes the reduction of gross emissions by major contributors. The growth of the economy, albeit at a declining rate, would lead to a near four-times expansion in emissions over the coming four decades. However, this growth will be countered by a reduction of energy and carbon intensity following a shift in China's economic structure, increased energy efficiency, electrification of carbon-intensive sectors, and a decisive move toward a carbon-free energy mix.

Exhibit 9: Breaking down the task



Source: Tsinghua, UBS and AXA IM Research, as of March 2021

Accomplishing these changes will require huge investments in renewables, green technology and infrastructure that is consistent with higher environmental standards. This will create jobs and growth opportunities for many emerging industries. On the flipside, traditional sectors that fail to adapt fast enough will face a grim future. The macro and micro economic impacts of this climate-induced transformation will be profound, far-reaching and long-lasting. We will discuss these topics in Part 2 of the report.

[5] Xie, Z.H. et al., "China's long-term low-carbon development strategy and pathway" Institute of Climate Change and Sustainable Development Tsinghua University, July 2020

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